English

BS2000/OSD

POSIX

Commands

User Guide

Valid for
BS2000/OSD V7.0/V8.0/V9.0

Edition November 2012

Comments… Suggestions… Corrections…

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Certified documentation according to DIN EN ISO 9001:2008

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Contents

1 Preface

POSIX (**p**ortable **o**pen **s**ystem **i**nterface for UNI**X)** is a range of UNIX-based standards which ensure the compatibility and interoperability of applications in a heterogeneous network. A heterogeneous network consists of computers from different manufacturers, as well as system and application software from different software suppliers.

The POSIX standard was defined as the national American standard by the Institute of Electrical and Electronics Engineers (IEEE) in 1989. It was then extended by the X/OPEN consortium, and in 1990 became adopted as the international standard. (X/OPEN Portability Guide IV).

The X/OPEN Portability Guide IV, also known as XPG4 standard, comprises 7 volumes, including interface definitions for basic operating systems, programming languages, data management and networking. The BS2000/OSD operating system as of V2.0 supports the XPG4 standards which are contained in the first two volumes:

- Volume 1: System Interfaces and Headers (approx. 350 program interfaces)
- Volume 2: Commands and Utilities (approx. 200 user interfaces)

In order to support these interfaces, the POSIX functionality was integrated into BS2000/OSD. POSIX designates both the IEEE standard and the BS2000/OSD “POSIX” functionality. POSIX satisfies the requirements to allow its certification according to the XPG4 standard, which is carried out in two stages: at the end of 1995, BS2000/OSD received the “XPG4 base branding” (XPG4) from “The Open Group” (previously X/OPEN), and around mid 1997 it received branding according to the “XPG4 UNIX profile” (also known as XPG4.2 or UNIX95). In addition, BS2000/OSD with its POSIX subsystem has been certified as an internet server by “The Open Group” in 1999.

The kernel of the POSIX software product is implemented as a BS2000 subsystem. The library functions of the XPG4 standard are available to the user via a C library, and a defined set of commands is available via a shell (POSIX shell). The C library is a component of the product CRTE (Common RunTime Environment).

Application programs can be easily ported with POSIX, irrespective of the operating system being used. Programs consistent with XPG4 can therefore also run in BS2000/OSD following recompilation.

POSIX program interfaces are offered together with BS2000 program interfaces. It is possible to use a combination of both BS2000 and POSIX program interfaces in the same program, albeit with certain restrictions.

1.1 Structure of the POSIX documentation

The following documentation is available to help you to familiarize yourself with and work effectively in the POSIX subsystem in BS2000/OSD:

- The POSIX manual “Basics for Users and System Administrators” [1] provides an introduction into working with the POSIX subsystem. It also describes the administration tasks that will arise when dealing with POSIX, and gives information on which BS2000 software products you can use in conjunction with this subsystem.
- This manual, POSIX Commands, contains a description of the POSIX commands with which you can work in the POSIX shell.
- All the information needed to use bs2fs file systems is provided in the POSIX manual “BS2000 filesystem bs2fs” [2].

POSIX documentation in the BS2000/OSD environment

The functionality of various software products in the BS2000/OSD environment is being expanded to enable you to combine these products with the use of the POSIX functions.

A series of utilities provide access to the POSIX file system. As a result, you can, for example, use EDT to process files from the POSIX file system.

Now that the CRTE (Common RunTime Environment) has been extended in accordance with the XPG4 standard, you can use the C Library Functions to write portable C programs irrespective of which operating system is running.

The manual “Basics for Users and System Administrators” [1] is the basic requirement for accessing POSIX functions from within other software products.

1.2 Objectives and target groups of this manual

The POSIX commands represent a comprehensive set of versatile programs and procedures for process control.

This manual contains a description of POSIX commands. It is a fundamental reference work for all POSIX users who already possess some basic knowledge of POSIX operation. The level of knowledge required corresponds to the information presented in the POSIX manual POSIX manual “Basics for Users and System Administrators” [1]. For further literature, please refer to the section References.

1.3 Summary of contents

The chapter *Working with the POSIX Shell* provides basic information about POSIX shell operation. It also provides a function-specific command summary and an example of accessing and working in the POSIX shell.

The chapter *International Environment (NLS Locale)* tells you something about the Native Language System.

The chapter *Commands* presents the commands in alphabetical order. In order to help users locate the relevant information, the outer running title of each page specifies the name of the described command together with a supplementary keyword in the case of very long descriptions.

The chapter *Tables and directories* provides a summary of the XPG4 conformity of the POSIX commands. It also includes lists of the metacharacters and regular expressions of the POSIX shell and tables of the ASCII and EBCDIC character sets.

The index at the back of the book is intended to help you locate topics more quickly.

For technical reasons the printed manual is devided into two volumes.

Readme file

The functional changes to the current product version and revisions to this manual are described in the product-specific Readme file.

Readme files are available to you online in addition to the product manuals under the various products at *http://manuals.ts.fujitsu.com*. You will also find the Readme files on the Softbook DVD.

Information under BS2000/OSD

When a Readme file exists for a product version, you will find the following file on the BS2000 system:

```
SYSRME.<product>.<version>.<lang>
```

This file contains brief information on the Readme file in English or German (<lang>=E/D). You can view this information on screen using the `/SHOW-FILE` command or an editor. The `/SHOW-INSTALLATION-PATH INSTALLATION-UNIT=<product>` command shows the user ID under which the product’s files are stored.

Additional product information

Current information, version and hardware dependencies, and instructions for installing and using a product version are contained in the associated Release Notice. These Release Notices are available online at *http://manuals.ts.fujitsu.com*.

1.4 Changes since the last edition of the manual

This edition of the present manual features the following changes compared to the previous version (order number: U22794-J-Z125-76-6):

The following new commands were added to the *Commands* chapter:

edtu	screen oriented editor in unicode mode
fuser	display file users
last	display last logged in users
logrotate	change logging files of the syslog daemon
ping	send echo requests to network hosts
su	substitute user ID

The following changes were made to the descriptions of the commands below:

man	display system documentation
posdbl	set up and manage global program cache
tail	deliver the last part of a file

The key combination @@z has been added to the section "Jobs" on page 62.

1.5 Notational conventions

As far as is possible, each command description is in a uniform pattern:

- Outer running title
- Inner running title (optional)
- Main title
- Description
- Synopsis
- Syntax description
- Exit status (optional)
- Error messages (optional)
- Files (optional)
- Environment variables (optional)
- Locale (optional)
- Examples (optional)
- See also (optional)

These elements are now described in detail.

Outer running title

The outer running title gives the command name. In the case of the larger commands it also acts as an orientation guide, the command name being followed by a keyword indicating the topic dealt with on the page.

Inner running title (optional)

The inner running title classifies certain commands for the sake of clarity, e.g. *Built-in sh command*.

Main title

The main title includes:
- the name of the command
- a short description of the command
- the suffix *(BS2000)* in the case of commands which are specially provided for operation with BS2000 as an extension to the XPG4 standard.

Description

Here the following are described:

– the functionality of the command
– the various purposes of individual formats if more than one is available
– the environment in which the command is to be used (e.g. entries in files, permissions, etc.)
– background information
– points to be observed before and after the command call.

In the case of commands which call complex programs (e.g. *awk, sh*), this section simply describes the program call. For further information, e.g. about *awk* operation, please refer to the associated syntax section.

Syntax

Syntax **cmd**[␣**-a**][␣**-b**][␣**-c**][␣**-d**arg1][␣**-f**␣arg2]␣file␣...

The meaning of the metasyntax is described below.

In the syntax:

Boldface characters
Constants: These characters must be entered exactly as shown.

Normal characters
Variables: These characters stand for other characters for which you may select and enter a suitable value.

[ ] Optional: arguments within square brackets are optional and may be omitted. The effects of these arguments are explained in the description of the options and arguments. You must not enter the square brackets themselves, unless specifically instructed to do so.

| A vertical bar identifies alternatives from which you may choose one only.

␣ Indicates a mandatory blank (space).

... Ellipses indicate that the preceding argument can be repeated. If blanks that are not part of the argument have to be placed between repetitions, the ellipses are preceded by ␣ (space).

Example

```
cmd[␣-a][␣-b][␣-c][␣-darg1][␣-f␣arg2]␣file␣...
```

The following arguments are mandatory:

- *cmd*
- one or more *file*s, each preceded by a blank.

The following arguments are optional extras:

- one or more of options *-a*, *-b*, *-c*; these options can either be listed separately:
  -a -b -c
  or grouped together:
  -abc
- option *-d*, where *arg1* must be replaced with an argument
- option *-f*, where *arg2* must be replaced with an argument.

In descriptive text:

No distinction is made between constants and variables in the descriptive text; all syntax elements as well as miscellaneous file names, path names, and commands are given in *italics*.

Input

In application examples, input into the system is identified by **`fixed-width, semibold`** type. Since all input lines are terminated with the ↵ key at character-mode terminals, and with the keys EM DUE at block-mode terminals, the keys at the ends of input lines are not specified.

Many inputs are terminal-dependent, they are different for block and character-mode terminals (see also "Terminal support" on page 27):

Output

Operating system output is shown in `fixed-width` font, except in descriptive text, where it is shown in *italics*.

Syntax description

option
: (For a description of options see the section “Command options” on page 34)

argument
: Description of the remaining arguments which you can pass when calling a command, e.g. input files, output files, parameters, variables, field separators etc.

Exit status (optional)

The exit status is the value which a command returns to the calling process following execution. The exit status provides information about command execution. The exit status is a numerical value which is contained in the ? variable. You can enter the command *echo $?* to query the exit status.

The exit status section is only included if the exit status deviates from following basic rule:

0	successful execution of the command
>0	the command has failed

Error messages (optional)

Important error messages are listed and explained here. Additional notes indicate how errors can be avoided and recovered.

Unless otherwise specified, error messages are sent to the standard error output. Standard error (stderr) is usually the screen.

Files (optional)

This section lists files that the command accesses or creates.

Environment variables (optional)

Some commands inspect the values of environment variables. These are listed here.

Locale (optional)

This section describes how NLS affects the command (see the chapter “International environment (NLS locale)” on page 87).

Examples (optional)

Examples aim to illustrate:

– the main function of the command

– the use of the principal options

– acceptable complex combinations of options and arguments

See also (optional)

This section contains references to other commands that perform similar functions or work in conjunction with the described command. References to literature containing more information on the command is provided where appropriate.
System calls and library functions for C developers are indicated by a pair of parentheses, e.g. *chdir()*.

Notes and warnings

BS2000 Sections which refer to special characteristics of POSIX operation with the BS2000 are identified in this way.

ℹ This symbol indicates important information which you must be careful to observe.

⚠ This symbol precedes warnings which you should observe in the interests of system and operating security.

References

The following examples show how references to other sections of the text, manuals, commands, functions, system calls and file formats are presented.

see the section “Command summary” on page 66	Reference to the section “Function-specific command summary” in this manual
see “Basics for Users and System Administrators” [1]	Reference to a manual which is listed as number [1] under *Related publications* at the back of this manual
see also *awk*	Reference to the *awk* command in this manual
see also *chdir()* [4]	Reference to the C function, system call or file format *chdir()* in the manual which is listed as number [4] under *Related publications* at the back of this manual

2 Working with the POSIX shell

The POSIX shell is the interface which connects you to the POSIX subsystem via the C runtime system/libraries.

The figure 1 illustrates the structure of POSIX in BS2000 and the integration of the POSIX shell.

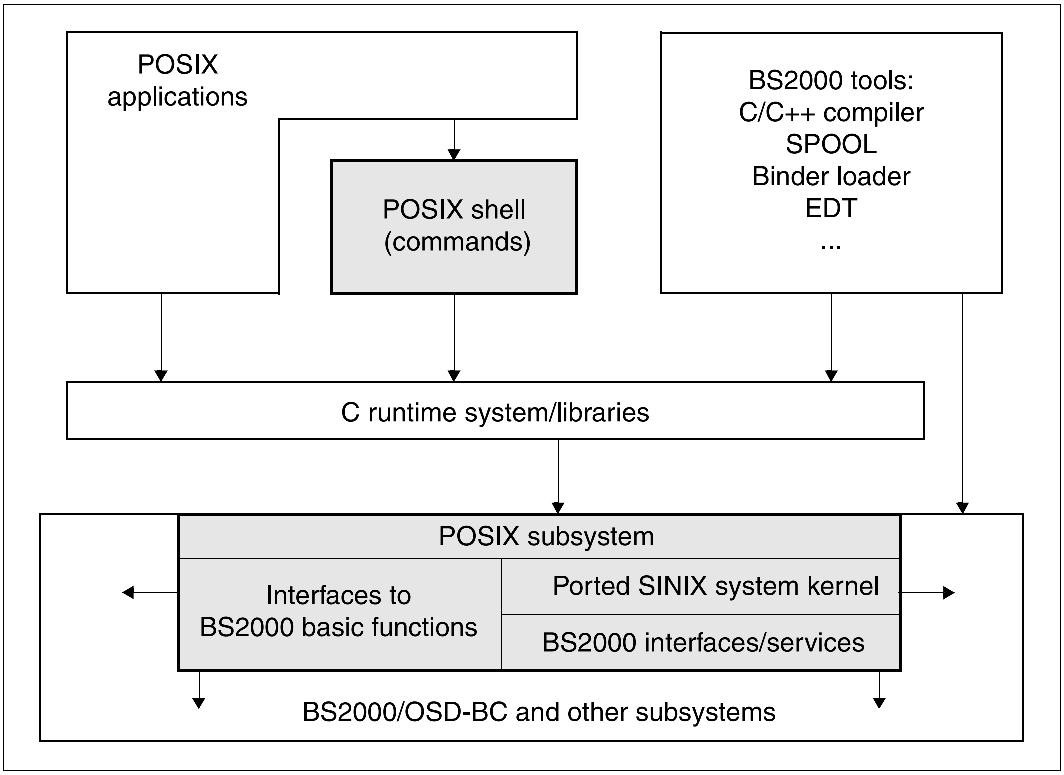
POSIX applications
POSIX shell (commands)
BS2000 tools: C/C++ compiler SPOOL Binder loader EDT ...
C runtime system/libraries
POSIX subsystem
Interfaces to BS2000 basic functions
Ported SINIX system kernel
BS2000 interfaces/services
BS2000/OSD-BC and other subsystems

Figure 1: Structure of POSIX in BS2000 and integration of the POSIX shell

The POSIX shell is a command interface which you can use in addition to the BS2000 command interface (see figure 2).

When you have successfully accessed the POSIX shell, you may use all the commands of the POSIX shell. After leaving the POSIX shell you may again enter BS2000 commands.

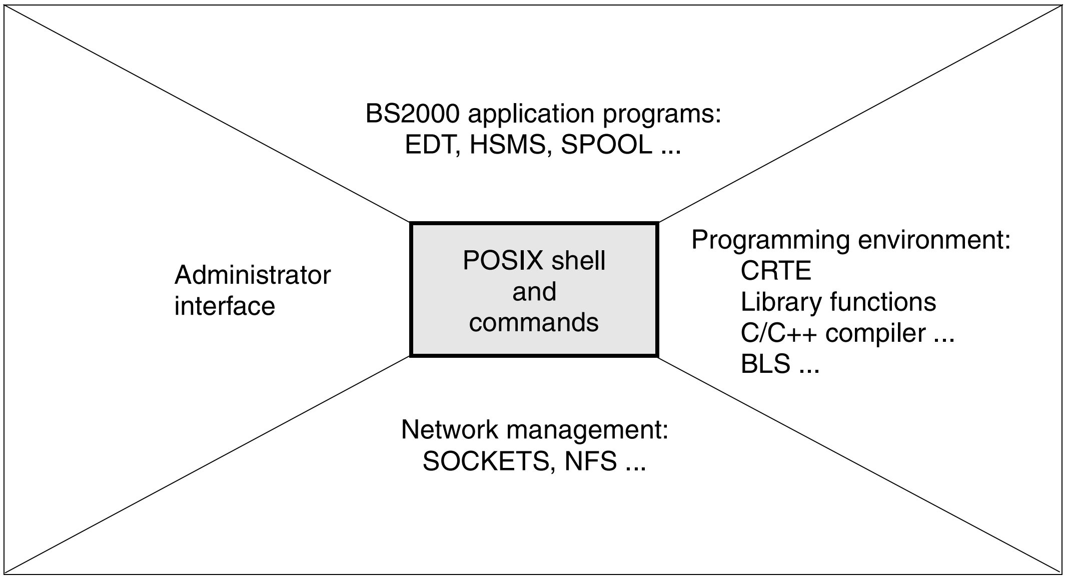

Figure 2: The POSIX shell command level

The POSIX shell reads commands from a terminal or from a file in the POSIX file system, interprets them in accordance with certain rules and is responsible for their execution. A file which contains commands for the POSIX shell is called a shell procedure (shell script).

The operation and performance of the POSIX shell depend on whether the terminal at which the user is working is a block or character-mode terminal.

The POSIX shell provides you with a comprehensive command language which you can use like a programming language. You can use the available commands to create your own programs which you can then run without the need for prior compilation.

2.1 Accessing the POSIX shell

You can access the POSIX shell in the following ways:

- via a BS2000 terminal (block-mode terminal)
- from a UNIX system (character-mode terminal)
- by means of an emulation

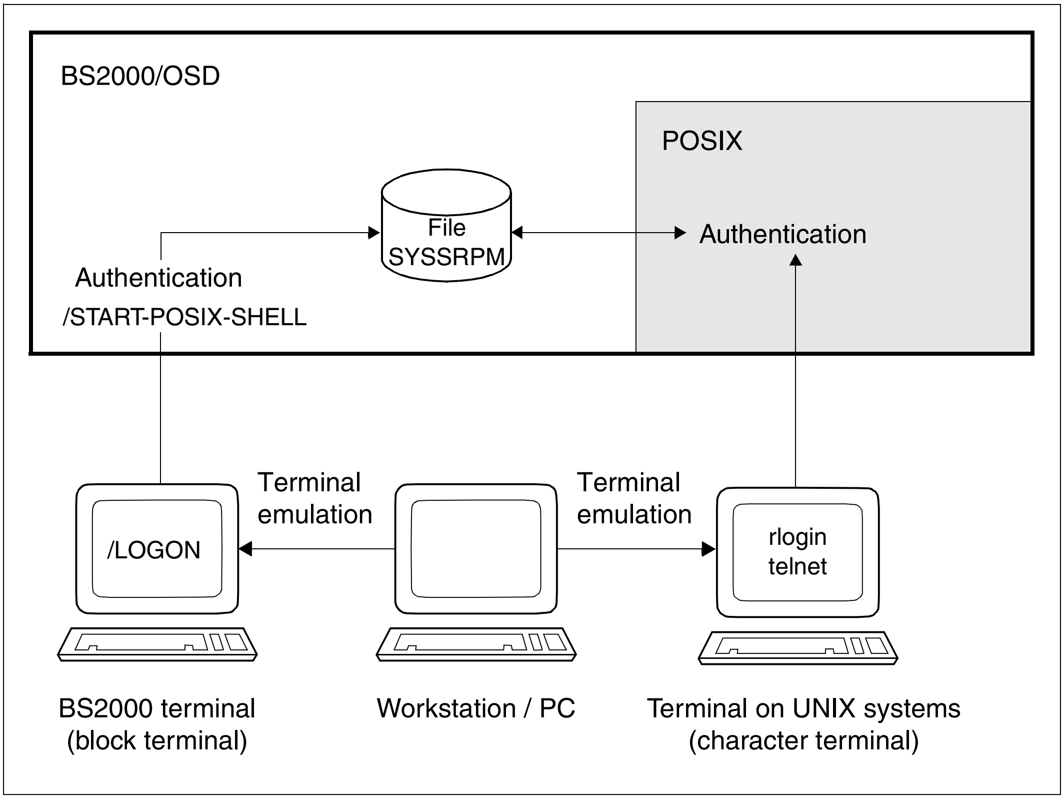

Figure 3: Ways of accessing the POSIX shell

Access via a BS2000 terminal

After successfully logging on to BS2000, any BS2000 user can enter the /START-POSIX-SHELL command to call the POSIX shell:

START-POSIX-SHELL
VERSION = ***STD** / <product-version without-man-corr>

VERSION = *STD / <product-version without-man-corr>
Version number of the program to be called (in this case the POSIX shell).
The default setting is *STD, which means that the version currently available is called.

Return codes

(SC2)	SC1	Main code	Meaning/Guaranteed messages
	0	CMD0001	No errors
255	1	CCM0999	The POSIX shell could not be started.

Effect of the START-POSIX-SHELL command

This command sets up the POSIX environment and calls the program entered in the SYSSRPM file for the relevant user (see the SHOW-POSIX-USER-ATTRIBUTES command).

If you have entered the POSIX shell as a standard program in your user data, then after entering /START-POSIX-SHELL you can work interactively with the POSIX shell and you may use all the commands and functions of the POSIX shell. POSIX shell-specific commands are available for interaction between BS2000 and the POSIX subsystem.

Terminating the POSIX shell

In order to return to BS2000 you must first enter the *exit* command to close the POSIX shell.

Access from a character terminal

You can use the *rlogin* command to log on to a BS2000 host from a terminal of a UNIX system, provided you have the required authorization to access it. In other words, you will need to have a user ID (login name) that is authorized for POSIX *rlogin* access, the associated password, and an account number that can also be used for *rlogin* access accounting on the BS2000 host. After logging on, you can use POSIX as if in local mode.

In order to connect to BS2000, you must enter the following command in the POSIX shell:

```
rlogin [-l <login-name>] <host>
```

If you do not enter a login name then the login name under which you are logged on at the remote computer is used. If you use the *rlogin* command, the system asks for the password for the required login name. The password is verified by the BS2000 SRPM component (**S**ystem **R**esources and **P**rivileges **M**anagement): The BS2000 login name and password specifications are checked against the access control attributes of the home pubset. If they match then the user is granted access to the POSIX subsystem. If the SECOS product is employed then the access control procedure can be further refined by means of LOGON protection.

If you use *rlogin* to access POSIX, then you can access BS2000 commands only to a limited extent (e.g. because of the missing SYSFILE environment).

Access via telnet

The *telnet* daemon *telnetd* provides direct access to BS2000 via the *telnet* protocol from the UNIX system and also directly from the PC via the *telnet* application, which appears to POSIX as a character terminal and behaves as such. Access control is handled in the same way as for *rlogin*, i.e. via BS2000 access mechanisms. Access without the entry of a password, as realized between UNIX systems (i.e. via an entry in the *.rhosts* file), is not supported.

Access via an emulation

The third way of accessing POSIX is by means of a terminal emulation. This means that you must first log on to a workstation or PC and then start a terminal emulation to emulate either a terinal of a UNIX system or a BS2000 terminal.

BS2000 terminal emulation

When you access POSIX via a BS2000 terminal emulation such as the EM9750 or MT9750, for example, your terminal acts as a block-type terminal, which means that you can enter BS2000 commands and /START-POSIX-SHELL as if at a BS2000 terminal (see page 24).

UNIX/SINIX terminal emulation for UNIX systems

UNIX/SINIX terminal emulations are available for workstations with UNIX system with graphical OSF/Motif-based interfaces and also for PCs running Windows (e.g. EM97801 and SINIX-TE). These emulations act as a character terminal of a UNIX system and enable you to enter commands such as *rlogin* (see page 24).

2.2 Special features of POSIX shell operation

Presettings in the user environment

When you have successfully accessed the POSIX subsystem, the POSIX shell is started. Before the POSIX shell reports that it is ready for operation, the following presettings are made in the user environment:

- The POSIX shell initializes the standard shell variables. It allocates default values to the following variables: *HOME*, *LANG*, *LOGNAME*, *MAIL*, *PATH*, *SHELL*, *TTY*, *TERM*, *TZ* and *USER*.
  If a variable has already been predefined by the SDF-P variable *SYSPOSIX* then this value is adopted. However, the shell variables *USER*, *TERM*, *TYP*, *LOGNAME*, *HZ*, *HOME* and *MAIL* may not be set by the user.
- The file */etc/profile* is executed.
- If you have created it, the file *$HOME/.profile* is executed.

Terminal support

POSIX supports the block-mode terminals which are used in BS2000 as well as the character-mode terminals employed in UNIX systems. The latter are connected to UNIX multiuser systems and are operated by POSIX via networks. If you access POSIX via a workstation then a character-mode terminal is emulated.

Block-mode and character-mode terminals operate differently:

- In the case of character-mode terminals each character that is input is immediately transferred to the UNIX system where it is transferred to the screen as a response to the input and displayed. Control functions such as cursor movement, uppercase/lowercase notation or the buffering of transfers are performed by the computer to which the terminal is connected. Screen-oriented applications are only permitted at character-mode terminals.
- In contrast, block-mode terminals transfer all the text entered at the screen to the computer in the form of a data block. Control functions are performed at the unit itself.

Block-mode terminals are directly connected to the BS2000 and POSIX. Both BS2000 and POSIX commands can be entered at this terminal type.

For BS2000 security reasons it is only allowed to write via block-mode terminals to terminals of the own process group. E.g. a `cp <file> /dev/term/xxx` processed for a block-mode terminal of another LOGON-Task will be rejected with `permission denied`.

Many inputs are terminal-dependent, i.e. they are different for block and character-mode terminals:

Block-mode terminal	Character-mode terminal
@@d	END
@@c	DEL
@@/	CTRL \
EM DUE	↵
@@z	CTRL Z
-	CTRL S / CTRL Q ...

Special functions (P keys, Ctrl keys)

You can call the command *bs2pkey* to make the following settings for the P3 and P4 keys:

P3 with @@c (CTRL C)
P4 with @@d (CTRL D)
P5 mit @@z (CTRL Z)

You may either call the program in the POSIX shell (without options) or enter it in the file */etc/profile*. In the latter case the program is called each time the shell is activated.

File transfer

POSIX files contain no records. Instead, they are byte-oriented. In contrast, BS2000 files contain record-oriented and/or PAM block-oriented data.

By default, POSIX handles files in EBCDIC format, whereas UNIX systems, MS-DOS and Windows handle files in ASCII format. ASCII files stored in the POSIX file system can only be processed in the POSIX shell if they have first been converted.

Routines for the conversion of data between POSIX and BS2000 formats are available in order to permit the exchange of POSIX and BS2000 files. Files are converted from the EBCDIC DF 03 character set to ASCII ISO 7-bit code, and vice versa (see also chapter “Tables and directories” on page 893). Only pure text files can be converted.

Automatic conversion

The environment variable *IO_CONVERSION* determines whether files accessed with POSIX commands (e.g. *awk*, *cat*, *grep*...) on mounted ASCII file systems are converted automatically. *IO_CONVERSION* is set to the value "NO" by default, which means that no automatic conversion occurs. If desired, automatic conversion can be enabled with the following command:

```
export IO_CONVERSION=YES
```

If you want to set automatic conversion for a POSIX user as the default value directly on starting the POSIX shell, this *export* command must be entered in the *.profile* file in the HOME directory of that user.

Note that automatic conversion must not be enabled when using the following tools, since the tools themselves also perform the same conversion:
dd, *iconv* and *bs2cp* with the *-k* option.

Handling of archives/libraries:
ar does not convert automatically, since *ar* libraries often contain binary data.

pax and *tar* convert automatically. However, a *pax* or *tar* archive must not be copied with *cp* if automatic conversion is enabled.

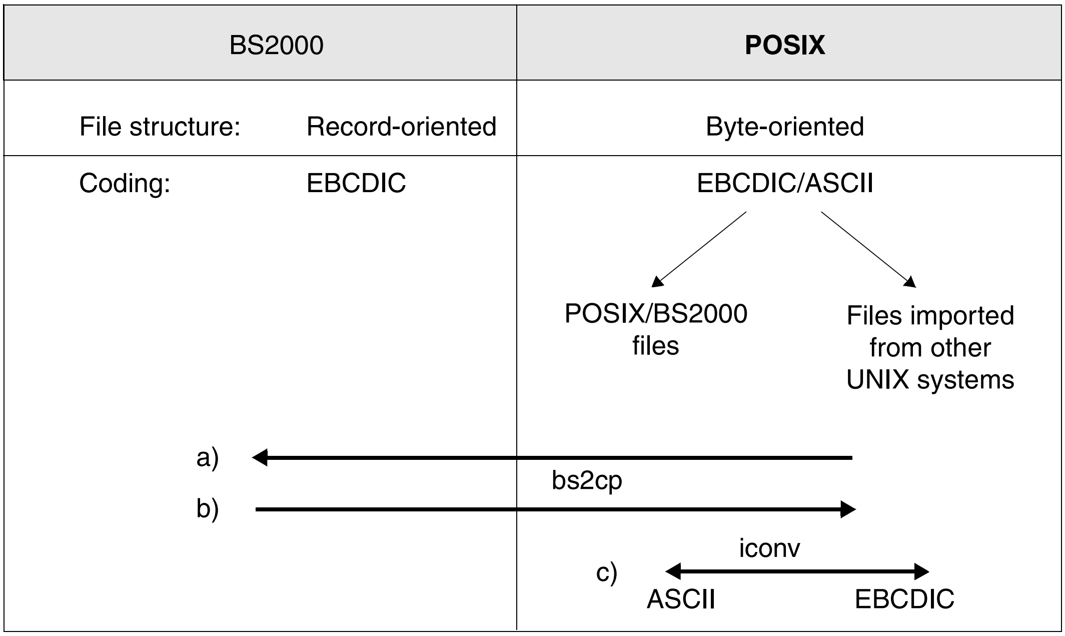

Figure 4: File transfer

a) Transferring files from POSIX to BS2000 (as seen by the POSIX shell):

   You use the POSIX command *bs2cp* to transfer files from POSIX to BS2000. You do not need to specify the *-k* option if the files use the EBCDIC character set in the two file systems.

   In addition, you may define file attributes for the BS2000 file. To do this you must use the POSIX command *bs2file* to define the BS2000 file attributes before issuing the "copy" command *bs2cp*. *bs2file* is mapped to the BS2000 command SET-FILE-ATTRIBUTES.

b) Transferring files from BS2000 to POSIX (as seen by the POSIX shell):

   You use the POSIX command *bs2cp* to transfer files from BS2000 to POSIX. You do not need to specify the *-k* option if the files use the EBCDIC character set in the two file systems.

   Depending on the BS2000 file type (SAM, ISAM or PAM) the following applies:

   – PAM files are always stored as binary files.

   – ISAM files are generally stored as text files in the POSIX file system.

   – In the case of SAM files and LMS elements (type S, J, X ,D), you can choose whether the file/element should be placed in the POSIX file system as a text file, binary file or binary text file. To do this, you must use the POSIX command *ftype* to specify the file processing mode before issuing the "copy" command *bs2cp*.

c) Use the POSIX command *iconv* to perform file conversion within the POSIX file system. The file contents are converted.

2.3 Entering commands from the POSIX shell

When you have successfully accessed the POSIX subsystem, the POSIX shell is started.

If you are using the POSIX shell in interactive mode, the POSIX shell outputs the value of the environment variable PS1 as a prompt before reading a command. By default, this is the dollar sign ($), or (#) for the privileged user, followed by a blank (␣).

Commands are entered in the following format:

```
command[␣options][␣parameters]␣ ...↵
```

For *command* you must specify the name of the POSIX command or shell procedure which is to be executed. The *options* allow you to specify control instructions for command execution. Under *parameters* you can enter a call argument which the POSIX shell passes to the *command*. You may also enter multiple call arguments for certain commands.

At character-mode terminals you must use tabs or spaces to separate the command names and call arguments. After the final call argument you can conclude command input by pressing the ↵ key (at character-mode terminals) or EM DUE (at block-mode terminals).

Pure BS2000 programs cannot be started from within the POSIX shell.

If the screen line is too short for the required input you may proceed in one of two ways:

- At the end of the line you may simply continue to type without pressing the ↵ key. When you have entered the complete command, press the ↵ key to terminate input.
- Enter \ ↵ to continue the line. The backslash (\) prevents the ↵ key from terminating command input. You may then continue to enter the command. When you press ↵ (without \), the command is executed.

Every POSIX command returns a value to the POSIX shell in which it was called. This is its exit status. If the command was executed correctly this value is 0; if errors were encountered its value is not equal to 0.

If a command outputs information on screen and the output exceeds the capacity of a screen page, then at character-mode terminals you can pause the output by pressing the key combination CTRL s and continue it by pressing CTRL q. This function is not supported at block-mode terminals.

2.3.1 Chaining commands

You can chain a set of commands together:

- You can use the | character to combine two commands to form a **pipeline**.
- You can use the characters; or & or && or || to combine multiple commands or pipelines to form a **command list**.

Pipeline

A pipeline is a sequence of two or more commands each of which is linked to the preceding command by means of the | character. A pipeline between two commands redirects the standard output of the first command to the standard input of the second command (see the section "I/O redirection" on page 36). For this reason, commands which are chained in this way must fulfil the following conditions:

- The first command must write to the standard output.
- The next command in the pipeline must read from the standard input.
- If the pipeline contains more than two commands, then all the commands which come between the first and last command of the pipeline must read from the standard input and write to the standard output.

The POSIX shell starts all of the piped commands as independent parallel processes. However, in a monoprocessor system, the processor can only handle one of these processes during each time slice. For this reason, processor time is devoted to the individual processes in turn.

Only the process corresponding to the first command in the pipeline does *not* receive its input from another process.
Only the process corresponding to the last command in the pipeline does *not* route its output to another process.

The POSIX shell waits until the last of the piped commands terminates before processing any further inputs.

Command list

A command list is a sequence of one or more pipelines separated by the symbols

; & && ||

and optionally terminated by

; & |&

The symbols, ;, &, and |& have equal precedence, which is lower than that of && and ||. The symbols && and || also have equal precedence. A semicolon (;) causes sequential execution of the preceding pipeline; an ampersand (&) causes asynchronous execution of the preceding pipeline (i.e. the shell does not wait for that pipeline to finish). The symbol |& after a command list causes asynchronous execution of the preceding command or pipeline with a two-way pipe established to the parent shell.

In the following, the term command refers to a command or a pipeline. The effect of the various characters is specified in the table below:

Character	**Effect**
;	The POSIX shell does not process the next command until the preceding command has terminated. It does not, however, issue a prompt.
&	The POSIX shell starts the preceding command in the background and then immediately processes the following command. The POSIX shell redirects the standard input of all background commands to a file which has the properties of */dev/null*. However, you may redirect the standard input of a background command to another file.
&&	The POSIX shell does not execute the following command unless the preceding command returns the value 0 as its exit status.
||	The POSIX shell does not execute the following command unless the preceding command returns a value other than 0 as its exit status.
|&	The POSIX shell starts the preceding command in the background with a two-way pipeline to the parent shell.

2.3.2 Further input after command invocation

Some commands expect you to enter additional data from the keyboard after you have pressed ↵ In such cases the cursor is positioned at the start of the next line and either no prompt appears at all or a special prompt, varying according to the command, appears instead. Each of the lines you now enter must be terminated with ↵. To terminate data entry, you generally either press END (or use @@d at block-mode terminals) or enter one of the special statements associated with your command.

If you terminate a command with ↵ leaving the command line incomplete, or if you escape ↵ with a backslash (\), the POSIX shell outputs the value of the shell variable PS2 (by default the "greater than" character > and a blank ␣) as prompt.

2.3.3 Command options

You can invoke commands with one or more options or with none at all. Options modify the way in which a command functions. They generally consist of a single letter. In the command syntax they are either shown exactly as you have to enter them (in bold type) or are collectively identified as "option" (in normal type).

The following rules generally apply when you enter more than one option:

- The order in which you list the options is immaterial.
- Options without arguments can be entered in two ways:
  - singly, e.g.: *cmd␣-a␣-b␣-c*
  - grouped, e.g.: *cmd␣-abc*
- Options that require an argument, for example -dargument or -f␣ argument, cannot be combined with those that do not. Such options must be entered individually, with blanks (␣) to separate them:

  cmd␣-abc␣-dargument␣-f␣argument
- Options and option combinations are introduced by a minus sign (-): *-abc*.
- Two hyphens (--) may be used to indicate the end of the options.
  You need to use -- if the first argument begins with -.

Most commands output a usage message if they are called with an incorrect option. The usage message tells you which options and operands can be used in conjunction with a command call.

Example Output of a usage message when an incorrect option is specified

```
$ ls␣-y
ls: Illegal option -- y

ls: Usage: ls -1RadCxmnlogrtucpFbqisfLe [files]
```

2.3.4 Specifying file names

The following conventions apply to file names:

- You may use any character with the exception of / and \0 (zero bytes terminating a character string).
- You should not enter the characters plus (+), minus (-) or period (.) at the beginning of a file name. The period is reserved for special files, e.g. for the file *.profile*.

  Example of the use of a file name beginning with the minus sign (-):

touch -- -file1	(before the file name is entered, the (void) options must be terminated)

- For more information on the use of the characters *, ?, [...], see the section "File name generation" on page 54.
- You should not use a number of special characters (see the chapter "Tables and directories" on page 893).
- If the filename contains spaces or tabs you must place it inside quotes.
- Unlike BS2000, POSIX distinguishes between uppercase and lowercase in file names.

There are two ways of specifying the names of files and directories in the POSIX shell:

- You can specify a relative path name. Relative path names always start from the current directory.
- You can specify an absolute path name. Absolute path names start with a slash (/) and specify the name relative to the root directory.
- A file name must not exceed 1024 characters in length. This limit includes the directory names, the name of the file itself and the slashes which are used as separators.

2.3.5 Built-in POSIX commands

Built-in POSIX commands are commands which the POSIX shell interprets and processes itself without, consequently, generating a new process. They differ from all the other “external” commands in the following ways:

- As subprograms, they are components of the binary file */bin/sh*. This means that you are not able to rename them.
  You can change access permissions for the */bin/sh* file only, not for the individual built-in POSIX commands.
- The POSIX shell prioritizes execution of built-in POSIX commands. If a built-in POSIX command has the same name as an external command then the POSIX shell always executes the built-in POSIX command when this name is specified. The external command is executed if the call name contains a slash (/), for example if it is called with the corresponding absolute path name.
- Built-in POSIX commands are faster because they are executed by the POSIX shell itself.

2.3.6 I/O redirection

Before a command is executed, its input and output may be redirected by means of a special notation interpreted by the POSIX shell. The following arguments may appear anywhere in a simple command or may precede or follow a command. They are not passed on to the invoked command, but are interpreted by the shell. Command and parameter substitution occurs before the specified *file* or *file descriptor* is used. File name generation is performed only if the pattern matches a single file. Blank interpretation is not performed

<file
  Redirects the standard input (file descriptor 0) of a command to *file*, so that input to the command is read from *file*.

\>file
  Redirects the standard output (file descriptor 1) of a command to *file*, so that output from the command is written to *file*. If the file does not exist, it is created. If it does exist, is a regular file, and the *noclobber* option is set (see *Built-in commands, set -o*), this causes an error. If *noclobber* is not set, the file is truncated to zero length and its existing contents are lost.

\>Ifile
  Same as >file, except that it overrides the *noclobber* option.

\>>file

Redirects the standard output (file descriptor 1) of a command to *file*, so that output from the command is written to *file*. If the file exists, output is appended to it; otherwise, the file is created.

<>file

Opens *file* for reading and writing as standard input.

<<[-]string

Introduces a "here document" (explained below). "Here documents" are used primarily in shell procedures to supply values to commands which can read from standard input. No parameter substitution, command substitution or file name generation is performed on *string*. Input to the POSIX shell is read up to (but excluding) a line that literally matches *string* or to an end-of-file. The resulting document, called a "here document", becomes the standard input for the command.

If one of the characters in *string* is quoted then all the characters of the "here document" are quoted for the POSIX shell.

i The *string* marking the last line must not be quoted.

If no characters of *string* are quoted:

– parameter and command substitution is performed,

– escaped newlines (\newline) are ignored, and

– a backslash (\\) must be used to quote backslashes (\\), dollar signs (*$*), backquotes (`) and the first character of *string* if they are to be treated literally in the text.

If - is appended to <<, then all leading tabs are stripped from *string* and from each line in the here document.

<&digit
>&digit

In the first form, the standard input is duplicated from file descriptor *digit*, i.e. is read from the file associated with *digit*. The second form does the same for the standard output.

<&-
>&-

The first form closes the standard input for the command, so that EOF is the only input to the command. The second form closes the standard output for the command, so that the command does not write any output.

<&p
>&p

The input from the co-process in a two-way pipeline is redirected to standard input. Similarly, the output to the co-process is redirected to standard output.

If one of the above redirections is preceded by a digit, the file descriptor number referred to is that specified by the digit (instead of the default 0 for *stdin* and 1 for *stdout*).

Example To open file descriptor 2 (*stderr*) for writing as a duplicate of file descriptor 1 (*stdout*):

```
    ... 2>&1
```

Order of redirections and background commands

The order in which redirections are specified is significant. The POSIX shell evaluates each redirection in terms of the association (file descriptor, file) at the time of evaluation. For example:

```
... 1>file 2>&1
```

first associates standard output (file descriptor 1) with *file* and then associates standard error (file descriptor 2) with the file associated with file descriptor 1 (i.e. *file*). In other words, both the standard output and the error messages from the command are written to *file*.
If the order were reversed, file descriptor 2 would be associated with the terminal (assuming file descriptor 1 had been), file descriptor 1 with *file*. This would mean that only the standard output would be written to file, not the error messages.

If you use *&* to start a command in the background without active job control then the standard input is automatically associated with a file which possesses the same properties as */dev/null*. If job control is active then the environment for command execution contains the same file descriptors, modified as appropriate by the input/output statements, as the executing POSIX shell.

You can set commands or pipelines to run in the background from within a script. They can then communicate with your program. To spawn a co-process of this type, you put the operator `|&` after the command. You can only use two-way pipes in scripts, not on the command line.

Command strings can be called as two-way pipes. If you abort the original process (e.g. with *kill -9 PID*) and then later attempt to write another command to a two-way pipe then a subshell is indeed called but the process is stopped. You receive the error message:

```
sh: bad file unit number.
```

2.3.7 Shell procedures and processes

Shell procedures are commands which have been grouped together to form a program. In order to create a shell procedure you must write the desired sequence of commands to a file. Enter *sh <file name>* to call a shell procedure. If the file possesses execution permission (*chmod +x <file name>*), you can call this command sequence directly, that is to say without *sh*.

This section describes the effect of the POSIX process structure when you are working with the POSIX shell, i.e. when you are entering commands or working with shell procedures.

Any input that you enter after /START-POSIX-SHELL is received by the POSIX shell and processed accordingly.

The most important commands are implemented as “built-in” commands. Some commands actually spawn a separate process, so the process in which the POSIX shell is running thus becomes a parent process.

Basically, any process can spawn a new process. Until the process spawns another process it is the child process of a parent process. However, as soon as it generates a new process it becomes the parent process of the new child process. It nevertheless retains its status as the child process of the process to which it is subordinate. In other words, a process can simultaneously be a parent process and a child process.

The parent-child process hierarchy is of great importance if you want to pass environment variables in shell procedures. All users can define the environment variables with which they wish their POSIX shell (= parent process) to operate. However, these environment variables are initially known only by the POSIX shell. If a child process is to operate with the environment variables used in the parent process (= POSIX shell) then these variables must be exported to the child process. The *export* command is available for this purpose.

2.3.8 Processing commands using the POSIX shell

Apart from the built-in POSIX commands, every command is linked to a file in the POSIX file system. The names of most command files are entered in the directory */usr/bin*. The shell variable *$PATH* contains a list of directories in which commands are searched. When executing a command, the POSIX shell reads the command, searches in the directories contained in *$PATH* for a file name which is identical to the command name, and executes the command.

In order to execute a command that is not one of its built-in commands, the POSIX shell spawns a new process and waits until that process terminates. It then displays the setting of the shell variable *PS1* as a prompt (by default, this is $ for non-privileged users or # for privileged users), which indicates that it is ready to process a new command. If you enter the command *date*, for example, the current date will immediately be displayed, and the POSIX shell will then issue the prompt so that you can enter a new command.

In the case of a command such as *date,* the period that elapses between command input and the POSIX shell reporting ready to process a new command is very short. However, this period may be substantially longer when a different command is input, for example when a file is compiled. This is because the POSIX shell does not report until execution of the command has been terminated. In order to avoid having to wait for extended periods at the terminal you can use the special character &. If you terminate command input with this character, the POSIX shell reports immediately with the screen prompt without waiting to terminate execution of the entered command. Commands which are terminated with & are started as background processes which you may leave to run without intervention.

2.3.9 Compound commands

Syntax

for␣identifier␣[␣**in**␣word...];**do**␣command_list;**done**

or

Syntax

for␣identifier␣[␣**in**␣word_list]
do␣command_list
done

The *for* command can be used to repeatedly execute *command_list*. Each time a *for* loop is executed, *identifier* is set to the next word taken from the *word_list*. If *word_list* is omitted, the *command_list* is executed once for each positional parameter (*"$@"*) that is set. Execution ends when there are no more words in the *word_list*.

Syntax

select␣identifier␣[␣**in**␣word_list] **do**␣command_list; **done**

or

Syntax

select␣identifier␣[␣**in**␣word_list]
do␣command_list
done

The *select* command can be used to repeatedly execute a given *command_list* under input control. *select* prints the set of words in *word_list* on standard output, each preceded by a number. The *PS3* prompt is then printed, and a line is read from the standard input. The content of the line read from standard input is saved in the variable *REPLY*. If this line matches the number of one of the listed words, then the value of the parameter *identifier* is set to the word corresponding to this number. If the line is empty, the *word_list* is printed again, and *identifier* is set to the name of the shell script. If *in word_list* is omitted, then the positional parameters are used instead (as is done with *for* loops). The *select* loop is executed repeatedly until a *break* built-in or end-of-file is encountered.

Example

The following POSIX shell script can be used to selectively print information on each individual file in the current directory:

```
select file in `ls`
do
  if [ -z "$file" ]
  then
     echo "Select number"
  else
     ls -lsid $file
  fi
done
```

Syntax

```
case␣word␣in
[[(]pattern[pattern]...)commando_list;;]...
esac
```

The *case* command provides for conditional branching to a command list on the basis of a pattern. *case* executes the *command_list* associated with the first *pattern* that matches *word*. The form of the patterns is the same as that used for file name generation (see the section "File name generation" on page 54).

i The optional left parenthesis preceding *pattern* must be specified if *case* commands are used within command substitutions with *$(...)*. This produces paired parentheses constructs in *$(...)*.

Syntax

```
if␣command_list1
then␣command_list2
[elif␣command_list3
then␣command_list4]...
[else␣command_list5]
fi
```

The *if* command can be used to conditionally execute a number of different command lists. The first list following *if* (*command_list1*) is executed as the condition, and if it returns a zero exit status (true), the list following the first *then* is executed (*command_list2*). Otherwise, the list following *elif* (*command_list3*) is executed as the next condition, and if its value is zero, the list following the next *then* (*command_list4*) is executed. Failing that, the *else* list (*command_list5*) is executed. If no *else* list or *then* list is executed, the *if* command returns a zero exit status.

Syntax

```
while␣command_list1
do␣command_list2
done
until␣command_list1
do␣command_list2
done
```

The *while* and *until* commands define loops with exit conditions. A *while* command repeatedly executes the condition *command_list1*, and if the exit status of the last command in the list is zero (i.e. true), it executes the *do* list in the body of the loop (*command_list2*); otherwise the loop terminates. If no commands in *command_list2* (the *do* list) are executed, the *while* command returns a zero exit status.

until may be used in place of *while* to negate the loop termination test. The *until* command tests whether the exit condition is false (non-zero) and terminates the loop as soon as it returns an exit status of zero (true).

Syntax **continue**␣number

continue continues with the next iteration of the superordinate *for*, *while*, *until* or *select* loop. If *number* has been specified, then the next iteration is performed in the superordinate loop which corresponds to *number*. If *number* is equal to 0, processing continues beyond the outermost loop. *continue 1* has the same effect as *continue*.

Syntax **break**␣number

break aborts the superordinate *for*, *while*, *until* or *select* loop. If *number* has been specified, then execution continues in the superordinate loop which corresponds to *number*. If *number* is equal to 0, then the outermost loop is exited. *break 1* has the same effect as *break*.

Syntax **return**␣number

If *return* is called in a function then the command returns to the calling procedure. The *return* status is determined by *number* or by the last command executed. If *return* is called outside of a function or in a procedure executed with a leading dot, then it has the same effect as a call to *exit*.

Syntax **(**command_list**)**

Executes *command_list* in a separate environment.

i If two consecutive left-hand parentheses (are required to define nested commands then these must be separated by a space. Failure to do so may result in their being interpreted as an arithmetical expression (see *Command substitution*).

Syntax **{**␣command_list**;}**

command_list is simply executed in the current POSIX shell.

i The left brace '{' must be followed by a space!
Note that unlike the parentheses (and), the braces { and } are reserved words and must be typed at the beginning of a line or after a semicolon (;) in order to be recognized as such.

Syntax **[[**␣expression␣**]]**

Evaluates the conditional *expression* and returns a zero exit status if *expression* is true; otherwise, 1.

See *Conditional expressions* for a description of *expression*.

Syntax **function**␣identifier␣**{**␣command_list**;}**
identifier␣**()**␣**{**␣command_list**;}**

Defines a function named *identifier*. This name is used to call the function like a command. The body of the function consists of the *command_list* that is enclosed within curly braces { and }.

i The left brace '{' must be followed by a space!

The braces {} are unnecessary if

– the command list consists of a single *for*, *case*, *if*, *while*, *until* or *select* statement.

Example

```
function␣identifier␣case␣word␣in␣...
identifier␣()␣for␣identifier...
```

– the command list is executed in a subshell, i.e. () instead of {}.

Example

```
function␣identifier␣(command_list)
identifier␣()␣(command_list)
```

Syntax **time**␣pipeline

The commands in *pipeline* are executed and the elapsed time and the *user* and *system* time are reported on standard error. The following reserved words are only recognized as the first word of a command and when not quoted:

```
if      then    elif    else    fi      case    esac    for
select  while   until   do      done    {       }       function
time    [[      ]]
```

2.3.10 Comments

A word beginning with the hash character # causes that word and all the following characters in the line to be ignored.

2.3.11 Aliasing

If the first word of a command is a defined alias, it is replaced by the text of the alias. An alias name consists of any number of characters excluding metacharacters, quoting characters, file expansion characters, parameter and command substitution characters, and the equal sign =. The replacement string can contain any valid POSIX shell script including the metacharacters listed above. The first word of each command in the replaced text will in turn be tested for aliases. If the last character of the alias value is a blank, the word following the alias will also be checked for alias substitution.

Aliases can be used to redefine built-in commands but cannot be used to redefine the reserved words listed above. Aliases can be created, exported and listed on standard output with the *alias* command and can be removed with the *unalias* command. Exported aliases remain in effect for scripts invoked by name, but must be reinitialized for separate invocations of the POSIX shell.

Aliasing is performed when scripts are read, not while they are being executed. Thus for an alias to take effect the alias definition command has to be executed before the command which references the alias is read.

Aliases are frequently used as a short hand for full path names. An option to the built-in *alias* command allows the value of the alias to be automatically set to the full path name of the corresponding command. These aliases are called tracked aliases. The value of a tracked alias is defined the first time the corresponding command is looked up and becomes undefined each time the *PATH* variable is reset. These aliases remain tracked so that the next reference will redefine the value. Several tracked aliases are compiled into the POSIX shell. The *-h* option of the built-in *set* command makes each referenced command name into a tracked alias.

The following exported aliases are compiled into the POSIX shell but can be unset or redefined with *unalias*.

```
autoload='typeset -fu'
false='let 0'
functions='typeset -f'
hash='alias -t'
history='fc -l'
integer='typeset -i'
nohup='nohup␣'
r='fc -e -'
true=':'
type='whence -v'
```

Example The following aliases could be defined to construct *l*, *ll* and *lf*:

```
alias l='/bin/ls -m'
alias ll='/bin/ls -l'
alias lf='/bin/ls -CF'
```

2.3.12 Tilde substitution

After alias substitution is performed, each word is checked to see if it begins with an unquoted ~ (tilde). If it does, then the word up to the next / (slash) is checked to see if it matches a login name in the */etc/passwd* file. If a match is found, the tilde and the matched login name are replaced by the login directory of the matched user. This is called a tilde substitution. If no match is found, the original text is left unchanged. A tilde by itself, or in front of a slash, is replaced by *$HOME*. A tilde followed by a plus sign or a minus sign is replaced by *$PWD* and *$OLDPWD*, respectively.

In addition, tilde substitution is attempted when the value of a "variable assignment" begins with a ~.

Example The command

```
cat ~/.profile
```

allows you to edit the *.profile* file in your login directory from any location in your file tree.

2.3.13 Command substitution

There are two ways of substituting the standard output of a command for a part of a word or a full word. In the first (new) form, the command is enclosed in parentheses and preceded by a dollar sign: *$(...)*. In the second (old) form, the command is enclosed within backquotes: `` `...` ``. If the second form is used, the string between the backquotes is processed for special quoting characters before the command is executed (see the section "Quoting metacharacters" on page 55). Trailing newlines are removed for both forms.

The command substitution *$(cat file)* can be replaced by the equivalent but faster *$(<file)*. Command substitutions on built-in commands which do not perform I/O redirection are carried out without a separate process being spawned.

Example The following command can be used to edit all the files in a directory which have names ending in *.c* and contain the string *include*:

```
for name in $( grep -l include *.c )
  do
      edt $name
  done
```

*grep -l include *.c* scans all *.c* files for the string *include*. The *-l* option tells *grep* to list the names of all the files in which it finds the string.

An arithmetic expression enclosed in double parentheses and preceded by a dollar sign, i.e. *$((...))*, is replaced by the value of the arithmetic expression within the double parentheses.

Example This command will print the second-last parameter in a shell script:

```
eval print \$$(( $#-1 ))
```

2.3.14 POSIX shell variables and parameter substitution

A parameter is an identifier, one or more digits, or any of the following characters:

* @ # ? - $!

A variable (a parameter denoted by an identifier) has a value and zero or more attributes. Variables can be assigned values and attributes with the built-in *typeset* command. The attributes supported by the POSIX shell are described under *typeset*. Exported parameters pass their values and attributes to the environment.

The POSIX shell supports one-dimensional arrays. An element of an array variable is referenced by a subscript. A subscript is denoted by a left square bracket [, followed by an arithmetic expression (see the section “Arithmetic evaluation” on page 56), followed by a right square bracket].

To assign values to an array, you can use the built-in *set* command as follows:
set -A name value...
The value of all subscripts must be in the permissible range. Arrays need not be declared; any reference to a variable with a valid subscript is legal, and an array will be created if necessary. Referencing an array without a subscript is equivalent to referencing element zero.

name=value[␣name=value]...

The value of a variable may be assigned in this form. If the integer attribute is set for a variable, its value can be used for arithmetic evaluations. Positional parameters (denoted by a number) may be assigned values with the built-in *set* command. Parameter *$0* is set from argument zero when the shell is invoked.

${parameter**}**

The dollar sign $ is used to introduce substitutable parameters. The POSIX shell reads all the characters from *${* to the matching *}* as part of the same word even if it contains braces or metacharacters. The value, if any, of the parameter is substituted. The braces are required when *parameter* is followed by a letter, digit, or underscore that is not to be interpreted as part of its name, or when a variable is subscripted. If *parameter* is one or more digits, then it is a positional parameter. A positional parameter with more than one digit must be enclosed in braces.

If *parameter* is defined by the character *** or *@*, then all the positional parameters, starting with *$1*, are substituted. The first character of the *IFS* variable is used as the field separator (see below). If an array identifier with the subscript *** or *@* is used, the value for each of the elements is substituted (separated by the same field separator character).

${#parameter**}**

If *parameter* is *** or *@*, the number of positional parameters is substituted. Otherwise, the length of the value of *parameter* is substituted.

${#identifier[*]**}**
The number of elements in the array *identifier* is substituted.

${parameter**:-**word**}**
If *parameter* is set and is non-null, its value is substituted; otherwise, *word* is substituted.

${parameter**:=**word**}**
If *parameter* is not set or is null, then it is set to *word*. The value of the parameter is then substituted.
Positional parameters may not be assigned values in this way.

${parameter**:?**word**}**
If *parameter* is set and is non-null, its value is substituted; otherwise, *word* is printed and the shell exits. If *word* is omitted, a standard message is printed.

${parameter**:+**word**}**
If *parameter* is set and is non-null, *word* is substituted; otherwise, the null string is substituted.

${parameter**#**pattern**}**
${parameter**##**pattern**}**
If the POSIX shell *pattern* matches the beginning of the value of *parameter*, then the value of this substitution is the value of *parameter* with the matched portion deleted; otherwise, the value of *parameter* is substituted. In the first form, the smallest matching pattern is deleted; in the second form, the largest matching pattern is deleted.

${parameter**%**pattern**}**
${parameter**%%**pattern**}**
If the POSIX shell *pattern* matches the end of the value of *parameter*, then the value of this substitution is the value of *parameter* with the matched portion deleted; otherwise, the value of *parameter* is substituted. In the first form, the smallest matching pattern is deleted; in the second form, the largest matching pattern is deleted.

In the previous 8 substitutions, *word* is not evaluated unless it is to be used as the substituted string.

Example

pwd is only executed if *dir* is not set or is equal to the null string.

```
echo ${dir:-$(pwd)}
```

If the colon is omitted from the above expressions, the POSIX shell only checks whether or not *parameter* is set; it does not check whether it is equal to the null string.

The following parameters are automatically set by the POSIX shell:

The number of positional parameters (in decimal).

- All options supplied to the POSIX shell on invocation or by the *set* command.

? The exit status returned by the last executed command.

$ The process ID of the current POSIX shell.

_ Initially, the value of _ (underscore) is an absolute path name of the POSIX shell or script being executed as passed in the environment. Thereafter, it is always assigned the last argument of the previous command. This parameter is not set for commands which run asynchronously. The underscore parameter is also used to hold the name of the matching *MAIL* file when checking for mail.

Example

The *tail* command uses *$_* to access the last file of the preceding *cat* command.

```
cat /usr/tmp/mydir/xyz* > all
tail $_
```

! The process number of the last command invoked as a background process.

ERRNO
The value of *errno* as set by the most recently failed system call. This value is system-dependent and is intended for debugging purposes.

LINENO
The line number of the current line within the script or function being executed.

OLDPWD
The previous working directory set by the *cd* command.

OPTARG
The value of the last option argument processed by the built-in *getopts* command.

OPTIND
The index of the last option argument processed by the built-in *getopts* command.

PPID
The process number of the parent of the current POSIX shell.

PWD
The present working directory set by the *cd* command.

RANDOM
Each time this variable is referenced, a random integer, uniformly distributed between 0 and 32767, is generated. You can initialize the sequence of random numbers by assigning a numeric value to *RANDOM*.

REPLY
: This variable is set by the *select* statement and by the built-in *read* command when no arguments are supplied.

SECONDS
: Each time this variable is referenced, the number of seconds since the invocation of the POSIX shell is returned. If this variable is assigned a value, the value returned upon reference will be the value that was assigned plus the number of seconds since the assignment.

The following variables are used by the POSIX shell:

CDPATH
: The search path for the *cd* command.

COLUMNS
: If this variable is set, then its value is used to define the width of the editing window when the POSIX shell is in edit mode as well as for outputting the *select* list. This variable is of use when the POSIX shell is accessed via *rlogin*.

EDITOR
: If the value of this variable ends with *vi* and if the variable *VISUAL* is not set then the corresponding option is set (see *set*). This variable is of use when the POSIX shell is accessed via *rlogin*.

ENV
: If this variable is set then it contains the path name of the procedure which is executed when the POSIX shell is called. This procedure is mostly used for function and alias definitions. The value of this variable is used to perform parameter substitution for file name generation.

FCEDIT
: The name of the standard editor for the built-in *fc* command. The only value which is currently permissible for this variable is *edt*.

FPATH
: The search path for function definitions. This path is used when a function having the attribute *-u* is accessed and no command is found. If an executable file is found then it is read and executed in the current environment.

HISTFILE
: If this variable is set when the POSIX shell is invoked, its value is the path name of the file that will be used to store the command history (see the section “Command re-entry” on page 65).

HISTSIZE
: If this variable is set when the POSIX shell is invoked, the shell will remember the commands you enter (command history). The number of previously entered commands that are accessible by this shell will be greater than or equal to the given number. The default is 128.

HOME
: The default argument (home directory) for the *cd* command.

IFS
: The POSIX shell's internal field separator, used to separate command words which result from command or parameter substitution and to separate words with the built-in *read* command. The value of *IFS* is normally set to space, tab, and newline. The first character of the *IFS* variable is used to separate arguments in *"$*"* substitutions (see the section "Quoting metacharacters" on page 55).

IO_CONVERSION
: If this variable is set to YES, and if POSIX commands (e.g. awk, cat, grep etc.) are being used to access files in a (mounted) ASCII file system, then conversion is performed automatically.

LINES
: If this variable is set, its value is to determine the column length for printing *select* lists. *select* lists will print vertically until about two-thirds of *LINES* lines are filled.

MAIL
: If this variable is set to the name of a *mail* file and the *MAILPATH* variable is not set, the shell informs you of the arrival of mail in the specified file.

MAILCHECK
: The value of this variable specifies how often (in seconds) the POSIX shell should check for changes in the modification time of any of the files specified by the *MAILPATH* or *MAIL* variables. The default value for *MAILCHECK* is 600 seconds. When the specified time has elapsed, the POSIX shell checks the mail files before issuing the next prompt.

MAILPATH
: A colon-separated list of file names. If this variable is set, the shell informs you of any modifications to the specified files that have occurred within the last *MAILCHECK* seconds. Each file name may be followed in the list by a question mark and a message that is to be printed. The message will undergo parameter substitution, with the variable *$_* defined as the name of the file that has changed. The default message is: "*you have mail in $_*".

PATH
: The search path for commands (see *Execution*). You may not change the value of this variable if you are using a restricted POSIX shell.

PS1
: The value of this variable is expanded for parameter substitution in order to define the prompt used by the POSIX shell. The default value is "*$*␣" or, in the case of privileged users, "#␣". The use of an exclamation mark *!* in the prompt is replaced by the command number (see the section "Command re-entry" on page 65).

PS2
: Secondary prompt string displayed by the POSIX shell when further input is expected after a newline character. The default is ">␣".

PS3
: Prompt string used within a *select* loop to prompt for the desired number. The default is "*#?*␣".

PS4
: The value of this variable is expanded for parameter substitution and precedes each line of an execution trace. The default execution trace prompt is "+␣".

SHELL
: The path name of the POSIX shell is stored in the environment. When called, the POSIX shell acts as a restricted shell if the pattern **r*sh** matches the file name component of the path name (see section "basename return non-directory portion of path name" on page 151).

TMOUT
: If *TMOUT* is set to a value greater than zero, the POSIX shell will automatically terminate if a command is not entered within the prescribed number of seconds after issuing the *PS1* prompt.
(Caution: the POSIX shell may have been compiled with a maximum bound for this value which cannot be exceeded).

VISUAL
: If the value of this variable ends with *vi* then the corresponding option is se (see section "Built-in POSIX commands" on page 36). This variable is of use when the POSIX shell is accessed via *rlogin*.

The POSIX shell assigns default values to the following variables:
PATH, PS1, PS2, PS3, PS4, MAILCHECK, TMOUT and *IFS.*

The variables *HOME, MAIL* and *SHELL* are set by the command */START-POSIX-SHELL*.

2.3.15 Blank interpretation

After parameter and command substitution, the results of substitutions are scanned for field separator characters and split into distinct arguments where such characters are found. Explicit null arguments (e.g. *""* or *''*) are retained. Implicit null arguments (those resulting from parameters that have no values) are removed.

2.3.16 File name generation

After these various substitutions, each word is examined for the presence of an asterisk *, question mark ? or left-hand square bracket [. However, this examination is only performed if the option *-f* (see *set*) has not been set. If one of these characters is found in a word then the word is considered as a pattern. The word is then replaced by lexicographically sorted file names which match the pattern. If no matching file name is found for the pattern then the word is retained unchanged.

If you use patterns for file name generation you must pay special attention to the characters period . and slash /: a period at the start of a file name or immediately after a /, as well as / itself must match explicitly. The special handling of these characters does not apply to other substitutions.

***** matches any string, including the null string.

? matches any single character. (Slashes and dots are treated specially; see above.)

[...]
matches any one of the characters enclosed within the square brackets.
A pair of characters separated by a dash (-) matches any character lexically between the pair, inclusive. A dash can be included in the set of characters to be matched as long as it is the first or last character.
If the first character following the left bracket is a an exclamation point, the enclosed set of characters is negated: any character not enclosed is matched.

A *pattern list* is a list of one or more patterns separated from each other by a | (vertical bar). Composite patterns can be formed with one or more of the following constructs:

?(pattern-list**)**
Optionally matches any one occurrence of the given patterns.

***(**pattern-list**)**
Matches zero or more occurrences of the given patterns.

+(pattern-list**)**
Matches one or more occurrences of the given patterns.

@(pattern-list**)**
Matches exactly one of the given patterns.

!(pattern-list**)**
Matches anything, except one of the given patterns.

2.3.17 Quoting metacharacters

A metacharacter is one of the following characters:
; & ( ) | < > space tab newline-character

A *blank* is either a tab or space. An identifier consists of a string of letters, digits and the underscore character _. This string must begin with a letter or underscore. Identifiers are used as names for functions and variables. A word is a string of characters which are separated by one or more metacharacters. Each of the metacharacters has a special meaning for the POSIX shell and is used as a word separator unless quoted.

Quote	Meaning
\	A metacharacter preceded by a backslash \ is quoted and therefore stands for itself. The pair \new-line-character is ignored or deleted by the POSIX shell.
’...’	All characters which are enclosed in apostrophes ’...’ are quoted. However, a pair of apostrophes may not enclose a single apostrophe.
"..."	Strings which are enclosed in quotes "..." are subject to parameter and command substitution. When accompanied by a backslash they can be used to quote the backslash \, backquote `, quotation mark " and dollar sign $. $* and $@ mean the same thing provided that they are not enclosed in quotes or used as a file name or as a value for variable assignment. Their meanings differ if they are used alone in quotes or if they used as command arguments. "$*" corresponds to "$1␣$2␣..." if ␣ is the value of the first character of the variable *IFS*, and "$@" stands for "$1"␣"$2"␣..., that is to say that the individual call arguments are retained.
`...`	Strings which are enclosed in backquotes `...` can be quoted by using the backslash \, backquotes ` and the dollar sign $. If the whole string needs to be enclosed in quotation marks "...`...`..." you can use the backslash \ to quote the quotation mark ".

The special meaning of reserved words or aliases can be removed by quoting any character of the reserved word. However, it is also sufficient to entire a single "\" before the name in order to quote the entire word (e.g. "\while").

The recognition of function names or built-in command names cannot be suppressed in this way.

2.3.18 Arithmetic evaluation

The built-in *let* command provides a mechanism for performing integer arithmetic. Evaluations are performed using *long* arithmetic. Constants are of the form [*base#*]*n*, where *base* is a decimal number between two and thirty-six representing the arithmetic base: *n* is a number in that base. If *base#* is omitted, base 10 is used.

An arithmetic expression uses much the same syntax, precedence, and associativity as the C language. All the integral operators, other than ++, --, *?, :* and the comma are supported. Variables can be referenced by name within an arithmetic expression without using the parameter substitution syntax (the $ character). When a variable is referenced, its value is evaluated as an arithmetic expression.

An internal integer representation of a variable can be specified as an attribute with the *-i* option of the built-in *typeset* command. Arithmetic evaluation is performed on the value of each assignment to a variable with the *-i* attribute. If you do not specify an arithmetic base, the first assignment to the variable determines the arithmetic base. This base is used when parameter substitution is performed.

Since many of the arithmetic operators must be quoted for the POSIX shell, an alternative form of the *let* command is provided. For any command which begins with a double left parenthesis *((*, all the characters until a matching double right parenthesis *))* are treated as a quoted expression. Thus *((a=a+b))* is equivalent to *let "a=a+b"*.

2.3.19 Conditional expressions

A conditional expression can be used to test attributes of files and to compare algebraic expressions and strings. In the POSIX shell, conditional expressions are specified as part of a compound command of the form *[[...]]*. Blank interpretation and file name generation are not performed on the words of the conditional expression between *[[* and *]]*. Each conditional expression can be constructed from one or more of the following unary or binary expressions:

In each of the expressions below, if *file* is of the form */dev/fd/n*, where *fd* is the file descriptor and *n* is an integer, then the test is applied to the open file whose descriptor number is *n*.

-a␣file
(access) True if *file* exists.

-b␣file
(block device) True if *file* exists and is a block special file.

-c␣file
(character device) True if *file* exists and is a character special file.

-d␣file
(directory) True if *file* exists and is a directory.

-f␣file
(file) True if *file* exists and is an ordinary file.

-g␣file
(group ID) True if *file* exists and has its set-group-ID bit set.

-k␣file
(stic**k**y) True if *file* exists and is has its sticky bit set.

-o␣option
(option) True if the named *option* is turned on (*option* can be set with *set*). You must use the full option name, e.g. *errexit*.

-p␣file
(pipe) True if *file* exists and is a FIFO special file or a pipe.

-r␣file
(read) True if *file* exists and the current process has read permission for it.

-s␣file
(size) True if *file* exists and has a size greater than zero.

-t␣filedes
(terminal) True if file descriptor number *fildes* is open and is associated with a terminal.

-u␣file
(user ID) True if *file* exists and has its set-user-ID bit set.

-w␣file
: (write) True if *file* exists and the current process has write permission for it.

-x␣file
: (execute) True if *file* exists and the current process has execute permission for it. If *file* exists and is a directory, then the current process must have permission to search in the directory.

-G␣file
: (group) True if *file* exists and its group matches the effective group ID of the current process.

-L␣file
: (symbolic link) True if *file* exists and is a symbolic link.

-O␣file
: (owner) True if *file* exists and is owned by the effective user ID of the current process.

-S␣file
: (socket) True if *file* exists and is a socket.

file1␣**-nt**␣file2
: (newer than) True if *file1* exists and is newer than *file2*.

file1␣**-ot**␣file2
: (older than) True if *file1* exists and is older than *file2*.

file1␣**-ef**␣file2
: (equal file) True if *file1* and *file2* exist and are links to the same file.

String attributes and comparisons

-n␣string
: (non-zero) True if *string* exists and is not a null string, i.e. if the length of the string is greater than 0.

-z␣string
: (zero) True if the specified *string* is a null string, i.e. if the length of the string is 0.

string␣**=**␣pattern
: True if *string* matches *pattern*.

string␣**!=**␣pattern
: True if *string* does not match *pattern*.

string1␣**<**␣string2
: True if *string1* comes before *string2* in the EBCDIC collating sequence.

string1␣**>**␣string2
: True if *string1* comes after *string2* based in the EBCDIC collating sequence.

Algebraic comparisons between integers

expr1␣**-eq**␣expr2
: (equal) True if *expr1* is equal to *expr2*.

expr1␣**-ne**␣expr2
: (not equal) True if *expr1* is not equal to *expr2*.

expr1␣**-lt**␣expr2
: (less than) True if *expr1* is less than *expr2*.

expr1␣**-gt**␣expr2
: (greater than) True if *expr1* is greater than *expr2*.

expr1␣**-le**␣expr2
: (less than or equal) True if *expr1* is less than or equal to *expr2*.

expr1␣**-ge**␣expr2
: (greater than or equal) True if *expr1* is greater than or equal to *expr2*.

Negated and compound expressions

A compound expression can be constructed from the above expressions with any of the following mechanisms. The mechanisms are listed in decreasing order of precedence:

(␣expression␣**)**
: True if *expression* is true. The enclosed *expression* can be a single expression or a group of concatenated expressions.

!␣expression
: Negation: true if *expression* is false.

expression1␣**&&**␣expression2
: Logical AND: True if *expression1* and *expression2* are both true.

expression1␣**||**␣expression2
: Logical OR: True if either *expression1* or *expression2* is true.

2.3.20 Environment

The environment of a process consists of a list of *name=value* pairs that is passed to an executed program in the same way as a normal argument list. The names must be POSIX shell-style identifiers; the values must be character strings (including the null string).

The POSIX shell interacts with the environment in several ways. On invocation, the shell scans the environment and creates a variable for each name found, giving it the corresponding value and marking it for export. Executed commands inherit the environment. If the user modifies the values of these variables or creates new ones using the *export* or *typeset -x* commands, they become part of the environment. The environment seen by any executed command is thus composed of any *name=value* pairs originally inherited by the shell, whose values may be modified by the current shell, plus any additions that have been marked in *export* or *typeset -x* commands.

The environment for any simple command or function may be augmented by prefixing it with one or more variable assignments. A variable assignment argument is a word of the form *identifier=value*.

command sees the following lines as equivalent:

```
TERM=450 command arguments
( export TERM ; TERM=450 ; command arguments )
```

If the *-k* option was set on POSIX shell invocation or with the built-in *set* command, all variable assignment arguments are exported to the environment, even if they occur after the command name.

2.3.21 Functions

The reserved word *function* (see section “Compound commands” on page 41) is used to define POSIX shell functions. Shell functions are read in and stored internally. Alias names are resolved when the function is read. Functions are executed like commands, with arguments passed as positional parameters (see section “Execution” on page 64).

Functions execute in the same process as the caller and share all open files and the present working directory with the caller.
Traps caught by the caller are reset to their default action inside the function. A trap condition that is not caught or ignored by the function causes the function to terminate; the condition is then passed on to the caller. A trap on *EXIT* set inside a function is executed after completion of the function in the environment of the caller.

Variables are usually shared between the calling program and the function. However, the built-in *typeset* command can be used within a function to define local variables whose scope includes the current function and all functions it calls.

The built-in *return* command is used to return from function calls. Errors that occur within functions return control to the caller.

Function identifiers or names can be listed with the *-f* or *+f* option of the built-in *typeset* command. The text of functions may also be listed with the *-f* option. Functions can be undefined with the *-f* option of the built-in *unset* command.
Functions are usually not accessible when the POSIX shell executes a shell script.

The *-xf* option of the *typeset* command allows a function to be marked for export. These functions can then be used in scripts that are executed without a separate invocation of the POSIX shell. Functions that need to be defined across separate invocations of the shell should be specified in the *ENV* file with the *-xf* option of *typeset*.

Example The following function named *lh* lists the top two levels of the directory hierarchy in which you are located or which you specify as an argument. Regular files are ignored as arguments.

```
function lh
{
  for i in ${*:-.}
  do
     if [[ -d $i ]]
     then
        print $i:
        cd $i
        ls -CF $( ls )
        cd - >/dev/null
     fi
  done
}
```

The *for* loop processes each of the specified arguments in succession. If you have not specified an argument, *$** is set to the current directory (.).
If a directory is present, its name and contents are listed as follows: *cd $i* switches to the directory to be listed; *$(ls)* is replaced by the content of the directory *$i*, and *ls -CF directory_list* lists the files, followed by the contents of the directories, with flags to indicate executables and directories. The subsequent *cd* command silently returns to the initial directory (before the first *cd $i*).

2.3.22 Jobs

If the *monitor* option of the built-in *set* command is turned on (*set -m*), an interactive POSIX shell associates a job with each pipeline. It maintains a table of current jobs, which you can written to standard output with the built-in *jobs* command, and assigns them small integer numbers. When a job is started asynchronously with *&*, the shell prints a line of the form:

```
[1] 1234
```

indicating that the job which was started asynchronously was job number 1 and had one (top-level) process, whose process ID was 1234.

If you want to start other processes while an existing process is being executed then you simply need to press the key combination CTRL Z (or @@z at block-mode terminals). This causes a STOP signal to be sent to the process which is currently running. The POSIX shell then indicates that the job has been stopped and issues a prompt. You may then modify the status of this job: you can use the built-in command *bg* (background) to run the job in background mode, leave it stopped while you execute other commands or retrieve it to the foreground using the built-in command *fg* (foreground).
CTRL Z (or @@z) has no effect on built-in commands, but only on commands which are executed in a forked process.

There are several ways to reference jobs in the shell. A job can be referenced by the process ID of any process or by one of the following expressions:

%number
: the job with the given job *number*.

%string
: any job whose command line begins with *string*.

%?string
: any job whose command line includes *string*.

%%
  the current job.

%+
  equivalent to *%%*

%-
  the previous job.

The POSIX shell registers changes in the status of jobs immediately. It normally informs you whenever a job becomes blocked so that no further progress is possible, but only just before it prints a prompt. This is done so that it does not otherwise disturb your work.

When the *monitor* option is turned on, each background job that completes triggers any trap set for *CHLD*.

If you try to exit the POSIX shell while jobs are running in the background or stopped, you will be warned with a message.

You may then use the *jobs* command to obtain an overview of the current situation. If you do this or immediately try to exit again, the shell will not warn you a second time, and the stopped jobs will be terminated.

2.3.23 Signals

The *INT* and *QUIT* signals for an invoked background command (*&*) are ignored if the job *monitor* option is not active. Otherwise, signals have the values inherited by the POSIX shell from its parent (see also the built-in *trap* command).

2.3.24 Execution

Each time a command is executed, the substitutions described above are carried out in the following order:

- quoting
- parameter substitution
- tilde substitution
- aliasing
- file name generation
- I/O redirection
- command substitution

If the command name matches the name of one of the built-in commands, it is executed within the current POSIX shell process. Next, the command name is checked to see if it matches one of the user-defined functions. If it does, the positional parameters are saved and then reset to the arguments of the function call. When the function completes or executes a built-in *return* command, the positional parameter list is restored and any trap set on *EXIT* within the function is executed. The exit status is that of the last command executed in the function. A function is also executed in the current POSIX shell process. If a command name is not a built-in command or a user-defined function, a process is spawned and an attempt is made to execute the command via the system call *exec*.

The shell variable *PATH* defines the search path for the directory containing the command. Alternative directory names are separated by a colon (:). The default path is */usr/bin:* (specifying */usr/bin* and the current directory in that order). The current directory can be specified by two or more adjacent colons, or by a colon at the beginning or end of the path list. If the command name contains a slash, the search path is not used. Otherwise, each directory in the path is searched for an executable file. If the file has execute permission but is not a directory or an *a.out* file, it is assumed to contain a shell script. A subshell is spawned to read it. Any non-exported aliases, functions and variables are removed in this case. A parenthesized command is executed in a sub-shell without removing non-exported quantities.

2.3.25 Command re-entry

The text of the last *HISTSIZE* commands entered from a terminal is saved in a *history* file. The default value for *HISTSIZE* is 128. If the *HISTFILE* variable is not set or if the file denoted by its value is not writable, the file *$HOME/.sh_history* is used to save the command history.

A POSIX shell can access the commands of all interactive shells which use the same history file. The built-in *fc* command can be used to list or edit a portion of this file. The portion of the file to be edited or listed can be selected by number or by giving the first character or characters of the command. A single command or range of commands may be specified.

If you do not specify an editor program as an argument to *fc*, the value of the variable *FCEDIT* is used. If *FCEDIT* is not defined, */usr/bin/ed* is used. The edited commands are printed and re-executed when you leave the editor.

The editor name - (if FCEDIT=-) is used to skip the editing phase and to directly re-execute the command. In this case a substitution variable of the form *old=new* can be used to modify the command before execution. For example, if *r* is aliased to *fc -e -*, then typing *r bad=good c* will re-execute the most recent command which starts with the letter *c*, replacing the first occurrence of the string *bad* with the string *good*.

2.4 Command summary

The summaries below provide

- an overview of all POSIX commands in the POSIX shell
- an overview according to functions

There are also commands which can be entered from within the POSIX shell but which are not described in this manual, for example the commands *cc* or *c89* which are used to call a compiler (for a description see the “C/C++ (BS2000/OSD)” manual [5]).

2.4.1 Summary of all commands of the POSIX shell

The POSIX shell comprises the basic shell (POSIX-BC) and the extended shell (POSIX-SH). It contains the POSIX commands found in the following table.

Entries in the *Type* column describe the command type:

bin	separate module
blt	built-in in the shell Apart from these commands, there are also some additional built-in commands (such as *for*, *while*, *if*, *break*, etc.), which are described in the section “Compound commands” on page 41ff.
scr	script

The column *LFS* describes whether the commands can process large POSIX files:

A	(large file **a**ware): uses large files correctly
S	(large file **s**afe): recognizes large files but rejects processing in a defined manner

Name	Location	Type	Delivery	Description	LFS
alias	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Define or display alias	
ar	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Administer libraries	S
asa	/usr/bin	bin	SINLIB.POSIX-SH	Convert control characters for positioning	
at	/usr/bin	bin	SINLIB.POSIX-SH	Execute commands at a later date	
awk	/usr/bin	bin	SINLIB.POSIX-SH	Programmable processing of text files	A
basename	/usr/bin	scr	SINLIB.POSIX-BC.SHELL	Separate file name from path	
batch	/usr/bin	scr	SINLIB.POSIX-BC.SHELL	Execute commands at a later date	
bc	/usr/bin	bin	SINLIB.POSIX-SH	Arithmetic language	
bg	-	blt	SINLIB.POSIX-BC.SHELL	Process jobs in background	
bs2cmd	-	blt	SINLIB.POSIX-BC.SHELL	Execute BS2000 command	
bs2cp	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Copy BS2000 files	A
bs2do	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Calling BS2000 procedures from POSIX	
bs2file	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Define file attributes for BS2000 files	
bs2lp	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Print files	
bs2pkey	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Assign P keys	
cal	/usr/bin	bin	SINLIB.POSIX-SH	Display calendar	
cancel	/usr/bin	bin	SINLIB.POSIX-SH	Delete print jobs	
cat	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Concatenate and output files	A
cd	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Change current directory	A
chgrp	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Change group number of file	A
chmod	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Change access rights	A
chown	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Change owner of file	A
cksum	/usr/bin	bin	SINLIB.POSIX-SH	Write checksums and file sizes	A
cmp	/usr/bin	bin	SINLIB.POSIX-SH	Compare files character by character	A
comm	/usr/bin	bin	SINLIB.POSIX-SH	Search for identical lines in two sorted files	S
command	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Execute simple command	
compress	/usr/bin	bin	SINLIB.POSIX-SH	Compress files	A
cp	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Copy files	A
cp	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Copy files	A
cpio	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Swap files and directories in and out	A
crontab	/usr/bin	bin	SINLIB.POSIX-SH	Execute commands at regular intervals	
csplit	/usr/bin	bin	SINLIB.POSIX-SH	Split file according to specific criteria	S
cut	/usr/bin	bin	SINLIB.POSIX-SH	Cut bytes, characters or fields from the lines of a file	S
date	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Display time and date	
dd	/sbin	bin	SINLIB.POSIX-SH	Copy and convert files	S
debug	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Test POSIX programs	

Name	Location	Type	Delivery	Description	LFS
df	/sbin	bin	SINLIB.POSIX-BC.SHELL	Display number of free and occupied disk blocks	A
diff	/usr/bin	bin	SINLIB.POSIX-SH	Compare files line by line	A
dirname	/usr/bin	scr	SINLIB.POSIX-BC.SHELL	Separate path prefix from file name	
du	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Display occupied memory space	A
dumpfs	/sbin	bin	SINLIB.POSIX-BC.ROOT	Display internal file system information	
echo	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Output call arguments	
ed	/sbin	bin	SINLIB.POSIX-SH	Line editor in interactive mode	
edt	-	blt	SINLIB.POSIX-BC.SHELL	Call BS2000 file editor EDT	S
edtu	-	blt	SINLIB.POSIX-BC.SHELL	Call BS2000 file editor EDT	S
egrep	/usr/bin	bin	SINLIB.POSIX-SH	Find pattern	S
env	/usr/bin	bin	SINLIB.POSIX-SH	Change environment when executing commands	
eval	-	blt	SINLIB.POSIX-BC.SHELL	Process call arguments and execute them as commands	
ex	/usr/bin	bin	SINLIB.POSIX-SH	Line editor	
exec	-	blt	SINLIB.POSIX-BC.SHELL	Overlay current shell	
exit	-	blt	SINLIB.POSIX-BC.SHELL	Terminate shell procedure	
expand	/usr/bin	bin	SINLIB.POSIX-SH	Convert tab character to blanks	S
export	-	blt	SINLIB.POSIX-BC.SHELL	Export shell variables	
expr	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Evaluate expressions	
expr	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Evaluate expressions	
false	/usr/bin	alias+scr	SINLIB.POSIX-BC.SHELL	Return end status not equal to 0	
fc	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Access to history file	
fg	-	blt	SINLIB.POSIX-BC.SHELL	Bring jobs into foreground	
fgrep	/usr/bin	bin	SINLIB.POSIX-SH	Find strings	S
file	/usr/bin	bin	SINLIB.POSIX-SH	Define file type	A
find	/usr/bin	bin	SINLIB.POSIX-SH	Search directories	A
fold	/usr/bin	bin	SINLIB.POSIX-SH	Split up long lines	S
fsck	/sbin	bin	SINLIB.POSIX-BC.ROOT	Check consistency of file system and correct interactively with user	
fsexpand	/sbin	bin	SINLIB.POSIX-BC.ROOT	Expand existing file systems	A
ftyp	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Define types of file processing (BS2000)	
fuser	/usr/sbin	bin	SINLIB.POSIX-BC.ROOT	Display file users	
gencat	/usr/bin	bin	SINLIB.POSIX-SH	Generate binary coded message catalog	
genso	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Generate shared object	
getconf	/usr/bin	bin	SINLIB.POSIX-SH	Call up configuration values	A
getopts	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Search procedure arguments for options	

Name	Location	Type	Delivery	Description	LFS
grep	/sbin	bin	SINLIB.POSIX-BC.SHELL	Get pattern	A
hash	/usr/bin	alias+scr	SINLIB.POSIX-BC.SHELL	Process shell hash table	
hd	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Hex dump	A
head	/usr/bin	bin	SINLIB.POSIX-SH	Output start of a file	A
iconv	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Convert code	A
id	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Output user identification	
inetd	/usr/sbin	bin	SINLIB.POSIX-BC.ROOT	Daemon for internet services	
info	/sbin	bin	SINLIB.POSIX-BC.ROOT	Online diagnostic tool	
ipcrm	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Remove setup for interprocess communications	
ipcs	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Output state of interprocess communications setup	
jobs	-	blt	SINLIB.POSIX-BC.SHELL	Output job information	
join	/usr/bin	bin	SINLIB.POSIX-SH	Merge two files according to matching fields	A
kill	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Send signals to processes	
last	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Display last logged in users	
let	-	blt	SINLIB.POSIX-BC.SHELL	Integer arithmetic	
lex	/usr/bin	bin	SINLIB.POSIX-SH	Create scanner	
ln	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Enter reference to file	A
locale	/usr/bin	bin	SINLIB.POSIX-SH	Call up information on the locale	
localedef	/usr/bin	bin	SINLIB.POSIX-SH	Define locale	
logger	/usr/bin	bin	SINLIB.POSIX-SH	Log messages	
logname	/usr/bin	bin	SINLIB.POSIX-SH	Query login name	
logrotate	/usr/sbin	scr	SINLIB.POSIX-BC.ROOT	Change logging files of the syslog daemon	S
lp	/usr/bin	bin	SINLIB.POSIX-SH	Print out files	
lpstat	/usr/bin	bin	SINLIB.POSIX-SH	Output information on print jobs	
ls	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Output information on directories and files	A
mailx	/usr/bin	bin	SINLIB.POSIX-SH	Interactively process messages	
make	/usr/bin	bin	SINLIB.POSIX-SH	Manage groups of files	
man	/usr/bin	scr	SINLIB.POSIX-SH	Use online documentation	
mesg	/usr/bin	bin	SINLIB.POSIX-SH	Forbid or permit receipt of messages	
mkdir	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Create directory	
mkfifo	/usr/bin	bin	SINLIB.POSIX-SH	Create FIFO	A
mkfs	/sbin	bin	SINLIB.POSIX-BC.ROOT	Create file system	
mknod	/sbin	bin	SINLIB.POSIX-BC.ROOT	Create device file	A
more	/usr/bin	bin	SINLIB.POSIX-SH	Control screen output	A
mount	/sbin	bin	SINLIB.POSIX-BC.ROOT	Mount file systems and remote resources	
mountall	/sbin	scr	SINLIB.POSIX-BC.ROOT	Mount two or more file systems	

Name	Location	Type	Delivery	Description	LFS
mv	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Move or rename files	A
newgrp	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Modify group membership	
nice	/usr/bin	bin	SINLIB.POSIX-SH	Change priority of commands	
nl	/usr/bin	bin	SINLIB.POSIX-SH	Number text lines	S
nm	/usr/bin	bin	SINLIB.POSIX-SH	Output an object file symbol table	
nohup	/usr/bin	bin	SINLIB.POSIX-SH	Execute command and ignore signals	
od	/usr/bin	bin	SINLIB.POSIX-SH	Output file contents in octal format	S
paste	/usr/bin	bin	SINLIB.POSIX-SH	Merge lines	S
patch	/usr/bin	bin	SINLIB.POSIX-SH	Use difference report	
pathchk	/usr/bin	bin	SINLIB.POSIX-SH	Check path names	
pax	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Process portable archives	A
pdbl	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Administer private POSIX loader	
ping	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Send echo requests to network hosts	
pkginfo	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Display information about software packages	
posdbl	/usr/sbin	bin	SINLIB.POSIX-BC.ROOT	Administer POSIX loader	
pr	/usr/bin	bin	SINLIB.POSIX-SH	Format files and output to standard output	
print	-	blt	SINLIB.POSIX-BC.SHELL	Output mechanism similar to echo	
printf	/usr/bin	blt+bin	SINLIB.POSIX-SH	Formatted output	
ps	/sbin	bin	SINLIB.POSIX-BC.SHELL	Query process data	
pwd	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Output path name of current working directory	
rcp	/usr/bin	bin	SINLIB.POSIX-BC.INET	Copy files from or to a remote computer	A
read	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Read arguments of standard input and assign shell variables	
readonly	-	blt	SINLIB.POSIX-BC.SHELL	Protect shell variables	
renice	/usr/bin	bin	SINLIB.POSIX-SH	Change priority of current processes	
rm	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Delete files	
rmdir	/sbin	blt+bin	SINLIB.POSIX-BC.SHELL	Delete directories	A
rmpart	/sbin	bin	SINLIB.POSIX-BC.ROOT	Remove partition	
rsh	/usr/bin	bin	SINLIB.POSIX-BC.INET	Execute commands on remote computer	
sed	/usr/bin	bin	SINLIB.POSIX-SH	Editor in procedure mode	
set	-	blt	SINLIB.POSIX-BC.SHELL	Set options or parameters, output variables	
sh	/sbin	bin	SINLIB.POSIX-BC.SHELL	POSIX shell command interpreter and programming language	A
shift	-	blt	SINLIB.POSIX-BC.SHELL	Move values of positional parameters to the left	
sleep	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Temporarily halt processes	
show_pubset_export	/sbin	scr	SINLIB.POSIX-BC.ROOT	Show file systems affected by EXPORT-PUBSET	

Name	Location	Type	Delivery	Description	LFS
sort	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Sort and/or merge files	
split	/usr/bin	bin	SINLIB.POSIX-SH	Distribute file across several files	A
start_bs2fsd	/sbin	scr	SINLIB.POSIX-BC.ROOT	Start copy daemons	
strings	/usr/bin	bin	SINLIB.POSIX-SH	Find printable strings in object or binary files	S
stty	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Output or modify attributes of a data display station	
su	/sbin	bin	SINLIB.POSIX-BC.ROOT	Substitute user ID	
sum	/usr/bin	bin	SINLIB.POSIX-SH	Calculate checksum of a file	A
sync	/sbin	bin	SINLIB.POSIX-BC.ROOT	Write back system cache	
tabs	/usr/bin	bin	SINLIB.POSIX-SH	Set tabulator stops	
tail	/usr/bin	bin	SINLIB.POSIX-SH	Output the last part of a file	A
talk	/usr/bin	bin	SINLIB.POSIX-SH	Talk with another user	
tar	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Archive files	A
tee	/usr/bin	bin	SINLIB.POSIX-SH	Join pipes together and copy input	
test	/usr/bin	blt-scr	SINLIB.POSIX-BC.SHELL	Check conditions	
time	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Measure command runtime	
times	-	blt	SINLIB.POSIX-BC.SHELL	Output total runtime of processes started up to now	
touch	/usr/bin	blt+bin	SINLIB.POSIX-BC.SHELL	Update modification and access times	A
tput	/usr/bin	bin	SINLIB.POSIX-SH	Initialize terminal or query terminfo database	
tr	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Replace or delete character	A
trap	-	blt	SINLIB.POSIX-BC.SHELL	Modify signal handling	
true	/usr/bin	alias+scr	SINLIB.POSIX-BC.SHELL	Return end status 0	
tsort	/usr/bin	bin	SINLIB.POSIX-SH	Sort topologically	
tty	/usr/bin	bin	SINLIB.POSIX-SH	Output path name of current terminal	
type	/usr/bin	alias+scr	SINLIB.POSIX-BC.SHELL	Query command type	
typeset	-	blt	SINLIB.POSIX-BC.SHELL	Set attributes for shell variable	
ulimit	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Limit file size for writing or query current limit	A
umask	/usr/bin	blt-scr	SINLIB.POSIX-BC.SHELL	Output or modify default allocation of access rights	
umount	/sbin	bin	SINLIB.POSIX-BC.ROOT	Unmount file systems and remote resources	
umountall	/sbin	scr	SINLIB.POSIX-BC.ROOT	Unmount two or more file systems	
unalias	/usr/bin	blt-scr	SINLIB.POSIX-BC.SHELL	Delete variables from alias tables	
uname	/sbin	bin	SINLIB.POSIX-BC.SHELL	Output basic data on the current operating system	
uncompress	/usr/bin	bin	SINLIB.POSIX-SH	Uncompress compressed files	A
unexpand	/usr/bin	bin	SINLIB.POSIX-SH	Convert blanks to tab characters	S
uniq	/usr/bin	bin	SINLIB.POSIX-BC.SHELL	Search for repeated lines	
uudecode	/usr/bin	bin	SINLIB.POSIX-SH	Decode file after mailx transfer	
uuencode	/usr/bin	bin	SINLIB.POSIX-SH	Encode file for mailx transfer	

Name	**Location**	**Type**	**Delivery**	**Description**	**LFS**
uuname	/usr/bin	bin	SINLIB.POSIX-SH	List names of system	
usp	/usr/bin	bin	SINLIB.POSIX-BC.ROOT	Dynamic setting of POSIX control parameters	
vi	/usr/bin	bin	SINLIB.POSIX-SH	Screen editor	
wait	/usr/bin	blt+scr	SINLIB.POSIX-BC.SHELL	Wait for termination of background processes	
wc	/usr/bin	bin	SINLIB.POSIX-SH	Count words, characters and lines	A
whence	-	blt	SINLIB.POSIX-BC.SHELL	Command localization	
who	/sbin	bin	SINLIB.POSIX-SH	Show active user IDs	
write	/usr/bin	bin	SINLIB.POSIX-SH	Send message to a user	
xargs	/usr/bin	bin	SINLIB.POSIX-SH	Create argument list(s) and execute command	
yacc	/usr/bin	bin	SINLIB.POSIX-SH	Create parser	
zcat	/usr/bin	bin	SINLIB.POSIX-SH	Output compressed files	A

2.4.2 Command summary according to functions

The following summary indicates the function-specific subdivision of POSIX commands. Since some commands can be allocated to more than one function, it is possible that names may be duplicated. For a detailed description of the commands in alphabetical order please refer to the chapter “Commands” on page 93.

The commands are allocated to the following main functions:

- Command interpreter
- Querying or modifying the user environment
- Managing and processing files and texts
  - outputting
  - processing
  - saving and archiving
  - compressing and restoring to uncompressed state
  - querying and modifying file properties
- modifying and managing the file system
  - modifying the file system
  - managing the file system
- Printing and print management
- Data display terminal
- Editors
- Auxiliary commands for shell procedures
- Reading, converting and outputting characters
- Querying and modifying user properties
- User administration
- Interuser communication
- Calendar functions and dates
- Arithmetic functions
- Compiler commands
- Program testing
- Job management
- Process information
- Process control

- Inter-process communication
- Terminal
- Checking storage availability
- Information on system data
- Online documentation
- Flushing the system buffer
- Calling BS2000 procedures
- Administer POSIX program cache
- Network commands
- NLS commands (Native Language System)

Command interpreter

sh	POSIX shell

Query or modify user environment

cd	change working directory
env	set environment for command execution
fuser	display file users
id	return user identity
last	display last logged in users
logname	display login name
ls	list directory contents
pwd	return working directory name
su	substitute user ID
tty	output path name of current terminal
who	show who is on the system

Managing and processing files and texts

- output

cat	concatenate and print files
hd	hex dump
head	copy the first part of files
more	page through a text file
od	dump files in various formats
pr	prepare files for printing
strings	find printable strings in object or binary files
tail	copy the last part of a file
zcat	display compressed files in expanded form

- process

awk	pattern scanning and processing language
cksum	write file checksums and sizes
cmp	compare two files
comm	select or reject lines common to two sorted files
csplit	context split
cut	cut out selected fields of each line of a file
diff	differential file comparator
edt, edtu	process file with EDT (BS2000)
egrep	search a file with an ERE pattern
fgrep	search a file for a fixed-string pattern
find	find files
fold	filter for folding lines
grep	search a file for a pattern
join	relational database operator
nl	number lines
paste	merge corresponding or subsequent lines of files
patch	use diff list

sort	sort, merge or sequence check text files
split	split a file into pieces
sum	print checksum and block count of a file
tr	transliterate characters
tsort	topological sort
uniq	report or filter out repeated lines in a file
wc	word, line and byte or character count

- save and archive

ar	manage libraries
cpio	copy in and out
dd	convert and copy files
iconv	codeset conversion
nm	convert and copy files
pax	portable archive processing
tar	file archiver

- compressing and restoring to uncompressed state

compress	compress files
uncompress	expand compressed files
zcat	display compressed files in expanded form

- query and modify file properties

chgrp	change file group ownership
chmod	change file modes
chown	change file ownership
file	check type of file
ls	list directory contents
touch	change file access and modification times
umask	get or set the file mode creation mask

Modifying and managing the file system

- modify file system

bs2cp	copy BS2000 files
bs2file	set BS2000 file attributes
cp	copy files
csplit	context split
find	find files
fsexpand	Expand existing file systems
ftyp	determine processing mode for BS2000 files
ln	link files
make	maintain groups of files
mkdir	make directory
mv	move files
rm	remove directory entries
rmdir	remove directories
split	split a file into pieces

- Manage file system

dumpfs	dump file system
fsck	file system check
mkfifo	make FIFO special file
mknod	make an inode
mount	mount a file system
mountall	mount file systems
pathchk	check pathnames
show-pubset_export	show file systems affected by EXPORT-PUBSET
start_bs2fsd	start copy daemons
umount	unmount a file system
umountall	unmount file systems

Printing and print management

asa	interpret carriage-control characters
bs2lp	send files to a printer
cancel	cancel requests to an LP print service
lp	send requests to an LP print service
lpstat	print information about the status of the LP print
pr	prepare files for printing

Editors

ed	interactive line editor
edt, edtu	process file with EDT (BS2000)
ex	command and display editor
sed	stream editor
vi	display editor (visual)

Auxiliary commands for shell procedures

basename	return non-directory portion of path name
dirname	return directory portion of path name
expr	evaluate arguments as an expression
false	return false value
getopts	parse utility options
athchk	check pathnames
sleep	suspend execution for an interval
test	evaluate expression
true	return true value
xargs	construct argument list(s) and execute command
[␣...␣]	evaluate expression

Reading, converting and outputting characters

echo	write arguments to standard output
hd	hex dump
od	dump files in various formats
print	output mechanism similar to echo
printf	formatted output
tee	join pipes and make copies of input

Querying and modifying user properties

id	return user identity
logname	display login name
mesg	permit or deny messages
newgrp	change to a new group

User administration

fuser	display file users
last	display last logged in users
who	show who is on the system

Interuser communication

mailx	interactive message processing system (mail extended)
mesg	permit or deny messages
talk	talk to another user
write	write to another user

Calendar functions and dates

at	execute commands at a later time
batch	execute commands at a later time
cal	print calendar
crontab	regularly execute commands at specific times
date	write the date and time

Arithmetic functions

bc	arbitrary precision arithmetic language
expr	evaluate arguments as an expression
let	integer calculations

Compiler commands

lex	generate programs for lexical tasks
yacc	yet another compiler-compiler

Program testing

debug	test POSIX programs

Job management

bg	run jobs in the background
fg	run jobs in the foreground
jobs	display status of jobs in the current session

Process information

logger	log messages
ps	report process status
time	time a simple command
times	write process times

Process control

at / batch	execute commands at a later time
kill	terminate or signal processes
nice	run a command at low priority (be nice)
nohup	run a command immune to hangups and quits
renice	alter the scheduling priority of running processes
sleep	suspend execution for an interval
wait	await process completion

Inter-process communication

ipcrm	remove inter-process communication facilities
ipcs	inter-process communication status

Data display terminal

bs2pkey	set P keys
expand	convert tabs to spaces
stty	display or modify attributes of a data display station
tabs	set tabs on a terminal
tput	initialize a terminal or query the *terminfo* database
tty	output path name of current terminal
unexpand	convert spaces to tabs

Checking storage availability

df	report free disk space
du	estimate file space usage

Information on system data

info	Online diagnostic tool
pkginfo	Display informations about software packages
ps	report process status
uname	output basic data on the current operating system
who	show who is on the system

On-line pages

man	display on-line manual pages

Clearing the system buffer

sync	flush system buffer

Calling BS2000 procedures

bs2do	Calling BS2000 procedures from POSIX

Administer POSIX program cache

pdbl	Administer private POSIX loader
posdbl	Administer POSIX loader

Networking commands

ping	send echo requests to network hosts
rcp	remote file copy
rsh	remote shell
uudecode	decode file after mailing with *mailx*
uuencode	encode file for mailing with *mailx*
uuname	list names of UUCP systems

NLS commands (Native Language System)

gencat	generate a binary encoded message catalog
locale	call up information about the locale
localedef	define locale

Subsystem administration

usp	Dynamic setting of POSIX control parameters

2.5 Example

This section presents an example of operation using the POSIX shell. You log onto the BS2000, output the directory which corresponds to your user ID and start the POSIX shell. Once in the POSIX shell, you first create a *.profile* file in which you define alias variables to simplify operation and specify a new prompt which displays the current path at any given time as an aid to orientation. Once the *.profile* file has been executed, the definitions it contains take effect.
You then transfer a file from the BS2000 file system to the POSIX file system where you process it.

```
/set-logon-parameters user-id=user1,account=... ———————————————————— (1)
/show-file-attributes ——————————————————————————————————————————————— (2)
%     114 :1OSN:$USER1.ANHANG.V2
%       3 :1OSN:$USER1.AVASQUER
%      78 :1OSN:$USER1.BIB.EXAMPLES.SDF
%       6 :1OSN:$USER1.DO.MSGCHECK
%    5007 :1OSN:$USER1.FS.USER1
%       3 :1OSN:$USER1.MSG.PROT
%       3 :1OSN:$USER1.OUTPUT
%       3 :1OSN:$USER1.PROG.C
%       3 :1OSN:$USER1.SYS.SDF.LOGON.USERPROC
/start-posix-shell —————————————————————————————————————————————————— (3)
POSIX Basisshell 09.0A43 created Feb 20 2012
POSIX Shell 08.0A43 created Aug 02 2011
Copyright (C) Fujitsu Technology Solutions 2009
              All Rights reserved
Last login: Thu Jul 19 11:50:17 on term/001 ————————————————————————— (4)
$ edt .profile —————————————————————————————————————————————————————— (5)
```

(1) `$ edt .profile` Log on to the BS2000 as usual.

(2) Use the BS2000 command SHOW-FILE-ATTRIBUTES to display the directory corresponding to your login name.

(3) Use the BS2000 command START-POSIX-SHELL to call the POSIX shell.

(4) You are accepted as a POSIX shell user.

(5) Create the *.profile* file with the POSIX editor edt.
Since the file does not exist, *edt* creates a new file (see page 85).

```
 1.00 alias ll='ls -l'
   2.00 alias la='ls -al'
   3.00 PS1='$PWD> '
   4.00
   5.00
   6.00
   7.00
   8.00
   9.00
  10.00
  11.00
  12.00
  13.00
  14.00
  15.00
  16.00
  17.00
  18.00
  19.00
  20.00
  21.00
  22.00
              POSIX editor ready for file .profile: new file
return                                                   0000.00:001(0)
LTG     EM:1                                          TAST
```

```
$ . .profile ——————————————————————————————————————————————————————— (6)
/home/user1> la ———————————————————————————————————————————————————— (7)
total 84
drwxr-xr-x   5 USER1    USROTHER    2048 Dec 22 14:03 .
drwxr-xr-x  63 SYSROOT  POSSYS      2048 Dec 22 06:35 ..
-rw-r--r--   1 USER1    USROTHER      48 Dec 22 14:02 .profile
-rw-------   1 USER1    USROTHER    2576 Dec 22 14:06 .sh_history
drwxr-xr-x   2 USER1    USROTHER    2048 Dec 15 17:18 c-source
drwxr-xr-x   2 USER1    USROTHER    8192 Dec  5 13:47 lost+found
-rw-r--r--   1 USER1    USROTHER      94 Dec 21 14:02 letter1
drwxr-xr-x   2 USER1    USROTHER    2048 Dec 19 15:05 test
  ...
/home/user1> cd c-source ——————————————————————————————————————————— (8)
```

(6) After creating the *.profile* file with *edt* and quitting the editor with the command *return*, you should evaluate the *.profile* file in the current shell. To do this, enter *.profile*.

(7) The POSIX shell reports with the newly defined prompt which displays the current path */home/user1*. You use the command for which the alias *la* has been defined to display all the files in the directory.

(8) Change to the subdirectory *c-source* in which, for example, you store your C programs.

```
/home/user1/c-source> bs2cp bs2:prog.c prog.c ———————————————————————  (9)
/home/user1/c-source> la
total 60
drwxr-xr-x  2  USER1      USER1GRP     2048   Jul 6 .
drwxr-xr-x  2  USER1      USER1GRP     2048   Jul 6 ..
-rw-r--r--  1  USER1      USER1GRP     2048   Jul 6 prog.c
/home/user1/c-source> cat prog.c —————————————————————————————————— (10)
#include <stdio.h>
main()
{
  printf("hello world\n");
  return(0);
}
/home/user1/c-source> cc -o prog prog.c ——————————————————————————— (11)
/home/user1/c-source> prog ———————————————————————————————————————— (12)
hello world
/home/user1/c-source> exit ———————————————————————————————————————— (13)
.... —————————————————————————————————————————————————————————————— (14)
/exit-job ————————————————————————————————————————————————————————— (15)
```

(9) Copy the file *prog.c*, which is located in the BS2000 file system, to the POSIX file system. The file is written to the current directory, *c-source*.

(10) Use *cat* to output the contents of the file *prog.c*.

(11) Compile the file *prog.c* using the C compiler. You want the result of the compilation to be written to the file *prog*.

(12) Run the program *prog*. It outputs the string “hello world” on screen.

(13) Enter the command *exit* to terminate the POSIX shell.

(14) You may enter further BS2000 commands if you so wish.

(15) Log off from BS2000.

3 International environment (NLS locale)

3.1 Native language support

The most of the UNIX derivatives always used to be based on the ASCII coded character set, with American English as the language in which the user communicated with the computer. For the commercial market, however, it has always been essential to offer interactive programs communicating in the language of the program user (language in this sense being taken to include regional conventions such as currency formats); and as a result considerable extra effort was required to produce national variants of programs for other markets.

The increasing international popularity of UNIX systems has now made it necessary to enhance the systems to cater flexibly for the differing scripts, languages and cultural conventions of its users.

With NLS (the Native Language System) X/Open has defined an interface which makes it possible to

– develop applications which communicate with the user in various native languages and conform to the associated local customs. Programs of this type make no assumptions about the language of the user and keep the data specifications separate from the program logic. Hence they are referred to as *internationalized* programs.

– supply the correct native language and associated local customs to the runtime environment of an internationalized application. This technique is known as *localization*. Hence the set of conventions relating to local custom and language which applies in a given environment is referred to as the *locale*.

The tools which NLS provides for these purposes include:

– an announcement mechanism which enables users to identify their own native language, local custom and codeset requirements to programs at runtime. This mechanism works on the basis of environment variables.

– message catalogs which allow program messages to be held apart from the program logic, translated into other languages and bound to the application at runtime.

- internationalized C library functions which make no assumptions about native language, territory and codeset and are thus capable of handling universal character classification, case conversion (up/downshifting), number format conversion and string collation (sorting).
- a set of C library functions which allow a personal language environment to be set, modified and disabled at program runtime.

All the POSIX commands described in this manual are 8-bit transparent. That includes all the command-line arguments and all the data and characters interpreted by the commands.

i There are, however, still certain restrictions on the portability of 8-bit data between POSIX and other systems:

- Data interchange between systems over email links may be restricted to 7-bit data on account of the mail or networking protocols being used.
- 8-bit data and file names may only be portable to systems which comply with the X/Open system interface definition.

For detailed information on NLS refer to the “Programmer's Guide: Internationalization - Localization” [14].

3.2 Defining an internationalized environment

3.2.1 The personal internationalized environment

POSIX supports announcement mechanisms which allow settings for language, national conventions and character set to be defined both on a system-wide basis and for individual users or user groups.

You set your working environment by assigning the name of the required locale to a set of environment variables reserved for that purpose. Whenever an internationalized program is invoked, these environment variables are read and the information for the locale assigned to them is bound to the program's runtime environment.

The environment variables which set the locale are:

Variable	**affects:**
LANG	Entire locale
LC_ALL	Entire locale
LC_CTYPE	Character classes and case conversion (shifting)
LC_COLLATE	Collating sequence
LC_TIME	Date and time formats
LC_MONETARY	Currency symbol and monetary value format
LC_NUMERIC	Representation of the radix character, exponent character and digit grouping symbol
LC_MESSAGES	Message texts and answers to yes/no questions

The precedence among these variables is as defined in section "Precedence among environment variables" on page 91.

These variables can be defined in one of the following formats:

Format 1: variable=locale-name

Format 2: variable=language[_territory][.codeset]

locale-name
language[_territory][.codeset]

name of a directory under */usr/lib/locale*. The length of this string should not exceed *{NL_LANGMAX}*.

The *LC_CTYPE*, *LC_COLLATE*, *LC_TIME*, *LC_MONETARY*, *LC_NUMERIC* and *LC_MESSAGES* variables also support an additional *@modifier* element specifying extra alternatives, for example a particular type of collating sequence:

LC_variable=language_territory.codeset@modifier

Example

In a German environment you can use *@modifier* to choose between the standard collating sequence (dictionary order) and the collating sequence preferred in the German telephone directory. The collation rules here differ in respect of uppercase and lowercase, umlauts and special characters. To select the phone book collating sequence you use the assignment:

```
LC_COLLATE=De_DE.88591@TE
```

If any of the variables *LC_CTYPE, LC_COLLATE, LC_TIME, LC_MONETARY, LC_NUMERIC* or *LC_MESSAGES* is undefined or is assigned the null string, its value defaults to the value of *LANG*.

If any of the variables *LC_CTYPE, LC_COLLATE, LC_TIME, LC_MONETARY, LC_NUMERIC* and *LC_MESSAGES* has an invalid value, or if the *LANG* variable is undefined or null, the system acts as if it were not internationalized; in other words, it collates according to the ASCII table, uses the American date format, English day and month names and so on. This is the default setting.

3.2.2 Precedence among environment variables

Like the *LANG* variable, the *LC_ALL* environment variable provides a general announcement mechanism for the entire locale, and it uses the same syntax. Unlike *LANG*, *LC_ALL* has the top precedence, which means that it overrides all other international environment variables. Setting *LC_ALL* is sufficient if one preset locale satisfies all user requirements for program localization.
LANG has the lowest precedence; so if it is set, it is still possible to set other international environment variables to customize the working environment of individual users to meet their specific requirements.

Precedence	**Environment variable**
high	LC_ALL
medium	LC_CTYPE LC_COLLATE LC_TIME LC_MONETARY LC_NUMERIC LC_MESSAGES
low	LANG

A typical case not covered by either *LANG* or *LC_ALL* is where you want to communicate with the system in one language but sort text files, for example, in another. In cases of this type, you set the international environment variables which allow you to modify individual aspects (categories) of your locale.

Thus if you want to communicate with the system in British English but you also need to sort German text files, you should define the following settings for the *LANG* and *LC_COLLATE* environment variables:

```
LANG=En
LC_COLLATE=C
```

By setting other variables you can set up a multi-language working environment.

i Note that the *LC_ALL* environment variable must be left unset in such cases, as it overrides all other international environment variables. If *LC_COLLATE* and *LC_ALL* are both set, *LC_COLLATE* is ignored.

3.2.3 Supplied locales

POSIX provides different locales:

- C
- De
- De.EDF04F
- De_DE.EDF04
- En_US.EDF04
- De.EDF04F@euro
- De_DE.EDF04@EU
- POSIX

The “POSIX” or “C” locale is equivalent to the behavior defined in the XPG4 standard.

The “De” locale is based on the German language, with sorting (collation) based on the standard sort order (as defined by Duden).

3.2.4 Restrictions

Commands which are not part of the XPG4 standard (see also page 895) are not internationalized.

4 Commands

alias define or display aliases

You can use the built-in *alias* command in the POSIX shell *sh* to redefine shell commands. However, you may not use it to redefine reserved words. You can use the *alias* command to define and export alias variables as well as to write them to standard output. The *unalias* command is used to delete alias variables. Exported alias variables remain effective for procedures which are called by name. However, they must be reinitialized for any new, explicit calls to the POSIX shell.
For the use of alias variables see the section “Aliasing” on page 45.

Syntax

Format 1: alias[␣**-t**][␣name]

Format 2: alias[␣**-x**][␣name**=**[value]]...

Format 1 **alias**[␣**-t**][␣name]

No option specified
alias with no arguments writes the list of aliases in the form *name=value* to standard output.

-t is used to set and list alias variables which possess a path specification (tracked alias). The *value* of this type of variable consists of the full path name as far as *name*. While changing the value of *PATH* invalidates the *value* definition, *name* retains the path specification. If option *-t* is not set then the pair *name=value* is output for every name which has no associated value in the argument list.

-t not specified:
alias outputs the pair *name=value* for every name which has no associated value in the argument list.

Format 2 **alias**[␣**-x**][␣name**=**[value]]...

A space at the end of *value* causes the next word in the command line to be checked for alias substitution.

-x is used to set and output exported alias variables. An exported alias variable is defined for procedures which are called by name.

Exit status The exit status is non-zero if no *value* is defined for *name*.

Variable *PATH*
Default variable for the POSIX shell. The absolute path name of the directories in which the POSIX shell is intended to search for commands is assigned to the variable.

Locale The following environment variables affect the execution of *alias*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You can use the following aliases to simplify the *ls* command:

```
$ alias ll='ls -l'
```

```
$ alias la='ls -al'
```

See also *unalias*

ar archive maintainer

ar is used to maintain archives (libraries).

In specific terms, you can use *ar* to perform the following file management functions. For each file management function the corresponding main key(s) is/are specified in the list:

- Create an archive file: -q or -r
- Quickly append a file to the end of the archive: -q
- Place/replace a file in the archive: -r
- Delete a file from the archive: -d
- Move a file within the archive: -m
- Print the contents of a file: -p
- List the files in the archive: -t
- Copy (extract) a file from the archive: -x
- Output symbols: -S

Syntax **ar**[␣**-V**]␣mainkey[modifier]...[posname]␣afile[␣filename]...

-V *ar* prints its version number to standard error output.

Main keys

When you call *ar*, you must specify precisely one main key (*-d, -m, -p, -q, -r, -t*, *-x* or *-S*), optionally followed by one or more arguments.

-d (d - delete) *ar* deletes the specified files from the archive. If no files are specified, *no* action is taken.

-m (m - move) *ar* moves the specified files within the archive.

With *posname*:
The files are placed after (*a*) or before (*b* or *i*) the file named *posname* (see *posname*).

Without *posname*:
The files are appended to the end of the archive.

-p (p - print) *ar* prints the contents of the specified files. If no files are specified, the contents of all files are printed.

-q (q - quickly) *ar* adds the specified files to the archive "quickly", i.e.:

- If the archive already exists, *ar* appends the named files to it without checking whether they are already present in the archive;
- If the archive does not yet exist, it is created.

No *posname* arguments are permitted.

The *-q* option is useful when creating a large archive step by step.

-r (r - replace) This option has three different effects, depending on whether the specified archive exists and whether it contains the named files:

- If the archive exists and contains the files, *ar* replaces the named files.
- If the archive exists but is missing one or more of the named files, *ar* adds the missing files to the archive.
- If the archive does not exist, *ar* creates the archive from the named files.

With modifier *u*:

ar replaces a file in the archive only if the named file has a later date of last modification than the version already in the archive.

With *posname*:
Files not yet in the archive are placed after (*a*) or before (*b* or *i*) the file *posfile* (see "posname" on page 98).

Without *posname*:
Files not yet in the archive are appended to the end of the archive.

-t (t - table) *ar* prints a table of contents of the archive file. If no files are specified, all files in the archive are listed; otherwise, only the named files.

-x (x - extract) *ar* copies (extracts) files from the archive. If no files are specified, all files in the archive are extracted. The archive itself remains unaltered.

-S ((S - Symbols) *ar* lists all symbols of the specified files. If no files are specified, *ar* lists all symbols which are contained in the library. The library is not changed by this.

Key modifiers

c (c - create) The message that *ar* usually issues when creating an archive is suppressed.

C (C - Create) Extracted files are prevented from being overwritten by files of the same name in the file system. This option is useful when -T is also used, to prevent truncated filenames from replacing files with the same prefix in the file system.

T (T - truncate) Truncates the names of extracted files. When files are extracted from an archive, their archive names may be longer than the file system can support. By default an error message will be output and the file will not be extracted if the filename is too long.

l (l - local) Can be specified, but is ignored.

s (s - symbol table) *ar* regenerates the archive symbol table, but only if new objects are included in the library or existing objects are replaced.

u (u - update) See main key *-r*.

v (v - verbose) *ar* reports each action it takes (adding files to the archive, moving them within the archive, extracting them from the archive, etc.). If *v* is used with the *-t* key, *ar* displays a detailed listing similar to that produced by the *ls -l* command (see *ls*).

posname
The *posname* argument specifies the position at which a file is inserted into the archive. *posname* may be:

a␣posfile
ar inserts the file before the named *posfile*.

b␣posfile
i␣posfile
ar inserts the file before the named *posfile*.

posfile is the name of a file already in the archive.

afile
Name of the archive to be created or processed.

file
Name of the file to be listed, printed out, added to, extracted from, or moved within the archive.
More than one file may be named on the command line. If you specify the same file more than once when calling *ar* with the *-q* or *-r* key, *ar* will enter the named file into the archive as often as specified. If a number of identically named files are contained in the archive, and you use *ar* without specifying a position, the first file with the given name will be accessed (rather than the most recent or oldest file, for example).

Structure of an archive

An archive is a single file that combines several files into one. By convention, the name of an archive file ends with the suffix *.a*. The purpose of an archive file is to enable the collective maintenance of a group of related files. Archives make it easier to maintain files, since you will often only need to specify the archive file instead of individually listing all its elements.
The constituents of an archive are typically object modules that usually form part of the same program or suite of programs.

The magic string and the file headers used by *ar* consist of printable ASCII characters. If an archive is entirely composed of printable files, the entire archive is printable.
When *ar* creates an archive, it creates headers in a format that is portable across all machines.

If the archive contains at least one object file, *ar* creates and maintains an archive symbol table. This symbol table is used by the link editor *ld* to effect multiple passes over the archive in an efficient manner. The archive symbol table is stored in a specially named file that is always the first file in the archive. This file is never listed or printed out like other archive files and is not accessible to the user. Whenever the *ar* command is used to create or update the contents of an archive, the symbol table is rebuilt. The symbol table can also be rebuilt by calling *ar* with the *-s* option.

As far as possible the virtual main memory is used and the export of elements to temporary files is avoided. If this is not successful, temporary files are created, but this is only necessary in the case of the main option *–m*. The following priorities then apply for the storage location of the temporary files:

1. the current directory
2. the directory specified in the *TMPDIR* variable
3. the */tmp* directory

Locale The following environment variables affect the execution of *ar*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME Determine the format of date and time strings in archive content listings produced in conjunction with the *v* modifier.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Quickly creating an archive file:

```
$ ar -qv afile.a atoi.o itoa.o
ar: creating afile.a
a - atoi.o
a - itoa.o
```

ar creates the archive *afile.a* from the files *atoi.o* and *itoa.o*. The *v* modifier tells *ar* to display the names of the files as they are added.

Example 2 Placing a new file at a specified position in an archive:

```
$ ar -rvb atoi.o afile.a atof.o
a - atof.o
```

ar copies *atof.o* into the archive file *afile.a*, placing it before *atoi.o*.

Example 3 Printing the table of contents of an archive:

```
$ ar -tv afile.a
rw-r--r-- 104/     1      2276 Jul 13 12:17 2008 atof.o
rw-r--r-- 104/     1       759 Jul 13 12:17 2008 atoi.o
rw-r--r-- 104/     1      1280 Jul 13 12:17 2008 itoa.o
```

Example 4 Extracting (copying) a file from an archive:

```
$ ar -xv afile.a atoi.o
x - atoi.o
```

The file *atoi.o* is copied from the archive *afile.a* into the working directory. The copy is also called *atoi.o*.

See also *cpio*, *pax*, *tar*

asa interpret carriage-control characters

asa will write its input files to standard output, mapping carriage-control characters from the text files to line-printer control sequences.The first character of every line will be removed from the input, and the following actions will be performed:

If the character removed is:

space	The rest of the line will be output without change.
0	A newline character will be output, then the rest of the input line.
1	One or more characters that causes an advance to the next page will be output, followed by the rest of the input line.
+	The newline character of the previous line will be replaced with one or more characters that causes printing to return to column position1, followed by the rest of the input line. If the + is the first character in the input, it will have the same effect as the space character.

Syntax

```
asa[␣file ...]
```

file
  A pathname of a text file used for input.
  If no *file* operands are specified, the standard input will be used.

Locale

The following environment variables affect the execution of *asa*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also *lp*

at execute commands at a later time

The *at* command

- reads commands from standard input or from a shell script and executes them at a later time specified by the user. A command list created in this way runs under a job number. (Format 1 and 2)
- lists on standard output any jobs scheduled with *at* or *batch* (see *batch*) which have not yet been processed (Format 3 and 4)
- removes jobs previously scheduled with *at* or *batch* (Format 5).

The output from Format 1 and Format 2 is sent to the user by *mailx* unless the standard output and standard error output of the commands to be executed have been redirected.

The environment variables, the current directory, the permissions for new files (see *umask* on page 797) and the maximum permissible file size (see *ulimit* on page 794) are retained, but open files and priorities are lost, and the *trap* command (shell built-in for catching signals) is deactivated. *at* writes the job number and the schedule time to standard error.

Jobs scheduled with *at* are retained even if the user who scheduled them closes the POSIX shell with *exit* or if the POSIX subsystem is shut down. There is no need to reschedule the jobs.

Before the call

The user ID must have a standard account number for *rlogin* access. This standard account number can be assigned using the ADD-USER, MODIFY-USER-ATTRIBUTES or ADD-POSIX-USER command.

If the file */usr/lib/cron.d/at.allow* exists, you can only use *at* if your login name appears in it.

If the file */usr/lib/cron.d/at.allow* does not exist, you can only use *at* if your login name does *not* appear in the file */usr/lib/cron.d/at.deny*.

If neither */usr/lib/cron.d/at.allow* nor */usr/lib/cron.d/at.deny* exists, only the POSIX administrator is allowed to use *at*.

If only an empty deny file exists, for example, everyone is allowed to use *at*.

Only the POSIX administrator is allowed to create and modify the *allow*/*deny* files. Each line in these files contains precisely one login name.

The *cron* daemon is started by means of an rc script.

Syntax

Format 1: at[␣**-m**][␣**-f**␣script][␣**-q**␣queue]␣**-t**␣time

Format 2: at[␣**-m**][␣**-f**␣script][␣**-q**␣queue]␣ time

Format 3: at␣**-l**[␣jobnumber]

Format 4: at␣**-l**␣**-q**␣queue

Format 5: at␣**-r**␣jobnumber

Execute commands at a later time

Format 1 **at**[␣**-m**][␣**-f**␣script][␣**-q**␣queue]␣**-t**␣time

-f␣script
at reads the commands to be executed from the specified shell script.
You can specify a number of commands, separated from one another by a semicolon (;) or a newline character. A command list created in this way runs under a job number.
You can exit the command list terminal-dependent with @@d or END.

-f not specified:
at reads the commands to be executed from the standard input.

-m Sends mail to the user after a job has been completed, indicating that the job is finished.
Mail is sent only if the job has not already generated a mail message.

-q␣queue
The *-q* option is used to assign a job to a specific queue in the */var/spool/cron* directory.

The values accepted for *queue* are:

a	for the default queue for jobs scheduled with *at*.
b	for the default queue for jobs scheduled with *batch*.
c	for the default queue for jobs scheduled with *crontab*.

-t␣time
Specifies the execution time for the commands. *time* is specified as follows:
`[[CC]YY]MMDDhhmm[.SS]`

CC	The first two digits of a date (century). *CC* not specified: If the two-digit date is greater than 68, the current century is assumed, otherwise the following is used.
YY	Two-digit year specification. *YY* not specified: The current year is assumed.
MM	Two-digit month specification (01 bis 12)
DD	Two-digit day specification (01 bis 31)

hh	Two-digit hour specification (00 bis 23)
mm	Two-digit minute specification (00 bis 59)
SS	Two-digit second specification (00 bis 61) The values 60 and 61 are intended for leap seconds. *SS* not specified: The value 0 seconds is assumed.

Format 2 **at**[␣**-m**][␣**-f**␣script][␣**-q**␣queue]␣time

The options are described under Format 1.

time:

Specifies the execution time for the commands. *time* is specified as follows:

time[␣date][␣+increment]

time: digits[suffix] or special_name

digits:

[h]h	1- and 2-digit numbers are interpreted as hours.
hhmm	4-digit numbers are interpreted as hours and minutes.
[h]h**:**[m]m	Digits separated by a colon are interpreted as hours and minutes.

suffix:

am	Interpreted as before 12 noon (dependent from the locale *LC_TIME*)
pm	Interpreted as after 12 noon (dependent from the locale *LC_TIME*)
am, pm omitted	Interpreted as 24-hour clock
zulu[**am**][**pm**]	Interpreted as Greenwich Mean Time
special_name:	**noon**, **midnight**, **now**

date

month␣day[,year] or
weekday[␣**nextweek**|**next**␣**week**] or
special_day

month (dependent from the locale LC_TIME):

jan[**uary**], **feb**[**uary**], **mar**[**ch**], **apr**[**il**], **may**, **jun**[**e**], **jul**[**y**], **aug**[**ust**], **sep**[**tember**], **oct**[**ober**], **nov**[**ember**], **dec**[**ember**], **nextmonth** | **next**␣**month**

day

A number between 1 and 31, depending on how long the month is.

year

Number defining the year to which the date applies
nextyear | **next␣year:** selects the following year
year not specified:
If the date given is after the current date, *at* assumes the next year; otherwise, the current year.

weekday (dependent from the locale LC_TIME):

mon[**day**], **tue**[**sday**], **wed**[**nesday**], **thu**[**rsday**], **fri**[**day**], **sat**[**urday**], **sun**[**day**]

nextweek|**next␣week**: selects the following week

special_day:

today, **tomorrow**, **nextday**, **next␣day**

nextday (or *next␣day*) means that the job is executed a full day later.
If the specified time lies before the current time, *at* interprets the following day as the current day. For example, if the job *at 10 nextday* were scheduled at 11:00am on 7/1/95, the job would be executed at 10:00am on 7/3/95; however, if *at 14 nextday* were specified at the same time, execution would begin at 14:00 hours on 7/2/95.

date not specified:

- corresponds to *today* if the specified time (rounded to the nearest minute) lies after the current time
- corresponds to *tomorrow* if the specified time (rounded to the nearest minute) lies after the current time
- corresponds to *now* if the specified time (rounded to the nearest minute) lies after the current time

+increment

increment is a positive integer that must be followed by one of the following units of time:
minute[**s**], **hour**[**s**], **day**[**s**], **week**[**s**], **month**[**s**], **year**[**s**]

Examples

at can typically be specified in the following ways:

```
at 0815am jan 24
at 8:15am jan 24
at 5pm friday
at now +1hour
```

List jobs yet processed

Format 3 **at␣-l**[␣jobnumber]

Format 4 **at␣-l␣-q␣**queue

-l[␣jobnumber]
at lists the specified *jobnumber*, if the corresponding job has not yet been processed. *jobnumber* is the number that is reported on standard error when a job is scheduled with *at*, *batch* or *cron.*

jobnumber not specified:
at lists all jobs that are yet to be processed, together with their job numbers.

-l␣-q␣queue
It is possible to specify the queue as an alternative to the jobnumber. *at* lists all of the jobs in *queue*.

Remove jobs

Format 5 **at␣-r␣**jobnumber

-r␣jobnumber
at removes the job *jobnumber*, which was previously scheduled with *at* or *batch*. *jobnumber* is the number reported on standard error when a command job is scheduled with *at* or *batch*. You can specify more than one job number, using blanks to separate them. Only the POSIX administrator is authorized to remove another user's jobs.

Exit status

0 *at* executed successfully

≠0 An error occurred while *at* was executing

Error The commonest error messages are:

`at: bad date specification`
You have entered the date in an incorrect format.

`at: too late`
The date you specified has already passed.

`at: This job may not be executed at the proper time`
time lies between "now" and "now+1hour".

`at: you are not authorized to use at. Sorry.`
You are not authorized to use *at*. Sorry. (See *Before the call*)

File

/usr/lib/cron/at.allow
List of login names with permission to use *at*. One login name is entered per line.

/usr/lib/cron/at.deny
List of login names explicitly denied permission to use *at*. One login name is entered per line

/var/spool/cron/atjobs
Directory containing a separate file for each *at* job which has not yet been executed. Each *at* job is allocated a file of its own with the file name *jobnumber.a*.

Variable

SHELL
Determine a name of a command interpreter to be used to invoke the *at* job. If the variable is unset or null, *sh* will be used. If it is set to a value other than a name for *sh*, the implementation will do one of the following: use that shell; use *sh*; use the login shell from the user database.

TZ
Determine the timezone. The job will be submitted for execution at the time specified be *timespec* or *-t time* relative to the timezone specified by the *TZ* variable. If *timespec* specifies a timezone, it will override *TZ*. If *timespec* does not specify a timezone and *TZ* is unset or null, an unspecified default timezone will be used.

Locale

The following environment variables affect the execution of *at*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
LC_TIME	Determine the format of date and time string.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The current date and the string *April Fool!* are to be displayed on terminal tty013 at 9 o’clock in the morning on the 1st of April.

```
$ at 1pm apr 1 ↵
echo `date`":April Fool!" >> /dev/tty013 ↵
END or @@d
```

See also *batch*, *crontab*, *date*, *kill*, *mailx*, *nice*, *ps*, *sh*, *sort*

awk pattern scanning and processing language

awk is a programmable text manipulation system.
When you call *awk* you specify an *awk* program it is to execute and the files it is to process. The actions defined in the program are then performed on the basis of the specified files. *awk* does not alter its input files. The results of the actions it performs are by default written on standard output.

awk offers the following advantages over text manipulation programs such as *egrep* and *sed*:

- *awk* operates on one record at a time. As with *egrep* and *sed*, an input record is defined as one line by default; but with *awk* you can change this setting and define some other unit of text as the record.
- Each input record is split into fields which can be accessed individually.
- A pattern (selection criterion) may be a condition defined by the logical combination of extended regular expressions and relational operators.
- You can program any actions that you require. *awk* is a high-level C-like programming language.

A detailed description of *awk* is provided below in the following sections:

- Typical *awk* applications (see page 112)
- Structure of an *awk* program (see page 114)
- Operation of the *awk* command (see page 115)
- The input file (records, fields, special variables) (see page 115)
- Basic elements of the *awk* language (comments, constants, variables) (see page 119)
- Expressions (see page 124)
- Patterns (see page 126)
- Actions (control-flow statements, functions) (see page 128).

Syntax

Format 1: awk[␣**-F**␣ERE][␣**-v**␣initialization]...␣prog[␣initialization]...[␣file]...

Format 2: awk[␣**-F**␣ERE][␣**-f**␣progfile]␣[␣**v**␣initialization]...[␣initialization]...[␣file]

-F␣ERE

Defines the field separator character for the input record (input field separator).

ERE	Extended regular expression that defines a character to be interpreted as the input field separator. Separators do not form part of the fields.

i To be able to use *t* as the input field separator, you must specify it as follows on the *awk* command line or in the BEGIN section of the *awk* program:
`awk -F“[t]“...` or `BEGIN {FS=“t“...}`

-F␣ERE not specified:
Blanks and tabs act as field separators.

-v␣initialization

Assignments in the form *var=value*.
The *var* variable which appears in the program is initialized to *value*.

var	Name of the variable to be initialized.
value	Initial value to be assigned to *var*. *value* can be defined in exactly the same way as an environment variable on shell level.

There is no difference between the assignment of a value with *-v initialization* and with *initialization* (see below).

prog

awk program argument.

Possible forms for *prog* are:

– ’awk-program’, i.e. an *awk* program written on the command line, or

– *-f progfile*, i.e. the name of a file containing an *awk* program.

’awk_program’

An *awk* program written on the command line.

You should always enclose the *awk* program in single quotes in order to prevent the shell from interpreting metacharacters. If the program is more than one line long, you must escape the newline character with a backslash.

Example:

Output all lines in the *input* file whose third field consists of the character ’0’

```
$ awk '$3 == 0' input
```

-f␣progfile
The *awk* program is located in the file named *progfile*.

initialization
Assignments in the form: *var=value*

The *var* variable (whether it appears in the *awk* program or not) is initialized to *value*. *initialization* and *file* may be specified in any order. The assignment is made at the time when the named file is opened.
Thus, an assignment before the first *file* argument will be executed after the BEGIN actions (if any), while an assignment after the last *file* argument will occur before the END actions (if any).

Exception
The $ variables (see *Basic elements*) cannot be initialized in this way.

var	Name of the variable to be initialized. The name must not begin with $.
value	Initial value to be assigned to *var*. *value* can be defined in exactly the same way as an environment variable on shell level.

file
Name of the text file to be processed. You may list more than one file if you wish. Files are read in the order in which they are listed. If *file* is a dash (-), *awk* reads from standard input.

file not specified:
awk reads from standard input. *awk* reads input one record at a time, processes it, and after each line outputs the result for that record. Hitting $\boxed{\text{END}}$ or $\boxed{\text{CTRL}}$ $\boxed{\text{D}}$ or @@d terminates your input.

Typical awk applications

awk is a tool which makes text manipulation tasks easy to accomplish. Typical applications for *awk* include:

- selectively extracting data from files
- checking the contents of files
- performing calculations on the data in a file
- changing the format of input data.

Using four simple examples, this section demonstrates how *awk* can be used.

Example A file called *supplies* contains a list of office supplies. It includes the name of each article, along with its quantity and unit price:

```
Pencil      100     0.60
Table         5   345.00
Lamp         20    79.80
Paper        75     1.00
Diskette   1000     2.40
Envelope   1500     0.20
```

Example 1 Select all articles with a quantity greater than 100:

```
$ awk '$2 > 100 {print}' supplies
Diskette   1000     2.40
Envelope   1500     0.20
```

With *$2* you access the second field of a line, which in this case is the quantity of each article. If the quantity is greater than 100, the condition is fulfilled, and the *print* function is executed. Since no arguments were specified for *print*, the whole line is output.

Example 2 Calculate the total price for all articles with a quantity greater than 100 and print this total along with the article name:

```
$ awk '$2 > 100 {print $1 "\t" $2*$3}' supplies
Diskette        2400
Envelope        300
```

Three arguments are entered for the *print* function in this example. The following is output:

$1	article name (first field)
\t	tab character
$2*$3	quantity (second field) times unit price (third field)

Example 3 Include a heading in the output:

```
$ awk 'BEGIN    {print "Article \tTotal"}
>      $2 > 100 {print $1 "\t" $2*$3}' supplies
Article         Total
Diskette        2400
Envelope        300
```

This example illustrates the use of the BEGIN pattern. *awk* executes the action after BEGIN only once, i.e. when the program is started. The heading is therefore printed only once at the beginning.

Example 4 Print a grand total of all amounts at the end.
For this purpose we use a variable called *sum*, which is initialized to zero in the BEGIN pattern. The product of column 2 and column 3 is calculated for each line, and all the products are summed up:

```
$ awk 'BEGIN    {sum=0; print "Article \tTotal"}
>      $2 > 100 {print $1 "\t" $2*$3; sum += $2*$3}
>      END      {print "\nGrand total: " sum} ' supplies
Article         Total
Diskette        2400
Envelope        300
Grand total: 2700
```

This example demonstrates the use of the END pattern. *awk* executes the action after END only once, i.e. before termination of the program. The grand total of all subtotals is therefore printed just once at the end.

Structure of an awk program

An *awk* program can consist of a BEGIN section, a main section, and an END section, structured as shown below:

Syntax

```
– BEGIN section –

[ BEGIN {action} ]

– Main section –

[[pattern] {action}
  | pattern [{action}]
  | function_definition
  .
  .
  .
                                        ]

– END section –

[ END {action} ]
```

pattern
: The *pattern* indicates which data is to be selected from the input files (see “Patterns” on page 126).

action
: The *action* indicates what to do with data that matches the pattern (see “Actions” on page 128).

function-definition
: A *function_definition* enables you to define your own functions (see “Functions” on page 135).

At least one of the three sections (*pattern*, *action* or *function-definition*) must be present.
In a *pattern {action}* pair, either the pattern or the action can be omitted. If the action is omitted, each line that matches the pattern is output; omitting the pattern causes the action to be performed on all lines.
The definition of a user-defined function may appear at any position in the main section.
Each of the following ust be located at the start of a line (following any number of blanks or tabs):

– the *BEGIN* section
– the *[pattern]{action}* and *pattern [{action}]* pairs
– the function definitions
– the *END* section.

Operation of the awk command

awk executes the *awk* program that is specified by the user, proceeding in the following sequence:

1. Initial processing
   The first step performed by *awk* is to initialize any variables that may have been defined. If there is a *BEGIN* section including an *action*, *awk* then executes the action specified there. The action in the *BEGIN* section is executed just once, before the first line is processed.

2. File processing
   Next *awk* processes the specified input files by reading the input records sequentially. For each input record, *awk* tries to match each pattern in the order that is specified in the *awk* program. If a pattern is matched, i.e. the selection criterion is fulfilled, the associated action is performed.
   If no pattern is specified for an action, *awk* performs the action for every record.
   If no action is specified for a pattern, the default action is to output (print) the record.
   Multiple input files are processed in the specified order.

3. Final processing
   When all the specified files have been processed, *awk* performs the action in the END section, if one has been included. *awk* then exits.

The input file

An input file consists of records that are subdivided into fields.

– **Records**
  Records are separated by a record separator. The record separator does not form part of a record. By default, a record is one line, and the record separator is the newline character. However, you do have the option of changing this setup by assigning any single character to the special variable *RS* (Record Separator). If you specify a string of characters as a value for *RS*, only the first character will be taken into account. The ordinal number of the current record is available in the variable *NR* (Number of Record). If there is more than one input file, *NR* counts from the start of the first file to the end of the last one. The special variable *$0* addresses the whole of the current record. Further information on variables is provided in the section “Basic elements of the awk language” on page 119.

– **Fields**
  Each record is split into fields separated by one or more field separators. The default field separator is white space (any sequence of tabs and blanks), but you do have the option of changing this by assigning any other character to the special variable *FS* (Field Separator). You can make this assignment either in the *awk* program or by using option *-F* on the command line. The value assigned to *FS* is interpreted as an extended regular expression (see section “Regular POSIX shell expressions” on page 897).

Example 1 To define the characters *x* and *y* as alternate field separators:
syntax on the *awk* command line: `-F[xy]`
syntax in the *awk* program: `FS=[xy]`

Example 2 To define the field separator as one or more occurrences of the character *x*:
syntax on the *awk* command line: `-Fx+`
syntax in the *awk* program: `FS=x+`

The default setting (any sequence of blanks and tabs) can be expressed by the regular expression `[␣\t]+`, where ␣ stands for a blank, and \t represents a tab.
Note that the newline character is always interpreted as a field separator, regardless of the value assigned to *FS*!

The number of fields in the current record is stored in the variable *NF* (Number of Fields). Individual fields of the current record are addressed by the predefined variables *$1*, *$2*, to *$NF*. Further information on variables is provided in the section “Basic elements of the awk language” on page 119.

Example Default setup

```
Field 1  Field 2    ...         Field 5 ...

This     is         the first   record              <--- Record 1

and      this       is the      second record.      <--- Record 2
```

Customized setup: *RS*="%"; *FS*=":";

```
Field 1   Field 2       Field 3

%Name   : Address      : Phone number      <--- Record 1

%SNI AG :81730 Munich : 089-636-1         <--- Record 2
```

Rules for record and field separators

- Default settings for record separators
  - The default record separator is the newline character.
  - If the null string is assigned to *RS* (*RS=""*),
    the file is treated as a single record. If several files are specified, each file will consist of a single record (which means that the ultimate value of *NR* will be equal to the number of files).
- Default settings for field separators
  - If the record separator is newline, the field separator defaults to blanks and tabs.
  - If the record separator is not a newline, the newline character **always** counts as a field separator, regardless of which character has been explicitly defined as the field separator (see Fields, example 2 on page 116).
  - If you explicitly assign a blank to *FS*, either with -F" " on the *awk* command line or by using the assignment FS=" ", then blanks **and** tab characters are treated as field separators.
  - On the other hand, if you explicitly assign the tab character to *FS* (FS="\t"), then only the tab character is treated as the field separator and not the blank.
- Leading field separators and field separator strings
  - The following applies to blanks, tabs and newlines as field separators:
  - Leading field separators are ignored.
  - Multiple occurrences of a field separator are treated as a single field separator (see example 9 on page 149).
  - For all other field separators, leading field separators are counted. In multiple occurrences of a field separator, each character is counted separately. Thus two consecutive field separators are deemed to have an empty field between them (see example 10 on page 150).
- Changing separators:

  If you need a number of different record separators in one file, you can change *RS* within the *awk* program. The new record separator comes into effect as soon as the assignment to *RS* has been implemented. Similarly, you can change *FS* within the *awk* program, should you require a number of different field separators in one file. The new field separator comes into effect as soon as the assignment to *FS* has been implemented.

Special variables for the input file

The following list shows all special *awk* variables pertaining to the input file and the corresponding values *awk* usually assigns to these variables.

FILENAME
: Name of the current input file, - for standard input

FS
: Input field separator (default: any sequence of blanks and tabs)

NF
: Number of fields in the current record

NR
: Ordinal number of the current record from start of input

FNR
: Ordinal number of the current record in the current file

RS
: Input record separator (default: newline)

$0
: Current record

$1
: First field of the current record

$2
: Second field of the current record

.
.
.

$NF
: Last field of the current record

You can change these variables within an *awk* program if you wish. This does not alter the input file. Further information on variables is provided in the section “Basic elements of the awk language” on page 119.

Basic elements of the awk language

This section gives a syntax of the basic elements of the *awk* language. You will need these elements in order to define pattern and action pairs.

Comments
You can include comments in an *awk* program, as in a shell script. A comment begins with the # character and continues till the end of the line.

Constants
There are two types of constant:

number

A number (numeric constant) is a signed or unsigned integer or floating point number. *awk* does not check its format. If your number contains invalid characters, *awk* attempts to filter out a valid part and ignores the rest.

integer
An integer is a sequence of digits from 0 to 9.

floating point number
A floating point number consists of a mantissa with or without an exponent.
The mantissa comprises an integer with or without a fractional part.
The fractional part is represented by a radix character and an integer.

string

A string (alphanumeric constant) is a sequence of characters, enclosed in double quotes "...". If the double quotes are omitted, *awk* will interpret the string as a variable name, a number, or an operator.

character
A single character is also enclosed in double quotes "..." in order to prevent *awk* interpreting the character as a variable name. A character may be a displayable character from the character set which is currently in use (see section “EDF04 character set” on page 913) or one of the following special characters as represented in C:

\" for "
\\ for \
\a for bell character
\n for newline character
\t for tab character
\v for vertical tab
\b for backspace
\r for carriage return
\f for page feed

Variables

awk allows you to use simple variables and arrays to store values.
The special variables are predefined; others can be defined by the user.

Name of a variable
The name of a user-defined variable can be any string made up of underscores (_), uppercase and lowercase letters and digits, beginning with a letter or an underscore.

Data type
Variables do not have a data type. You can thus assign either a number or a string to any variable. If the context is clearly numeric, variables are treated as numeric; otherwise, they default to alphanumeric. Example:

```
x = "Miller";    # Variable x contains the string Miller
x = "3"+4   ;    # Variable x has a value of 7
```

Declaration
awk variables do not need to be explicitly declared. User-defined variables are automatically declared the first time they are used.

Initialization
Special variables are initialized to predefined values by *awk*. Depending on the context, user-defined variables are initialized by *awk* to the null string or to 0 by default. If you wish, you can specify other initial values when you call *awk*.

Exceptions:
- When i>NF, $i will not always be the null string.
- $ variables cannot be initialized on the command line.

Special variables

awk recognizes the special variables shown in the list below. The values *awk* usually assigns to these variables are indicated in the list. New values may be assigned to the variables by the user.

ARGC
  Number of elements in the array *ARGV*

ARGV
  Array holding the command line arguments (excluding options and the *prog* argument), numbered from 0 to ARGC-1

ENVIRON
  Array holding the values of environment variables, where the indexes are the names of the variables

FILENAME
  Name of the current input file, - for standard input

FS
: Input field separator (default: any sequence of blanks and tabs)

NF
: Number of fields in the current record

NR
: Ordinal number of the current record from start of input

FNR
: Ordinal number of the current record in the current file

OFS
: Output field separator (default: one blank)

ORS
: Output record separator (default: newline)

OFMT
: Output format for floating point numbers (see page 142)
(default: %.6g, up to 6 places after the decimal point)

RS
: Input record separator (default: newline)

RLENGTH
: Length of the string matched by the *match* function

RSTART
: Starting position of the string matched by the *match* function. Numbering begins with 1.This value always corresponds to the value returned by the *match* function.

SUBSEP
: Subscript string separator for multi-dimensional arrays. The default setting is \034.

$0
: Current record

$*n*
: Field *n* of the current record

$NF
: Last field of the current record

What is the effect of changing special variables?

Example The assignment

```
$1 = "new";
```

assigns the string *new* to *$1*; but this does not actually alter the first field of the current input record.

This also applies to the following *awk* settings relating to the input file:

1. The current input file does not change when you assign a new name to FILENAME.
2. When you assign a value to a variable $i where i>NF, *NF* is assigned the value *i*.
3. If you assign a new value to *NR*, you only alter the number assigned to the current line; you do not move to a different line.

Example The contents of *$0* remain the same even if *NR* is modified:

```
{print NR, $0; NR=NR+34; print NR, $0}
```

A typical output would then be:

```
10 This is the tenth line
44 This is the tenth line
```

i When you assign a new value to a variable, its old value is deleted. Thus, if you change *NF*, for example, the information on the number of fields in the current record is lost.

Peculiarity of $ variables:
You can specify the number of a $ variable as a constant or as an expression which evaluates to the number.

Example You can use `$(NF-1)` to access the second-last field.

Array

An array is a set of constants or variables.

An array element is addressed as follows:

Syntax

```
array_name[index]
```

array_name
  Name of a variable.

index
  A simple variable.
  The index may be numeric or alphanumeric. The *index* you specify can therefore be a number, a string, or an expression that evaluates to an index value.

awk provides two special types of arrays:

- Dynamic arrays
  Arrays, like simple variables, do not need to be declared. Above all, there is no need to define dimensions. New array elements are created automatically as and when required.
- Associative arrays
  Individual array elements can be accessed via an alphanumeric index.
  A special control-flow statement is provided in order to process all elements of an associative array:

  for (index in array) statement

  index assumes the index values present to this point in **random** order, and the specified *statement* is executed once for each array element (see control-flow statement *for*).

Example

A file called *expenses* contains various expenses incurred. For each item of expenditure the file shows the date, month, amount, and a brief description, with a colon to separate them. For example:

```
01:January:   40.78:Supplies
05:January: 6789.00:Laser printer
23:March:    240.32:Lamps
11:January:  478.00:Chairs
01:February:  45.00:Journals
```

Using an associative array you can easily calculate total expenditure for each month from the data in this file. The program in the example uses an array called *mexpenses* and the names of the months as an alphanumeric index. For each line, the expenses in the third field (*$3*) are summed up to produce total expenditure for each month appearing in the second field (*$2*).

```
$ awk 'BEGIN {FS=":"}
>      {mexpenses[$2] += $3;}
>      END {for (i in mexpenses) print "Total spent in",\
>           i, mexpenses[i]  } ' expenses
Total spent in January 7307.78
Total spent in February 45
Total spent in March 240.32
```

Expressions

An expression can be any of the following:

Syntax

- constant
- variable
- function_call
- un_op expression
- expression bin_op expression
- **(**expression**)**
- expression **?** expression **:** expression

constant
: Numeric or alphanumeric constant (see “Basic elements of the awk language” on page 119.

variable
: Variable (see “Basic elements of the awk language” on page 119).

function_call
: Invocation of a predefined function (see “Functions” on page 135).

expression
: Expression.

un_op
: Unary operator (see “awk operators” on page 125).

bin_op
: Binary operator (see “awk operators” on page 125).

Expressions are evaluated and return a value. They may appear both in patterns and in actions.

awk operators

awk recognizes all C operators plus the operators for pattern matching and string concatenation.
The following list shows all *awk* operators in ascending order of precedence. Operators in the same line have the same precedence

=	assignment operator
+= -= *= /= %= ^=	compound assignment operators as in C
||	logical OR
&&	logical AND
~ !~	pattern matching operators
> >= < <= != ==	relational operators
operand list	concatenation
+ -	plus, minus
* / %	multiply, divide, remainder
!	logical NOT
^ **	exponent
++ --	increment, decrement

Evaluation of expressions

Since no data type is prescribed for the operands, you can freely mix numeric and alphanumeric constants. *awk* determines from the context whether a numeric or alphanumeric operation is required.
Please note that, as in C, there are no special truth values. Like C, *awk* treats a value of 0 as false and a non-zero value as true. This means that any non-zero value as an argument of a logical operation is held to be true. If the result of a logical operation is true, it is represented as 1.

Example `(2&&2)+3=4`

Patterns

Patterns (selection criteria) are specified by the user as a means of indicating which data is to be selected from the input files. A pattern can have any of the following forms:

Syntax

– **/**regexp**/**
– relexp
– matchexp
– pattern_range
– compound_pattern

/regexp**/** - Regular expression
awk supports extended regular expressions (see section “Regular POSIX shell expressions” on page 897). A regular expression is enclosed in slashes /.../.

Example A regular expression matching any number of occurrences of a, b or c:

```
/[abc]+/
```

compare relexp
relexp is an expression (see “Expressions” on page 124) featuring relational operators. The operators and their meanings are:

a **>** b	*a* greater than *b*?
a **>=** b	*a* greater than or equal to *b*?
a **<** b	*a* less than *b*?
a **<=** b	*a* less than or equal to *b*?
a **==** b	*a* equal to *b*?
a **!=** b	*a* not equal to *b*?

Operands *a* and *b* are any expressions. If both operands are numeric, the comparison is numeric; if not, it is alphanumeric.

matchexp

matchexp is an expression (see “Expressions” on page 124) featuring pattern matching operators. It involves the comparison of a regular expression (pattern) with a string. The pattern matching operators and their meanings are:

str **~** p	string *str* must match pattern *p*
str **!~** p	string *str* must not match pattern *p*

Using *matchexp* as a pattern allows you to select individual fields.

Example Select all records with a first field starting with A or a:

```
$1 ~ /^[Aa]/
```

The regular expression ^[Aa] represents strings that begin with A or a. The first field of the record ($1) must match (~) the regular expression, i.e. begin with A or a.

pattern_range

A pattern range takes the form:

/`regexp`**/, /**`regexp`**/**

Specifying a range causes the associated action to be executed for all records that lie within the range. The limits of the range (start and end) are defined by two regular expressions. The range begins with the first record containing a string that matches the first regular expression and ends with the first record containing a string that matches the second regular expression.

Example Select the range from the first line beginning with C to the first line beginning with K and output the first field of every line in the selected range:

```
/^C/, /^K/  {print $1}
```

compound_pattern

Logical operators (see *Expressions*) can be used to negate patterns and to combine several of them to form a single pattern. The logical operators and their meanings are:

!pat	Negation of pattern *pat*
pat1 **||** pat2	*pat1* or *pat2*. The criterion is satisfied if *pat1* or *pat2* matches.
pat1 **&&** pat2	*pat1* and *pat2*. The criterion is satisfied if both *pat1* and*pat2* match.
(pat**)**	Parentheses

A compound condition is evaluated from left to right.

Example Match all records that have an even number of fields and a letter between M (inclusive) and Q (exclusive) in the first field.

```
NF%2==0 && $1 >= "M" && $1 < "Q"
```

You can generally combine patterns in several ways in order to make the same selection. Thus, if the currently valid collating sequence defines the range [M-Q] as the uppercase letters M, N, O, P and Q, the above selection could also be made with pattern matching operators:

```
NF%2==0 && $1 ~ /^[MNOP]/
```

Since the first *awk* condition depends on t he collating sequence of the currently valid character set, it may not return the same result in every case. The second *awk* line, by contrast, will always select only those records in which the first field begins with the letter M, N, O or P.

Actions
Actions indicate what to do when a pattern is matched. An action will typically involve processing one of the selected files. An action has to begin in the same line as the associated pattern. If this is not possible, the newline character must be escaped with a backslash. Blanks and tabs between the action and the pattern are ignored.
An action comprises one or more statements and must be enclosed in braces {...} as shown below:

Syntax **{statement␣[;statement]...}**

Statements
A statement can be any of the following:

Syntax
– expression
– control_statement

expression
An expression is evaluated but is not put to any further use unless *expression* is in the form of an assignment, an increment or a decrement (see section “Expressions” on page 124).

control_statement
A *control_statement* allows you to control the flow of an *awk* program (see section “Control-flow statements” on page 129).

A single statement may be spread over several lines, in which case each line except the last must end with a backslash. The backslash escapes (cancels the effect of) the newline character.

Multiple statements

You can group together a number of statements within one pair of braces {}. Statements are delimited by means of:

- a semicolon ;
- a right brace }
- a newline character.

Control-flow statements

Control-flow statements allow you to control the flow of an *awk* program. *awk* recognizes the following control-flow statements:

break	terminate a loop
continue	skip remainder of loop
exit	terminate the *awk* program
for	loop counter and looping an array
if	conditional statement
next	skip to the next input record
while	execute iteratively
do	execute iteratively
delete array[i]	delete element *i* of the named *array*
return x	return from a function with a value
return	return from a function without a value

The control-flow statements are described below in alphabetical order.

break - Terminate a loop

break can be used in the body of a *for*, *while*, or *do* loop. *break* causes an immediate exit from the enclosing loop.

Syntax **break**

Example While records continue to start with a dot, keep reading in the next record. Terminate the loop if the second field of the retrieved record is greater than 1000.

```
{ while($1 ~ /^\./)
    {
       getline;
       if($2 > 1000) break;
    }
}
```

continue - Skip remainder of loop

continue can be used in the body of a *for*, *while* or *do* loop. The *continue* statement causes the current iteration to be terminated and the next one to begin.

Syntax **continue**

Example Print even fields only:

```
{
   i=1;
   while(i++ <= NF)
      {
        if(i%2) continue;
        else print $i
      }
}
```

do - Execute iteratively

The statement in a *do* loop (or a *do-while* loop) is executed iteratively while a specified condition continues to be satisfied. In contrast to the *while* loop, the statement in a *do* loop is always executed at least once.

Syntax **do**␣{anweisung}␣**while**␣(expression**)**

statement
  Statement that is executed in each iteration of the loop. If several statements are to be executed, they have to be grouped together in braces ({ }) and separated by semicolons or linefeed characters.

expression
  Expression (see "Expressions" on page 124) that specifies the condition.

Example Print out the individual fields of a record:

```
{ i=0; do {print $(++i)} while (i != NF) }
```

exit - Terminate the awk program

exit terminates the *awk* program.

If an END section is present, *awk* executes the action specified in it; if not, the program is terminated immediately.

Syntax **exit**

Example If the commercial at symbol @ appears in the input, print the result and terminate processing:

```
...
/@/ {exit}
...
END {print ergebnis}
```

for - Loop counter

The statement in a *for* loop is executed iteratively while a condition continues to be satisfied.

Syntax **for(**expr1**;** expr2**;** expr3**)** statement

expr1
: Expression (see “Expressions” on page 124).
expr1 is evaluated once at the start of the *for* statement. *expr1* is often used to initialize incrementing variables.
Example: `i=1`

expr2
: Expression (see “Expressions” on page 124).
expr2 is evaluated before each iteration. The specified *statement* is executed only if *expr2* is non-zero (true); otherwise, the loop is terminated.
Example: `i<10`

expr3
: Expression (see “Expressions” on page 124).
expr3 is evaluated after each iteration. When incrementing variables are used, *expr3* increments the variable.
Example: `i++`

statement
: Statement that is executed in each iteration of the loop. If several statements are to be executed, they have to be grouped together in braces {}.

Example Print out the fields of the current record in reverse order.

```
{for(i=NF; i>0; i--) print $i}
```

for - Looping an array

This variant of the *for* statement is a special *awk* facility for the handling of arrays.

Syntax **for(**index␣**in**␣array**)**␣statement

index
: Variable (see *Basic elements*) that assumes all values of the elements of *array* in random order. The index can be numeric or alphanumeric.

array
: Array to be processed.

statement
: Statement to be executed for each array element. If several statements are to be executed, they have to be grouped together in braces { }.

Example The array named *month* contains the number of days in each month. Each array element is subscripted with the name of the month, e.g.
`month["January"]=31.`
The following *awk* program prints the name of each month together with the number of days in it.

```
$ awk ' BEGIN { month["January"]=31;    \
>               month["February"]=28;   \
>               month["March"]=31;      \
>               month["April"]=30;      \
>               month["May"]=31;        \
>               month["June"]=30;       \
>               month["July"]=31;       \
>               month["August"]=31  }   \
>       END { for(i in month) print i,"has",month[i],"days" } '
```

```
May has 31 days
August has 31 days
July has 31 days
April has 30 days
June has 30 days
January has 31 days
March has 31 days
February has 28 days
```

if - Conditional statement

The statement in an *if* construct is executed if the specified condition is satisfied.

Syntax **if(**expr**)**␣statement1␣[**else**␣statement2]

expr
Expression (see “Expressions” on page 124) that defines the condition to be satisfied. If *expr* is non-zero (true), *statement1* is executed.

statement1
Statement to be executed if *expr* is true. If several statements are to be executed, they have to be grouped together in braces { }.

statement2
Statement to be executed if *expr* is false. If several statements are to be executed, they have to be grouped together in braces { }.

Example If field 1 is greater than field 2, fields 2 and 3 are printed; if not, fields 4 and 5 are printed:

```
{ if($1 > 2) print $2, $3; else print $4, $5 }
```

next - Skip to the next input record

The *next* statement causes *awk* to suspend processing of the current record; statements that follow *next* are not applied to the current record. *awk* then reads the next input record. *NR*, *NF*, *FNR*, *$0*, and *$1* to *$NF* are reset.

Difference between *next* and the *getline* function:

getline sets the current record to the next one. Statements that follow *getline* are executed using the next record's values for the $ variables and for *NR*, *NF*, and *FNR*.

Syntax

next

Example

Records that begin with a dot are ignored:

```
{ if ($1 ~/^\./) next }
```

while - Execute iteratively

The statement in a *while* loop is executed iteratively while a specified condition continues to be satisfied.

Syntax

while(expr**)**␣statement

expr
: Expression (see “Expressions” on page 124) that specifies the condition.

statement
: Statement that is executed in each iteration of the loop. If several statements are to be executed, they have to be grouped together in braces { }.

Example

Print all input fields, writing each field in a separate output line:

```
{ i = 1;
  while (i <= NF) {
      print $i
      i++
  }
}
```

Functions

awk provides a wide range of built-in functions and also offers you the option of defining functions of your own:

Syntax **function**␣name**(**arg,...**)**␣**{**statements**}**

The *{statements}* may be preceded by a newline character. There may also be blank lines within the braces {...}. A function definition has the same precedence as *pattern {action}* pairs in the main section of an *awk* program.

Within an action section, function calls can be entered anywhere in an expression, except before the function declaration. There must be no space between the function name and the left parenthesis when a function is called.
Nested and recursive function calls are legal.

Though most functions do not require you to enclose arguments in parentheses, it is a good practice to use them as a means of increasing program transparency. When you pass an array as an argument, a pointer to the array is passed (call by reference), which means that you can change the elements of the array from the function. In the case of scalar variables, the value of the variable is copied and passed (call by value), which means that you cannot change the value of the variable from the function. The scope of function arguments is restricted to the local function, whereas the scope of all other variables is always global. If you need a local variable in a function, define it at the end of the argument list in the function definition. Any variable in the argument list for which no current argument exists is a local variable with a predefined value of *0*.

As in C, some functions return a result (e.g. *exp*), while others are procedural in character (e.g. output functions). The *return* statement can be used with or without a return value or may be omitted entirely. In the latter case, the return value would be undefined if it were to be accessed.

Example In the example below, the function named *search* looks for the string *who* in the array *allnames* and returns the index or *-1*. The third argument, *incr,* is used as a local variable.

```
   ...
{ print $1, search($1, allnames) }
   ...
function search(who, allnames, incr)
{
   for (incr=0; allnames[incr]; incr++)
      if (index(allnames[incr], who) == 1
          && length(allnames[incr]) == length(who))
             return incr
   return -1
}
```

Built-in functions

– **Input function**

getline	Read input record

– **Output functions**

print([arg,...])	Standard output function
printf(format [arg,...])	Formatted output

– **Arithmetic functions**

atan2(y,x)	Arc tangent of *y/x*
cos(x)	Cosine
exp(x)	Exponential function
int(x)	Truncate to integer
log(x)	Natural logarithm
rand()	Return a random number
sin(x)	Sine
sqrt(x)	Square root
srand([x])	Set the seed (initial value) for *rand()*

– **String functions**

gsub(re,repl[,instr])	Global substitution function
index(str1,str2)	Return first occurrence of substring
length([str])	Return length of string
match(str,re)	Check whether string *str* matches regular expression
split(str,array,[sep])	Subdivide string
sprintf(format,e1,e2,...)	Return formatted output as string
sub(re, repl[,instr])	Substitution function
substr(str,m,[n])	Define substring
tolower(s)	Convert to lowercase
toupper(s)	Convert to uppercase

– **General functions**

close(expr)	Close file or pipe
system(expr)	Call shell command

The following section describes each of these functions in alphabetical order together with the associated arguments. The argument you specify can either be a constant or an expression (see “Expressions” on page 124). *awk* first evaluates the expression arguments and then applies the function to the computed results.

atan2 - Arc tangent
atan2 calculates the arc tangent of the quotient of two numbers. *atan2(y,x)* returns the arc tangent of *y/x*.

Syntax

```
atan2(y,x)
```

y,x Numbers that produce the quotient for which the arc tangent is to be calculated.

close - Close file or pipe
close closes the specified file or pipe.

Syntax

```
close(expr)
```

expr
  Name of the file or pipe to be closed, see redirection under “printf - Formatted output” on page 142.

cos - Cosine
cos calculates the cosine of a number.

Syntax

```
cos(x)
```

x Number for which the cosine is to be calculated.

exp - Exponential function
exp calculates *e* to the power of *x*.

Syntax

```
exp(x)
```

x Number for which e^x is to be computed.

getline - Read a record

awk retrieves a record as directed (see also the control-flow statement *next* on page 134).

getline has several different formats, with the following return values:

1 successful execution
0 end-of-file
-1 error

Syntax **getline**

awk reads the next input record from the input file into $0. *NR*, *NF*, *FNR*, *$0*, and *$1* to *$NF* are reset.

Example If a record contains %%%, the next record is read. In other words, input records containing %%% are ignored.

```
    /%%%/ {getline}
```

Syntax **getline**␣<␣file

awk reads a record from the named *file* into $0. *NF*, *$0*, and *$1* to *$NF* are reset.

file
Name of the file from which a record is to be read.

Syntax **getline**␣var

awk fetches the next input record from the input file and puts it into the variable *var*. *NR* and *FNR* are reset.

var
Variable into which the next record is to be read.

Syntax **getline**␣var␣<␣file

awk fetches a record from the named *file* and puts it into the variable *var*. *NR*, *NF*, *FNR*, *$0*, and *$1* to *$NF* remain unchanged.

var
Variable into which the record is to be read.

file
Name of the file from which the record is to be read.

Syntax

```
command␣|␣getline␣[var]
```

The output of the named *command* is redirected to *getline*. Each *getline* call in this format causes *awk* to read the next line from the output of *command* and write it into $0 or the variable *var*.
If *var* is specified, *NR*, *NF*, *FNR*, *$0*, and *$1* to *$NF* remain unchanged; if not, *NF*, *$0*, and *$1* to *$NF* are reset.

This construct is equivalent to calling the C function *popen()* with mode *r*.

var
: Variable into which the record is to be written.

  var not specified: The record is written into *$0*.

command
: Name of the command whose output is to be read.

gsub - Global substitution function
gsub globally substitutes the string *repl* for all strings in $0 or *instr* that match the extended regular expression *RE*.
gsub returns the number of substitutions

Syntax

```
gsub(re,repl[,instr])
```

re Extended regular expression that specifies the pattern to be matched.

repl
: String to be substituted for the strings that match *re*.

instr
: String in which the substitution is to be made.

  instr not specified: Substitution is done in *$0*.

index - Search for substrings
index searches for a substring within a string. If the substring is present, *index* returns the starting character position (numbered from 1 onward) of its first occurrence in the string; if not, it returns a *value* of 0.

Syntax

```
index(str1,str2)
```

str1
: String in which *index* looks for the substring.

str2
: Substring that *index* looks for.

Example Comparing the string "ToTo-LoTo" with "To"

```
index("ToTo-LoTo","To") returns 1.
```

int - Truncate to integer
int returns the largest integer equal to or smaller than the argument.

Syntax **int**(x)

x Number that is to be truncated to its integer part.

length - Return length
length returns the length of a string.

Syntax **length**[(str)]

str *length* returns the length of string *str*.

str not specified:
length returns the length of the current input record $0.

log - Logarithm
log calculates the natural base *e* logarithm.

Syntax **log**(x)

x Number whose natural log is to be computed.

match - Match regular expressions
match checks whether a string in *str* matches the extended regular expression in *re*.
If a matching string is found, *match* returns the character position in *str* (numbered from 1 onward) at which the string begins; if not, it returns 0.
The variable *RSTART* is set to the return value of *match*; *RLENGTH* is set to the length of the matching string (or -1 if no matching string is found).

Syntax **match**(str,re)

str String in which the pattern is to be matched.

re Extended regular expression.

print - Standard output function

print is the standard output function. *print* outputs either the current record or the specified arguments and terminates its output with the output record separator *ORS*. For further details refer to page 142.

Syntax **print**(arg1[[,]arg2]...)[redirection]

No argument specified:
print writes the current input record on standard output.

arg1arg2
Arguments that are to be printed.
print evaluates the expression arguments and concatenates the results in the order in which the arguments are specified.

arg1,arg2
Arguments that are to be printed. *print* outputs the evaluated expression arguments in the specified order, separated by the output field separator *OFS* if they are separated by commas in the *print* statement.

redirection
Output can be redirected to a file or piped to a program. You can use up to 10 output files.

redirection can be in the form of:

>, >>, name of program

>file
The output is written to the named *file*. The former contents of *file* are deleted the first time *print* is called. All subsequent *print* or *printf* outputs to *file* in the same *awk* program are appended to the end of *file*. Unless explicitly closed, *file* remains open until the end of the *awk* program.

>>file
The output is appended to the previous contents of *file*. Unless explicitly closed, *file* remains open until the end of the *awk* program.

Iprog
The output is piped to the program named *prog*.

You are only permitted to open one pipe to *prog* within an *awk* program, but you can pipe any number of *print* or *printf* outputs to it.
This construct is equivalent to calling the C function *popen()* [4] with mode *w*.
Unless explicitly closed, the pipe remains open until the end of the *awk* program.

The file or program name can specified directly (enclosed in "...") or via a variable that evaluates to the file name.

Caution!
If you redirect output to the input file, the input file will be destroyed without any warning!

Output format

print outputs integers in decimal and prints strings at full length. Apart from that, the output format is contingent on the following predefined variables:

OFS - output field separator
OFS is one space by default. If you wish, you can assign any one character to *OFS* to change the output field separator.

ORS - output record separator
ORS is the newline character by default. If you wish, you can assign any one character to *ORS* to change the output record separator.

OFMT - floating point output format
OFMT defines the output format for floating point values and is set to "%.6g" by default. This means that the fractional part of a floating point number is printed with a maximum of 6 places. If you wish, you can assign a different *printf* format for floating point numbers to *OFMT* (see „printf - Formatted output“ below).

Example Print the first and second fields, separated by a blank:

```
{print $1,$2}
```

Example Concatenate the first and second fields without an output field separator:

```
{print $1$2}
```

or

```
{print $1 $2}
```

printf - Formatted output
printf is the output function for formatted output. The output format can be specified as in the standard *printf()* function in C.

Syntax **printf**(format,arg,...)[redirection]

format
String defining the output format. The output format comprises plain characters and format elements (conversion specifications). Printable characters are output unaltered. The special characters listed in the "Basic elements" section are converted immediately. For example, *\n* sets the position to the start of the next line.

All format elements begins with the percent sign. The most common format elements are presented in the following list:

%c	single character
%d	decimal integer
%e	floating point number in exponential notation, e.g. 5.234e+2
%f	floating point number, e.g. 52.34
%g	%e or %f, whichever is shorter
%o	octal integer (base 8)
%s	character string
%u	unsigned decimal integer
%x	hexadecimal integer (base 16)

arg

Arguments that are to be printed.
printf evaluates the expression arguments, allocates them in the given order to the specifications in *format*, and outputs them in the appropriate format.

- If the format element is incompatible with the argument, e.g. a numeric format specification for an alphanumeric argument, a 0 is printed.
- If there are more arguments than format elements, the excess arguments are ignored, i.e. not printed.
- If there are more format elements than arguments, an error message is issued.

redirection

Redirection is as for *print*.
redirection not specified:
printf prints on standard output.

Example Field 1 is printed as a decimal number with at least 2 positions, followed by ** as a separator, followed by field 2 as a string of at least 5 characters, followed by newline:

```
{ printf("%2d**%5s\n", $1,$2) }
```

rand - Return a random number
rand returns a random number *r*, where 0 <= *r* < 1.

Syntax **rand**

Also refer to *srand*.

sin - Sine

sin returns the sine of a number.

Syntax **sin**(x)

x Number whose sine is to be computed.

split - Subdivide strings

split divides a string into substrings and stores each substring as an element in an array. The elements are subscripted in ascending order, starting with 1.
split returns the number of array elements.

Syntax **split(**str,array[,sep]**)**

str
String that is to be split.

array
Name of the resulting array.

sep
Extended regular expression specifying the characters that act as a separator between the substrings in *str*.

sep not specified:
FS is used as the separator.

Example The input:

```
{
    s=split("january:february:march", months, ":");
    for(i=1; i<s; i++) print months[i];
}
```

produces the output

```
january
february
march
```

sprintf - Return formatted output as a string

sprintf formats in exactly the same way as *printf*, but there is no direct output. *sprintf* instead returns the formatted output as a string, which could then be assigned to a variable or used for a similar purpose.

Syntax **sprintf**(format,arg,...)

format
String defining the output format (see "printf - Formatted output" on page 142).

arg
Arguments that are to be output (see "printf - Formatted output" on page 142).

Example The following *awk* program fragment produces the same output as the example given under *printf*.

```
{ x = sprintf("%2d**%5s\n", $1,$2); print x }
```

sqrt - Calculate the square root

sqrt calculates the square root of a number.

Syntax **sqrt**(x)

x Number whose square root is to be computed.

srand - Set the seed for the rand function

srand sets the seed (starting point) for the *rand* function to the number *x*, or to the current time if no argument is specified.

Syntax **srand**([x])

x Number that is to serve as the seed for *rand*.

sub - Substitution function

sub substitutes the string *repl* for the first instance of a string in *$0* or *instr* that matches the extended regular expression *RE*.
sub returns the number of substitutions.

Syntax **sub**(re,repl[,instr])

re Extended regular expression that specifies the pattern to be matched.

repl
String to be substituted for the strings that match *re*.

instr
String in which the substitution is to be made.

instr not specified:
The substitution is done in *$0*.

substr - Define a substring

substr extracts a substring from a string.

Syntax **substr(**str,m[,n]**)**

str
: String from which the substring is to be extracted.

m
: Position in *str* at which the substring begins. Character positions are numbered consecutively from left to right, starting with one.

n
: Maximum length of the substring.

  n not specified:
  The substring extends to the end of *str*.

Example The input

```
{
x = substr("060789",3,2); print "Month = "x
}
```

produces the output:

```
Month = 07
```

system - Call shell command

system executes the specified shell command and returns its exit status.

Syntax **system**(command)

command
: Name of the shell command to be executed.

Error If an *awk* program contains errors, *awk* issues corresponding error messages and exits immediately. The error messages indicate the cause of the error, if detectable by *awk*, and the *awk* program line in which *awk* thinks the error is to be found. Typical error messages are:

`awk: syntax error at source line xxx`
Line xxx of the *awk* program contains a syntax error.

`awk: illegal statement source line number xxx`
Line xxx of the *awk* program contains an illegal statement.

Locale The following environment variables affect the execution of *awk*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions and in comparisons of string values.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and input files, the behavior of character classes within regular expressions, the identification of characters as letters, and the mapping of upper- and lower-case characters for the *toupper* and *tolower* functions.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_NUMERIC	Determine the representation of the radix character, the exponentiation symbol and the digit grouping character.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

awk Examples

Example 1 Output all input lines in which field 3 is greater than field 5:

```
$ awk '$3 > $5' file
```

Since no action has been specified, *awk* prints the selected lines by default.

Example 2 Print every 10th line of a file:

```
$ awk '(NR % 10) == 0' file
```

Example 3 Print the second to last and the last field in each line, separated by a colon:

```
$ awk 'BEGIN {OFS=":"}  \
>      {print $(NF-1), $NF}' file
```

If a line consists of a single field, the entire line is output twice, separated by a colon (first *$0*, then *$1*).

Example 4 Add up the values of the first field of every line and print the total and average at the end:

```
$ awk '{s += $1} \
>      END {print "Total: ", s, "Average: ", s/NR}'\
>      file
```

Example 5 Find a preprocessor *if* directive, i.e. a range of lines in which the first line begins with #if and the last line with #endif:

```
$ awk '/^#if/, /^#endif/' file
```

Example 6 Print all lines in which the first field differs from that of the previous line:

```
$ awk '$1 != prev { print; prev = $1 }' file
```

Example 7 *file* contains a list of data about young people, with the second field containing one of the entries *school*, *university*, *apprenticeship* or *elsewhere*. For statistical purposes, you want to count how many are at school and university:

```
$ awk '$2 ~ /school/ {incr["school"]++}
>     $2 ~ /university/ {incr["university"]++}
>     END {print "school:" incr["school"]; \
>          print "university:" incr["university"]} ' file
```

Example 8 The file *contents* lists the table of contents of a text. The table of contents is organized in decimal classification and has the format:

```
1. Foreword
2. Introduction
3. The Game of Chess
3.1. History
3.2. Rules
3.2.1 Setting Up the Figures
.
.
.
4. The Game of Checkers/Draughts
4.1. History
.
.
.
8. Index
```

The following *awk* program can be used to give the list a more orderly format:

```
$ awk '{$1=$1"      ";    \
>      $1=substr($1,1,6);  \
>      print $0} ' contents >> con.form
```

The output lines are prepared in the following stages:

First, six blanks are added to the end of the first field (*$1=$1␣␣␣␣␣␣"*). Then the first field is truncated to six characters. Thus the first field of each line is 6 characters long, and field 2 always starts at column 7. The output in the file *con.form* will be as follows:

```
1.    Foreword
2.    Introduction
3.    The Game of Chess
3.1.  History
3.2.  Rules
3.2.1 Setting Up the Figures
.
.
.
4.    The Game of Checkers/Draughts
4.1.  History
.
.
.
8.    Index
```

Example 9 The following *awk* program in the file *prog* prints the number of fields and the actual fields of each record. The record separator has been redefined as the dollar sign. The field separators are thus blanks, tabs, and the newline character:

```
BEGIN { RS="$"; printf "Record\tNum" }
      { printf ("\n%4d\t%3d\t", NR, NF);
        for(i=1;i<=NF; i++) printf "%s:", $i }
END {print"\n"}
```

The file *text* contains the following text:

```
first record$  second   record     $
$
fourth     and  last
record$
```

The call:

```
$ awk -f prog text
```

returns:

```
Record  Num
     1    2      first:record:
     2    2      second:record:
     3    0
     4    4      fourth:and:last:record:
     5    0
```

Example 10 You now change the file *text* to:

```
&&
first&&record$second record$$fourth
and&
last
record&
```

and call *awk* again, this time using the *-F* option to change the field separator to &.

```
$ awk -F"&"  -f prog text
```

The output returned is:

```
Record  Num
     1    6    :::first::record:
     2    1    second record:
     3    0
     4    8    fourth:and::last::record:::
```

This example illustrates how fields are separated when a non-standard separator is used. The first line (&&) of the *text* file is a part of the first record and now yields 3 fields, for example, because each individual separator in a string of separators (&&) is counted, and the newline implicitly acts as a separator as well (2 & + 1 newline = 3).

See also *egrep*, *fgrep*, *grep*, *lex*, *sed*

basename return non-directory portion of path name

You can use *basename* to

– extract the basic file name (basename) from the full path name,

– strip any suffixes from the file name.

basename strips all characters up to and including the last / from the specified string and writes the result to standard output. The basic file name can thus be separated from its path prefix. If you also specify a string suffix as a command-line argument, *basename* will strip this suffix as well. *basename* is useful in shell scripts.

Syntax

```
basename[␣string[␣suffix]]
```

string
string can be any character string.
basename deletes all characters up to and including the last / from *string* and writes the result to standard output. Strings that do not include a slash are output unmodified.

string not specified:
A period (dot) is written to standard output.

suffix
suffix can be any character string.
If the specified *suffix* matches the end of *string*, *string* is output without *suffix*.

Locale

The following environment variables affect the execution of *basename*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The name *prog* is to be generated from */home/catherine/program*:

```
$ basename /home/catherine/program ramm
prog
```

Example 2 The following shell script compiles a C source program. *basename* generates the name of the compiled program from the file name used as a command-line argument for the shell script. The compiled program is stored in an executable file in the current working directory. The shell script is called *compile*.

Contents of *compile*:

```
c89 –o ’basename $1 .c’ $1
```

If you call *compile* as follows:

```
$ compile /home/anna/cprogs/tab.c
```

then the name of the C source file is passed to the command *c89* (control program for the compiling and linking of C programs, see *c89* [5]) in the positional parameter $1.

The shell replaces the operand for the *c89* option *-o* with the result of the *basename* call. The name of the executable file is *tab*.

See also *dirname, ed*

batch execute commands at a later time

batch reads commands from standard input, puts them in a queue, and executes them when system load level permits.

Standard output and standard error output of the commands to be executed are sent to the user by *mailx* unless they are redirected elsewhere. The environment variables, the current directory, the permissions for new files (see *umask* on page 797) and the maximum permissible file size (see *ulimit* on page 794) are retained, but open files and priorities are lost, and the *trap* command (shell built-in for catching signals) is deactivated.

batch writes the job number and the schedule time to standard error.

Jobs scheduled with *batch* are retained even if the user who scheduled them closes the POSIX shell with *exit* or if the POSIX subsystem is shut down. There is no need to reschedule the jobs.

batch has exactly the same effect as *at -qb* with no further options.

Before the call

The user ID must have a standard account number for *rlogin* access. This standard account number can be assigned using the ADD-USER, MODIFY-USER-ATTRIBUTES or ADD-POSIX-USER command.

If the file */usr/lib/cron.d/at.allow* exists, you can only use *batch* if your login name appears in it.

If the file */usr/lib/cron.d/at.allow* does not exist, you can only use *batch* if your login name does *not* appear in the file */usr/lib/cron.d/at.deny*.

If neither */usr/lib/cron.d/at.allow* nor */usr/lib/cron.d/at.deny* exists, only the POSIX administrator is allowed to use *batch*.

If only an empty deny file exists, for example, everyone is allowed to use *batch*.

Only the POSIX administrator is allowed to create and modify the allow and deny files. Each line in these files contains precisely one login name.

Syntax

```
batch ↵
command ... ↵
END or @@d
```

command
: Any command or shell script. You can specify more than one *command* at a time, using semicolons or newlines to separate them. The resulting command list is executed under a single job number.

Error

```
at: you are not authorized to use at. Sorry.
```

Permission to use *batch* denied (see “Before the call” on page 153).

File

/usr/lib/cron.d/at.allow
List of login names with permission to use *batch*. One login name is entered per line.

/usr/lib/cron.d/at.deny
List of login names explicitly denied permission to use *batch*. One login name is entered per line.

/var/spool/cron/atjobs
Directory containing a separate file for each *batch* job which has not yet been executed. Each *batch* job is allocated a file of its own with the file name *jobnumber.b*.

Variable

SHELL
Determine a name of a command interpreter to be used to invoke the *at* job. If the variable is unset or null, *sh* will be used. If it is set to a value other than a name for *sh*, the implementation will do one of the following: use that shell; use *sh*; use the login shell from the user database.

TZ
Determine the timezone. The job will be submitted for execution at the time specified be *timespec* or *-t time* relative to the timezone specified by the *TZ* variable. If *timespec* specifies a timezone, it will override *TZ*. If *timespec* does not specify a timezone and *TZ* is unset or null, an unspecified default timezone will be used.

Locale

The following environment variables affect the execution of *batch*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_TIME	Determine the format and contents for date and time strings written by *batch*.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example In the following example, the standard input is redirected, and *batch* takes its work from the file *jobs*:

```
$ batch < jobs
job 604763316.b at Mon Mar  9 14:48:36 2009
```

The jobs contained in the file *jobs* are run in sequential order as background processes by *batch*. When the job is complete, you can have the result displayed on the screen by *mailx*.

See also *at*, *crontab*, *mailx, ulimit*

bc arbitrary-precision arithmetic language

You can use *bc* to perform arithmetical calculations. *bc* is an interactive program for a C-like input language.

Syntax **bc**[␣**-l**][␣file...]

-l *-l* stands for */usr/lib/lib.b*, which is a library containing *bc* programs for various mathematical functions.
The *-l* option must be specified if you want to use any the following functions:

s(x)	sine
c(x)	cosine
e(x)	base e exponential function
l(x)	natural logarithm
a(x)	arctangent
j(n,x)	n-th order Bessel function

file
Name of file containing a *bc* program. You may specify more than one file. When all statements from all files have been processed, *bc* reads from standard input. You can then enter further statements.

file not specified:
bc reads from standard input.

Elements of bc programs

A *bc* program consists of
– definitions
– statements
– comments

The following symbols are used in defining the structure of *bc* programs:

L	(L - letter) stands for one of the letters a-z
E	(E - expression) stands for an expression
S	(S - statement) stands for a statement

Comments

Comments are enclosed in /*...*/ as in C.

Statements

Statements in *bc* can be:

- Expressions (see *Expressions*)

  The value of a statement that is an expression is printed unless the main operator is an assignment.

- Blocks (grouped statements): {S; ...; S}
- Conditional statement: if (E) S

  If expression E is true, i.e. has a non-zero value, then statement S is executed.

- Iteration statements:
  - while (E) S
    Expression E is evaluated and if it has a non-zero value, statement S is executed. E is then evaluated again, and S is executed again if E is still non-zero. This process is repeated for as long as E has a non-zero value.
  - for (E; E; E) S
    First, the first expression is evaluated. Next, the second expression is evaluated and if it has a non-zero value, statement S is executed. Lastly, the third expression is evaluated. Then the second expression is evaluated again and statement S is again executed if it is non-zero, and so on. Unlike in C programs, a for statement must always contain three expressions.
- Jump statement: break

  The break statement can be used only within an iteration statement. It causes termination of the nearest while or for statement. Program execution continues with the statement that follows the terminated iteration statement.

- Termination statement: quit

  The quit statement stops execution of a *bc* program. The quit statement is interpreted as soon as it is read, not when the *bc* program is executed.

  Example

  The following *bc* program terminates immediately without printing the value of a:

  ```
  a=5
  if (a>10) quit
  a)
  ```

You can separate statements from one another with a semicolon or a newline character.

Expressions

Expressions consist of operands and operators.

Operands are names or arbitrarily long numbers with optional sign and decimal point.

Names

L	simple variables
L	function names
L[E]	array elements
ibase	base (radix) for input numbers, default: 10
obase	base (radix) for output numbers, default: 10
scale	number of fractional digits, default: 0

If arrays are used as function arguments or defined as automatic variables, empty square brackets must follow the array name.

The same name may be used simultaneously for an array, a function, and a simple variable. All variables are global to a *bc* program.

Other operands

(E)	result of E
sqrt(E)	square root of E
length(E)	number of significant decimal digits in E
scale(E)	number of fractional digits in E
L(E, ...,E)	

Operators

+ - * /	addition, subtraction, multiplication, division
^	power operator
%	remainder of integer division (can now also be applied to floating-point numbers.
++ - -	increment and decrement operators, which can be applied to names in prefix or postfix notation
< <= == >= > !=	relational operators (less than, less than or equal to, equal to, greater than or equal to, greater than, not equal to)

=	assignment operator
=@	compound assignment operators, where a=@b is the same as a=a@b. @ can be any of the operators + - * / ^ or %.

The logical operators *&&* and || are *not* recognized by the *bc* command.

Function definition

```
define L (L, ...,L) {
         auto L, ...,L
         S; ...;S
         return (E)
  }
```

Example

```
   define p(x) {
         auto q
         q = p * p
         return (q)
     }
```

Declaring the identifiers of a function as auto restricts their scope to that function. All function arguments are passed by value.

Functions in the math library /usr/lib/lib.b

Definitions of the mathematical functions listed below are contained in the library */usr/lib/lib.b*. The functions can be accessed by calling *bc* with option *-l*.

```
s(x)    sine
c(x)    cosine
e(x)    base e exponential function
l(x)    natural logarithm
a(x)    arctangent
j(n,x)  n-th order Bessel function
```

x values in mathematical functions must be specified in absolute radian measure.

If you have write permission for */usr/lib/lib.b*, you can add definitions of further functions and also modify or delete existing ones.

Defining bases for input and output numbers

With *ibase* and *obase* you can specify the base used for interpreting input and output values (input and output number radix). The following rules apply:

1. If you do not explicitly assign values to *ibase* and *obase*, input numbers are interpreted as decimal and results are output in decimal.
2. If you have already defined the input base with an *ibase=n* statement, the number that you use to define the output base in an *obase=m* statement must be in input base *n* as well.

Example

The input base is to be 2, the output base 16:

```
$ bc
ibase=2
obase=10000
10100000/1010
10
```

Fractional digits

Each expression *E* in *bc* is associated with a specific number of fractional digits. You can use the *scale* variable to inspect or change this number and the *scale(E)* function just to inspect it.

Example

In the following example the value of operand *a* is divided by the value of operand *b* with the *scale* variable initially left unset: the result contains no fractional digits. Then *scale* is assigned a value of 8: the result of the division is now correct to 8 places after the decimal point.
Finally we inspect the number of fractional digits in the result and the value of *scale*.

```
$ bc
a=15.0
b=7.8
a/b
1
scale=8
a/b
1.92307692
scale(a/b)
8
scale
8
@@d or END
$
```

If you join two expressions using an operator, the number of fractional digits associated with the result is governed by a rule specific to the operator you use. The rules for *bc* operators are described below. Various symbols are used in the descriptions:

a = first operand
b = second operand
R = number of fractional digits in the result of a calculation
A = scale(a)
B = scale(b)

-
++
--

The unary minus sign and the increment and decrement operators ++ and -- (in prefix and postfix notation) do not affect the number of fractional digits.

Rule: `scale(E) = scale (-E) = scale(--E) = scale(++E) ...`

Example

a is assigned a value with three fractional digits. The query function *scale(a)* here always returns 3, regardless of whether *a* has a -, -- or ++ operator and regardless of the fact that *scale* was previously assigned a different value:

```
$ bc
scale=1
a=1.123
scale(a)
3
scale(-a)
-3
scale(a++)
3
scale(--a)
3
@@d or END
$
```

+
-

With the binary operators + and -, *R* is equal to the number of fractional digits in the operand with the most fractional digits, regardless of whether you have previously assigned *scale* some other value.

Rule: `R = max(A,B)`

Example

The *scale* variable is assigned a value of 1. Operand *a* is assigned a value with 2 fractional digits, *b* a value with three fractional digits. Thus *b* has more fractional digits than *a*, and also more than *scale*. The query function returns 3 for both operands, the greater number in *b* taking precedence.

```
$ bc
scale=1
a=0.12
b=0.123
scale(a+b)
3
scale(b-a)
3
@@d or END
$
```

* With multiplications, a value previously assigned to *scale* is significant: *bc* first calculates *max*, which is the highest of the values *scale*, *A* and *B*. It then forms the sum of *A* and *B* and compares this value with *max*. *R* is then the lower (*min*) of these two values.

Rule: `R = min (A+B, max (scale, A, B))`

Example

scale has a value of 9, *A* and *B* are both 1. Thus the highest of the three values is 9. The sum of the number of fractional digits in the two operands is 2. The number of fractional digits in the result of the multiplication is the lower from the comparison of *max* and this sum, which is 2.

```
$ bc
scale=9
a=0.1
b=0.1
scale(a*b)
2
@@d or END
$
```

/ With divisions, the precision of the result is equal to the value of scale:

Rule: `R = scale`

Example

scale is first given a value of 8. Then the operands are assigned integer values. The result is also an integer. In spite of that, the query function returns 8, and the result is shown correct to 8 places after the decimal point.

```
$ bc
scale=8
a=16
b=4
scale(a/b)
8
a/b
4.00000000
@@d or [END]
$
```

^ With the power operator, *R* is formed as follows:

– If the integer exponent *e* is equal to or greater than 0:
bc takes the higher (*max*) of the two values *scale* and *A*. It then multiplies *A* by the absolute value *m* of the exponent, compares the result with *max*, and takes the lower of the two values.

  Rule: `R = min (A*m, max (scale, A))`

– If the integer exponent *e* is less than 0:
The precision of the result is equal to the value of *scale*.

  Rule: `R = scale`

Example 1

scale is given a value of 7. *a* has one fractional digit, and the absolute value of exponent *e* is 4, i.e. greater than 0. The higher value from the comparison of *scale* and *a* is 7. However, the result of multiplying *a* and *m* is 4. Thus the number of fractional digits after exponentiation is 4:

```
$ bc
scale=7
a=3.1
e=4
scale(a^e)
4
a^e
92.3512
@@d or END
$
```

Example 2

However, if you set the exponent *e* to -4, the number of fractional digits is equal to the value of *scale*:

```
$ bc
scale=7
a=3.1
e=-4
scale(a^e)
7
a^e
.0108281
@@d or END
$
```

=
=@

With the assignment operators, the value of *R* is equal to that of *A* after assignment. For a given compound operator =@, the rule for calculating the number of fractional digits is the same as for the corresponding simple operator @.

Rules: `R  = scale(b)   and   R = scale(a@b)`

Example 1

a is assigned a number with one fractional digit, *b* a number with two fractional digits: *scale(a)* is 1 and *scale(b)* is 2. If you inspect *scale(a)* after assigning the operands, *bc* returns a value of 2, which is *scale(b)*. If you then inspect *a* again, the value returned is the value assigned to *b*:

```
$ bc
a=0.1
b=0.12
scale(a)
1
scale(b)
2
a=b
scale(a)
2
a
.12
@@d or END
$
```

Example 2

a is assigned a number with two fractional digits, *b* a number with three. In the ffunction call, *a* is assigned the value resulting from adding the two operands. *bc* sees the number of fractional digits in the result of an addition as being equal the number of fractional digits in the operand with the most fractional digits. After assignment *a* has the same number of digits, i.e. three:

```
$ bc
a=0.12
a=0.123
scale(a)
2
scale(b)
3
a=+b
scale(a)
3
a
.243
@@d or END
$
```

% With remaindering, if the value of scale is non-zero, the result is computed as follows:

```
a%b = a - (a / b) * b
```

First the division is performed using the precision of *scale*. The precision of the multiplication by *b* is equal to:

```
scale + B
```

In other words the multiplication is performed with full precision. Thus here the % operator can be used as a measure of the precision with which the division is performed.

Finally *R* is whichever is the higher of *A* and (*scale* + *B*).

Rule: `R = max ((scale + B), A)`

Example

scale has a value of 4, *a* and *b* each have one fractional digit. The result of remaindering has five fractional digits:

```
$ bc
scale=4
a=1.2
b=1.1
scale(a%b)
5
a%b
.00001
@@d or END
$
```

File /usr/lib/lib.b
Math library

Locale The following environment variables affect the execution of *bc*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Addition, subtraction, multiplication, and division of numbers. Non-integer results are to have 2 digits after the decimal point:

```
$ bc
scale=2
3+7
10
8-15
-7
7*6
42
3/5
.60
quit
$
```

Example 2 Defining a function to compute an approximate value of the exponential function.

```
scale=20
define e(x){
      auto a, b, c, i, s
      a = 1
      b = 1
      s = 1
      for(i=1;1==1;i++){
              a = a*x
              b = b*i
              c = a/b
              if(c==0) return (s)
              s = s+c
        }
  }
```

The termination criterion of the for loop is contained in the body of the loop (*if(c==0)*) and is not given by the second expression of the for statement as is usually the case.
In a C program, the second expression of the for statement would simply be omitted; but in a *bc* program the for statement must always have 3 expressions. The expression *1==1*, which is always true, has been inserted for this reason.

Example 3 Printing approximate values of the exponential function of the first ten integers.

```
for(i=1;i<=10;i++) e(i)
```

Example 4 Printing the squares of the integers 1 to 4:

```
$ bc
for(i=1;i<5;i++) {i*i}
1
4
9
16
quit
```

See also *expr, let*

bg run jobs in the background

You can use the built-in command *bg* in the POSIX shell *sh* to specify jobs for background processing.

Syntax

bg[␣job-id...]

job-id
: Each specified job is held for background processing. The section "Jobs" on page 62 describes the format of *job-id*.

job-id not specified:
The current job is specified for background processing.

Locale

The following environment variables have an effect on the execution of *bg*:

LANG	Specifies a default value for the locale variable that is unset or null. If *LANG* is unset or null, the corresponding locale default value is used. If the locale variable contains an invalid setting, locale behaves as if no variables had been set.
LC_ALL	If this value is set, i.e. is not empty, this value overwrites the values of all other locale variables.
LC_CTYPE	Determines the locale for the interpretation of byte sequences as characters (e.g. single-byte as opposed to multibyte characters in arguments).
LC_MESSAGES	Determines the format and content of error messages.
NLSPATH	Determines the position of the message catalog for the processing of *LC_MESSAGES*.

Example

You wish to specify job *%1* for background processing:

```
$ bg %1
```

See also

fg, jobs, kill, wait

bs2cmd execute BS2000 command *(BS2000)*

The POSIX command *bs2cmd* executes a BS2000 command.

Syntax

```
bs2cmd[␣-h]␣cmd
```

-h Displays the command syntax and explains the options.

cmd
BS2000 command:
Any BS2000 command in accordance with the BS2000 syntax in SDF format may be specified here.
(The ISP format is now only supported for compatibility reasons.)

Special characters in the BS2000 command (e.g. $, *) must be escaped by a backslash ('\'). Alternatively, the entire cmd string must be enclosed in quotes.

The command name, operands and operand values are converted to uppercase letters. For commands in the ISP format, only the command name is converted to uppercase.

Hint

The *bs2cmd* command is also supported with *rlogin* and *telnet* accesses to POSIX.

SYSFILE environment:
BS2000 commands that need the SYSFILE environment for execution can be currently executed only in the base shell, since the SYSFILE environment is not fully initialized in a subshell.

Unloading the shell:
When *bs2cmd* is called from the base shell, the unloading of the shell is prevented by specifying a corresponding BS2000 command (e.g. START-PROGRAM or a user-defined command whose CALL procedure terminates the running program). *bs2cmd* issues a message (SDP0250), and the BS2000 command is not executed. The unloading of the base shell cannot be currently prevented on calling *bs2cmd* from a subshell.

Example The following command shows the catalog entries of the SYSRME files on the BS2000 ID $QM212:

```
/home/user1> bs2cmd 'show-file-attributes $qm212.sysrme.*'

%      15 :1OSN:$QM212.SYSRME.ARCHIVE.090.D
%      15 :1OSN:$QM212.SYSRME.ARCHIVE.090.E
  .
  .
  .
%      12 :1OSN:$QM212.SYSRME.POSIX-BC.070.D
%      12 :1OSN:$QM212.SYSRME.POSIX-BC.070.E
%      18 :1OSN:$QM212.SYSRME.POSIX-BC.080.D
%      18 :1OSN:$QM212.SYSRME.POSIX-BC.080.E
%:1OSN: PUBLIC:    15 FILES RES=      210  FREE=       18  REL=       0 PAGES
%:1OSN: PUB/S2:     2 FILES RES=      123  FREE=        1  REL=       0 PAGES

/home/user1>
```

See also *bs2cp*, *bs2file*

bs2cp copy POSIX/BS2000 files *(BS2000)*

bs2cp copies files from the POSIX file system to BS2000 and vice versa. The command has four formats:

– Copying a single POSIX file to BS2000 and vice versa (see below)

– Copying POSIX files to BS2000 as DVS files (see page 175)

– Copying POSIX files to a BS2000 PLAM library (see page 176)

– Copying BS2000 files with wildcard syntax to a POSIX file directory (see page 177)

The command creates physical copies. Hence, after copying the files are physically present in both the POSIX and BS2000 file systems.

Format 1 Copying a single POSIX file to BS2000 and vice versa

Syntax

```
bs2cp[␣-k|␣-t␣table][␣-f][␣-l][␣-h]␣bs2:file␣filecopy
bs2cp[␣-k|␣-t␣table][␣-f][␣-l][␣-h]␣file␣bs2:filecopy
```

-k The file content is converted during copying:

– from ASCII to EBCDIC, if *file* is a file of the POSIX file system

– from EBCDIC to ASCII, if *file* is a BS2000 file (**bs2:** entered).

This option is ignored and no conversion is performed if the original file or the file copy is a PLAM library element of the *L* (*LLM*) type.

Unlike control with the *IO_CONVERSION* environment variable, *-k* will convert independently of the POSIX file system type. Hence, it will also convert when the POSIX file system is an EBCDIC file system (i.e. not an ASCII file system or an NFS-mounted file system).

-k is only meaningful with text files. The *b2cp* command does not perform any contents plausibility check for meaningful conversion.

-t table

The file content is converted during copying using the *table* file as conversion table.

i The options *-k* and *-t* are mutually exclusive.

This is similar to the option *-k* in that the option will be ignored and no conversion will take place if the original file or the file copy is a PLAM library element of the *L (LLM)* type.

Properties of the *table* file:

- EBCDIC format.
- It must contain exactly 256 character pairs. They must be composed of the following characters: *0* to *9*, *a* to *f* and *A* to *F*.
- All EBCDIC characters from *X'00'* to *X'40'* can be placed between the character pairs. These are for example blank spaces, tabulators or newline characters.
- The file can be of any size. However, only the first 8172 characters (max.) are evaluated.

If the absolute path name of the *table* file is not given, the command will look up in *$BS2CPTABS*. If this variable is not set or is empty, the command will search for the *table* file in the */usr/lib/bs2cp* directory.

At first, a 256-byte conversion table is created from the *table* file during the conversion. This is done by compressing each of the 256 character bytes to a hex decimal character. After that, each of the characters from the file to be copied is replaced by a character from the conversion table which is addressed via the binary value of the input character.

The input character *M* is for example substituted by byte 212 of the conversion table because *M* has the EBCDIC value *X'D4'* and hence the decimal value *212*.

An example of the structure of the code table can be found under "Example table for option -t" on page 179.

-f By default, *stderr* is checked during copying from POSIX to BS2000 and the user is prompted if existing BS2000 files/elements should be overwritten or not. This dialog prompt is suppressed with *-f* and existing files are overwritten.

This option is ignored (if indicated) during copying from BS2000 to POSIX. Existing POSIX files are always overwritten.

If the environment variable *OV* exists, the dialog query is omitted regardless of the *-f* option. If *OV* = "*Y*", existing BS2000 files/elements are overwritten, otherwise they are not overwritten and a message is issued instead.

-l Each successfully copied file is reported as follows:
`bs2cp: copy from` *path name* `to` *path name* `done`

-h Output of the command syntax with explanation of options.

bs2:

The *file* or *filecopy* entered with this option is a BS2000 file.

DVS files are addressed by their name. Special characters (e.g. $ in the BS2000 user ID) in file names must be masked by a preceding backslash character or by bracketing the character strings **bs2:***file* or **bs2:***filecopy* in single inverted commas.

A library element is called in the following form (also see example 3 on page 183):

'lib(elem[,[type][,vers]])'

where

lib	is the name of the PLAM library in BS2000.
elem	is the name of the element.
type	is the type of element. The element types *S*, *M*, *J*, *P*, *D*, *X* and *L* are supported. Default value is *S*.
vers	is the version of the element. Default is **HIGH*.

i One of the files (*file* or *filecopy*) must be a BS2000 file or library element. POSIX file directories cannot be copied into BS2000. Wildcard syntax and construction entries are not supported.

file

Name of the file to be copied.

filecopy

Name of the copy. If *filecopy* is an existing BS2000 file or a library element, the user is prompted if it should be overwritten. The option *-f* and the environment variable *OV=Y* suppress this prompt.

The following is valid for a *filecopy* that is a BS2000 DVS file:

– If *filecopy* already exists, *bs2cp* will adopt the file attributes from the file catalog.

– If *filecopy* does not yet exist, it will be created. Prior to the *bs2cp* call, the file type of the new file can be set with the *ftyp* command. If no file type is set, a SAM file with a variable record length will be created.

The following is valid if *filecopy* is an element of a BS2000 PLAM library:

– An existing *elem* library element will be overwritten if the option *-f* is set or if the environment variable *OV* is set to *Y*.

– If the *elem* library element does not yet exist, it will be created. The *ftyp* and *bs2file* commands can also be used to influence the file types of non *L*-type elements.

– If no PLAM library with the name *lib* exists, it will be created.

Format 2 Copying POSIX files to BS2000 as DVS files

Syntax **bs2cp␣-x**[␣**-k**|␣**-t**␣table][␣**-f**][␣**-l**][␣**-h**][␣**-p**␣prefix][␣**-s**␣suffix]␣file . . . ␣**bs2:**

-x Extended format of the *bs2cp* command.

-k -t
see format 1 (page 172).

-f This is analogous to format 1. By default, *stderr* is checked during copying and the user is prompted if existing BS2000 files should be overwritten. However, the prompt offers several reply options:
`bs2cp: overwrite A ?` *y* (yes), *n* (no), *a* (all) or *q* (quit)

If *q* is selected, the command *bs2cp* is aborted with an exit status unequal to null.

The dialog query is suppressed with *-f*. Already existing files are always overwritten.

If the environment variable *OV* exists, the dialog query is omitted regardless of the *-f* option. If *OV* = "*Y*", existing BS2000 files/elements are overwritten, otherwise they are not overwritten and a message is issued instead.

-l Each successfully copied file is reported as follows:
`bs2cp: copy from` *path name* `to` *path name* `done`

-h Output of the command syntax with explanation of options.

-p prefix
The *prefix* character string precedes the names of the copies.

-s suffix
The *suffix* character string is appended to the names of the copies.

file...
is a list consisting of one or more POSIX files where shell special characters (wildcards) can be used to generate file names. *file* must not be a file directory.

bs2:
The copies are placed in BS2000 as DVS files. The copies always receive the same plain file names as the originals written in upper case. They can, however, be expanded with *prefixes* and *suffixes*. Any underscore characters will be converted into dollar signs.

If files already exist, the user will be prompted if they are to be overwritten. Moreover, the user can specify that all the following files will be overwritten without any prompt being displayed. It is also possible to cancel processing.

By default, the files are copied to the BS2000 user ID of the POSIX user in the home pubset. The prefix entered with *-p* can be used to indicate another Cat ID or User ID.

See example 4 on page 183.

Format 3 Copying POSIX files to a BS2000 PLAM library

Syntax

bs2cp␣**-x**[␣**-k**|␣**-t**␣table][␣**-f**][␣**-l**][␣**-h**][␣**-p**␣prefix][␣**-s**␣suffix]␣file . . .
␣’**bs2:**lib**(**[**,**[type][**,**vers]]**)**’

-x Extended format of the *bs2cp* command.

-k -t
see format 1 on page 172.

-f By default, *stderr* is checked and the user is prompted if existing BS2000 elements should be overwritten or not. This dialog prompt is suppressed with *-f* and existing files will be overwritten.

If the environment variable *OV* exists, the dialog query is omitted regardless of the *-f* option. If *OV* = "*Y*", existing BS2000 files/elements are overwritten, otherwise they are not overwritten and a message is issued instead.

-l Each successfully copied file is reported as follows:
`bs2cp: copy from` *path name* `to` *path name* `done`

-h Output of the command syntax with explanation of options.

-p prefix
The *prefix* character string precedes the names of the copies.

-s suffix
The *suffix* character string is appended to the names of the copies.

file...
is a list consisting of one or more POSIX files where shell special characters (wildcards) can be used to generate file names. *file* must not be a file directory.

’**bs2:**lib**(**[**,**[type][**,**vers]]**)**’
The copies are created as elements of the BS2000 PLAM library *lib*. For *type* and *vers* see format 1, page 174. The element names are created from the original simple file names (in upper case). They can be expanded with *prefixes* and *suffixes*.

See example 5 on page 184.

Format 4 Copying BS2000 files with wildcard syntax to a POSIX file directory

Syntax **bs2cp**␣**-x**[␣**-k**|␣**-t**␣table][␣**-l**][␣**-h**][␣**-p**␣prefix][␣**-s**␣suffix]␣**'bs2:**file' |
␣**'bs2:**lib**(**elem[**,**[type][**,**vers]]**)'**␣`file` directory

-x Extended format of the *bs2cp* command.

-k -t
see format 1 on page 172.

-l Each successfully copied file is reported as follows:
`bs2cp: copy from` *path name* `to` *path name* `done`

-h Output of the command syntax with explanation of options.

-p prefix
The *prefix* character string precedes the names of the copies.

-s suffix
The *suffix* character string is appended to the names of the copies.

'bs2:file'
file is a fully or partially qualified DVS file name with wildcard syntax (special character "*" of the BS2000 command SHOW-FILE-ATT or FS). Only one **bs2:***file* operand is permitted.

Important: If the name consists of blank spaces only or is missing altogether, this is equivalent to the "*" wildcard character.

'bs2:lib**(**elem[,[type][,vers]]**)'**
elem is the fully qualified name of a PLAM element or the partially qualified name of several PLAM elements with LMS wildcard syntax. The following wildcard special characters are supported: * < : >. Other special characters for LMS wildcards are not guaranteed.

Special case: If *elem* is not specified, all elements of the corresponding type and version will be used (this is equivalent to the wildcard character "*").

Minimal entry: **bs2:***lib***()** all elements of type *S* and of highest version are copied.

file directory
The BS2000 files/elements are copied to the POSIX file directory indicated. The common shell notation is permitted for file directories. For example:

. (period)	Current directory
~ (tilde)	Home directory
/dvz1/dvz2	absolute path
dvz1/dvz2	Relative path starting at the current directory

See example 6 on page 184 and example 7 on page 184.

Hint

EXIT status in the extended formats 2 through 4

If several files are to be copied with the same *bs2cp* call, the exit status will only be *0* if all copies were successfully completed. As soon as the first error occurs, the exit status will be unequal to *0* and the remaining files will not be copied.

Copying library elements

When library elements are copied to POSIX files or vice versa, the software product LMS must be installed.

DVS file attributes supported

bs2cp only supports file attributes which are supported by the C runtime system with STREAM I/O. Hence, SAM files with fixed record length can only be opened as binary type (*ftyp binary*).

ftyp binary supports the following file attributes:

FCB-TYPE	REC-FORM	BLKCTRL	BLKSIZE (STD,n)	RECSIZE (r Byte)	Max. number of data bytes
SAM	F	PAMKEY	1<=n<=16	1<=r<=n*2048	RECSIZE
SAM	F	DATA(2K)	1<=n<=16	1<=r<=n*2048-16	RECSIZE
SAM	F	DATA(4K)	2<=n<=16	1<=r<=n*2048-16	RECSIZE
SAM	V	PAMKEY	1<=n<=16	4<=r<=n*2048-4	RECSIZE - 4
SAM	V	DATA(2K)	1<=n<=16	4<=r<=n*2048-16	RECSIZE - 4
SAM	V	DATA(4K)	2<=n<=16	4<=r<=n*2048-16	RECSIZE - 4
SAM	U	PAMKEY	1<=n<=16		BLKSIZE
SAM	U	DATA(2K)	1<=n<=16		BLKSIZE - 16
SAM	U	DATA(4K)	2<=n<=16		BLKSIZE - 16
PAM		PAMKEY	1<=n<=16		BLKSIZE
PAM		DATA(2K)	1<=n<=16		BLKSIZE - 12
PAM		DATA(4K)	2<=n<=16		BLKSIZE - 12
PAM		NO(2K)	1<=n<=16		BLKSIZE
PAM		NO(4K)	2<=n<=16		BLKSIZE

ftyp text supports the following file attributes:

FCB- TYPE	REC- FORM	BLKCTRL	BLKSIZE (STD,n)	RECSIZE (r Byte)	Max. number of data bytes
SAM	V	PAMKEY	1<=n<=16	4<=r<=n*2048-4	RECSIZE - 4
SAM	V	DATA(2K)	1<=n<=16	4<=r<=n*2048-16	RECSIZE - 4
SAM	V	DATA(4K)	2<=n<=16	4<=r<=n*2048-16	RECSIZE - 4
SAM	U	PAMKEY	1<=n<=16		BLKSIZE
SAM	U	DATA(2K)	1<=n<=16		BLKSIZE - 16
SAM	U	DATA(4K)	2<=n<=16		BLKSIZE - 16
ISAM		PAMKEY	1<=n<=16	12<=r<=n*2048	BLKSIZE
ISAM		DATA(2K)	1<=n<=16	12<=r<=n*2048	BLKSIZE - 12
ISAM		DATA(4K)	2<=n<=16	12<=r<=n*2048	BLKSIZE - 12

The record keys of ISAM files are not transferred. It is not possible to copy temporary files from BS2000 or via remote file access.

Example table for option -t

Structure of a EBCDIC standard table. A target file is created with a 1:1 copy of the source file:

```
00  01  02  03  04  05  06  07  08  09  0A  0B  0C  0D  0E  0F
10  11  12  13  14  15  16  17  18  19  1A  1B  1C  1D  1E  1F
20  21  22  23  24  25  26  27  28  29  2A  2B  2C  2D  2E  2F
30  31  32  33  34  35  36  37  38  39  3A  3B  3C  3D  3E  3F
40  41  42  43  44  45  46  47  48  49  4A  4B  4C  4D  4E  4F
50  51  52  53  54  55  56  57  58  59  5A  5B  5C  5D  5E  5F
60  61  62  63  64  65  66  67  68  69  6A  6B  6C  6D  6E  6F
70  71  72  73  74  75  76  77  78  79  7A  7B  7C  7D  7E  7F
80  81  82  83  84  85  86  87  88  89  8A  8B  8C  8D  8E  8F
90  91  92  93  94  95  96  97  98  99  9A  9B  9C  9D  9E  9F
A0  A1  A2  A3  A4  A5  A6  A7  A8  A9  AA  AB  AC  AD  AE  AF
B0  B1  B2  B3  B4  B5  B6  B7  B8  B9  BA  BB  BC  BD  BE  BF
C0  C1  C2  C3  C4  C5  C6  C7  C8  C9  CA  CB  CC  CD  CE  CF
D0  D1  D2  D3  D4  D5  D6  D7  D8  D9  DA  DB  DC  DD  DE  DF
E0  E1  E2  E3  E4  E5  E6  E7  E8  E9  EA  EB  EC  ED  EE  EF
F0  F1  F2  F3  F4  F5  F6  F7  F8  F9  FA  FB  FC  FD  FE  FF
```

Error

path name `: Permission denied`

You do not have read permission for this file or you do not have write permission for the file directory.

path name `: no such file or directory`

The file or file directory indicated does not exist.

path name `: is a directory`
The name entered describes a file directory and not a file.

path name `: DMS FSTAT error xxx`
Too many files have been entered.

`invalid character pair:` *xx* `(valid only 0, ..,9,A,..,F)`
An erroneous conversion table was indicated with option *-t*.

`incorrect number of character pairs:` *xxx* `(must be 256)`
An erroneous conversion table was indicated with option *-t*.

`more than 256 character pairs given`
An erroneous conversion table was indicated with option *-t*.

`do not use options -k and -t at the same time`
The options *-k* and *-t* cannot be used at the same time.

`file name name invalid in this case`
A name was indicated after **bs2:** in format 2.

`element name name invalid in this case`
An element name was given in format 3.

`invalid target name path name`
The name of the target file contains an "*".

lib`(`*elem*`,`*type*`,`*vers*`) already exists`
The output library element already exists. (The *-f* option was not specified, the environment variable *OV* does not exist, and the entry takes place from *stdin* (-).)

lib`(`*elem*`,`*type*`,`*vers*`) not accessible`
The output library element cannot be accessed. You either have no write authorization for the library or for the element, or *lib* is not a PLAM library.

file `already exists`
The BS2000 output file already exists. (The *-f* option was not specified, the environment variable *OV* does not exist, and the entry takes place from (-).)

path name: `is a directory`
The path name specified refers to a directory.

path name `is not an executable file`
An attempt was made to copy a POSIX file which does not have the format (UFS-LLM) of an executable file into a library as an L element.

`closing bracket missing`
The closing bracket is missing in the element specification. (An opening bracket was found.)

`Copy from DMS file to DMS file not supported - use command /COPY-FILE` *f1 ,f2*
Copying a BS2000 file to a BS2000 file is not supported. The /COPY-FILE command must be used for this purpose.

`Copy from UFS file to UFS file not supported - use command cp` *f1 f2*
Copying a POSIX file to a POSIX file is not supported. The POSIX command *cp* must be used for this purpose.

`Copy of UFS directories is not supported`
`.` or `..` was specified as *file*.

`DMS FSTAT error D`*xxx*
The system function FSTAT for a BS2000 file returns the error code `D`*xxx*.

`element name` *elem* `too long`
The element name (format 2, 3 or 4) specified as the source is longer than 64 characters.

`FILE command for "`*filename*`" returned error`
The FILE command for the BS2000 output file returned an error. A message of the FILE command was output immediately beforehand. (The message is connected to a *bs2file* or *ftyp* command which was issued by the user beforehand.)

`file` *filename* `not found`
The BS2000 input file was not found.

`Invalid BS2000 filename:` *file*
The specified file name ends with a `.` (period).

`invalid character in` *elem*
The specified element name contains illegal characters.

`invalid element name` *elem*
The element name *elem* starts or ends with `.` or `-`.

`LMS error - LMS`*nnnn*`[, PLA`*mmmm*`][, DMS or macro RC` *xxxx*`]`
`(fct=`*fct*`, lib=`*lib*`, elem=`*elem*`, type=`*type*`, ver=`*vers*`, file=`*filename*`)`
When a library element is accessed, LMSUP reports an error with the error code LMS*nnnn*, possibly supplemented by the PLAM error code and/or the DMS or macro error code (the meaning of the error codes can be inquired using `bs2cmd help LMS`*nnnn* etc.).
The second line is output only if the `-l` or `-x` option was specified. *fct* is `ADD`, `SEL` or `TOC`. When *fct*=`TOC`, the *filename* specification remains empty.

`LMS end errorcode` *xx*
LMSUP, which is needed to copy library elements, could not be terminated properly.

`LMS init errorcode` *xx*
LMSUP, which is needed to copy library elements, could not be initialized.

`LMS toc errorcode` *xx*
The library’s directory could not be read any futher.

`LMS tocprim errorcode` *xx*
The library’s directory could not be read.

`No POSIX file involved - use utility LMS`
A library element and a BS2000 file were specified as the source and the destination or vice versa.

`No write of` *file*`. OV is set to` *value*
The specified BS2000 file was not overwritten because the `-f` option was not specified and the environment variable *OV* is set and not equal to *"Y"*.

`No write of` *lib*`(`*elem*`,`*type*`,`*vers*`). OV is set to` *value*
The specified element was not overwritten because the `-f` option was not specified and the environment variable *OV* is set and not equal to *"Y"*.

`opening bracket missing`
The opening bracket is missing in the element specification. (A closing bracket was found.)

`PLAM element` *elem*`, type` *type*`, version` *vers* `not accessible`
The input element which is specified as the source cannot be accessed. You either have no read authorization for the library or the element, or *lib* is not a PLAM library.

`PLAM element` *elem*`, type` *type*`, version` *vers* `not found`
The input element specified as the source was not found.

`PLAM element name longer than 64`
The specified element name is longer than 64 characters.

`PLAM element name missing`
The element name is missing in the element specification for format 1.

`PLAM element version longer than 24`
The specified element version is longer than 24 characters.

`PLAM element version` *vers* `invalid`
The version specification *vers* contains illegal or wildcard characters.

`PLAM element type not supported`
The specified type is not `S`, `M`, `J`, `P`, `D`, `X` or `L`.

`PLAM error - PLA`*mmmm*`[, DMS or macro RC` *xxxx*`]`
`(fct=`*fct*`, lib=`*lib*`, elem=`*elem*`, type=`*type*`, ver=`*vers*`, file=`*filename*`)`
When a library element is accessed, PLAM reports an error with the error code `PLA`*mmmm*, possibly supplemented by the DMS or macro error code (the meaning of the error code can be inquired using `bs2cmd help PLA`*mmmm* etc.).
The second line is output only if the `-l` or `-x` option was specified. *fct* is `ADD` or `SEL`.

`PLAM library name missing`
The library name is missing in the element specification.

`PLAM library name longer than 54`
The library name is longer than 54 characters.

`PLAM library` *lib* `not found`
The specified PLAM library does not exist.

`PLAM names must end with single closing bracket`
The element name ends with more than one closing bracket.

`too many opening brackets`
The element specification contains more than one opening bracket.

`too many tokens within brackets`
The element specification contains more than three *elem*, *type*, *vers* specifications separated by commas.

Example 1 Copy the BS2000 *techdoc* file into the file directory */usr/fl*, using the same file name. The character set should converted from EBCDIC to ASCII (option *-k*).

```
$ bs2cp -k bs2:techdoc /usr/fl/techdoc
```

Example 2 Copy the *techdoc* file in the POSIX file system to BS2000, using the file name *flcopy.* The current character set is retained (no option *-k*).

```
$ bs2cp techdoc bs2:flcopy
```

Example 3 The *documentation* file is a *D*-type element in the BS2000 PLAM library *product*. Copy the element to the file directory */usr/product*.

```
$ bs2cp 'bs2:product(documentation,D)' /usr/product/documentation
```

Example 4

```
$ bs2cp -x -p posix. -s .sich /home/do/sich/dat* bs2:
bs2cp: overwrite FILE1 ? [y=yes/n=no/a=all/q=quit] a

$ ls /home/do/sich
file1 file2 file3

$ bs2cmd fstat posix.
       12  :ABCD:$USER.POSIX.FILE1.SICH
        9  :ABCD:$USER.POSIX.FILE2.SICH
       18  :ABCD:$USER.POSIX.FILE3.SICH
```

Example 5

```
$ ls
genpos.c   hrcv.c      hrcv.s     hrmgt.c   hrupos.c   hsdax.c

$ bs2cp -x -l -p p hr*.c 'bs2:clib(,s,300)'
bs2cp:     copy from hrcv.c to CLIB(PHRCV.C,S,300) done
bs2cp:     copy from hrmgt.c to CLIB(PHRMGT.C,S,300) done
bs2cp:     copy from hrupos.c to CLIB(PHRUPOS.C,S,300) done
```

Creates the PLAM library CLIB with the following content:

```
   TYPE NAME      VER (VAR#) date
   (S) PHRCV.C   300 (0001) 2008-05-27
   (S) PHRMGT.C  300 (0001) 2008-05-27
   (S) PHRUPOS.C 300 (0001) 2008-05-27
```

Example 6

```
$ bs2cmd fstat '$user2.*kvh*'
        9  :ABCD:$USER2.AKVH7
       12  :ABCD:$USER2.KVHMEM
       12  :ABCD:$USER2.ZKVH

$ bs2cp -x -s .c 'bs2:$user2.*kvh*' /home/tag/kvh

$ ls -l /home/tag/kvh
total 12
-rw-r--r--  1 kvh       prod5       2321 May 27 13:56 akvh7.c
-rw-r--r--  1 kvh       prod5      18549 May 27 13:56 kvhmem.c
-rw-r--r--  1 kvh       prod5        971 May 27 13:56 zkvh.c
```

Example 7

From the BS2000 PLAM library *$USER2.DOCLIB*, all elements of type *D*, file names starting with *KVH* and version *300* are to be copied to the file directory */home/usr/doc*. The prefix *doc.* is to precede the names of the copies.

```
$ bs2cp -xl -p doc. 'bs2:$user2.doclib(kvh*,d,300)' /home/usr/doc
bs2cp: copy from $USER2.DOCLIB(KVHGEN,D,300) to /home/usr/doc/doc.kvhgen done
bs2cp: copy from $USER2.DOCLIB(KVHPROD,D,300) to /home/usr/doc/doc.kvhprod
done
bs2cp: copy from $USER2.DOCLIB(KVHZ,D,300) to /home/usr/doc/doc.kvhz done

$ ls -l /home/usr/doc
total  12
-rw-r--r--   1 kvh      prod5      21738 May 31 06:21 doc.kvhgen
-rw-r--r--   1 kvh      prod5       7461 May 31 06:21 doc.kvhprod
-rw-r--r--   1 kvh      prod5      11729 May 31 06:21 doc.kvhz
```

See also *bs2file*, *ftyp*

bs2do calling BS2000 procedures from the POSIX shell *(BS2000)*

The BS2000 procedure to be executed is started in an ENTER-JOB with the CALL-PROCEDURE command. *bs2do* waits synchronously for the ENTER-JOB to terminate.

Syntax

bs2do[␣**-DV**][␣**-o**␣outfile]␣procedure␣[[**(**]parameter[**)**]]

-D Debug mode - temporary files are not deleted and remain available for diagnosis.

-V Verbose - single steps are logged to *stdout.*

-o the BS2000 system file SYSOUT opened when the ENTER-JOB is started is copied to the POSIX file *outfile.*

outfile
name of the POSIX file into which the BS2000 system file SYSOUT is copied when the ENTER-JOB is started. *outfile* can be any POSIX path name.

procedure
name of the file containing the BS2000 procedure to be executed.
procedure can be any POSIX path name or a string **bs2:***BS2Name*, where *BS2Name* is a BS2000 procedure name according to the SDF syntax of the operand FROM-FILE of the BS2000 /CALL-PROC command.

parameter
parameters of the BS2000 procedure to be executed. Entries are made according to the SDF syntax of the PROCEDURE-PARAMETERS operand of the BS2000 /CALL-PROC command, the enclosing parentheses being optional.

i The following applies to *procedure* and *parameter*: special characters (e.g. (,), $) are to be masked for the shell. *bs2do* does not interpret the operands, e.g. among other things keywords in keyword parameters are not converted to uppercase.

File

Input files:
- *stdin*: not used
- procedure file *procedure*
- options file *optionfile,* where *optionfile* can be any POSIX path name.
  By default, */opt/BS2DO/options/bs2doopt.std* is installed.

Output files:
- *stdout*: output of messages if the option *-V* (verbose) is specified
- *stderr*: *bs2do* error messages, contents of the job variable defined in the options file *optionfile*
- BS2000 system file SYSOUT copied to POSIX file *outfile*, if the *-o* option is specified

Variable

BS2DOOPT: POSIX path name of an options file. If the environment variable *BS2DOOPT* is not defined, the implicitly installed options file *optionfile* is used.

Hint Extended description

bs2do sets up the batch job #T.*pid*.ENTER in BS2000, where *pid* is the POSIX process number of the process executing *bs2do*. The batch job is initiated with

```
/.DOpid LOGON
```

If the procedure *procedure* is located in the POSIX file system, it is copied to the BS2000 file T.*pid*.PRO. The batch job is then started as follows:

```
/ENTER-JOB   FROM-FILE=#T.pid.ENTER,-
PROCESSING-ADMISSION=SAME,-
HOST=*STD,-
JOB-CLASS=*STD,-
JOB-PRIORITY=*STD
```

The operands PROCESSING-ADMISSION, HOST, JOB-CLASS and JOB-PRIORITY can be set via the options file *optionfile*.

In the batch job, the system file SYSOUT is assigned to the file #T.*pid*.OUT, the job variable *#BS2DOJV* is set up and then the *procedure* is called, the name of the *#BS2DOJV* job variable can be set via the options file *optionfile*:

```
/CALL-PROC  FROM-FILE=T.pid.PRO,-
       PROC-PAR=parameter,-
       LOGGING=NO
```

The LOGGING operand can be set via the options file *optionfile*. The FROM-FILE operand is only specified if *procedure* is in the POSIX file system. Otherwise, the string *procedure* is adopted unchanged. Special characters (e.g. (,),$) are to be masked for the shell.

After the procedure *procedure* terminates, the system file SYSOUT is closed and the POSIX shell is started.

```
/START-PROG SHELL
```

The *SHELL* operand can be set via the options file *optionfile*.

If no error display was set in *procedure* (/EXIT-PROCEDURE ERROR=NO), the signal SIGUSR1 is sent to the parent process of the batch job as a terminating message.

If the error display was set in the procedure *procedure* (/EXIT-PROCEDURE ERROR=YES), the value of the job variable *#BS2DOJV* and the signal SIGUSR2 are sent to the parent process of the batch job as a terminating message.

In both cases, if the *-o outfile* option is specified, the file #T.*pid*.OUT is first copied to the POSIX file *outfile*. When the shell terminates, all T.*pid* files are deleted and the batch job is terminated.

All temporary #T.*pid* files are also deleted. In debug mode (*-D* option), no temporary files are created, but only T.*pid* files that are not deleted when the batch job terminates.

The options file

The structure of the *options* file is as follows:

```
keyword keyword = value
```

Lines that do not begin with a valid *keyword* are ignored. Continuation lines are exceptions to this rule. *value* can be extended beyond the end of a line with the - character.

List of supported keywords and corresponding values:

BS2DOJV
: Job variable name (optional). If job variables are not offered by the product, no *value* may be specified for this *keyword*

SHELL
: Operand of START-PROG for loading the POSIX shell

PROCESSING-ADMISSION
HOST
JOB-CLASS
JOB-PRIORITY
: Correspond to the operand of ENTER-JOB with the same name

LOGGING
: Corresponds to the operand of CALL-PROC with the same name

The standard options file */opt/BS2DO/options/bs2doopt.std*:

```
#
#  bs2do controlling job variable
#  (temporarily in order to allow parallel calls within one user ID)
#
BS2DOJV = #BS2DOJV
#
#  BS2000 enter-job operands
#
PROCESSING-ADMISSION = SAME
HOST = *STD
JOB-CLASS = *STD
JOB-PRIORITY = *STD
#
#  BS2000 call-proc operands
#
LOGGING = NO
#
#  BS2000 shell configuration  (POSIX-BC shell with
#                               correction level >= A12
#                               POSIX-SH shell with correction level
#                               level >= A52)
#
```

```
SHELL = *M($TSOS.SINLIB.POSIX-BC.030.SHELL, SH, -
RUN-MODE=ADVANCED, PROG-MODE=ANY)
#
```

Restrictions

Since *bs2do* cannot bypass the BS2000 security mechanisms, restrictions must be observed if PROCESSING-ADMISSION <> SAME is set in the options file:

– The user ID in which the ENTER-JOB is to be executed must have POSIX user permissions.
– If the *-o* option is specified, the user ID in which the ENTER-JOB is to be executed must have search and write permissions in the current directory in which *bs2do* was called. Otherwise, the ENTER-JOB SYSOUT file is not copied to the UFS, even if the *-o* option is set.
– The procedure to be executed is not copied from the UFS into another user ID, i.e. executing a procedure under a different user ID is only supported with *procedure* being equal to **bs2:***BS2Name*.

Example

In the following examples, a prefixed DO: represents the shell prompt which is followed by entries to the shell. Lines between the shell prompts are the outputs from the commands concerned. The procedure *proc* is included as an example:

```
/BEGIN-PROCEDURE PAR=YES(PROC-PAR=(&CMD='STA',&CMDPAR='L'))
/
/       WRITE-TEXT T='-----> ''&CMD &CMDPAR'''
/       &CMD &CMDPAR
/       SKIP-COMMAND TO-LABEL=OK
/
/       SET-JOB-STEP
/       MOD-JV JV-CONTENTS=#BS2DOJV,-
/              SET-VALUE=C'Command ''&CMD &CMDPAR'' failed'
/       SKIP-COMMAND TO-LABEL=ERR
/
/.ERR   REMARK
/       WRITE-TEXT T='-----> DOING EXIT-PROCEDURE ERROR=YES'
/       EXIT-PROCEDURE ERROR=YES
/
/.OK    REMARK
/       WRITE-TEXT T='-----> DOING EXIT-PROCEDURE ERROR=NO'
/       EXIT-PROCEDURE ERROR=NO
/
END-PROCEDURE
```

Example 1 Procedure *proc* in POSIX, simple evaluation of the termination status

```
DO: bs2do proc
%   JMS0066 JOB ODO492CACCEPTED ON 04-04-23 AT 11:28, TSN=57EE
DO: echo $?
0
```

Example 2 Procedure *proc* in BS2000 file, SYSOUT is output in POSIX

```
DO: bs2do -o example2.out bs2:proc
%   JMS0066 JOB ODO494CACCEPTED ON 04-04-23 AT 11:29, TSN=57EG
DO: cat example2.out
/CREATE-JV JV=#BS2DOJV
/SET-JOB-STEP
/MODIFY-JV JV=#BS2DOJV,SET-VALUE=C' '
/SET-JOB-STEP
/CALL-PROC FROM-FILE=proc,LOGGING=NO
-----> 'STA L'
NAME         TSN TYPE       PRI     CPU-USED CPU-MAX ACCOUNT#
DO494       57EG 2 BATCH    9 220     0.6044   32000 1
RLOGIN      57C7 2 DIALOG   0 210    14.3916   9999  1
%  SPS0171 NO LOCAL SPOOLOUT JOB PRESENT
%  SPS0420 RSO WARNING : SOME RSO PRINT-JOBS CANNOT BE DISPLAYED
%  SCP1095 DPRINTSV WARNING : SOME DPRINT PRINT-JOBS CANNOT BE ..
-----> DOING EXIT-PROCEDURE ERROR=NO
/SKIP-COMMANDS TO-LABEL=NOERR
/.NOERR  REMARK
/SYSFILE SYSOUT=*DUMMY
```

Example 3 Procedure *proc* in BS2000 PLAM library, erroneous procedure parameter

```
DO: bs2cp proc 'bs2:BS2LIB(PROC,J)'  # copy proc in PLAM library
DO: bs2do -o example3.out bs2:\(BS2LIB,PROC\) "CMDPAR='x x'"
%  JMS0066 JOB 'DO501' ACCEPTED ON 04-04-23 AT 12:51, TSN = 57EN
BS2DOJV: Command 'STA x x' failed
DO:echo $?
1
DO: cat example3.out
/CREATE-JV JV=#BS2DOJV
/SET-JOB-STEP
/MODIFY-JV JV=#BS2DOJV,SET-VALUE=C'  '
/SET-JOB-STEP
/CALL-PROC FROM-FILE=(BS2LIB,PROC),PROC-PAR=(CMDPAR='x x'),LOGGING= ..
-----> 'STA x x'
%  EXC0898 INVALID OPERAND IN COMMAND. COMMAND REJECTED
%  CMD0205 ERROR IN PRECEDING COMMAND OR PROGRAM AND PROCEDURE ..
-----> DOING EXIT-PROCEDURE ERROR=YES
%  CMD0205 ERROR IN PRECEDING COMMAND OR PROGRAM AND PROCEDURE ..
/SET-JOB-STEP
/SKIP-COMMANDS TO-LABEL=ERROR
/.ERROR  REMARK
/SYSFILE SYSOUT=*DUMMY
```

Example 4 Procedure *proc* in POSIX, erroneous procedure parameter, redirection of *stderr*

```
DO: bs2do proc "CMD='STA P',CMDPAR=',TYPE=x " 2>example4.err
DO: echo $?
1
DO: cat example4.err
%  JMS0066 JOB 'DO620' ACCEPTED ON 04-04-23 AT 15:43, TSN = 57H1
BS2DOJV: Command 'STA P ,TYPE=x' failed
```

bs2file set BS2000 file attributes *(BS2000)*

bs2file defines the BS2000 file attributes of the file which is to be transferred.
bs2file is mapped to the BS2000 FILE command.

Syntax **bs2file**[␣**-h**]␣file**,**operand_list

-h Prints out the command syntax with an explanation of the options.

file
Fully qualified file name in BS2000. The file attributes of this file are defined and used in the associated *bs2cp* command.

Specifying "*" ("\" is used for quoting) instead of a file name indicates that the settings in the *bs2file* command are valid for all files of the next *bs2cp* command. The file attributes then apply to the file(s) specified in the *bs2cp* command.

If a fully qualified file name is specified, the *bs2file* entry only loses its validity if the file attributes are successfully analyzed in a *bs2cp* call when the file names are identical. If an asterisk (*) is specified, the *bs2file* entry loses its validity when the *bs2cp* command terminates.

operand_list
List of file attributes. The format of the *operand_list* must correspond to the format of the FILE command (BS2000).
You may not use the operand "LINK=" in the FILE command.

Hint If you issue multiple *bs2file* commands for a file then only the last attributes to be specified are valid.

In the case of ISAM files, only the values KEYPOS=5 and KEYLEN=8 are supported for the key position and key length respectively.

Error Error messages of the FILE command

Example The BS2000 file *doccopy* is to be set up as a PAM file.

```
$ bs2file doccopy,fcbtype=pam
```

See also *bs2cp*, *ftyp*

bs2lp send files to a printer *(BS2000)*

Print jobs are sent to the BS2000 spool via the PRNT macro. No ID is allocated for the print job. Management of the print job is only possible using the BS2000 spool.

Syntax **bs2lp**[␣option]...[␣file] ...

option

-c This option is always set implicitly. The specified file is copied and the copies are printed.

-d Output medium. You can specify a printer name or a pool name (printer class name). The environment variables *LPDEST* and *PRINTER* are not supported.

-ncopies
Use this option to specify the number of times the file is to be printed. The largest supported value for *copies* is 255, the smallest is 1.

-ncopies not specified:
A value of 1 is assumed for the number of copies.

-ttitle
(t - title) *title* will be printed in the header of the printout.

-m, -o, -s, -w
Ignored.

file
Name of the file which is to be printed. You can also enter more than one file. These files are then printed in the order in which they are specified when the command is called.
You must specify any options which you only wish to apply to one file before entering the name of the file in question.

file not specified:
bs2lp reads from the standard input.

Mode of operation

The POSIX file is copied as a temporary SAM file, i.e. the ERASE operand is always implicitly set when SPOOL is called.

Specifying additional operands for print jobs

All keyword operands of the PRNT macro can be implicitly specified through the .lprc file which is searched for in the current HOME directory. At least one PRNT operand must be fully defined for each line. A line may contain more than one operand if these are separated by commas.The entries in the .lprc file are transferred to PRNT without checking.

Example .lprc file:

```
FORM=STD
LINES=80
ROT=90, CHARS=R01
```

You cannot simultaneously specify an operand and an option which is mapped to this operand.

Option mapping:
– the option *-d* is mapped to the BS2000 operand DEST
– the option *-n* is mapped to the BS2000 operand COPIES
– the option *-t* is mapped to the BS2000 operand TEXT.

Error `bs2lp: ERROR: No (or empty) input files`

Exit status 0, if spool jobs were started successfully.

Example The command *bs2lp -n2 file* and the entries in the .lprc file described above result in the following spool call for BS2000:

```
PRNT file, COPIES=2,FORM=STD.LINES=80,ROT=90,CHARS=R01
```

bs2pkey set pkeys *(BS2000)*

You can set the P keys [P3], [P4] and [P5] as follows by calling the command *bs2pkey*

[P3] with @@c ([CTRL] [C])
[P4] with @@d ([CTRL] [D])
[P5] with @@z ([CTRL] [Z])

This command has no options.

Syntax **bs2pkey**

The program is called either in the POSIX shell (with no options) or can be included in the file */etc/profile*. The program is then activated every time the shell is called.

cal print calendar

cal writes a calendar on the standard output.

Syntax

```
cal[[␣month]␣year]
```

No argument specified:
cal prints the calendar for the current month.

month
cal prints the calendar for the specified month.

The possible values for *month* are 1 to 12.
If you specify a value for *month*, you must also specify a value for *year*.

month not specified:
cal prints the calendar for the entire year.

year
The calendar for the specified year is printed.

The possible values for *year* are 1 to 9999.

Please note that *cal 10*, for example, refers to 10 A.D., not 2010.

i If you call *cal* using the argument *1752* or the arguments *9 1752*, the output for September is shorter than usual. This is because *cal* allows for an adjustment of 11 days which took place in that month in 1752.

Exit status The exit status is non-zero if the values specified for *year* or *month* lie outside the permissible range.

Error

```
Bad argument [ for month | for year ]
```

The values you have specified for *year* or *month* are not within the permissible range.

Variable *TZ*
Determine the timezone used to calculate the value for the current month.

Locale The following environment variables affect the execution of *cal*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments). *LC_CTYPE* governs character classes, character conversion (shifting) and the behavior of character classes in regular expressions.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME Determine the format and contents of the calendar.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Print the calendar for Januar 2009 in the Locale C:

```
$ cal 1 2009
    January 2009
Su Mo Tu We Th Fr Sa
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
```

cancel cancel line printer requests

You can use *cancel* to abort or cancel any of the print jobs that you submitted with the *lp* command.

i Nonprivileged users can abort or cancel only print jobs submitted under their own login names.

Information on print jobs is displayed by the *lpstat* command.

Syntax

Format 1: cancel[␣jobno...]␣printer...

Format 2: cancel␣jobno...␣[printer...]

You must specify a value for at least one of the operands.

jobno

In *jobno* you specify the job number of a print job. The job number is the number that is reported on standard output when you submit a print job with the *lp* command.
You may specify more than one job number, using blanks to separate them.
If necessary, you can obtain a list of all pending print jobs with the *lpstat* command. Nonprivileged users can request information only about the status of print jobs submitted under their own login names.
cancel issues a message on standard output to tell you which print jobs have been cancelled or aborted.

printer

In *printer* you specify the name of a RSO printer or a printer group. You may specify more than one name. Any print job currently running on *printer* is aborted, and the printer is freed for the next job. *cancel* issues a message on standard output to tell you which print jobs have been aborted.
You can use *lpstat* to find out which printers currently have jobs of the own userid running on them.

Error

```
cancel: printer "G005" was not busy
```

None of the printers in the printer group that you specified, G005 in this case, had a print job running on it. When you specify a printer group name, you can only terminate a job that is currently printing on a printer in the named group. You cannot use this method to cancel print jobs that have been submitted but are still waiting to be executed. To cancel queued print jobs, you must specify the job number.

```
cancel: request "TSN-AB35" non existent
```

The job number you specified in the *cancel* call, TSN-AB35 in this case, is not the number of an existing print job. Use *lpstat* to obtain a list of all currently executing and pending print jobs.

```
UX:cancel: WARNING: "XY" is not a request id or a printer
   TO FIX: Cancel requests by id or by name of printer where printing.
```

When you called *cancel*, you specified an argument XY which is neither a job number nor the name of a printer group.

Locale
The following environment variables affect the execution of *cancel*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the default locale will be used. If any of the variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1
You inadvertently submit the same print job twice, so you want to cancel the second one.

```
$ lp test test
request id is TSN-6J1V (test)
request id is TSN-6J1W (test)
$ cancel tsn-6j1w
request “TSN-6J1W“ cancelled
```

Example 2
Your system has two printer groups, G001 and G002, each of which consists of one printer.

The job currently executing on printer group G001 is to be aborted:

```
$ cancel G001
request "TSN-1234" cancelled
```

The job number of the terminated print job was TSN-1234.
The print jobs with job numbers TSN-9WJ7 and TSN-9WAS are to be cancelled:

```
$ cancel TSN-9WJ7 TSN-9WAS
request "TSN-9WJ7" cancelled
request "TSN-9WAS" cancelled
```

See also
lp, *lpstat* [12]

cat concatenate and print files

The *cat* command reads files in sequence and writes them to standard output. *cat* has no effect on the sequence and format of the characters in the files.
If you name more than one file when calling *cat*, these files are output sequentially in the specified order. If you do not name a file, *cat* reads from standard input.

Syntax **cat**[␣**-s**][␣**-u**][␣file]...

No option specified:
Output is buffered in *BUFSIZ*-byte blocks. The value of *BUFSIZ* is governed by the machine you are working on. It is defined in the file */usr/include/stdio.h* and may be 8192 bytes. If the files named on the command line do not exist, *cat* tells you that it cannot open them.

-s Messages reporting that files do not exist are suppressed.

-u Output without buffering, one byte at a time.

file
Name of the file that is to be printed. You may specify more than one file. If you use a dash as the name for *file*, *cat* reads from standard input.

file not specified:
cat reads from standard input.

Caution!
Redirecting the output of *cat* to one of the files being read will result in the loss of that file's original contents. In the following command, for example, the contents of *file1* are lost: `cat file1 file2 file3 > file1`

Error
```
cat >out_file out_file: cannot create
```
You have no write permission for the output file *out_file* or for the directory which contains *out_file*.

```
cat in_file cat: cannot open in_file: Permission denied
```
You have no read permission for the input file *in_file*.

Locale The following environment variables affect the execution of *cat*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments). *LC_CTYPE* governs character classes, character conversion (shifting) and the behavior of character classes in regular expressions.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Concatenate and redirect the output of two files:

```
$ echo Monday Tuesday Wednesday >file1
$ echo Thursday Friday Saturday >file2
$ cat file1 file2 > file3
$ cat file3
Monday Tuesday Wednesday
Thursday Friday Saturday
```

Example 2 Display the contents of *file1*

```
$ cat file1
In Xanadu did Kubla Khan
A stately pleasure dome decree:
Where Alph, the sacred river, ran
```

Now write two lines of text into *file2*. Terminate input with [END] or @@d depending on the terminal type used.

```
$ cat > file2
Through caverns measureless to man
Down to a sunless sea.
```

Now move the contents of *file1* and *file2* to *file3*, add two lines from standard input, and then print the contents of *file3*. Terminate input with [END] or @@d depending on the terminal type used.

```
$ cat file1 file2 - > file3
For he on honey dew hath fed
And drunk the milk of paradise.
$ cat file3
In Xanadu did Kubla Khan
A stately pleasure dome decree:
Where Alph, the sacred river, ran
Through caverns measureless to man
Down to a sunless sea.
For he on honey dew hath fed
And drunk the milk of paradise.
```

See also *cp, pr*

cd change working directory

The built-in *cd* command in the POSIX shell *sh* makes the specified directory your current working directory.
The *cd* command is rejected in a restricted shell.

Syntax

Format 1: cd[␣directory]

Format 2: cd␣-

Format 3: cd␣old␣new

Format 1 Change directory using *CDPATH*

cd[␣directory]

directory

Name of the directory that is to become your current working directory. You must have execute permission for this directory. If you specify a relative or absolute path name for *directory*, you must have execute permission for all the directories which make up this path name.

If the name of the specified directory begins with one of the following characters, the command looks for the directory without reference to the *CDPATH* environment variable (see POSIX environment variables):

/ means that the search begins in the root directory.
./ means that the search begins in the current directory.
../ means that the search begins in the parent directory.

If the name of the specified directory does not begin with any of the above characters, *cd* evaluates the *CDPATH* environment variable:

– If the *CDPATH* variable has not been defined or is null, *cd* looks for the specified directory relative to the current working directory.
– If the *CDPATH* variable has been assigned a value, *cd* looks for the specified directory sequentially in the directories whose paths are defined in the *CDPATH* variable. On finding the directory, *cd* writes the absolute path name of this directory on standard output before switching to it.

directory not specified:
The *cd* command puts you in your home directory. The home directory is identical to the login directory unless there is a different path name assigned to the shell variable *HOME*.

Format 2 **cd␣-**

- Specifying the - as an operand has the same effect as the command `cd “$OLDPWD“ && pwd` which changes to the last active directory and writes its name.

Format 3 Change directory with text substitution

cd␣old␣new

cd substitutes the string *new* for the string *old* in the current directory name (*PWD*) and tries to change to this new directory.

Error `sh:` *file*: `not found`
The specified directory does not exist. You can verify this with *ls -l*.

`sh:` *file*: `not a directory`
Your argument is not a directory. This can also be verified with *ls -l*.

file: `permission denied`
You do not have execute permission for the specified directory.
If you have specified a relative or absolute path name for *directory*, you do not have execute permission for one of the directories which make up this path name.

`rsh: cd: restricted`
cd has been rejected because you are working in a restricted shell.

Variable *HOME*
contains the absolute path name of your home directory.

CDPATH
You can assign to *CDPATH* the absolute path names of directories that *cd* is to search.
By default this variable is undefined.

OLDPWD
Path name of the previous directory used by *cd -*.

PWD
Path name of the current directory. This name is set by *cd* following the change to this directory.

Locale The following environment variables affect the execution of *cd*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following entry makes the subdirectory *dates* the current directory:

```
$ cd dates
$ pwd
/home/rose/dates
```

Example 2 User *rose* has redefined the *CDPATH* environment variable. She now wishes to change to her subdirectory *usr*, but with the following commands ends up in the directory */usr* instead:

```
$ echo $CDPATH
/:/home/rose/dates:.
$ pwd
/home/rose
$ ls -l
drwx--x--x 2 ROSE        144 Feb 28 12:32 usr
drwx--x--x 2 ROSE        192 Feb 28 11:51 dates
-rw------- 1 ROSE      11734 Mar  7 16:22 tests
.
.
.
$ cd usr
$ pwd
/usr
```

The *usr* directory is first looked for in the directories whose path names are assigned to the *CDPATH* variable. In this case, *CDPATH* contains a / for the root directory as the first path name. The current directory is the last to be searched by *cd*.

User *rose* can prevent *cd* from evaluating the *CDPATH* environment variable by formulating the command in the following way:

```
$ cd ./usr
$ pwd
/home/rose/usr
```

See also *pwd*
chdir() [4]

chgrp change file group ownership

chgrp changes the user group for a file or a directory. You can only use it if you are the file/directory owner or the POSIX administrator.

Only the POSIX administrator is permitted to change the user group for each file as he or she wishes.
There is an operating system configuration option *_POSIX_CHOWN_RESTRICTED* which can be used to place a restriction on the groups to which users without POSIX administrator privileges can reassign their files. If this option is in effect, as an ordinary user you can assign your files to another group only if

– you are listed in the */etc/group* file as a member of the new group (see *File* on page 205), and
– you currently belong to the new group, which means that before calling *chgrp* you must change to the new user group with the *newgrp* command (see section “newgrp change to a new group” on page 582 and the example on page 205).

If *chgrp* is called by a user who does not posses POSIX administrator permissions then all the s-bits (set-user-ID and set-group-ID, see section “chmod change file modes” on page 206) set for the specified files are reset.

Syntax **chgrp**[␣**-h**][␣**-R**]␣gid␣file␣...

-h If *file* is a symbolic link, *chgrp* changes the group ID of the symbolic link itself. Without this option, the group ID of the file referenced by the symbolic link is changed.

-R (recursive) *chgrp* recursively descends through the specified directories, changing the group ID as it proceeds and traversing any symbolic links that it encounters.

gid
(group id). New group name or new group ID. *gid* must appear in */etc/group*.

file
Name of the file or directory for which the user group is to be redefined. You can also list any number of files and/or directories.

Error *file*`: Not super-user`
You are not permitted to change the user group of the specified file, since you are not the owner of the file or have not been entered as a member of the specified group or do not currently belong to the group. Only the POSIX administrator is authorized to redefine the group for all files.

`chgrp: unknown group:` *gid*
The group name you have specified for *gid* is not in the */etc/group* file.

File */etc/group*
The group file */etc/group* contains a list of all existing user groups. Each line of this file consists of four colon-separated fields: `groupname:groupid:user,user...`

Only the POSIX administrator is permitted to create new user groups and to enter new group members.

Locale The following environment variables affect the execution of *chgrp*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You are currently working under the login name *cindy*; this name is entered in the */etc/group* file as a member of the user groups *ag* and *prog*. At present, you belong to the user group *ag* as is evident from the fact that the name *ag* is entered for "group" when you create new files:

```
$ >file
$ ls -l file
-rw-------   1 CINDY    ag          0   Feb 17 15:48 file
```

You now wish to change the user group for *file*; the new group is to be *prog*. To do this, you first use the *newgrp* command to switch to the *prog* group and then change the group for *file* with *chgrp*.

```
$ newgrp prog
$ chgrp prog file
$ ls -l file
-rw-------   1 CINDY    prog        0   Feb 17 15:48 file
```

See also *chmod*, *chown*, *id*, *newgrp*
chown() [4]

chmod change file modes

chmod is used to change the permissions of a file (its protection mode).

Only the owner or the POSIX administrator is authorized to change the permissions of a file. A file's set-group-id bit can be set only by a user whose current group ID is the same as the file's group ID (see *chgrp* on page 204 and *newgrp* on page 582).

Syntax **chmod**␣[**-R**]␣mode␣file␣...

-R (recursive) *chmod* recursively descends through the specified directories, changing the mode for each file it encounters.

mode
In *mode* you specify how the permissions for one or more named files are to be changed. There are two forms of *mode* specification:
- symbolic
- absolute

file
Name of the file for which you wish to define or alter the permissions. *file* may also be a directory. Multiple names are also allowed.

Symbolic form

```
[who]op[permission][,[who]op[permission]]...
```

who
In *who* you say who the file permissions apply to.
The choices for *who* are:

u	for the owner (user)
g	for the group
o	for others
a	for *ugo*, i.e. all users.

or any combination of the letters *u*, *g*, *o*.

who not specified:
who defaults to *ugo*, i.e. all users. The permissions for *ugo* are set with allowance for the bits in the file-creation mode mask (see *umask*).

op

In *op* you specify whether permissions are to be granted, left unchanged, or revoked. The choices for *op* are:

+	to add (grant) permissions,
–	to take away (revoke) permissions,
=	to assign permissions absolutely, i.e. only the listed permissions are granted, all others are revoked.

permission

In *permission* you specify which permission(s) you wish to grant or revoke. The choices for *permission* are:

r	for read permission
w	for write permission
x	(x - execute) for execute permission or for permission to browse files and directories.
X	for execute permission or for permission to search in a file, if at least one x bit is set, or in directories. If the file is not a directory, or if no x bit has been set for the file, this option is ignored.
s	for the set-user-ID or set-group-ID bit. Entering *s* in a *chmod* command is only useful in conjunction with *u*, *g*, or *ug* (if *who* is not specified, it defaults to *ug*). Set-user-ID and set-group-ID bits only apply to executable binary files (not to shell scripts) (see *The s bits*).
t	for sticky bit (t bit). Only the POSIX administrator is able to set the sticky bit. Attempts by non-privileged users to set the sticky bit are ignored. Entering *t* in a *chmod* command is useful only in combination with *u* or *a* or if *who* is not defined. A set sticky bit only applies to executable files (see *The sticky bit*). If you change the mode of a file which has the sticky bit set, the sticky bit is automatically cleared.
l	(lock) for mandatory locking of files, directories or records, referring to a file's ability to have its reading or writing permissions locked while a program is accessing it. *file*'s l bit can be set only if its group execute permission is not set and its set-group-id bit is set.

Thus the following examples are *not* correct and would result in error messages:

chmod g+x,+l file
chmod g+s,+l file

u	Use the permissions of the current owner.
g	Use the permissions of the current group.
o	Use the permissions of the current *others* mode.

permission not specified:
This is only useful in combination with the **=** operator; all permissions are then revoked for the *who* in question.

As indicated above, you can specify several "who-op-permission" arguments in a row, provided they are separated by commas as follows:

```
chmod g-w,o-rw file
```

The string you specify for *mode* is processed by *chmod* from left to right. For instance, a-w,u+w grants write permission to the owner, revoking it for all others.

Absolute form

An absolute *mode* is a three or four digit octal number. The admissible octal values are obtained by logically ORing (in binary) the octal modes shown below. The effect is the same as adding the modes in octal or decimal. A leading zero (neither the s bit nor the sticky bit set) may be omitted.
The specified permissions are granted; all other permissions are revoked.

4000	Set user ID on execution
20#0	Set group ID on execution if # is 7, 5, 3 or 1.Set mandatory locking if # is 6, 4, 2 or 0.The value of # is ignored if *file* is a directory. In this case you can only use the symbolic form for *mode*.
1000	sticky bit (t bit)
0400	read permission for owner
0200	write permission for owner
0100	execute permission (or directory search permission) for owner
0040	read permission for group
0020	write permission for group
0010	execute permission (or directory search permission) for group
0004	read permission for others
0002	write permission for others
0001	execute permission (or directory search permission) for others

Example

To grant read, write, and execute permission to the owner and read and execute permission to the group, you would enter a value of 750 for *mode*:

```
400 + 200 + 100 + 40 + 10 = 750
```

The file then has the permissions *rwxr-x---*

The s bit

When an executable program which has the set-user-ID bit set is called, the *effective* user ID of the associated process is the same as the user ID of the *owner* of the file (and not that of the caller). In other words, the process runs under the user ID of the program owner and can therefore also access files for which the caller of the program does not have explicit access permission.
The *real* user ID of the process remains that of the program *caller*.

If the set-group-ID bit is set, the effective group ID of the process is the same as the group ID of the program *owner*. This means that the process runs under the group ID of the program owner.
The *real* group ID of the process remains that of the program *caller*.

The s bits are only useful for executable binary files (executable programs) and not for shell scripts. Although *chmod* can be used to set the s bits for files that contain a shell script, the setting will essentially have no effect.

When changes are made to a file, the s bits are reset for security reasons.

If the POSIX administrator sets the s bit for a program which he or she owns, all users who can call the program are thereby authorized to carry out any operations that the POSIX administrator is allowed to perform using the program. Hence the POSIX administrator should not set the s bit unless it is certain that security will not be compromised, leading to data loss for example.

Example of an s bit application

One example of an s bit application is the *mailx* command.

Messages sent with *mailx* to user USER1 are written to the file `/var/mail/USER1`. This file belongs to the group `MAIL`, and its owner is `USER1`. Both group and owner have read and write permission; no other users have any permissions for the file:

```
-rw-rw----       USER1      MAIL   /var/mail/USER1
```

Thus ordinarily a user from a different group (USER2, for example) would be unable to write messages to this file.

However, since the *mailx* command has the s bit set for the `MAIL` group, after calling *mailx* USER2 temporarily becomes an effective member of the `MAIL` group and thus has write permission for `/var/mail/USER1`.

The sticky bit (t bit)

Only the POSIX administrator is able to set the sticky bit (t bit). Attempts by non-privileged users to set the sticky bit are ignored.

The sticky bit only has an effect on directories and executable files. It is possible to use *chmod* to set it on other files, but it will then have no effect.

If the sticky bit is set on an executable file, it is possible to some extent to save on the overhead usually involved in reading a program in from the disk file again every time the program is started.

If a directory is writable and has the sticky bit set, files within the directory cannot be removed, renamed or linked to unless one or more of the following conditions apply:
- the file belongs to the user
- the directory belongs to the user
- the user has write permission for the file
- the user is a privileged user

In the output of the *ls -l* command, the sticky bit if set appears in the last position of the listed permissions. If the x bit has simultaneously been set for "other users", a *t* appears; if not, a *T*.

The l bit

The *lockf()* function allows a program to place a lock on a file which it is accessing. If this file has its l bit set, the function call results in mandatory locking of the file (see *lockf()* [4]).

Error

`chmod: ERROR: Invalid mode`
You have defined an illegal set of permissions for *chmod*.

`chmod: WARNING: Locking not permitted on file, a group executable file`
Files with group execute permission cannot also have the l bit set.

`chmod: WARNING: Execute permission required for set-ID on execution for` *file*
In order to turn on a file’s set-user-ID bit you need to have execute permission for the file.

Locale

The following environment variables affect the execution of *chmod*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The following examples all refer to a file with the permissions *rw-------*. The first two columns of the table contain possible *mode* arguments; the last column shows the result of a *chmod* call using these arguments.

Symbolic form	Absolute form	Result
`u-w`	`400`	`r--------`
`-w`	`400`	`r--------`
`go+r`	`644`	`rw-r--r--`
`go=r`	`644`	`rw-r--r--`
`go+rw`	`666`	`rw-rw-rw-`
`=rw`	`666`	`rw-rw-rw-`
`+rx`	`755`	`rwxr-xr-x`
`=r`	`444`	`r--r--r--`
`ug=rw,o=r`	`664`	`rw-rw-r--`
`u=rwx,g=rx,o=`	`750`	`rwxr-x---`
`+x,u+s`	`4711`	`rws--x--x`
`+xt`	`1711`	`rwx--x--t`

The sticky bit (last example) can only be set by the POSIX administrator. Attempts by non-privileged users to set the sticky bit are ignored.

See also

chgrp, *ls*, *newgrp*, *umask*
chmod(), *chown()* [4]

chown change file ownership

chown assigns a new owner to a file or a directory.

Only the POSIX administrator may change the owners of a file as he or she wishes.
In contrast, users who do not possess POSIX administrator permissions may only change the owners of their own files. If the operating system option *_POSIX_CHOWN_RESTRICTED* is in effect, even the owner of a file is prevented from changing the ownership of that file.
If *chown* is called by a user without POSIX administrator permissions, the s-bit for owners, 4000, is reset.

Syntax

chown[␣**-h**][␣**-R**]␣uid[:gid]␣file␣...

-h If *file* is a symbolic link, *chown* changes the owner of the symbolic link. Without this option, the owner of the file referenced by the symbolic link is changed.

-R (recursive) *chown* recursively descends through the specified directories, changing the file owner as it proceeds and traversing any symbolic links that it encounters.

uid[:gid]
Login name or user ID of the new owner. Optionally, the group ID may also be specified.

file Name of the file that is to have a new owner. Directories and multiple file names are also allowed.

Error

`chown:` *file*`: Not super-user`
You may not change the owner of the file *file* since you are not the owner of *file* or the *_POSIX_CHOWN_RESTRICTED* variable is set on your system.

`chown: Unknown user:` *newowner*
You have entered a user ID for *newowner* which is not entered in the user table.

Locale

The following environment variables affect the execution of *chown*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You are working as the POSIX administrator and want to change the owners of a file. You wish to assign the new owner *MARK* to the file *text1* whose owner is *CATHY*. To do this, enter:

```
# ls -l text1
-rw-------   1 CATHY    ag          2426   Feb 17 15:48 text1
# chown mark text1

# ls -l text1
-rw-------   1 MARK     ag          2426   Feb 17 15:48 text1
```

See also *chgrp*, *chmod*
chown() [4]

cksum write file checksums and sizes

The cksum utility calculates and writes to standard output a cyclic redundancy check (CRC) for each input file, and also writes to standard output the number of octets in each file. The CRC used is based on the polynomial used for CRC error checking in the referenced Ethernet standard.

Syntax

```
cksum[␣-C][␣file...]
```

options

-C *C* calculates the CRC checksum in the same way as in previous versions.

file

A pathname of a file to be checked. The files may be of any type.

file not specified:
The standard input is used. You must use END or @@d to terminate input from standard input.

Encoding

The encoding for the CRC checksum is defined by the generating polynominal:

$G(x) = x^{32}+x^{26}+x^{23}+x^{22}+x^{16}+x^{12}+x^{11}+x^{10}+x^{8}+x^{7}+x^{5}+x^{4}+x^{2}+x+1$

Mathematically, the CRC value corresponding to a given file is defined by the following procedure:

1. The n bits to be evaluated are considered to be the coefficients of a mod 2 polynomial M(x) of degree n -1. These n bits are the bits from the file, with the most significant bit being the most significant bit of the first octet of the file and the last bit being the least significant bit of the last octet, padded with zero bits (if necessary) to achieve an integral number of octets, followed by one or more octets representing the length of the file as a binary value, least significant octet first. The smallest number of octets capable of representing this integer is used.
2. M(x) is multiplied by x^{32} (that is, shifted left 32 bits) and divided by G(x) using mod 2 division, producing a remainder R(x) of degree $\leq$31.
3. The coefficients of R(x) are considered to be a 32-bit sequence.
4. The bit sequence is complemented and the result is the CRC.

Locale

The following environment variables affect the execution of *cksum*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Stdout

For each file processed successfully, the *cksum* utility will write in the following format:

```
"%u %d %s\n", <ckecksum>, <# of octets>, <pathname>
```

If no file operand was specified, the pathname and its leading space will be omitted.

Exit status

0 All files were processed successfully.

>0 An error occurred.

Hint

cksum utility is typically used to quickly compare a suspect file against a trusted version of the same, such as to ensure that files transmitted over noisy media arrive intact. However, this comparison cannot be considered cryptographically secure. The chances of a damaged file producing the same CRC as the original are astronomically small; deliberate deception is difficult, but probably not impossible.

Although input files to *cksum* can be any type, the results need not be what would be expected on character special device files or on file types not described by the XSH specification. Since this document does not specify the block size used when doing input, checksums of character special files need not process all of the data in those files.

The algorithm is expressed in terms of a bitstream divided into octets. If a file is transmitted between two systems and undergoes any data transformation (such as moving 8-bit characters into 9-bit bytes), identical CRC values cannot be expected. Implementations performing such transformations may extend *cksum* to handle such situations.

Example Calculating the checksum for *test*, a file containing a list of the days of the week.

```
$ cat test
Monday Tuesday Wednesday Thursday Friday Saturday Sunday
$ cksum test
1222782406 57 test
```

See also *sum*

cmp compare two files

The *cmp* command does a comparison of two files byte by byte (character by character). If the files differ, *cmp* reports the differences on standard output.
If the files are identical, *cmp* remains silent.

Syntax **cmp**[␣**-l**|␣**-s**]␣file1␣file2

No option specified

If the files are identical, *cmp* remains silent.

If the files differ, *cmp* indicates the byte (character) and line number of the *first* difference that it detects between *file1* and *file2* as shown below:

```
file1 file2 differ: char bytenumber, line linenumber
```

-l All differences are reported in the following form:

```
bytenumber   byte(file1)   byte(file2)
```

bytenumber represents the displacement of the difference from the beginning of the file. The first byte of the file is assigned number 1, and blanks are counted.
bytenumber is given in decimal notation.

The *byte* columns show the bytes which differ between *file1* and *file2* and are in octal notation. An ASCII table of octal-coded values is provided in *Tables and directories*. If the files are identical, nothing is output.

-s *cmp* remains silent. The exit status value is returned but not automatically displayed on the screen. You can enter the command *echo $?* to query the exit status.

file1␣file2

The names of the files that you wish to compare.

– If you use a dash - as the name for *file1*, *cmp* reads from standard input and compares your input with *file2*.

– If one of the two files ends before *cmp* can detect a difference, *cmp* reports that the end of the file has been reached in the shorter file by issuing the following message:

```
cmp: EOF on file
```

– If one character is missing in one of two otherwise identical files, *cmp -l* reports all following bytes as differences. This is due to the shift in character positions.

– The first character of a file is assigned *bytenumber* 1, not 0.

– Blanks and newline characters are included in the *bytenumber* count.

Exit status

0 files identical

1 files differ

2 inaccessible file or missing argument

Error `cmp: cannot open` *file*

You do not have read permission for one of the files, or one of the files does not exist.

Locale The following environment variables affect the execution of *cmp*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Compare two files and print the differing *bytes* (octal) and their *bytenumber* (decimal).

```
$ echo 1 2 3 4 5 7 8 a >file1
$ echo 1 2 3 4 5 6 9 a >file2
$ cmp -l file1 file2
    11 367 366
    13 370 371
$
```

Example 2 The shell script *delete.eq* compares two files and deletes one of them if they are identical.

```
if cmp -s $1 $2
then
  rm $2
fi
```

When you call the script with

```
$ delete.eq file1 file2
```

you pass *file1* and *file2* to it as positional operands. The *-s* option causes *cmp* to return the exit status. If the value of the exit status is 0 (=true), *file2* is deleted; otherwise, it is retained.

See also *comm*, *diff*

comm select or reject lines common to two files

comm compares two files in which the lines are sorted on the basis of the currently valid collating sequence. Sorting can be performed with the *sort* command (see page 706).

Syntax **comm**[␣**-123**]␣file1␣file2

No option specified

comm produces three columns with the following meanings:

Column 1: lines which occur in *file1* only

Column 2: lines which occur in *file2* only

Column 3: lines which occur in both files

option

-1 Column 1 is not output.

-2 Column 2 is not output.

-3 Column 3 is not output.

Combinations of options *1*, *2* and *3* are also permitted, e.g.:

-12 *comm* outputs all lines common to both files.

-23 *comm* outputs all lines which only occur in *file1*.

-13 *comm* outputs all lines which only occur in *file2*.

-123 *comm* generates no output.

file1␣file2

Names of the two sorted files which you want to compare.
The *comm* command will not function properly unless both files have been sorted. If you use a dash as one of the names, *comm* reads from standard input.

Locale The following environment variables affect the execution of *comm*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_COLLATE Determine the locale for the collating sequence *comm* expects to have been used when the input files were sorted.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The file *books* contains the titles of books and their authors. Each line contains the title of one book and the name of its author, with a space between them. You would now like to search the file *books* for a number of authors whose names you have listed in the file *authors1*. The contents of *books* and *authors1* are as follows:

```
books                                               authors1

"Gormenghast" Peake                                 Blyton
"Buddenbrooks" Mann                                 Gogol
"Noddy" Blyton                                      Joyce
"Ulysses" Joyce                                     Kafka
                                                    Mann
                                                    Tolstoy
```

You can now proceed as follows:

- Use *awk* to extract the authors from *books*.
- Sort the authors in *books* using *sort*.
- Redirect the output of *sort* to the new file *authors2*.
- Compare the files *authors1* and *authors2* using *comm -2*.

```
$ awk '{printf"%s\n",$2}' books| sort > authors2
```

The file *authors2* contains the following:

```
Blyton
Joyce
Mann
Peake
```

```
$ comm -2 authors1 authors2
        Blyton
Gogol
        Joyce
Kafka
        Mann
Tolstoy
```

All authors which are only in *authors1* are output in column 1. Then come the contents of column 3, which lists all authors present in both files.

See also *cmp*, *diff*, *sort*, *uniq*

command execute a simple command

command informs the shell that the arguments are to be executed as simple commands. The shell functions are not evaluated.

command also provides information about how a command name is interpreted by the shell (see Format 2).

Syntax

Format 1: command [␣**-p**]␣command_name [␣argument ...]

Format 2: command [␣**-v** |␣**-V**]␣command_name

Format 1

command [␣**-p**]␣command_name [␣argument ...]

option

-p The command search is performed using a default value for *PATH* which ensures that all standard commands can be found.

command_name
The name of a command or a special built-in command.

argument
One of the strings as an argument for *command_name*.

Format 2

command[␣**-v** |␣**-V**]␣command_name

option

-v A string is written to the standard output. This string specifies the path name or command which the shell uses to call *command_name* in the current shell environment.

– Commands, regular built-in commands, *command_names* containing a slash as well as implementation-specific functions which are specified by the *PATH* variable are written as absolute path names.

– Shell functions, special built-in commands and regular built-in commands which cannot be accessed via the definition in the *PATH* variable as well as reserved shell terms are specified as simple names.

– An alias is written as a call line which represents the alias definition.

– In other cases, no string is written to the output. The exit status specifies that the command could not be found.

The standard output is formatted as follows:
“%s\n”, <path name or command>

-V A string is written to the standard output. This string specifies how the shell interprets the name in the *command_name* operand in the current shell environment. Although the format of the string is not specified, it nevertheless defines which of the following categories *command_name* belongs to. The associated information is also defined:

- Commands, regular built-in commands and implementation-specific functions which are found via the *PATH* variable are identified as such. In this case the string contains the absolute path name.
- Other shell functions are identified as functions.
- Aliases are identified as aliases. The definitions are specified in the string.
- Special built-in commands are identified as special built-in commands.
- Regular built-in commands which cannot be accessed via the definition in the *PATH* variable are identified as regular built-in commands. (The term "regular" is optional.)
- Reserved shell terms are identified as reserved shell terms.

The standard output is formatted as follows:
“%s\n”, <undefined>

command_name
The name of a command or of a special built-in command.

Field of application

The command search sequence can be used to disable functions, regular built-in commands and the path search sequence. This is necessary so that functions which share the same name for a command are able to call this command (instead of a recursive function call).

The default system path is available via *getconf*. Since under certain circumstances *PATH* must have been set before *getconf* is called, the following options are available:

```
command -p getconf _CS_PATH
```

Occasionally it can be desirable to suppress the properties of special built-in commands. For example:

```
command exec > non_writable_file
```

This input does not cause a non-interactive procedure to abort. The output status can be queried by the procedure.

Return code 127 is used for *command, env, nohup, time* and *xargs* if an error occurs or if *command_name* could not be found. This enables applications to determine whether it was impossible to find a command or whether the command was terminated with an error. The value 127 was selected because it is not generally used for any other meaning. Low values are generally used for "normal error conditions". Values higher than 128 may be mistaken for termination resulting from signal reception. For similar reasons, the value 126 was selected to indicate that although the command was found, it could not be called. Many procedures generate informative error messages which differentiate between 126 and 127. This distinction between return codes 126 and 127 is based on experience of the Korn shell which handles these codes as follows: 127 is used if all attempts to execute the command *exec* fail with [ENOENT]; 126 is used if an attempt to execute *exec* fails for any other reason.

Since with the options *-v* and *-V* the output for *command* is generated in accordance with the current shell environment, *command* is generally provided as a regular built-in shell command. If the call is issued in a subshell or a special run environment such as:

```
(PATH=foo command -v)
nohup command -v
```

this does not always yield correct results. Thus, for example, in certain run environments most implementations are unable to recognize alias names, functions or special built-in commands if the call is made via the *nohup* or *exec* functions.

Two types of regular built-in commands may be present in a system. Both are described separately under *command*. The description of a command search allows for the implementation of a default command as a regular built-in command provided that this is read at the correct position in a *PATH* search. Thus, for example, the result of *command -v* true may be the path name */bin/true* or a similar path name. Other, implementation-specific commands which are not defined in this documentation may also occur as built-in commands. No path name is allocated to such commands. The output is identified as that of (regular) built-in commands. In no case can applications execute the command *exec*, use *nohup*, disable the output by means of another *PATH* etc.

Locale The following environment variables affect the execution of *command*:

LANG Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.

LC_ALL If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.

LC_CTYPE Determines the internationalized environment for the interpretation of byte sequences as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determines the format and contents of error messages. The internationalized environment specified here is also valid for informative messages written to standard output.

NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.
PATH	Determines the search path used during the command search, except where a default value has been set with *-p*.

Example 1 A version of *cd* is generated which outputs the current directory precisely once:

```
cd() {
       command cd “$@“ >/dev/null
       pwd
      }
```

Example 2 A "safe shell procedure" is started in which the procedure cannot be influenced by the parent:

```
IFS='
'
#   The preceding value should be <space><tab><newline>.
#   IFS is set to the default value.

\unalias -a
#   All possible aliases are reset.
#   unalias is quoted to prevent the use of
#   any alias.

unset -f command
#   The command may not be a user function.

PATH=“$(command -p getconf _CS_PATH):$PATH“
# Introduce PATH prefix.

#   ...
```

Provided that the access permissions for the directories called by *PATH* are set correctly, then at this point the procedure can make sure that the called commands actually correspond to the commands which are to be addressed. Great care is taken here since it is assumed that implementation-specific extensions may be present which permit user functions when called. Although this possibility is not described in this documentation, such an extension is perfectly possible. For example the variable *ENV* precedes the call to a procedure with a user-defined start procedure. Such a procedure might, for example, define functions which affect the application.

See also *sh, type*

compress compress files

compress reduces the size of files using adaptive Lempel-Ziv coding: recurrent strings in the text are reduced to unique codes ranging from 9 to a maximum of 16 bits.

If the calling process has the appropriate privileges, the owner, access permissions, and the dates of last access and modification of the specified files remain the same.

Each specified file is replaced by a file with the same basename plus a *.Z* extension.

The amount of compression obtained depends on the size of the input file, the value of *bits* (see option *-b* below), and the distribution of recurrent substrings. Typically, files containing only text or source code are reduced by 50-60%. Compression achieved with the Lempel-Ziv approach is generally much better than that achieved with Huffman coding, and takes less time to compute.

No compression is performed if
- the input file is not a regular file (if it is a directory, for example)
- there are other links to the input file
- the input file already has a *.Z* extension
- the *.Z* file to be created already exists, and *compress* is being executed in the background
- no savings can be achieved by compression

Files compressed with *compress* can be decompressed with *uncompress*.

zcat produces uncompressed output on the standard output, but leaves the compressed file intact.

Syntax

Format 1: compress [␣**-fv**][␣**-b**␣bits][␣file ...]

Format 2: compress [␣**-cfv**][␣**-b**␣bits][␣file]

No option specified
The specified files are compressed if storage space can be saved as a result.

option

-c Simply writes the output of *compress* to standard output without modifying or creating any files. Only one file is allowed with *-c*.

-f (f - force) Forces compression even if no space savings will be achieved or the *.Z* file that will be created already exists. If the *.Z* file already exists it will be overwritten.

-f not specified:
compress prompts to verify whether an existing *.Z* file should be overwritten. No prompt is issued if *compress* is running in the background.

-v (verbose) Displays the percentage reduction for each file compressed:

```
file Compression: xx.xx% -- replaced with file.Z
```

-b␣bits

Sets the upper limit (in bits) for recurrent substring codes to *bits*. The value for *bits* must be between 9 and 16. Lowering the number of bits will result in larger, less compressed files.

The *bits* parameter specified during compression is encoded within the compressed file, together with a magic number to ensure that it is impossible to further compress a file which is already compressed.

-b not specified:
The value of *maxbits* defaults to 16.

Caution!
Although compressed files are compatible between machines with large memory, the *-b␣12* option should be used for file transfer to architectures with a small process data space (64 Kbyte or less).

file

Name of the file to be compressed. You may specify more than one file.
If you specify a hyphen (-) for one of the files, *compress* will read that file from standard input.
file must not be a directory, and there must be no other links to it.

The compressed file is assigned the name *file.Z*, and the named *file* is deleted after successful compression. *file.Z* has the same access permissions, access time and modification time as *file*. The maximum length of the name of *file* depends on the file system being used. The maximum allowable length is equal to the maximum file name length supported by the file system, minus 2 characters. This allows for the extension to *file.Z*. If this length is exceeded, *file* will not be compressed.

file not specified or specified as a hyphen (–):
Data from standard input is written in compressed form to standard output.

Exit status

0	Compression successful
1	Error
2	Compression of one or more files not performed, as it would have increased the size of the file.
>2	Error

Error

file`: filename too long to tack on .Z`
The name of the compressed file is too long. No compression takes place.

file `-- not a regular file: unchanged`
If the input file is not a regular file it is left uncompressed.

file`: -- has xx other links: unchanged`
The input file has *xx* other links; it is left uncompressed.

file `unchanged`
No savings can be achieved by compression. The input file remains uncompressed. The *-f* option can be used to force compression.

Locale

The following environment variables affect the execution of *compress*:

LANG	Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_CTYPE	Determines the internationalized environment for the interpretation of byte sequences as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Example

The file *films*, which occupies 4862 bytes in uncompressed form, is to be compressed.

```
$ ls -l
total 10
-rw-------  1  FELIX    group1    4862 Aug 19 09:27 films
$ compress -v films
compress: filme: 50.78% Compression -- replaced with films.Z
$ ls -l
total 6
-rw-------  1  FELIX    group1    2393 Aug 19 09:27 films.Z
```

See also

uncompress, *zcat*

cp copy files

cp copies files. Copying means: the file is afterwards physically present in two locations.

cp has four formats. The command copies
- one file to another with a different name (Format 1)
- one or more files to a different directory, with the copy retaining the same basename as the corresponding original (Format 2).
- each file *file* in the file hierarchy to one of the target paths specified below (formats 3 and 4)

Syntax

Format 1: cp[␣**-fip**]␣file␣copyfile

Format 2: cp[␣**-fip**]␣file␣...␣directory

Format 3: cp␣**-R**[␣**-fip**]␣file␣...␣directory

Format 4: cp␣**-r**[␣**-fip**]␣file␣...␣directory

Format 1 **Copy one file: cp**[␣**-fip**]␣file␣copyfile

-f If it is impossible to obtain a file descriptor for *copyfile* (step 3.a.ii.), then an attempt is made to call *unlink()* for *copyfile*. Processing is continued.

-i (interactive) If the named *copyfile* already exists, *cp* will ask you to confirm whether this file may be overwritten. A *y* answer means that the copy operation should proceed. Any other answer prevents *cp* from overwriting *copyfile*.
If the standard input is not a terminal, this option is ignored and no copying is performed.

-p The following properties of all *files* are duplicated in the corresponding *copyfile*:

1. The last time the data was changed and the time of the last access. If this procedure should fail for any reason then *cp* writes a message to the standard error output.
2. The user ID and group ID. If this procedure should fail for any reason then *cp* writes a message to the standard error output.
3. The bits for permissions as well as the bits S_ISUID and S_ISGID. If this procedure should fail for any reason then *cp* writes a message to the standard error output.

If it is impossible to duplicate user ID or group ID then the bits for S_ISUID and S_ISGID are duplicated.

The sequence for the duplication of the properties listed above is not defined. *copyfile* is not deleted if these properties cannot be retained.

file
Name of the original file.

copyfile

Name of the copy file.
If *copyfile* does not yet exist, a new file is created.

Unless the *-p* option is used, the copy will have the same mode as the original file, and the user and group ID of the copy will be those of the user who called *cp*, but the time of last modification of the copy will be set to the time the copy was made.

Caution!
If a file named *copyfile* already exists and the *-i* option is not used, the existing file will be overwritten without confirmation, but its mode, owner, and group will be preserved.

If *copyfile* is a link to a file, all links will be retained. The contents of *copyfile* will be overwritten with the contents of *file*.

Format 2 **Copy files to another directory**

cp[␣**-fip**]␣file␣...␣directory

-fip see Format 1

file

Name of the original file. You can give a list of names and thus copy several files at once. Each of the copies is assigned the same basic file name (basename) as the corresponding original.

Caution!
If there is a file in *directory* with the same basename as any original, and the *-i* option has not been set, the existing file will be overwritten without confirmation.

directory

Name of the directory in which the copies are to be placed. This must not be the directory in which the original files are located.

Unless the *-p* option is set, the copies will have the same modes as the originals, and the user and group ID of the copies will be those of the user who called *cp*, but the time of last modification of each copy will be set to the time the copy was made.

Format 3 **cp**␣**-R**[␣**-fip**]␣file␣...␣directory

-fip see Format 1

-R copies data hierarchies.

If the option *-R* is set then the following steps are performed:

i. *copyfile* is created with the same file type as *file*.

ii. The permissions for *copyfile* are set to match those of *file*. Modification is subsequently performed via the user's file creation mask provided that the option *-p* has not been specified.

If this procedure should fail for any reason then *cp* writes a message to the standard error output. Processing of *file* is halted. However, other files may be processed as appropriate.

file␣directory
see Format 2

Format 4 **cp**␣**-r**[␣**-fip**]␣file␣...␣directory

-fip see Format 1

-r Copies file hierarchies. The way in which special files are handled is implementation-dependent.

If option *-r* is set then the way in which special files are handled is implementation-dependent.

file␣directory
see Format 2

Procedure

If *directory* already exists and is actually a directory, then the name of the target path for the individual files in the file hierarchy consists of a string formed by *directory*, a slash and the relative path name of the file corresponding to the directory which contains *file*.

If *directory* does not yet exist and two operands are specified, then the name of the corresponding target path for *file* is the directory *directory*. The name of the corresponding target path for all other files in the file hierarchy consists of *directory*, a slash and the relative path name of the file corresponding to *file*.

An error occurs if *directory* does not exist and more than two operands are specified. An error also occurs if *directory* exists and is a file type as defined in the XSH specification but is not a directory.

In the following description *file* is the file to be copied irrespective of whether it is specified via an operand or whether it is specified in a *file* operand as a file in a file hierarchy. The term *copyfile* designates the file which is specified by the target path.

The following steps are performed for each *file*:

1. If *file* and *copyfile* designate the same file, *cp* writes a message to the standard error output where required. Processing of *file* is halted. However, other files may be processed as appropriate.
2. If *file* is a directory then the following steps are performed:
   a) If neither the option **-R** nor the option **-r** is specified, *cp* writes a message to the standard error output. Processing of *file* is halted. However, other files may be processed as appropriate.

   b) If *file* is not specified as an operand, and if *file* is either "." or "..", then processing of *file* is halted. However, other files may be processed as appropriate.

   c) If *copyfile/directory* is present and is a file type which is not specified in the XSH specification then the system reaction will depend on the specific implementation.

   d) If *copyfile/directory* is present and is not a directory, then *cp* writes a message to the standard error output. Processing of *file* as well as of any other files which are subordinate to *file* in the file hierarchy is halted. However, other files may be processed as appropriate.

   e) If the directory *copyfile/directory* does not exist then it is created and assigned the access permissions which apply to *file*. Modification is subsequently performed via the user's file creation mask, if the option *-p* has not been set, together with a bitwise OR operation with S_IRWXU. If *copyfile* cannot be created, *cp* writes a message to the standard error output. Processing of *file* is halted. However, other files may be processed as appropriate. It is not possible to predict whether or not *cp* will attempt to copy files to the file hierarchy corresponding to *file*.

   f) The files in the directory *file* are copied to the directory *copyfile/directory*. Steps 1 to 3 are followed for the *files*.

   g) If *copyfile/directory* have already been created then the access permissions are modified (if necessary) so that they are compatible with the access permissions for *file*. Modification is subsequently performed via the user's file creation mask provided that the option **-p** has not been specified.

   h) *cp* does not process *file* any further. However, other files may be processed as appropriate.

3. If *file* is a regular file then the following steps are performed:
   a) If *copyfile* is present then the following steps are performed:
      i. If the option *-i* has been set then *cp* writes a prompt to the default standard output and reads a line from the standard input. If the input is not a confirmation then *cp* discontinues processing of *file*. However, other files may be processed as appropriate.
      ii. A file descriptor for *copyfile* is obtained by performing the steps specified in the function *open()* in accordance with the XSH specification. *copyfile* is used as the path argument and the bitwise, inclusive OR operation of O_WRONLY and O_TRUNC is used as the *oflag* argument.
      iii. If the attempt to obtain a file descriptor fails and if the option *-f* has been set then *cp* attempts to remove the file by performing the steps specified in the function *unlink()* in accordance with the XSH specification. *copyfile* is used as the path argument. If this attempt is successful then *cp* continues processing with step 3b.

   b) If *copyfile* is not present then file descriptor is obtained by performing the steps specified in the function *open()* in accordance with the XSH specification. *copyfile* is used as the path argument and the bitwise, inclusive OR operation of O_WRONLY and O_TRUNC is used as the *oflag* argument. The permissions for *file* are taken from the *mode* argument.
   c) If the attempt to obtain a file descriptor fails then *cp* writes a message to the standard error output. Processing of *file* is halted. However, other files may be processed as appropriate.
   d) The contents of *file* are written to the file descriptor. If write errors occur then *cp* writes a message to the standard error output and continues processing with step 3e.
   e) The file descriptor is terminated.
   f) *cp* halts processing of *file*. If a write error has occurred at step 3d then it is impossible to predict whether or not *cp* will continue to process further files. If no write error occurred in step 3d then *cp* will continue to process files.

Error

`cp: Cannot access` *file*
The named *file* does not exist.

`cp: Cannot open file:Permission denied`
You have no read permission for *file*.

`cp: cannot create` *file*
You do not have write permission for the directory in which *file* is to be created, or the named directory does not exist.

`cp:` *dir* `directory`
dir is a directory and cannot be copied (Format 1), or you have not set the *-r* option (Format 4).

Locale The following environment variables affect the execution of *cp*:

LANG	Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_COLLATE	Ddetermines the internationalized environment for the behavior of ranges, equivalence classes and multicharacter collating elements used in the extended regular expressions defined for the affirmative response.
LC_CTYPE	Determines the internationalized environment for the interpretation of byte sequences as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files) and the behavior of character classes used in the extended regular expressions defined for the affirmative response.
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The file *techlit* is to be copied before it is changed. The copy is to be called *tl* and to be located in the same directory as *techlit*.

```
$ cp techlit tl
```

Example 2 All files from the current directory with names beginning with *fil* are to be copied into the directory */home/do/save*, and their times of last modification are to be duplicated.

```
$ cp -p fil* /home/do/save
$ ls -l /home/do/save
total 4
-rw------  1  DOBER  gr1       37 Nov 11 11:11  file1
-rw------  1  DOBER  gr1       97 Apr 01 13:24  file2
-rw------  1  DOBER  gr1      116 Dec 31 12:13  filei3
-rw------  1  DOBER  gr1      381 Feb 16 08:08  file4
```

See also *chmod*, *ln*, *mv*, *rm*

cpio copy in and out

The *cpio* command has three functions:

– it copies one or more files into an archive file (Format 1)
– it retrieves files from a previously created archive (Format 2)
– it copies files into a directory (Format 3)

i The *cpio* command has been withdrawn from the XG4 standard and replaced by the command *pax*.

Consequently, only the *pax* command should be used in the future, since *cpio* is now supported only for compatibility reasons.

Syntax

Format 1: cpio␣-o[**Bacv**][␣**-D**␣archive]

Format 2: cpio␣-i[**Bcdmrtuvf**][␣**-D**␣archive][␣pattern...]

Format 3: cpio␣-p[**adlmruv**]␣dir

Only the three main options **-o**, **-i** and **-p** are detailed in the descriptions of the various formats shown above. The remaining options are listed in section “Modifiers and single options” on page 238. The various modifiers that can be used with each format are indicated in the format descriptions.

Format 1 **Copy files out**

cpio␣-o[**Bacv**][␣**-D**␣archive]

Modifiers
Bacv

Single option
-D␣archive

-o (out) *cpio* reads a list of pathnames of plain files from standard input and copies these files along with some status information in a special archive format to standard output or to the archive specified with the single option *-D*. The archive format is the same as the one created with the command *pax -x cpio*, where output is padded to a 512-byte boundary. The number of 512-byte blocks copied is written by *cpio* to standard error.

Format 2 **Copy files in**

cpio␣**-i**[**Bcdmrtuvf**][␣**-D**␣archive][␣pattern...]

Modifiers
Bcdmrtuvf

Single option
-D␣archive

-i (in) *cpio* reads from standard input or the archive specified with the single option *-D*, which is assumed to be the product of a previous *cpio -o*, and extracts from it only those files with names that match *pattern* (see below).

The extracted files are copied into the current directory tree in accordance with the specified options. The extracted files are given the same permissions as the files copied out with *cpio -o*. The user ID and group ID are those of the user calling *cpio - i*.
It is only when the system administrator calls *cpio - i* that the extracted files retain the same user or group ID as the files copied out with *cpio -o*.

Only the system administrator can extract special files.

pattern
pattern specifies the files to be selected from the archive.
All shell metacharacters for file name generation can be used in defining *pattern* (see section “File name generation” on page 54).

If *pattern* is not specified, all files are extracted from the archive.

Format 3 **Copy files to a directory**

cpio␣**-p**[**adlmruv**]␣dir

Additional option
adlmruv

-p (pass) *cpio* reads a list of pathnames of plain files and copies these files to the named directory *dir* in accordance with the specified options.

The number of 512-byte blocks copied by *cpio* is written to standard error.

dir
Name of the directory to which the files are to be copied. This directory must exist even if the *-d* modifier is specified.

Modifiers and single options

The following modifiers may be specified in any order. Apart from the single option *-D,* they must all be directly appended to the main option *-o*,*-i* or *-p* without intervening blanks.

a (access time) Resets access times of input files after they have been copied. If the modifier *l* is also specified, the access times of files to which links exist are not reset.

B (block) Sets an I/O block size of 512 bytes. This option is only meaningful for special files with direct access (raw devices).

This modifier must not be used in combination with the main option *-p*.

c (compatible) *cpio* writes or reads header information in the archive in character format for compatibility reasons.

d (directory) Subdirectories are automatically created as needed.

f Only the files not matching *pattern* are copied.

l (link) This option must only be used in combination with option *-p*.
It results in the creation of links to the files, instead of the files being copied.

m (modification time) The original file modification times are retained.
This modifier has no effect on directories.
The modifiers *m* and *a* must not be specified together, since they are mutually exclusive.

r (rename) Allows files to be renamed interactively on extraction.
cpio prompts for a new name for each file.

If you respond with a blank line (by simply pressing the Enter key), the file will not be renamed.

If you respond with a dot (**.**), the file is copied without changing its name.

Otherwise, the name of the file is changed to the text entered in response to the prompt.

t (table of contents) *cpio* produces a table of contents of the archive.
No files are copied.

u (unconditional) Replaces an existing file with an extracted file even if the existing file has a more recent access date than the one being extracted.

If the *u* modifier is not specified, the existing file is not overwritten.

v (verbose) Causes *cpio* to display the names of the processed files.
If *v* is used in conjunction with the modifier *t*, additional information on the processed files is displayed.

␣**-D**␣archive

archive names the archive file from which files are extracted or to which they are copied. This archive file is used instead of the standard input or standard output.

Error

`Old format cannot support expanded types on file`

You have not specified the *-c* option. Due to compatibility reasons, *cpio* maintains the i-nodes of files to be copied in the old format, so i-nodes exceeding 64 Kbytes can only be processed if you have specified the *-c* option.

`directories are not being created`

You did not specify the *-d* option in Format 2.

Locale

The following environment variables affect the execution of *cpio*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the internationalized environment for the behavior of ranges, equivalence classes and multicharacter collating elements in extended regular expressions for yes/no queries.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes in extended regular expressions for yes/no queries.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_TIME	Determine the format and contents of the calendar.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 All files in the current directory with names that begin with *mb* are to be copied out to an archive file named *mailarchive*:

```
$ find . -name 'mb*' -print | cpio -o -D mailarchive
15776 blocks
```

The *find* command searches the current directory for file names that begin with *mb* and writes all such file names to standard output, which is piped (|) to the standard input of *cpio*. *cpio -o* then reads the file names and copies the appropriate files along with status information to the archive file *mailarchive* (option *-D*). When it has finished, *cpio* writes the number of copied blocks to standard error.

Example 2 List the contents of the archive file named *mailarchive*.

```
$ cpio -it -D mailarchive
mbox
mbox.new
mbox.old
15776 blocks
```

Example 3 The directory named *dir.old* is to be copied together with all its subdirectories. The duplicate directory is to be named *dir.new*:

```
$ cd dir.old
$ find . -print | cpio -pdl ../dir.new
```

The *cd* command changes the current directory to *dir.old*. The command *find* then searches this directory and all other directories below it and writes the names of all the files that it find to standard output. Since the standard output of *find* is piped (|) to the standard input of *cpio*, *cpio* reads the file names and copies the files to the directory *dir.new* (which, in this example, is at the same level in the file tree as *dir.old*). Subdirectories are created as needed (*-d*), i.e. all subdirectories of *dir.old* are copied recursively. Since the *-l* option also specified here, instead of copying the files, links are created to the files where possible.

See also *ar*, *cat*, *echo*, *find*, *ls*, *pax*, *tar*

crontab schedule periodic background work

crontab is used to have commands, shell scripts or executable programs executed regularly at specific times.

You can use *crontab* to:
- schedule command jobs (Format 1)
- have scheduled jobs listed (Format 2)
- delete scheduled jobs (Format 3)
- edit scheduled jobs (Format 4)

Jobs scheduled with *crontab* are retained even if the user who scheduled them closes the POSIX shell with *exit* or if the POSIX subsystem is shut down. There is no need to reschedule the jobs.

Before the call

The user ID must have a standard account number for *rlogin* access. This standard account number can be assigned using the ADD-USER, MODIFY-USER-ATTRIBUTES or ADD-POSIX-USER command.

If the file */usr/lib/cron.d/cron.allow* exists, you can only use *crontab* if your login name appears in it.
If the file */usr/lib/cron.d/cron.allow* does not exist, you can only use *crontab* if your login name does *not* appear in the file */usr/lib/cron.d/cron.deny*.
If neither */usr/lib/cron.d/cron.allow* nor */usr/lib/cron.d/cron.deny* exists, only the POSIX administrator is allowed to use *crontab*.

If only an empty deny file exists, for example, everyone is allowed to use *crontab*.

Only the POSIX administrator is allowed to create and modify the allow and deny files. Each line in these files contains precisely one login name.

Before the *crontab* command is called, the POSIX administrator must have started up the cron daemon (*/etc/init.d/cron␣start*).

Caution!
If you inadvertently enter the *crontab* command with no arguments, do *not* attempt to get out with [CTRL] [D]! This will cause all entries in your *crontab* file to be removed. Instead, use [DEL] to exit.

Syntax

Format 1: crontab[␣file]

Format 2: crontab␣-l[␣login_name]

Format 3: crontab␣-r[␣login_name]

Format 4: crontab␣-e[␣login_name]

Format 1

Scheduling command jobs

crontab[␣file]

To schedule a command job with *crontab* you have to specify:
– the command (or shell script or program) that is to be executed, and
– the times at which it is to be executed (e.g. every Friday or every January 15).

When you call *crontab* in the above format, *crontab* copies these specifications into your *crontab* file */var/spool/cron/crontabs/login_name*. The */usr/sbin/cron* process checks every minute whether there are commands in the *crontab* file which need to be executed, and if there are any, it has them executed.

To execute the specified *command*, *crontab* invokes a new shell (*sh*) from your home directory. *crontab* supplies a default environment for every shell, defining *HOME*, *LOGNAME*, *SHELL* (/bin/sh), and *PATH* (:/bin:/usr/bin:/usr/lbin). If you wish to have your *.profile* executed, you must specify this explicitly in the *crontab* file.

If neither the standard output nor the standard error output have been redirected for the commands in the *crontab* file, both the standard output and the standard error output will be sent to you by *mailx*.

There can be at most one *crontab* file per login name. If the *crontab* file */var/spool/cron/crontabs/login_name* does not exist, it is created when *crontab* is called. If it already exists, its contents are overwritten. In other words, if you wish to schedule additional command jobs with *crontab*, you should use the *-e* option.

file
Name of the file containing the commands and the times at which they are to be executed.
file must be in the format described below (see “Format of a crontab file” on page 243).

file not specified:
crontab reads the text entered from the standard input. The text that you enter in this case must be in the format described below (see “Format of a crontab file” on page 243).

Format 2 **Listing scheduled jobs**

crontab␣-l[␣login_name]

-l (list) *crontab* lists the contents of your *crontab* file */var/spool/cron/crontabs/login_name*. If the file is not available, an error message is issued (see *Error* on page 245).

login_name
If a *login_name* is specified, the *crontab* file of the corresponding user is listed. However, only the POSIX administrator is permitted to specify a *login_name*.

Format 3 **Deleting scheduled jobs**

crontab␣-r[␣login_name]

-r (remove) *crontab* deletes your *crontab* file */var/spool/cron/crontabs/login_name*.

login_name
If a *login_name* is specified, the *crontab* file of the corresponding user is deleted. However, only the POSIX administrator is permitted to specify a *login_name*.

Format 4 **Editing scheduled jobs**

crontab␣-e[␣login_name]

-e (edit) The *-e* option allows you to edit a copy of your *crontab* file or to create an empty file to edit (if *crontab* does not exist) and save this file as the current *crontab* file. The *VISUAL* environment variable determines which editor is called. If *VISUAL* is not defined, the *EDITOR* environment variable is checked, and if *EDITOR* is not defined, *ed* is invoked.

login_name
If a *login_name* is specified, the *crontab* file of the corresponding user is edited. However, only the POSIX administrator is permitted to specify a *login_name*.

Format of a crontab file

Your *crontab* file, or the text that you enter from standard input, (see *Format 1*) must be in the following format:

Text comprising:
– lines to define a command job, and
– comment lines, if required.

Blank lines are not permitted.

Command job definition lines

A line defining a command job consists of six fields separated by blanks or tabs. The fields contain the following information:

```
1         2       3                 4        5               6
minute    hour    day of month      month    day of week     command
```

Fields 1 to 5 specify the times at which the command in field 6 is to be executed.

Minute	Range of values: 0-59 or *pattern*
Hour	Range of values: 0-23 or *pattern*
Day of month	Range of values: 1-31 or *pattern*
Month	Range of values: 1-12 or *pattern*
Day of week	Range of values: 0-6 (0=Sunday) or *pattern*
Command	Name of the command that is to be executed at the specified time. If your command needs to read data from standard input, you have to use the percent character %. Each % character in the command field that has not been escaped with a backslash (\) is interpreted as a newline character. The shell executes the content of the command field only up to the first unescaped percent or newline character; the remainder of the field is passed to the command as standard input (see example 3 on page 247).

pattern may be:
– an asterisk * (standing for all legal values)
– a range described as *number-number*
– a comma-separated list of legal numbers or ranges, e.g.: 1,3,5 or 1-3,5

Specifying the day

Two fields are available for specifying the day; field 3 (day of month) and field 5 (day of week).

If you enter a number, a range or a list in the third field as well in the the fifth field, both specifications are valid, independently of each other.

For example, if your *crontab* file contains the line:

```
0 0 1,15 3 1 command
```

then *command* will be executed on March 1 and March 15 as well as on every Monday in March.

If you wish to specify the day in one field only, you must enter an asterisk in the second field. Thus if your *crontab* file contains the line:

```
0 0 * 3 1 command
```

then *command* will be executed on every Monday in March.

Comment lines

A comment line has the hash character # in column one and may be followed by any arbitrary text. You can use comment lines in the *crontab* file to explain the function of the command job or to arrange the job into sections for the sake of clarity. Please note that the input text that you pass to *crontab* can contain any number of comment lines but must not include any blank lines.

Exit status

0 Successful execution of *crontab*.

≠0 An error occurred during *crontab* execution.

Error

```
crontab: you are not authorized to use cron. Sorry.
```

See *Before the call* above.

Format 1

```
crontab: can't open your crontab file.
```

You have called *crontab* with the name of a file which does not exist or cannot be accessed.

```
crontab: error in previous line; ...
```

If any line of the input text that you pass to *crontab* is not in the correct format, *crontab* displays the relevant line followed by the above error message. The ellipses (...) shown here are replaced by a more detailed description of the error, e.g.:

```
unexpected character found in line
```

An illegal character was found in the line.

```
number out of bounds
```

A specified number is not in the permitted range.

Format 2

```
crontab: can't open your crontab file.
```

Your *crontab* file */var/spool/cron/crontabs/login_name* does not exist and therefore cannot be read with *crontab -l*.

File

/usr/lib/cron.d/cron.allow
List of login names with permission to use *crontab*. One login name is entered per line.

/usr/lib/cron.d/cron.deny
List of login names explicitly denied permission to use *crontab*. One login name is entered per line.

/var/spool/cron/crontabs/login_name
crontab file of the user identified by *login_name*.

Variable

The following environment variables are used by *crontab*.

VISUAL	The *VISUAL* environment variable determines which editor is used when the *-e* option is specified.
EDITOR	If *VISUAL* is not set, the *EDITOR* environment variable determines which editor is used when the *-e* option is specified.

Locale

The following environment variables affect the execution of *crontab*:

LANG	Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_CTYPE	Determines the internationalized environment for the interpretation of bytes of text data as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Example 1 You want the system to remind you on May 15 every year that it is Aunt Jemima’s birthday. To do this, you set up a file called *birthday* with the following contents:

```
0 0 15 5 * echo Today is Aunt Jemima's birthday !!!
```

Please note that since you only wish to make an entry for the day of the month and not for the day of the week, you must enter an asterisk in the "day of week" field.

You now pass the file named *birthday* to your *crontab* file:

```
$ crontab birthday
```

The system will then send you the appropriate message via *mailx* at 00.00 hours on May 15 of each year. This will obviously only function if the system has not been turned off during that night.

Example 2 Let us assume that on every Monday, at 1:30 p.m., you want to remind yourself and a co-worker of your aerobics class that evening. Your reminder is to be displayed on the screen. You are at terminal tty007 and she is at terminal tty014. You can also include comment lines in the input text so that your text is easier to read with *crontab -l* at a later stage. Your *crontab* file could then be set up as follows:

```
# *   = all legal values
# n-n = range
# n,n = list
# Day of week: 0 = Sunday
#
# Min  Hrs  Day(Mon)  Mon  Day(Wk)  Command
#
30   13      *        *    1      echo Aerobics this evening ! >/dev/tty007
30   13      *        *    1      echo Aerobics this evening ! >/dev/tty014
```

Every Monday at 1:30 p.m., you and your colleague will now receive the message "Aerobics this evening !" at your respective terminals (and not in your mailboxes).

Example 3 Every Monday, you want to *mailx* the message below to user *melodie*, who works on a system called *jukebox*:

```
It may be blue
But it will pass too!
```

You do this by putting the following line in your *crontab* file:

```
0 0 * * 1 mailx melodie@jukebox %It may be blue %But it will pass too!
```

See also *at*, *mailx*, *sh*, *vi*

csplit split files based on context

csplit splits the contents of a file or the text it reads from standard input into smaller sections and writes all or some of these sections to separate output files. The original file is left unaltered.
The way in which *csplit* divides a file and the sections for which output files are created are specified in the command-line arguments.
csplit creates a maximum of 100 output files per call.

Syntax **csplit**[␣**-ks**][␣**-f**␣name][␣**-n**␣numberl]␣file␣arg1...argn

No option specified
The output files are named *xx00, xx01*, and so on.

For each output file that it creates, *csplit* writes a character count on standard output. Any files that have already been created are removed if an error occurs.

option

-f␣name
The output files are called *name00, name01*, etc.

-f not specified:
The output files are named *xx00, xx01*, and so on.

-k Files that have already been created are retained if an error occurs.

-n␣number
The current number of the output files comprises number digits, whereby 1 ≤ *number* ≤ 9.

Example

For *-n␣4*, the output files are called *xx0000*, *xx0001* etc.

-n not specified:
The current number consists of 2 digits.

-s The output of a character count is suppressed.

file
Name of the input file.
If you use a dash (-) as the name for *file*, *csplit* reads from standard input.

arg1...argn
You can specify several arguments, each of which references a particular line in the input file. These lines represent the points at which *csplit* is to split the file into sections. Each dividing line becomes the first line of a new section. If you specify *n* arguments, *csplit* divides the file into *n*+1 sections.

csplit usually writes each section to a separate output file.

This does not apply when the argument %*regular_expression*%[+*number*][-*number*] is used (see below). The last section (section *n*) is always written to an output file.

The arguments you specify are processed by *csplit* in the order in which you list them. To begin with, the first line of the input file is the current line. After an argument has been processed, the line referenced by this argument becomes the current line. The line referenced by the next argument must lie in the range between but not including the current line and the end of the input file. Thus the line referenced by the second argument must come after the line referenced by the first argument.

argument can be specified as follows:

/regexp**/**[**+**number][**-**number]

An argument in the form */regexp/* references the next line after the current line that matches the specified regular expression. The section from the current line up to but not including the line that matches the regular expression is written to an output file. The line matching the regular expression now becomes the current line.

The +*number* or -*number* offset shifts the dividing line *number* lines after (+) or before (-) the line that matches the regular expression. The line that is *number* lines after (+) or before (-) the line matching the regular expression thus becomes the current line.

Simple regular expressions (see *Tables and directories, Regular POSIX shell expressions*) are recognized. If the argument contains blanks or shell metacharacters (see *Tables and directories, POSIX shell metanotation*), you must either escape every such character with a backslash \ or enclose the whole argument in single quotes '...'. The regular expression must not contain any newline characters.

%regexp**%**[**+**number][**-**number]

An argument in the form %*regexp*% references the next line after the current line that matches the specified regular expression. The line that matches the regular expression becomes the current line. *csplit* in this case **does not** create an output file for the relevant section.

If the +*number* or -*number* offset is also specified, the current line will be the line that is *number* lines after (+) or before (-) the line containing the regular expression.

Simple regular expressions (see section "Regular POSIX shell expressions" on page 897) are recognized. If the argument contains blanks or shell metacharacters (see section "Metacharacters for the POSIX shell" on page 904), you must either escape every such character with a backslash \ or enclose the whole argument in single quotes '...'. The regular expression must not contain any newline characters.

num
: This argument references the line with line number *num*. *csplit* writes the section from the current line up to but not including the *num*th line to an output file. The *num*th line then becomes the current line.

{n}
: This argument is an abbreviation for *n* arguments of the previous type (see above) and means: "repeat the preceding argument *n* times", where *n* is an integer greater than 1.

The *{n}* argument can be entered after any of the above-mentioned arguments, with a blank to separate them.
Thus if it follows an argument in the form */regexp/+number][-number]* or *%regexp%[+number][-number]*, this argument will be repeated *n* times.

Example

`'/regexp/' {2}` is an abbreviation for
`'/regexp/' '/regexp/' '/regexp/'`

If *{n}* follows an argument of the *num* type, the file will be split *n* times, from the *num*th line onward, into sections of *num* lines each.

Example

`100 {2}` is an abbreviation for `100 200 300`

Error
: `argument - out of range`
The line referenced by the specified *argument* lies outside the permissible range. The legal range is from, but not including, the current line to the end of the file.

`100 file limit reached at arg ...`
You have specified so many arguments that *csplit* would need to create more than 100 output files.

Locale
: The following environment variables affect the execution of *csplit*:

LANG
: Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.

LC_ALL
: If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.

LC_COLLATE Determines the internationalized environment for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.

LC_CTYPE Determines the internationalized environment for the interpretation of byte sequences as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions.

LC_MESSAGES
Determines the format and contents of error messages.

NLSPATH Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The file *book* contains a text that is subdivided into three chapters. The first chapter is preceded by a preface; an appendix follows the last chapter. Each chapter begins with the title "CHAPTER ..."; the title of the appendix is "APPENDIX".
You now wish to put the preface, the individual chapters, and the appendix into separate files. The output files are to be named *chap00*, *chap01*, etc.

```
$ csplit -f chap book '/CHAPTER/' '/CHAPTER/' '/CHAPTER/' '/APPENDIX/'
1636
15124
32743
20344
2576
```

```
$ ls
book
chap00
chap01
chap02
chap03
chap04
```

The file *chap00* contains the preface and consists of 1636 characters. The appendix is located in the file *chap04*.
The same results could also have been obtained by abbreviating the *csplit* call as follows:

```
$ csplit -f chap book '/CHAPTER/' {2} '/APPENDIX/'
:
```

You can now edit the sections separately, and later you can join them again using *cat*:

```
$ cat chap0[0-4] > book
```

Example 2 The input file *file* is to be split into sections every hundred lines. To do this, you enter:

```
$ csplit file 100 {98}
```

The argument {98} stands for 98 arguments: 200 300 ... 9900.

If *file* contains 9900 or more lines, *csplit* creates 100 output files. The first output file *xx00* includes line 1 to 99 (inclusive); the last output file, *xx99*, contains the rest of *file* from line 9900 onward.
If *file* contains fewer than 9900 lines, *csplit* issues the error message "{98} - out of range" and terminates. If you include option *-k* in the call, the files already created are retained.

```
$ csplit -k file 100 {98}
```

If *file* contains only 9830 lines, for example, then *xx98* is the last output file created and includes lines 9800 to 9830.

Example 3 The file *prog.c* contains a C source program. The program includes a *main* function and a maximum of 20 further functions. In accordance with C conventions, each function ends with a right brace at the beginning of a line (in column 1). Right braces within a function are not located in the first column of a line.
Each function is now to be written to a separate file. To do this, you enter:

```
$ csplit -k prog.c '%main(%' '/^}/+1' {19}
```

If the program contains exactly 20 functions in addition to the *main* function, *csplit* splits the file into 22 sections.
Section 0 contains all lines from the beginning of the file up to but not including the start of the *main* function. This section will **not** be written to an output file (argument *%main(%*).
Section 1 contains the *main* function and is written to the output file *xx00* (argument /^}/+1).
Functions 1 to 19 are similarly written to separate output files in succession (argument {19}).
The final section, i.e. section 22, contains the rest of the input file (which in this case is function 20) and is written to the output file *xx20*.

If the program contains fewer than 20 functions, *csplit* will terminate at the last function and issue the error message "{19} - out of range". Since the *-k* option has been set, the created files will, however, be retained.

See also *ed*, *sh*, *split*

cut — cut out selected fields of each line of a file

cut reads the input text line by line from files or from the standard input and cuts out of each line selected bytes (Format 1), characters (Format 2) or fields (Format 3). *cut* outputs the removed components at the standard output.

Syntax

Format 1: cut␣-b␣list␣[**-n**][␣file..]

Format 2: cut␣-c␣list[␣file]...

Format 3: cut␣-f␣list[␣**-d␣**char][␣**-s**][␣file]...

Format 1 **Cutting out bytes**

cut␣-b␣list␣[**-n**][␣file..]

-b␣list
(bytes) *cut* cuts out of each input line the bytes which are in the position specified in *list* and sends them to the standard output.

list is a list of numbers or numerical ranges. The elements in the list must be separated by commas and arranged in ascending order. The range *n1-n2* refers to all the numbers between *n1* and *n2* inclusive.

The following abbreviations can be used to specify ranges:
-*n* for 1-*n*
n- for *n*-"last column"

Example

1,3,5	*cut* cuts the 1st, 3rd and 5th columns.
1-3,5	*cut* cuts the 1st, 2nd, 3rd and 5th columns.
-3,5	is an abbreviation for 1-3,5
3-	is an abbreviation for 3-"last column"

-n A character which may consist of multiple bytes is not cut out byte by byte. Every *list* character which is specified in the range *n1-n2* is treated as follows:

If *n1* is not the first byte of the character, then *n1* is ignored in order to cut the first byte of the character.
If *n2* is not the last byte of the character, then *n2* is ignored. The last character to precede *n2* is selected. *n2* is reset to zero if there is no preceding character.

file
Name of the input file. You may input multiple files.

file not specified: *cut* reads from the standard input.

Format 2 **Cutting out columns**

cut␣**-c**␣list[␣file]...

-c␣list

(column) The columns specified in *list* are cut out from each input line and written to standard output. A column is exactly one character wide.

list possesses the format described under Format 1.

file

Name of the input file.
You may name more than one file.

file not specified: *cut* reads from standard input.

Format 3 **Cutting out fields**

cut␣**-f**␣list[␣**-d**␣char][␣**-s**][␣file]...

-f␣list

(field) *cut* cuts out the fields specified in *list* from each input line and writes them on standard output.
A field comprises all characters that are located between two field delimiters. Two successive field delimiters mark an empty field. The field delimiter defaults to the tab character, but you can redefine it in the *-d* option.
The output fields are separated from one another by one field delimiter each. Input lines with no field delimiters are output in full (unless the *-s* option is set). This is generally useful for table subheadings.

list is specified as described under Format 1.

-d␣char

The character given as *char* serves as the field delimiter.
If *char* is a blank or a shell metacharacter (see section “Metacharacters for the POSIX shell” on page 904) it must be enclosed in single quotes: -d’*char*’.

-d not specified:
The field delimiter defaults to the tab character.

-s Lines with no field delimiters are suppressed.

-s not specified: Lines with no field delimiters are output in full.

file

Name of the input file.
You may name more than one file.

file not specified: *cut* reads from standard input.

Error

`ERROR: line too long`
A line can have no more than 1023 characters or fields. Alternatively, the newline character may be missing.

`cut: Bad list for b/c/f option`
Incorrect *list* specification or missing option *-b, -c* or *-f*. No error is reported if the line possesses fewer fields than are required by *list*.

`cut: No delimiter`
The delimiter character missing from the *-d* option.

`ERROR: cannot handle multiple adjacent backspaces`
Adjacent backspaces cannot be processed correctly.

`cut: Cannot open` *file*
The named *file* cannot be read or does not exist. If multiple files have been specified, processing will continue on the other files.

Locale

The following environment variables affect the execution of *cut*:

LANG	Provides a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_CTYPE	Determines the internationalized environment for the interpretation of byte sequences as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Print the first 72 characters of each input line:

```
$ cut -c1-72 file
```

Example 2 The first and third fields of the */etc/group* file (the group name and group number) are cut out and output. The individual fields in this file are separated by means of a colon.

```
$ cut -f1,3 -d: /etc/group
```

Example 3 The names of customers whose bills are due on the first day of any month are to be filtered out of the *invoice* file of a mail order house along with the amount due from each of them. The file is structured as follows:

```
Homewood        Milwaukee         10,000        06.01.05
Mackenzie       Detroit            7,000        07.06.05
Macnamara       Boston             8,000        05.01.05
Tinniswood      Atlanta              450        06.20.05
```

The fields in the table are separated by exactly one tab and padded with blanks.

```
$ grep '\.01\.05' invoice  | cut -f1,3 > names
$ cat names
Homewood        10,000
Macnamara        8,000
```

Explanation: *grep* finds all lines containing the string .01.05 and writes them to standard output. *cut* receives these lines as input, selects the first and third fields, and writes its output to the file *names*.

If you would then like each customer name in the *names* file to be preceded by the date and then sorted accordingly, you could enter:

```
$ grep '\.01\.05' invoice | cut -f4 > date
$ paste date names | sort
05.01.05        Macnamara        8,000
06.01.05        Homewood        10,000
```

Explanation: The first command line writes the date associated with the selected customer names to the file named *date*. The *paste* command pastes the lines in the *date* and *names* files horizontally, separating them with the default tab character. The *sort* command then sorts the output lines in ascending order of date.

See also *awk*, *grep*, *paste*

date write the date and time

date writes the current date and time on standard output.

The form in which *date* outputs dates and times depends on the value of the environment variable *LC_TIME* or, if that is undefined or null, on the value of *LANG*. If both are undefined or null, or if the required database is not available, or if one of the NLS variables has an invalid value, *date* acts as if in a non-internationalized system, printing dates and times in American format.

Mode of operation

The system works with UTC (Universal Time Coordinated; this is the same as GMT - Greenwich Mean Time). *date* converts UTC to local time and vice versa. If the environment variable *TZ* is defined and option *-u* is not set then this variable is used to determine the time zone and convert UTC to local time.

Syntax

Format 1: date[␣**-u**][␣**+**format]

Format 2: date␣**-a**[␣**-**]␣sss.fff

Format 1 **date**[␣**-u**][␣**+**format]

No argument specified
date prints the current date and time in a format governed by the current locale.

-u Displays the current date and time in Greenwich Mean Time (GMT).
If the *-u* option is set, the *+format* specification is ignored.

+format
The *format* argument defines the output format for *date*. If *format* contains blanks or tabs or other shell metacharacters which you do not want the shell to interpret, you should enclose *format* in single quotes:
+’format’.

format is essentially similar in format to the first argument of the *printf()* function in C or *awk* (see *awk*, *printf* (page 142) and the C function *printf()* [4]).

The output of *date* can be formatted by means of field descriptors in the *format* argument. Field descriptors take the form of a percentage sign followed by a letter and are replaced in the output by their values (see page 258). All characters that are not part of a field descriptor are copied to the output unmodified. The output is always terminated with a newline character.

Format 2 **date␣-a**[␣**-**]␣sss.fff

-a[␣**-**]␣sss.fff
Adjusts the system clock time by *sss.fff* seconds, where *fff* represents fractions of a second. This adjustment can be positive or negative (-). The system's clock will be sped up or slowed down until it has changed by the specified amount.

Field descriptors

The following overview lists all legal field descriptors. Although the field descriptors *%h* and *%b* are essentially identical, both descriptors have been retained for compatibility reasons.

%n	newline character
%t	tab character
%c	date and time in the default format of the current locale
%C	century (first two digits of the year, 00-99)
%D	date in the format %m/%d/%y
%x	date in the format of the current locale
%y	year (last two digits of the year, 00-99)
%Y	year (last two digits of the year, 00-99)
%m	month
%h	month (in letters, abbreviated) in the format of the current locale
%b	identical to %h
%B	month (in letters, in full) in the format of the current locale
%W	week number of year (00 to 53, with Monday as the first day of the week)
%V	week number of the year (01 to 53, with Monday as the first day of the week). The first week in January is counted as week 1 if it contains at least 4 days. Otherwise this week is counted as week 53 of the previous year
%U	week number of the year (00 to 53, with Sunday as the first day of the week)
%j	day of year (001 to 366)
%d	day of month (01 to 31)
%e	day of month (1 to 31, single-digit numbers preceded by a blank)
%a	abbreviated weekday name in the format of the current locale
%A	full weekday name in the format of the current locale
%w	day of week (0 to 6, Sunday = 0)
%u	day of week (1 to 7, Monday = 1)
%R	time in the format %H:%M
%T	time in the format %H:%M:%S
%X	time in the format of the current locale
%r	time in a.m./p.m. notation, as %I:%M:%S %p
%H	hour (00 to 23)
%I	hour (01 to 12)
%p	string containing ante-meridiem or post-meridiem indicator(a.m./p.m. affix) in the format of the current locale.
%M	minute (00 to 59)

%S	second (00 to 61)
%Z	timezone name, or no output if no timezone exists (governed by the value of the environment variable *TZ*, see *POSIX shell variables*).

Modified field descriptors

If an alternative representation is defined in your local environment(e.g. before and after Christ) you can call it using modified field descriptors. Modified field descriptors are in the form *%Eletter* or *%Oletter*. The modified field descriptors that can be used are listed in the overview below.
If no alternative representation has been defined, all modified field descriptors output the value of the current unmodified field descriptors.

%Ec	date and time in the alternative format
%EC	name of the time period (e.g. "year") in the alternative representation
%Ex	date in the alternative format
%EX	time in the alternative format
%Ey	year in which the time period in the alternative representation begins
%EY	year in the alternative representation
%Od	day of month in alternative numeric representation
%Oe	day of month in alternative numeric representation
%OH	hour (24-hour clock) in alternative numeric representation
%OI	hour (12-hour clock) in alternative numeric representation
%Om	month in alternative numeric representation
%OM	minutes in alternative numeric representation
%OS	seconds in alternative numeric representation
%Ou	weekday in the alternative format (Monday = 1)
%OU	week of the year in alternative numeric representation (same as for %U)
%OV	week of the year in alternative numeric representation (same as for %V)
%Ow	weekday in the alternative format (Sunday = 0)
%OW	week of the year in alternative numeric representation (same as for %W)
%Oy	year in the alternative format

Variable *TZ*

If defined, the environment variable *TZ* contains information on timezones. *date* uses *TZ* to determine the timezone and to convert from UTC (Universal Time Coordinated) to local time and vice versa.

The default value "`MEZ-1MSZ-2,M3.5.0/02:00:00,M10.5.0/03:00:00`" of the TZ variable must be interpreted as following:

– Standard time zone

Name	MEZ
Time difference	Zone - 01:00:00 = UTC

– Alternative time zone

Name	MSZ
Time difference	Zone - 02:00:00 = UTC

– Switchover time to the alternative time zone

Month	3 = March
Week	5 (or 4)
Weekday	0 = Sunday
Time	02:00:00

– Switchover time to the standard time zone

Month	10 = October
Week	5 (or 4)
Weekday	0 = Sunday
Time	03:00:00

Locale The following environment variables affect the execution of *date*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME Determine the format and contents of date and time strings written by *date*.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Printing date and time
If you call *date* without arguments at 17:00 hours EST on June 19, 2009, and the system clock is set to the correct time, the following will be printed

```
Fri Jun 19 17:00:00 MSZ 2009
```

The command:

```
$ date '+DATE: %m/%d/%y%nTIME: %H:%M:%S'
```

generates the following output:

```
DATE: 06/19/09
TIME: 17:00:00
```

You have defined the environment variable *CFTIME* and used *echo* to output the value of *CFTIME*:

```
$ echo $CFTIME
%d %B %y
```

If the system clock is set correctly then, on 19 June 2005 at 17.00 CET, a call to *date* with no argument results in the output

```
19 June 05
```

See also *cal*
ctime(), printf() [4]

dd convert and copy a file

The *dd* command can be used to copy files while making any necessary conversions, e.g. from EBCDIC to ASCII or vice versa.

dd is well-suited for input/output via raw devices (raw physical I/O), because it can read and write in blocks of any size. Note, however, that any given raw device can only handle the block sizes for which it is specifically designed (512-byte blocks for a floppy disk drive, for example. If the size of the file you want to convert is not a multiple of the appropriate block size, you must use the *conv=sync* option.

After completion, *dd* reports the number of whole and partial input and output blocks on standard error.

Caution!
Never use *dd* to copy files between file systems which have different block sizes. Using a block device to copy a file may result in extra nulls being added to the file to pad the final block to the block boundary.

Syntax **dd**[␣option...]

No option specified
dd reads from standard input and writes to standard output. No conversions are performed. The input and output block sizes default to 512 bytes.

option

if=input_file	Name of input file
of=output_file	Name of output file
ibs=n	Input block size (in bytes)
obs=n	Output block size (in bytes)
bs=n	Input and output block size (in bytes)
cbs=n	Conversion buffer size (in bytes)
skip=n	Skip first *n* blocks of input file
iseek=n	Seek *n* blocks from beginning of input file before copying
oseek=n	Seek *n* blocks from beginning of output file before copying
seek=n	Seek *n* blocks from beginning of output file before copying
count=n	Copy/convert only first *n* blocks of input file
conv=value[,value...]	Several values for *conv*

conv=ascii	Convert from EBCDIC to ASCII
conv=ebcdic	Convert from ASCII to EBCDIC
conv=siemens	Convert from ASCII to Siemens-specific EBCDIC
conv=ibm	Convert from ASCII to IBM-specific EBCDIC
conv=block	Convert newline-terminated records to fixed-length records
conv=unblock	Convert fixed-length records to newline-terminated records
conv=lcase	Convert uppercase letters to lowercase
conv=ucase	Convert lowercase letters to uppercase
conv=swab	Swap every pair of bytes
conv=noerror	Do not stop processing on error
conv=sync	Pad every input block to the number of characters defined in *ibs=n*
conv=notrunc	Do not truncate the output file

If size arguments are needed for an option, you can specify them as follows:

n	means *n* times 1
*n***b**	means *n* times 512
*n***k**	means *n* times 1024
*n***w**	means *n* times 2
*n***x***m*	means *n* times *m*

if=input_file

In *input_file* you give the name of the input file from which *dd* is to read.

if=input_file not specified:
dd reads from standard input.

of=output_file

output_file designates the name of the output file to which *dd* is to write.

of=output_file not specified:
dd writes to standard output.

ibs=n

(input block size) In *n* you specify the input block size in bytes.

ibs=n not specified:
The input block size defaults to 512 bytes.

obs=n

(output block size) In *n* you specify the output block size in bytes.

obs=n not specified:
The output block size defaults to 512 bytes.

bs=n

(block size) In *n* you specify a value in bytes for both the input and output block size. The value specified for *bs* overrides the values of *ibs* and *obs*.

cbs=n

(conversion buffer size) In *n* you specify a value in bytes for the conversion buffer size. This specification is only effective in the following cases:

- for conversions from EBCDIC to ASCII and vice versa
- for conversions from and to fixed-length records.

(see *conv=ascii*, *conv=ebcdic*, *conv=ibm* and *conv=block*, *conv=unblock,* page 265).

skip=n

The first *n* blocks of the input file are skipped, and copying begins at block number *n*+1. This option is only appropriate for magnetic tape, where *iseek* is undefined.

iseek=n

The first *n* blocks of the input file are skipped, and copying begins at block number *n*+1. This option is specially designed for disk files, where *skip* can be extremely slow. It is only accepted with devices which support the *lseek* system call (such as disk units).

skip and *iseek* are mutually exclusive.

oseek=n

The copy of the input file (after conversion, if specified) begins *n* blocks into the output file (i.e. at block *n*+1). The first *n* blocks of the output file remain unchanged. This option is only accepted with devices which support the *lseek* system call (such as disk units).

seek=n

seek performs the same function as *oseek*.

count=n

Only the first *n* blocks of the input file are copied (and converted, if specified).

conv=value[,value...]

You can specify several comma-separated values for *conv* and thus have a number of conversions performed.

The values *ascii*, *ebcdic* and *ibm* cannot be used in combination.
The same applies to the pairs *block* and *unblock*, and *lcase* and *ucase*.

conv=ascii

Conversion from EBCDIC to ASCII.

The number of characters defined in *cbs=n* is copied into the conversion buffer and any specified character mapping is done. Trailing blanks are removed, and a newline character is added. The output block size of the file is thus adjusted to the value defined in *cbs=n*. If *cbs* is unspecified or set to 0, input file character mapping is done, but trailing blanks are not removed.

conv=ebcdic

Conversion from ASCII to EBCDIC.

The ASCII characters are read into the conversion buffer and converted to EBCDIC. Trailing blanks are added in order to produce the output block size defined in *cbs=n*. If *cbs* is unspecified or set to 0, input file character mapping is done, but the file's block structure is not changed.

conv=siemens

Conversion from ASCII to EBCDIC as described above, but by using a Siemens-specific EBCDIC table. The Newline character is converted as follows:: X'0A' <-> X'05' .

conv=ibm

Conversion from ASCII to EBCDIC as described above, but using an IBM-specific EBCDIC table.

conv=block

Conversion of newline-terminated ASCII records to fixed-length records. The ASCII characters are read into the conversion buffer, and blanks are added to adjust the record length or output block size to the value defined in *cbs=n*. If *cbs* is unspecified or set to 0, this option produces a simple file copy.

conv=unblock

Conversion of fixed-length ASCII records to newline-terminated records. The record length is determined by the value defined in *cbs=n*. This number of characters is repeatedly read into the conversion buffer, where excess trailing blanks are removed and a newline character is added before the characters are sent to the output. If *cbs* is unspecified or set to 0, this option produces a simple file copy.

conv=lcase

Uppercase letters are converted to the corresponding lowercase letters.

conv=ucase

Lowercase letters are converted to the corresponding uppercase letters.

conv=swab

The bytes in each pair of bytes are swapped. If an input block contains an uneven number of bytes, the last byte is ignored.

conv=noerror
Processing is continued even if an error occurs.

conv=sync
Every input block is padded to the value specified in *ibs=n*. When *block* or *unblock* is specified, blanks are used, otherwise null-bytes.

conv=notrunc
The output file is not regenerated. All blocks that are not overwritten explicitly by *dd* remain unchanged.

Locale The following environment variables affect the execution of *dd*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), the classification of characters as upper- to lower-case, and the mapping of characters from one case to the other.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The contents of an EBCDIC tape with a block structure of 10 times 80 bytes is to be written to the ASCII file *xy*:

```
$ dd if=/dev/rmt32 of=xy ibs=800 cbs=80 conv=ascii
```

See also *cp*

debug program debugging in forked tasks

The *debug* command enables POSIX programs which can be started from within a shell to be debugged.

Syntax

Format 1: debug[␣**-e**]␣program[␣arguments]...

Format 2: debug[␣**-p**]␣pid

Format 1 **debug**[␣**-e**]␣program[␣arguments]...

The program to be debugged is loaded in the task generated from within the shell by means of a fork (fork task). Once the program has been loaded, but before the first command is executed, control is passed to the user on BS2000 command level. The process ID of the fork task is displayed as a prompt (see also Example 1 below).

-e *program* is loaded without its external symbols dictionary.

program
: Name of the program to be debugged. The program must be executable.

arguments
: *program* arguments.

Format 2 **debug**[␣**-p**]␣pid

The program running in the fork task with process ID *pid* is stopped. The user is given control on BS2000 command level. The process ID of the interrupted fork task is displayed as a prompt (see also Example 2 on page 268).

-p Interrupts the program in the task with process ID *pid.*

pid
: Process ID of the task that is to be stopped.

Example 1 The example below illustrates what happens up to the point where the program to be debugged is loaded. When the prompt pid/ appears, the program is ready to start as it would be after a /LOAD-PROGRAM command. AID commands can be used to influence how debugging is to proceed. The program starts again after the /RESUME-PROGRAM command in the fork task.

```
/START-POSIX-SHELL
$ cd myprogdir
$ ls -l myprog
-rwxr-xr-x  1  MYUSER    MYGROUP 1150976  Wed May 11 13:10:50 MSZ 2005 myprog
$ debug myprog
% AID0348 Program stopped due to EXEC event (PID=0000000055)
0000000055/
```

Example 2 This example illustrates what happens when a program executing in a fork task is interrupted. When the *pid/* prompt appears, the program has been interrupted as when K2 is pressed. AID commands can be used to influence how debugging is to proceed. The program starts again after the RESUME-PROGRAM command in the interrupted fork task.

```
/START-POSIX-SHELL
$ ps -e
    UID  PID  PPID  C     STIME TTY        TIME  CMD
SYSROOT  243     1  0  16:32:38 term/001   0:01  [sh]
SYSROOT  245   243  0  16:33:44 term/001   0:00  [loop]

$ debug -p 245
% AID0492 %STOP was send for fork task (PID=0000000245)
$
% AID0348 Program stopped due to STOP event (PID=0000000245)
0000000245/
```

df report free disk space

You can use *df* to determine the number of free disk blocks and inodes which are still available at mounted or unmounted local systems and to obtain information on the file system coding (ASCII or EBCDIC).

Syntax

Format 1: df[␣**-F**␣FSType]␣ **-P**[␣**-klV**][␣file]

Format 2: df[␣**-F**␣FSType][␣**-begklntVv**][␣**-o**␣ufs_options]...[␣file]

Format 3: df␣**-c**[␣file]...

Format 1 **df**[␣**-F**␣FSType]␣ **-P**[␣**-klV**][␣file]...

option

-F␣FSType
The file system with which you want to work is of the type *FSType*. You only need to specify this option if the file system is unmounted.

FSType may be:

ufs	Berkeley file system
bs2fs	bs2fs file system
proc	Pseudo file system for accessing process data
fdfs	Pseudo file system for accessing file descriptors

-P Prints the following information in columns for all mounted file systems or for the specified file systems:

filesystem	Special file for the file system
bytes	Total disk space in 512-byte blocks
used	Used disk space in 512-byte blocks
available	Available disk space in 512-byte blocks
capacity	Percentage of disk space used
mounted on	Name of the directory on which the file system is mounted

-k Prints the following information in columns for all mounted file systems or for the specified file systems (like option *-P)*. Storage space is listed in 1024-byte blocks (instead of 512-byte blocks).

The storage space specification takes account of the reserved storage space which can only be used by the POSIX administrator.

-l *df* prints the number of free blocks and inodes for all locally mounted file systems or for the specified file systems. The *-l* option is set by default. It cannot be combined with *-e* or *-o*.

-V *df* expands the *df* command line and writes the completed command to standard output, but does not execute the command. *df* completes the command line, adding information derived from */etc/mnttab* and */etc/vfstab* to input provided by the user.

The added information relates to the option *-F␣FSType* and/or the associated special file, depending on which of the two components, if either, was specified on the command line.
If you enter *df␣-V* without other options and arguments, you will be shown a list of *df* command lines indicating all mounted file system types and the associated special file names.

file
file is either the name of a directory or the name of a special file which contains a file system. If you name a directory, *df* examines the file system mounted on that directory. You may name more than one *file*.

file not specified:
df prints out information on all mounted file systems or all file systems of type *FSType*.

Format 2 **df**[␣**-F**␣FSType][␣**-begklntVv**][␣**-o**␣ufs_options]...[␣file]...

No option specified
df prints the number of free blocks and inodes in all mounted or all specified file systems.

option

-F␣FSType
The file system with which you want to work is of the type *FSType*. You only need to specify this option if the file system is unmounted.

FSType may be:

ufs	Berkeley file system
bs2fs	bs2fs file system
proc	Pseudo file system for accessing process data
fdfs	Pseudo file system for accessing file descriptors
nfs	File system mounted on the remote host (network file system, Berkeley)

-b Prints the free disk space (in Kbytes). This option cannot be combined with *-o*.

-e Prints the number of free inodes. This option cannot be combined with *-o*, and it overrides the *-l* option.

-g Prints the entire *statvfs* structure for all mounted file systems or for *FSType* or *file*. The output consists of 4 lines containing the following information:

dir	Name of the directory on which the file system is mounted (the string *dir* does not appear in the output)
device	Associated special file (the string *device* does not appear in the output)
block size	Block size of the file system
frag size	Fragment size of the file system
total blocks	Total number of blocks in frag size units
free blocks	Total number of free blocks
available	Number of free blocks for non-POSIX administrators
total files	Total number of inodes
free files	Number of free inodes
filesys id	File system identification number
name	File system designation (the string name does not appear in the output)
fstype	File system type
flag	File system flags
filename length	Maximum length of file names

This option cannot be combined with *-o*, and it overrides options *-b, -e, -k, -l, -n, -r* and *-v.*

-k Prints the following information in columns for all mounted file systems or for the specified file systems:

filesystem	Special file associated with the file system
kbytes	Total disk space in 1024-byte blocks
used	Used disk space in 1024-byte blocks
avail	Available disk space in 1024-byte blocks
capacity	Percentage of disk space used
mounted on	Name of the directory on which the file system is mounted

The storage space specification takes account of the reserved storage space which can only be used by the POSIX administrator.

This option cannot be combined with *-o*, and it overrides options *-b, -e, -k, -l, -n, -r* and *-v*.

-l *df* prints the number of free blocks and inodes for all locally mounted file systems or for the specified file systems. The *-l* option is set by default. It cannot be combined with *-e* or *-o*.

-n *df* outputs the file system type.
If you combine *-n* with *-o* or *-f* then an error message is displayed.

-t *df* prints the number of free blocks and files as well as the total number of available blocks and files for each mounted or specified file system.
-t overrides the *-b* option. Combining *-t* with *-o i* produces a totals line for all the columns in the *-o i* output.

-V *df* expands the *df* command line and writes the completed command to standard output, but does not execute the command. *df* completes the command line, adding information derived from */etc/mnttab* and */etc/vfstab* to input provided by the user.

The added information relates to the option *-F␣FSType* and/or the associated special file, depending on which of the two components, if either, was specified on the command line.
If you enter *df␣-V* without other options and arguments, you will be shown a list of *df* command lines indicating all mounted file system types and the associated special file names.

-v *df* prints the following information in columns for all mounted file systems or for the specified file systems:

Mount Dir	Name of the directory on which the file system is mounted
Filesystem	Special file associated with the file system
blocks	Total disk space, in 512-byte blocks
used	Used disk space, in 512-byte blocks
free	Free disk space, in 512-byte blocks
%used	Percentage of disk space used

This option cannot be combined with *-o*, and it overrides options *-b, -e, -k, -l, -n, -r* and *-v*.

-o␣ufs_option

If the file system type is *ufs*, you can use a *ufs*-specific option:

i *df* prints the following information in columns:

Filesystem	Name of the special file
Filesystem	Name of the associated special file
iused	Number of used inodes
ifree	Number of free inodes
%iused	Percentage of inodes used
Mounted on	Name of the directory on which the file system is mounted

The only options with which *-o␣i* can be combined meaningfully are *-F* and *-t*.

file

file is either the name of a directory or the name of a special file associated with a file system. If you name a directory, df examines the file system mounted on that directory. You may name more than one *file*.

file not specified:
df examines all locally and remotely mounted file systems or all file systems of type *FSType*.

Format 3 **df**␣**-c**[␣file]...

option

-c The command outputs the type of coding (ASCII or EBCDIC) for all locally mounted file systems or those specified with *file*. This option cannot be combined with other options.

Hint In UFS file systems the available disk space is as a rule less than the free disk space. The reason for this is that some of the disk space (10%) is reserved for privileged applications and is consequently not available for normal applications.

Error Some of the following error messages also indicate the correct syntax, but use some syntax elements that differ from the ones in the above description. The table below shows which syntax elements are equivalent:

Syntax element in the error message	Equivalent in the above description
specific_options	ufs_option
directory | special	file
generic options	-begkltvV

`df: Cannot access` *file*
An invalid or incomplete special file or directory name was specified with *df␣-V* .

`df ufs: Usage: df [-F ufs] [generic options] [-o i] [directory|special]`
An invalid *ufs_option* argument was specified with the *-o* option. *ufs_option* can only be *i*.

`df: operation not applicable for FSType FStype`
An invalid file system type (*xxx*) was specified for *FSType* in the command *df␣-F␣FSType␣-o␣i*. The only type that can be specified in combination with the *-o* option is *ufs*.

File

*/dev/dsk/**
Special files associated with the file systems

/etc/mnttab
Table of mounted file systems

/etc/vfstab
List of default parameters for each file system

*/etc/fs/FStyp/**
Commands for specific file system types

Locale

The following environment variables affect the execution of *df*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Printing the associated file system types for all user directories:

```
$ df -n /h*
/home    : ufs
/home2   : ufs
/home3   : ufs
```

Example 2 Printing the entire *statvfs* structure for the file system */stand*:

```
$ df -g /stand
/stand           (/dev/dsk/c0d0s10):     512 block size     512 frag size
  10710 total blocks  7577 free blocks   7577 available      104 total file
    100 free files      10 filsys id                           /stand
    bfs fstype  0x00000000 flag           14 filename length
```

Example 3 The file system coding is to be output for the */home* and */var* directories:

```
$ df -c /home /var
/home    : EBCDIC
/var     : ASCII
```

See also *du*

diff compare two files

The *diff* utility will compare the contents of *file1* and *file2* and write to standard output a list of changes (with *ed*-like commands) necessary to convert *file1* into *file2*. This list should be minimal. No output will be produced if the files are identical.

Syntax **diff**[␣option]␣file1␣file2

No option specified

If the compared files are identical, *diff* produces no output. When the files differ, the output is as follows:

```
1. line[range] from       ed command     line[range] from
   file1                                 file2
2. lines that are only in file1
3. lines that are only in file2
```

The lines are displayed in the following format:

```
             a
1. n1[,n2]   d n1[,n2]
             c

2. < text of line from file1
        .
        .
        .
        – – –
3. > text of line from file2
        .
        .
        .
```

a, d, and *c* are *ed*-like commands meaning:

a append

d delete

c change

The output is to be interpreted as follows:

The *ed* commands *a, d*, and *c* with their preceding line (or range) specifications show how *file1* can be converted into *file2*.

If you replace *a* with *d* and *d* with *a* and use the line (or range) specifications to the right, the commands indicate how *file2* can be converted into *file1*. Lines from file1 are marked <; those from file2 are marked >.

option

-a *diff* produces a diff with all lines of context from both files. Those lines only in *file1* are prepended with -; those only in *file2* are prepended with +. Lines which are identical in both files are prepended with ␣..

-b *diff* ignores trailing blanks or tabs at the end of lines as well as differing numbers of blanks at corresponding positions within text lines. Leading blanks and blank lines are reported as differences.

-i *-i* must not be combined with *-h*.
diff ignores the case of letters; for example, it considers 'A' to be the same as 'a'.

-t *diff* expands tab characters in output lines. In normal or *-c* output, *diff* adds character(s) to the start of each line that may adversely affect the indentation of the original source lines and make the output lines difficult to interpret. The *-t* option preserves the original source's indentation.

-w *diff* ignores all blanks (space and tab characters) and treats strings of blanks of any length as equivalent; for example, it considers 'if␣(␣a␣=␣=␣b␣)' to be the same as 'if(a==b)'.

The following options are mutually exclusive:

-c *diff* produces a listing in three parts with a slightly modified output format. The output begins with the names and creation dates of *file1* and *file2*. Then come the lines that differ, with the lines not present in *file2* marked with a minus sign (-) and the lines that differ in *file1* and *file2* marked with an exclamation point (!). There are also three lines of context before and after the differing lines.

-C␣number
Produces a listing of differences identical to that produced by *-c*, but with *number* lines of context before and after each difference.

-e The *-e* option must not be combined with *-h*, *-l* or *-s*.
diff produces output suitable for use as an *ed* script. The *ed* script contains *a*, *d*, and *c* commands and the related text lines as input for the editor *ed* to convert *file1* to *file2*. Before you pass the script to the editor, you should add the statements *w* and *q* at the end of the script and insert the command *e file1* at the start (see *ed* on page 291).

-f The *-f* option must not be combined with option *-h*.
diff generates a similar script to the one created with option *-e*, but converting in the opposite direction. This script, however, is **not** usable with *ed*.

Editing scripts produced under the *-e* and *-f* options may be incorrect when dealing with lines comprising nothing but a single period.

The following options modify the way in which *diff* works:

-h The *-h* option must not be combined with *-e*, *-f*, *-i*, *-c*, *-C*, *-n* or *-D*.
diff operates faster, and you can process files of any length. However, the result produced by option *-h* is not reliable!

-n Produces a script similar to *-e*, but with the *ed* commands listed in reverse order. In addition, a count of the lines to be changed is printed after each *insert* or *delete* command.

-D␣string
In this case *file1* and *file2* must be C source programs or contain C source fragments. *diff* creates a merged version of *file1* and *file2* with C preprocessor controls included so that compilation of the result is equivalent to compiling *file1* if *string* is not defined, and is equivalent to compiling *file2* if *string* is defined.

The following options are used to compare directories:

-l *diff* produces output in long format. Before checking for differences, *diff* pipes each text file through *pr* to paginate it. Differences other than those in text files are remembered and are summarized after all text file differences have been reported.

-r Applies *diff* recursively to all common subdirectories encountered.

-s Reports files that are identical; these would not otherwise be mentioned.

-S␣name
Starts a directory *diff* in the middle, beginning with the file *name*.

file1␣file2
Names of the files *diff* is to compare. If *file1* is a directory, then a file in that directory with the same name as *file2* is compared against *file2*. If *file2* is a directory, then the comparison is made with a file named *file1* from that directory.

If both *file1* and *file2* are directories, *diff* looks in both directories for files with the same name to compare. In this case *diff* will not compare block special files, character special files or FIFO special files to any files as well as regular files to directories.

If either the *file1* or *file2* operand is a -, the standard input will be used in its place. In this case the input files must be text files.

Exit status

0	Files are the same
1	Files are different
>1	Input error

Error

`diff: two filename arguments required`
You have specified an incorrect number of files. Only two files can be compared at a time.

`diff: No such file or directory`
One of the specified files does not exist.

`diff: files too big, try -h`
You need to use the *-h* option, as the files to be compared are too large.

`diff: Permission denied`
You do not have read permission for one of the specified files.

Variable

TZ
Determine the locale for affecting the timezone used for calculationg file timestamps written with the *-C* and *-c* options

Locale

The following environment variables affect the execution of *diff*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
LC_TIME	Determine the locale for affecting the format of timestamps written with the *-C* and *-c* options.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The files *file1* and *file2* have the following contents:

```
file1                   file2

Jack Jill               Jack and Jill
went up the hill        went uphill
to fetch a pail         of water
of water
```

By calling *diff*, you can identify the lines in which the two files differ.

```
$ diff file1 file2
1,3c1,2
<Jack Jill
<went up the hill
<to fetch a pail
– – –
>Jack and Jill
>went uphill
```

Explanation: In order to convert *file1* into *file2*, lines 1 to 3 inclusive from *file1* (1,3) must be replaced (c) by lines 1 to 2 inclusive (1,2) of *file2*. The contents of each of these lines are shown in the output lines beginning with the < or > characters. Lines in *file1* are marked <; lines in *file2* are marked >.

Example 2 Compare files and produce an *ed* script:

```
Contents of file1:       Contents of file2:

today is monday          today is tuesday
it is cold               it is autumn
                            it is cold
```

After the following command, *diff* outputs the *ed* commands with which *ed* could convert *file1* into *file2*. To be able to use this output as input for *ed*, you need to add the statements *w* and *q* to the end of the *ed* script.

```
$ diff -e file1 file2
1c
today is tuesday
it is autumn
.
$
```

See also *cmp*, *comm*, *ed*, *pr*

dirname return directory portion of pathname

dirname can be used to strip the file name (basename) from the full access path. *dirname* takes a string as its argument, removes the final slash and all characters to the right of it, and writes the rest of the string on standard output. *dirname* is useful in shell scripts.

Syntax

dirname[␣string]

string

string can be any string of characters.
dirname deletes the final slash and all characters to the right of it and writes the remaining portion to standard output. If string does not contain a slash, a dot is written to standard output.

string not specified:
a dot is written to standard output.

Locale

The following environment variables affect the execution of *dirname*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

In the following example, the path prefix */usr/src/cmd* is assigned as a value to the *NAME* variable:

```
NAME=`dirname /usr/src/cmd/xyz.c`
```

See also

basename,

du estimate file space usage

du outputs the amount of disk space used by directories, subdirectories, and ordinary files in blocks of 512 bytes.

Syntax **du**[␣**a** |␣**s**][␣**-kx**][␣**-r**]...[␣file...]

No option specified

If *name* is a directory, *du* lists the space occupied by the specified directory and all its subdirectories. The disk space occupied by ordinary files in the specified directory is included in the count, but not listed individually.
If *name* is not a directory, *du* does not output anything for it.

option

-a If *file* is a directory then *du* reads the storage space allocated to each of the files in this directory individually. If *file* is not a directory then *du* reads the storage space allocated to *file*. The option *-a* can be combined with the option *-s*.

-k *du* outputs the occupied storage space, specifying the number of occupied 1024-byte blocks.

-r *du* issues an error message if *file* is a directory for which you possess no read permission or if it is a file which cannot be opened. The option *-r* is always set.

-s *du* only outputs the total amount of storage space occupied by the section of the file tree or the file. The option *-s* cannot be combined with the option *-a*.

-x When file sizes are calculated, only those files which use the same special file as *file* are considered.

file

Name of the file or directory for which disk usage is to be displayed. A file with two or more links is only counted once. A file that has a hole in it (e.g. if only block 1 and block 100 are used) will result in an incorrect block count. If *name* refers to an ordinary file, *du* remains silent if invoked without options.

file not specified:
The disk space occupied by the current directory and all its subdirectories is displayed.

Locale The following environment variables affect the execution of *du*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 List the disk usage, in 512-byte blocks, of all subdirectories of the current directory whose names begin with *DIR*. The space occupied by ordinary files is included, but not listed individually.

```
$ du DIR*
6       DIR-1
136     DIR-2/SUB-1
140     DIR-2
5       DIR-3
54      DIR-4
```

Example 2 List the disk usage, in 512-byte blocks, of all subdirectories of the current directory whose names begin with *DIR*. The disk usage of ordinary files is listed individually in this case because the *-a* option is used.

```
$ du -a DIR*
1       DIR-1/file1
1       DIR-1/file2
1       DIR-1/file3
6       DIR-1
0       DIR-2/file4
1       DIR-2/file5
34      DIR-2/SUB-1/file6
99      DIR-2/SUB-1/file7
136     DIR-2/SUB-1
140     DIR-2
1       DIR-3/file8
1       DIR-3/file9
5       DIR-3
50      DIR-4/file10
1       DIR-4/file10.bak
54      DIR-4
```

See also *df*

dumpfs dump file system

The command *dumpfs* outputs the super block and cylinder group information for the specified file system. This command can, for example, be used to determine the block and fragment sizes which are specifed for the file system as well as the minimum required storage space in percent.

Syntax **dumpfs**␣file_system

file_system
Name of the file system for which the information is to be output.

i This command may only be entered by the POSIX administrator. It is only of use to system maintenance staff for diagnostic purposes.

Hint The *dumpfs* command is not supported for bs2fs file systems.

Example Printing out information on the / directory:

```
# dumpfs /
magic   11954   time    Thu Jun  8 10:04:06 1995
sblkno  4       cblkno  6       iblkno  8       dblkno  72
sbsize  4096    cgsize  4096    cgoffset 8      cgmask  0xfffffff8
ncg     2       size    2048    blocks  1907
bsize   8192    shift   13      mask    0xffffe000
    fsize   4096    shift   12      mask    0xfffff000
frag    2       shift   1       fsbtodb 1
minfree 10%     maxbpg  1024
maxcontig 1     rotdelay 0ms    rps     60
csaddr  72      cssize  4096    shift   9       mask    0xfffffe00
ntrak   8       nsect   16      spc     128     ncyl    32
cpg     16      bpg     512     fpg     1024    ipg     2048
nindir  2048    inopb   64      nspf    2
nbfree  400     ndir    87      nifree  2157    nffree  5
cgrotor 0       fmod    0       ronly   0

cs[].cs_(nbfree,ndir,nifree,nffree):
        (66,29,918,3) (334,58,1239,2)


cg 0:
magic   90255   tell    6000    time    Thu Jun  8 08:35:05 1995
cgx     0       ncyl    16      niblk   2048    ndblk   1024
nbfree  66      ndir    29      nifree  918     nffree  3
rotor   870     irotor  833     frotor  864
frsum   3
sum of frsum: 3
iused:  0-6, 8-832, 835-846, 848-1126, 1129-1134, 1136
```

```
free:   575, 844-845, 864, 871, 876-881, 894-901, 904-913, 916-917,
        920-1023
b:
   c0:  (0)      0 0 0 0 0 0 0 0
   c1:  (0)      0 0 0 0 0 0 0 0
   c2:  (0)      0 0 0 0 0 0 0 0
   c3:  (0)      0 0 0 0 0 0 0 0
   c4:  (0)      0 0 0 0 0 0 0 0
   c5:  (0)      0 0 0 0 0 0 0 0
   c6:  (0)      0 0 0 0 0 0 0 0
   c7:  (0)      0 0 0 0 0 0 0 0
   c8:  (0)      0 0 0 0 0 0 0 0
   c9:  (0)      0 0 0 0 0 0 0 0
   c10: (0)      0 0 0 0 0 0 0 0
   c11: (0)      0 0 0 0 0 0 0 0
   c12: (0)      0 0 0 0 0 0 0 0
   c13: (5)      1 0 0 0 2 0 2 0
   c14: (29)     8 0 7 0 8 0 6 0
   c15: (32)     8 0 8 0 8 0 8 0

cg 1:
magic   90255   tell    40e000  time    Thu Jun  8 10:04:51 1995
cgx     1       ncyl    0       niblk   2048    ndblk   1024
nbfree  334     ndir    58      nifree  1239    nffree  2
rotor   234     irotor  716     frotor  256
frsum   2
sum of frsum: 2
iused:  0-805, 807, 809, 811
free:   353, 355-1023
b:
   c0:  (0)      0 0 0 0 0 0 0 0
   c1:  (0)      0 0 0 0 0 0 0 0
   c2:  (0)      0 0 0 0 0 0 0 0
   c3:  (0)      0 0 0 0 0 0 0 0
   c4:  (0)      0 0 0 0 0 0 0 0
   c5:  (14)     3 0 3 0 4 0 4 0
   c6:  (32)     8 0 8 0 8 0 8 0
   c7:  (32)     8 0 8 0 8 0 8 0
   c8:  (32)     8 0 8 0 8 0 8 0
   c9:  (32)     8 0 8 0 8 0 8 0
   c10: (32)     8 0 8 0 8 0 8 0
   c11: (32)     8 0 8 0 8 0 8 0
   c12: (32)     8 0 8 0 8 0 8 0
   c13: (32)     8 0 8 0 8 0 8 0
   c14: (32)     8 0 8 0 8 0 8 0
   c15: (32)     8 0 8 0 8 0 8 0
```

echo write arguments to standard output

The POSIX shell built-in *echo* writes its arguments to standard output and terminates. The following takes place before the output is generated:

1. As with every other command, the shell interprets the command line arguments and then passes the edited arguments to *echo*. The argument separators recognized by the shell are blanks and tabs.
2. *echo* interprets any remaining special characters that control output (see description of *argument* below).
3. *echo* displays processed arguments as follows:
   - Each argument is separated from the next by a blank even if you have entered more than one argument separator between individual arguments in the call.
   - A newline character is output at the end of the last argument.

You can use *echo* to
- examine values of shell variables,
- generate messages in shell scripts and thus test how they function,
- test how the shell interprets a command call without the command being executed,
- redirect data to a pipe and test how the pipe processes this input.

Besides the shell built-in *echo*, there is also a command called */usr/bin/echo*. The shell generates a new process to execute */usr/bin/echo*. Otherwise, */usr/bin/echo* operates in the same way as *echo*.

Syntax

```
echo[␣argument...]
```

argument

Any string delimited by blanks or tabs. The last argument is terminated by means of a command separator.

You may specify any number of arguments, provided they are separated by at least one tab or blank character.

As with any other command, this string is also initially interpreted by the shell:

- If the string contains an asterisk, question mark, or [...], the shell replaces this string by all suitable file names in the current directory. If no suitable file name is found, the shell passes the string on to *echo* unaltered.
- ’string’
  All shell metacharacters are escaped by the single quotes. The shell passes the string as an argument to *echo* without the quotes. All blanks, tabs and newline characters entered within single quotes are retained.

- \` string\`
  The shell executes *string* as a POSIX command and passes the output of this command to *echo*. Characters assigned to the environment variable IFS are interpreted by the shell in the output as argument delimiters. The default characters assigned to IFS are the blank, tab or newline characters.
- "string"
  The double quotes escape all shell metacharacters except for the backslash \\, backquotes \` ...\` and the dollar sign $. The shell passes the processed string to *echo* as an argument. All blanks, tabs, and newline characters within the double quotes are retained.

The shell built-in *echo* also interprets the control characters described below. Since the backslash has a special meaning for the shell, it must be escaped:

- by preceding it with another backslash \\
  This also applies if the argument containing this control character is enclosed within double quotes.
- by single quotes ’...’
  If the argument containing this control character is enclosed within single quotes, the backslash need not be escaped again.

Example

```
$ echo hello\\tuser
hello   user
$ echo hello’\’tuser
hello   user
$ echo ’hello\tuser’
hello   user
$ echo "hello\tuser"
hello   user
```

Control characters

The following control characters influence the output of *echo*, provided the backslash has been appropriately escaped:

Please note the terminal-specific characteristics.

\c
echo prints the arguments entered up to this control character, omitting the newline and ignoring the remaining arguments.

\f
(form feed) This control character is not converted if the output is written to the terminal. If the output from *echo* is sent to a printer, for example, all arguments entered after this control character will be written on the next page.
\f corresponds to CTRL L

\n
(newline) All arguments that follow the newline character are written in the next line.
\n corresponds to ↵ or CTRL J

\t
Control character for tab; *echo* moves the cursor to the next tab stop. Characters entered after *\t* are written by *echo* from this column onward.
The setting of tab stops depends on the data terminal that is used. On a Siemens Nixdorf 97801 terminal, tab stops are set at the following columns:
1, 9, 17, 25, 33, 41, 49, 57, 65, 73, 79
\ t corresponds to ⇥ or CTRL I

\0n
n must be a one, two or three figure octal number. The *echo* command outputs the corresponding character (see *Tables and directories, EDF04 character set*). In this way you can, for example, generate characters with an internal code greater than FF (EDF04) even if you do not possess an 8-bit terminal.
A dummy character is output to represent non-displayable characters (device-dependent).

i If a character in octal notation is to be followed by an additional digit that is not part of the octal number, you must use the full three-digit form of the octal number.

Example

```
$ echo '\0337'|od -xc
0000000    df15
        337  \n
0000002
$ echo '\00337'|od -xc
0000000    1bf7    1500
        033   7  \n
0000003
```

If control characters of the above type are to be interpreted by neither the shell nor *echo*, they must be entered as follows:

Example

```
$ echo \\
\
$ echo \\\\t
\t
$ echo '\\t'
\t
$ echo "\\\t"
\t
```

The above example applies to the remaining strings as well.

argument not specified:
echo produces only a blank line.

Locale The following environment variables affect the execution of *echo*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following interactive session will demonstrate when blanks, tabs and newline characters are retained:

```
$ echo Today is         Monday.
Today is Monday.
```

In this case *echo* receives three arguments and returns them with one blank between each.

```
$ echo "Today is         Monday."
Today is         Monday.
```

All blanks entered within the double quotes are retained.

Example 2 User *anna* wants to know what value is assigned to the HOME variable:

```
$ echo $HOME
/home/anna
```

Example 3 The following line in a shell script will cause an error message to be written on standard error:

```
echo File $1 not found >&2
```

Example 4 A string constant is to be placed before the output of the *date* command:

```
$ echo "Today's date and time:  \\c"; date
Today's date and time:  Mon Mar  9 17:22:05 MEZ 2009
```

The control character \c prevents *echo* from interpreting the newline. The backslash must be escaped despite the double quotes.

See also *print*

ed interactive line editor

ed is an interactive line editor. Furthermore, with the help of *ed scripts* (see “Working with ed scripts” on page 306), you can easily process several files with the same sequence of commands. *ed* can handle the output of the *diff -e* command (see page 276f).

Syntax **ed**[␣**-**|␣**-s**][␣**-p**␣string][␣file]

␣**-**|␣**-s**

The *-s* option corresponds to the old - option, which is still supported.

The *-s* option suppresses the following default outputs:

– number of bytes processed by the *ed* commands:
e (edit)
r (read)
w (write)

– the question mark character, which warns against inadvertent deletion of the buffer contents during execution of the *ed* commands:
e (edit)
q (quit)

– the exclamation mark ! used as an *ed* prompt after a ! command.

-p␣string

In *string* you can define the prompt that *ed* displays in command mode. *string* can be one or more characters.

-p␣*string* not specified:
ed does not display a prompt string.

file

The name of the file that you wish to process. *ed* copies the file into its internal buffer and saves *file* as the current file name.

file not specified:
You start by working on an empty buffer and only decide upon a file name when using the *w*␣*file* command to write the buffer contents into a file.

ed buffer

When *ed* is invoked, a buffer is opened.

If you have not entered a file name, the buffer will be empty. You can then fill it with text during your editor session.

If you have named a file, a copy of the file is read into the buffer. During your editor session, you essentially process the contents of the buffer.

Before you exit the editor again, you must decide whether you want to save the newly created or modified buffer contents by writing them to a file.

If you wish to save the buffer contents, you use the *w*[␣*file*] (write) command to write the contents of the buffer back to the specified file (by default the one named when *ed* was invoked) and then exit the editor with the *q* (quit) or *Q* (Quit) commands or with the [END] key.

If you do not wish to save the buffer contents, you can exit the editor without writing back the contents of the buffer with *w*. You do this by pressing *Q* or *q* twice. When you press *q* the first time, *ed* will issue a ? as a warning to prevent you from inadvertently deleting the buffer contents. The buffer will not be deleted unless and until you press *q* a second time. If you prefer, you can also enter *Q* or [END] instead of the second *q*.

Operating modes

ed provides you with two operating modes: command mode and input mode. *ed* enters command mode when it is called with *ed[␣file]* [↵]. In command mode you specify a command in a line and confirm your input by pressing [↵].

Input mode is activated by means of one of the following commands:

a (append)
i (insert)
c (change)
(see "ed commands" on page 295).

In input mode, all the input characters which follow, including various non-printing characters (e.g. key codes of cursor keys), are written to the working copy in the buffer. *ed* does not accept any commands in input mode. If you wish, you can define a prompt for command mode (see option *-p* and *ed* command *P*) so that you can instantly detect the mode in which you are currently working. You leave input mode either by pressing [DEL] or by entering a period (.) in the first column and hitting [↵]. When you press [DEL], *ed* normally ignores all input since the last [↵] and displays a ? as a warning.

Command structure

For *ed*, there is a *current line* at all times. As a rule, the line last processed by a command represents the current line. If you do not specify another address in front of the commands, they will always refer to the current line.

Most *ed* commands have the following structure:

```
[range]ed-command[parameter...] ↵
```

range

The *range* you enter identifies the lines in the buffer to which the *ed* command is to be applied. One or two addresses can be specified in *range*:

range = address

The line identified by *address* is selected.

range = address1,address2

address1,*address2* identifies the range between the specified limits (inclusive). The search for both addresses begins at the current line, which is not changed until commands are executed.
address2 must refer to a line that follows the line referenced by *address1* in the buffer. Otherwise, *ed* reports an error.

range = address1;address2

address1;*address2* identifies the range between the specified limits (inclusive). The search for *address1* begins at the current line. The new current line is set to the line identified by *address1*, and only then is *address2* calculated. You can use this feature to define the starting line for forward and backward searches (see the section "Addresses" on page 294, *//* and */RE/* on the following page) .
address2 must refer to a line that follows the line referenced by *address1* in the buffer. Otherwise, *ed* reports an error.

range not specified:
ed assumes the default address for each command; this address is described for each of the *ed* commands.

If *ed* requires no address but you have nevertheless specified one, *ed* reports an error.

If you have specified more addresses than necessary, *ed* uses the last address(es) specified.

Addresses

Addresses are constructed as follows:

Address	*Meaning*
.	Current line
$	Last line
n	*n*th line
'x	The line marked with the letter *x*. *x* must be a letter in lowercase (see *k* command).
/RE**/**	A simple regular expression *RE* enclosed in /.../ (see section “Regular POSIX shell expressions” on page 897) addresses the first line containing a character string that matches the regular expression, searching forward from the current line. If *ed* does not find a match in any line, the search wraps around and continues from the beginning of the file until a match is found or the current line is reached again. If the regular expression *RE* contains the delimiter / or ?, this must be escaped using \\. The characters \n in a regular expression do *not* match newline characters in the searched text! A regular expression may only appear once in *range*. Thus, /RE1/,/RE2/, for example, will only address the first line that matches /RE2/.
//	A null regular expression // addresses the line matching the regular expression last specified.
?RE**?**	Like /RE/, except that the search begins at the current line and proceeds toward the beginning of the file. If the regular expression *RE* contains the delimiter / or ?, this must be escaped using \\.
addr[**+**]n	*n*th line after the line identified by *addr*.
addr[**-**]n	*n*th line before the line identified by *addr*.
+n	*n* lines forward from the current line.
-n	*n* lines backward from the current line.
[addr]**+**...	
[addr]**-**...	One line forward (+) or backward (-) from the line identified by *addr*. Each occurrence of + or - respectively increases or decreases the address specification by 1. Thus, ++ addresses the second line after the current line (2 lines forward).
,	A comma stands for the address pair 1,$ if followed by a command; if not, the last line is output.

; A semicolon stands for the address pair .,$ if followed by a command; if not, the last line is output.

ed commands

The following list includes a systematic overview of all *ed* commands that you can enter in the command mode. The detailed command description that follows is arranged in alphabetical order.

- **Activate input mode**
  a (append)
  append text after addressed line
  c (change)
  delete and replace
  i (insert)
  insert text before addressed line
- **Output prompt in command mode**
  P (prompt
  use * as prompt
- **Undo commands**
  u (undo)
  undo most recent command
- **Abort commands**
  DEL
  abort execution of command
- **Explain errors**
  h (help)
  explain last error message
  H (Help)
  toggle help mode on and off. If help mode is on, error messages are printed for all subsequent ? diagnostics (see *Error* on page 306)
- **Modify text**
  a (append)
  append text after addressed line
  c (change)
  delete and replace
  d (delete)
  delete lines from buffer
  i (insert)
  insert text before addressed line

- **Output lines**
  p (print)
  print addressed lines
  l (list)
  output with non-printing characters in alternative representation or as octal numbers
  address
  output addressed lines
  address/+number
  output addressed lines
  n (number)
  print indicated lines with line numbering
  ↵
  output line following current line
- **Output line numbers**
  address=
  output addressed line number
  n (number)
  output lines with line numbering
- Move specified line ranges
  t (transfer)
  append a copy of addressed lines
  m (move)
  move lines to after addressed line
- **Search and replace**
  s (substitute)
  search and replace
- **Join lines**
  j (join)
  join contiguous lines
- **Mark linves**
  k (mark)
  mark addressed lines
- **Process selected lines with commands**
  g (global)
  apply command list globally to all lines that match the given */RE/*
  G (Global)
  apply interactive command list globally to all lines that match the given */RE/*
  v (vice-versa)
  like *g*, but for all lines that do not match */RE/*.
  V (Vice-versa)
  like *G*, but for all lines that do not match */RE/*.

- **Change current file name**
  f (file-name)

  change/display current file name

- **Execute shell commands**
  !

  send command to shell for interpretation

- **Read files into buffer**
  e (edit)

  delete buffer and read named file into it

  E (Edit)

  clear buffer without warning and reload original

  r (read)

  read file into buffer

- **Save buffer contents**
  w (write)

  write buffer contents into file

  W (write)

  append buffer contents to file

- **Quit the editor**
  q (quit)

  quit *ed*

  Q (Quit)

  quit *ed* without warning

  END

  quit *ed*

Description of the ed commands

The square brackets [] are not to be entered. They merely indicate that the entry enclosed within them is optional.
As a rule, only one command may be entered per line. However, you can append the suffixes *l, n*, or *p* to the commands (with the exception of *e, f, r*, and *w*) if the functions described under *l, n*, and *p* are to be executed.

[address]**a**
text
. (append) reads the *text* input and appends it to the line addressed in *address*. The current line is now either the last line of the inserted text or, if you have not entered any text, the addressed line. Address 0 is legal for this command: it causes the "appended" text to be inserted at the beginning of the buffer. The maximum number of characters that may be entered from a terminal is 2048 per line (including the newline character).

address not specified:
address = .

[range]**c**
text
. (change) deletes the specified *range* and replaces these lines with the*text* input. The current line is now either the last line of the entered text or, if you have not entered any, the line preceding the deleted lines.

range not specified:
range = .,.

[range]**d**
(delete) deletes the specified *range*. The line after the last line deleted becomes the current line. If the deleted lines were at the end of the buffer, the new last line becomes the current line.

range not specified:
range = .,.

e[␣file]
(edit) deletes the entire buffer and reads in a copy of the contents of the named *file*. If the contents of the buffer have been modified but not saved with *w*, *ed* prevents inadvertent deletion of the buffer by first issuing a ? as a warning. If you now enter *e* again, the old buffer contents are deleted without further comment. The number of bytes read is output provided you did not call *ed* with the *-s* option. The current line is the last line of the buffer. The specified file name *file* is remembered for possible use as a current file name in subsequent *e*, *r*, and *w* commands. If *file* is replaced by an exclamation point !, the rest of the line is interpreted as a shell command and executed. The output of the shell command is read into the buffer. A shell command that is preceded by an ! is not stored as the file name.

file not specified:
file = current file name

E[␣file]

(Edit) behaves like *edit*, except that it overwrites the buffer without issuing a ? as a warning even if the buffer contents have been modified but not saved.

file not specified:
file = current file name

f[␣file]

(file) sets the current file name to *file*. The current file name is used by the commands *e*, *E*, *r* and *w*.

file not specified:
ed outputs the current file name.

[range]␣**g/**RE**/**commandlist

(global) first marks all lines containing a character string which matches the regular expression *RE*. *RE* is a simple regular expression (see section “Regular POSIX shell expressions” on page 897). Then *commandlist* is executed for each line marked, with the current line being set to the next marked line in each case.

A single command or the first in a *commandlist* must be entered in the same line as the *g* command. All lines in *commandlist* except the last one must end with \↵; the last command itself with ↵.

The commands *a*, *i*, and *c* with their associated input *text* are allowed. All lines in *text* must also be terminated with \↵. The period "." usually used to terminate input can be omitted from the last line of *commandlist*.

An empty *commandlist* is equivalent to the *p* command.

The *g*, *G*, *v*, and *V* commands are not permitted in the *commandlist*.

The global command must not be combined with the ! command.

range not specified:
range = 1,$

[range]**G/**RE**/**

(Global) is the interactive variant of the *g* command. First, every line that matches *RE* is marked. *RE* is a simple regular expression (see section “Regular POSIX shell expressions” on page 897). The first of the marked lines is printed. At the same time, this line becomes the current line.

You now have the option of specifying a command to be executed (other than *a*, *c*, *i*, *g*, *G*, *v*, or *V*). After the execution of that command, the next marked line is printed, and so on.

A newline acts as a null command; an ampersand & causes the re-execution of the most recent command executed within the current invocation of *G*.

Note that the commands input as part of the execution of the *G* command may address and affect any lines in the buffer. The *G* command can be terminated by pressing the DEL key.

range not specified:
range = 1,$

h (help) issues a short error message that explains the reason for the most recent ? symbol displayed on the screen. See *Error* for a list of possible error messages.

H (Help) causes *ed* to enter a mode in which error messages are printed instead of the ? symbol for all errors that follow. It will also explain the previous ?, if any. You can deactivate the help feature by calling the *H* command again.
The *H* mode is normally off. See *Error* for a list of possible error messages.

[address]**i**
text
. (insert) inserts the given *text* before the line referenced by *address*. The last inserted line of text, if any, becomes the current line; otherwise, the addressed line does. This command differs from the *append* command only in the placement of the entered *text*. Address 0 is not legal. The maximum number of characters that may be entered from a terminal is 2048 per line (including the newline character).

address not specified:
address = .

[range]**j**
(join) joins all lines in the specified *range* into one line by removing the appropriate newline characters. If you have only specified one address, nothing happens. The new line becomes the current line.

range not specified:
range = .,.

[address]**k**x
(mark) marks the line referenced by *address* with the letter specified in *x*, where *x* must be in lowercase. The marker itself is not output. The marked line can then be addressed by using *'x* (single quote x). The current line is unaffected.

address not specified:
address = .

[range]**l**

(list), in contrast to *p*, outputs the specified *range* as follows: some non-printing characters are output in alternative representation (e.g. tab characters), the remaining non-printing characters are output as octal numbers. Overlength lines are folded into several lines, each terminated by the line continuation character \. Each line must end with *$*. An *l* command can be appended to any command other than *e*, *f*, *r*, or *w*.

The following alternative representations are used:

\\	Backslash (for distinguishing octal characters)
\a	Warning, Bell *)
\b	Backspace *)
\f	Form Feed
\n	Newline
\r	Carriage Return
\t	Tab
\v	Vertical tab *)

*) These non-printing characters are supported on character terminals only (i.e. when the POSIX shell is accessed via *rlogin*)

range not specified:
range = .,.

[range]**m**address

(move) re-positions the lines in the specified *range* after the line addressed by *address*. The last of the shifted lines becomes the current line. If you specify a value of 0 for *address*, the *range* is moved to the beginning of the file. If *address* falls within the *range* of moved lines, *ed* issues an error message.

range not specified:
range = .,.

[range]**n**

(number) prints the *range* of addressed lines, preceding each line by its line number and a tab character. The last line to be printed becomes the new line. The *n* command can be appended to any command other than *e*, *f*, *r*, or *w*.

range not specified:
range = .,.

[range]**p**

(print) prints the *range* of addressed lines. Non-printing characters are not output unchanged. Overlength lines are continued in the next line, i.e. are not identifiable as such. The current line is the last line printed. The *p* command can be appended to any command other than *e*, *f*, *r* and *w*. For example, *dp* deletes the current line and prints the new current line.

range not specified:
range = .,.

P (Prompt) causes *ed* to use an asterisk * or the defined prompt string as a prompt in command mode (see option *-p* above). You can deactivate this mode again by calling *P* a second time. This mode is normally deactivated.

q (quit) terminates *ed*. If you have changed the buffer contents since the last time the buffer was saved or overwritten, but have not yet written these changes to a file with *w*, *ed* outputs a ? as a warning (to prevent inadvertent deletions) and waits for further input. By entering END, *Q*, or the *q* command a second time, you can now exit *ed* without further warnings and without saving the buffer.

Caution!
If you continue after the first *q* with actions that do not change the buffer contents, no new warning will be issued when you press *q* again. *ed* will be terminate without saving the buffer.

Q (Quit) terminates *ed* immediately without warning even if you have changed the buffer contents since last saving or overwriting and have not yet written these changes to a file with *w*.

[address]**r**[_file]

(read) reads the named *file* and inserts its contents after the line identified by *address*. The address 0 is legal for this command and causes the file contents to be written at the start of the buffer. If the read was successful, the number of bytes read is output unless you called *ed* with the *-s* option. The current line is the last line read in. The currently remembered file name is not changed to *file* unless you invoked *ed* without a file name and *file* is the very first file name mentioned since *ed* was invoked. If *file* is replaced by the ! character, the rest of the line is interpreted as a shell command and executed. The output of this command is then read. Such a command is not remembered as the current file name.

address not specified:
address = $

file not specified:
file = current file name

[range]**s/**RE**/**replacement_string**/**[**g**][**l**][**n**][**p**][count]

(substitute) searches each line in *range* for strings which match *RE*. *RE* is a simple regular expression (see section “Regular POSIX shell expressions” on page 897). On *each* line in which a match is found, strings that match *RE* are replaced by *replacement_string*.
If *ed* does not find a matching string, it returns a ? to indicate an error. To delimit the regular expression *RE* from the *s* command and the *replacement_string*, any other character except the blank or newline can be used instead of /. The character selected is recognized as a delimiter by virtue of coming immediately after *s*. Afterwards, the current line is the line in which the last substitution took place.

count	Substitute for the *count*th occurence only of the *RE* found on each addressed line.
g	Globally substitute for all non-overlapping instances of the *RE* rather than just the first one. If both *g* and *count* are specified, the results are unspecified.
l	Write to standard output the final line in which a substitution was made. The line will be written in the format specified for the *l* (list) command.
n	Write to standard output the final line in which a substitution was made. The line will be written in the format specified for the *n* (number) command.
p	Write to standard output the final line in which a substitution was made. The line will be written in the format specified for the *p* (print) command.

Metacharacters in the replacement string

Metacharacters	Meaning
&	is replaced by the string which matches regular expression *RE* in a successful search.
\n	is replaced by the character string matching the *n*th regular subexpression, delimited by\(...\), of *RE* where *n* is a decimal digit. If nested parenthesized subexpressions are present, *n* is determined by counting occurrences of \ from left to right.
%	is replaced by the replacement string from the most recent *s* command if *replacement_string* consists solely of the % character.

The special meaning of these characters can be suppressed by preceding each of them with a backslash \.

Splitting a line in the replacement string

To split a line you can include an escaped newline character, i.e. \↵, in *replacement_string*. This type of substitution command cannot be used in a *commandlist* with a *g* or *v* command.

range not specified:
range = .,.

[range]**t**a
copies the addressed *range* after the specified line *a*. 0 is allowed for *a*. The current line is the last of the copied lines.

range not specified:
range = .,.

u (undo) nullifies the effect of the most recent command that modified anything in the buffer. The following commands can be undone: *a*, *c*, *d*, *g*, *i*, *j*, *m*, *r*, *s*, *t*, *v*, *G*, and *V*.

[range]**v/**RE**/**commandlist
(vice versa) causes *commandlist* to be executed on all lines containing *no* string that matches the regular expression *RE*. *RE* is a simple regular expression (see section “Regular POSIX shell expressions” on page 897). *v* functions identically to the global command *g* with the selection criterion reversed.

v should not be combined with the ! command.

range not specified:
range = 1,$

[range]**V/**RE**/**
(Vice versa) is the interactive variant of the *v* command. You can use *V* to process all lines that contain *no* string matching the regular expression *RE*. *RE* is a simple regular expression (see section “Regular POSIX shell expressions” on page 897). *V* functions identically to the global command *G* with the selection criteria reversed.

range not specified:
range = 1,$

[range]**w**[␣file]
(write) writes the specified *range* into the named *file*. The currently remembered file name is not changed if previously set. If the file name has not been set, *file* is used as the new current file name. The old contents of *file* are overwritten in the process. If the named *file* does not exist, it is created. The current line remains unchanged. After a successful write operation the number of characters written is displayed, provided you did not invoke *ed* with the *-s* option.

If *file* is replaced by !, the rest of the line is interpreted as a shell command and executed. The standard input for the shell command is the *range* of addressed lines. Such a command is not remembered as the current file name.

range not specified:
range = 1,$

file not specified:
file = current file name

[range]**W**[␣file]
(Write) appends the specified *range* to the end of the named *file*. This command is the same as the *w* command above, except that *w* overwrites existing files. If *file* does not exist, it is created.

address
The line identified by *address* is output.

[address]**+**num
This command outputs the line that is *num* lines after the line identified by *address*.

address not specified:
address = .

[address]**=**
The line number of the line identified by *address* is output; the current line is not changed by this command.

address not specified:
address = $

!command
The remainder of the line after the ! is interpreted and executed as a shell command. If an unescaped % character appears within the text of *command*, it is replaced by the remembered file name. !! causes the last *command* to be repeated. In both cases, the expanded command line is echoed. On completion of the *command*, *ed* is reactivated. The current line remains unaffected. This command must not be combined with *g* and *v*!

↵
Entering ↵ alone in the command mode causes the line after the current line to be printed. This is the same as specifying .+1p. You can use this feature to step through the buffer.

The input of a command in command mode or a text line in input mode must be terminated by pressing the ↵ key.

DEL
You can use the DEL key to interrupt a currently executing *ed* command or to cancel the entry of a line. *ed* will then respond by displaying a ’?’.

[END] or [CTRL] [D] or @@d

The [END] key (or any of the key combinations) has the same effect as the *q* command.

If the closing delimiter of a regular expression or of a replacement string (e.g. a /) is the last character before a newline, you may omit that delimiter. In such a case, the addressed line is printed. The following pairs of commands are equivalent:

```
s/s1/s2      s/s1/s2/p
g/s1         g/s1/p
?s1          ?s1?
```

Working with ed scripts

Since *ed* reads commands and text that is to be inserted from standard input, you can redirect the input to a file and have *ed* read the file instead. Thus

```
$ ed - file < ed_scriptfile > output
```

edits the named *file* and processes it with the *ed* commands stored in the specified *ed_scriptfile*. The *-s* option suppresses default output of message texts to the screen.

The advantage of using *ed scripts* is that they allow you to reproduce specific command sequences at any time and use them as often as required. Furthermore, this feature enables you to perform these tasks in a background process while you continue working at the terminal without interruptions:

```
$ ed file < ed_scriptfile&
```

If your *ed* script contains errors, *ed* will exit on encountering the first error.

Exit status

0 if successful

>0 if *ed* is called incorrectly or if a script is aborted due to incorrect use of *ed* commands.

Error

If you do not enter a blank between option *p* and *string* in the *ed* call or if you forget to enter the *string*:

```
ed: -p arg missing
```

If you make a mistake when entering *ed* commands:

```
?
```

This means that the command contains syntax errors.

```
?file
```

The indicated *file* is not available or cannot be read.

More detailed information can be obtained by using the *h* and *H* commands. The commonest error messages are listed below. They are all self-explanatory:

```
line out of range
warning: expecting 'w'
no space after command
unknown command
bad range
cannot open input file
illegal or missing delimiter
illegal suffix
illegal or missing filename
no match
```

File

ed.hup
Data is saved in this file if *ed* receives the SIGHUP signal (see *kill* on page 452).

/var/tmp
If this directory exists, it is used as the directory for storing the temporary work file.

/tmp
/tmp is the directory used to store the temporary work file if the *TMPDIR* variable is not assigned the name of an existing directory and *var/tmp* does not exist.

Variable

TMPDIR
If this variable is set and is not null, it is used instead of */var/tmp* as the directory for storing the temporary work file.

HOME
Determine the pathname of the user's home directory.

Locale

The following environment variables affect the execution of *ed*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions. *LC_CTYPE* also governs which characters the *ed* command *l* treats as non-printing.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Example of an *ed script*:

The first three lines of a file are to be replaced by one line with the text "Addresses", and all occurrences of the word "Street" are to be replaced by "Plaza".

Contents of the *edscript*:

```
1,3c
Addresses
.
1,$s/Street/Plaza/g
w
```

Processing of a file with commands from *edscript*:

```
$ ed file < edscript
```

When *ed* reads commands from a file instead of the keyboard, the editor is exited as soon as *ed* encounters the first incomprehensible command.

Example 2 Example of a *here script* (see *sh*):

In a set of files that are to be passed as command-line arguments to the script *xy*, the first three lines are to be replaced by one line with the text "Addresses", and all occurrences of the word "Street" are to be replaced by "Plaza".

Contents of the script file *xy*:

```
for i in $*
do
ed $i << scrend
1,3c
Addresses
.
1,\$s/Street/Plaza/g
w
scrend
done
```

Processing of the files *text1*, *text2* and *text3* with script *xy*:

```
$ sh xy text1 text2 text3
```

The string << *scrend* after the *ed* call causes the shell to transfer the text up to the string *scrend* as input to *ed*. The second string *scrend* must exist as a single word in a line, without leading blanks. The special meaning of the $ symbol must be escaped with a \ in the address specification 1,$. This is because the shell would otherwise interpret the following *s* as the name of a shell variable.

Example 3 The following example demonstrates and explains a number of *ed* commands:

```
$ ed                   - Call ed
P                      - Output prompt * in command mode
*a                     - Append to current line, in this case beginning of file
line1                  - Input text
line2
line3
.                      - Terminate input mode
*1,$p                  - Output line 1 through to last line
line1
line2
line3
*p                     - Output current line (= last line processed)
line3
*n                     - Output current line with line number
3       line3
*1,$n                   - Output line 1 through to last line with line numbers
1       line1
2       line2
3       line3
*2c                    - Replace line 2 with following input including tabs
line2 ⇥ line2 ⇥ line2
another line2
.                      - Terminate input mode
*p                     - Output current line
another line2
*1,$n                  - Output line 1 through to last line with line numbers
1       line1
2       line2   line2   line2
3       another line2
4       line3
*4s/3/4                - In line 4, search for the character 3 and replace it
                         with 4
line4
*n                     - Output current line with line number
4       line4
*1,$s/l/L/g            - Search from line 1 through to last line for all
                         l characters and replace them with L
```

```
*1,$p              - Output line 1 through to last line
Line1
Line2   Line2   Line2
another Line2
Line4
*2l                - Output line 2 with non-printing characters as mnemonic
                     overstrikes.

Line2>Line2>Line2
*
*2r file           - Read the contents of file into the buffer after line 2
                      and output the number of characters read in. file must
                       already exist!

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*1,$n              - Output line 1 through to last line with line numbers
1       Line1
2       Line2  Line2  Line2  - This line and the two which follow are
3       line1 of file          out of file
4       line2 of file
5       last line of file
6       another Line2
7       Line4
*6,7c              - Replace lines 6 to 7 by the following input
very last line
.                  - Terminate input mode
*1,$n              - Output line 1 through to last line with line numbers
1       Line1
2       Line2   Line2   Line2
3       line1 of file
4       line2 of file
5       last line of file
6       very last line
*q                 - Attempt to quit editor with q
?                  - Warning
*h                 - Explain question mark
warning:expecting 'w'
                   - Explanation: w command expected by ed (to save contents
                     of the buffer) was not entered
*w exp             - Write the contents of the buffer to the file exp
85                 - Number of characters written is output
*q                 - Quit editor
$                  - Shell prompt
```

See also *ex*, *grep*, *sed*, *sh*, *stty*, *umask*, *vi*
Tables and directories, Regular expressions

edt screen-oriented editor EDT *(BS2000)*

edt calls the BS2000 file editor EDT, see the “EDT (BS2000/OSD) Statements“ manual [7]. EDT V17.0 and higher is called in compatibility mode. *edt* is the editor for block-mode terminals. The *edtu* command is available to call EDT in Unicode mode. If you are working with character-mode terminals, you can use *ex* or *vi* for example.
You can use this command and the EDT functions to copy files from the POSIX file system to the BS2000 and vice versa.

Syntax **edt**[␣**-k**][␣**-i**index]␣file

-k Prior to editing, the file contents are converted from ASCII to EBCDIC code. Before being written back to the file, the contents are recoded to ASCII. You can use this option if you wish to use *edt* to process an ASCII-coded file.

-iindex
This option is required if files containing more than 9999 lines have to be read.
The product <index> * 0.0001 gives the number of the first line and the step size used between line numbers. If there is no <index> specification then <index>=10000, i.e. the number of the first line and the step size value are both 1. Within EDT itself, the EDT statement *renumber* can be used to perform renumbering.

file
File name of the POSIX file. You may specify one file only. If the specified file does not yet exist, the empty work file 0 is opened.

Hint EDT can create, read in, copy, write back and close POSIX files. The *@XOPEN*, *@XCOPY*, *@XWRITE* and *@CLOSE* statements are available for this purpose (see the “EDT (BS2000/OSD) Statements“ manual [7]).

To write the opened POSIX file back to the BS2000 file system, use the EDT statement *@write*’<filename>’ when in EDT level 0.

You can terminate EDT with *@HALT* (write the opened POSIX file back to the POSIX file system in interactive mode) or *@RETURN* (unconditionally write the opened POSIX file back to the POSIX file system in interactive mode). Use *@WRITE* at EDT level 0 to write an opened UFS file back (to UFS).

Blank lines in the file are displayed as lines with a length of 1 (the character X'0D'). They are subsequently converted back to blank lines on saving the file.

The tab character ('\t') is not expanded to the corresponding number of spaces.

The *edt* command cannot be used in a pipe.

Error

`edt cannot be used within a pipe`
The *edt* command was incorrectly used in a pipe.

`edt cannot be used within a forked process`
The *edt* command was entered in a subshell. This is not allowed.

`edt: file` *file* `open for read failed`
You do not possess read permission for *file*.

`*** read only ***` in the edt message line
The file which you wish to edit is write-protected.

`edt: file` *file* `open for write failed, permission denied`
You do not have write permission. The following messages are then displayed:

```
edt: edited file(s) not saved!
edt: terminate edt? reply (y=yes; n=no)?
```

`edt: file` *file* `open for write failed, no such file or directory`
The path does not exist. The following messages are then displayed:

```
edt: edited file(s) not saved!
edt: terminate edt? reply (y=yes; n=no)?
```

`edt: file` *file* `write: UFS file system failed, no space`
Not enough space in the POSIX file system to write the file. The following messages are then displayed:

```
edt: edited file(s) not saved!
edt: terminate edt? reply (y=yes; n=no)?
```

If, for the reasons above, the file cannot be written, the user may stay in EDT and take the necessary action to save the file, for example change the write permission or use `@WRITE'`*file*`'` to save the file.

Example

The POSIX file */usr/home/file.pos* is to be saved in the BS2000 file system as the BS2000 file *file.bs2*.

```
$ edt /usr/home/file.pos

.....
@WRITE 'file.bs2'   (EDT statement)
.....
```

edtu screen oriented editor in unicode mode

edtu calls the BS2000 file editor EDT in Unicode mode, see the “EDT (BS2000/OSD) Unicode Mode Statements“ manual [8]. In contrast to the *edt* command, which calls EDT in compatibility mode, this command makes the complete functional scope of EDT V17.0 or higher available.

The major functional enhancements compared with compatibility mode are:

- Support of XHCS character sets, including Unicode
- Processing of files with record lengths of up to 32768 bytes
- Availability of all 22 work files, also in F mode
- New screen formats (@VDT F3..F4)
- Support of POSIX files in the EDT statements @COPY, @OPEN and @WRITE (instead of the EDT V16 statements @XCOPY, @XOPEN and @XWRITE)

Like *edt*, *edtu* is also only available on BS2000 block-mode terminals and not on character-mode terminals (*rlogin*, *telnet*, *ssh*).

In contrast to *edt*, however, *edtu* can also be called in subshells. This does not, however, apply for shells in which the necessary SYSFILE environment is not installed because, for instance, they were generated in an *su* session.

Syntax **edtu**[␣**-hrl**][**-i** n] [**-c** ccsn | **-k**] [**-v** vdt] [pathname] ...

-h Help. The syntax of the *edtu* command is output in English.

-r All files are opened in read mode only. When edtu is terminated, all open files are discarded without an inquiry.

-l Information lines are displayed (corresponds to @PAR GLOBAL,INFO=ON).

-i n
The lines are numbered with the step size <n> * 0.0001 (still supported for compatibility reasons only). By default the lines are numbered automatically.

-c ccsn
The file(s) specified with *pathname* is/are available in the *ccsn* character set (default: EDF041).

-k The file(s) specified with *pathname* is/are available in the ISO character set (corresponds to: `-c ISO88591`).

-v vdt
EDT is started with screen format *vdt* (F1..F4, default: F1) (corresponds to @VDT *vdt)*.

pathame

The UFS file *pathname* is opened for editing. Up to 22 files can be opened in work files 0 through 21.

Pipe outputs (e.g. `ls | edtu`) are always read into work file 0 and are always discarded when *edtu* terminates.

Hint

edtu writes a table of contents of all opened files to work file 22. The EDT dialog begins in this work file if more than one file has been opened. If only one file has been opened, the dialog begins in work file 0.

EDT can be terminated in the following ways:

– *@HALT* or *@END*
  Stores modified files after an inquiry

– *@HALT FORGET*
  Discards modified files without an inquiry

– *@RETURN*
  Stores modified files without an inquiry

When EDT is terminated, the following messages are issued if the work file *number* was modified and EDT was not terminated with *@RETURN*:

`workfile` ***number file*** `not saved (readonly file); return to EDT dialog? (y=yes, n=no):`
The file *file* opened in work file *number* could not be written back as it is write-protected.

`workfile` ***number***`: ufs file` ***file*** `not saved; ...`
The POSIX file *file* which is opened in work file *number* has not yet been written back.

`workfile` ***number***`: element` ***element*** `in lib` ***library*** `not saved; ...`
The library element *element* from library *library* which was opened in work file *number* has not yet been written back.

`workfile` ***number***`: BS2000 file '`***file***`' not saved; ...`
The BS2000 file *file* opened in work file *number* has not yet been written back.

Depending on the type of termination, one of the following texts is appended to these messages:

– In the case of *@HALT FORGET*

  `(discarded because of @HALT FORGET)`
  The changes are discarded because termination took place with *@HALT FORGET*.

– In the case of *@HALT or @END*

  `save it? (y=yes, n=no, r=return):`
  Inquiry as to whether the file is to be written back or EDT is to be returned to.

- If the modified work file *number* was written back, one of the following messages is issued:

  `workfile` ***number***`:` ***file*** `saved`
  The file *file* opened in work file *number* was written back.

  `workfile` ***number***`: ufs file` ***file*** `saved`
  The POSIX file *file* which is opened in work file *number* was written back.

  `workfile` ***number***`: element %s in lib %s saved`
  The library element *element* from library *library* which was opened in work file *number* was written back.

  `workfile` ***number***`: BS2000 file` ***file*** `saved`
  The BX2000 file *file* opened in work file *number* was written back.

Options *-k* and *-c* only have an influence on open POSIX files and not on BS2000 files which are subsequently opened in the EDT dialog. If neither of the options *-k* or *-c* is specified, automatic conversion of POSIX files to ASCII file systems with the help of the environment variable *IO_CONVERSION* is supported.

The tab character ('\t') is not converted into the corresponding number of blanks.

In contrast to *edt, edtu* can also be read from a pipe:

```
command | edtu [options] [files ...]
```

The output of the pipe is read into work file 0, and this is then labeled with the read-only attribute, i.e. the user must, if necessary, ensure that work file 0 is saved. Any files specified are read into work file 1 etc.

Error

`edtu can run on BLOCK terminals (/dev/term/*) only`
The *edtu* command was entered on a character-mode terminal (*rlogin*, *telnet*, *ssh*).

`edtu cannot be used within this forked process`
The *edtu* command was entered in a subshell in which the required SYSFILE environment is not initialized. This is not permitted.

`file` ***file*** `does not exist`
The file *file* is not available.

`new file` ***file*** `may not be created`
The file *file* cannot be generated.

`open failed; file` ***file*** `is a directory`
file is a directory.

`open failed; no read access for file` ***file***
You have no read authorization for *file*.

`EDT reports error for cmd '`*command*`'`
EDT has reported an error for the command *command*.

egrep search a file with an ERE pattern

egrep reads lines from one or more files or from standard input and compares these lines with the specified patterns. Unless told otherwise (by options), *egrep* copies every line that matches one of the patterns to standard output.
egrep permits the use of extended regular expressions in the specified pattern (see section “Regular POSIX shell expressions” on page 897).
If you specify more than one input file, the relevant file name will be displayed before each output line.

Syntax

Format 1: egrep[␣**-bchilnvy**]␣**-e**␣patternlist[␣file...]

Format 2: egrep[␣**-bchilnvy**]␣**-f**␣patternfile[␣file...]

Format 3: egrep[␣**-bchilnvy**]␣patternlist[␣file...]

The formats are described together since the patterns which *egrep* uses to compare the input lines are specified either via *patternlist* or using the option *-e patternlist* or *-f patternlist*. You must specify one of these arguments. Two of them or all three together are not permitted.

No option specified
egrep outputs all lines that match at least one of the patterns specified in *patternlist*. If you specify more than one input file, each output line will be preceded by the name of the file in which the line was found.

option

-b (block) Each output line is preceded by the number of the block in which it was found. Each file is made up of 512-byte blocks which are numbered consecutively from 0. The *-b* option is sometimes useful in locating disk block numbers by context (see the *offset* argument for the *od* command, for example).

-c (count) *egrep* outputs only the number of lines found (i.e. the lines that *egrep* would have displayed without the *-c* option, see *Example 4*); the lines themselves are not displayed.

-h (hidden) When searching multiple files, *egrep* does not write the file name before each output line.

-i or **-y**
(ignore) *egrep* does not distinguish between uppercase and lowercase

-l (list) *egrep* simply outputs the names of files that contain at least one of the matching lines. (These are the lines that *egrep* would output if the *-l* option were omitted, see *Example 5*.) Each file name is printed just once. The lines themselves are not displayed.

-n (number lines) Each output line is preceded by its line number in the relevant input file. Line numbering starts at 1. If *egrep* is reading from standard input, the line number refers to the standard input.

-v (v - vice versa) *egrep* outputs all the lines which correspond to *none* of the specified patterns.

Together with option *-c*:
egrep only outputs the number of such lines.

Together with option *-l*:
egrep only outputs the names of the files containing such lines.

-e␣patternlist
(expression) You will need this option if the first expression in *patternlist* begins with a minus sign. When used in conjunction with the *-e* option, a *patternlist* of this type is not interpreted as an option itself but as a list of patterns which *egrep* is to use in searching for matching input lines.

-f␣patternfile
(file) *egrep* reads the pattern list from the file named *patternfile*. Each line in *patternfile* is interpreted as an extended regular expression.

patternlist
A list of extended regular expressions that *egrep* is to use in searching for matching input lines (see section "Regular POSIX shell expressions" on page 897). Individual regular expressions must be separated by the newline character. Any newline character within *patternlist* is interpreted like an OR separator (|) in an extended regular expression. Regular expressions of the type (r|s) can also be specified without the parentheses: r|s (see Example 1 on page 320).
If *patternlist* contains newline characters or other characters that have a special meaning for the shell, you must enclose the specified *patternlist* in single quotes: '*patternlist*'.

If the first expression in *patternlist* begins with a minus sign, you must specify *patternlist* along with the *-e* option or terminate the option list with -- to prevent the *patternlist* from being interpreted as an option itself.

file
Name of the file that *egrep* is to scan. You may name any number of files.

file not specified:
egrep reads its input from standard input.

grep, fgrep and egrep

The *grep*, *fgrep* and *egrep* commands perform similar functions and are largely identical in terms of usage. The following section lists the most important differences between these commands.

grep processes simple regular expressions. Only one regular expression may be specified in each call.

fgrep processes strings only. However, you may specify several strings in one call. The strings can either be entered directly in the command line, separated by newline characters, or passed to *fgrep* from within a file.
fgrep is fast and compact and can search for a large number of strings. All specified strings are searched for in each individual line.

egrep processes extended regular expressions. Among other things, these include all simple regular expressions with one exception: the \(...\) construct used in simple regular expressions does not have a special meaning in extended regular expression syntax and is hence not processed by *egrep*.
Several regular expressions can be specified together, separated by newline characters. *egrep* interprets these newline characters as an OR operator (the vertical bar character; see *Tables and directories, Regular POSIX shell expressions*). The regular expressions can either be specified directly in the command line or passed to *egrep* via a file.

Exit status

0	Matching lines found
1	No matching lines found
>1	Syntax error or "File cannot be opened". This exit status remains valid even if lines have been found in other input files.

Locale The following environment variables affect the execution of *egrep*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The files *customer1* and *customer2* will be used as a basis for all following examples. Their contents are given below:

customer1:

```
080685    999.98  20 Units  Item  038   Nicolson Ltd.
120387   1240.25   3 Units  Item  023   Robinson Ltd.
180588    330.87   1 Units  Item  332   Robinson Ltd.
```

customer2:

```
morrow lance, 86 sherwood street, london w1
robinson peter, 16 garden hill, london ec3
```

Example 1

Output lines that match a pattern (without an option and with option *-i*):

```
$ egrep Robinson customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Robinson Ltd.
customer1:180588    330.87   1 Units  Item  332   Robinson Ltd.
```

If you also wish to find lines containing the word *robinson* in lowercase you enter:

```
$ egrep -i robinson customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Robinson Ltd.
customer1:180588    330.87   1 Units  Item  332   Robinson Ltd.
customer2:robinson peter, 16 garden hill, london ec3
```

More complicated patterns can be set up with the help of regular expressions, e.g.: Display lines which contain the string *Nicolson* or *Robinson*:

```
$ egrep '(Nicol|Robin)son' customer1 customer2
customer1:080685    999.98  20 Units  Item  038   Nicolson Ltd.
customer1:120387   1240.25   3 Units  Item  023   Robinson Ltd.
customer1:180588    330.87   1 Units  Item  332   Robinson Ltd.
```

Instead of the regular expression (Nicol|Robin)son you could also use the following regular expression:

```
(Nicolson|Robinson)
```

In this case you can leave out the parentheses;

```
Nicolson|Robinson
```

The OR operator (|) in the last expression Nicolson|Robinson could also be replaced by a newline character (see *Example 2*).

Example 2 Using several patterns (without an option and with option *-f*):

```
$ egrep '^1
> 1$' customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Robinson Ltd.
customer1:180588    330.87   1 Units  Item  332   Robinson Ltd.
customer2:morrow lance, 86 sherwood street, london w1
```

Alternatively, you could write both patterns into a file called *names* (each pattern in a separate line) and then call *egrep* as follows:

```
$ egrep -f names customer1 customer2
```

The same result is obtained when the newline character that separates the patterns ^1 and 1$ is replaced by the OR operator:

```
$ egrep '^1|1$' customer1 customer2
```

Example 3 Output lines that match *none* of the specified patterns (option *-v*):

```
$ egrep -v '^1
> 1$' customer1 customer2
customer1:080685    999.98  20 Units  Item  038   Nicolson Ltd.
customer2:robinson peter, 16 garden hill, london ec3
```

The above call thus yields all lines that neither begin nor end with 1. The same result can also be obtained with the following call (see *Example 2*):

```
$ egrep -v '^1|1$' customer1 customer2
```

Example 4 Display the number of lines found (option *-c*):

To begin with, the number of lines that start with 1 are to be output for each input file.

```
$ egrep -c '^1' customer1 customer2
customer1:2
customer2:0
```

The number of lines that *do not* begin with 1 are now to be displayed.

```
$ egrep -c -v '^1' customer1 customer2
customer1:1
customer2:2
```

Example 5 Display file names only (option *-l*):

Display file names only (option *-l*):

The names of files containing lines that begin with 1 are to be output first.

```
$ egrep -l '^1' customer1 customer2
customer1
```

The names of files containing lines that do not start with 1 are displayed next.

```
$ egrep -l -v '^1' customer1 customer2
customer1
customer2
```

Example 6 Display found lines with relevant line numbers (option *-n*):

```
$ egrep -n -i robinson customer1 customer2
customer1:2:120387   1240.25   3 Units  Item  023   Robinson Ltd.
customer1:3:180588    330.87   1 Units  Item  332   Robinson Ltd.
customer2:2:robinson peter, 16 garden hill, london ec3
```

See also *ed, fgrep, grep, sed*

env set environment for command execution

The *env* command can be used to display current environment variables and their values or to set them for the execution of a specific command. *env* inspects the current environment, modifies it according to the assignment in *name=value*, and then executes the command in the modified environment. The existing specifications for *name* and *value* are overwritten by the new ones, and the new arguments are merged into the inherited environment before the command is executed. The valid environment for the execution of *command* thus consists of the new specifications together with any unmodified environment variables.

If no command is specified, *env* prints the resulting environment.

Syntax

env[␣**-i**|␣**-**][␣name=value]...[␣command[␣arg...]]

–i|␣**-**

The original environment is ignored; *command* is then executed with exactly the environment specified by the arguments.

The *i* option corresponds to the old - option, which will continue to be supported.

name**=**value

name specifies the name of a variable that is to be valid for *command*.

value is the value of *name* which is to apply to *command*.

command

Name of the command or shell script which you would like to have executed in the defined environment.

arg

Argument, e.g. positional parameters or user-defined variables which can be passed to *command*.

Exit status

0	The *env* utility was completed successfully
1-125	Error
126	The utility specified by *utility* was found but could not be invoked.
127	The utility specified by *utility* could not be found.

Variable

PATH
Determine the location of the *utility*. If *PATH* is specified as a *name=value* operand to *env*, the value given will be used in the search for *utility*.

Locale

The following environment variables affect the execution of *env*:

LANG
: Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
: If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
: Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
: Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH
: Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

Output the current values of environment variables:

```
$ env
_=/usr/bin/env
TTY=/dev/term/004
IO_CONVERSION=NO
PATH=/usr/bin:/opt/bin::/etc:/usr/sbin
TERM=BLOCK
HZ=100
LOGNAME=TESTUSER
PROGRAM_ENVIRONMENT=SHELL
HOME=/TESTUSER
TZ=MEZ-1MSZ-2,M3.5.0/02:00:00,M9.5.0/03:00:00
MAIL=/var/mail/TESTUSER
SHELL=/sbin/sh
USER=TESTUSER
LANG=
```

Example 2 Output the modified values of environment variables:

```
$ env PATH=$HOME/proz
_=/usr/bin/env
TTY=/dev/term/004
IO_CONVERSION=NO
PATH=/TESTUSER/proz
TERM=BLOCK
HZ=100
LOGNAME=TESTUSER
PROGRAM_ENVIRONMENT=SHELL
HOME=/TESTUSER
TZ=MEZ-1MSZ-2,M3.5.0/02:00:00,M9.5.0/03:00:00
MAIL=/var/mail/TESTUSER
SHELL=/sbin/sh
USER=TESTUSER
LANG=
```

The *PATH* environment variable has been modified.

Example 3 Output modified values of environment variables using the - option:

```
$ env - PATH=$HOME/proz
PATH=/TESTUSER/proz
```

The original environment is ignored.

Example 4 Invocation of the file *ardor*, located in */TESTUSER/SAYINGS*, i.e. in a subdirectory of the HOME directory.

Contents of file *ardor*:

```
echo "$1 $2 $3 $4 $2 $3 $1 love $4!"
```

Now call *ardor* from any location in your file tree with the arguments *I know that you*:

```
$ env PATH=$HOME/SAYINGS ardor I know that you
I know that you know that I love you!
```

With the new definition of the *PATH* variable, you effectively define the location where the entered command is to be sought (the file *ardor* in our case), i.e. in a subdirectory of the HOME directory, which you specify with the value of the variable HOME ($HOME).
The character strings *I*, *know*, *that*, and *you* are passed as arguments to the positional parameters $1, $2, $3 and $4.

The contents of *ardor* are correctly executed here because *echo* is a built-in command of the *sh* shell. Due to the change in the *PATH* variable, all POSIX commands in */usr/bin*, */usr/sbin* or */opt/bin* can no longer be found. To enable the execution of POSIX commands again, the *PATH* variable must be modified as shown in the example below.

Example 5 Call the file *delcopy*, which is located in the directory */TESTUSER/proc*. This file contains a script that compares two files and deletes one of them if both files are identical.

Contents of the file *delcopy*:

```
if cmp -s $1 $2
then
rm $2
fi
```

Call the *delcopy* file from any location in your file tree with the arguments *file1* and *file2*:

```
$ env PATH=$PATH:$HOME/proc delcopy file1 file2
```

In this case, the new path is appended to the original one. This ensures that the *delcopy* script can be executed along with all SINIX commands contained in it. If only the path for *delcopy* were specified, the following error message would be issued.

```
/TESTUSER/proc/delcopy: cmp: not found
```

See also *sh*, *set*, *exec*
profile, *environ* [13]

eval construct command by concatenating arguments

The POSIX shell built-in *eval* can be used to pass command-line arguments to the *sh* shell for execution. The shell evaluates these arguments and then executes them as commands.

The specified command-line arguments are thus evaluated twice by the shell:

– First, when the shell processes the *eval* command line.

– Second, when the processed command-line arguments are executed by the shell as commands. Each command-line is processed by the shell before execution.

When do you need eval?

The shell processes each command line in a number of steps (see section “Execution” on page 64), interpreting specific metacharacters in each processing step. The original command line may be modified by the individual processing steps.

If, for example, the shell replaces a variable with its value or a command with its output, metacharacters may occur in the command line which may not be interpreted by the shell in subsequent processing steps. The shell built-in *eval* makes sure that metacharacters left by the previous step are interpreted in the following step (see also *Examples* on page 328).

Syntax **eval**␣[argument␣...]

argument
Any string delimited by blanks or tabs. The last argument must be terminated by a command separator.

You may specify any number of arguments with at least one blank or tab between them. The specified arguments are executed by the shell as a command.

Locale The following environment variables affect the execution of *eval*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following command line cannot be executed as intended unless *eval* is used:

```
$ cmd='date;echo name'
$ $cmd
sh:date;echo: not found
$ eval $cmd
Mon Mar 09 15:46:02 MEZ 2009
name
```

To begin with, the shell replaces the *cmd* variable with its value. After the value has been substituted for the variable, the shell no longer recognizes the colon as a command separator. Calling *eval* causes the shell to interpret the semicolon as intended, since the $cmd argument is processed twice, i.e. rescanned by the shell.

Example 2 The shell script *evaltest* will be used to demonstrate how the *eval* command is processed by the shell. The script file has the following contents:

```
set -x
loginname=max
for i in 1 2 3 4
do
  eval group$i=$loginname$i
  eval echo \$group$i
done
```

set -x causes the shell running the shell script to write the commands processed to standard error output before executing them.
On executing this shell script, you will receive the following output on the screen (without the line numbers):

```
$ sh evaltest
1  + loginname=max
2  + eval group1=max1
3  + group1=max1
4  + eval echo $group1
5  + echo max1
6  max1
:
```

This example shows only what is output the first time the loop is run.

Line 2 shows how the first *eval* command line is processed:
here the shell has substituted the value 1 for $i and the value max for $loginname. *eval* must be invoked as the shell does not recognize the equals sign as an assignment operator the first time the loop is run. The shell executes an assignment only if the variable name (i.e. the string in front of the equals sign =) begins with a letter or the underscore character _ and contains letters, numbers and underscores only. *group$i* is an illegal variable name as it contains the dollar character.

Line 3 shows that the assignment is made.
When the command-line arguments are interpreted by the shell a second time, the equals sign is interpreted as intended, since the argument preceding the = sign represents a legal name for a shell variable.

Line 4 demonstrates how the second *eval* command line is processed:
the shell has substituted the value 1 for the positional parameter $i and removed the escape character \ preceding the $. *eval* is required in this case to ensure that the shell replaces the *group1* variable by its value.
Line 5 shows how the *echo* command is processed. Here, the shell has substituted the value max1 for *$group1*. Line 6 contains the output of the *echo* command.

See also *set*

ex command and display editor

ex is a line-based text editor.

i Only users who have accessed the POSIX shell via *rlogin* can use *ex* (except in line mode).

ex offers you various operating modes:

- In the *ex* input mode you enter text directly.
- In the *ex* command mode you enter commands. Among other things, commands enable you to:
  - position the cursor
  - search for (and replace) text patterns with the aid of regular expressions
  - switch to another file
  - invoke a shell

You also have the option of switching from the line editor *ex* to the screen editor *vi*.

Layout of this description

The description of how to call *ex* on POSIX shell level is followed by the sections:

Functionality of *ex*
- Operating modes of *ex*
- Saving the editor buffer and quitting *ex*
- Presetting *ex*
- Current and alternate files
- Regular expressions
- Replacement strings
- Buffers
- Error and signal handling

ex commands
- Addressing
- Parameters
- Commands

ex options

Syntax **ex**[␣option]␣file...

option

-s (silent) All interactive output of the editor is suppressed. The *-s* option must be set when *ex* is to read its commands from a command script.

The *-s* option has replaced the old - option.

-t␣tag
(tag) *ex* loads the file containing the *tag* for editing and positions the tag definition under the cursor at the center of the screen. The tags file containing the search strings for the definitions must be in the same directory. This option is typically used by C programmers to quickly locate the definition of a function or macro on calling the editor. The tags file needed for this purpose must first be built with the *ctags* command.

-r␣file
(recover) Restores the *ex* session in which you were editing *file* if *ex* or the system crashed during your session.
Changes that are only in the editor buffer are not copied to the edited file after a system or *ex* editor crash. POSIX does, however, try to save the buffer contents by creating a copy of it, if possible. *file* is recovered, including any changes made prior to the crash, and is retrieved into the *vi* buffer. You can now continue editing the file or save the changes in another file.

-L Lists the names of all files saved following an editor or system crash.

-w␣n
Sets the value of the ex *window* option (see page 356) to *n*.

-R (readonly) The named *file* is opened in readonly mode. This mode prevents the original *file* from being accidentally overwritten, but allows you to write the buffer contents to a file with another name.

Caution!
The file can still be overwritten with *w!* in the *ex* command mode.

-v (vi) Invokes the *vi* editor. A detailed description of *vi* is provided in this manual (see *vi* on page 822).

-c␣command
Positions the editor at a specific line of the file to be edited or executes an *ex* command when *ex* is invoked. If you position the editor at a line, the selected line will be displayed in the center of the screen. By contrast, if you have an *ex* command executed, the editor will be positioned at the last line of the file after executing the command, unless the *ex* command you specify (e.g. search) positions the editor itself.

command not specified:
The *ex* editor is positioned at the end of the file.

command specified:
command may be specified as a line number (*n*), a search command (/*pattern*), or any other *ex* command (see “Commands” on page 341). The specified command is executed on invocation of *ex*:

n *n* must be an integer. *ex* is positioned to the *n*th line of the file.

/pattern *ex* is positioned to the first line containing *pattern*. If the *pattern* you specify includes metacharacters, you must escape them to protect them from being interpreted by the shell.

’ex-command’ or "ex-command"
ex-command can be any *ex* command. The *ex* command must be quoted (using single or double quotes) in order to prevent it from being interpreted by the shell. If the editor is not already positioned as a result of an *ex* command, *ex* will be positioned to the last line of the file.

Example

When *ex* is called with:

```
ex -c /tuesday appointments
```

the file *appointments* is opened, and the cursor is positioned at the first line that contains the word *tuesday*.

file
Name of the file that you wish to edit. If you specify a number of files, these files will be processed in the order in which they are listed. The *ex* command *n* can be used to switch to the next file.

file not specified:
ex opens an empty buffer into which you can write your text. The contents of this buffer are not assigned a name until you write them back (with *w*) to a file or assign a name explicitly using the *f* command.

Caution!
If your file contains null characters, *ex* will discard them when reading in the file. No null characters appear in files written by *ex*.

Functionality of ex

ex always works on a buffer, not on files. When you start an *ex* session, a working copy of the file you are editing is read into the editor buffer. All the editing changes you make are initially performed in this buffer and are not saved until you use the *w* (write) command to copy the buffer contents back into the original file.
Once you have done this, you can quit *ex* using the *q* command.
If you wish to exit the *ex* editor without writing back the changes to the original file, you must enter *q!*.

Null ASCII characters (see section “ASCII character set (ISO 646)” on page 909) are discarded in input files and thus cannot appear in output files.

Operating modes of ex

ex offers you two file editing modes:

– the *ex* command mode, and

– the *ex* input mode.

You can also switch from *ex* to the *vi* editor, which provides you with additional operating modes (for more details see *vi*, “vi modes” on page 827).

When *ex* is invoked, it comes up in command mode, as indicated by the prompt : displayed on the screen. The commands *a* (append), *i* (insert), and *c* (change) can be used to switch to the input mode, which enables you to add or modify text in the buffer (see “Commands” on page 341).

In input mode, all subsequent input characters, including various non-printing characters, are written into the buffer. Commands are not interpreted as such. You can exit from input mode by entering a period (.) in the first column and then pressing ↵.

Saving the editor buffer and quitting ex

ex must be in command mode to save the editor buffer or to quit the *ex* editor.

Use the following command to save the contents of your editor buffer to the file edited or that specified:

w[␣file]
    (write) The contents of the editor buffer are saved to the file specified.

file not specified:
The contents of the editor buffer are written back to the edited file.

You can quit *ex* using one of the following options:

q (quit) Quit *ex*. This works only if the editor buffer has not been modified at all or if the modified editor buffer has been saved to a file.

q! (quit) Quit *ex*. Unsaved modifications made to the editor buffer are not saved.

x Quit *ex* and write the modified editor buffer to the edited file.

wq[␣file]
(write and quit) Quit *ex* and write the modified editor buffer to the *file* specified.

file not specified:
The contents of the editor buffer are written to the edited file.

Caution!
ex does not issue a warning if you place text in named buffers and do not save it before exiting the editor. The text is irretrievably discarded.

Presetting ex

The *ex* editor can, to some extent, be adapted to suit your requirements and working habits. This entails using the *ex* command *se* (set), which allows you to set or change specific options (see "ex options" on page 352). The changes you make remain in effect for the current session. Details on how to change default settings permanently can be found in the *vi* command description (see page 822).

Current and alternate file

The file (or its copy) being edited by *ex* at any given moment is referred to as the current file. The alternate file is the file most recently mentioned in an editing command. If you switch to the alternate file, the file you switch from becomes the new alternate file. When specifying files, you can use the % character for the current file and the # character for the alternate file. These characters are replaced in file names by the names of the current file and the alternate file, respectively.

Example

```
w %.bak
```

backs up the current file to a file with the same name but with the extension *.bak*.

Regular expressions

The interpretation of metacharacters in regular expressions depends on whether or not the *magic* option has been set for the *ex* editor (see “ex options” on page 352).

When *magic* is set:

character
: An ordinary character stands for itself. The following are metacharacters, **not** ordinary characters:

^	(caret) at the beginning of a pattern
$	(dollar sign) at the end of a pattern
*	(asterisk) anywhere except at the beginning of a pattern
.	(period) at any position in a pattern
[	(left square bracket) at any position in a pattern
~	(tilde) at any position in a pattern

Metacharacters have special meanings and must be escaped with a backslash \ if they are to lose their special meanings.

^ ^ at the beginning of a pattern stands for the beginning of the line.

$ $ at the end of a pattern stands for the end of the line.

. stands for any one character.

\<
\>
: \< matches the beginning of a word. The word must begin with a letter, digit, or underscore and be preceded by the beginning of the line or a character other than the above. \> matches the end of a word.

[string]
: Any character contained in *string*, where *string* is not a sequence of blank characters. The following characters have special meanings within *string*:
  – a dash - between a pair of characters defines a range, e.g. *[a-z]* matches *a*, *z*, and all the characters which come between them in the ASCII collating sequence.
  – if a caret ^ is the first character in *string*, it causes the construct to match any characters not included in *string*.

  If these characters are escaped by a backslash, they lose their special meanings.

* Zero, one or more occurrences of the regular expression preceding the * character.

~ Matches the replacement string used in the last *s* command (substitute, see “Commands” on page 341).

\\(pattern\\)
: A regular expression *pattern* can be enclosed in parentheses escaped by backslashes. This serves only to identify them for substitution actions (see *Replacement strings* below).

rs
: A sequence of two regular expressions *r* and *s* is a regular expression in itself. *rs* matches all strings which consist of a string matching *r* followed by a string matching *s*.

When *nomagic* is set:

If *nomagic* has been set, the only characters that have special meanings are:
- caret ^ at the beginning of a pattern
- dollar $ at the end of a pattern, and
- backslash \\.

The following characters only have a special meaning if they have been escaped by a preceding backslash \\:
- period .
- asterisk *
- left square bracket [
- tilde ~

Replacement strings

The ampersand character & (with a preceding backslash, i.e. \\&, if *nomagic* is set) in the replacement string stands for the text matched by the pattern, i.e. the text to be replaced.

The tilde ~ (\\~ if *nomagic* is set) is replaced by the replacement string used in the previous *s* (substitute) command.

The sequence \n, where *n* is an integer, is replaced by the text that is matched by the pattern enclosed in the *n*th set of parentheses \\(...\\).

If the replacement string includes the sequence \u or \l, the character that immediately follows \u (upper) or \l (lower) in the replacement string will be converted to uppercase (for *u*) or lowercase (for *l*) if this character is a letter. The sequence \U or \L converts into uppercase or lowercase all letters until the end of the replacement string or until the sequence \E or \e is encountered.

Buffers

ex uses one unnamed and 26 named buffers, named **a** through **z**.

You can use these buffers to copy text with *ya* (yank), to save deleted text with *d* (delete), and to subsequently retrieve this text with *pu* (put).

The *d*, *pu*, and *ya* commands use the unnamed buffer unless you explicitly name a buffer. In other words, if you do not specify a buffer for a delete operation, for example, the material you delete will be saved in the unnamed buffer.

You can save blocks of text in up to 26 buffers. The buffers are designated in either lowercase or uppercase letters from a-z (or A-Z). If you use lowercase letters, the old contents of the buffer will be overwritten by the new text, i.e. the old contents are deleted. If you use uppercase letters, the old buffer contents are not overwritten; the new text is appended to the old one instead.

Error and signal handling

When an error occurs during an *ex* session, *ex* sends the BEL character (acoustic signal; see section “ASCII character set (ISO 646)” on page 909) to the terminal and prints an error message.

If an interrupt signal is received, *ex* returns to command mode, allowing you to enter a new *ex* command.
If the editor input is from a file, *ex* exits at the interrupt signal.

Entering commands

Unlike most *vi* commands, which are interpreted and executed by *vi* immediately, *ex* commands must be "dispatched" by pressing the ↵ key.

Command lines which start with double quotes " are ignored. This means that you can use lines of this kind to insert comment lines in a command script.

Addressing

An address is used to specify a particular line. Some *ex* commands expect one or more addresses as input. The specified line or line range (an inclusive range of all lines from the first address to the second) is then processed by the *ex* command.

For *ex*, there is at all times a current line. This is explicitly addressed by a period (.). As a rule, the current line is the line last processed by a command or the line to which the editor has been explicitly positioned (e.g. by a search command).

Addresses must be separated from one another by a comma or a semicolon. Such address lists are evaluated by *ex* from left to right.

– When a semicolon (;) is used as a separator, the current line is set to the value of the first address before the second address is interpreted.

– When a comma (,) is the separator, all addresses are calculated relative to the current line. The current line is not changed until the command is executed.

If more addresses are given than the command requires, then all but the last address (when a line is expected) or the last two addresses (if a range is expected) are ignored. When a command requires two addresses, the first line that is addressed must precede the second one in the buffer. If you do not specify any address (null address), *ex* will use the current line by default.

address

.	Current line of the buffer.
$	Last line of the buffer.
n	*n*th line in the buffer. The lines are numbered sequentially from 1.
’x	The line marked with the letter *x*, where *x* must be a lowercase letter (see “Commands” on page 341, *ma* or *k*). ’*x* is the address of the marked line. Before *ex* executes a movement command, the current line is marked. You can return to it with ’ ’ (2 single quotes).

/RE/

A simple regular expression enclosed in /.../ (see section “Regular POSIX shell expressions” on page 897) addresses the first line which contains a character string which matches the regular expression, searching forward from the current line. If necessary, *ex* wraps around from the end of the buffer to its start to continue the search (see “ex options” on page 352, *wrapscan*). If the line matching *RE* is only to be printed, the second / may be omitted.

RE not specified:
The previous specified pattern is used.

?RE?

As *RE*, but searching backward.

+n
-n

If an address starts with a plus or minus sign followed by a decimal number *n* (optional), the line that lies *n* lines after (+) or before (-) the current line will be addressed. Thus, .+3, +3 and +++ have the same effect.

adr+
adr-

If an address ends with a plus or minus sign, the line that is located one line after (+) or before (-) the line identified by the address is referenced. A single - refers to the line before the current line. The + or - signs at the end of an address have a cumulative effect; the address ++ thus addresses the second line after the current line, 3++ addresses line 5, and ++ and .+2 are identical.

% The % (percent) sign stands for the address pair 1,$, i.e. the entire buffer.

Parameters

The following parameters are used with *ex* commands:

line = *address*
: A single line address, which you can specify in any of the forms described earlier in the *Addressing* section.

  line not specified:
  The default value (the period .) applies. The period stands for the current line.

range = *address,address*
: range = *address;address*

  A pair of line addresses that defines an inclusive range of lines. The addresses can be separated by a comma or a semicolon. A *range* should not be specified together with a number *n*, since the *last* address of the specified range will then be interpreted as the *first* address of a range of *n* lines that begins with the last address. In other words, you would end up addressing a range that comes after the one intended. This has been taken into account in the *ex* command syntax.

  range not specified:
  The default value .,. applies.

  .,. represents only the current line.

n
: A positive integer. In *n* you specify the number of lines to be processed.

  n not specified:
  The default value is 1.

flag
: One or a combination of the *ex* commands # (see *nu*), *p*, and *l*. These commands display a line in a specific format and are executed after the preceding *ex* command completes.

␣
: The blanks need not always be specified. However, in the interest of clarity, they have not been indicated as optional here.

Any number of plus or minus characters may be combined with these parameters.

Commands

Overview of ex commands and their abbreviations

CTRL **D**	(scroll)	display *n* lines, where *n*=$scroll (see options)
ab	abbrev	define abbreviations
a	append	add text after specified line
ar	args	display argument list of command line
c	change	replace text line
co	copy	copy text range
d	delete	delete text range
e	edit	change edited file
f	file	display current file name
g	global	execute command for all lines matching */RE/*
i	insert	insert text lines
j	join	join two lines
l	list	output text with non-printing characters
map	---	define macros
k	mark	mark lines
m	move	move line range
ma	mark	mark lines
n	next	edit next file
nu	number	number and output lines
#	number	number and output lines
pre	preserve	preserve contents of buffer
p	print	print range of text
pu	put	put lines back in buffer
q	quit	quit the editor
r	read	read copy of a file into the buffer
rec	recover	reconstruct file after system crash
rew	rewind	rewind argument list (cf. *ar*)
se	set	display and set options
sh	shell	call shell
so	source	read command from file
s	substitute	search and replace
unab	unabbrev	cancel word from abbreviation list made with *do*
u	undo	undo effect of previous command
unm	unmap	remove macro definition made with *map*
v	---	like *g*, but for all lines that do not match */RE/*
ve	version	output version number of the editor
vi	visual	switch to *vi*
w	write	write buffer contents to file
x	exit	quit editor after saving buffer content
ya	yank	copy lines to buffer
z	(window)	output specific text range

!	(escape)	execute shell command
& s	(resubst)	repeat the last *substitute* command
<	(lshift)	shift text range to left
>	(rshift)	shift text range to right
=	(line no)	display the line number

No command specified
If you specify only a *line* or a *range*, the command *p* (print) is automatically assumed and executed. If a null line is entered, the next line is printed (equivalent to .+1p)

CTRL **D**
(ASCII EOT) prints the next *n* lines, where *n* is the value of the *ex* option *scroll*.

ab[**brev**]␣word␣text
(abbreviate) This command is only effective in *vi* mode!

If you enter *word* in the *vi* input mode as a complete word (i.e. not as a word fragment), it is replaced by the string *text*. If *text* is to include special characters, e.g. ↵, these characters must be preceded by CTRL V.

[line]␣**a**[**ppend**][**!**]
(append) Causes *ex* to enter *input* mode, placing the input text after the specified line. Use a *line* value of 0 to put a line at the beginning of the buffer. The last line of new input becomes the new current line. If there is no new input, the target *line* becomes the current line.
Input is terminated by a period (.) entered in column 1.

ar[**gs**]
(arguments) Prints the argument list from the command line of the *ex* call, enclosed in square brackets [...].

line␣**c**[**hange**][**!**]␣n
range␣**c**
(change) *ex* switches to *input* mode. *n* lines or the lines in *range* are replaced by the lines you enter next.
The last input line becomes the current line. If no text lines are entered, the specified range is deleted, i.e. *c* has the same effect as the *d* (delete) command. Input is terminated by a period (.) entered in column 1.

chd[**ir**][**!**]␣[directory]
cd[**!**]␣[directory]
(chd/cd - change directory) *ex* changes the current working directory to *directory*.

directory not specified:
The directory name in the *HOME* environment variable will become the new working directory.

[range]␣**co**[**py**]␣line[␣flags]
[range]␣**t**␣line[␣flag]

(copy) Copies the lines specified by *range* to after *line*. If *line* is assigned a value of 0, the *range* of lines (i.e. text) will be copied to the beginning of the buffer.

[line]␣**d**[**elete**][␣buffer][␣n]
[range]␣**d**[**elete**][␣buffer]

(delete) The lines in *range*, or *n* lines from the given *line*, are deleted from the buffer. If a named *buffer* is specified, the deleted text is saved in it. You can use the *ex* command *pu* to retrieve the contents of this buffer if you wish. The first line following the deleted material becomes the current line, unless the deleted lines were at the end of the buffer. In that case, the last line in the buffer becomes the current line.

e[**dit**][**!**][␣+line][␣file]
ex[**!**][␣+line][␣file]

(edit) The named *file* is edited. If the current buffer has been modified since the last *w* (write) command, *ex* warns you and aborts the command. You can, however, force the execution of the *e* command by appending an exclamation mark to the *e*: *e! file*. The current line is the last line of the buffer; however, if this command is called from *vi*, the current line becomes the first line of the buffer.

+line

The specified *line* becomes the current line. *line* can be given as:

- a line number *n*
- the dollar symbol $ (for end of file)
- a regular expression in the form /*RE* or ?*RE*.

f[**ile**][␣name]

(file) Prints the current file name and other information, e.g. the number of lines and the position of the current line.

name specified:
name becomes the current file name

range␣**g**[**lobal**]/RE/cmds

(global) First marks all lines within the given *range* that match the pattern specified in *RE*; then applies the given *cmds* to the each of marked lines in turn, with each marked line becoming the current line while it is being edited.

The commands given in *cmds* may be specified on separate lines, provided newline characters are escaped with a backslash. If *cmds* are omitted, all lines will be printed. The *a(ppend)*, *c(hange)*, and *i(nsert)* commands are allowed; the terminating period at the end of *cmds* may be omitted. The *visual* command is also permitted, and takes input from the display terminal.

The following commands are not permitted in *cmds*: *global* and *undo*.

The following edit options are not allowed in *cmds*: *autoprint*, *autoindent* and *report*.

Example

```
1,$g/^\*/s//+/
```

All occurrences of * in the first column ^ of line 1 and of all lines through to the end of the file ($) are replaced by a plus character (+) by the substitute command (*s*).

[line]␣**i**[**nsert**][**!**]

(insert) *ex* enters input mode; the input text is placed before the specified line. The last line inserted becomes the current line, but if no text is inserted, the line before the target *line* becomes the current line. Input is terminated by a period (.) entered in column 1.

[line]␣**j**[**oin**][**!**][␣n][␣flag]
[range]␣**j**[**oin**][**!**][␣flag]

(join) Joins the lines in *range*, or *n* lines from *line*, into one line. The command inserts at least one blank between two previously split lines; two blanks are provided if a line ends with a period. If a following line begins with a right parenthesis, no blanks are inserted. Extra white space at the start of a line is discarded.

Appending an exclamation mark to the *j* command (*j!*) produces a simpler join with no white space processing.

[line]␣**l**[**ist**][␣n][␣flag]
[range]␣**l**[**ist**][␣flag]

(list) Displays the specified lines. Tab characters are replaced by `^I`, and the end of each line is marked with a trailing $. The only useful *flag* is #, when the lines are to be preceded by their line numbers. The last line printed becomes the current line.

map[␣x␣commands]   Format 1
map![␣x␣text]   Format 2

Only works with *vi*!

Format 1: Macro definitions for *vi* command mode

This format of the *map* command is used to define macros for use in the *vi* command mode. The first argument *x* is a single character, or the sequence #*n*, where *n* is a digit that refers to function key *n*. When this character or function key is typed in *vi* command mode, *vi* responds as if the corresponding *commands* were entered. The specified *commands* are interpreted as a sequence of *vi* commands. If special characters, white space, or newline characters are to be used in the *commands*, they must be escaped with CTRL V.

Example 1

You want to define a macro which replaces an * occurring at the beginning of a line (column 1) by a blank ␣ throughout the entire file. The name of this macro is to be *. Enter the following in your *.exrc* file (see section *Presetting ex*) so that you can call the macro when required:

```
:map * :1,$s/^\*/  /
```

Example 2

You now want to define a macro and bind it to function key F1. This macro is to search for the next line that begins with a particular regular expression *RE* and then automatically delete this line.
To do this, you enter (from *vi* command mode):

```
:map CTRL V F1 /^rA  CTRL V ↵dd ↵
```

Format 2: Macro definitions for *vi* input mode

This format of the *map* command defines macros for use in *vi* input mode (see Format 1 above). *Every x* entered in *vi* input mode is replaced by *text*.
(In the *ab* command, by contrast, *x* is replaced only when alone).

If *x* is not to be replaced by *text*, it must be escaped by preceding it with CTRL V.

Formats 1 and 2:

Macro definitions can be cancelled with:

`unmap x` or `unmap! x`

[line]␣**ma**[**rk**]␣x
[line]␣**k**␣x
(mark) Marks the specified *line* with the character *x*, which must be a single lowercase letter. The *x* must be preceded by a blank or tab. The current line position is not affected.

[range]␣**m**[**ove**]␣line

(move) Moves the specified lines (*range*) to after the target line. The first of the moved lines becomes the current line.

n[**ext**][**!**][␣file]...

file not specified:
(next) The next file from the command line argument list is edited (cf. *f* and *ar*). If the current buffer has been modified since the last *w* (write) command, *ex* warns you and aborts the command. You can, however, force the execution of the *n* command by entering an exclamation mark after the *n*: *n!*.

file specified:
The previous argument list is replaced by the specified file(s), and the first specified file is edited.

[line]␣**nu**[**mber**][␣n][␣flag]
[range]␣**nu**[**mber**][␣flag]
[line]␣**#**[␣n][␣flag]
[range]␣**#**[␣flag]

(number) Prints the lines, each preceded by its line number. The only useful flag in this case is *l*. The last line printed becomes the current line.

pre[**serve**]

(preserve) The current editor buffer is saved as though the system had just crashed. The *pre* command is for use in emergencies, e.g. when a *w* (write) does not work because the disk is full, and the buffer contents cannot be saved in any other way.

[line]␣**p**[**rint**][␣n]
[range]␣**p**[**rint**]

(print) Prints the specified lines, with non-printing characters printed as control characters in the form `^x`; DEL is represented as `^?`. The last line printed becomes the current line.

[line]␣**pu**[**t**][␣buffer]

(put) Lines deleted with *d* (delete) or copied to a buffer with *y* (yank) are put back in after the specified *line*. *buffer* represents a buffer name from **a** to **z**.

buffer not specified:
The text in the unnamed buffer is retrieved.

q[**uit**][**!**]

(quit) Quits the editor. If the buffer has been modified since the last *w* (write) command, a warning is printed and the *q* command fails. You can, however, force the execution of the *q* command by appending an exclamation mark to the *q*: *q!*. All changes not saved with *w* will then be discarded.

[line]␣**r**[**ead**][!][␣file]

(read) Places a copy of the specified *file* in the buffer after the target *line*. Use a value of 0 to place text at the beginning of the buffer. If there is no current file at this point (e.g. when *ex* is called without a file name), then *file* becomes the current file. The last line read becomes the current line; in *vi* mode, the first line read becomes the current line.

file not specified:
The current file is read.

If *file* is given as !*cmd*, then *cmd* is interpreted as a POSIX command and passed to the shell. The output of the command is then read in to the buffer.

rec[**over**]␣file

Recovers *file* from the save area after an editor or system crash.

rew[**ind**][**!**]

(rewind) The argument list (see *ar*) is rewound, and the first file in the list is edited. If the buffer has been modified since the last *w* (write) command, a warning is printed and the *rew* command is not executed. You can, however, force the execution of the *rew* command by appending an exclamation mark to the *rew* command: *rew!*. All changes not saved with *w* are then discarded.

se[**t**][␣parameter]

(set) The *set* command can be used to display or set options. There are two types of options: those that have "Boolean" (i.e. on or off) values and those that do not. One example of a Boolean parameter is the *number* option. If this option is set, line numbers are displayed; when *nonumber* is set, no line numbers are displayed. By contrast, the *report* option is non-Boolean. The value of this option (default = 5) defines the number of lines that must be changed by a command before *ex* and *vi* issue a message.

parameter

all	The values of all options are displayed.
option**?**	The current value of the specified option is displayed.
option	Only for options with Boolean values: The option is set.
nooption	Only for options with Boolean values: The option is not set.
option**=**value	Only for options with non-Boolean values: The option is assigned the specified *value*.

parameter not specified:
set displays user-defined *ex* options, i.e. options that deviate from default settings.

More detailed information on *ex options* is provided in the corresponding section.

sh[**ell**]

If the *SHELL* variable is set, the shell defined in that variable is invoked; otherwise, the Bourne shell *sh*. When you exit the shell, you will be returned to the editing session at the point you left off.

so[**urce**]␣file

Reads and executes commands from the specified *file*. Such *so* commands may be nested.

[line]␣**s**[**ubstitute**][/RE/repl/[options][␣n][␣flags]]
[range]␣**s**[**ubstitute**][/RE/repl/[options][␣flags]]

(substitute) The first occurrence of a pattern that matches *RE* (regular expression) in each line of the given range is replaced by the string *repl* (see "Regular expressions" on page 335 and "Replacement strings" on page 336). The range is either given in *range* or specified as *n* lines from the specified *line*.

/RE/repl not specified:
The */RE/repl* from the previous *substitute* command will be used.

options

g	(global) *All* strings that match *RE* in the line are substituted.
c	(confirm) Before each substitution, the line is output with the pattern to be replaced shown in the line below it, marked by a ^ character. Entering *y* causes the substitution to be made; any other input causes the command to abort. The last line that contains a substitution becomes the current line.

una[**bbrev**]␣word

(unabbreviate) *word* is deleted from the list of abbreviations set up by *ab*.

u[**ndo**]

(undo) Reverses the changes made by the previous editing command. *g* (global) and *vi* (visual) are considered single commands in this case. Commands which affect the external environment, such as *w* (write), *e* (edit), and *n* (next), cannot be undone.

An *undo* can itself be reversed with a follow-up *u*.

All markers for lines changed and subsequently restored are lost with *u*.

unm[**ap**][**!**]␣x

(unmap) Removes the macro definition created by *map* for *x*.

[range]␣**v**[**ice**]/RE/cmds

(vice versa) This is the same as the *global* command, except that *cmds* are applied to all lines that do not match the pattern *RE*.

ve[**rsion**]

Prints the current version of the editor.

[line]␣**vi**[**sual**][␣type][␣n]

Enters *vi* mode at the specified *line*. The *type* is optional and may be given as a minus sign (-) or a period (.), as in the *z* command, to specify the position of the specified *line* on the screen window. The default is to place the line at the top of the screen window. *n* specifies an initial window size; the default is the value of the *ex* option *window*. The command *Q* exits *vi* mode and returns you to *ex*. For further information, see *vi* on page 822.

[range␣]**w**[**rite**][**!**][␣file] (Format 1)
[range␣]**wq**[**!**][␣file] (Format 2)

Format 1: Write to a file

(write) The specified *range* is written to the named *file*, and the number of lines and characters written is printed.

If an *alternate* file is specified, and the file exists, the command will fail in order to prevent the alternate file from being accidentally overwritten. The execution of *w* can, however, be forced by appending an exclamation mark to the command: *w!*.

To append to the *file*, use the form *w>>*. If the *file* does not exist, an error message is issued.

If !*cmd* is specified instead of *file*, then *cmd* is interpreted as a POSIX command. The command interpreter is invoked, and the specified *range* is passed as standard input to the command.

range not specified:
The entire current file is written to *file*.

file not specified:
The current file is used by default. The *w* command cannot be executed if there is no current file and no *file* is specified.

Format 2: Write to a file and quit *ex*

(write and quit) The command *wq* is equivalent to a *w* followed by a *q*; *wq!* is equivalent to *w!* followed by *q*.

x[**it**][**!**]

(exit) Writes out the buffer if changes have been made since the last *w* and then (in any case) quits.

line␣**ya**[**nk**][␣buffer][␣n]
range␣**ya**[**nk**][␣buffer]

Copies (yanks) the specified *range*, or *n* lines from the specified *line*, to the named *buffer*.

buffer not specified:
If no buffer is specified, the unnamed buffer is used.

[line]␣**z**[␣type[]␣n]

(window) Displays *n* lines from the area in which *line* is located.

n not specified:
n defaults to the value of the *window* variable.

type

type is an optional parameter and can be specified as follows:

-	A - causes the *line* to be placed at the bottom of the screen.
+	A + causes the *line* to be placed at the top of the screen.
.	A . causes the *line* to be placed at the bottom of the screen.
^	A ^ writes out *n* lines starting *n*2* lines before the addressed *line.* The net effect of this will be that a *z*^ command following another *z* command writes the previous page.
=	A =centres the addressed *line* on the screen with a line of hyphens written immediately before and after it. The number of preceding and following lines of text written will be reduced to account for these lines of hyphens.

The last line printed becomes the current line.

type not specified:
line is placed at the top of the displayed area.

Caution:
ex prints the number of logical rather than physical lines. More than a screen full of output may result if there are lines which are longer than the screen width.

!␣command

(escape) The remainder of the line after the exclamation mark is passed to the system command interpreter for execution. A warning is issued if the buffer has been changed since the last *w* (write) command. The specified command is then executed. If the *command output* has not been redirected, it is displayed on the screen, but does not change the file. The *command itself* may, however, modify the file, e.g.
!cat /etc/profile>> %.
A single ! is printed when the command completes. The current line position is not affected.

Within the text of *command*, the percent sign % and the hash character # are expanded as file names (see “Current and alternate file” on page 334*)*.

An exclamation mark in *command* is replaced with the text of the previous ! command. Thus, !! means "repeat the preceding command". If any such expansion is done, the expanded line will be echoed.

[range]␣**!**␣command

(escape) In this form of the ! command, the lines specified in *range* are passed to the *command* as standard input and replaced by the output of the *command*.

range not specified:
range is not replaced by the current line (.,.); the other form of the ! command applies.

" Command lines that start with double quotes " are ignored. This means that you can use lines of this kind to insert comment lines in a command script.

line␣**&**options␣n␣flags
range**&**options␣flags
line␣**s**[**ubstitute**]options␣n␣flags
range**s**[**ubstitute**]options␣flags

(resubst) Repeats the previous *s* (substitute) command, as if *&* were replaced by the previous *s/RE/repl/*. The same effect is obtained by omitting the */RE/repl/* string in an *s* command.

line␣**<**␣n
range␣**<**

(lshift) Shifts the defined line range (or the *n* lines that follow *line*) to the left by the number of spaces specified by the *shiftwidth* option. White space (blanks and tabs) is lost in the shift process; other characters are not affected. The last line changed becomes the current line.

line␣**>**␣n
range␣**>**

(rshift) Shifts the defined line range (or the *n* lines that follow *line*) to the right by the number of spaces specified by the *shiftwidth* option. White space (blanks and tabs) is not lost, but inserted as required.

line**=**

(line number) Prints the line number of the specified *line*. The current line position is not affected.

line not specified:
The line number of the last line is displayed.

ex options

ex provides a number of options with which you can govern the behavior of both the *ex* and (more importantly) the *vi* editors (see *vi*, “Customizing the vi environment” on page 858).

All options have default settings; these settings are valid at the time *ex* or *vi* is invoked. Use the *ex* command *se* (set) if you wish to have all options displayed:

```
set all↵
```

The above command can also be used to change one or more options:

```
set showmode scroll=15↵
```

This command shows the *vi* input mode in the status line and sets the number of lines scrolled by the CTRL D key to *15*.

The command:

```
set↵
```

displays all options set to non-default values.

There are two types of options: those that have "Boolean" (i.e. on or off) values and those that do not. One example of a Boolean parameter is the *showmode* option. When this option is not set, it is named *noshowmode*. The *scroll* option, by contrast, is an example of a non-Boolean parameter.

autoindent, ai
noautoindent, noai (default)

If *autoindent* is set, each line in insert mode is aligned with the beginning of the previous line; tabs and blanks are inserted to produce this alignment. The starting indentation of a line is determined by the line it is appended after (*a*), the line it is inserted before (*i*), or the first line to be changed (*c*). Extra indentation can be provided as usual; succeeding lines will automatically be indented to the new alignment.

To reduce the level of indentation, you can press CTRL D one or more times to move the start of the line to the left to positions which are multiples of *shiftwidth*. Thus if the current cursor position is 25 and *shiftwidth* is set to 10, pressing CTRL D once will move the cursor to the left to position 20, while pressing it twice will take the cursor to position 10.
A caret ^ followed by a CTRL **D** removes all indentation temporarily for the current line; a *0* (zero) followed by a CTRL **D** removes all indentation.

autoprint, ap
noautoprint, noap (default)

Prints the current line after each command that changes buffer text. *autoprint* is suppressed during global search and replace operations (see *g*, *s* and *v*).

autowrite, aw
noautowrite, noaw (default)
Writes the buffer to the current file if the buffer has been modified, and an *e* (edit), *n* (next), *rew* (rewind) or *!* (escape) command has been given.

beautify, bf
nobeautify, nobf (default)
Causes all control characters other than tab, newline and form feed to be discarded from the input text.

directory=dir
dir=dir
The value of *dir* specifies the directory which is to hold the editor buffer. If the user does not have write permission for this directory, the editor quits.

edcompatible, ed
noedcompatible, noed
Causes the presence of *g* and *c* suffixes on *s* (substitute) commands to be remembered for use as toggles.

errorbells, eb
noerrorbells, noeb
Rings the terminal bell before displaying error messages in the last line (usually in reverse video).

exrc, ex
This option has been deactivated for security reasons. It normally causes *.exrc* files in the current directory to be evaluated.

flash, fl (default)
noflash, nofl
If the terminfo description contains an entry for flashing the screen to indicate an error, this option can be used to inform users when they have made an invalid entry.

hardtabs=number
ht=number
If the terminal has hardware tabs, this option can be used to set the number of spaces to which the tab stops are set (to optimize screen output).

ignorecase, ic
noignorecase, noic (default)
Treats all uppercase characters in the text as lowercase when a search is made. Uppercase characters in regular expressions are also mapped to lowercase, except in character class expressions.

lisp
nolisp (default)
Activates the *autoindent* option and modifies the *vi* commands left parenthesis (, right parenthesis), left brace {, right brace }, double left brackets [[, and double right brackets]] suitably.

list
nolist (default)
All printed lines will be displayed with tabs shown as `^I`, and the end of line marked by a $.

magic (default)
nomagic
Changes interpretation of characters in regular expressions and substitution replacement strings (see the relevant sections).

mesg (default)
nomesg
Grants/denies other users permission to write to the terminal (e.g. with the *write* command).

modelines (default)
nomodelines
The first and last five lines of a file that is read in are interpreted as editor commands and executed if they are in the form:
`ex:`*command*`:`

novice
nonovice (default)
Defines the level of detail for error messages.

number, nu
nonumber, nonu (default)
Causes lines to be printed with line numbers.

optimize, opt
nooptimize, noopt (default)
Allows you to set the terminal with or without automatic carriage returns (to optimize output).

paragraphs=string
para=string
The value of this option is a string in which each successive pair of characters specifies the name of an *nroff* macro that begins a paragraph. A macro appears in the text in the form *.XX*, where the . is the first character in the line.

prompt (default)
noprompt
When *prompt* is set, the *:* prompt is displayed in command mode; otherwise, there is no command-mode prompt.

readonly
noreadonly (default)
If *readonly* is set, the editor can only be used to read files, not to make changes to the text. If *noreadonly* is set, you can make changes to files.

redraw (default)
noredraw
The editor simulates an intelligent terminal on a dumb terminal. Since this is likely to require a large amount of output to the terminal, it is useful only at high transmission speeds.

remap (default)
noremap
If *remap* is set, macro translation allows for macros defined in terms of other macros; translation continues until the final product is obtained. Only one step of translation is performed if *noremap* is set.

report=n
When the number of lines changed, deleted, or copied by the last command exceeds *n*, a message is issued in the status line.

scroll=n
The value *n* specified for *scroll* determines the number of lines that the screen will scroll when a CTRL *D* command is entered. It also controls the number of lines displayed by a *z* command (twice the value of *scroll*).

sections=string
sect=string
The value assigned to this option is a string in which each successive pair of characters specifies the name of an *nroff* macro which begins a section. A macro appears in the text in the form *.XX*, where the . is the first character in the line.

shiftwidth=n
sw=n
The value *n* specified for *sw* is used for the spacing of tab stops used by the tab key, the *autoindent* option, and by the < and > (shift) commands.

showmatch, sm
noshowmatch, nosm (default)
When a right parenthesis) or right brace } is entered in *vi*, the matching left parenthesis (or left brace { is shown, provided the matching character is still on the screen.

showmode, smd
noshowmode, nosmd (default)
When *smd* is set, an indication is provided in the status line as to whether *vi* is in *vi* input mode.

slowopen, slow
noslowopen, noslow (default)
In *vi*, prevents screen updates during input to improve throughput on unintelligent terminals.

tabstop=n
ts=n
n specifies the software tab spacing to be used by the editor when expanding tabs in the input file.

taglength=number
tl=number
Defines how many characters are to be considered significant in searches with the *:tag* command. A value of 0 means that all characters are to be considered.

tags=files
Names of tag files, separated by blanks.

term=string
string tells *vi* what type of terminal is being used. (The default is the value of the environment variable *TERM*.)

terse
noterse (default)
Setting *terse* causes shorter error messages to be issued.

timeout
notimeout
Sets/cancels a timeout period.

ttytype=string
string tells *vi* what type of terminal is being used. (The default is the value of the environment variable *TERM*.)

warn (default)
nowarn
When *warn* is set, the warning *No write since last change* is issued if a *:!* command is given before the most recent changes to the editor buffer have been saved with *w*.

window=n
The number of lines in a *vi* text window.

wrapmargin=n
wm=n

Only effective in *vi*. If *n*>0, a newline is automatically added to an input line at a word boundary such that lines end at least *n* spaces from the right margin of the terminal screen.

The setting of automatic line breaks can be deactivated by setting the value of *n* to 0 (default).

wrapscan, ws (default)
nowrapscan, nows

Setting *wrapscan* causes searches begun by the /.../ or ?...? commands to wrap around from the end of a buffer to the beginning (or vice-versa). When *nows* is set, the search runs through to the end or beginning of the buffer as appropriate and then terminates.

writeany, wa
nowriteany, nowa (default)

When *nowa* is set, a check is performed before a *w* command to determine whether the file exists. This is to prevent an existing file from being accidentally overwritten. You can override the overwrite protection with *w!*. Setting *wa* inhibits the normally provided overwrite protection.

Error

When an error occurs, *ex* sends the acoustic signal BEL (see section “ASCII character set (ISO 646)” on page 909) to the terminal and prints a message. If an interrupt signal is received, *ex* returns to command level, allowing you to enter a new *ex* command. If the editor input is from a file, *ex* exits at the interrupt signal.

If *ex* detects an internal error, it attempts to preserve the buffer if the most recent changes have not been saved. If you wish to access the backed up data, you must call *ex* with the *-r* option.

File

$HOME/.exrc
File containing default values for *ex* and *vi*. These defaults are overridden if conflicting settings have been assigned to *EXINIT*.

Variable

TERM
The type of data terminal used must be defined in the environment variable TERM.

EXINIT
Environment variable with default values for *ex* and *vi*. These defaults always apply.

PATH
Determine the search path for the shell command specified in the editor commands *shell*, *read* and *write*.

HOME
Determine a pathname of a directory that will be searched for an editor startup file named *.exrc*.

SHELL
Determine the preferred command-line interpreter for use in !, *shell*, *read* and other commands with an operand of the form *!string*. For the shell command, the program will be invoked with the single argument *-i*, for all others it will be invoked with the two arguments *-c* and *string*. If no *SHELL* variable is set, or it is set to a null string, the *sh* utility will be used.

COLUMNS
Override the system-selected horizontal screen size.

LINES
Override the system-selected vertical screen size, used as the number of lines in a screenful and the vertical size in visual mode.

Locale The following environment variables affect the execution of *ex*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), the behavior of character classes within regular expressions, the classification as upper- or lower-case letters, the case conversion of letters, and the detection of word boundaries.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The following example demonstrates and explains a number of *ex* commands:

```
$ ex figures                 -  Call ex (file name "figures")
"figures" 4 lines, 19 characters
:set number                  -  Output line numbers
:1,$p                        -  Output line 1 through to last line
     1  one                  -  Original contents of figures
     2  two
     3  three
     4  four
:1 c 1                       -  Modify line 1
     1  ONE                  -  New line 1
     2  .                    -  Quit input mode
:2,3 co 4                    -  Copy lines 2 to 3 after line 4
     6  three
:1,$ g/two/s//TWO/           -  Replace "two" by "TWO" throughout the file
:2 a                         -  Insert new line after line 2
     3  THREE                -  New line 3
     4  .                    -  Quit input mode
:4 i                         -  Insert new line before line 4
     4  FOUR                 -  New line 4
     5  .                    -  Quit input mode
:5,$ d a                     -  Delete line 5 and all lines to end of file
     4  FOUR
:1,$p                        -  Output line 1 through to last line
     1  ONE
     2  TWO
     3  THREE
     4  FOUR
:wq                          -  Save the contents of the buffer and quit ex
"figures" 4 lines, 19 characters
```

See also *ed, vi*

exec execute commands and open, close or copy file descriptors

The POSIX shell built-in *exec* performs two functions:

- It overlays the current shell with another program (Format 1). When this program starts, the current shell is terminated. No new process is created, as is evident from the fact that the process ID does not change (see Example 2 on page 363).

  If you enter *exec* interactively, when the specified program exits you return to the parent shell of the previous shell; if your previous shell was a login shell, your session terminates.
  If *exec* is called from a shell script, the script terminates. Commands that follow an *exec* call in the script will never be executed.

- It can be used to redirect the standard input or the standard output of the shell to a file (Format 2). All commands entered after *exec* has been executed will read from or write to this file until you terminate the current shell.

Syntax

Format 1: exec␣program[␣redirection]

Format 2: exec␣redirection

Format 1 **Replacing the shell with another program**

exec␣program[␣redirection]

program
  Any command, program or shell script, but not another *sh* command. You will need execute permission for the associated file.

  The current shell terminates, and *program* is executed instead. On completion of the specified *program*, control reverts to the old shell's parent, or the welcome screen is displayed.

redirection
  If the specified program reads from standard input or writes to standard output, a file can be assigned for the input or output instead.
  redirection can be specified as follows:

>file	The standard output of the specified program is redirected to *file*. Any data previously in *file* will be deleted.
>>file	The standard output of the program specified is redirected to *file*. Data already contained in *file* is not deleted; program output is appended to it instead.

2>file The standard error output of the specified program is redirected to *file*.

<file The standard input of the specified program is redirected to *file*, i.e. the program reads its input from this file.

Format 2 **Redirecting the shell's standard input/standard output**

exec␣redirection

redirection
Commands that read from standard input or write to standard output are assigned a file for their input/output. The redirection applies to all commands that the current shell executes after *exec*.
redirection can be specified as follows:

>file All commands executed by the current shell write their output to the specified file sequentially. Data previously in *file* is deleted.
The output from all commands can be collected in this way.

If you have entered *exec* interactively, the redirection can only be cancelled by:

– pressing the [END] or @@d. This terminates the current shell.

– entering *exec >/dev/tty*. This redirects the standard output back to the screen.

If *exec* is called from a shell script, the redirection will only apply to commands that follow the *exec* call in the script. Redirection can be cancelled within the script by including the command *exec >/dev/tty* at the appropriate position in the script. This will redirect the standard output of all subsequent commands back to the screen.

>>file All commands executed by the current shell write their output to the specified file sequentially. Data already contained in *file* is not deleted; program output is appended to it instead.

2>file Standard error is redirected to *file* for all commands executed by the current shell.

<file
: If you specify *exec* interactively, the current shell will read the commands to be executed from the specified file. The shell exits after the last command.

If this command appears in a shell script, all commands that follow the *exec* call in the script read their input from the specified file. Each read operation modifies the position of the read pointer in this file. If the read pointer is set to the end of the file (EOF), all following commands will receive no input.

The command *exec </dev/tty* can be used to redirect the standard input back to the keyboard for all subsequent commands.

file
If you have entered *exec* interactively, *file* must be the name of a shell script. You will only need read permission for this shell script.

When *exec* is called from a shell script, *file* designates the name of the file from which all subsequent commands are to obtain their input.

Locale
The following environment variables affect the execution of *exec*:

LANG
Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH
Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 What happens when you make the following input?

```
$ exec date
```

First, the *exec* command terminates the shell and then causes the *date* command to be executed. The current date is displayed on the screen.

If you have entered the command in your POSIX shell the BS2000 prompt is output. If you want to recommence work with the POSIX shell you must re-enter the *START-POSIX-SHELL* command.

If you entered the command from a subshell, control will be returned to the parent shell.

Example 2 As indicated earlier, the process ID does not change when the current shell is replaced by another program. This concept is demonstrated with reference to the following files:

– Contents of the file *proc1*:

```
echo The process ID of proc1 is: $$
sh proc2
```

– Contents of the file *proc2*:

```
echo The process ID of proc2 is: $$
exec proc3
```

– The file *proc3*, which must be executable, contains the following:

```
echo The process ID of proc3 is: $$
```

The shell script *proc1* is now initiated:

```
$ sh proc1
The process ID of proc1 is: 2755
The process ID of proc2 is: 2760
The process ID of proc3 is: 2760
```

Since *proc3* is called from *proc2* with *exec*, both shell scripts run under the same process ID. To be exact, the shell that executes *proc2* is replaced by the shell that executes *proc3*.

Example 3 The *exec* command is used in the *exctest* shell script to redirect the standard input to the file */etc/group* for all following commands. The contents of the *exctest* file is given below:

```
: Invocation with sh exctest
exec </etc/group
read lines
echo $lines
echo
cat
```

The shell script *exctest* is now initiated:

```
$ sh exctest
root::0:root

daemon::1:daemon
sys::2:sys:
bin::3:bin,admin
uucp::4:
.
.
.
```

The shell built-in *read* assigns the first line of the */etc/group* file to the variable *line*.
The *echo $line* command outputs the content of this variable.

The *cat* command also reads its input from the */etc/group* file. Since the read pointer is now set to the second line of this file, *cat* displays the file's contents from the second line onward.

The read pointer is now set to EOF. Any further commands after the *cat* call would consequently receive the null string as input.

See also *exec()* [4]

exit cause the shell to exit

The POSIX shell built-in *exit* is used to terminate shell scripts. If you wish, you can define an exit status for the terminated script by following *exit* with a number.

Without *exit*, shell scripts terminate:
- when the last command has been executed, i.e. when the executing shell detects an end-of-file (EOF). The exit status is then the status of the last command executed.
- when the executing shell cannot find a command or detects a syntax error; the exit status is then non-zero.

If you call *exit* interactively, either the shell (or subshell) in which you are currently working or the POSIX shell terminates.

Syntax

```
exit[␣n]
```

n Any number between 0 and 256. This number defines the Exit status with which the shell script terminates.
If you specify a larger number, the exit status will not be set to the specified number but to the integer remainder of dividing the specified number by 256.

As described in other sections, certain exit status values are reserved for specific purposes. Applications may only use these values for these purposes:

126:	An executable command was found but the file is not an executable file.
127:	No executable file was found.
>128:	A command was interrupted by a signal.

trap is executed for EXIT before the shell terminates. This fails to occur only if *exit* itself is called in this *trap*. In this latter case, the shell terminates immediately.

You can use the command *echo $?* to query the exit status.

n not specified:
The exit value of the command executed before the *exit* call is used.

Exit status

The exit status is *n* if it is set. Otherwise the exit status is the exit status of the last command executed or zero if no command has been executed. If *exit* is executed as part of a *trap* then the last command executed is taken to be the command which was executed immediately before the *trap*.

Example 1 The *false* command can be implemented by means of the following shell script:

```
: Shell version of the false command
: Exit status allways 1
exit 1
```

Example 2 The two shell scripts named *end* and *check* will be used to demonstrate how the exit status can be evaluated:

– The *end* script contains the following:

```
: Invocation with sh end file
if [ -f "$1" ]
then exit 2
elif [ -d "$1" ]
then exit 3
else exit 4
fi
```

– The *check* file is scripted as follows:

```
: Invocation with sh check file
sh end "$1"
case $? in
     2) echo Contents of file $1:; cat $1;;
     3) echo Contents of $1:; ls -l $1
     4) echo Entering $1 is meaningless for this script!
esac
```

The shell script *check* is now initiated:

```
$ sh check .profile
Contents of file .profile:
HOME=/usr1/rose/src
export HOME
...
```

The shell script *check* calls the script named *end*. This script returns an exit status of 2, since *.profile* is a normal file. The commands specified in the case statement under the matching pattern 2 are then executed.

The contents of the above two shell scripts cannot be simply combined into a single file, since the *exit* command terminates the script.

This shell script *endaction* shows how the exit status can be interpreted within a script:

```
: Invocation with sh endaction file
(if [ -f "$1" ]
   then exit 2
   elif [ -d "$1" ]
         then exit 3
         else exit 4
 fi)
 case $? in
      2) echo Contents the file $1:; cat $1;;
      3) echo Content of $1:; ls -l $1;;
      4) echo Entering $1 is meaningless for this script!
 esac
```

The parentheses around the if statement cause a subshell to be invoked. This subshell terminates with the exit status that is specified in the relevant *exit* command. Control is subsequently returned to the parent shell, i.e. the shell that processes the *endaction* script. This shell executes the remaining commands.

See also *false*
exit() [4]

expand convert tabs to spaces

The *expand* command writes files or the standard input to the standard output with tab characters replaced by one or more blanks needed to pad the line to the next tab stop.

All backspace characters are copied to the output and cause the column position count for tab stop calculations to be decremented. The column position count will not be decremented below zero..

Syntax

Format 1: expand[␣**-t**␣tablist][␣file...]

Format 2: expand[␣-tabstop |␣-tab1,tab2,...,tabn][␣file...]

Format 1

expand[␣**-t**␣tablist][␣file...]

-t␣tablist
Specifies the tab stops. The argument *tablist* must consist of one or more numbers, separated by blanks or commas, in ascending order. A list separated by blanks must be enclosed in quotes.

If only one number is specified, the tab stops will be set to *tablist* column positions instead of the default 8 column positions. If multiple numbers are given, the tabs will be set at the specified column positions.

Each tab stop position N must be an integer value greater than zero, and the specifications must be in ascending order. This means that tabbing from the start of the line of output to position N causes the next character output to be in the (N +1)th column position in that line.

If the *expand* command has to process a tab character at a position beyond the last position specified in a multiple tab stop list, the tab character is replaced by a blank in the output.

file The *file* whose tab characters are to be replaced by blanks.

Format 2 **expand**[␣-tabstop |␣-tab1,tab2,...,tabn][␣file...]

-tabstop |␣-tab1,tab2,...,tabn
Specifies the tab stops. A single number is specifed as *tabstop* with a leading minus; multiple tabstops are specified after a leading minus as *tab1, tab2, ..., tabn* and so forth.

file The *file* whose tab characters are to be replaced by blanks.

Standard Output (stdout)

The standard output is equivalent to the input files with tab characters converted into the appropriate number of blanks.

Locale The following environment variables affect the execution of *expand*:

LANG	Specifies a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_CTYPE	Determines the internationalized environment for the interpretation of bytesequences (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files). The internationalized environment for the processing of tab characters and blanks and for the specification of the width in column positions each character would occupy on a constant-width output device.
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

See also *tabs*, *unexpand*

export set export attribute for variables

The POSIX shell built-in *export* marks the specified shell variable for export. This means that the name of this variable and its value will subsequently be known and accessible to all commands.
Exported variables are deleted when the shell in which they were defined and exported is terminated. Frequently used variables should therefore be defined and exported in the *$HOME/.profile* file.
Positional parameters and shell functions cannot be exported. Some standard variables of the shell are available in all subshells without needing to be exported. These include *HOME, IFS, PATH, PS1* and *PS2*. If you wish to assign some other value to these variables, and if the modified value is to be valid in every subshell, you will need to *export* these variables. Otherwise, the default value is valid in each subshell.
The built-in *sh* command *set* outputs all variables and associated values which are defined in the current shell. This therefore includes variables which you have not exported.
The command *export* outputs the names and values of all shell variables which are passed to each called command and each subshell.

Syntax

Format 1: export[␣name[=value]]...

Format 2: export␣-p

Format 1 **export**[␣name[=value]]...

name[=value]
Name of the shell variable which you wish to export. You may also assign a value *value* to this variable after calling *export*.
You may specify as many shell variables as you wish, each separaed by a space.

name not specified:
export writes the names of all exported shell variables in the current shell to the standard output. The output takes the following form:

```
name=value
...
```

Format 2 **export␣-p**

-p If *-p* is set, *export* outputs the names and values of all the variables which have been exported. The output has the following format and is sent to the standard output:

`“export %s=%s\n”,` *name*, *value*

The option *-p* provides transferrable access to the values which can be saved and then subsequently restored (e.g. by means of a dot procedure).

The shell formats the output and ensures that the quotation marks are used correctly. This means that output is suitable for re-entry in the shell in the case of commands which have the same export results.

Locale The following environment variables affect the execution of *export*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The shell script *ps1* is to display the value of the *PS1* variable. The script file contains the following:

```
: Invocation with sh ps1
echo PS1: $PS1
```

The following interactive session demonstrates why the shell variable *PS1* has to be exported:

```
$ export
export HOME
export PATH
$ PS1=hello
$ sh ps1
PS1:
$ export PS1
$ export
export HOME
export PATH
export PS1
$ sh ps1
PS1: hello
```

When you define a shell variable, it is only known in the current shell. Since a shell script is always run by a subshell, variables for shell scripts have to be exported.

See also

env, set

expr evaluate arguments as an expression

expr interprets command-line arguments as expressions and evaluates them in succession. The result of the evaluation is displayed on standard output.
You can use *expr* to compare strings with one another, for example, or to perform calculations with integers.

Syntax **expr**␣expression␣...

expression

expression may either consist of one operand only, or two operands linked by an operator. Any arbitrary string can be specified as an operand. Strings that consist of digits only (0 to 9) are interpreted as integers. Integers preceded by a minus sign are interpreted as negative numbers.

Operands and operators are separated from one another by a separator. The value specified for the *IFS* variable is used as the separator. If you wish to enter a string which contains spaces or tabs as an operand you must therefore enclose the entire string in apostrophes '...' or quotes "..." to prevent these characters being interpreted as separators. You must also enclose special shell characters in apostrophes '...' or quotes "..." or quote them by means of the backslash \ (see *IFS* in the section "POSIX shell variables and parameter substitution" on page 52).

If *expression* consists of only one operand, the result of the evaluation will be the operand itself.

The following section describes how two operands can be linked. The operators are arranged in the order of increasing precedence; operators with equal precedence are enclosed in braces {...}.

A result of 0 stands for the value 0, not a null string.

Linking operators

op1␣**|**␣op2

If *op1* is neither the null string nor 0, the expression evaluates to *op1*; otherwise, *op2*.

op1␣**&**␣op2

If neither *op1* nor *op2* is equal to the null string or 0, the result returned is *op1*; otherwise, 0.

op1␣rel␣op2

rel may be one of the following relational operators:

<	less than
<=	less than or equal to
=	equal to
>=	greater than or equal to
>	greater than
!=	not equal to

If the condition is fulfilled, the comparison returns a result of 1. If the condition is not satisfied, the result of the comparison is 0. If both *op1* and *op2* are integers, the comparison is numeric; otherwise, they are interpreted as strings and compared alpha-numerically.

op1␣{**+ -**}␣op2

If *op1* and *op2* are both integers, the result returned is the sum of, or difference between, the two numbers. If either of the arguments is not an integer, *expr* issues an error message (see *Error* on page 375).

op1␣{*** / %**}␣op2

When *op1* and *op2* are integers, the result is equal to the value obtained from the specified arithmetic operation:

*	Multiplication
/	Division (integers only)
%	Remaindering

If either of the arguments is not an integer, *expr* issues an error message (see *Error* on page 375).

op1␣**:**␣op2

The strings *op1* and *op2* are compared with one another, starting with the first character in each string and ending with the last character in *op2*. *op2* may be specified in the form of a simple regular expression (see section “Regular POSIX shell expressions” on page 897). If *op1* and *op2* match each other (i.e. from the first character in both strings to the last character in *op2*), *expr* usually returns the number of matching characters. However, if you enter the pattern \(...\) for *op2*, the part of *op1* that matches this pattern will be displayed (see Example 6 on page 376 and Example 7 on page 376).

(...)

The use of parentheses *(...)* enables you to influence the sequence of evaluation. Parenthesized expressions are evaluated first even if they contain operators with lower precedence.

Exit status

0 if the expression is neither invalid nor null nor 0

1 if the expression is null or 0

2 for invalid expressions or division by 0

Error

`expr: Non-numeric argument`
You are only allowed to specify integers as operands when using the arithmetic operators +, -, *, /, %.

`expr: Division by zero`
You have tried to divide by 0.

`expr: Syntax error`
You have made a syntax error when calling *expr*, e.g. you have not delimited operands and operators by blanks or tab.

`expr: RE error`
When using the relational operator : in an expression, you have not specified the second operand as a simple regular expression in the correct format.

Locale

The following environment variables affect the execution of *expr*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions. *LC_COLLATE* also governs the behavior of relational operators in string comparisons. Thus if the letters *a* and *ä* form part of an equivalence class, the expression `expr $var:'[[=a=]]` returns a value of 1 if the value of the variable is *a* or *ä*.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Simple calculation:

```
$ expr 21 + 9 '*' 2 / 6
24
```

Example 2 A value of 1 is added to variable *a* in the following example.

```
$ echo $a
3
$ a=`expr $a + 1`
$ echo $a
4
```

Example 3 This example compares two environment variables:

```
$ echo $op1 $op2
text1 text2
$ expr $op1 = $op2
0
```

If the value of a variable is itself an operator used by *expr*, the comparison will not work. This problem can be solved by combining the variable with a "safe" character:

```
$ echo $op1 $op2
= =
$ expr $op1 = $op2
expr: syntax error
$ expr X$op1 = X$op2
1
```

Example 4 Displaying the number of characters in *VAR*:

```
$ echo $VAR
Hallo
$ expr $VAR : '.*'
5
```

Example 5 Comparing two strings:

```
$ expr boycott : boy
4
```

Example 6 The absolute path name of a file, e.g. */usr/latino/parnassum/infinitum* is stored in variable *a*. To obtain the basic file name, i.e. *infinitum*, you enter:

```
$ expr abc : [\^d-f]
1
```

Example 7 The absolute path name of a file, e.g. */usr/latino/parnassum/infinitum* is stored in variable *a*. To obtain the basic file name, i.e. *infinitum*, you enter:

```
$ expr $a : '.*/\(.*\)'
infinitum
```

Example 8 If variable *a* contains either the absolute path name or the basename of a file, you can extract the file basename as follows:

```
$ expr $a : '.*/\(.*\)' \| $a
```

false return false value

The built-in POSIX shell *sh* command *false* returns an exit status which is not equal to zero. This enables you to generate the condition *false* in shell procedures.
Similarly, you can use the command *true* to generate the condition *true* (exit status equal to 0).

Syntax **false**

Exit status Always non-zero

Example The exit status of *false*:

```
$ false
$ echo $?
1
```

See also *true*

fc process command history list

The commands issued from an interactive POSIX shell are stored in a *history* file which can be accessed using the built-in *fc* command. *fc* allows you to:

– edit individual command lines from the *history* file before they are executed (Format 1)
– list command lines on standard output (Format 2)
– change commands before they re-execute, without editing the *history* file (Format 3)

Syntax

Format 1: fc[␣**-r**][␣**-e**␣editor][␣first[␣last]]

Format 2: fc␣**-l**[␣**-nr**][␣first[␣last]]

Format 3: fc␣**-s**[␣old=new][␣first]

Format 1 **fc**[␣**-r**][␣**-e**␣editor][␣first[␣last]]

-r The commands are made available in reverse order.

-e␣editor
editor is the name of the editor to be used. If the editor name is not supplied, the value of the variable *FCEDIT* is used. If *FCEDIT* is not set, the default editor */usr/bin/ed* is invoked.

first[␣last]
The range of commands from *first* to *last* in the last *HISTSIZE* commands typed at the terminal is selected for editing and subsequent execution. The *first* and *last* arguments may be specified as numbers or as strings.

[+]number	A positive number representing a command number; command numbers can be displayed with the *-l* option.
-number	A negative decimal number representing the command that was executed by this many commands previously. For example, *-1* is the immediately preceding command.
string	A string is used to select the most recently entered command that begins with this string.

first and *last* specified
All commands entered between *first* and *last* are selected for editing. If *first* is a more recent command than *last*, the commands are listed for editing in reverse order (as with option *-r*).

last not specified
The value for *first* is used.

first and *last* not specified
The last (most recent) command is edited.

Format 2 **fc**␣**-l**[␣**-nr**][␣first[␣last]]

-l The commands and command numbers are merely written to standard output and can neither be edited nor executed.

-n Command numbers are suppressed when listed with *-l*.

-r Commands are listed in reverse order.

first[␣last]
The range of commands from *first* to *last* in the last *HISTSIZE* commands typed at the terminal is selected for editing and subsequent execution. The *first* and *last* arguments may be specified as numbers or as strings.

[+]number	A positive number representing a command number; command numbers can be displayed with the *-l* option.
-number	A negative decimal number representing the command that was executed by this many commands previously. For example, *-1* is the immediately preceding command.
string	A string is used to select the most recently entered command that begins with this string.

first and *last* specified
All commands entered between *first* and *last* are listed. If *first* is a more recent command than *last*, the commands are listed for editing in reverse order (as with option *-r*).

last not specified
The previous command is listed.

first and *last* not specified
The previous 16 commands are listed.

Format 3 **fc**␣**-s**[␣old=new][␣first]

-s The commands are re-executed. No editor is invoked.

old=new
The command is modified before being executed. The command is re-executed after *new* has been substitued for *old*.

first
All commands since *first* are executed. See Format 2 for a detailed description.

first not specified
The previous command is used.

Error

sh: /bin/ed: not found
The shell variable *FCEDIT* is not set to *ed*.

Variable

HISTFILE
If this variable is set when the POSIX shell is invoked, its value is the path name of the file that will be used to store the command history (see the section “Command re-entry” on page 65).

HISTSIZE
If this variable is set when the POSIX shell is invoked, the shell will remember the commands you enter (command history). The number of previously entered commands that are accessible by this shell will be greater than or equal to the given number. The default is 128.

FCEDIT
The name of the standard editor for the built-in *fc* command.

Locale

The following environment variables affect the execution of *fc*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Listing the previous 16 commands:

```
$ ls -l
$ fc -s ls=fc
:
```

is identical to

```
$ fc -l
```

Example 2 Re-executing the previous command:

```
$ fc -s
```

is identical to

```
$ fc -s -- -1
```

fg run jobs in the foreground

You can use the built-in POSIX shell *sh* command *fg* to run jobs in the foreground.

Syntax

```
fg[␣job-id...]
```

job-id
: Each of the entered jobs is moved to the foreground. The section *Jobs* in the chapter "Entering commands from the POSIX shell" contains a description of the format of *job-id*.

  job-id not specified: The current job is moved to the foreground.

Exit status

0 if execution is successful

>0 if an error occurs

Locale The following environment variables affect the execution of *fg*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Job %1 is to be moved to the foreground:

```
$ fg %1
```

See also *bg, jobs, kill, wait*

fgrep search a file for a fixed-string pattern

fgrep reads lines from one or more files or from standard input and searches the lines for strings. Unless told otherwise (by options), *fgrep* copies every line containing one of the specified strings to standard output.
If you specify more than one input file, the relevant file name will be displayed before each output line.

Syntax

Format 1: fgrep[␣**-bchilnrvxy**]␣**-e**␣patternlist[␣file...]

Format 2: fgrep[␣**-bchilnrvxy**]␣**-f**␣patternfile[␣file...]

Format 3: fgrep[␣**-bchilnrvxy**]␣patternlist[␣file...]

The formats are described together since the strings which *fgrep* uses to compare the input lines are specified either via *patternlist* or using the option *-e patternlist* or *-f patternfile*. You must specify one of these arguments. Two of them or all three together are not permitted.

No option specified
fgrep outputs all lines that match at least one of the strings specified in *list*. If you specify more than one input file, each output line will be preceded by the name of the file in which the line was found.

option

-b (block) Each output line is preceded by the number of the block in which it was found. Each file is made up of 512-byte blocks which are numbered consecutively from 0. Option *-b* is sometimes useful in locating disk block numbers by context (see the *offset* argument for the *od* command on page 598, for example).

-c (count) *fgrep* outputs only the number of lines found (i.e. the lines that *fgrep* would have displayed without the *-c* option, see *Example 4*); the lines themselves are not displayed.

-h (hidden) When searching multiple files, *fgrep* does not write the file name before each output line.

-i or **-y**
(ignore) *fgrep* does not distinguish between uppercase and lowercase.

-l (list) *fgrep* simply outputs the names of files that contain at least one of the matching lines. (These are the lines that *fgrep* would output if the *-l* option were omitted, see Example 5 on page 388.) Each file name is printed just once. The lines themselves are not displayed.

-n (number lines) Each output line is preceded by its line number in the relevant input file. Line numbering starts at 1. If *fgrep* is reading from standard input, the line number refers to the standard input.

-r (recursive) Names that refer to directories are processed recursively; in other words, all the files and subdirectories in that directory are scanned as well.

-v (vice versa) *fgrep* outputs all lines that *do not* match any of the specified strings.

In conjunction with option *-c*:
fgrep prints only the number of lines that do not match.

In conjunction with option *-l*:
fgrep only outputs the names of files containing such lines.

-x (exact) *fgrep* outputs lines consisting solely of one of the specified strings.

In conjunction with option *-c*:
fgrep only outputs the number of such lines.

In conjunction with option *-l*:
fgrep outputs the names of files containing such lines.

-e␣patternlist
(expression) This option is needed if the first expression in *patternlist* begins with a - (dash). The *-e* option ensures that such strings are not interpreted as an option but as a list of strings to be matched with the input lines.

-f␣patternfile
(file) *fgrep* reads the search strings from the named *patternfile*. Each line in *patternfile* is interpreted as a string.

patternlist
List of strings that *fgrep* is to use when comparing input lines. The individual strings must be separated by newline characters. If *patternlist* includes newline characters or other characters that have a special meaning for the shell, you must enclose *patternlist* in single quotes: '*patternlist*'.

file
Name of the file that *fgrep* is to scan. You may name any number of files.

file not specified:
fgrep reads input lines from the standard input.

grep, fgrep and egrep

The *grep*, *fgrep* and *egrep* commands perform similar functions and are largely identical in terms of usage. The following section lists the most important differences between these commands.

grep processes simple regular expressions. Only one regular expression may be specified in each call.

fgrep processes strings only. However, you may specify several strings in one call. The strings can either be entered directly in the command line, separated by newline characters, or passed to *fgrep* from within a file.
fgrep is fast and compact and can search for a large number of strings. All specified strings are searched for in each individual line.

egrep processes extended regular expressions. Among other things, these include all simple regular expressions with one exception: the \(...\) construct used in simple regular expressions does not have a special meaning in extended regular expression syntax and is hence not processed by *egrep*.
Several regular expressions can be specified together, separated by newline characters. *egrep* interprets these newline characters as an OR operator (the vertical bar character; see section “Regular POSIX shell expressions” on page 897). The regular expressions can either be specified directly in the command line or passed to *egrep* via a file.

Exit status

0 Matching lines found

1 No matching lines found

>1 Syntax error or “Cannot open file”. This exit status remains valid even if lines have been found in other input files.

Locale The following environment variables affect the execution of *fgrep*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The files *customer1* and *customer2* are the basis for all the examples below. Their contents are as follows:

customer1:

```
080685    999.98  20 Units  Item  038   Johnson Ltd.
120387   1240.25   3 Units  Item  023   Skinner Ltd.
180588    330.87   1 Units  Item  332   Skinner Ltd.
```

customer2:

```
morrow lance, 86 sherwood street, london w1
skinner robert, 16 garden hill, london ec3
```

Example 1 Output lines that match a string (without an option and with option *-i*):

```
$ fgrep Skinner customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:180588    330.87   1 Units  Item  332   Skinner Ltd.
```

If you also wish to display lines containing the word *skinner* in lowercase you enter:

```
$ fgrep -i skinner customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:180588    330.87   1 Units  Item  332   Skinner Ltd.
customer2:skinner robert, 16 garden hill, london ec3
```

Example 2 Search several strings (without an option and with the *-f* option):

```
$ fgrep 'Skinner
> Johnson' customer1 customer2
customer1:080685    999.98  20 Units  Item  038   Johnson Ltd.
customer1:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:180588    330.87   1 Units  Item  332   Skinner Ltd.
```

Alternatively, you could write both strings into a file called *names* (each string in a separate line) and then call *fgrep* as follows:

```
$ fgrep -f names customer1 customer2
```

Example 3 Output lines that do not contain the given string (option *-v*):

```
$ fgrep -v Skinner customer1 customer2
customer1:080685    999.98  20 Units  Item  038   Johnson Ltd.
customer2:morrow lance, 86 sherwood street, london w
customer2:skinner robert, 16 garden hill, london ec3
```

Example 4 Display the number of lines found (option *-c*):

To begin with, the number of lines containing the string *Skinner* are to be output for each input file.

```
$ fgrep -c Skinner customer1 customer2
customer1:2
customer2:0
```

Next the number of lines that do not contain the string *Skinner* is to be displayed.

```
$ fgrep -c -v Skinner customer1 customer2
customer1:1
customer2:2
```

Example 5 Display file names only (option *-l*):

First the names of files containing the string *Skinner* are to be output.

```
$ fgrep -l Skinner customer1 customer2
customer1
```

Now the names of files with lines not containing the string *Skinner* are to be displayed.

```
$ fgrep -l -v Skinner customer1 customer2
customer1
customer2
```

Example 6 Display found lines with their line numbers (option *-n*):

```
$ fgrep -n -i skinner customer1 customer2
customer1:2:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:3:180588    330.87   1 Units  Item  332   Skinner Ltd.
customer2:2:skinner robert, 16 garden hill, london ec3
```

See also *ed, egrep, grep, sed*

file determine file type

The *file* command takes a list of one or more files and classifies each file on the basis of its contents. The types distinguished by *file* include directories, special files, FIFO files, archive libraries, C source programs, executable programs, shell scripts, and normal text files.

Caution!
file looks up the *magic* number in the *magic* file to identify the target file. If it fails to identify the file by this method, it tries various plausibility checks. Consequently the results are not always reliable.

Syntax

Format 1: file[␣**-h**][␣**-m**␣magicfile][␣**-f**␣ffile]␣argfile␣...

Format 2: file[␣**-h**][␣**-m**␣magicfile]␣**-f**␣ffile[␣argfile␣...]

Format 3: file␣**-c**[␣**-m**␣magicfile]

Classify a file

Format 1 **file**[␣**-h**][␣**-m**␣magicfile][␣**-f**␣ffile]␣argfile␣...

Format 2 **file**[␣**-h**][␣**-m**␣magicfile]␣**-f**␣ffile[␣argfile␣...]

-h (hidden) If *argfile* is a symbolic link, the link will not be followed and the following error message will be printed:

```
file1: symbolic link to file2
```

-m␣magicfile
(magic) Causes *file* to use *magicfile* instead of the system file */etc/magic* to identify the magic numbers of the files being classified.

-f␣ffile
file interprets the *ffile* argument as the name of a file which contains the names of all files to be examined. If this option is omitted, you must name at least one file to be classified.

argfile
Name of the file to be classified by the *file* command. If *argfile* is a symbolic link, *file* will follow the link and test the original file referenced by the symbolic link. You can name any number of files. If the *-f* option is omitted, you must name at least one.

Format 3 **Check the magic file**

file␣**-c**[␣**-m**␣magicfile]

-c (check) The magic file, by default the system file */etc/magic*, is checked for format errors. However, if the *-m* option is specified, the magic file *magicfile* is checked instead.

-m␣magicfile
(magic file) Causes *file* to check the alternate magic file *magicfile* for format errors.

Mode of operation

file performs a series of tests on each input file and attempts to classify it on the basis of its contents. If it appears to be a text file, *file* examines an initial segment (the first 512 bytes) and tries to guess the language it was created in. The accuracy of the guess cannot be guaranteed, however.

If the input file is an executable program, it is identified as such, and further information is provided with respect to its contents. To do this, *file* searches the file for "magic numbers", i.e. for numeric constants or string constants that give an indication of the type of file. The file */etc/magic* contains an explanation of these magic numbers.

Output

file writes its file classification to standard output. In the following you find the output string and meaning of the most important file types that *file* classifies:

ascii text: ASCII text file

block special: Block special file

c program text: C source program

character special: Character special file

commands text: Shell script

cpio archive: Archive generated by cpio

current ar archive: Archive library (see ar)

data: Data file

directory: Directory

executable: Executable file (e.g. LLMs)

empty file: Empty file

fifo: FIFO file

fortran program text: FORTRAN source program

tar archive: Archive generated by tar, pax

text: EBCDIC text file

File *ˈ/etc/magic*
File containing a key to the magic numbers

Locale

The following environment variables affect the execution of *file*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The file *list* contains the following file names:

```
dir
letter
lib.a
prog.c
```

The following command line will yield information on the contents of each classified file type:

```
$ file -f list
dir:            directory
letter:         ascii text
lib.a:          current ar archive
prog.c:         c program text
```

Thus *dir* is a directory, and *letter* contains normal ASCII text. *lib.a* is an archive library; *prog.c* contains a C program.

The same output could also have been obtained with a command line reading:

```
$ file dir letter lib.a prog.c
```

See also

c89 [5]

find find files

find scans directories and all their subdirectories for files which match a specified search criterion. Files located in this way can be listed and/or processed with a command.
find locates not only ordinary files, but also directories, special files and FIFOs.

Syntax **find**␣directory␣expression

directory
: Name of the directory that is to be scanned. *find* will search through this directory and recursively through its subdirectories, provided you have read and execute permission (r and x bit) for them. More than one directory may be named.

expression
: *expression* may be given as one or more primary expressions (primaries) of the kind listed below or as a combination of these primaries.

find applies *expression* to each file in the specified directories or subdirectories by evaluating primaries from left to right. Each primary is considered to have a "true" or "false" value for a file. The truth value of each expression and the next relational operator determine whether or not *find* will process the next primary.
Most primaries define conditions, i.e. they return a value of true if the current file satisfies the condition. The expressions:

-print
-exec command **\;**
-ok command **\;**

are not conditions. They cause actions to be executed, e.g. output of the file name or deletion of the file. When *find* processes one of these expressions, the associated action is always performed, regardless of whether the expression returns a value of true or false. If none of the above action primaries are specified, *find* exits with an error message. Shell metacharacters that appear in *expression* must be escaped to ensure that they are passed to *find* and not interpreted by the shell.

Primaries as conditions

The following section describes primaries; the method of combining primaries is shown thereafter.

If you use options to find files with specific attributes (e.g. the files modified within a given period), the relevant option must come before the *-print* option (see below), as otherwise all files will be listed.

In the following discussion, *n* represents a decimal integer; +*n* means "more than *n*", -*n* means "less than *n*", and *n* means "exactly *n*".

-name␣file
True if *file* matches the name of the current file.
You can also use the usual shell metanotation for file name generation, but then *file* must be enclosed in single quotes, e.g. find /usr/adam -name 'group.*' (see section "Metacharacters for the POSIX shell" on page 904). Only file basenames may be specified; pathnames such as *text/tmp* are not permitted.

-perm␣mode
True if the file permission flags exactly match *mode* (see *chmod* on page 206). *mode* can also be an octal number. If *mode* is prefixed by a minus sign (-), only the bits that are set in *mode* are compared with the file permission flags, and the expression evaluates true if they match.

-type␣character
True if the current file is of type *character*, where *character* can be:

f	ordinary file
d	directory
b	block special file
c	character special file
l	symbolic links
p	named pipe or FIFO file

-fstype␣name
True if the file system to which the current file belongs is of type *name*, where *name* can be *ufs* or some special file systems such as *proc* or *fdfs*.

-links␣[+-]n
True if there are (more/less than) *n* links to the current file.

-inum␣[+-]n
True if the current file has an inode number greater than (+), less than (-), or equal to *n*. The expression *-inum +n -inum -m* can be used to find all inode numbers between *n* and *m*.

-user␣login_name
True if the current file belongs to the user *login_name*. This option is only of use for users with uid=0 (command *id*).

-nouser
True if the current file belongs to a login name which is not present. This option is only of use for users with uid=0 (command *id*).

-group␣group_name
True if the current file belongs to the group *group_name*.

-nogroup
True if the current file belongs to a group that is not listed in the */etc/group* file.

-size␣[**+-**]n[**c**]
c not specified:
True if the current file is (more / less than / equal) *n* blocks long, where one block is 512 bytes.

c specified:
True if the current file is (more / less than / equal) *n* bytes long.

-atime␣[**+-**]n
(access) True if the current file was last accessed (more / less than / equal) *(n-1*) to *n**24 hours ago. The access time of directories searched by *find* is changed by *find* itself.

-mtime␣[**+-**]n
(modification time) True if the current file was last modified (more / less than / equal) *(n-1*) to *n**24 hours ago.

-ctime␣[**+-**]n
True if the inode of the current file was last modified (more / less than / equal) *(n-1*) to *n**24 hours ago.

-newer␣file
True if the current file is "newer" than the specified *file*, i.e. if it was created or modified at a later point in time.

-local
True if the current file physically resides on the local system.

-prune
Always true. If this expression is processed no search is conducted in files or directories which lie below the current level in the file hierarchy.

-xdev
Always true. If this expression is processed no search is conducted in files or directories which lie below directories which have a different device number (*st_dev*, see the *stat()* function [4]). If *-xdev* is set then this applies to the entire expression even if *-xdev* is not normally processed.

Action primaries

-print
Always true. If this expression is present, it causes *find* to print the path name of the current file on standard output.

-exec␣command␣**\;**
command is executed as soon as this expression is processed.
You must terminate *command* with a blank and an escaped semicolon (\;).

A set of braces {} can be used to represent the name of the current file.

The expression *-exec command* \; is true if the executed *command* returns an exit status of 0. The truth value is significant when this expression is combined with other expressions.

-ok␣command␣**\;**
Like *-exec*, except that *find* asks if the command is to be executed each time the expression is processed. The command is only executed if you respond with the character or string signifying "y[es]" in the current locale (see environment variable *LANG*).

Expressions that affect the behavior of find

-depth
Always true. If present, this expression causes *find* to act upon entries in a directory before the directory itself.

-follow
Always true. This expression causes symbolic links to be followed. It should not be combined with the *-type l* expression.

-mount
Always true. If this expression is present, it causes *find* to restrict its search to the file system containing the directory specified.

Combining expressions

The expressions described above can be combined with one another as shown below.
Please note the blanks used before and after the operators!
The operators are listed in order of decreasing precedence.

\(␣expression...␣**\)**
Parentheses group expressions together. The parentheses themselves must be escaped with a backslash, since they have a special meaning for the shell.

!␣expression
Negation, i.e. true if the expression evaluates to false.

expression␣expression
Logical AND, i.e. true if both expressions are true. If the first expression is false, *find* does not process the second expression.

Example

If the second expression is
-exec command **\;**
the specified command will only be executed if the first expression is true.

expression␣**-o**␣expression

Logical OR, i.e. true when either of the expressions is true. If the first expression is true, *find* does not process the second expression.

Example

If the second expression is
-exec command **\;**
the command will only be executed if the first expression is false.

Error **Error messages without command termination (exit status 0)**

`find: cannot read dir` ***dir***`: Permission denied`
Since you have no read permission for the *dir* directory, this directory cannot be scanned. *find* does not terminate after this error message, but continues scanning directories for which you do have the required access permissions (r bit).

`find: cannot access` ***dir/file***`: permission denied`
Since you have no execute permission (x bit) for *dir*, this directory cannot be scanned. *find* does not terminate after this message but searches through those directories for which you do have the appropriate perimissions (r and x bits).

`find: cannot open` ***dir***`: No such file or directory`
There is no directory named *dir*.

Error messages with command termination (non-zero exit status)

`find: missing conjunction`
You have either combined primaries incorrectly in the *find* call or specified more than one argument in a primary.

`find: no action specified`
You have not specified an action (*print, exec, ok*).

`find: incomplete statement`
You have forgotten the escaped semicolon \; which is required to terminate a command in an *-exec* or *-ok* expression.

`find: insufficient number of arguments`
You have specified too few arguments.

`find: path-list predicate-list`
You have failed to specify the pathname list for *directory*.

File */etc/group*
File containing group names

Locale The following environment variables affect the execution of *find*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements used in pattern matching notation for the -n option. In file name generation patterns in square brackets (such as *find . -name '[[=a=]]*' -print*), the *LC_COLLATE* environment variable governs the scope of character ranges, equivalence classes and collating elements.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments), the behavior of character classes in pattern matching notation for the *-n* option and the behavior of character classes within regular expressions.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 A simple example to illustrate how *find* works:

Display the path names of all files that
- are located in the current directory or in a subdirectory and
- have the name *tmp*.

```
$ find . -name tmp -print
```

In this case, *expression* comprises two primaries that are linked by a logical AND operator. *find* first checks the *-name tmp* primary for each file. If this expression is true (i.e. the current file is named *tmp*), *find* will also process the expression *-print*, which outputs the path names. Otherwise, *find* does not process the *-print* expression and remains silent.

Please note the sequence. If you entered:

```
$ find . -print -name tmp
```

instead, *find* would process the *-print* expression for each file, i.e. would output the path names of all files.

Example 2 A more complex example:

Display the path names of all files that
– are located in the current directory or its subdirectories, and
– are named *tmp* or have names ending in *.xx*.

```
$ find . \( -name tmp -o -name '*.xx' \) -print
```

Please note the use of blanks between the arguments!

find begins by processing the parenthesized specifications for each file. These comprise two primaries linked by a logical OR operator.
find first tests the *-name tmp* primary. If this expression is true (i.e. if the current file is named *tmp*), *find* does not process the expression *-name '*.xx'* at all; this is because the result of the expression in parentheses will be true in any case. If *-name tmp* evaluates to false, *find* tests the second primary, i.e. *-name '*.xx'*. If this expression is true (i.e. the file name ends in *.xx*), the parenthesized expression will also evaluate to true; otherwise, the result of the expression in parentheses is false.
If the parenthesized expression is true, *find* then processes the *-print* expression, i.e. outputs the file names (AND operator; see *Example 1*). If false, *find* does not process the *-print* expression, i.e. remains silent.

Example 3 Search all entries in the */usr/santaclaus* directory and its subdirectories and print the files not owned by *santaclaus*.

```
$ find /usr/santaclaus ! -user santaclaus -print
```

Example 4 Delete all files that,
– are named *tmp* or have names ending in *.xx*, and
– have not been accessed for more than 7 days.

Confirmation is to be requested before the removal of each file.

```
$ find / \( -name tmp -o -name '*.xx' \) -atime +7 -ok rm {} \;
```

Example 5 Recursively print all file names in the current directory and below, but skipping all SCCS directories:

```
$ find . -name SCCS -prune -o -print
```

See also *chmod*, *ln*, *test*
stat() [4]

fold filter for folding lines

fold folds the lines of text files or the standard input so that they do not exceed the preset or specified line length. The default presetting is 80 characters per line.

The lines are folded through the insertion of a newline character so that each output line (termed "segment" in the following) does not exceed the preset or specified line length (or does not exceed the maximum number of bytes). However, lines are not folded in the middle of a character. Behavior is not predictable if *number* is smaller than the number of columns which may be occupied by a single input character.

If a carriage return, backspace or tab is read in the input and the option *-b* is not set then the input is considered to be a character:

Backspace
: The current line length is reduced by one. However, it cannot assume a negative value. *fold* does not insert a newline character either immediately before or after a backspace.

Carriage return
: The current line length is set to zero. *fold* does not insert a newline character either immediately before or after a carriage return.

Tab
: All tabs that are read move the column position pointer to the next tab stop position. Tab stop positions are located at all column positions *n* where: *n* modulo 8 is equal to 1.

Caution!
If the input lines contain underscores then *fold* may react incorrectly.

Syntax **fold**[␣**-bs**][␣**-w**␣width][␣file...]

No option specified
: *fold* folds the input lines so that no line exceeds a maximum width of 80 characters (default).

option

-b (bytes) The line length is calculated in bytes not column positions.

-s (segment) If a line segment contains a blank within the first *number* of column positions (or bytes) then the line is folded after the last space which fulfils the *number* condition. If no space which fulfils this condition exists then the *-s* option is ineffective for this input line.

-w␣width
(width) Defines the maximum width of a line, where *width* is the number of characters per line.

width should be a multiple of 8 if tabs are present in the input line.

file
Name of the text file to be folded. You may name several such files, in which case the specified options will be applied to each file.

file not specified:
fold reads from standard input.

Locale The following environment variables affect the execution of *fold*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), and for the determination of the width in column positions each character would occupy on a constant-width font output device.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Printing a file named *notes* on standard output.

The following result is obtained with the *cat* command:

```
$ cat
Notes:
Remind Carl to send in a bid within the next two weeks. The new deadline
for the evaluation of all bids is the end of June.
```

Using the *fold* command, you have the option of redefining the length of the output lines.

The following command folds the contents of the *notes* file so that each line has a maximum width of 40 characters:

```
$ fold -w 40 notes
Notes:
Remind Carl to send in a bid within the
next two weeks. The new deadline for the
evaluation of all bids is the end of Jun
e.
```

See also *pr*

fsck file system check

fsck checks file systems for inconsistencies and corrects these interactively with the user. The user's agreement is requested before any corrective measures are implemented. Any inconsistencies other than those mentioned above may result in data loss. Diagnostic messages provide information about the extent and seriousness of such losses.

fsck automatically corrects less serious inconsistencies such as unreferenced inodes, excessive reference counter values in inodes, missing blocks in the free blocks list, blocks which simultaneously appear in the free blocks list and in files or incorrect superblock counters. A message is output for each inconsistency which is corrected. This message displays the type of correction and the file system in which it was performed. After the file system has been corrected, *fsck* outputs the number of files in the file system, the number of occupied and free blocks and the corresponding percentage values.

By default, the command waits for the user's response, which must be either *yes* or *no*, before performing any correction. If the user does not possess write permission for the file system then *fsck* defaults to *-n* (no correction).

The command checks for the following inconsistencies:

1. Blocks claimed by multiple inodes or the free block list.
2. Blocks which are claimed by multiple inodes or the free block lits and which lie outside the file system.
3. Incorrect reference counters.
4. Incorrect directory sizes.
5. Incorrect inode formats.
6. Blocks which are not listed anywhere.
7. Directory checks, files which point to an unassigned inode, inode numbers outside the allocated range, omission of '.' and '..' as the first directory entry.
8. Superblock checks: More blocks for inodes than are present in the file system.
9. Incorrect format for free block list.
10. Total of free blocks and/or free inodes incorrect.

If the user agrees, orphaned files or directories (i.e. allocated but unreferenced) are relinked through being written to the *lost+found* directory. The allocated name corresponds to the inode number. If the *lost+found* directory does not yet exist it is created at this point. If not enough space is available, the directory is extended.

To designate a file system you may specify the name of the block or character-oriented device on which it is located or the name of the mountpoint.

Syntax **fsck**[␣**-F**␣**ufs**|**UFS**][␣**-y**|**-n**|**-m**][[␣special_file ...]

The following options are possible:

-F␣ufs|UFS
Specifies ufs as the file system type.

-y All inconsistencies are checked. The questions asked by *fsck* are answered with "yes".

-n All inconsistencies are checked. The questions asked by *fsck* are answered with "no".

-m The status in the file system's superblock is checked. This option ensures that the file system is suitable for mounting.

special_file
special_file represents a block or character special device (for example, /dev/dsk/234). It is preferable to use a character special device. *fsck* cannot be applied to mounted block special devices.

special_file not specified:
fsck looks through the */etc/vfstab* file and executes *fsck* for all the character special devices in the *fsckdev* field of */etc/vfstab* for which there is a numeric entry in the *fsckpass* field.

Hint In almost all cases it is quicker to examine character-oriented devices. For file systems which were mounted with a journal, the *–m* option is also sufficient to place the file system in a consistent status in a very short time after a system crash. The check of all the inconsistencies, on the other hand, can take a very long time depending on the size and utilization level of the file system.

The *fsck* command is not supported for bs2fs file systems.

File *lost+found*

/etc/vfstab
List of default parameters for each file system

See also *mount, mountall, umount*

fsexpand expand existing file systems

fsexpand enables file systems to be expanded by PAM pages or cylinder groups. The file systems may not be mounted.

Syntax

fsexpand[␣**-i**][␣**-p**␣pam pages|␣**-c**␣cylinder groups]␣device

The following options are possible:

-i Outputs file system information. Output takes place to stdout.
In particular information is output on how ideal an expansion is, e.g. to prevent unused PAM pages in the expanded file system. In conjunction with the *-p* or *-c* option, information is output before the expansion (source file system) and after the expansion (target system).

-p␣pam pages
Expansion of a file system by PAM pages.
The file system is expanded by the specified number of PAM pages.

-c␣cylinder groups
Expansion of a file system by cylinder groups.
The file system is expanded by the specified number of cylinder groups. The size of a cylinder group in the source file system can be ascertained before expansion using *fsexpand -i*. Up to a file size of a little more than 2 GB, the size is 2048 PAM pages. From 2 GB on, the size increases. With a file size of 4 GB, for example, it is then 4096 PAM pages.

device
Device name */dev/rdsk/...* (character-oriented device only, i.e. not */dev/dsk*) or BS2000 file name.
device must be writeable when an expansion is to take place. If the file system is located on the HOME pubset, the BS2000 file name (with or without catid) must match the notation in the */etc/partitions* file.

Hints

The *fsexpand* command is not supported for bs2fs file systems.

A file system is expanded in two steps:

1. Physical expansion
2. Combining (administration) units of the file system (known as cylinder groups) to form larger units (compactification)

   Compactification is performed only if the expanded file system is greater than 2 GB and at least double the size of the original file system.

Compactification requires a considerable amnount of the runtime for *fsexpand*. If, for example, a file system which is 1 GB in size is expanded by a value which is only slightly above 1 GB (i.e. with compactification), the runtime is extended by a factor of 3 - 4 compared to expansion by a value which is slightly less than 1 GB (i.e. without compactification). However, compactification has the advantage that considerable gains in performance can be achieved when the file system is used because at runtime the requirement for memory and CPU time is lower thanks to the administration units being combined.

Example

```
$ fsexpand -i '$BACH.BACH.TEST

device /dev/rdsk/8 in Containerfile: $BACH.BACH.TEST

size of BS2000 Containerfile (PP):     12288
last page used in Containerfile (PP):  12288
size used for POSIX filesystem (PP):   12288
unused in Containerfile (PP):          0
Cylindergroups in filesystem:          6
Cylinders in cylindergroup (PP):       16
size of a cylindergroup (PP):          2048
inodes per cylindergroup:              2048
inodes total:                          12288
datablocks (4K) in filesystem:         5731
        free blocks            directories            free inodes
        1853                   4                      12232
optimal values for expansion of container: 0 PP + N * 2048 PP
```

ftyp define file processing mode *(BS2000)*

ftyp determines whether files are interpreted as text or binary files when copied between BS2000 and the POSIX file system using *bs2cp*. The command is only effective for SAM files and for text-type PLAM library elements (element type other than LLM). PAM files and LLMs are always interpreted as binary files and ISAM files are always interpreted as text files.
If no *ftyp* command is entered, all SAM files are interpreted as text files.

Syntax **ftyp**[␣**-h**][␣**text**|**binary**|**textbin**]

No option specified
The *text* option is used.

option

-h Prints out the command syntax with an explanation of the options.

text
SAM files and text-type library elements are to be interpreted as text files.

When writing to the BS2000, newline characters (x’15’) are converted into line change (record change); Tab characters (x’05’) are replaced by a corresponding number of spaces to tab position.

When a file is read from the BS2000 a newline character is appended to each record which is read (x’15’).

i This option can not be used for SAM files with fixed record length.

binary
SAM files are to be interpreted as binary files.

No conversions are performed.

i This option can also be used for SAM files with fixed record length. In this case the last record is padded out with binary zeros.

textbin

SAM files and text-type library elements are to be interpreted as binary text files.

When writing to the BS2000, newline characters (x’15’) are converted into line change (record change).

Tabs are not converted.

When a file is read from the BS2000 a newline character is appended to each record which is read (x’15’).

i This option can not be used for SAM files with fixed record length.

Example The *input* file of the POSIX file system should be transferred to the BS2000 as a binary file.

```
$ ftyp binary
$ bs2cp input bs2:output
```

See also *bs2cp, bs2file*

fuser display file users

The *fuser* command allows you to display processes using a file or file system.

Syntax **fuser** [**-c**|**-f**] [**-u**] [**-k**] path ...

-c All processes which use arbitrary files from the file system at the mountpoint *path* are displayed.

-f Only those processes are displayed which use the *path* file themselves (for device files only).

-u Displays the user ID of the processes found after the process ID.

-k The processes found are terminated with the SIGKILL signal.

path
File name or file system mount point.

Options *-c* und *-f* not specified:

For special device files representing a mounted file system the option *-c* is set implicitly, for all other files the option *-f* is set.

Für each process found *fuser* displays:

```
nnnc(USER)
 |  | |
 |  | └── Benutzername (to stderr, optional)
 |  └── one or more usage flags (to stderr)
 └── Prozess-ID (nach stdout)
```

Usage flag

c	current directory
r	root directory
o	file opened for read/write
t	file opened for execution

Example 1 Display users of a file:

```
# fuser /var/adm/syslog
/var/adm/syslog:       54o
# ps -fTp 54
    UID   PID   TSN  PPID  C    STIME TTY       TIME CMD
   ROOT    54  0606     1  0 05/06/11 ?         0:02 [syslogd]
#
```

Example 2 Display users of two file systems with user names:

```
# fuser -cu /opt /home/froede
/opt:      226t(SYSROOT)     240t(SYSROOT)
/home/froede:      628co(FROEDE)
#
```

Example 3 Display information on all processes using a file system:

```
# fuser -c /var 2>/dev/null | read PIDLST
# for PID in $PIDLST
> do
> ps -p $PID -o user= -o pid= -o tsn= -o comm=
> done
 SYSROOT   603  07GN in.rlogind
 SYSROOT   226  0653 prngd
 SYSROOT    54  0606 syslogd
  FROEDE   628  07HD sh
 SYSROOT   201  065E cron
 SYSROOT   606  07GR sh
 SYSROOT   625  07HA in.rlogind
#
```

The process IDs concerned are read into the *PIDLST* variable, display of the usage flags (stderr) being suppressed. The process IDs are then processed further in the for loop.

gencat generate a formatted message catalog

The *gencat* utility merges the contents of a message text source file into a binary encoded message catalog.

The message catalog is created if it does not already exist. If it does exist, its messages are included in the new message catalog. If the set numbers and message numbers of existing and newly defined message texts match, *gencat* replaces the old message texts currently contained in the message catalog with the new message texts defined in the message text file.

Message catalogs produced by *gencat* are binary encoded, which means that their portability cannot be guaranteed between different types of machine. Thus, just as C programs need to be recompiled for each type of machine, message catalogs must be recreated with *gencat*.

A message text source file can contain either set and message numbers or simply message numbers. In the later case, the set *NL_SETD* is assumed for the set numbers.

Syntax **gencat**[␣**-lm**]␣catfile[␣msgfile...]

option

-l If *catfile* already exists, information on messages contained in it will be written to standard output in the following format:

```
SET set_num, MESSAGE mesg_num, OFFSET offset, LENGTH msg_len,
message_txt
*
```

offset indicates the distance from the beginning of the file to the start of the message text, i.e.

– first message: offset (1) = 0
– n th message: offset (n) = offset (n-1) + msg_len (n)

-m The *-m* option ensures compliance with the X/Open Standard.

The *-m* option is supplied for compatibility with previous versions of *gencat* released in a number of specialized internationalization products. This option will cause *gencat* to build a single file *catfile* which is compatible with the format catalogs produced by the earlier versions. The retrieval routines detect the type of catalog they are using and act appropriately.

The *-m* option corresponds to the default behavior of *gencat* and need not be explicitly set.

No option specified

gencat behaves as described under the *-m* option.

catfile

Name of the binary encoded message catalog that *gencat* is to generate from the message text file *msgfile*.

If a dash (-) is specified for *catfile*, *gencat* prints to standard output.

msgfile

Name of the message text source file. *gencat* generates a binary encoded message catalog from this file.

If a dash (-) is specified for *msgfile*, *gencat* reads from standard input.
More than one message text file may be specified.

Format of a message catalog

A message catalog created by *gencat* with the option *-m* contains the following structures in the given order:

- The catalog header, *CAT_HDR*, consisting of:
  - the file's magic number
  - the number of sets in the message file
  - the space (in bytes) needed to load the file, excluding the length of the file header
  - the position at which the message headers begin, excluding the length of the file header
  - the position at which the message texts begin, excluding the length of the file header
- A set header, *CAT_SET_HDR*, for each existing set. This header consists of:
  - the set number
  - the number of messages in the set
  - the initial offset in the table
- A message header, *CAT_MSG_HDR*, for each existing message. This header consists of:
  - the message number
  - the length of the message in bytes
  - the message offset in the table
- The individual message texts, delimited by \0.

Locale

The following environment variables affect the execution of *gencat*:

LANG
: Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
: If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
: Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
: Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH
: Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

Generating a binary encoded message catalog *en_wc.cat* from the English message text file *en_wc.msf* for the *wc* command. The contents of the message text file are as follow:

```
1 wc: cannot open %s \n
2 together \n
3 Syntax: wc[␣-c|␣-m][␣-lw][␣file...] \n
```

The following command generates the message catalog:

```
$ gencat en_wc.cat en_wc.msf
```

See also

iconv
catopen(), catgets(), catclose(), limits.h, nl_types.h [4]

getconf get configuration values

In the first synopsis form, *getconf* writes the value of the variable specified by the *system_var* operand to the standard output.

In the second syntax form, *getconf* writes the value of the variable specified by the *path_var* operand to the standard output. This value is valid within the path specified by the *pathname* operand.

The value of each configuration variable is output as if it were determined by calling the function from which it was defined. The value reflects the conditions in the current execution environment.

If the specified variable is valid, but is not defined on the system, *getconf* writes `%undefined` to the standard output.

Syntax

Format 1: getconf␣system_var

Format 2: getconf␣path_var␣pathname

Format 1 **getconf**␣system_var

system_var
Name of a configuration variable whose value can be obtained using the *confstr*() or *sysconf()* functions [4]. The following values are supported:

ARG_MAX, BC_BASE_MAX, BC_DIM_MAX, BC_SCALE_MAX, BC_STRING_MAX, CHAR_BIT, CHAR_MAX, CHAR_MIN, CHARCLASS_NAME_MAX, CHILD_MAX, CLK_TCK, COLL_WEIGHTS_MAX, CS_PATH, EXPR_NEST_MAX, INT_MAX, INT_MIN, LINE_MAX, LONG_BIT, LONG_MAX, LONG_MIN, MB_LEN_MAX, NGROUPS_MAX, NL_ARGMAX, NL_ARGMAX, NL_LANGMAX, NL_LANGMAX, NL_MAX, NL_MAX, NL_MSGMAX, NL_MSGMAX, NL_SETMAX, NL_SETMAX, NL_TEXTMAX, NL_TEXTMAX, NZERO, OPEN_MAX, POSIX_ARG_MAX, POSIX_CHILD_MAX, POSIX_JOB_CONTROL, POSIX_LINK_MAX, POSIX_MAX_CANON, POSIX_MAX_INPUT, POSIX_NAME_MAX, POSIX_NGROUPS_MAX, POSIX_OPEN_MAX, POSIX_PATH_MAX, POSIX_PIPE_BUF, POSIX_SAVED_IDS, POSIX_SSIZE_MAX, POSIX_STREAM_MAX, POSIX_TZNAME_MAX, POSIX_VERSION, POSIX2_BC_BASE_MAX, POSIX2_BC_DIM_MAX, POSIX2_BC_SCALE_MAX, POSIX2_BC_STRING_MAX, POSIX2_C_BIND, POSIX2_C_DEV, POSIX2_C_VERSION, POSIX2_CHAR_TERM, POSIX2_COLL_WEIGHTS_MAX, POSIX2_EXPR_NEST_MAX, POSIX2_FORT_DEV, POSIX2_FORT_RUN, POSIX2_LINE_MAX, POSIX2_LOCALEDEF, POSIX2_RE_DUP_MAX, POSIX2_SW_DEV, POSIX2_UPE, POSIX2_VERSION, RE_DUP_MAX, SCHAR_MAX, SCHAR_MIN, SHRT_MAX, SHRT_MIN, SSIZE_MAX, STREAM_MAX, TMP_MAX, TZNAME_MAX, UCHAR_MAX, UINT_MAX, ULONG_MAX, USHRT_MAX, WORD_BIT, XOPEN_CRYPT, XOPEN_ENH_I18N, XOPEN_SHM, XOPEN_VERSION, XOPEN_XCU_VERSION, XOPEN_XPG2, XOPEN_XPG3, XOPEN_XPG4

The symbol *PATH* is also recognized. It returns the same value as the *confstr*() [4] value CS_PATH. *getconf* also recognizes the variables

`LOGNAME_MAX, PAGE_SIZE, PAGESIZE and PASS_MAX .`

i All variable names can be specified with or without a leading underscore (_).

Format 2 **getconf**˽path_var˽pathname

path_var
Name of a configuration variable whose value can be obtained using the *pathconf*() [4] function. The following values are supported:

LINK_MAX, MAX_CANON, MAX_INPUT, NAME_MAX, PATH_MAX, PIPE_BUF, POSIX_CHOWN_RESTRICTED, POSIX_NO_TRUNC, POSIX_VDISABLE

i All variable names can be specified with or without a leading underscore (_).

pathname
Pathname for which the variable specified by *path_var* is to be determined.

Locale The following environment variables affect the execution of *getconf*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Exit status The following exit values are returned:

0 The specified variable is valid and information about its current status was written to the standard output.

>0 An error occurred.

Example 1 In this example, the value of {NGROUPS_MAX} is obtained (Format 1):

```
$ getconf NGROUPS_MAX
16
```

Example 2 In this example, the value of {NAME_MAX} is obtained for a specific directory (Format 2):

```
$ getconf NAME_MAX /usr
255
```

Example 3 This example shows how to deal more carefully with results that mightbe unspecified:

```
if value=$(getconf PATH_MAX /usr); then
        if [ “$value“ = “undefined“ ]; then
                echo PATH_MAX in /usr is infinite.
        else
                echo PATH_MAX in /usr is $value.
        fi
else
        echo Error in getconf.
fi
```

Note that the following calls in a C program could return different results:

```
sysconf(_SC_POSIX_C_BIND);
```

and:

```
system(“getconf POSIX2_C_BIND“);
```

The *sysconf*() [4] call returns a value that corresponds to the conditions when the program is either compiled or executed. The *system*() [4] call to *getconf* always returns a value that corresponds to the conditions when the program is executed.

See also *pathconf(), confstr(), sysconf()* [4]

getopts parse utility options

The POSIX shell built-in *getopts* is used by shell scripts to parse arguments and options in the command line and to check for valid options. It supports all applicable rules of the command syntax standard.
You can use *getopts* in shell procedures to analyze the arguments specified when the procedure is called. The individual options and arguments are stored in sequence in shell variables and can then be easily queried or checked. If an option in the argument list is not permitted or if *getopts* finds no corresponding argument for an option which requires an argument then *getopts* issues a corresponding error message.

The argument list should always be processed using *getopts* and examined for valid options in order to ensure that all procedures and commands process the argument list in the same way.

Syntax **getopts**␣optstring␣name[␣arg]...

optstring

A string which may consist of letters and colons : . The letters specified in *optstring* are considered by *getopts* to be permitted shell procedure options. If a letter is followed by a colon then *getopts* expects an argument or a group of arguments for this option. Any arguments must be separated from the option by spaces or tabs.

name

Name of the shell variable in which *getopts* places the next option each time it is invoked.

arg␣...

Argument list parsed by *getopts*.

arg not specified:
getopts parses the argument list of the command line with which the script was invoked.

Mode of operation

Each time it is invoked, *getopts* places the next option in the shell variable *name* and the index of the next argument to be processed in the shell variable *OPTIND*. Whenever the *shell* command interpreter or a shell script is invoked, *OPTIND* is initialized to 1.

In the case of options which require an argument, this argument is assigned to the shell variable *OPTARG*. Options which require an argument must be identified by a colon : in *optstring*. If no option is present or if the option has no argument then *OPTARG* is reset.

If an invalid option is identified then a question mark ? is assigned to the shell variable *name*. Invalid options are those which are not present in *optstring*. In this case (if the first character in *optstring* is a colon :) the located option character is assigned to the shell variable *OPTARG*. However, no output is written to the standard error output. Otherwise the shell variable *OPTARG* is reset and a message is written to the default error output. This is interpreted as a detected error in the argument presentation for the calling function. It is, however, not a *getopts* error.

If an option argument is missing, then:

– If the first character of *optstring* is a colon :, the shell variable specified in *name* is set to the colon and the shell variable *OPTARG* is set to the detected option character.

– Otherwise the shell variable specified in *name* is set to the question mark, the shell variable *OPTARG* is reset and a message is written to the standard error output. This is interpreted as a detected error in the argument presentation for the calling function. It is, however, not a *getopts* error. A message is output as indicated but the exit status is zero.

When the end of the option list is encountered, *getopts* exits with a non-zero exit status. The special option -- may be also used to identify the end of the options.

Changing the value of the shell variable *OPTIND* or invoking *getopts* with different sets of arguments may lead to unexpected results.

Locale

The following environment variables affect the execution of *getopts*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The following fragment of a shell script *scrpt* shows how you might process the arguments for a script that can take the options *-a* or *-b*, as well as the option *-o*, which requires an option argument. Options *-a* and *-b* are mutually exclusive, and if both are specified, only the one listed second applies:

```
while getopts abo: c
do
      case $c in
      [ab])          FLAG=$c;;
      o)             OARG=$OPTARG;;
      \?)            echo "usage: $0 [-a| -b] [-o <arg>]"
                     exit 2;;
      esac
done
shift `expr $OPTIND - 1`
```

This code accepts any of the following invocations of *scrpt* as equivalent:

```
proz -a -b -o "xxx z yy" file
proz -a -b -o "xxx z yy" -- file
proz -ab -o "xxx z yy" file
```

grep search a file for a pattern

grep reads lines from one or more text files or from standard input and compares these lines with a specified pattern. Unless told otherwise (by options), *grep* copies every line that matches the pattern to standard output.
grep permits the use of simple regular expressions in the specified pattern (see section "Regular POSIX shell expressions" on page 897).
If you specify more than one input file, the relevant file name will be displayed before each output line.

Syntax

Format 1: grep[␣**-E**|␣**-F**][␣**-c**|␣**-l**|␣**-q**][␣**-bihnrsvxy**]␣**-e**␣patternlist
[␣**-f**␣patternlist][␣file...]

Format 2: grep[␣**-E**|␣**-F**][␣**-c**|␣**-l**|␣**-q**][␣**-bihnrsvxy**][␣**-e**␣patternlist]
␣**-f**␣patternfile[␣file...]

Format 3: grep[␣**-E**|␣**-F**][␣**-c**|␣**-l**|␣**-q**][␣**-bihnrsvxy**]␣patternlist[␣file...]

The formats are described together since the patterns which *grep* uses to compare the input lines are specified either via *patternlist* or using the option *-e patternlist* or *-f patternfile*.

No option specified
grep outputs all lines that match the given *pattern*. If you specify more than one input file, each output line will be preceded by the name of the file in which the line was found.

option

-E (E - extended) *grep* treats each pattern as an extended regular expression.Option *-E* is equivalent to the *egrep* command.

-F (F - fast grep) *grep* searches for strings. Option *-F* is equivalent to the *fgrep* command.

-c (count) *grep* outputs only the number of lines found (i.e. the lines that *grep* would have displayed without the *-c* option, see *Example 3*); the lines themselves are not displayed.

-l (list) *grep* simply outputs the names of files that contain at least one of the matching lines. (These are the lines that *egrep* would output if the *-l* option were omitted, see Example 4 on page 423.) Each file name is printed just once. The lines themselves are not displayed.

-q (quiet) *grep* writes nothing to the standard output even if matching lines are found.

-b (block) Each output line is preceded by the number of the block in which it was found. Each file is made up of 512-byte blocks which are numbered consecutively from 0. The *-b* option is sometimes useful in locating disk block numbers by context (see the *offset* argument for the *od* command on page 598, for example).

-i or **-y**
(ignore) when performing comparisons, *grep* does not distinguish between uppercase and lowercase.

-h (hidden) When searching multiple files, *grep* does not write the file name before each output line.

-n (number lines) Each output line is preceded by its line number in the relevant input file. Line numbering starts at 1. If *grep* is reading from standard input, the line number refers to the standard input.

-r (recursive) Names that refer to directories are processed recursively; in other words, all the files and subdirectories in that directory are scanned as well.

-s (silent) Error messages produced for non-existent files or files which the user is not authorized to read are suppressed.

-v (vice versa) *grep* outputs all lines that *do not* match the specified pattern.

In conjunction with option *-c*:
grep prints only the number of lines that do not match.

In conjunction with option *-l*:
grep only outputs the names of files containing such lines.

-x (x - exact) *fgrep* only outputs lines which contain one of the specified strings and no other characters.

-e␣patternlist
(e - expression) You need to set this option when the first expression in *patternlist* starts with a hyphen -. When *-e* is set, such a pattern list is not interpreted as an option but as a list of patterns with which *egrep* is to compare the input lines.

-f␣patternfile
(f - file) *egrep* reads the list of patterns from the file *patternfile*. Every line in *patternfile* is interpreted as an extended regular expression.

patternlist
A simple regular expression to be used by *grep* when searching for matching input lines (see section “Regular POSIX shell expressions” on page 897).
If *patternlist* contains characters that have a special meaning for the shell, you must enclose it in single quotes: '*patternlist*'.

file
Name of the file that *grep* is to scan. You may name any number of files.

file not specified:
grep reads its input from standard input.

i *grep* can only be applied to text files. Applying *grep* to binary files (history files, for example) will produce an undefined result, because the occurrence of a null byte logically terminates an input line.

grep, fgrep and egrep

The *grep*, *fgrep* and *egrep* commands perform similar functions and are largely identical in terms of usage. The following section lists the most important differences between these commands.

grep processes simple regular expressions.

fgrep processes strings only. However, you may specify several strings in one call. The strings can either be entered directly in the command line, separated by newline characters, or passed to *fgrep* from within a file.
fgrep is fast and compact and can search for a large number of strings. All specified strings are searched for in each individual line.

egrep processes extended regular expressions. Among other things, these include all simple regular expressions with one exception: the \(...\) construct used in simple regular expressions does not have a special meaning in extended regular expression syntax and is hence not processed by *egrep*.
Several regular expressions can be specified together, separated by newline characters. *egrep* interprets these newline characters as an OR operator (the vertical bar character; see section "Regular POSIX shell expressions" on page 897). The regular expressions can either be specified directly in the command line or passed to *egrep* via a file.

Locale The following environment variables affect the execution of *grep*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Exit status

0 Lines found

1 No line found

>1 Syntax error or “Cannot open file”. This exit status remains valid even if lines have been found in other input files.

Example The files *customer1* and *customer2* will be used as a basis for all following examples. Their contents are given below:

customer1:

```
080685    999.98  20 Units  Item  038   Johnson Ltd.
120387   1240.25   3 Units  Item  023   Skinner Ltd.
180588    330.87   1 Units  Item  332   Skinner Ltd.
```

customer2:

```
morrow lance, 86 sherwood street, london w1
skinner robert, 16 garden hill, london ec3
```

Example 1 Output lines that match a specified pattern (without an option and with option *-i*):

```
$ grep Skinner customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:180588    330.87   1 Units  Item  332   Skinner Ltd.
```

If you also wish to display lines containing the word *skinner* in lowercase you enter:

```
$ grep -i skinner customer1 customer2
customer1:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:180588    330.87   1 Units  Item  332   Skinner Ltd.
customer2:skinner robert, 16 garden hill, london ec3
```

More complicated patterns can be set up with the help of regular expressions, e.g.:

Display all 1994 entries from the file *customer1*; these are lines that contain the number 94 in columns 5 and 6:

```
$ grep '^....94' customer1
120394 1240.25   3 Units  Item  023   Skinner Ltd.
```

Example 2 Output lines that *do not* match the specified pattern (option *-v*):

```
$ grep -v '^1' customer1 customer2
customer1:080685    999.98  20 Units  Item  038   Johnson Ltd.
customer2:morrow lance, 86 sherwood street, london w1
customer2:skinner robert, 16 garden hill, london ec3
```

Example 3 Display the number of found lines (option *-c*):

First display the number of lines that start with 1 for each input file.

```
$ grep -c '^1' customer1 customer2
customer1:2
customer2:0
```

The number of lines that *do not* start with 1 are to be displayed next.

```
$ grep -c -v '^1' customer1 customer2
customer1:1
customer2:2
```

Example 4 Display file names only (option *-l*):

The names of files containing lines that begin with a 1 are to be output first.

```
$ grep -l '^1' customer1 customer2
customer1
```

The names of files containing lines that do not start with 1 are displayed next.

```
$ grep -l -v '^1' customer1 customer2
customer1
customer2
```

Example 5 Display found lines with their line numbers (option *-n*):

```
$ grep -n -i skinner customer1 customer2
customer1:2:120387   1240.25   3 Units  Item  023   Skinner Ltd.
customer1:3:180588    330.87   1 Units  Item  332   Skinner Ltd.
customer2:2:skinner robert, 16 garden hill, london ec3
```

See also *ed, egrep, fgrep, sed,*
stdio [4]

hash remember or report utility locations

The POSIX shell built-in *hash* has two functions:

– it can write the contents of the hash table on standard output or enter the specified command in the hash table (Format 1),
– it can delete the contents of the hash table (Format 2).

Each shell maintains its own hash table, in which it enters all commands that are invoked under their basic file names (basenames). Whenever you invoke a command under its basename, the shell first searches the hash table for your command. This accelerates the search process. If the command is not yet in the hash table of the current shell, it is entered there.

When you start a subshell, its hash table is empty. When you terminate the subshell, the parent shell returns with its own hash table, and the hash table of the subshell is deleted.

Syntax

Format 1: hash[␣name]...

Format 2: hash␣-r

Format 1 **Display or extend hash table**

hash[␣name]...

name
Basename of a command, an executable shell script, or an executable program. The shell searches for this file by examining the contents of the PATH variable. When the file is found, the following information is passed to *hash*:
– the appropriate relative path name in the form *./name* if the current directory is assigned to the PATH variable and contains *name*, or
– the absolute path name.

The *hash* command enters this path name into the hash table. If *name* is not present in any of the directories assigned to the *PATH* variable, an error message is issued.

The following cannot be specified for *name*:
– shell scripts for which you have no execute permission.
– commands with a *name* that includes a slash. This means that you cannot enter absolute or relative path names.
– shell built-ins, since they are subroutines of *sh* and thus do not have names that represent executable files.

By the same token, executable shell scripts and commands are not entered in the hash table unless they are invoked under their basenames.

name not specified:
The *hash* command writes the contents of the hash table on the standard output. The output can, for example, be structured as follows:

```
ls=/usr/bin/ls
cat=/usr/bin/cat
chmod=/usr/bin/chmod
```

Format 2 **Delete hash table**

hash␣-r

-r Deletes the contents of the hash table.

If you modify the value of the *PATH* variable, the contents of the hash table are automatically deleted. When you terminate the current shell, the hash table associated with this shell is also deleted.

You should always delete the contents of the hash table in the current shell in the following circumstances:

You have created an executable file in a directory *dira* whose path name is assigned to the *PATH* variable. Some other directory *dirb*, also specified in *PATH*, already contains an identically named command file which already appears in the current hash table. In this case the shell will always execute the older command, even if its directory (*dirb*) comes after the first one (*dira*) in the *PATH* variable.

Deleting the hash table with *hash -r* will cause the shell to execute the first command it finds the next time either of these commands is invoked. In other words, the sequence of the entries in the *PATH* variable will be the determining factor. The path name of the first command found is now entered into the hash table, i.e. your command will always be executed from now on when you invoke it under its basename.

Error *name*`: not found`
This error message may be produced for any of the following reasons:
– *name* is not contained in any of the directories whose respective paths have been entered in the *PATH* variable.
– *name* is actually contained in one of these directories, but is not executable.
– *name* is a shell built-in or a shell function.

Variable *PATH*
Search path of the shell

Locale

The following environment variables affect the execution of *hash*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

Display the contents of the hash table:

```
$ echo $PATH
/bin:/usr/bin:.
$ hash
cat=/usr/bin/cat
ls=/usr/bin/ls
```

Example 2

Add a command to the hash table:

```
$ hash cat
$ hash
cat=/usr/bin/cat
```

The command */usr/bin/cat* is now a new entry in the hash table.

Example 3 The following excerpt from a session demonstrates when the hash table is cleared:

```
$ hash
cat=/usr/bin/cat
ls=/usr/bin/ls
$ sh
$ hash
$ cp <file1> <file2>
...
$ ls
...
$ hash
cp=/usr/bin/cp
ls=/usr/bin/ls
$ exit
$ hash
cat=/usr/bin/cat
ls=/usr/bin/ls
```

The hash table in the new subshell is empty. When the subshell is terminated, the hash table of the parent shell becomes valid again, while that of the subshell is deleted.

hd hex dump

hd prints the contents of files in hexadecimal, octal or decimal notation or as character strings. It can also display the position of characters within a string.

Syntax **hd**[␣-format]...[␣**-A**][␣**-t**][␣**-s**␣offset[*****][**wlbk**]][␣**-n**␣count[*****][**wlbk**]][␣file]...

If no format, offset, and count is specified:

The output is identical to that of *hd -abx -A*, i.e. addresses and bytes are shown in hexadecimal. In addition, all bytes that represent printable characters are shown as such, and non-printing characters are represented by a dot. Addresses are displayed at the beginning of each line, followed by the hexadecimal representation of the bytes in the next few columns and the actual characters (with dots if required) on the right.

Addresses are calculated relative to the start of the file. If no file is specified, the standard input is read; otherwise, the contents of all specified files are listed.

-format

Format that determines how individual byte blocks are to be interpreted and output (see “Format description” on page 429).

-A (ASCII) All printable characters appear unaltered; non-printing characters are represented by a dot. The characters are shown in the column to the right of the first output format.

-t (text) If this option is set, *hd* will ignore all format options that do not affect addresses. Each text line is printed with the address shown at the start of the line. Long lines are folded (split). The notation for control characters (values 0x00 to 0x1f) is a caret followed by the corresponding character (^@ to ^_). Bytes with the high order bit set are shown with a preceding tilde (~), but without the high order bit itself. The caret, tilde and backslash characters are preceded by a backslash in the output. Some special cases are represented by numeric values, e.g. a 7-bit DELETE (127) character as \177, and an 8-bit DELETE (255) as \377, respectively.

-s␣offset[*****][**wlbk**]

Relative address at which printing of the file is to begin. If you do not specify a file or if you supply the input via a pipeline, a corresponding number of bytes will be skipped. *hd* will abort processing of the current file if you give it an invalid address.
The relative address consists of a number, which can be specified in decimal, hexadecimal (preceded by *0x*) or octal (preceded by *0*), and optionally a flag indicating a unit size directly after the number. The possible flags are:

w	2-byte units (i.e. one word)
l	4-byte units (i.e. one long word)
b	512-byte units (i.e. half of one Kbyte)
k	1024-byte units (i.e. one Kbyte)

You can mark the difference between a hexadecimal number that includes the digit *b* and the *b* flag by putting an asterisk (*) between the hexadecimal number and the *b* flag.

The following examples show how the offset can be specified:
-s 111 (111 bytes), *-s 124l* (496 bytes), *-s 0xa*b* (5120 bytes), *-s 011k* (9216 bytes).

-s␣offset[*][wlbk] not specified:
The output begins at the start of the file.

-n␣count[*][**wlbk**]
Number of bytes to be dumped. The *count* is specified in the same format as the offset, i.e. in decimal, hexadecimal or octal, followed by an optional *w*, *l*, *b* or *k* flag (see the *-s* option).

file
Name of the file to be dumped by *hd*. More than one file may be named.

file not specified:
hd reads input lines from standard input.

Format description

A format consists of the following components:
– the byte block option (*a*, *b*, *c*, *l* or *w*) and
– the method by which a byte block is to be interpreted in the output, i.e.: hexadecimal (*x*), decimal (*d*) or octal (*o*).

All specified interpretation methods are applied to all specified byte blocks in a format. Format options can be combined and repeated to display addresses, characters, words, etc. in various ways. For example, you could combine *-ax -bx* into *-abx*, or specify *-cxdo* to show all characters in hexadecimal, decimal, and octal.

Byte block options

a (address) Format option for addresses. Addresses are only interpreted by one method, i.e. in hexadecimal, octal, or decimal. The address is always shown at the start of each line to be displayed, or in the first line of an output block if multiple lines are required for the formats.

b (byte) Format option for byte.

c (character) Format option for characters. All printing characters are displayed. C-language escape sequences are output as defined in the language; all other characters are shown in octal, hexadecimal or decimal, depending on the interpretation method.

l (long word) Format option for 4 bytes.

w (word) Format option for 2 bytes.

Interpretation methods

x (hexadecimal) *hd* interprets addresses or byte blocks as hexadecimal numbers.

d (decimal) *hd* interprets addresses or byte blocks as decimal numbers.

o (octal) *hd* interprets addresses or byte blocks as octal numbers.

Without an interpretation method, but with a byte block option:
The format is interpreted as *-xdo*.

With no byte block option except for addresses:
hd uses *-bx* in addition to the specified address format.

Without a byte block option, but with an interpretation method:
The format is interpreted as *-acbwl*.

-format not specified:
hd acts as if *hd -abx -A* were specified.

See also *od*

head copy the first part of files

head copies the opening lines of a file to standard output. If no file is given, *head* reads from standard input.

Syntax

Format 1: head[␣**-n**␣number][␣file]

Format 2: head[␣**-**number][␣file]

Format 1 **head**[␣**-n**␣number][␣file]

-n␣number
Number of lines to be output. *number* must be a positive decimal number. The space ␣ between *-n* and *number* is optional.
-n␣number not specified:
The first 10 lines are output.

file Name of the input file. If more than one file is named, the files will be processed in the order in which they are listed, and the output of each file begins with:
==>*file*<==.

Format 2 **head**[␣**-**number][␣file]

-number
Number of lines to be output. *number* must be a positive decimal number.
-n␣number not specified:
The first 10 lines are output.

file Name of the input file. If more than one file is named, the files will be processed in the order in which they are listed, and the output of each file begins with:
==>*file*<==.

Locale The following environment variables affect the execution of *head*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example To see the first 5 lines of three files, you enter the *head* command as shown below:

```
$ head -5 file1 file2 file3
```

The first five lines of each of the three files are written to standard output as follows:

```
==>file1<==
Lines 1-5 of file 1

==>file2<==
Lines 1-5 of file 2

==>file3<==
Lines 1-5 of file 3
```

See also *cat*, *more*, *tail*

iconv code set conversion

iconv reads input characters from a file or from standard input, converts the encoding of these characters, and writes the results on the standard output.

The conversions that can be performed with *iconv* are defined in conversion tables located in the directory */usr/lib/iconv*.

iconv is typically used to convert characters from the ISO 8859-1 character set to an ISO 646 ASCII variant codeset for a particular language and vice versa (see Examples on page 434).

BS2000 You can use *iconv* for code conversions between ISO646 and EDF03, that is to say between ASCII 7-bit code and EBCDIC.

Syntax **iconv**␣**-f**␣fromcode␣**-t**␣tocode[␣file]

-f␣fromcode
-t␣tocode

iconv expects the conversion table to be in the file */usr/lib/iconv/fromcode.tocode.t*. Any character that does not exist in the target codeset is converted to an underscore '_'.

file Name of the file for which codeset conversion is to be performed.

file not specified:
iconv reads from standard input.

Error `Not supported xx to yy`
iconv does not support the requested conversion from codeset *xx* to target codeset *yy*.

File */usr/lib/iconv*
Directory containing the standard conversion tables for codeset conversion

/usr/lib/iconv/iconv_data
Auxiliary file for *iconv*

/usr/lib/iconv/.t*
Conversion tables

Locale

The following environment variables affect the execution of *iconv*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments). During translation of the file, this variable is superseded by the use of the *fromcode* option-argument.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

List all conversion tables:

```
$ ls /usr/lib/iconv

646.edf03.t    646es.8859.t  8859.646.t    8859.646es.t  8859.edf04.t
646da.8859.t   646fr.8859.t  8859.646da.t  8859.646fr.t  edf03.646.t
646de.8859.t   646it.8859.t  8859.646de.t  8859.646it.t  edf04.8859.t
646en.8859.t   646sv.8859.t  8859.646en.t  8859.646sv.t  iconv_data
```

Example 2

Convert the file named *letter* and save the result in a file named *letter.conv*. The conversion is to be made from the German variant of the ISO 646 codeset (ASCII derivative) to the target codeset ISO 8859-1:

```
$ iconv -f 646de -t 8859 letter > letter.conv
```

Example 3

You want to convert the contents of the file *bs2000* from ASCII to EBCDIC and write the result to the file *bs2000.conv*:

```
$ iconv -f 646 -t edf03 bs2000 > bs2000.conv
```

id return user identity

id writes the following on the standard output for the invoking process:
– the user ID (UID)
– the login name
– the group ID (GID)
– the group name.

If the effective and real IDs/names are not identical, both are printed.

Syntax

Format 1: id[␣**-a**][␣user]

Format 2: id[␣**-G**][␣**-n**][␣user]

Format 3: id[␣**-g**][␣**-nr**][␣user]

Format 4: id[␣**-u**][␣**-nr**][␣user]

Format 1 **id**[␣**-a**][␣user]

-a (all) In addition to the ID and login name of the user, *id* reports all the groups to which the invoking process belongs and all the groups to which the invoking user belongs.

user
Login name for which the information is output.
If *user* is specified and the process possesses the relevant access permission then the user ID and group ID of the selected user are output. In this case it is assumed that the effective and real IDs are identical. If the database lists more than one permitted group assignment for the user then these assignments are also output.

user not specified
If the *user* operand is not specified then *id* outputs the user and group IDs together with the corresponding login name and group name of the caling process at the standard output.

Format 2 **id**[␣**-G**][␣**-n**][␣user]

-G Only the various group IDs (effective, real and supplementary) are output in the format "%u\n". If more than one group assignment is present then all group assignments are output in the format "%u" before the newline character.

-n Outputs the name in the format "%s" instead of the format "%u".

user
see format 1

Format 3 **id**[␣**-g**][␣**-nr**][␣user]

-g Only the effective group ID is output.

-n Outputs the name as a string.

-r Only the real ID is output.

user
see format 1

Format 4 **id**[␣**-u**][␣**-nr**][␣user]

-u Only the effective user ID is output.

-n Outputs the name as a string.

-r Only the real ID is output.

user
see format 1

File *\/etc/group*
Group file containing group names and the associated group IDs and login names.

Locale The following environment variables affect the execution of *id*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

To check your current user ID, group ID, and their corresponding names, you enter:

```
$ id
```

id might then report the following:

```
uid=227(USER1) gid=100(USROTHER) groups=100(USROTHER)
```

See also

logname, newgrp, who,
getuid() [4]

info online diagnostic tool

info outputs POSIX subsystem characteristics during a POSIX session. In addition to general information relating to the status of the subsystem it supplies selected items of process information relating to the POSIX users in varying degrees of detail.

Ordinary POSIX users are shown information on the general status of the POSIX subsystem (option *-s*), on the POSIX control parameters (option *-t*) and on their own processes.
The POSIX administrator can also view information on any user process running on the system.

Syntax **info␣-d**|**␣-h**|**␣-s**|**␣-t**|**␣-p**[**␣-f**][**␣-u␣**user][**␣-g␣**gid][**␣-p␣**pid]

-d Produces a dump for the POSIX subsystem

-h Displays help

-p Concise information on all POSIX user processes

-s General information on the status of the POSIX subsystem

-t Lists the POSIX control parameters (see the manual “Basics for Users and System Administrators” [1])

-pf Full information on all POSIX user processes

-p␣-u␣user
Concise information on all processes belonging to *user*. *user* may be a login name or a user ID number (UID).

-p␣-g␣gid
Concise information on all processes with the group ID number *gid*.

-pf␣-u␣user
Full information on all processes belonging to *user*. *user* may be a login name or a user ID number (UID).

-pf␣-g␣gid
Full information on all processes with the group ID number *gid*.

-p␣-p␣pid
Detailed information on the process with the process ID number *pid*.

Example 1 A POSIX user requesting information about the POSIX subsystem:

```
$ info -s

GLOBAL SYSTEM INFORMATION:
init-TSN: 38YK
System status: System is activ !
Rootfsname: :POSX:$SYSROOT.FS.ROOT
Number of POSIX users (without 'init' and 'info'):
  TU users          : 6
  TPR users         : 0
  Connected tasks   : 6

$
```

Example 2 The POSIX administrator requesting information about POSIX user processes:

```
# info -p

PROCESSINFORMATION GENERAL:

USERNAME    PID    PPID   TU/TPR       TSN       SYSCALL
ROOT      18989       1   TU-Task      8RJZ            3
ROOT          1       0   TU-Task      38YK            0
ROOT         16       1    ------      8RJ5           87
ROOT         23       1    ------      8RKC            3
ROOT       9059    9043    ------      5YQU           54
ROOT      18001      16    ------      9VKQ           87
VSX0       7050    7039    ------      5W3F            3
:
#
```

ipcrm remove inter-process communication facilities

The command *ipcrm* can be used to remove one or more semaphores, message queues, shared memory or inter-process communication facilities (IPC facilities) from the system. These can be specified either by their identifiers or by the key with which each such IPC facility was created.

The identifiers and keys of IPC facilities can be listed with the help of the *ipcs* command (*ID* and *KEY* output columns). For more information on how a message queue, shared memory or semaphore is removed, refer to the *msgctl()*, *shmctl()* and *semctl()* functions in the manual “C Library Functions (BS2000/OSD)” [4].

Syntax

ipcrm[␣option]...

option

-q␣msgqid
(queue) Removes the message queue identified as *msgqid* from the system and destroys the data structures associated with it.

msgqid
Identifier of the message queue to be removed. This identifier is displayed by the *ipcs* command in the *ID* column.

-Q␣msgkey
(queue) Removes the message queue identifier *msgkey* from the system and destroys the data structures associated with it.

msgkey
Key of the message queue to be removed. This key is displayed by the *ipcs* command in the *KEY* column.

-m␣shmid
(memory) Removes the shared memory identified as *shmid* from the system and destroys the data structures associated with it.

shmid
Identifier of the shared semaphore set to be removed. This identifier is displayed by the *ipcs* command in the *ID* column.

-M␣shmkey
(memory) Removes the shared memory identified as *shmkey* from the system and destroys the data structures associated with it.

shmkey
Key with which the shared memory to be removed was created. This key is displayed by the *ipcs* command in the *KEY* column.

-s␣semid
(semaphore) Removes the semaphore set identified as *semid* from the system and destroys the data structures associated with it.

semid
Identifier of the semaphore set to be removed. This identifier is displayed by the *ipcs* command in the *ID* column.

-S␣semkey
(semaphore) Removes the semaphore set identified as *semkey* from the system and destroys the data structures associated with it.

semkey
Key with which the semaphore set to be removed was created. This key is displayed by the *ipcs* command in the *KEY* column.

Example

Use *ipcs* to first print a report on the status of the inter-process communication facilities and then remove the message queue with the identifier 40 from the system:

```
$ ipcs
IPC status from /dev/kmem as of Mon Mar 9 08:40:41 2009
T     ID     KEY         MODE        OWNER    GROUP
Message Queues:
q     40  0x0000004b -Rrw-rw-rw-  user1   usrother
Shared Memory:
Semaphores:
$ ipcrm -q 40
```

See also

ipcs
msgctl(), *msgget()*, *semctl()*, *semget()*, *semop()*, *shmctl()*, *shmget()* [4]

ipcs inter-process communication status

ipcs prints information about active inter-process communication facilities (IPC facilities).

You can specify options to control
- the type of IPC facilities for which information is to be displayed
- what information is to be shown.

Since the states of IPC facilities may change while *ipcs* is running, the displayed information is only current at the time of the request.

Syntax

```
ipcs[␣option]...
```

No option specified

ipcs prints information in short format for
- message queues
- shared memory
- semaphores

that are currently active in the system. The meanings of individual output columns are described in the section “Output” on page 444.

option

There are options for defining the type of IPC facility and options for defining the type of information.

Defining the type of IPC facility

-q (message queues) Prints information about active message queues.

-m (memory) Prints information about active shared memory.

-s (semaphores) Prints information about active semaphores.

If the *-q*, *-m* or *-s* option is set, only information about the corresponding IPC facility is shown. Any combination of these options is possible. If none of the options are specified, information on all types of IPC facilities will be displayed.

Defining the type of information

The following section describes the options that select the type of information to be provided for the IPC facilities specified by the *-q*, *-m* and *-s* options. See the "Output" on page 444 for the meaning of the individual output columns.

-a (all) Sets all options that print various types of information. This is a shorthand notation for *-b*, *-c*, *-o*, *-p* and *-t*.

-b (biggest) Prints the biggest allowable size for each respective IPC facility:
- For message queues: the maximum number of bytes in a message to be placed on the queue.
- For shared memory: the size of the memory segments.
- For semaphores: the number of semaphores in each set of semaphores.

-c (creator) Prints the user ID (login name) and group name of the creator of the IPC facility.

-o (outstanding) Prints information on outstanding IPC facilities, including:
- the number of messages on queue
- the total number of bytes in messages on queue
- the number of processes attached to a shared memory segment.

-p (process) Prints process number information, including:
- the process ID of the last process that sent a message
- the process ID of the last process that received a message
- the process ID of the process that created a shared memory segment
- the process ID of the last process that used a shared memory segment (attach, detach).

-t (time) Prints time information. The time of the last control operation that changed the access permissions for all IPC facilities is displayed:
- For message queues: time when the system call *msgrcv()* [4] (receive message from queue) or *msgsnd()* [4] (send message to queue) was last used.
- For shared memory: time when the system call *shmat()* [4] or *shmdt()* [4] was last used.
- For semaphores: time when the system call *semop()* [4] was last used on a semaphore.

Output

The column headings and the meanings of the columns in an *ipcs* listing are given below. The letters in parentheses (...) indicate the options which cause the corresponding heading to appear. *all* means that the heading always appears.

CBYTES (a,o)
: The number of bytes in messages currently outstanding on the associated message queue.

CGROUP (a,c)
: The group name to which the creator of the IPC facility belongs.

CREATOR (a,c)
: The user ID (login name) of the creator of the IPC facility entry.

CTIME (a,t)
: The time when the associated entry was created or changed.

GROUP (all)
: The group name of the group to which the owner of the IPC facility belongs.

ID (all)
: The identifier for the IPC facility.

KEY (all)
: The key used as an argument when creating the IPC facility with *msgget()* (create message queue) or *semget()* (create semaphore set).

LRPID (a,p)
: The process ID of the last process to receive a message from the associated queue.

LSPID (a,p)
: The process ID of the last process to send a message to the associated queue.

MODE (all)
: The IPC facility access modes and status indicators. The mode consists of 11 characters that are interpreted as follows:

  The first character is:

  S if a process is waiting on a *msgsnd()*
  D if the shared memory segment in question was detached. The character disappears when the shared memory segment is detached by the last process that was attached to it.
  – if a process is not waiting on a *msgsnd()*.

The second character is:

R if a process is waiting on a *msgrcv()*
C if the shared memory segment is cleared on executing the first attach.
− if a process is not waiting on a *msgrcv()*.

The next 9 characters are interpreted as three sets of three bits each:
– The first set refers to the access permissions of the owner of the IPC facility.
– The second set represents the access permissions of others belonging to the same user group as the owner of the IPC facility entry.
– The third group refers to the access permissions of all other users.

Within each set, the first character indicates permission to read, the second character indicates permission to write or alter the IPC facility entry, and the last character is currently unused.

The permissions are specified as follows:

r if read permission is granted
w if write permission is granted
a if permission to alter the IPC facility entry is granted
− if the indicated permission is not granted.

NSEMS (a,b)
The number of semaphores in the associated semaphore set.

OTIME (a,t)
The time the last semaphore operation was completed on the associated semaphore set.

OWNER (all)
The user ID (login name) of the owner of the IPC facility entry.

QBYTES (a,b)
The maximum number of bytes allowed in messages outstanding on the associated message queue.

QNUM (a,o)
The number of messages currently outstanding on the associated message queue.

RTIME (a,t)
The time the last message was received from the associated message queue.

STIME (a,t)
The time the last message was sent to the associated message queue.

NATTCH (a,o)
The number of processes attached to the shared memory segment involved.

SEGSZ (a,b)
The size of the shared memory segment involved.

CPID (a,p)
: The process ID of the process that created the shared memory segment.

LPID (a,p)
: The process ID of the last process that used a shared memory segment (attach, detach).

ATIME (a,t)
: The time at which the last attach on the shared memory segment involved was completed.

DTIME (a,t)
: The time at which the last detach on a shared memory segment was completed.

T (all)
: Type of IPC facility:

q	stands for message queue
m	stands for shared memory
s	stands for semaphore.

File *etc/group*

The */etc/group* file contains a list of all created group names.

Example The *server* program sets up a message queue. You first start this program in the background and then check the status of the inter-process communication facilities with *ipcs*:

```
$ server &
$ ipcs
IPC status from /dev/kmem as of Mon Mar 09 08:40:41 2009
T     ID     KEY         MODE        OWNER    GROUP
Message Queues:
q     40  0x0000004b -Rrw-rw-rw-  user1   usrother
Shared Memory:
Semaphores:
```

See also *ipcrm*
msgctl(), *msgget()*, *semctl()*, *semget()*, *semop()*, *shmctl()* [4]

jobs display status of jobs in the current session

jobs writes to the standard output. It provides information about the specified jobs or, if *job-id* is missing, all active jobs.

Syntax

jobs[␣**-l**|**p**][␣**-n**][␣job-id]...

-l Lists process IDs in addition to the normal information.

-p Lists only the process group.

-n Lists only the jobs which have already been completed.

job-id
Information about the specified jobs is output. The section *jobs* in the chapter "Entering commands from the POSIX shell" contains a description of the format of *job-id*.

job-id not specified: Information about all active jobs is output.

Locale

The following environment variables affect the execution of *jobs*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Exit status

0 if execution is successful

>0 if an error occurs

See also *bg, fg, kill, wait*

join relational database operator

join compares two files on the basis of relations ("join fields") and joins all pairs of lines with identical join fields. The result is displayed on the standard output.

When *join* is invoked, a join field on which the files are to be compared must be specified for each of the two files. Each field is bounded by a pair of field separators. *join* compares each line in the first file with lines in the second and displays one output line on the standard output for each pair of lines with identical join fields. The output line comprises specific fields from both lines.

i Before the call:
Each input file must be sorted so that the join fields are arranged in the currently valid collating sequence (see *sort*). If the default field separator is used (*join* without the *-t* option), leading separators must be ignored (see *sort* (page 706) option *-b*) when the files are sorted. However, if you invoke *join* with option *-t*, leading field separators must be taken into account when sorting the files (see *sort* (page 706) without option *-b*).

Syntax

Format 1: join[␣**-a**␣n|␣**-v**␣n][␣**-e**␣string][␣**-o**␣list][␣**-t**␣c][␣**-1**␣field]
[␣**-2**␣field]␣file1␣file2

Format 2: join[␣**-a**␣n][␣**-e**␣string][␣**-j**␣field][␣**-j1**␣field][␣**-j2**␣ field]
[␣**-o**␣list...][␣**-t**␣c]␣file1␣file2

The formats are described together since the option *-j␣field* in format 2 corresponds to the options *-1␣field -2␣ field* in format 1. *-j1␣field* is equivalent to *-1␣field* and *-j2␣ field* is equivalent to *-2␣ field*.

No option specified

The first field in a line is the default join field for both files; the default separators are blanks, tabs, and newline characters. Multiple field separators count as one field separator, and leading separators are ignored.
join displays one output line on the standard output for each pair of lines with identical join fields. Each output line consists of the following entries in the given order:

– the common field
– the rest of the line from the first file
– the rest of the line from the second file

The default output field separator is a blank.

option

-a␣n
(additional output) in addition to the normal output, *join* outputs all the lines of the *n*th input file whose comparison field does not match any comparison field in the other file. You may enter 1 or 2 for *n*. If you require output for both files enter *-a␣1 -a␣2*.

Option *-a* and option *-v* must not both be specified.

-v␣n
Instead of the standard output, a line is generated for each line in *n* for which no match is found. *n* may be 1 or 2. If you enter both *-v␣1* and *-v␣2* then all the lines for which there is no match are output.

-e␣string
(empty output fields) Replaces empty output fields with the specified string.

-j[n]␣m
The *m*th field is specified as the comparison field for the *n*th file. You may enter 1 or 2 for *n*; *m* must be a whole number greater than or equal to 1.
If you do not specify the option *-j* for the other file then the comparison field for this other file is the 1st field.

n not specified:
The join field for both files is the *m*-th field.

-j not specified:
The join field for both files is the first field.

-o␣list
(output format)*join* changes the **o**utput line format, so that each output line comprises the individual fields specified in *list*. The common field is not printed unless you explicitly specify it in *list*.

The *list* you specify must consist of elements in the form *n.m*, where *n* is either 1 or 2, and *m* is greater than or equal to 1. Each element in the form *n.m* stands for the *m*th field in the *n*th file. Individual elements must be delimited by blanks or tabs.

-t␣c
Defines character *c* as a field separator for both input and output lines. Each occurrence of *c* is interpreted as a field separator, i.e.
– two consecutive *c* separators designate an empty field, and
– a leading *c* is significant and designates an empty first field.

In addition, the newline character acts as a field separator for the input lines.
The default field separators (blanks and tabs) are interpreted as field separators only if you specify them as a value for *c*.

-1␣field
Joins the field *field* from file 1. The fields are decimal whole numbers starting with 1.

-2␣field
Joins the field *field* from file 2. The fields are decimal whole numbers starting with 1.

file1 file2
Names of the two files to be joined on the basis of common fields by *join*.
If you use a dash (-) as the name for *file1*, *join* reads from standard input.

> **i** If the files are not sorted on their join fields, *join* will not process all lines!
>
> Problems may arise if a numeric file name (e.g. 1.2) is specified for *file1* and the *-o* option is used immediately before this file name is listed. To avoid such conflicts, a numeric file name should be preceded by a slash (e.g. ./1.2).

Locale The following environment variables affect the execution of *join*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the collating sequence *join* expects to have been used when the input files were sorted.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 In the file *place*, a place is assigned to a name. In the file *amount*, an amount and a date are assigned to the same names. Both files are sorted by name. *join* is to join the two files on the names:

Contents of *place*:

```
Albert Buffalo
Hugh Washington
Irene Philadelphia
```

Contents of *amount*:

```
Albert   287.56  20.03.94
Hugh      23.15  25.06.93
Hugh     167.87  16.12.93
Irene   1212.12  12.12.94
Irene      1.98  01.01.94
```

Join the two files on the first join field:

```
$ join place amount
Albert Buffalo 287.56 20.03.94
Hugh Washington 23.15 25.06.93
Hugh Washington 167.87 16.12.93
Irene Philadelphia 1212.12 12.12.94
Irene Philadelphia 1.98 01.01.94
```

Join the two files and format in columns with *awk*:

```
$ join place amount | awk '{printf("%-10s %-15s %-10s %-10s\n",$1,$2,$3,$4)}'
Albert    Buffalo           287.56    20.03.94
Hugh      Washington         23.15    25.06.93
Hugh      Washington        167.87    16.12.93
Irene     Philadelphia     1212.12    12.12.94
Irene     Philadelphia        1.98    01.01.94
```

Example 2 In the file *city*, a name is assigned to a city. In the file *amount* (see Example 1), an amount and a date are assigned to a name. *city* is sorted by cities, *amount* by names. *join* is to join the two files on the names.

Contents of *city*:

```
Buffalo      Albert
Buffalo      Frank
Washington   Hugh
New York     Eric
Philadelphia Irene
```

In this example, the join field for *city* is field 2, while that of *amount* is field 1.
Before the files are joined, *city* must be sorted on field 2. The output is subsequently formatted into columns with *awk*:

```
$ sort -b +1 city | join -j1 2 - amount | \
> awk '{printf("%-10s %-15s %-10s %-10s\n",$1,$2,$3,$4)}'
Albert     Buffalo         287.56     20.03.94
Hugh       Washington      23.15      25.06.93
Hugh       Washington      167.87     16.12.93
Irene      Philadelphia    1212.12    12.12.94
Irene      Philadelphia    1.98       01.01.94
```

See also *awk*, *comm*, *sort*, *uniq*

kill terminate or signal processes

The *kill* command sends the specified signal to a set of processes indicated by a process number (PID). The *ps* command can be used to find the process number of any process to which you want to send a signal.

Syntax

Format 1: kill[␣**-**signal]␣pid␣...

Format 2: kill␣**-s**␣signal␣pid␣...

Format 3: kill␣**-**signal␣**-**pgid␣...

Format 4: kill␣**-l**␣[exit-status]

Format 1 **Send signals to processes**

kill[␣**-**signal]␣pid␣...

-signal

Signal to be sent to the processes. This signal can be given in the form of a number or a symbolic name. The symbolic signal name is the name as it appears in the header file *<sys/signal.h>*, without the SIG prefix. A list of these names can be printed with the *-l* option.

Any signal defined in the header file *<sys/signal.h>* may be specified. The signals with the signal numbers and symbolic names below are significant on command level:

1 - SIGHUP
Halt if the user hangs up

2 - SIGINT
Interrupt via DEL

3 - SIGQUIT
Quit

9 - SIGKILL
Kill, terminate process unconditionally

15 - SIGTERM
Software termination, terminate process gracefully

The symbolic name 0 which represents the signal value zero is also recognized.

signal not specified:
kill sends the signal SIGTERM (15) to the specified processes. This will normally kill processes that do not catch or ignore the signal.

pid
: Number (ID) of the process to which a signal is to be sent.
Users can only send signals to their own processes. The POSIX administrator can send signals to all processes.

Current process IDs can be listed with the *ps* command.

A *pid* value of 0 has a special meaning: the signal is sent to all processes in your process group.

Format 2 **Send signals to processes**

kill␣**-s**␣signal␣pid␣...

-s␣signal
: Signal to be sent to the processes. This signal can be given in the form of a number or a symbolic name. The symbolic signal name is the name as it appears in the header file <*sys/signal.h*>, without the SIG prefix. A list of these names can be printed with the *-l* option.

Format 3 **Send signals to process groups**

kill␣**-**signal␣**-**pgid␣...

-signal
: Signal to be sent to the processes of a process group. This signal can be given in the form of a number or a symbolic name. The symbolic signal name is the name as it appears in the header file <*sys/signal.h*>, without the SIG prefix. A list of these names can be printed with the *-l* option.

-pgid
: The signal is sent to all processes with process group ID *pgid*.

Users can only send signals to their own processes.
The POSIX administrator can send signals to all processes.

If you specify a value of *1* for *pgid*, the designated *signal* will be sent to every process whose real user ID matches the effective user ID of the *kill* command. As privileged user you send the signal to all processes, with the exception of a number of system processes.

Format 4 **List symbolic signal names**

kill␣-l␣[exit-status]

-l A list of all symbolic signal names is printed.

exit-status
Signal number or exit status of a process which is terminated by a signal.

Error `no such process`
You specified an invalid value for *pid*.

`no such process group`
You specified an invalid value for *pgid*.

File *<sys/signal.h>*
Header file in which the symbolic names of signals are defined.

Locale The following environment variables affect the execution of *kill*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The signal SIGKILL (9) is used to terminate process number 312:

```
$ kill -9  312
```

Example 2 The following example outputs the status of a terminated job:

```
job
stat=$?
if [ $stat -eq 0 ]
then      echo job completed successfully.
elif [ $stat -gt 128 ]
then      echo job terminated by signal SIG$(kill -l $stat).
else      echo job terminated with error code $stat.
fi
```

In order to prevent the possibility that either a signal number or a process group may be specified in the presence of a start argument which contains a negative number and thereby cause an ambiguity, ISO POSIX-2 DIS requires that the former case is always assumed. Therefore if the default signal is to be sent to a process group (e.g. 123), the application must use a command which resembles the following:

```
kill -TERM -123
kill -- -123
```

See also *ps, trap*
kill(), signal() [4]

last display last logged in users

The *last* command allows you to display the last (and currently) logged in users. It displays the user name, the terminal name, the remote host name (if available) and the login and logout times.

Syntax **last** [**-n** number] [**-f** filename] [**-a**] [name | tty]

-n number
Maximum number of records to be displayed. By default all records will be displayed.

-f filename
Name of the wtmpx/utmpx file to be used; default: */var/adm/wtmpx*.

-a Alternative output layout; the host name will be output in the rightmost column. Thus the host name will not be truncated in case of fully qualified DNS names.

name | tty
Only records concerning the specified user or terminal name are output.

i A special record with the user name `reboot` is written at POSIX startup time.

File */var/adm/wtmpx*
File with all currently and previously logged in users..

/var/adm/utmpx
File with all currently logged in users.

Example 1 Show all information from */var/adm/wtmpx*:

```
$ last
froede    pts/1       mch7509d.mch.fsc Tue May 10 13:00   still logged in
FROEDE    pts/0       MCH4987D         Tue May 10 13:00   still logged in
TSOS      term/001    ~                Mon May  9 12:46 - 12:58 (1+00:11)
TSOS      term/002    ~                Fri May  6 10:47   still logged in
TSOS      term/002    ~                Wed May  4 21:53 - 21:55  (00:02)
SYSROOT   sf/003      ~                Wed May  4 21:39 - 21:39  (00:00)

...

SYSROOT   sf/002      ~                Thu Apr 21 20:41 - 20:41  (00:00)
reboot    ~           ~                Thu Apr 21 20:40

/var/adm/wtmpx begins Thu Apr 21 20:40
$
```

Example 2 Show all information on currently logged in users:

```
$ last -f /var/adm/utmpx
froede    pts/1        mch7509d.mch.fsc Tue May 10 13:00   still logged in
FROEDE    pts/0        MCH4987D         Tue May 10 13:00   still logged in
TSOS      term/002     ~                Fri May  6 10:47   still logged in
reboot    ~            ~                Thu Apr 21 20:40

/var/adm/utmpx begins Thu Apr 21 20:40
$
```

Example 3 Show login information on user FROEDE in alternative output format:

```
$ last -a froede
froede    pts/1        Tue May 10 13:00   still logged in
mch7509d.mch.fsc.net
FROEDE    pts/0        Tue May 10 13:00   still logged in  MCH4987D
FROEDE    term/001     Wed May  4 10:28 - 10:34  (00:06)   ~
FROEDE    pts/0        Mon May  2 17:10 - 15:27 (1+22:17)  MCH4987D
FROEDE    term/002     Fri Apr 29 13:06 - 13:08  (00:02)   ~

/var/adm/wtmpx begins Thu Apr 21 20:40
$
```

Example 4 Show information on the last reboot:

```
$ last reboot
reboot    ~            ~                Thu Apr 21 20:40

/var/adm/wtmpx begins Thu Apr 21 20:40
$
```

See also *who*

let integer arithmetic

The built-in shell command *let* provides integer arithmetic. Calculations are performed using *long* arithmetic. Constants are represented in the form [*base*#]*n* where *base* is an integer between 2 and 36 which specifies the base and *n* is a number accompanying this base. If *base* is not specified, calculations are performed in base ten.

Syntax

Format 1: **let**␣argument␣...

Format 2: **((**argument**))**␣...

Format 1 **let**␣argument

argument
Each argument is an arithmetic expression. The results obtained on evaluation are output.

Format 2 **((**argument**))**

Since many of the arithmetic operators must be quoted for the POSIX shell, an alternative form of the *let* command is provided. For any command which begins with a double left parenthesis *((*, all the characters until a matching double right parenthesis *))* are treated as a quoted expression. Thus *((a=a+b))* is equivalent to *let "a=a+b"*.

Arithmetic evaluation

An arithmetic expression uses much the same syntax, precedence, and associativity as the C language. All the integral operators, other than ++, --, *?:*, and the comma are supported. Variables can be referenced by name within an arithmetic expression without using the parameter substitution syntax (the $ character). When a variable is referenced, its value is evaluated as an arithmetic expression.

An internal integer representation of a variable can be specified as an attribute with the *-i* option of the built-in *typeset* command. Arithmetic evaluation is performed on the value of each assignment to a variable with the *-i* attribute. If you do not specify an arithmetic base, the first assignment to the variable determines the arithmetic base. This base is used when parameter substitution is performed.

Exit status

0 if the value of the last expression was not equal to 0

1 otherwise.

Error
```
sh:<expr>: bad number
```
Incorrect expression

Example The following example illustrates a simple arithmetic operation. Both *let* notations are used.

```
$ let var=10
$ echo $var
10
$ ((var=var-3))
$ echo $var
7
```

lex generate programs for lexical tasks

lex generates a C program from a *file* which contains the "*lex* source text" which you have developed for the problem in hand. A *lex* source text consists of a maximum of three sections: Definitions, rules and user functions. The rules specify the patterns which are searched for in an input text and the action which is taken if a pattern is found. The definitions and user functions are optional.

lex generates a file with the name *lex.yy.c*. If *lex.yy.c* is compiled and linked with the Lex library, it copies the input to the output unless a pattern specified in the file is found. In this case the corresponding program text is executed. The pattern which has been matched is located in *yytext[]*, an external character field. Checking and matching of the input file is performed for the search patterns in sequence.

Syntax **lex**[␣**-ctvnV**][␣**-Q**[**y**|**n**]][␣file ...]

options

-c represents the use of C responses and is the default

-t the program is written to the file *lex.yy.c*, not to the standard output

-v provides a two line statistical summary

-n prevents the printout of the summary generated by *-v*

-V outputs version information at the standard error output

-Q[**y**|**n**]
determines whether or not version information is to be output to the output file `lex.yy.c`. *y*|*n* stands for a yes/no argument in whatever language environment is set. In an English-language environment you enter *-Qy* to have version information written to *lex.yy.c* and *-Qn* to suppress the version information. In a German-language environment, for example, you would use *-Qj* or *-Qn* (for *ja* or *nein*).
By default, no version information is output.

file Input file. Multiple files are treated as a single file.

file not specified
If no file is specified the standard input is used.

Some standard table sizes are too small for some users.The table sizes for the automatons which are finally generated can be set in the definition section:

`%p` *n*	Number of positions is *n* (default 2500)
`%n` *n*	Number of statuses (default 500)
`%e` *n*	Number of nodes on syntax tree is *n* (1000)
`%a` *n*	Number of transitions is *n* (2000)
`%k` *n*	Number of packed character classes is *n* (2500)
`%o` *n*	Size of output field is *n* (3000)

The use of one or more sizes automatically entails the option *-v* if the option *-n* is not used.

The rules section of *file* starts with the delimiter *%%*. In the rules section you can define local variables for *yylex()*. In the rules section, all lines which start with a space or a tab and precede the first rule are copied to the start of the function *yylex()* directly after the first left-hand parenthesis.

Each rule consists of a regular expression which describes a pattern which is to be located and actions which are to be performed if the pattern is found. Input text which corresponds to no search pattern is passed on unchanged to the input file by *lex*. A regular expression consists of text characters with or without additional operators.

The following operators can be used with *lex*

`\x`	x
`"xy"`	xy, even if x and/or y are lex operators (except \)
`[xy]`	x or y
`[x-z]`	x, y or z
`[^x]`	any character except x
`.`	any character except newline character
`^x`	x at line start
`<y>x`	x if lex is in start status y
`x$`	x at line end
`x?`	x once or not at all
`x*`	empty string or multiple occurrences of x
`x+`	one or more occurrences of x
`x{m,n}`	m to n occurrences of x
`xx|yy`	xx or yy
`x |`	the action of x is also the action for the next rule
`(x)`	x
`x/y`	x if y follows
`{xx}`	substitution for xx from definition section

Special tasks can be performed in the action section of a rule. To this end, *lex* provides the following macros:

input()	another character is read from the input stream
unput()	a character is deferred for a later read process

output()	a character is written to the output stream

You can redefine these macros yourself if you want to control input/output yourself. In this case, ensure that consistency is maintained.

Apart from the storage of detected patterns in *yytext[]* there are other ways of processing detected text patterns using *lex* functions:

yymore()	Newly recognized characters are appended to those which are already present in *yytext[]* (*yytext[]* is normally overwritten with the next character to be found).
yyless(*n*)	Only the first *n* characters in *yytext[]* are considered.
REJECT	Strings which overlap or which are partially contained in other strings are processed. *REJECT* jumps directly to the next rule without modifying the contents of *yytext[]*.

Hint

If a *lex* program is linked with *c89* [5], then *-ll* must be specified as the archive parameter.

Locale

The following environment variables affect the execution of *lex*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If any of the internationalisation variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If set to a non-empty value, override the values of all the other internationalisation variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions. If this variable is not set to the POSIX locale, the results are unspecified.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files), and the behavior of character classes within regular expressions. If this variable is set to the POSIX locale, the results are unspecified.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

See also

yacc

ln link files

ln creates links to existing files or directories. This allows you to access these files and/or directories under various file names or path names (see *Functionality*).

To make a link with *ln*, you need write permission for the directory in which the link is to be entered.

There are two types of link:

– Hard link:
  When you create a hard link to a file, there are multiple directory entries for this file, either in one directory or in different directories, but the physical file is only present once. The inode for each file contains a link counter which is decremented by one when a link is removed. The file itself is not deleted until all links to it have been removed.
  A hard link cannot be used to refer to a directory or to files on different file systems.

– Symbolic link:
  A symbolic link is a file that contains a path name. When the shell encounters a file name that represents a symbolic link, it replaces this name with the specified path name. Thus what you access is not the symbolic link, but the file to which the path name points.
  You can set up symbolic links to any files or directories, even to those on different file systems.

Syntax

Format 1: ln[␣option]␣source␣target

Format 2: ln[␣option]␣source␣...␣targdir

Format 3: ln␣-s␣source␣target

Format 4: ln␣-s␣source␣...␣targdir

Format 1 **Make a hard link**

ln[␣option]␣source␣target

ln makes a new link named *target* to the file named *source*. The file can then be accessed under both names, i.e. *source* and *target*.

No option specified
  If there is already a file with the same name as the new link and you do not have write permission for it, *ln* will display its access permissions and ask you to confirm whether or not the link should be made. The link will not be created unless your answer begins with *y* (see *target* (page 464) and Example 2 on page 470).

  Caution!
  If the standard input is not a terminal, no confirmation is requested and the link is not made.

option

-f (force) If a file named *target* already exists, *ln* creates the link without asking questions, regardless of whether or not you have write permission for the file.

-n If a file named *target* already exists, its contents are not overwritten.
The *-f* option overrides this option.

source
Name of the file to which you want to make a link. The file must already exist when you call *ln*. You are not allowed to specify a directory as the *source*.

target
Name of the link that you wish to make to *source*. *target* can be a simple file name (basename) or an absolute or relative path name:

a basename:
ln enters the basename *target* in the current working directory.

an absolute or relative path name in the form *prefix/name*:
ln enters the basename *name* in the directory identified as *prefix*.

If there is already a file named *target* and you have write permission for it, *ln* creates the link without asking questions. In other words, the name *target* now references *source*, and not the file originally called *target*; and if *target* was the only link to (i.e. name of) the original file, the contents of the original file are deleted.
If you do not have write permission for the original *target*, *ln* asks you if you really want it to make the link (see option *-f* and Example 2 on page 470).

If the parent directory of *target* is writable but has the sticky bit set, one of the following conditions must be fulfilled in order to for *target* to be created:
– the file must be owned by the user
– the directory must be owned by the user
– the user must have write permission for the file
– the user must be a privileged user.

This format of *ln* cannot be used to create links that span different file systems. Such links can be made using the *-s* option (see *Format 3* on page 466 and *Format 4* on page 466).

Format 2 **Make a hard link with the same name in another directory**

ln[␣option]␣source␣...␣targdir

ln creates a link to the file (or files) named *source* in another directory named *targdir*. The file can then be accessed in two different directories under the same basic file name (basename).

No option specified
If there is already a file with the same name as the new link to be created, and if you do not have write permission for it, *ln* will display its access permissions and ask you to confirm whether or not the link should be made. The link will not be created unless your answer begins with *y*.

⚠ **Caution!**
If the standard input is not a terminal, no confirmation is requested and no link is created.

option

-f (force) If *targdir* already contains a file named *source*, *ln* creates the link without asking questions, regardless of whether or not you have write permission for it.

-n If a file named *source* already exists in *targdir*, its contents are not overwritten.
The *-f* option overrides this option.

source
Name of the file to which you want to make a link. The file must already exist when you call *ln*. You are not allowed to make links to directories. You can name any number of files in one call. The specified *source* can be a file basename or an absolute or relative path name:

a basename:
ln enters the basename *source* in the named *targdir*.

an absolute or relative path name in the form *prefix/name*:
ln enters the basename *name* in the named *targdir*.

If there is already a file with the basename *source* in *targdir* and you have write permission for it, *ln* creates the link without asking questions. In other words, the link now references *source*, and not the file in *targdir* originally called *source*; and if *source* was the only link to (i.e. name of) the original file, the contents of the original file are deleted.

If you do not have write permission for the original file in *targdir*, *ln* asks you if you really want it to make the link (see option *-f* and Example 2 on page 470).

targdir
Name of the directory in which the link is to be entered. The directory must already exist.

This format of *ln* cannot be used to create links that span different file systems.

Format 3 **Make a symbolic link**

ln␣**-s**␣source␣target

ln -s makes a symbolic link named *target* to the named *source*, where *source* can be a file or a directory. The main difference with *ln -s* is that it creates symbolic links, which can span different file systems. This is not possible with hard links.

source
: Name of the file or directory to which a symbolic link is to be made. *source* may be specified as any path name and need not exist. It may also reside on a different file system from *target*.

target
: Name of the symbolic link that you wish to make to *source*. *target* can be a file basename or an absolute or relative path name:

  a basename:
  ln enters the basename *target* as a symbolic link in the current working directory.

  an absolute or relative path name in the form *prefix/name*:
  ln enters the basename *name* in the directory identified as *prefix*.

  If a file named *target* already exists, an error message is returned (see *Error* on page 468). The existing file is not overwritten.

Format 4 **Make a symbolic link with the same name in another directory**

ln␣**-s**␣source␣....␣targdir

For each file or directory that is specified as *source*, *ln* creates a symbolic link in the directory *targdir*. These links can span different file systems.

source
: Name of the file or directory to which you want to make a symbolic link. You can name any number of sources in one call.
  The specified *source* can be an absolute or relative path name:

  an absolute or relative path name in the form *prefix/name*:
  ln enters the basename *name* in the directory *targdir* as a symbolic link to *prefix/name*.

  If *targdir* already contains a file with the same basename as *name*, an error is returned (see page 468), and the existing file is not overwritten.

targdir
: Name of the directory in which the symbolic links are to be created. This directory must exist.

Functionality

- Hard links

  When *ln* makes a link to a file, the basic file name (basename) associated with the link is entered in the appropriate directory. This entry receives the same inode number as the original file name. Thus, both file names have the same inode, and consequently the same attributes (access permissions, owner, dates, etc.). The physical file referenced by the file names is only present once, but the user can now access the same file under different file or path names (see Example 1 on page 469).

  The inode number indicates whether two file names are linked to the same file (see *ls -i* on page 492); the number of links shows you how many directory entries exist for the file (see *ls -l* on page 492).

  The *rm* command can be used to remove an entry (link) from a directory. If there was more than one link to the file, it can still be accessed under the remaining names. *rm* does not delete the file itself until the last link (i.e. name) is removed.

- Symbolic links

  A symbolic link is a file that contains a path name. These path names can be listed with the command *ls -l*. When the shell encounters a file name that represents a symbolic link, it replaces this name with the specified path name. In other words, one path name is mapped to another. There is no link counting mechanism in this case; when a symbolic link is removed, the file containing the path name is deleted.
  The inode of the physical file that is referenced by a symbolic link does not contain any information about the link. The link counter only keeps track of hard links. This means that if you delete the target of a symbolic link, the link will continue to exist, but will now refer to a file having no contents and no inode.
  Symbolic links are not restricted by file system boundaries, and the path names contained in them may refer both to files and to directories.

  Symbolic links can be shown with the *ls* command:

  – *ls -l* indicates which files in the specified directory are symbolic links. The contents of each symbolic link, i.e. the path name of the referenced file, are shown following the file name and the symbol '->'.

  – *ls -L* provides information on the file or directory that is referenced by the symbolic link.

  Operations involving '..' (such as 'cd ..') in a directory that is symbolically linked will reference the original directory, not the target.

Error

```
ln: Cannot link <source> to <target>: Permission denied
```

ln cannot create the named *link*, since you do not have write permission for the directory in which the link is to be entered.

```
ln: cannot access <file>: no such file or directory
```

ln cannot access the named *file*, either because it does not exist or because you have no execute permission (x bit) for a directory that appears in the path name of *file*.

```
ln: <dir> is a directory
```

You have specified the directory *dir* instead of a file. *ln* only establishes hard links to regular files, special files, or FIFO files, not to directories.

```
ln: are on different file systems
```

You have tried to create a link to a file and enter it in a different file system. *ln* does not create hard links across file systems; try using the *-s* option.

```
ln: cannot create
ln: File exists
```

You have tried to use the *-s* option to create a link named *file* in a directory, but there is already a file under the same name in that directory.

Locale

The following environment variables affect the execution of *ln*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 User Pat is the owner of the files *frogs* and *snails*, both of which are in the directory */HOME/PAT*. Mary is to now work with these files as well. To continue working in her own directory and save herself the bother of entering long path names, Mary establishes links to these files in her own directory */HOME/MARY*. To be able to do this, she has to have:

– write permission for her own directory */HOME/MARY*
– execute permission for Pat's directory */HOME/PAT*:

To be able to read and modify the files, Mary also needs read and write permission for the files themselves. In our example these conditions are met if Mary is a member of the group *proj* (see below).
The fastest way for Mary to set up the links is to call *ln* in Format 2:

```
$ ln /HOME/PAT/frogs /HOME/PAT/snails /HOME/MARY
```

The same result can be achieved by calling *ln* twice in Format 1:

```
$ ln /HOME/PAT/frogs /HOME/MARY/frogs
$ ln /HOME/PAT/snails /HOME/MARY/snails
```

As is evident from the following *ls* calls, *ln* has entered the file names *frogs* and *snails* in the directory */HOME/MARY*. The number of links to the files has been incremented by 2 (*ls -l*). The *ls -i* calls show that the file names *frogs* and *snails* have the same inode numbers in both directories.

```
$ ls -l /HOME/MARY
total 6
-rw-rw----   2 PAT      proj          34   Mar 09 15:08 frogs
-rw-rw----   2 PAT      proj        1217   Mar 09 18:59 snails

$ ls -i /HOME/PAT/frogs /HOME/MARY/frogs
16435 /HOME/PAT/frogs
16435 /HOME/MARY/frogs

$ ls -i /HOME/PAT/snails /HOME/MARY/snails
 4766 /HOME/PAT/snails
 4766 /HOME/MARY/snails
```

The *ls -l* call above shows that Pat is still the owner of the files. Pat can at any time cancel Mary's right to use the files, e.g. by saying:

```
$ chmod 600 frogs snails
```

If Mary wants to create links with different names, she has to call *ln* twice in Format 1.

```
$ ln /HOME/PAT/frogs /HOME/MARY/sugar
$ ln /HOME/PAT/snails /HOME/MARY/spice
```

Example 2 The following examples shows you what happens if you call *ln* in Format 1 when there is already a file with the chosen link name:

In the current working directory there are three file names: *letter*, *list* and *text*. *letter* is a link to file1, *list* and *text* are links to file2. You do not have write permission for file2:

```
$ ls -l
total 3
-rw-r--r--   1  BRIAN    other     57  Jul 17 14:29 letter
-r--r--r--   2  NEIL     other    103  Jul 16 15:30 list
-r--r--r--   2  NEIL     other    103  Jul 16 15:30 text
```

You now enter:

```
$ ln letter list
ln: list: 444 mode (y/n) ?n
```

You answered *n*, so *ln* does not make the link.

If you have write permission for file2, *ln* makes the link without asking questions:

```
$ ls -l
total 3
-rw-r--r--   1  BRIAN    other     57  Jul 17 14:29 letter
-rw-rw-rw-   2  NEIL     other    103  Jul 16 15:30 list
-rw-rw-rw-   2  NEIL     other    103  Jul 16 15:30 text
$ ln letter list
$ ls -l
total 3
-rw-r--r--   2  BRIAN    other     57  Jul 17 14:29 letter
-rw-r--r--   2  BRIAN    other     57  Jul 17 14:29 list
-rw-rw-rw-   1  NEIL     other    103  Jul 16 15:30 text
```

As *ln* has created a link named *list* for *letter* (file1), *list* is now a link to file1, and no longer to file2. *text* is now the only link to file2.

```
$ ln letter text
$ ls -l
total 3
-rw-r--r--   3  BRIAN    other     57  Jul 17 14:29 letter
-rw-r--r--   3  BRIAN    other     57  Jul 17 14:29 list
-rw-r--r--   3  BRIAN    other     57  Jul 17 14:29 text
```

Now *text* is also a link to file1; file2 no longer exists.

Example 3 User Norbert needs a quick and simple way to access the directory of his colleague Andrea (*/HOME2/ANDREA*) from his own directory (*/HOME/NORBERT*). He therefore creates the following symbolic link by calling *ln* in Format 3:

```
$ ln -s /HOME2/ANDREA /HOME/NORBERT/andr
```

Norbert can now use the symbolic link *andr* to directly access Andrea's directory from his own directory, even though her directory resides on another file system:

```
$ ls -lL andr
total 16
drwxr-xr-x   2 ANDREA   usrother    2560 Feb 27 13:20 PASCAL
drwxr-xr-x   2 ANDREA   usrother    2048 Mar  5 17:32 COURSES
drwxr-xr-x   2 ANDREA   usrother     512 Mar  5 12:07 LETTERS
drwxr-xr-x   2 ANDREA   usrother     512 Feb 26 10:05 bin
-rw-r-xr-x   1 ANDREA   usrother     148 Feb 20 09:28 testprog
```

Example 4 User Norbert has created the directories *letters89*, *letters90* and *letters91* in his home directory */HOME/NORBERT*:

```
$ ls /HOME/NORBERT
letters 89  letters 90  letters 91
```

He now wants direct access from */HOME/NORBERT/letters91* to the other two directoris. To do this, he creates two symbolic links by calling *ln* in Format 4:

```
$ cd /HOME/NORBERT
$ ln -s /HOME/NORBERT/letters 89 /HOME/NORBERT/letters90 letters91
$ cd letters91
$ ls -og letters??
lrwxrwxrwx   1     25 Mar  6 12:42 letters89 -> /HOME/NORBERT/letters89
lrwxrwxrwx   1     25 Mar  6 12:42 letters90 -> /HOME/NORBERT/letters90
$ ls letters90
offers      letter.henry  letter.nigel  text
```

See also *chmod, cp, ls, mv, rm*
link(), readlink(), stat(), symlink() [4]

locale get locale-specific information

The *locale* command writes information about the current locale or other public locales to the standard output. In the following section, a public environment is an environment provided by the implementation that the application can access.

If *locale* is called without any arguments, it summarizes the current locale for each environment category as determined by the settings of the environment variables.

If the command is called with operands, it outputs values assigned to the keywords in the environment categories as follows:

– If a keyword name is specified, the keyword as well as the category containing the keyword is output.

– If a category name is specified, the category as well as all the keywords contained in it are output.

Syntax

Format 1: locale[␣**-a**|␣**-m**]

Format 2: locale[␣**-ck**]␣name...

options

-a Outputs information about all available public locales. The locales available include POSIX.

-c Outputs the selected environment categories (see “Standard ouptput (stdout)” on page 473).
The *-c* option improves legibility if several categories are selected (e.g. using several keyword names or a category name). This option is valid with or without the specification of the *-k* option.

-k Outputs the names and values of the selected keywords.

-m Outputs the character map name.

name
The name of the environment category (see *localedef* on page 476), the name of a keyword in an environment category or the reserved name *charmap*. The specified category or the specified keyword can be specified as *name* operands in any order.

Locale

The following environment variables have an effect on the execution of *locale*:

LANG	Specifies a default value for the locale variable that is unset or null. If *LANG* is unset or null, the corresponding locale default value is used. If the locale variable contains an invalid setting, locale behaves as if no variables had been set.

LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

File

Standard ouptput (stdout)

If *locale* is called without options or operands, the names and values of the *LANG* and *LC_** environment variables are written to the standard output. One line is used for every variable, *LANG* is output first. Only variables set in the environment and not overwritten by *LC_ALL* are output in the following format:

```
"%s=%s\n", variable_name, value
```

The names of the *LC_** variables not set in the environment or overwritten by the *LC_ALL* variable are output in the following format:

```
"%s=\"%s\"\n", variable_name, implied_value
```

implied_value is the name of the locale selected by the implementation for this category based on the values in *LANG* and *LC_ALL*.

value and *implied_value* are enclosed in single quotes so they can be reused as an entry some time in the future.
value is not enclosed in double quotes (to differentiate it from *implied_value*, which is always enclosed in double quotes).

The *LC_ALL* variable is output last, using the first format outlined above. If this variable is not set, it is output in the following format:

```
"LC_ALL=\n"
```

The following points apply when specifying arguments:

1. If the *-a* option is set, the names of all the public locales are output in the following format:

   ```
   "%s\n", locale_name
   ```

2. If the *-c* option is specified, the names of all the selected categories are output in the following format:

   ```
   "%s\n", category_name
   ```

   If keywords were also selected, these are output immediately after the category to which they belong.

   If the *-c* option is not specified, only the keywords and not the category names are output.

3. If the *-k* option is specified, the names and values of the selected keywords are output. If the value is non-numeric, it is output in the following format:

   ```
   "%s=\"%s=\"\n", keyword_name, keyword_value
   ```

   For the *charmap* keyword, the name of the character map is output if a character map was specified using the *localedef -f* option during the creation of the locale. *charmap* is used as *keyword_name* here.

   Numeric values are output in one of the following formats:

   ```
   "%s=%d\n", keyword_name, keyword_value
   "%s=%c%o\n", keyword_name, escape_character, keyword_value
   "%s=%cx%x\n", keyword_name, escape_character, keyword_value
   ```

   escape_character is the character defined by the *escape_char* keyword in the current locale (see XBD specification, Section 5.3, Locale Definition [15]).

   Keyword values that are combined (list entries) are separated by semicolons in the output. If the keyword values contain semicolons, double quotes, backslashes, and/or control characters, these characters are escaped using a preceding escape character.

4. If the *-k* option is not specified, the values of all the keywords are output in the following format:

   ```
   "%s\n", keyword_value
   ```

   For the *charmap* keyword, the name of the character map is output (if available).

5. If the *-m* option is specified, a list of all the available character maps is output in the following format:

   ```
   "%s\n", charmap
   ```

   The output can be used as an argument for the *localedef -f* option.

Exit status

0 All the information requested was found and output.

>0 An error occured.

Example The examples are based on the following locales:

```
LANG=locale_x
LC_COLLATE=locale_Y
```

The *locale* command would have the following output:

```
LANG=locale_x
LC_CTYPE="locale_x"
LC_COLLATE=locale_Y
LC_TIME="locale_x"
LC_NUMERIC="locale_x"
LC_MONETARY="locale_x"
LC_MESSAGES="locale_x"
LC_ALL=
```

The `LC_ALL=POSIX locale -ck decimal_point` command would create the following output:

```
LC_NUMERIC
decimal_point="."
```

The following command shows a *locale* application that can be used to determine whether a response entered by a user is a yes-response (affirmation):

```
if printf "%s\n" "$response" | grep -Eq "$(locale yesexpr)"
then
      affirmative processing goes here
else
      non-affirmative processing goes here
fi
```

See also *localedef*

localedef define local environment

The *localedef* command converts source definitions for locales into a format that can be used by the functions and commands whose operational behavior is determined by the setting of the locale variables. This format is defined in the XBD specification, Chapter 5, Locale [15].

Every POSIX system user has the facility to create new locales locally. However, only a user with the appropriate privileges (usually system administrators) can install these locales on the system so that they can be used by functions, applications, and commands. This is done either by copying the files created locally to `/usr/lib/locale/`*`name`* and `/usr/lib/charmap/`*`charmap`*.

localedef reads source definitions for one or more of the categories in the locales, which belong to the same locale, from the file specified with the *-i* option (if specified), or from the standard input.

The *name* operand indicates the target environment. The command supports the creation of locales which are "public" (i.e. can be accessed generally), as well as locales which are private (i.e. with restricted access rights). On POSIX systems, only users with the appropriate privileges can create or alter general access locales.

Every category source definition is indicated by the name of the accompanying environment variable and is terminated with an `END` *category-name* instruction. The following categories are supported:

LC_CTYPE	Defines character classification and case conversion.
LC_COLLATE	Defines collation rules.
LC_MONETARY	Defines the format and symbols used for the formatting of monetary information.
LC_NUMERIC	Defines the decimal point, the thousands separator and radix character and the grouping symbol for the editing of non-monetary numeric information.
LC_TIME	Defines the format and contents of date and time specifications.
LC_MESSAGES	Defines the format and values of yes/no responses (affirmations and negations).

Syntax

localedef[␣**-c**][␣**-f**␣charmap][␣**-i**␣sourcefile]␣name

options

-c Creates an output file, even if warning message is output.

-f␣charmap

Specifies the pathname of a file which contains an assignment of the symbolic character symbols and collating element symbols to the actual character coding (character map). The *charmap* format is described in X/Open CAE Specification, System Interface Definitions [15]. This option must be specified if symbolic names are used that were not defined using the collating-symbol key word.

-f not specified:
The character assignment defined in the */usr/lib/charmap/posix* file (ISO 8859-1) is used.

-i␣sourcefile

The pathname of a file which contains the source definitions.

-i not specified:
The source definitions of the default input are read. The format of the input file is described in X/Open CAE Specification, System Interface Definitions [15].

name

Specifies the locale. The use of this name is described in X/Open CAE Specification, System Interface Definitions [15].

- If *name* contains one or more slashes, *name* is interpreted as a pathname, in which the definitions created for the locales are saved.
- If *name* does not contain a slash, the locale is private, and is generated in the current directory.

Because only one name can be specified, the only categories that can be processed in a call are those that belong to the same locale.

Locale

The following environment variables have an effect on the execution of *localedef*:

LANG	Provide a default value for the internationalisation variables that are unset or null. If *LANG* is unset or null, the corresponding locale default value is used. If any of the internationalisation variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the vaules of all the other internationalisation variables.
LC_COLLATE	(This variable has no affect on *localedef*; the POSIX locale will be used for this category.)

LC_CTYPE	Determines the locale for the interpretation of sequences of bytes of text data as characters (e.g. single-byte as opposed to multibyte characters in arguments and input files). This variable has no affect on the processing of *localedef* input data; the POSIX locale is used for this purpose, regardless of the value of this variable.
LC_MESSAGES	Determines the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determines the location of the message catalogs for the processing of *LC_MESSAGES*.

File

Standard input

If the *-i* option is not specified, the standard input must be a text file containing one or more source definitions for categories for locales, as described in the XBD specification, Section 5.3, Locale Definition [15]. If lines are continued using the escape mechanism, there is no length restriction for the entire input line

Input files

The file containing the description of a character set (charmap argument in *-f*) is described in X/Open CAE Specification, System Interface Definitions [15]. If a source definition of a category for an locale contains the copy instruction (as described in X/Open CAE Specification, System Interface Definitions [15]) and this instruction specifies a valid locale, *localedef* behaves as if the source definition contained a valid source definition of the category for the locale specified.

Output files

The format of the created output corresponds to the format of the internationalization database on POSIX systems:

name if slashes are contained) or *./name* (without slashes) is the pathname of a directory containing the following newly generated files:

LC_COLLATE	File with collating informationn
LC_CTYPE	File with information on the character type (ctype)
LC_MONETARY	File with monetary information
LC_NUMERIC	File with numeric information
LC_TIME	File with date and time information
LC_MESSAGES	Directory with message information
LC_MESSAGES/Xopen_info	File with yes/no information

loc_info	File with information on the name and path of the character map

A copy of the character map is also created in `/usr/lib/charmap`, if the *-f* option is used.

Exit status

The following exit values are transferred:

0 No errors occurred and the locales were successfully created.

1 Warnings were output, but the locales were created successfully nonetheless.

2 The locale specification exceeded implementation limits or the coded character set or sets used were not supported by the implementation. No locale was created.

4 Warnings occurred and no output was created.

Error

If an error is detected in the input file, no output file is created.

If warnings occur, an output file is created provided that the *-c* option was specified. The following conditions will cause warning messages to be output:

– A symbolic name not contained in the *charmap* file was used for the description of the *LC_CTYPE* or *LC_COLLATE* categories (for other categories this causes an error condition).

– The number of operands for the order keyword exceeds the `{COLL_WEIGHTS_MAX}` limit.

– The source contains optional keywords which are not supported by the implementation.

Hint

The character map definition is optional, and is not contained in the locale definition. This allows both completely self-defined source files and generic sources (applicable to more than one coded character set). To aid portability all character map definitions must have the same symbolic name for portable character sets. As described in X/Open CAE Specification, System Interface Definitions [15], it depends on the relevant implementation whether users or applications can use additional character set description files. Therefore, the *-f* option might only operate correctly if a *charmap* supported by the implementation is specified.

See also

locale
X/Open CAE Specification. System Interface Definitions [15]

logger log messages

The *logger* utility allows logging of information in the file */var/adm/logger* for later use by the POSIX administrator. The locations of the saved messages, their format and retention period are all unspecified.

This utitlity is useful for determining why non-interactive utilities have failed.

Syntax

```
logger␣string
```

string
: One of the string arguments whose contents are concatenated together, in the order specified, separated by single space characters.

  string appears in the output (see Example below).

Locale

The following environment variables affect the execution of *logger*:

LANG	Provide a default value for the internationalisation variables that are unset or null. If *LANG* is unset or null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalisation varibles contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalisation variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error. (This means diagnostics from *logger* to the user or application, not diagnostic messages that the user is sending to the system administrator.)
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

A batch application, running non-interactively, tries to read a configuration file and fails; it may attempt to notify the POSIX administrator with:

```
logger myname: unable to read file foo. [timestamp]
```

See also *mailx, write*

logname return user’s login name

logname writes the user's login name on the standard output.

Syntax

```
logname
```

File

/etc/profile
File that is evaluated by each login shell. It is used for setting a shell environment, depending on the contents of the LOGNAME (login name of the user) environment variable passed by login. This file is created by the POSIX administrator.

Locale

The following environment variables affect the execution of *logname*:

LANG	Provide a default value for the internationalisation variables that are unset or null. If *LANG* is unset or null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalisation varibles contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalisation variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

You log in under the login name POSUSER1 and then display this login name.

```
$ logname
POSUSER1
```

See also

env, id, who

logrotate change logging files of the syslog daemon

The *logrotate* command enables logging files to be changed. *logrotate* analyzes the configuration file of the syslog daemon (by default */etc/syslog.conf*), searching in it for all logging files which are used by the syslog daemon. *logrotate* creates copies of these logging files whose file names are formed from the original file names with the suffix “0”. If copies exist from previous changes of the logging files, the suffix in each name is incremented by 1, beginning with the name that is numerically highest. In other words <logfile>.<n> becomes <logfile>.<n+1>, ..., <logfile>.0 becomes <logfile>.1 and <logfile> becomes <logfile>.0. A maximum of four preceding logging files (suffixes ".0" through ".3") are stored. Older logging files are deleted.

The current <logfile> file is not deleted, but emptied after copying.

The syslog daemon is then caused to close the open logging files and to open new ones.

The `logrotate -n 1` command is called automatically when the POSIX subsystem is terminated and started.

Further information is provided in the sections “POSIX logging files” in the POSIX manual “Basics for Users and System Administrators” [1].

Syntax

logrotate [**-f** config_file] [**-n** line_num]

-f With this option the configuration file must be specified if a configuration file other than */etc/syslog.conf* was defined for the syslog daemon, e.g. by changing its *rc* scripts.

-n Execution of *logrotate* is restricted to files which contain at least the specified number of lines.
(Default: 4 lines).

File

/usr/sbin/logrotate

/etc/syslog.conf

lp send files to a printer

With *lp* you can:

– have files printed on a printer (print job)
– select the RSO printer or printer group on which a print job is to be run
– have a header page printed
– modify printer options for print jobs

lp associates a print job with each named file. If no file is specified, the data to be printed is expected from the standard input. The files are printed in the order in which they are listed. *lp* assigns a unique job number (request ID) to each print job and writes this number on the standard output. This number can be used later to cancel or abort a print job or to have status information on the print job displayed.

Currently printing jobs and jobs which have already been submitted, but not yet started, can be aborted or cancelled with *cancel*.

Information on the status of print jobs can be displayed with *lpstat*.

Syntax **lp**[␣**-c**][␣**-d**␣dest][␣**-n**␣copies][␣**-s**][␣**-o**␣par] ...[␣**-t**␣title][␣file...]

No option specified
The specified files are printed on any free printer in the default printer group (normally ALL).

option

-c (c - copy) *lp* makes copies of the specified files when invoked and then prints these copies.
The *-c* option is always implicitly enabled.

-d␣dest
Chooses *dest* as the RSO printer or printer group that is to do the printing. If the printer group includes more than one printer, the job (or request) will be printed on the first available printer in the group.
dest can be given as the name of any RSO printer or printer group.

The names of legal RSO printer or printer groups can be listed with the command *lpstat -a*.

-d␣dest not specified:
If the environment variable *LPDEST* is set, its value is used. If *LPDEST* is undefined, the print job is printed on a printer in the default printer group. This is either printer group ALL or the user/terminal-specific printer group.

-n␣copies

This option defines how many copies of the files are to be printed. *copies* can be any integer that falls within an effective range from 1 to 99.

-n␣copies not specified:
copies defaults to 1.

-o␣`par`

par can be used to set any or all of the print parameters *line-spacing, control-char-pos* and *control-mode* or selects the print parameters for the output of PostScript files.
If these parameters are to be used in combination, the *-o␣par* option must be specified for each parameter.

The parameters can have the following values:

```
line-spacing = 1 | 2 | 3 | *s[td] | *e[bcdic] | *a[sa] | *i[bm]

control-char-pos = *std | <int 1..2040>

control-mode = *pa[ge-mode] | *li[ne-mode] | *lo[gical-mode] | *ap[a] |
               *ph[ysical]
postscript | ps
```

If the print parameters *line-spacing, control-char-pos* or *control-mode* are specified, the values are passed through to the corresponding operands of the BS2000 PRINT-DOCUMENT command (DOCUMENT-FORMAT), siehe Handbuch „Commands“ [11] .

If there are control characters in the file being printed (such as *\f* for form feed), they will be interpreted only if both of the following conditions are met:

– the file is being printed on an RSO printer

– the *control-mode* parameter is set to **line-mode* or **physical*

If *control-mode* is not specified, any control characters in the file will be represented as non-printing characters (smudge characters).

When the *postscript* (or *ps*) parameter is specifed, the BS2000 print parameters for outputting PostScript files are set. The other printer parameters are then not meaningful. The printer selected must be able to print PostScript files.

-s (s - silent) Suppresses the message "`request id is <request-id>`" from the *lp* command.

-t␣title

(t - title) Prints the specified *title* on an additional header (banner) page.

file | -

Name of the file to be printed. More than one file may be specified. If you name a number of files, they are printed in the order in which you list them.

If you use a dash (-) as the name for file, *lp* reads from standard input and creates a temporary file in the `/var/spool/lp/temp` directory.

For each file to be printed, *lp* issues a message in the form:

```
request id is <request-id> (<basename>)
```

<`request-id`> is output in the format "`TSN-nnnn`", where *nnnn* is the BS2000 TSN.

<`basename`> is the basename of *file*, i.e. the part of the path name which comes after the last slash ("/").

When *lp* reads from standard input, the message is:

```
request id is printer group-id (standard input)
```

file not specified:
lp reads from standard input.

Error

```
lp: can't access the file "file"
lp: Make sure file names are valid
lp: No (or empty) input files.
```

You do not have read permission for *file*, or *file* does not exist. The print job for *file* is rejected.

```
lp: standard input is empty
lp: request not accepted
```

You omitted the file name or used a dash (-) instead, but you have not entered anything from standard input. The job has consequently been rejected.

```
lp: Requests for destination "XYZ" aren't being accepted.
lp: Use the "lpstat -a" command to see why this destination is not
accepting requests.
```

The printer group XYZ that you specified for *dest* when calling *lp* with the *-d* option is not a valid RSO printer or printer group.

It may also be that the environment variable *LPDEST* is assigned the value XYZ. Unless explicitly specified otherwise, this value will then be substituted for *dest* for all *lp* calls.

```
lp: unrecognized option "-x"
```

An invalid option, *-x* in this case, has been used.

File

*/var/spool/lp/temp/**
Temporary file *lp* creates when reading from standard input.

Variable *LPDEST*
Name of a printer group (class of printers).
-d␣$LPDEST is the default when *-d␣dest* is not specified.

Locale The following environment variables affect the execution of *lp*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME Determine the format and contents of date and time strings displayed in the *lp* banner page, if any.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Three files, *t1*, *t2* and *t3*, are to be printed. Three copies each of files *t2* and *t3* are required.

```
$ lp t1 -n 3 t2 t3
request id is TSN-153D (t1)
request id is TSN-153E (t2)
request id is TSN-1540 (t3)
```

lp issues a message for each file to be printed.

Example 2 Two files, *t1* and *t2*, are to be printed. Two printer groups, G001 and G002, are defined. The value of the environment variable *LPDEST* is G001.
t1 is to be printed on printer group G001; *t2* on G002:

```
$ lp t1
request id is TSN-234A (t1)
$ lp -dG002 t2
request id is TSN-234C (t2)
```

Since the environment variable *LPDEST* is set to G001, the printer group need not be specified for *t1*. If *LPDEST* were undefined or assigned some value other than G001, the command would be written as follows:

```
$ lp -dG001 t1
$ lp -dG002 t2
```

See also *cancel*, *lpstat*

lpstat report line printer status information

lpstat outputs information about the current status of all requests submitted with *lp*.

Nonprivileged users are shown information relating only to print jobs submitted under their own login names.
Privileged users ($TSOS) are shown information relating to all print jobs.

Currently printing jobs and jobs which have already been submitted can be aborted or canceled with *cancel*.

Syntax **lpstat**[␣**-drst**][␣**-a**[list]][␣**-c**[list]][␣**-o**[list]][␣**-p**[list]][␣**-u**[list]][␣ID....]

No option specified

lpstat prints the following information of all the user's print requests made by *lp* on standard output:

- the job number assigned by *lp* when invoked,
- the login name of the job originator,
- the size of the file to be printed (in bytes),
- if a job is currently printing, the name of the RSO printer on which the job is being running.

option

list can be a list of items separated from one another by a comma, or a quoted list of items separated from one another by a comma or one or more blank characters, or combiniton of both.

-a[list]
Write the acceptance status of destinations for output request.
The *list* argument is a list of intermixed RSO printer names and class names.

-c[list]
Write the class names and their members.
The *list* argument is a list of class names.

-d Write the system default destination for output request in the following format:

```
system default destination: *CENTRAL
```

-o[list]
Write the status of output requests.
The *list* argument is a list of intermixed RSO printer names, class names and request IDs.

-p[list]
Write the status of printers.
The *list* argument is a list of RSO printer names.

-r Write the status of the line printer request scheduler: `scheduler is running`

-s Write a status summary, including the status of the line printer scheduler, the system default destination, a list of class names and their members:

```
scheduler is running
system default destination: *CENTRAL
```

-t Write all status information (see Example 2 on page 490).

-u[list]
Write the status of output requests for users.
The *list* argument is a list of login names.
As a nonprivileged user you are only allowed to specify your own login name.

ID A request *ID*, as returned by *lp*.

Variable *TZ*
Defines the time zone within date and time specifications.

Locale The following environment variables affect the execution of *lpstat*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
LC_TIME	Determine the format of date and time strings output when displaying line printer status information with the *-a, -o, -p, -t* or *-u* options.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Information of all submitted and currently running printing jobs:

```
$ lpstat
TSN-6XDZ QM212JNA 12837 *ACT LE       *CENTRAL HP
```

Example 2 Output of all status information

```
$ lpstat -t
scheduler is running
system default destination: *CENTRAL
DROS336  accepting requests
DRS03    accepting requests
DR9001   accepting requests
DR9022   accepting requests
EMDRS001 accepting requests
:
:
TC12G002 accepting requests
DROS336   9001RP     idle
DRS03     9022RP     idle
EMDRS003  9022RP     stopped
EMDRS016  9022RP     idle
LB        HP-PRINT   printing
LC        HP-PRINT   printing
LD        HP-PRINT   printing
LE        HP-PRINT   printing
MDRS05    9001RP     idle
:
TSN-6XK4 QM212JNA 329853 *ACT LE       *CENTRAL HP
```

See also *lp*, *cancel* [12]

ls list directory contents

ls is used to obtain detailed information on files and directories. The type, scope and output format of the displayed information can be specified by setting various options.

Syntax **ls**[␣option]...[␣file]...

No argument specified

ls lists the names of files and directories in the current working directory. The output is sorted in alphabetical order.

No option specified

file is a directory:
ls lists the names of the files and directories in it using a single-column output format. The output is sorted in alphabetical order. The only files not listed are those which begin with a dot, such as *.profile*.

file is a file:
ls displays the name of the file. You can use a partially qualified file name. If an asterisk (*) is specified for *file*, all files and directories (and their contents) are listed.

option

-a Lists all file names, including those that begin with a dot.

-b Non-printing characters in file names are represented in the octal notation *\ddd*, where *ddd* is the octal value of the character (see *Tables and directories, EBCDIC character set*).

-c Together with option *-l*
Lists time of last modification of the inode (file created, mode change, etc.) instead of the time at which the file was last modified.

Together with option *-t*:
ls uses the time of last modification of the inode as the sort criterion instead of the time of last modification of the file.

-C Multi-column output with entries sorted down the columns in alphabetical order. The default is one entry per line of output.

ls uses the environment variable *COLUMNS* to determine the number of character positions per line. If this variable is not set, the value of the environment variable *TERM* is checked in the terminfo database in order to determine the number of columns. If this information cannot be obtained, 80 characters per line are assumed.

-d If *file* is a directory, *ls* lists its name (not its contents). This option is often used together with *-l* in order to obtain information on the status of the directory. If *file* is omitted, *ls* outputs a period for the current directory.

-f Forces each argument to be interpreted as a directory and lists the entries of each directory in the order in which they appear. If no argument is specified, the entries in the current directory are listed. This option turns on the *-a* option and turns off options *-l*, *-t*, *-F*, *-s* and *-r*.

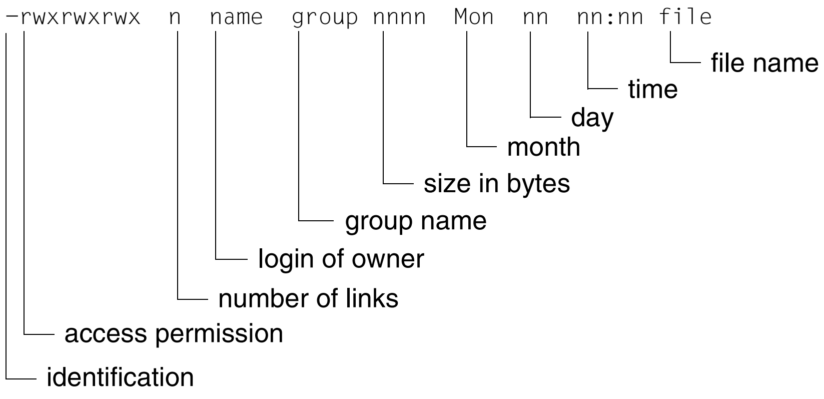
-F Puts a slash (/) after each file name if the file is a directory, an asterisk (*) if the file is declared as an executable, a commercial at symbol (@) if the file is a symbolic link, a vertical bar | if it is a FIFO file.

-g Has the same effect as *-l*, except that the owner is not printed.

-i Prints the unique identification number (inode number) for each file in the first column of the report.

-l A list of detailed information is provided in long format for each file.

This information is displayed as shown below:



```
-rwxrwxrwx  n  name  group nnnn  Mon  nn  nn:nn file
```

Identification

d	for a directory
l	for a symbolic link
b	for a block special file
c	for a character special file
m	for a shared data (memory) file
p	for a FIFO file (named pipe)
s	for a semaphore
-	for an ordinary file

Access permissions

3 sets of 3 characters each provide information on the permissions of
- the file owner (characters 1 to 3),
- users belonging to the same group (characters 4 to 6),
- other users (characters 7 to 9).

Each set uses the following codes:

Position 1:

r	for read permission or - for no read permission.

Position 2:

w	for write permission or - for no write permission.

Position 3:

x	for execute permission
s	for execute permission with s bit set
t	for execute permission with t bit (sticky bit) set
T	for no execute permission with t bit (sticky bit) set
S	for the l bit (set-user-ID bit set, execute permission not set)
-	for no execute permission with no special bit set

If the s bit (set-user-ID mode) is set for the owner or the group and the corresponding x bit (execute permission) is also set, the *x* will be replaced by an *s*. The s bit cannot be set without the corresponding x bit.

In the case of group permissions, an *S* may occupy the position of the x bit if the l bit is set for the file, i.e. if mandatory locking has been enabled for the file. Neither the x bit nor the s bit can be set for the group in this case.
If the l bit is set for a file, a program using the *lockf()* function can lock read and write access to the file for as long as it is accessing that file (see *chmod*).

For `others` permissions, the position of the x bit may be occupied by a *t* or *T*. These refer to the state of the sticky bit (t bit): *t* stands for set sticky bit with x bit, *T* for set sticky bit without x bit (see *chmod*).

Number of links
Decimal number indicating the number of links to the file; at least 1.

Login of owner
Login name of the file owner.

Group name
Group name of the file owner.

Size in bytes
Decimal number that indicates the file size in bytes.
If a special file is listed, the major device number and the minor device number are displayed instead of the file size.

Month, day, time
Indicates the date and time of the last modification to the file. If the last modification was made more than six months ago, the year is output instead of the time.

File name
Name of the file.

In the case of directories, the size of the entire directory is displayed in addition to the individual file sizes. This size is specified in 512-byte blocks (see Example 4 on page 497).

If the file or directory is a symbolic link, the file name is printed followed by an arrow '->' and the pathname of the referenced file.

Note that in a Remote File Sharing environment, you may not always have the permissions indicated by the output of the *ls -l* command.

-L With symbolic links, the link name is listed rather than the name of the original file or directory.

Example

```
$ ls -l
-rw------- 1   HUGO     other       7593   Nov 30 10:48 file
-rw------- 1   HUGO     other          3   Dec 17 10:53 linker -> file

$ ls -lL
-rw------- 1   HUGO     other       7593   Nov 30 10:48 file
-rw------- 1   HUGO     other       7593   Nov 30 10:48 linker
```

-m Lists files across the page (stream output format), separated by commas. *ls* uses an environment variable, *COLUMNS*, to determine the number of character positions per line. If this variable is not set, the value of the environment variable *TERM* is checked in the terminfo database in order to determine the number of columns. If this information cannot be obtained, 80 columns are assumed per line.

-n Same effect as *-l*, except that the user ID and the group ID are displayed instead of the login and group names.

-o Same effect as *-l*, except that the group is not displayed.

-p Puts a slash (/) after each file name if the file is a directory.

-q Non-printing characters in file names are represented by question marks.

-r Reverses the sorting order.

-R If *file* is not specified:
All files and directories in the current directory are listed, followed by a recursive listing of all subdirectories and the files contained in them.

if *file* is specified *file* is the name of a directory.

The names of all files and subdirectories of the specified directory are listed recursively.

-s Prints the size of each file in column 1 (in 512-byte blocks) in addition to the file names.

-t Sorts by time last modified instead of by file name (latest first).

-u Together with option *-t*
Uses the time of last access as the sort criterion.

Together with option *-l*
The time of last access is displayed instead of the time of last modification.

-x Multi-column output with entries sorted across instead of down the page. *ls* uses the environment variable, *COLUMNS*, to determine the number of character positions per line. If this variable is not set, the value of the environment variable *TERM* is checked in the terminfo database in order to determine the number of columns. If this information cannot be obtained, 80 characters per line are assumed.

-1 Prints only one entry per line of output.

file
Name of the file or directory for which you want information to be listed. You can also name more than one file or directory.

file not specified:
The contents of the current directory will be listed.

File *etc/group*
Contains all the groups that have been set up.

Variable *COLUMNS*
Determine the user's preferred column position width for writing multiple text-column output. If this variable contains a string representing a decimal integer, the *ls* utility calculates how many pathname text columns to write (see *-C*) based on the width provided. The column width chosen to write the names of files in any given directory will be constant. Filenames will not be truncated to fit into multiple text-column output.

TZ
Determine the timezone for date and time strings written by *ls*.

Locale The following environment variables affect the execution of *ls*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the collating sequence of the output from *ls*.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments). It determines which characters are defined as non-printing characters in conjunction with the *-q* option.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_TIME	Determine the format and contents of date and time strings when the *-g, -l, -n,* and *-o* options are used.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Listing the contents of the current directory in long format. User's login name: *HUGO*.

```
$ ls -l
total 142
drwx--x--x 2   HUGO     other        48   Dec  1 16:13 ADDRESSES
-rw------- 1   HUGO     other       356   Dec 17 13:58 card_a
-rw------- 1   HUGO     other     24802   Dec  1 12:13 card_b
-rw------- 1   HUGO     other      7890   Nov 30 10:48 card_c
-rwx--xr-x 1   HUGO     other      7253   Dec 21 13:37 card_d
-rw------- 1   HUGO     other      9476   Dec 21 13:37 card_e
-rwx--x--x 1   HUGO     other         0   Dec 18 13:16 card_f
-rw------- 1   HUGO     other       593   Nov 30 10:48 letter1
-rw------- 1   HUGO     other       837   Dec 17 10:53 letter2
-rw------- 1   HUGO     other      3247   Dec 17 13:46 letter3
-rw------- 1   HUGO     other      5222   Nov 30 10:48 letter4
-rw-rw-rw- 1   HUGO     other      4687   Dec 21 11:15 letter5
-rw------- 1   HUGO     other       228   Nov 30 10:48 letter6
-r-------- 1   HUGO     other       105   Dec 21 13:39 typescript
```

Example 2 Multi-column output of the current directory using a line width of 80 columns per line. (This output form is also the default for terminal output).

```
$ ls -C
ADDRESSES   card_c      card_f      letter3     letter6
card_a      card_d      letter1     letter4     typescript
card_b      card_e      letter2     letter5
```

Example 3 Multi-column output after defining the line width as 40 columns per line.

```
$ COLUMNS=40
$ export COLUMNS
$ ls -C
ADDRESSES   card_e      letter4
card_a      card_f      letter5
card_b      letter1     letter6
card_c      letter2     typescript
card_d      letter3
```

Example 4 Listing the current directory in long format (option *-l*), marking directories (option *-p*) and including all files that begin with a period (option *-a*). User's login name: *sisyphus*.

```
$ ls -pla
total 120
drwxr-xr-x  10 SISYPHUS   other       5720   Nov 17 08:00 ./
drwxr-xr-x  13 SYSROOT    root        3380   Nov 04 11:48 ../
-rw-------   1 SISYPHUS   other         79   Jul 19 14:21 .profile
-rw-------   1 SISYPHUS   other         14   Oct 21 08:56 .rhosts
-rwx------   1 SISYPHUS   other        125   May 25 10:29 begin
drwx--x--x   2 SISYPHUS   other       3380   Nov 09 10:30 commands/
drwx------   2 SISYPHUS   other       1820   Oct 11 15:35 letters/
drwxr-----   3 SISYPHUS   other       2340   Oct 11 15:35 lingua/
-rw-------   1 SISYPHUS   other       2082   Nov 08 12:29 ls.ex
-rw-------   1 SISYPHUS   other      11597   Nov 17 07:59 ls.rc.1
-rw-------   1 SISYPHUS   other       1351   Jul 19 15:14 plural
drwx------   2 SISYPHUS   other       3380   Oct 11 15:36 post/
drwx------   2 SISYPHUS   other       1560   Oct 11 15:36 pro/
drwx--x--x   2 SISYPHUS   other       2080   Nov 07 10:43 proc/
drwx------   2 SISYPHUS   other       1560   Oct 11 15:36 screens/
drwx--x--x   2 SISYPHUS   other       1040   Nov 15 08:23 sdg/
```

Example 5 List all files and directories (and their contents). Each directory name is followed by a colon.

```
$ ls -C *

Mailboxes  authors   bvp.col

lingua:
car.cdr    engl.ger  examples  terms

screens:
out        pause     sinix
```

See also *chmod, find, ln*

mailx interactive message processing system (mail extended)

This description is divided into the following sections:

- Introduction
- Synopsis of *mailx* formats
- Description of individual formats
  - Format 1: Read mode (from page 501)

    mailx commands in read mode
    Input format
    Functional overview
    Descriptions in alphabetical order
    Functionality in read mode
  - Format 2: Send mode (from page 520)

    mailx commands in send mode (tilde commands)
    Input format
    Functional overview
    Descriptions in alphabetical order
    Functionality in send mode
- *mailx* command and startup files (from page 526)
- Variables
  - *mailx* variables (from page 528)
  - Environment variables (from page 533)
- Note on error messages
- Files
- Examples
- See also

Introduction

mailx enables you to send and receive electronic mail. If MAIL of the interNet Services (formerly *inter*Net Value Edition) ist installed you can exchange messages with other users on the same system.

The presence of mail, if any, is usually indicated when you log in. You are also notified if new mail arrives while you are using *mailx*.

Messages have a message header holding information needed for message forwarding.

The message header contains the following fields:

– Message	Number of the message
– From	Sender of the message, date and time
– To	Recipient of the message
– Subject	Title of the message (see option *-s*)
– Status	Processing status of the message (see description on page 519)

The header is followed by a blank line and then the text of the message.

The *mailx* utility allows you to:

– check for the presence of mail (read mode, Format 1, option *-e*)

– read messages (read mode, Format 1)

– use SINIX commands to process incoming messages (read mode, Format1, *mailx* commands *!*, | and *pipe*)

– send messages (send mode, Format 2)

– use an editor to edit messages during a *mailx* session (read and send mode, *mailx* commands *edit*, *visual*, *˜e* and *˜v*).

mailx automatically collects read messages in a user-specific mailbox (*$HOME/mbox* by default).

Synopsis of mailx formats

Syntax

Format 1: mailx[␣option]

Format 2: mailx[␣option]...␣recipient...

Format 1

Read mode

mailx[␣option]

No option specified
mailx behaves as described in *Functionality in read mode*.

option

-e *mailx* simply checks whether there are any messages, terminating with an exit status of 0 if the user has mail. Otherwise, an exit status of 1 is returned.
mailx does not execute any startup files (see “mailx command and startup files” on page 526).

-f[␣file]
mailx reads messages from *file*.

file not specified:
mailx reads messages from the user-specific mailbox *$HOME/mbox*.

-f␣file not specified:
mailx reads messages from the default mailbox */var/mail/$USER*.

-H (H **-** Header) *mailx* displays only the header summaries and terminates. The exit status is 0 if the user has mail, otherwise 1.

The structure of a header summary is described in *Functionality in read mode*).

-i (i - ignore) *mailx* ignores the signal *SIGINT* (see the *mailx* variable *ignore* on page 530).

-n *mailx* does not initialize from the global startup file */etc/mail/mailx.rc* (see “mailx command and startup files” on page 526).

-N *mailx* does not print the initial header summary.

-u␣login_name
mailx reads messages from the default mailbox of the specified user, provided you have the required read permission.

-V *mailx* displays its version number and exits.

mailx commands in read mode

Input format

mailx commands in read mode have the following format:

```
[command][␣msglist][␣argument]...
```

command
: Name of a *mailx* command. Most command names can be abbreviated. In “Descriptions in alphabetical order” on page 507 the accepted abbreviations are shown in bold print.

  command not specified:
  If you simply press ↵ at the *mailx* prompt, *mailx* executes the *print* command.

msglist
: One or more messages to be processed by the command. If several messages are specified, they are separated by blanks.

  msglist can be one or more of the following:

n	Message number *n*
.	The current message (marked > in the header summary)).
^	The first undeleted message.
$	The last message.
*****	All messages.
+	The next message.
–	The preceding message.
n-m	Messages *n* through *m* inclusive.
login_name	All messages from the specified user.
/str	All messages with the string *str* in the subject field (the case is ignored).

:msgtype
All messages of type *msgtype*, which can be any of the following:

d	deleted messages (useful only with the *mailx* command *undelete*)
n	new messages
o	old messages (any messages not in state *new* or *read)*
r	read messages
u	unread messages

msglist not specified:
mailx defaults to the current message.

argument
String argument as appropriate to the command (see descriptions). If *argument* is a file name, the usual shell metanotation may be used. If a string containing blanks is to be interpreted as a single argument, it must be enclosed in double quotes.

Functional overview

This section provides an overview of all *mailx* read-mode commands, grouped by function. Some commands may appear more than once. The overview is followed by descriptions of all the commands in alphabetical order.
Most commands can be abbreviated. In “Descriptions in alphabetical order” on page 507 the abbreviated forms are shown in bold print.

Help functions

?	Display summary of *mailx* commands
help	Display summary of *mailx* commands
list	List names of all *mailx* commands
=	Display current message number
size	Display size of message
from	Display header summary
z+	Scroll header display one page forward
z-	Scroll header display one page back
headers	Display screen page of headers
top	Display first five lines of message header
folders	List contents of directory defined by *mailx* variable *folder*
version	Display *mailx* version number

Quitting mailx

exit	Quit *mailx* without changing mailbox
xit	Quit *mailx* without changing mailbox

quit	Quit *mailx*

Displaying the header summary

from	Display header summary
headers	Display screen page of headers
z+	Scroll header display one page forward
z-	Scroll header display one page back

Manipulating and displaying the message header

discard	Suppress message header fields
undiscard	Undo the effect of *discard*
ignore	Suppress message header fields
unignore	Undo the effect of *ignore*
top	Display first five lines of message header
retain	Display only specified fields of message header

Displaying messages

print	Display message
type	Display message
next	Skip to next matching message
Print	Display message with full message header, ignoring *discard*
Type	Display message with full message header, ignoring *discard*

Editing messages

edit	Call editor to edit message (value of *mailx* variable *EDITOR*, default: *ed*)
visual	Call editor to edit message (value of *mailx* variable *VISUAL*, default: *vi*)

Changing the mailbox

file	Close current mailbox and open named one
folder	Close current mailbox and open named one

Saving messages

hold	Hold messages in mailbox
preserve	Hold messages in mailbox
save	Write message to file
copy	Write message to file
write	Write message to file, omitting header
mbox	Write message to user's standard mailbox
touch	Write message to user's standard mailbox
Save	Write messages to file named after sender of first message
Copy	Write messages to file named after sender of first message

Deleting messages

delete	Delete message
dp	Delete message, display next
dt	Delete message, display next

Switch to send mode and send or reply to message

mail	Send message
Mail	Send message, recording copy in file
reply	Reply to message
respond	Reply to message
followup	Reply to message, recording reply
Reply	Reply to list of messages
Respond	Reply to list of messages
Followup	Reply to list of messages, recording replies

Undoing mailx commands during a mailx session

undelete	Restore deleted messages
touch	Undo effect of *hold*
hold	Undo effect of *touch*
unalias	Erase aliases
undiscard	Undo effect of *discard*
unignore	Undo effect of *ignore*
unset	Erase variables

Invoking command interpreters, running shell commands

!	Escape to shell
!!	Repeat last shell command
shell	Invoke command interpreter
pipe	Pipe messages to standard input of shell command
|	Pipe messages to standard input of shell command

Miscellaneous

#	Null command (for including comments in command files)
=	Display current message number
alias	Declare aliases for mail recipients (same as *group*)
alternates	Declare alternate names for your login name
cd	Change directory
chdir	Change directory
echo	Echo string (like SINIX *echo* command)
folders	List contents of directory defined by *mailx* variable *folder*
group	Declare aliases for mail recipients (same as *alias*)

if mode cmdlist1 else cmdlist2 endif	if construct which selects a command list to execute on the basis of the mode (send, read)
set	Set variables
size	Display size of message
source	Read and execute command file
unset	Erase variables

mailx commands not allowed in command files

!	Escape to shell
Copy	Write messages to file named after sender of first message
edit	Call editor to edit message
followup	Reply to message, recording reply
Followup	Reply to list of messages, recording replies
hold	Hold messages in mailbox
mail	Send message
Mail	Send message, recording copy in file
preserve	Hold messages in mailbox
reply	Reply to message
Reply	Reply to list of messages
respond	Reply to message
Respond	Reply to list of messages
shell	Invoke command interpreter
visual	Call editor to edit message

Descriptions in alphabetical order

Some command names have synonyms. The full description is always next to the name which comes first in alphabetical order.

Most of these commands can be used both interactively and in command files. Exceptions to this rule are mentioned at the appropriate place (see “Functional overview” on page 503).

The bold print in the command names refers to the abbreviated forms.

!shell_command

Executes *shell_command*. By default the command interpreter specified in the *mailx* variable *SHELL* will be invoked and the specified command line will be passed to it.

If *SHELL* is not set, */bin/sh* will be invoked.

If the *bang* variable is set, the last shell command executed is saved by *mailx* and can be repeated with *!!*.

The *!* command is not permitted in a command file.

#comment

This is the null command used to introduce comments in command files (e.g. *.mailrc*).

= Displays the current message number.

? Displays a summary of all *mailx* commands.

alias[␣alias-name[␣recipient]]...
group[␣alias-name[␣recipient]]...

Declares an alias for the given recipients. The defined recipients are substituted when you use the aliases as recipients.

alias-name : Any string.

alias-name not specified : *mailx* displays a list of defined aliases.

recipient not specified: *mailx* displays the definitions for *alias-name*.

alternates[␣name]...

Declares alternate names for your login name. Once you reply to a message, *mailx* deletes these alternative names from the list of recipients.

name: String for the alternate name.

name not specified: *mailx* displays the current list of alternate names.

cd␣[directory]
chdir␣[directory]

Changes to the indicated directory.

directory not specified: *mailx* changes to *$HOME*.

copy[[␣msglist]␣file]
Copies the specified messages to the named *file*. If *file* already exists, it is extended. The messages are marked as read (*R*) and copied to the user-specific mailbox when the default mailbox is closed.

No argument specified:
mailx appends the current message to *$HOME/mbox*.

If you do not subsequently delete the message, it will be saved again the next time the default mailbox is closed.

Copy[␣msglist]
Copies the specified messages to a file in the current directory. The name of this file is derived from the name of the author of the first message in the message list (From entry).
If this file already exists, it is extended.

The messages are marked as read (*R*) and copied to the user-specific mailbox when the default mailbox is closed.

The *Copy* command is not permitted in a command file.

delete[␣msglist]
Deletes the specified messages from the current mailbox. If the *mailx* variable *autoprint* is set, the message following the last deleted message is printed.

A deleted message can be restored with *undelete* during a *mailx* session.

discard[␣field]...
ignore[␣field]...
Suppresses printing of the specified header fields in the output if they appear at the start of a line and come before a colon, e.g.: *Cc:, Date:, Status:, Subject:, To:*. You do not need to include the colon, and *mailx* ignores the case of the letters in *field*.

discard has an effect on the *mailx* commands *next*, *pipe* (or |), *print*, *type*, *~f* and *~m*, but not on *Print*, *Type, ~F* and *~M*.

No fields are suppressed when messages are saved.

The effect of *discard* can be undone with *undiscard* or *unignore*. *retain* suppresses the effect of *discard*: all fields are ignored except those explicitly specified.

field not specified:
discard displays the current list of fields being ignored, if any.

dp[␣msglist]
dt[␣msglist]
(delete and print) Deletes messages from the mailbox and displays the message that follows the last one deleted.

A deleted message can be restored with *undelete* during a *mailx* session.

echo␣string␣...

Echoes *string* on standard output (like the SINIX *echo* command).
The value of an environment variable can be accessed as *$name*. *echo* always displays the value of the environment variable, even if a *mailx* variable of the same name has been defined.

edit[␣msglist]

Invokes the editor specified with the *mailx* variable *EDITOR* (default editor: *ed*) and loads the specified messages.

The edited message will be available in the mailbox again at the end of the editing session.

The text is edited in a temporary file named */tmp/Rz$$*, where *$$* is the process ID of the *mailx* process (see *Files*).

The *edit* command is not permitted in a command file.

exit
xit

Exits from *mailx* without changing the current mailbox, i.e.
- deleted messages are restored,
- read messages are not saved in *$HOME/mbox*, and
- edited messages retain their original status.

Also refer to the *mailx* command *quit*.

file[␣file]
folder[␣file]

Quits the current mailbox (like *quit*) and reads in the specified file as another mailbox. The appropriate header lines are displayed.

file

Name of the mailbox to be processed, or the following metanotation:

%	the current mailbox
%login_name	the default mailbox of the named user (*/var/mail/$USER*)
+file	the file *file* in the directory *folder* (see *mailx* variable *folder*)
#	the previous mailbox
&	the user-specific mailbox (*$HOME/mbox* or the mailbox defined by the *mailx* variable *$MBOX*)

file not specified:
mailx remains in the current mailbox and simply reports the number of messages in it.

fi % closes and reopens the current mailbox. This allows you to read any new messages that have arrived during your *mailx* session.

folders

Lists the names of all files in the directory defined by the *mailx* variable *folder* (messages are saved and recorded in this directory by *mailx*).

followup[␣message]

Replies to the specified message like the *mailx* command *reply*.

mailx switches to send mode and considers the recipients to be

– the author of the specified message, i.e. the entry in the "From" field is taken over to the "To" field,

– the other recipients of the message, i.e. the entries in the "To" field are transferred to the "To" list, while those in the Cc field are copied to the Cc list.

When you have completed your input, *mailx* sends the message.

In contrast to *reply*, *followup* records the message in a file named after the recipient (with the network path removed). The storage location of this file depends on whether the *mailx* variables *folder* and *outfolder* are set. If both are set, the file is stored in the directory defined by the *folder* variable. Otherwise it is stored in the current directory. The file is extended if it already exists.

The *followup* command is not permitted in a command file.

Followup[␣msglist]

Replies to the first of the messages specified in the message list in the same way as the *mailx* command *Reply*.

mailx switches to send mode and sends the reply to each sender of a message in *msglist*.

When you have completed your input, *mailx* sends the message.

In contrast to *reply*, *Followup* records the message in a file named after the sender of the first message (with the network path removed). The storage location of this file depends on whether the *mailx* variables *folder* and *outfolder* are set. If both are set, the file is stored in the directory defined by the *folder* variable. Otherwise it is stored in the current directory. The file is extended if it already exists.

The *Followup* command is not permitted in a command file.

from[␣msglist]

Prints the header summary for all specified messages on the standard output.

group␣alias-name recipient...

Declares aliases for the given recipients (see *alias*).

headers[␣message]

Displays the screen page of headers which includes the specified *message*. A screen page contains 20 lines or the number of lines defined by the *screen* variable.

message not specified:
mailx displays the current *message*.

help

Displays a summary of the *mailx* commands (see also *?*).

hold[␣msglist]
preserve[␣msglist]

Holds (i.e. preserves) the specified messages in the default mailbox.

The messages are marked *H* in the header and remain in the mailbox, even if they have been read or saved.

The effect of *hold* can be undone with *touch* (and vice versa).

The *hold* and *preserve* commands are not permitted in a command file.

if mode
command_list1
else
command_list2
endif

if construct which selects a command list to execute on the basis of the specified mode.

mode

mode is the mode (send or read) in which you invoked *mailx*. It can be:

s	(send) *command_list1* is executed if you invoked *mailx* in send mode; otherwise, *command_list2* is executed.
r	(read) *command_list1* is executed if you invoked *mailx* in read mode; otherwise, *command_list2* is executed.

command_list1
command_list2

Lists of *mailx* commands. Commands which are not permitted in command files are also not permitted here, i.e.: *!, edit, followup, Followup, mail, Mail, reply, Reply, respond, Respond, shell* and *visual*.

if, *else*, *endif* and all the commands in the command lists must each be on a separate line.

ignore[␣field]...

Suppresses printing of the specified header fields (see *discard* on page 508).

list
: Lists the names of all available *mailx* commands on standard output (also refer to *help* and *?*).

mail␣recipient...
: Sends a message to *recipient*.

  mailx switches to send mode and mails the message as soon as you have finished entering the text.
  If the *mailx* variable *record* is set, the message will be written to the file defined there. If the file already exists, it is extended.

  The *mail* command is not permitted in a command file.

Mail␣recipient...
: Sends a message to *recipient*.

  mailx switches to send mode and mails the message as soon as you have finished entering the text.
  mailx records your message in the current directory in a file named after the recipient. If the file already exists, it is extended.

  The *Mail* command is not permitted in a command file.

mbox[␣msglist]
: Writes the listed messages to the user-specific mailbox when the current mailbox is closed and then deletes them from the current mailbox, even if they have not been read. All such messages are marked *M* in the header summary.

  The user-specific mailbox is *$HOME/mbox* or the file defined by the *mailx* variable *MBOX*.

next[␣message]
: Goes to the next message containing *message* in the header summary. For *message* you can enter characteristics as for a message list.

  If, for example, the next message you want to read is that of a particular sender, specify *next sender*.
  The *sender* can be an e-mail address or a local user ID.

  message not specified: *mailx* displays the message following the current one.

  next otherwise works in the same way as *print*.

pipe[[␣msglist]␣shell_command]
| [[␣msglist]␣shell_command]

Pipes the specified messages to the standard input of the given *shell_command*. The messages are marked as read (*R*) in the header summary. If the *mailx* variable *page* is set, a form feed character is inserted after each message (FF = CTRL L = X'0C').

No argument specified:
The default message is the current message, and the default command is the one specified by the *mailx* variable *cmd*. If *cmd* is not set, the *pipe* command is ignored.

preserve[␣msglist]

Preserves the specified messages in the default mailbox (see *hold*).

print[␣msglist]
type[␣msglist]

Prints the specified messages on the standard output.

The messages are marked as read (*R*) in the header summary. They are copied to the user-specific mailbox upon termination of the default mailbox and then deleted from the current one. The user-specific mailbox is *$HOME/mbox* or the file defined by the *mailx* variable *MBOX*.
If the *mailx* variable *crt* is set, messages longer than the number of lines specified by the *crt* variable are paged through the POSIX command *more*. You can use the *mailx* variable *PAGER* to specify a POSIX command other than *more*.

Print[␣msglist]
Type[␣msglist]

Like *print*, except that the whole header is always displayed, i.e. *Print* overrides the effect of *discard* and *ignore*.

quit

Exits from *mailx*, closing the currently processed mailbox.
If the default mailbox was being processed, the following applies:

- Read messages (*0*) and messages processed with *mbox* (*M*) are copied to the user-specific mailbox and then deleted. The user-specific mailbox is *$HOME/mbox* or the file defined by the *mailx* variable *MBOX*.
- Unread messages (*U*) and messages processed with *hold* or *preserve* (*P*) are retained in the default mailbox.
- Explicitly saved messages (*S*) are deleted from the mailbox, if the *keepsave* variable is not set.

Also refer to the *mailx* commands *exit* and *xit*.

reply[␣message]
respond[␣message]

Replies to the indicated message.

mailx switches to send mode and considers the recipients to be

- the author of the specified message, i.e. the entry in the "From" field is taken over to the "To" field,
- the other recipients of the message, i.e. the entries in the "To" field are transferred to the "To" list, while those in the Cc field are copied to the Cc list.

When you have completed your input, *mailx* sends the message.

Unlike *followup*, *reply* does not automatically create a file to record your reply. It only does so if the *mailx* variable *record* is set, in which case the message will be written to the file defined there. If the file already exists, it is extended.

The *reply* and *respond* commands are not permitted in a command file.

Reply[␣msglist]
Respond[␣msglist]

Replies to the first message in the message list.

mailx switches to send mode and sends the response to the sender of each message in *msglist*.

When you have completed your input, *mailx* sends the message.

Unlike *Followup*, *Reply* does not automatically create a file to record your reply. It only does so if the *mailx* variable *record* is set, in which case the message will be written to the file defined there. If the file already exists, it is extended.

The *Reply* and *Respond* commands are not permitted in a command file.

retain[␣field]

displays only the specified fields of the message header. The other fields are suppressed. *retain* displays the specified fields as well, if they are contained in the list of fields to suppress, i.e. *retain* overrides the effects of *discard* or *ignore*.

field not specified:
retain displays the current list of fields to display if available.

save[[␣msglist]␣file]

Saves the indicated messages in the named *file*, extending it if it already exists.

The messages are marked as saved (*S*), which means that they are deleted from the default mailbox as soon as you quit *mailx*, unless you have set the *keepsave* variable.

No argument specified:
mailx appends the current message to the end of *$HOME/mbox*.

Save[␣msglist]

Saves the specified messages in a file in the current directory. The file name is derived from the name of the sender of the first message in *msglist* ("From" entry; network addresses are removed). If the file already exists, it is extended.

The messages are marked as saved (*S*), which means that they are deleted from the default mailbox as soon as you quit *mailx*, unless you have set the *keepsave* variable).

set[␣name[=value]]

Sets the variable *name*.

name	Name of a *mailx* variable or a freely defined variable.
value	Any string or numeric value. \n within *value* is interpreted as a newline character, \t as a tab. *value* not specified: *name* is set to the null string.

No argument specified:
Prints all set variables and their values. The values are enclosed in double quotes.

You cannot change the values of environment variables. However, if you define an internal variable of the same name, *mailx* will use its value until you reset it (this does not apply to the *mailx echo* command).

The tilde command *~i variable* can be used to insert the value of *variable* in the text of a message.

You can delete variables with *unset*.

shell

Invokes by default the command interpreter specified in the *SHELL* variable. If *SHELL* is not set, */bin/sh* will be invoked.

You can specify a different command interpreter with the *mailx* variable *SHELL*.

The *shell* command is not permitted in a command file.

size[␣msglist]

Displays the size of the specified messages on standard output in the form *message_number: number_of_characters*.

source␣file

Reads the specified file as a command file and executes the *mailx* commands in it. *mailx* then returns to the interactive mode (see *mailx command and startup files* below).

top[␣msglist]

Displays the first 5 lines of the header for each specified message on the standard output. You can change the number of lines displayed with the *mailx* variable *toplines*.

touch[˽msglist]
Causes the specified messages to be trated as read, i.e. they are copied to the user-specific mailbox upon termination of the default mailbox and then deleted from the current one. The user-specific mailbox is *$HOME/mbox* or the file defined by the *MBOX* variable.

This does not apply to messages that were saved with *save* or *Save*.

touch cancels the effect of *hold* and vice versa.

type[˽msglist]
Prints the specified messages on standard output (see *print* on page 513).

Type[˽msglist]
Like *print*, except that the whole header is always displayed (see *Print* on page 513).

unalias[˽alias-name]...
Deletes the specified alias names.

undelete[˽msglist]
Restores the specified messages provided they were deleted during the current session. The messages are marked as read (*R*).

If the *autoprint* variable is set, the last restored message is displayed.

msglist not specified:
If *msglist* is not specified, it defaults to the first deleted message following the current message that has not been undeleted if there is one, or the last deleted message preceding the current message that has not been undeleted otherwise.

undiscard[˽field]
unignore[˽field]
Deletes the specified header fields from the list of fields being ignored.

field not specified:
Deletes the whole of the list of fields being ignored.

unset[˽name...]
set[˽noname...]
Deletes the specified variables.

If you delete a variable with the same name as an environment variable, you can access the value of the corresponding environment variable again.

version
Displays the current version and release number of *mailx*.

visual[␣msglist]
Invokes the editor specified by the *mailx* variable *VISUAL* (default editor: *vi*) and loads the indicated messages.

The edited message is placed in the mailbox at the end of the editing session.

The text is processed in a temporary file named */tmp/Re$$*, where *$$* is the process ID of the *mailx* process.

The *visual* command is not permitted in a command file.

write[␣msglist]␣file
Writes the specified messages in the named *file*. If the file already exists, it is extended.

write does not copy the header and the trailing blank line.

The messages are marked as saved (*S*) in the header summary. They are deleted from the default mailbox as soon as you quit *mailx*, unless you have set the *keepsave* variable.

xit Exits from *mailx* without changing the current mailbox (see *exit* on page 509).

z[+|–] Scrolls the header display one page forward (*z+*) or back (*z-*). The number of lines per page is set by the *screen* variable. If *screen* is not set, 20 lines are displayed by default.

+|– not specified:
Same as *z+*.

Functionality in read mode

At start-up time, *mailx* will take the following steps in sequence:

1. Establish all variables at their stated default values.
2. Process command-line options, overriding corresponding default values.
3. Import any of the DEAD, EDITOR, MBOX, LISTER, PAGER, SHELL or VISUAL variables that are present in the environment, overriding the corresponding default values.
4. Read *mailx* commands from an unspecified system start-up file, unless the *-n* option is given to initialize any internal *mailx* variables and aliases.
5. Process the start-up file of *mailx* commands named in the user *MAILRC* variable.

If no mail is present, *mailx* issues the message:

```
No mail for login_name
```

If mail has been received, *mailx* responds with a message line, an overview of all messages currently in the mailbox, and the *mailx* prompt *?*. You can now enter *mailx* commands.You can use the *?*, *help* and *list* command to get a list of all the available commands.

Headers

When you call *mailx* or use one of the *mailx* commands *from*, *headers* or *z*, *mailx* displays a header line for each message present. A header can have up to 9 blank-separated fields, e.g.:

```
N   1 hadea    Mon Sep    21 13:05    10/164    Beeblebrox
```

These fields refer to:

`N`	Processing status (see next subsection)
`1`	Message number. The messages are renumbered each time *mailx* is invoked. The oldest message is numbered 1.
`hadea`	Sender
`Mon Sep 21`	Date message received
`13:05`	Time message received
`10/164`	Size of message in lines/characters
`Beeblebrox`	Title (first 25 characters of subject entry)

Processing status

The processing status is the entry in the first header field. The status will be one of the following:

O (old) The message has been read by a previous *mailx* call. It will be stored in *$HOME/mbox*, when you quit *mailx* or close the default mailbox.

U (unread) The message has been present in the system mailbox for more than one invocation of *mailx* and has not yet been read. It will be preserved in the current mailbox when you quit *mailx* using *quit*.

R (read) The message has been read. It will be saved in *$HOME/mbox*, if you quit *mailx* or the default mailbox.

N (new) The message has arrived since you last called *mailx* or changed mailboxes. Messages in state *new* when *mailx* quits will be retained in the system mailbox.

M (mbox) The message has been saved with *mbox*.

H (hold) The message has been marked by the *hold* or *preserve* command. It will stay in the default mailbox when you close it.

S (save) The message has been saved with a *save*, *Save* or *write*. It will be deleted from the default mailbox when you close it.

>c This is the current message. This is the message referenced by *mailx* commands if you do leave *msglist* unspecified. The character *c* stands for any of the above status characters.

User-specific mailbox

Messages are written to the user-specific mailbox if
- you have read them but not deleted or explicitly saved them
- you have manipulated them with *mbox* or *touch*
- you have switched from the default mailbox to another mailbox using the *file* or *folder* command
- you have quit *mailx* with *quit* (except where the variable *hold* is set, then the messages remain in the standard mailbox).

The user-specific mailbox is *$HOME/mbox* or the file defined by the *mailx* variable *MBOX*. The file is extended if it already exists. If you use the *-f* when you call *mailx*, you can process this file with *mailx* commands in exactly the same way as the default mailbox.

Format 2 **Send mode**

mailx[␣option]...␣recipient␣...

No option specified

mailx behaves as described in “Functionality in send mode” on page 525.

option

-F (file) *mailx* records all outgoing messages in a file named after the first specified recipient. This file is created in your home directory and can be processed with *mailx* like a mailbox.

-F not specified:
mailx searches for the record file defined in the *mailx* variable *record*. Nothing is recorded if this variable is not set.

-i *mailx* ignores the SIGINT signal (see also the *mailx* variable *ignore*).

-n *mailx* does not initialize from the global startup file */etc/mail/mailx.rc* (see “mailx command and startup files” on page 526 below).

-s␣subject

(subject) *mailx* enters *subject* in the *Subject:* header field. of the header summary. This allows you to indicate the subject of the message.

subject
Any string. If the string includes blanks or special characters, it must be enclosed in double quotes.

recipient

One or more recipients. *recipient* can be:

- E-mail address (if you are using MAIL of the interNet Services)
- a login name on the local system
- an alias group (see *mailx* read-mode command *alias*)
- a pipe symbol followed by a shell command

If *recipient* begins with a pipe symbol (|), the rest of the name is taken to be a shell command to pipe the message through.

mailx commands in send mode (tilde commands)

Input format

Apart from being preceded by an escape symbol, *mailx* send-mode commands have the same format as read-mode commands.

```
[command][␣msglist][␣argument]...
```

˜
: Tilde as escape symbol. The *mailx* variable *escape* can be used to define a different character as the escape symbol. But the different character must not be a character which describes a command (e.g. ? or !).

command msglist argument
: As described above under *mailx commands in send mode*, "Input format" on page 502.

Functional overview

This section provides an overview of all *mailx* send-mode commands, grouped by function. Some commands may appear more than once.
The overview is followed by descriptions of all the commands in alphabetical order.

Help functions

˜?	Display summary of tilde commands
˜p	Display message being entered

Terminating/aborting text input

˜.	Terminate input and send
˜x	Abort input and do not send
˜q	Abort input and save but do not send

Inserting values of variables, old messages and files

˜a	Insert value of *sign* variable
˜A	Insert value of *Sign* variable
˜i	Insert value of *mailx* or environment variable
˜d	Insert contents of *$HOME/dead.letter*
˜f	Insert old messages
˜F	Insert old messages
˜m	Insert old messages
˜M	Insert old messages
˜r	Insert contents of named file
˜<	Insert contents of named file

Invoking command interpreters, running shell commands

˜!	Escape to shell
˜<!	Run shell command and insert output in text
˜|	Pass text to shell command and replace with command output

Displaying text

˜p	Display message being entered

Editing text

˜e	Call editor to edit text (default: *ed*)
˜v	Call editor to edit text (default: *vi*)

Modifying mailing lists

˜b	Add names to Bcc list
˜c	Add names to Cc list
˜t	Add names to To list
˜h	Edit To, Subject, Cc and Bcc fields

Manipulating the message header

˜c	Add names to Cc list
˜t	Add names to To list
˜h	Edit To, Subject, Cc and Bcc fields
˜s	Replace contents of Subject field

Recording text

˜w	Write message being entered to file, omitting header
˜q	Abort input and save text but do not send

Send-mode commands which expect mailx to have been called in read mode

˜_	Execute mailx command
˜:	Execute mailx command
˜f	Insert old messages
˜F	Insert old messages
˜m	Insert old messages
˜M	Insert old messages

Executing mailx read-mode commands

˜_	Execute mailx read-mode command
˜:	Execute mailx read-mode command

Descriptions in alphabetical order

mailx commands in send mode (tilde commands) must start with an escape symbol in column one. The default escape symbol is a tilde (˜), but this can be redefined with the *mailx* variable *escape*.

Tilde commands are not permitted in a command file.

˜!shell_command
: executes the specified *shell_command*. Invokes by default the command interpreter specified in the *SHELL* variable. If *SHELL* is not set, */bin/sh* will be invoked.

˜. Terminates message input and sends the message.

If you are working via *rlogin* on a remote computer, this tilde command will be interpreted as an instruction to clear down the connection, with the result that the remote session will be terminated immediately. Here are some possible solutions:

- redefine the escape symbol with the *mailx* variable *escape*
- set the *mailx* variable *dot*, so that you can terminate input simply with a dot in column one
- terminate input with END

˜:mailx-read-command
˜_mailx-read-command
: Executes the specified *mailx* read-mode command.

You must have invoked *mailx* in read mode (and then switched to send mode with a *mailx* command such as *mail*). Otherwise, *mailx* will only execute commands that have nothing to do with the processing of a mailbox (e.g. *set* or *exit*).

The underscore in the second format is mandatory.

˜? Displays a summary of all tilde commands.

˜a (autograph) Inserts the value of the *mailx* variable *sign* in the message.

˜A (autograph Inserts the value of the *mailx* variable *Sign* in the message.
This enables you to define an alternate sign-off string, for example.

˜b␣name...
: (blind carbon copy) Adds one or more names to the blind carbon copy (Bcc) list. The Bcc list contains the names of additional recipients of the message. These names are not included in the header.

˜c␣name...
: (carbon copy) Adds one or more names to the carbon copy (Cc) list. The Cc list contains the names of additional recipients. These names are included as part of the header information (the Cc entry).

~d (dead letter) Reads the contents of the file *$HOME/dead.letter* into the message. This file contains messages which *mailx* could not send or which you aborted with *~q*.

~e (ed editor) Invokes the editor specified by the *mailx* variable *EDITOR* (default editor: *ed*) and loads the partial message. Input of the partial message may be continued after the editing session.

~f[␣msglist]
(file) Inserts the specified messages, without alteration, into the message text.
This command is only executed if *mailx* was invoked in read mode (Format 1).

~F[␣msglist]
works like *~f*, but inserts always the whole message header. *discard*, *ignore* and *retain* will be ignored.

~h (header) Prompts successively for the following information:

To:	Recipient
Subject:	Subject of the message
Cc:	Carbon copy list containing additional recipients of the message; the names in this list appear in the Cc field of the header
Bcc:	Blind carbon copy list. Like Cc, except that the names do not appear in the header

The fields are displayed with existing values (if any), which you can edit as if you had just entered them.

~i␣variable
Inserts the value of the named *variable* into the message text. The named *variable* can be a *mailx* variable or an environment variable.

~m[␣msglist]
(move) Inserts the indicated messages into the text, shifting each line one tab stop to the right.
This command is executed only if *mailx* was invoked in read mode (Format 1).

~M[␣msglist]
works like *~m*, but inserts always the whole message header. *discard*, *ignore* and *retain* will be ignored.

~p (print) Displays the message being entered.

~q Quits input mode by simulating an interrupt. The input text is not aborted but saved in the *$HOME/dead.letter* file. This tilde command has the same effect as the DEL key except that it cannot be suppressed with the *ignore* variable.

˜r␣file
˜r␣**!**shell_command
˜<␣file
˜<␣**!**shell_command
(read) Inserts the contents of *file* or the output of *shell_command* into the message text.

˜s␣string...
(subject) Sets the Subject field of the header to the specified *string*. Multiple blank-separated strings do *not* need to be quoted.

˜t␣recipient...
(to) Adds the indicated names of one or more recipients to the "To" field of the header. Multiple names must be separated by blanks.

˜v (vi editor) Invokes the screen editor identified by the *mailx* variable *VISUAL* (default editor: *vi*) and loads the partially entered message. Input of the edited message can be continued on completion of the editing session.

˜w␣file
(write) Copies the partially entered message, without the header, into the specified file. If the file does not exist, it will be created. Otherwise the message is appended to the specified file.

˜x Exits, aborting the message being entered. The partially entered message is neither sent nor saved.

˜|␣shell_command
Pipes the current text of the message to the standard input of *shell_command*.
If the shell command returns an exit status of 0, the current text is replaced by the output of the command.

Invokes by default the command interpreter specified in the *SHELL* variable. If *SHELL* is not set, */bin/sh* will be invoked.

Functionality in send mode

When you call *mailx*, it first processes startup files. These files may be used to initialize *mailx* variables, for example (see *mailx command and startup files*).

Then, unless you use the *-s* option to specify a message subject, *mailx* displays:

```
Subject:
```

and expects you to enter the subject of the message. This line, which may consist of up to 1024 characters, is written by *mailx* into the *Subject:* field of the message header. If the subject is too long, *mailx* will print the message `mail: ERROR signal 10`, and the mail will not be delivered.

mailx will now be in send mode, which means that you can enter your message text. All *mailx* tilde commands are permitted during text input. They must start in column 1. Once you have sent off a tilde command with ↵, *mailx* redisplays the whole of the command you have entered in the same line, followed by the string `(continue)` when it has finished executing the command. If you use one of the commands for inserting text into your message text (such as *˜a*), *mailx* will not echo the text on the screen. You can view the original text and the inserted text with the *˜p* command.

mailx stores the input text in a temporary file in the */tmp* directory.

The command ˜. or the END key signals the end of input.

Tilde commands in read mode

Some tilde commands only offer their full functionality if you call *mailx* in read mode (Format 1) and temporarily switch from there to send mode. The commands in question are: ˜_ and *˜:* (execute mailx command) and *˜f* and *˜m* (insert old messages).

The read commands you can use to switch temporarily to send mode so as to send or reply to a message are *followup, Followup, mail, Mail, reply, Reply, respond* and *Respond*.

mailx command and startup files

Command files

Command files are files that contain *mailx* commands. Each *mailx* command must be entered in a separate line. You can execute command files by using the *source* command during a *mailx* session, or you can use them as startup files (see below).

Tilde commands are not permitted in command files, and nor are the commands *!, edit, followup, Followup, mail, Mail, reply, Reply, respond, Respond, shell* and *visual*.

The *copy, Copy, hold* and *preserve* commands are permitted, but then any subsequent commands which are intended to operate on a message list will be ignored.

If an error occurs in a command file, *mailx* ignores all subsequent commands in the file. An error also occurs if a message list refers to a non-existent message (see Example 2 on page 536).

Startup files

Startup files are command files that *mailx* processes every time it is invoked, unless you call it in read mode using the *-e* or *-n* options.

mailx first processes the global startup file */etc/mail/mail.rc*, followed by the private startup file *$HOME/.mailrc*, provided such files exist.
You can redefine the path name of the private startup file with the *MAILRC* variable.

The *mailx* commands in the startup files may not use *msglist*, because this information is not yet provided when executing the startup files.

Variables

mailx utilizes environment variables, *mailx* variables and freely defined variables.

All variables can be imported, and during a *mailx* session they can be set and reassigned with the *set* command and deleted with *unset*.

mailx variables, i.e. all variables consisting of lowercase letters only, can only be set within *mailx* (e.g. in startup files). Contents of shell variables with the same names are not inherited by *mailx* variables.

If you use *set* to reassign an imported variable, the new value applies until you change it again, delete it with *unset* or end your *mailx* session.

The *mailx* command *echo* always references the original value of an imported variable.

asksub, *header* and *save* are enabled by default.

Of the variables which can be assigned values, the following have default values:

– *DEAD=$HOME/dead.letter*

– *EDITOR=ed*

– *escape=˜*

– *MBOX=$HOME/mbox*

– *LISTER=ls*

– *PAGER=more*

– *prompt=?*

– *screen=20*

– *SHELL=/bin/sh*

– *toplines=5*

– *VISUAL=vi*

The references to *Associated commands* in the following list relate to the *mailx* commands particularly affected by the setting or deletion of the variable in question.

mailx variables

allnet
mailx treats all network names ending with matching login names as identical. Addresses in the form *...computer_name!computer_name!login_name* are treated as network names. See also the *metoo* variable.

Default value: The variable is not set.

append
Appends messages saved in the user-specific mailbox (*$HOME/mbox* by default) to the end of the file.

Associated commands: *copy, Copy, file, folder, mbox, next, print, Print, type, Type, quit, touch*

Default value: The variable is not set.

ask
asksub
Causes *mailx* to prompt for the subject when invoked (see also option *-s*).

Associated commands: *~h, ~s*

Default value: The variable is set.

askbcc
mailx prompts for the Bcc list after the subject is entered.

Associated commands: *~c, ~h*

Default value: The variable is not set.

askcc
mailx prompts for the Cc list after the subject is entered.

Associated commands: *~c, ~h*

Default value: The variable is not set.

autoprint
Displays the next message after the *delete* command, and the restored message after the *undelete* command.

Default value: The variable is not set.

bang
Causes *mailx* to remember the last command executed with *!shell_command*. You can then repeat the command by entering *!!*.

Default value: The variable is not set.

cmd=shell_command
Sets the default command used by *pipe* and | to the specified *shell_command* (only used if no command is specified in *pipe*).

Default value: None.

crt=number
Pipes message output having more than *number* lines through the command specified by the *PAGER* variable (*PAGER=more* by default).

Associated commands: *dp, dt, next, print, Print, type, Type, ˜p*

Default value: The variable is not set.

debug
Enables diagnostics for debugging. If you set this variable, mail will not be delivered.

Default value: The variable is not set.

dot
Causes a line consisting solely of a dot in column one to terminate input (instead of the command ˜.).

Default value: The variable is not set.

escape=c
Substitutes *c* for the tilde escape symbol. *c* may not be a character describing a command (e.g. ? or !)

Default value: ˜

flipr
The effects of the commands *reply, respond* and *Reply, Respond* are exchanged.

Associated commands: *reply, Reply, respond, Respond*

Default value: The variable is not set.

folder=directory
If both *folder* and *outfolder* are set, reply texts with the *followup* and *Followup* commands will be recorded in *directory*, not in the current directory. If *directory* does not begin with a slash, *mailx* sets the directory name to *$HOME/directory*.

You can also use the form *+filename* to reference these record files in any *mailx* command which accepts file names. *mailx* will then expand the name by prepending *directory*.

Default value: The variable is not set.

header
Causes the header summary, the current *mailx* version string and the number of messages to be displayed when *mailx* is invoked.

Default value: The variable is set.

hold
Preserves read messages in the default mailbox instead of putting them in the user-specific mailbox file (also refer to *MBOX* variable on page 533).

Associated commands: *copy, hold, mbox, next, preserve, print, Print, quit, touch, type, Type*

Default value: The variable is not set.

ignore Ignores the SIGINT signal during message input.

Associated commands: *followup, Followup, mail, Mail, reply, Reply, respond, Respond, ~q* (DEL)

Default value: The variable is not set.

ignoreeof The end-of-file signal (EOF, END key) is to be ignored during message input (also refer to the *dot* variable on page 529).

Associated commands: *followup, Followup, mail, Mail, reply, Reply, respond, Respond, ~.*

Default value: The variable is not set.

indentprefix=string
During the insertion of a message into a text each line of the message begins with *string*.

Associated commands: *~m, ~M*

Default value: Tab character.

keep The mailbox should not be deleted when it is empty.

Default value: The variable is not set.

keepsave Messages that are marked as saved (*S*) in the header are not to be deleted from the default mailbox.

Associated commands: *save, Save, write*

Default value: The variable is not set.

metoo If your own login name appears in the list of recipients ("To" list), it is not deleted from the list. See also the *mailx* command *alias* and the *allnet* variable.

Associated commands: *alias, alternates, followup, group, reply, respond, ~h*

Default value: The variable is not set.

outfolder If both *outfolder* and *folder* are set, reply files with the *followup* and *Followup* commands will be stored in the directory defined by *folder* (also refer to *record* variable on page 531).

If only *outfolder* (or only *folder*) is set, reply files will be stored in the current directory.

Default value: The variable is not set.

page Causes a form feed character (FF = CTRL L = X'0C') to be inserted after each message routed through a *pipe* or | command.

Default value: The variable is not set.

prompt=string

Sets the input prompt for *mailx* read-mode commands to *string*.

Default value: *?*

quiet Suppresses the display of the opening message and version identifier when *mailx* is invoked.

Default value: The variable is not set.

record=file Records all outgoing mail in the named *file*. The file is extended if it already exists.

Associated commands: *mail, Mail, reply, Reply, respond, Respond, ~.*

Default value: The variable is not set.

save Saves messages that could not be sent, e.g. due to an error or an interrupt from DEL during input. These messages are saved in the file specified by the *DEAD* variable.

Associated commands: *followup, Followup, mail, Mail, reply, Reply, respond, Respond, ~d, ~q* (DEL)

Default value: The variable is set.

screen=number

mailx displays *number* header lines.

Associated commands: *header*
Default value: Dependent on the terminal type specified by *TERM*, usually 20

sendwait After a read command, waits for the background mailer to finish before returning control to the user.

Associated commands: *followup, Followup, mail, Mail, reply, Reply, respond, Respond*
Default value: The variable is not set.

showto If you send a message and include yourself among the recipients, the name of the first recipient in the recipient list (To list) will appear in the header list displayed, not your login name.

Associated commands: *from, headers, z+, z-*
Default value: The variable is not set.

sign=string Defines an autograph string to be inserted into the text of a message.

Associated commands: *~a, ~i*
Default value: The variable is not set.

Sign=string Defines an (additional) autograph string to be inserted into the text of a message.

Associated commands: *~A, ~i*

Default value: The variable is not set.

toplines=number
mailx displays *number* lines from the message header.

Associated commands: *top*

Default value: 5

Error *mailx*'s error messages are largely self-explanatory.

File */etc/mail/mail.rc*
Global startup file

$HOME/.mailrc
Private startup file

/var/mail/$USER
The default mailbox that is searched by *mailx* for incoming messages.

$HOME/mbox
User-specific mailbox in which *mailx* saves messages that have been read.

$HOME/dead.letter
File that is used by *mailx* to save messages that could not be sent, e.g. due to an error or an interrupt with the DEL key during input. If the file already exists, it is overwritten.

./<username>
Files created in the current directory with names derived from a login name. These files are created by *mailx* in response to the following commands:
Copy, followup, Followup, Save.

You can also select some other directory instead of the current directory (see the *mailx* variables *folder* (page 529) and *outfolder* (page 530)).

*/tmp/R[emsxz]**
Temporary files.

/tmp/Rz$$
Temporary file used by the commands *edit*, *visual*, *~e*, and *~v*. *$$* is the process ID of the *mailx* process.

*/usr/share/lib/mailx/mailx.help**
Help message files

Variable **Environment variables**

DEAD=file The named *file* is used by *mailx* to save messages that could not be sent, e.g. due to an error or an interrupt during input. This file is extended if it already exists.

Associated commands: *followup, Followup, mail, Mail, reply, Reply, respond, Respond, ˜d, ˜q* ($\boxed{\text{DEL}}$)

Default value: *$HOME/dead.letter*

EDITOR=shell_command
In a *mailx* session, message texts can be edited with the editor named as *shell_command* (also refer to *mailx* variable *VISUAL* (page 534)).

Default value: *ed*.

HOME=directory
Home directory.
Specifies the default directory in which *mailx* creates or searches for the files *dead.letter, mbox, .mailrc*, and the files used to record outgoing messages (see the commands *followup* (page 510), *Followup* and *˜f*).

LISTER=shell_command
Uses *shell_command* to list files in the *folder* directory.

Associated commands: *folders*

Default value: *ls*

MAILRC=file *file* defines the name of the private startup file (default: *$HOME/.mailrc*; see "mailx command and startup files" on page 526).

MBOX=file *file* designates the user-specific mailbox in which *mailx* is to save read messages before removing them. Each additional message extends the file (also refer to the *hold* variable on page 529).

Associated commands: *copy, hold, mbox, next, preserve, print, Print, quit, save, touch, type, Type*

Default value: *$HOME/mbox*

PAGER=shell_command
Uses the specified *shell_command* for the paging of output that exceeds the number of lines defined in the *crt* variable.

Associated commands: *dp, dt, next, print, Print, type, Type, ˜p*

Default value: *more*

SHELL=shell_command
: Defines the command interpreter used by *mailx* to execute POSIX commands.

  Associated commands: *!, shell*

  Default value: */bin/sh*

TERM
: Contains information about the terminal type. The *TERM* variable will be evaluated if the *mailx* variable *screen* is not set.

USER
: The *USER* variable tells *mailx* the login name of the user, to enable it to identify the default mailbox etc.

VISUAL=shell_command
: In a *mailx* session, message texts can be edited with the editor named as *shell_command*.

  Associated commands: *visual, ~v*

  Default value: *vi*.

Locale The following environment variables affect the execution of *mailx*:

LANG
: Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
: If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
: Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and the handling of case-insensitive address and header-field comparisons.

LC_MESSAGES
: Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.

NLSPATH
: Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Replying to a message

User marvin receives the message `you have mail`, so he calls *mailx* without options. He sees a few lines of text and some header lines, has all his messages displayed one after the other (using ↵, for example) and finally replies to the fourth message. The text of his reply is to be recorded in the current directory (*followup* or *fo*). While in send mode, he changes the Subject entry assigned automatically by *mailx* (*˜s*) and inserts his sign-off string, as defined in his *sign* variable, at the end of the text (*˜a*). Before sending his letter (*˜.*), he has it redisplayed (*˜p*) and then quits *mailx* with *xit* or *x* so as to retain all his messages in the mailbox.

```
mailx
mailx version 4.0 Type ? for help
"var/mail/MARVIN": 4 messages 4 new
>N 1   ARTHUR     Fri Sep  6   9:21    13/373      betelgeuse
 N 2   FRODO      Fri Sep  6  12:00    13/365      sysadm
 N 3   PETER      Mon Sep 16  10:01     9/232      qed
 N 4   BENNY      Tue Sep 17  16:43    21/593      Project S
 ↵
 :
fo BENNY
To: <BENNY>
Subject: Re: Project S

˜s Final report on P S˜s Final report on P S
.
.
˜a˜a

˜p˜p
--------
Message contains:
To: <BENNY>
Subject: Final report on P S

Hi there, Ben!
Thanks for the minutes. What I really need is the final report itself,
 and not just Real Soon Now, but tomorrow at the latest. I need a
 printed version, not just a file.
 Regards,
 (-: marvin :-)
 (continue)
 ˜.

 ? x
 Held 4 messages in /var/mail/MARVIN
 $
```

Example 2 Example of a startup file

The following startup file sets variables and prints all messages from *winnie* (with *lp*) when *mailx* is invoked in read mode.

```
# Processing variables
set page crt=24 cmd=lp VISUAL
set sign="\n\tFord Prefect\n\tSales Division\n\t Detroit"

# Sender: Network system administrator
alias sys root@orlando root@annapolis root@chicago

# Prints specific mail
if r
pipe winnie lp
from winnie
endif
```

Note that *mailx* terminates the script if any command cannot be executed. This might be the case here with the *pipe* command if no messages from *winnie* were present. In other words, *mailx* then would not execute the *from* command (or any others that might follow).

See also *ed*, *ls*, *more*, *sh*, *vi*

make maintain, update and regenerate groups of programs

In modular programming, programs are typically made up of a number of files. *make* is a tool for updating programs of this type.

make uses a *makefile*, in which you can define targets and dependencies between targets. If one source file has been modified, *make* regenerates the program by recompiling only those parts which are directly or indirectly dependent on the modified file.

make regenerates the target if it is older than at least one of the files on which it is dependent. *make* allows for the dependency relationships between the file and checks the date and time when a file was last modified.

The *makefile* is normally called `makefile`, `Makefile`, `s.makefile` or `s.Makefile`. If you follow this naming convention, you can call *make* without specifying any arguments. *make* will look for the *makefile* in the current working directory or in the `SCCS` directory and will regenerate the target if at least one modification has been made.

Syntax **make**[␣**-einpqrst**][␣**-f**␣makefile]...[␣**-k**|**-S**] [macro=name]... [target]...

options

-e Cause environment variables to override macro assignments within *makefiles.*

-f␣makefile
Specify a different *makefile*. *makefile* is a pathname of a description file, which is also referred to as the *makefile*.

-i Ignore error codes returned by invoked commands. This mode is the same as if the special target *.IGNORE* were specified without prerequisites.

-k Continue to update other targets that do not depend on the current target if a non-ignored error occurs while executing the commands to bring a target up-to-date. *-k* overrides earlier *-S* options.

-n Useful for debugging. Write commands that would be executed to standard output, but do not execute them. Even lines with an at sign (@) character prefix will be written to standard output. Lines with a plus sign (+) prefix will be executed.

-p Write to standard output the complete set of macro definitions and target description. The output format is unspecified.

-q Return a zero exit value if the target file is up-to-date; otherwise an exit value of 1. Targets will not be updated if this option is specified. However, a command line (associated with the targets) with a plus sign (+) prefix will be executed.

-r Clear the suffix list and do not use the built-in rules.

-s Do not write command lines or touch messages to standard output before execution. This mode is the same as if the specified target `SILENT` were specified without prerequisites.

-S Terminate *make* if an error occurs while executing the commands to bring a target up-to-date. This will be the default and the opposite of *-k*.

-t Update the modification time of each target as though a touch target had been executed. A command with a plus sign (+) prefix will be executed.

Creating a makefile

The *makefile* specified by the *-f* option is a carefully structured file containing explicit instructions for updating programs. The file contains a sequence of entries defining dependencies.

The first line of each entry is a blank-separated, non-empty list of targets, followed by :, then by a list (which may be empty) of required files or dependencies. Text following a ; and all following lines that begin with a tab are shell commands that are to be executed in order to update the target.

The first non-blank line which does not begin with a tab or # starts a new dependency or macro definition. Shell commands may be continued across several lines with a <backslash><newline> sequence. Everything that *make* outputs (apart from the initial tab) is passed directly to the shell unmodified. Thus

```
 echo a\
 b
```

will cause *ab* to be output just as the shell would.

Commands extending across several lines may be no more than `LINE_MAX` lines long if the *.POSIX* directive is used.

Comments start with a number sign (#) and continue until an unescaped newline character is reached.

The following *makefile* says that *pgm* depends on two files, *a.o* and *b.o*, and that they in turn depend on their corresponding source files (*a.c* and *b.c*), and a common file *incl.h*:

```
pgm: a.o b.o
      c89 a.o b.o -o pgm
a.o: incl.h a.c
       c89 -c a.c
b.o: incl.h b.c
       c89  -c b.c
```

Executing a makefile

Command lines are executed one at a time, each by its own shell. The SHELL environment variable or the SHELL macro can be used to specify the shell that *make* should use to execute commands. The default is `/usr/bin/sh`.

The following directives (special targets) can be included in a *makefile* to control the behavior of *make*:

.POSIX	This special target must be specified without prerequisites or commands. If it appears before the first non-comment line in the makefile, *make* will process the makefile specified by this section; otherwise the behavior of *make* is unspecified.
.DEFAULT	If the makefile uses this special target, it must be specified with commands, but without prerequisites. The commands will be used by *make* if there are no other rules available to build a target.
.IGNORE	Prerequisites of this special target are targets themselves; this will cause errors from commands associated with them to be ignored in the same manner as specified by the *-i* option.
.PRECIOUS	Prerequisites of this special target will not be removed if *make* receives the quit or interrupt signal. If no prerequisites are specified, all targets will be ignored.
.SILENT	Prerequisites of this special target are targets themselves; this causes commands associated with them to not be written to the standard output before they are executed.

Command lines can have one or more of the following prefixes: an at sign @, a hyphen (-), or a plus sign (+). These modify the way in which make processes the command. When a command is written to standard output, the prefix is not included in the output.

@	the command will not be written to standard output before it is executed.
-	any error found while executing the command will be ignored
+	a command line will be executed even if the *-n*, *-q* or *-t* option is specified.

A line is output when it is executed unless the *-s* option is present or the .SILENT directive applies to the file or the initial character sequence includes a @. The *-n* option causes the command to be output without being executed unless a there is a + prefixed to the command line (in which the command will always be executed). The *-t* option updates the modified date of a file without executing any commands except where there is a + prefixed to a command).

Normally (or when the *-S* option is set), commands which return a non-zero status cause *make* to terminate. The exit status is ignored if the *-i* option is present or if the *.IGNORE* directive applies to the file or if the initial character sequence of the command includes **-**. If the *-k* option is present, work is abandoned on the current entry, but continues on other branches which are not dependent on that entry.

Interrupt and quit signals cause the target file to be deleted unless the *.PRECIOUS* directive applies to it.

Environment

The environment is read by *make*. All variables are assumed to be macro definitions and processed as such. The environment variables are processed before any *makefile* and immediately after the predefined rules. Thus macro assignments in *makefile* override environment variables. The *-e* option causes the environment to override macro assignment in a *makefile*. File name suffixes and their associated rules in a *makefile* override predefined rules for any identical suffixes.

The `MAKEFLAGS` environment variable may contain macros and any input options other than *-f* and *-p* which are valid for the command line. *make* interprets the variable before the command line. When *make* is invoked, the identically named macro `MAKEFLAGS` (and the variable, if undefined) is automatically supplied with the current options and macros and passed on to invocations of commands. Consequently the `MAKEFLAGS` always contains the latest definitions. This proves very useful for “super-makes”. In fact, when the *-n* option is used, `$(MAKE)` is always executed anyway. That means that you can run *make -n* recursively on a whole software system to see what would have been executed. This is possible because the *-n* is added to `MAKEFLAGS` and passed to further invocations of $(MAKE). This is one way of debugging all the *makefiles* for a software project without actually running anything.

The environment variable PROJECTDIR provides a directory to be used to search for SCCS files not found in the current directory. If the value of PROJECTDIR begins with a slash, it is considered an absolute pathname; otherwise, the home directory of a user of that name is examined for a subdirectory *src* or *source*. If such a directory is found, it is used. Otherwise, the value is used as relative pathname.

Include files

If *include* followed by a blank or a tab appears at the start of a line in a *makefile*, the rest of the line is interpreted as a file name, and the associated file will be read by the current invocation after substitution of any macros.

Macro definitions

Macro definitions are in the form *string1 = string2.*
string2 is defined as all characters, if any, after the equal sign, up to a comment character (#) or an unescaped newline character.

Subsequent appearances of $(*string1*[:*subst1*=[*subst2*]]) are replaced by *string2*.
The parentheses are optional if a one-character macro name is used and there is no substitution rule. The optional :*subst1=subst2* is a substitution rule. If a rule is specified, all non-overlapping occurrences of *subst1* in the specified macro are replaced by *subst2*. Strings for this type of substitution are delimited by blanks, tabs, newline characters and beginnings of lines. An example of the use of a substitution rule is shown in the *Libraries* section.

Internal macros

The *make* utility maintains five internal macros that can be used in target and inference rules.

$* evaluates to the current target name with its suffix deleted. It is evaluated at least for inference rules.

$@ evaluates to the full target name of the current target, or the archive filename part of a library archive target. It is evaluated for both target and inference rules.

$< in an inference rule, $< evaluates to the file name whose existence allowed the inference rule to be chosen for the target. In the *.DEFAULT* rule, the *$<* macro evaluates the current target name. The *$<* macro is evaluated only for inference rules. For example, in the *.c.a.* inference rule, *$<* represents the prerequisite *.c* file. An example for making optimized *.o*-files from *.c*-files is:

```
.c.o:
  c89 -c -O $*.c
```

or:

```
.c.o:
  c89 -c -O $<
```

$? evaluates to the list of prerequisites that are newer than the current target. It is evaluated for both target and inference rules.

$% evaluates only when the current target is an archive library member of the form `libname(member.o)` . In theses cases, *$@* evaluates to *libname* and *$%* evaluates to `member.o`.

Each of the internal macros has an alternative form. When an upper-case D or F is appended to any of the macros, the meaning is changed to the *directory part* for D and *filename part* for F. The directory part is the path prefix of the file without a trailing slash; for the current directory, the directory part is ".". When the $? macro contains more than one prerequisite filename, the `$(?D)` and `$(?F)` (or `${?D}` and `${?F}`) macros expand to a list of directory name parts and filename parts respectively.

Default rules

Certain file names, such as those ending in .o, have inferable prerequisites (dependency relationships) such as .c or .s. If no update commands for such a file are defined in the *makefile*, *make* looks for and compiles files matching the default prerequisites in order to make the target. For this purpose *make* has inference rules that allow it to build files from other files by examining suffixes and determining an appropriate inference rule to use. The following are the default inference rules:

```
.c      .c~      .f    .f~    .s      .s~     .sh    .sh~   .C     .C~
.c.a    .c.o     .c~.a .c~.c  .c~.o   .f.a    .f.o   .f~.a  .f~.f  .f~.o
.h~.h   .l.c     .l.o  .l~.c  .l~.l   .l~.o   .s.a   .s.o   .s~.a  .s~.o
.s~.s   .sh~.sh  .y.c  .y.o   .y~.c   .y~.o   .y~.y  .C.a   .C.o   .C~.a
.C~.C   .C~.o    .L.C  .L.o   .L~.C   .L~.L   .L~.o  .Y.C   .Y.o   .Y~.C
.Y~.o   .Y~.Y
```

The user can add rules to this list by entering them in the *makefile*.

The inference of prerequisites can be controlled. The rule for creating a file with the suffix .o from a file with the suffix .c is specified as an entry with c.o.: as the target and no dependents. Shell commands associated with the target define the rule for creating a .o file from a .c file. A target with no slashes in it and beginning with a dot is identified as a rule and not as a true target.

The default rules for *make* appear in the rules.c source file for the *make* program. They can be modified locally. The following command is used to output the rules compiled into the *make* on any machine in a form suitable for recompiling:

```
make -pf - 2>/dev/null </dev/null
```

A tilde in the above rules refers to an SCCS file. Thus the rule .c~.o would convert an SCCS C source file to an object file (.o). Since the s. of the SCCS files is a file name prefix, it is incompatible with the *make* suffix concept. Thus the tilde is a way of changing a file reference to an SCCS file reference.

A rule with only one suffix (e.g. .c:) defines how to build x from x.c. In effect, the other suffix is null. This is useful when buildings targets from only one source file (for instance, shell scripts or simple C programs).

Additional suffixes can be defined as a list with *.SUFFIXES*. The order of the list is significant: the first possible name for which a file and a rule are present is selected. The default list is:

```
.SUFFIXES .o .c .c˜ .y .y˜ .l .l˜ .s .s˜ .sh .sh˜ .h .h˜ .f .f˜
.C .C˜ .Y .Y˜ .L .L˜
```

The above command for outputting the internal rules also displays this list of suffixes implemented on the current machine. Multiple suffix lists are cumulative; *.SUFFIXES:* with no dependencies clears the list of suffixes.

Thus the example shown under “Creating a makefile” on page 538 can be formulated more concisely:

```
pgm: a.o b.o
      cc a.o b.o -o pgm
a.o b.o: incl.h
```

The default inference rules use certain macros to permit the inclusion of optional elements in the resultant command sequence. For example, `CFLAGS`, `LFLAGS` and `YFLAGS` are used for compiler options for *cc* [5], *lex* and *yacc* respectively.

The `.SCCS_GET` directive allows you to modify the default commands for accessing `SCCS` files which are not in the current working directory. The default rule is:

```
.SCCS_GET: sccs $(SCCSFLAGS) get $(SCCSGETFLAGS) $@
```

Libraries

If a target or prerequisite contains parentheses, it will be treated as a member of an archive library, where the string in parentheses refers to a member in the library.

Thus `lib(file.o)` and `$(LIB)(file.o)` refer to an archive library that contains `file.o`. This assumes that the `LIB` macro has been defined previously. The expression `$(LIB)(file1.o file2.o)` is not valid. Rules associated with archive libraries take the form *.XX.a*, where *XX* is the suffix of the file from which the archive member is to be made. Unfortunately, the current implementation requires *XX* to be different from the suffix of the archive member. Thus it is not possible to specify that `lib(file.o)` is dependent on `file.o`.

The most common use of the archive interface follows. Here, it is assumed that the source files are all C-language source:

```
lib:  lib(file1.o) lib(file2.o) lib(file3.o)
       @echo lib is now up-to-date
.c.a:
      $(CC) -c $(CFLAGS) $<
      $(AR) $(ARFLAGS) $@ $*.o
      rm -f $*.o
```

In fact, this `.c.a` rule is predefined in *make* and is superfluous in this example. A more interesting but more limited example of archive library maintenance is:

```
lib:  lib(file1.o) lib(file2.o) lib(file3.o)
      $(CC) -c $(CFLAGS) $(?:.o=.c)
      $(AR) $(ARFLAGS) lib $?
      rm $?
      @echo lib is now up-to-date .c.a:;
```

In this case the macro substitution mechanism is used. The *$?* list is defined as the set of object file names (within `lib`) whose C source files are outdated. The macro substitution mechanism replaces `.o` with `.c`. Unfortunately it is not yet possible to translate to `.c~`, but this transformation may be implemented in the future. Also note the disabling of the `.c.a:` rule, which would have created each object file one after the other. This special construct considerably accelerates archive library maintenance, but it does become rather cumbersome if the archive library contains a mix of assembly programs and C programs.

File

[Mm]akefile and s.[Mm]akefile
`/usr/bin/sh`

Hint

Some commands return an inappropriate non-zero status. You can overcome this problem by using *-i* or the command line prefix –.

File names containing the characters = : @ cannot be processed.
Commands which are directly executed by the shell, particularly *cd*, are ineffectual across new-lines in *make*.
The syntax lib(file1.o file2.o file3.o) is invalid. It is not possible to build lib(file.o) from file.o.

Locale

The following environment variables affect the execution of *make*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If any of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If set to a non-empty value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also

ar, lex, *yacc, c89* [5]

man display system documentation

The *man* command allows you to use the POSIX online documentation, in other words to have the syntax and description of a POSIX commands written to standard output.

Syntax

man[␣**-x**]␣command ...

man -k␣expression

-x Only the command syntax is written to standard output. If this option is not set the full description of the command is output.

-k Scans the POSIX-internal database. This database contains a brief description of every command. Every line which contains the specified expression is output.

command
The name of one or more POSIX commands. If there is no description available for one of the commands the following error message is output:
`Manual entry not found: /usr/share/man/En/`***text***`.txt.Z`
If more than one command is specified and *-x* is not set, the output command defined by the *PAGER* variable is called separately for each command.

expression
An expression according to the syntax of the grep command. The search is performed case-insensitive (`grep -i`).

File

/usr/share/man/En/.txt.Z*
/usr/share/man/De/.txt.Z*
These files contain the manual entries; one file per command and language.

/usr/share/man/En/man.index
/usr/share/man/De/man.index
Brief descriptions of the commands.

Variable

PAGER
Determines the command which will display or process the information. The information will be sent to standard input of the command. The default value is `more -d`.

Locale

The following environment variables affect the execution of *man*:

LANG	Determines the language for the output of documentation and of messages. If the contents of the variable start with "De" oder "de" the output language will be German. Otherwise it will be English.
LC_ALL	If set to a non-empty string value, that value overwrites the value of the *LANG* variable.

Example 1 Displaying Information about the *mkdir* command:

```
$ man mkdir
mkdir - make directories
========================

mkdir is used to create new directories.
...
(END) [RETURN]
$
```

Example 2 Displaying all the commands which contain the string "attrib" in their brief description:

```
$ man attrib
Manual entry not found: /usr/share/man/En/attrib.txt.Z
$ man -k attrib
bs2file - set BS2000 file attributes
export - set export attribute for variables
readonly - set read-only attributes for variables
typeset - set attributes for variables
unset - unset values and attributes of variables and functions
(END) [RETURN]
$
```

Beispiel 3 Send the brief description of all commands to the default printer:

```
$ PAGER=lp man -k .
lp: request id is TSN-0V02 (TSN0V01.2011-04-27.144908-1.standard_input)
$
```

Example 4 Displaying the syntax of the head command:

```
$ man -x head
+-- Syntax --------------------------------------------------------------+
|                                                                        |
| Format 1: head[ -n number][ file]                                      |
|                                                                        |
| Format 2: head[ -number][ file]                                        |
|                                                                        |
+------------------------------------------------------------------------+
$
```

See also *cat*, *more*, *lp*

mesg permit or deny messages

mesg controls the receival of messages on terminals that have logged on to POSIX with *rlogin* or *telnet*. You can use *mesg* to check whether your terminal can receive messages or to grant or deny other users the permission to send messages to your terminal with *write*.

Syntax

```
mesg[␣y|␣n]
```

No option specified

mesg reports the current setting for your terminal and returns an exit status of 0 if messages may be sent to it, or 1 if they cannot.

option

y Grants other users permission to write messages to your terminal.

This corresponds to the old argument *-y* which is still supported.

n Denies other users permission to write messages to your terminal. Messages sent via *wall* or *write* by the POSIX administrator override this denial.

This corresponds to the old argument *-n* which is still supported.

Exit status

0 Messages are receivable

1 Messages are not receivable

>1 Error

File

*/dev/tty** and */dev/term/tty**
Files containing terminal-specific information.

Locale

The following environment variables affect the execution of *mesg*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 User *heidi*, who is logged in at terminal *tty001*, checks the current setting for this terminal:

```
$ mesg
is n
```

Messages are not receivable at terminal *tty001*. Thus no messages can be sent to *heidi* while she is working at terminal *tty001*:

```
$ write heidi
Permission denied.
```

Example 2 *heidi* can change the setting at terminal *tty01* by entering:

```
$ mesg y
```

See also *tty*, *write*
wall [13]

mkdir make directories

mkdir is used to create new directories.

mkdir automatically makes the following standard entries in the new directory:

.	(dot)	for the directory itself
..	(dot dot)	for the parent directory

To be able to use *mkdir* you have to have write permission in the parent directory.

Syntax **mkdir**[␣**-m**␣mode][␣**-p**]␣directory␣...

No option specified

mkdir creates the named directories in mode *777* (see section “chmod change file modes” on page 206) unless the *umask* command has been used to change the file-creation mode mask (see section “umask get or set the file mode creation mask” on page 797).

option

-m␣mode

(mode) The access permissions specified in *mode* are used for the new *directory* (see section “chmod change file modes” on page 206).

-p (parent) (parent) *mkdir* creates any non-existing parent directories that are given in the path name of *directory* before creating the directory itself.

directory

Name of the directory that you wish to create. You can also create more than one directory at a time.

directory can be given either as a relative path name or as an absolute path name.

The user ID and the group ID of the new directory are set to the real user ID and real group ID of the calling process.

Exit status

0	If all directories given in the command line were made successfully.
≠ 0	If an error occurs. *mkdir* also prints an error message.

Locale The following environment variables affect the execution of *mkdir*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Creating a new directory named *letters* in the directory */home/sisyphus/general*:
First you check which directory you are in. The default directory mode is set to *777*.

```
$ pwd
/home/sisyphus
```

Next you list the contents of this directory:

```
$ ls -l
total 145
-rw-r--r--   1 SISYPHUS   group1      5329   Nov 03 09:54 diff.rc.1
drwx--x--x   2 SISYPHUS   group1      2589   Aug 03 15:08 general
                  .
                  .
                  .
drwxr-----   3 SISYPHUS   group1      2340   Jun 11 15:35 lingua
drwx------   2 SISYPHUS   group1      3380   Oct 11 15:36 post
drwx--x--x   2 SISYPHUS   group1      2080   Nov 04 16:08 proc
drwx------   2 SISYPHUS   group1      1560   Oct 11 15:36 screens
```

Then you create the new directory:

```
$ mkdir general/letters
```

Finally you check whether a directory named *letters* has been created:

```
$ cd general
$ ls -l
total 5
drwx--x--x   2 SISYPHUS   group1       520   Jan 22 16:21  letters
```

See also *rm, rmdir, umask*

mkfifo make FIFO special files

mkfifo creates the FIFOs special files specified in its argument list.
For every file argument, the *mkfifo* command behaves as if the *mkfifo* function (see *mkfifo* [4]) was called with the following arguments:

– the *path* argument of *mkfifo*[4] is set to *file*.

– the *mode* argument of *mkfifo*[4] has the value 0666 or the value of *mode* if the *-m* option is specified.

If an error occurs during the creation of a FIFO special file, *mkfifo* writes a diagnostic message to the standard error output and then continues with the remaining arguments, if any.

Syntax

```
mkfifo[␣-m␣mode]␣file...
```

No option specified
: *mkfifo* creates the FIFO special files specified in *file* with the access rights 666, modified by the current file-creation mode mask (see section “umask get or set the file mode creation mask” on page 797).

-m␣mode
: *mkfifo* creates the new FIFO special file with the access rights specified in *mode* (see section “chmod change file modes” on page 206). If specified symbolically, the operands + and - are interpreted relative to a default value of a=rw .

file
: The name of the FIFO special file that you would like to create. You can specify a number of FIFOs.

Locale

The following environment variables affect the execution of *mkfifo*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Is used for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also *chmod*, *umask*
mkfifo [4]

mkfs make file system

mkfs creates a ufs file system by writing on the special file *file*. *mkfs* waits 10 seconds before starting to build the file system. During this time you can abort the command by pressing the DEL key.

Syntax **mkfs**[␣**-F**␣ufs][␣**-V**][␣**-m**|**-s**][␣**-q**][␣**-y**][␣−**o**␣specific options]␣file[␣size]

Caution!
The functionality of the *mkfs* command is incorporated in the POSIX installation program (see the manual “Basics for Users and System Administrators” [1]), so it is not described in further detail here. If you nonetheless need to make explicit use of *mkfs*, you will find a description of the command and its options in the Reliant UNIX System administrator’s reference manual [13].

mknod make an inode

The command *mknod* creates a directory entry for a special file.

Syntax

Format 1: mknod␣name[␣**b**|**c**]␣device_class␣device_number

Format 2: mknod␣name␣**p**

Format 1

mknod␣name[␣**b**|**c**]␣device_class␣device_number

Only the POSIX administrator may enter this format.

name
Name of the special file which is to be created

option

b for a block-oriented special file

c for a character-oriented special file

device_class␣device_number
Number of the device class. This may be entered in octal or decimal notation. You must enter a leading zero if you choose octal notation. The device number assignment is system-specific.

Example of possible device classes (major device number):

58	Terminal file (*/dev/term/*...)
59	SF terminal file (*/dev/sf/*...) (SYSFILE is used to access terminals from within BS2000 batch procedures)

i It is not sufficient merely to create the TERM and SF special files. The appropriate POSIX parameters also have to be set if these files are to be used:

File: $TSOS.SYSSSI.POSIX-BC.*nnn* (*nnn* = version, see the POSIX manual "Basics for Users and System Administrators" [1])

Parameters:

NOTTY	Maximum number of terminal connections that can be used
NOSSTY	Maximum number of SF terminal connections that can be used

These parameters only take effect when you restart the POSIX subsystem.

Format 2 **mknod**␣name␣**p**

name
Name of the special file

p Generates a FIFO file (known as a pipe)

Example Creating an additional special file (*/dev/term*). This example was conducted under the POSIX administrator's ID.

```
# cd /dev/term
/dev/term # ls -l /dev/term/511
crw-rw-rw- 1 SYSROOT  TTY   58,511 Jan 14 2008 /dev/term/511
/dev/term # mknod /dev/term/512 c 58 512
/dev/term # chmod a+w /dev/term/512
/dev/term # ls -l /dev/term/512
crw-rw-rw- 1 SYSROOT SYSROOT 58,512 Jan 27 14:14 /dev/term/512
```

See also *mknod* [4]

more display files on a page-by-page basis

The *more* command is used to page through the contents of one or more files on the terminal.
more displays its output by scrolling up lines on the screen.

Syntax

Format 1: more[␣**-cdefisu**][␣**-n**␣number][␣**-p**␣command][␣file]...

Format 2: more[␣**-cdefisu**][␣**-n**␣number][␣**+**command][␣-lines][␣+line_number] [␣+/pattern][␣file]...

No option specified

The output is displayed one screenful at a time by default and can be controlled further with the commands described below. If you do not specify any of the options or built-in commands, *more* pauses after each screenful.
After the first screenful, `(<filename>..%)` appears as a prompt at the bottom of the screen.
If you press the space bar ␣ (on block-mode terminals ␣↵), *more* displays another screenful. If you press only ↵, the screen is scrolled one more line down.
more provides a two-line overlap between screens for continuity. If *more* is reading input from a file, the percentage of lines displayed so far is also shown (`..%`). This does not occur when *more* is used in combination with a pipe (|).

option

-c *more* clears the screen before displaying a new page; useful on faster displays. The *-c* option is ignored if the terminal does not have the ability to clear the screen.

-d On block terminals, comments and warnings referring to unavailable screen control facilities are suppressed.

-e Causes *more* to automatically exit the file the first time it reaches the end of the file. By default, *more* exits when it reaches the end of the file for the second time.

-f *more* does not fold long lines that extend beyond the right edge of the screen. The *-f* option cannot prevent line breaks automatically generated by the terminal hardware. *more* continues to count the displayed lines as if no line breaks have occurred.

-i Case is ignored during a search, i.e. lowercase and uppercase are regarded as the same. A search can also be conducted for overscored or underscored text. This option is ignored if the search pattern itself contains uppercase letters.

-s *more* compresses the output file by replacing multiple blanks with a single blank.

-u *more* suppresses generation of underlining escape sequences.

-u not specified:
more handles underlining produced by text formatters such as *nroff* in a manner appropriate to the terminal. If the terminal can do underlining or has a stand-out mode, *more* supplies appropriate escape sequences as called for in the text file.

-n␣number
Specify the number of lines per screenful. The *number* argument is a positive decimal integer.

-p␣command
The *-p* option in the command line is the same as specifying *+/ command*, i.e. *more* executes *command* each time at new file is displayed.

This is the same as the + *command* that is also supported.

-lines
The value which you specify for *lines* defines the number of lines in each screenful.

+line_number
more starts output of the file at the given *line_number*.

+/pattern
pattern is a regular expression which may be used to browse through a text file. The output begins two lines above the string which matches *pattern*.
Unlike patterns used with editors, this construct should not end with a / (slash). If it does, the trailing slash will be interpreted as a character in the search pattern.

file
Name of the file or files to be displayed. If multiple files are given, the name of the current file is displayed in a header line before each file.

Commands

When *more* pauses at the end of a screenful, you can control subsequent output with the following commands:

n space_bar
more displays *n* more lines. If you press the space bar (on block-mode terminals ␣ ↵) without a value for *n*, the next screenful is displayed.

n ↵
more displays *n* more lines. If you press ↵ without a value for *n*, the next line is displayed.

n CTRL **d**
n**d**
more displays *n* more lines and sets the scroll size to *n*.

n**z** *more* sets the number of lines per screenful to *n* and displays the next screenful.

n**s** *more* skips *n* lines of output and prints the text that follows. The omission is indicated by a comment at the skipped position.

n**f** The number you specify for *n* defines how many screenfuls are to be skipped. The number of lines omitted as a result is indicated at the skipped position.

n CTRL **b**
n**b**
more skips back *n* screenfuls.

q
Q
:q
:Q
The above four forms of Q terminate *more*.

= *more* displays the current line number.

v *more* calls the *vi* editor and skips to the current line of the current file. The current line is the last line displayed by *more*.

h *more* displays a tabular overview of all *more* commands with a brief description of their functions.

n**/**pattern
more searches forward for the *n*th occurrence of the regular expression *pattern*. If the given pattern occurs fewer than *n* times and if *more* is reading from a file rather than a pipe, the position in the file remains unchanged. If *more* is reading from a pipe, it will terminate.
If the search succeeds, *more* displays a new screenful starting two lines before the line containing the *n*th match.

/n *more* searches for the *n*th occurrence of the last regular expression entered.

' (single quote) *more* goes to the point from which the last search for a regular expression was started. All subsequent single quotes are ignored. If no search has been performed yet, *more* goes to the start of the file.

!shell_command
more invokes a new shell to execute the specified *shell_command*. Two additional variables may be used when defining *command*:
% is expanded to the current file name;
! is expanded to the previous shell command.
If you need to include a *%* or *!* in the command, you must escape it by preceding it with a backslash.

n:n *more* skips forward to the *n*th next file named in the command line. If fewer than *n* files are listed, *more* skips to the last file; without a value for *n*, it skips to the next file in the given order. If you are already in the last file, *more* terminates.

n:p *more* skips back to the *n*th previous file named in the command line. If fewer than *n* files are listed, *more* skips to the first file.
This command will not work if *more* is reading from a pipe.

:f *more* displays the current file name and line number.

. (dot) *more* repeats the previous command.

Functionality

The *more* command set the terminal to *noecho* mode. In other words, *more*'s built-in commands are not displayed on your terminal when you enter them, except for regular expressions, the exclamation point, and the slash.
more operates in *cbreak* mode, which means that the commands listed above are processed as soon as they are completed and need not be confirmed with ↵. This mode also causes both commands to automatically terminate at the end of the text file.
Since *more* is generally more efficient at skipping forward than back, it is not very suitable for performing reverse searches on large files.
more discovers the terminal's display characteristics by reading the *terminfo* files.

File

*/usr/share/lib/terminfo/**
File containing display characteristics.

/usr/lib/more.hlp
Help file

Variable

COLUMNS
Override the system selected horizontal screen size.

EDITOR
Used by the *v* command to select an editor.

LINES
Override the system selected vertical screen size. The *-n* option takes precedence over the LINES variable for determining the number of lines in a screenful.

Locale The following environment variables affect the execution of *more*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Displaying the file named *test*, starting at the location of the word *example* and without folding long lines:

```
$ more -f +/example test ↵
```

The output begins two lines above the first line which contains the word *example*.

See also *cat*, *ed*, *man*, *sh*

mount mount a file system

mount (Format 2 and Format 3, see page 565) integrates a ufs file system into the file system hierarchy at the path name position *mountpoint.* This position must already exist. If *mountpoint* possesses any contents prior to the mount operation these remain hidden until the file sysem is dismounted again.

mount (Format 4 and Format 5, see page 567) mounts a bs2fs file system at a particular position in the POSIX file system. A bs2fs file system is understood to be a selectable set of files in BS2000 which are made available transparently in POSIX so that they can be accessed using POSIX means (commands, program interfaces). The files are selected via the user and catalog ID and wildcard symbols.

In addition, *mount* (Format 1) can be used to output a list of all the mounted file systems.

Please refer to the manual “NFS (BS2000/OSD)” [9] for details of how to mount nfs file systems.]

Syntax

Format 1: mount[␣**-v**␣|␣**-p**]

Format 2: mount[␣**-F**␣**ufs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]{␣resource␣|␣mountpoint}

Format 3: mount[␣**-F**␣**ufs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]␣resource␣mountpoint

Format 4: mount[␣**-F**␣**bs2fs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]
{␣resource␣|␣mountpoint␣}

Format 5: mount[␣**-F**␣**bs2fs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]␣resource␣mountpoint

Display a list of mounted file systems

Format 1 **mount**[␣**-v**␣|␣**-p**]

No option specified
mount displays a list of all mounted file systems (see Example).

option

-v Displays a new presentation of the output. The new output contains the file system type and options in addition to the information in the old output. The fields *mountpoint* and *resource* change places (see Example).

-p Displays a list of the mounted file systems in the */etc/vfstab* format (see Example).

mount ufs file systems

Format 2 **mount**[␣**-F**␣**ufs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]{␣resource␣|␣mountpoint}

Format 3 **mount**[␣**-F**␣**ufs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]␣resource␣mountpoint

The descriptions of Format 2 and Format 3 have been combined, since they differ only in terms of the (optional) specifications *resource* and *mountpoint*.

Format 2 can be used only if an entry for the relevant file system already exists in the */etc/vfstab* file. The missing specification for *resource* or *mountpoint* is then added from this.

Formats 2 and 3 can be entered only by the POSIX administrator.

No option specified
mount displays a list of all mounted file systems.

-F␣ufs
Specifies *ufs* as the file system type.

-V Displays the entire command line on screen but does not execute the command. The command line is displayed together with the options and arguments entered by the user and with the values derived from */etc/vfstab*. This option allows you to check the general validity of the command line.

-r Mounts the file system with read access.

-o Specifies *ufs* file system-specific options. Multiple options should be comma-separated. If invalid options are specified a warning is issued and the invalid options are ignored. The following options may be selected:

f	Imitates an */etc/mntab* entry but does not mount a file system. The parameters are not checked.
n	Mounts the file system without making an entry in */etc/mnttab*.
journal	If there is no journal, one is created when the file system is mounted. This journal is used for a quick restart after a system crash. When the *ro* option is specified, the *journal* specification has no effect, i.e. there is no journaling in the event of read-only accesses.
rw | **ro**	Read/write or read only access. The default value is *rw*.
nosuid	By default, the file system is mounted in such a way that the s-bit is set for users. If you specify *nosuid* then the default value is deactivated and the file system is mounted without the s-bit being set for users.

remount Is used together with *rw*. A file system which has been mounted with read access only can be remounted with read/write access. This option fails if the file system is not currently mounted or has been mounted with *rw*.

bs2fscontainer

Specifies the file system which is to be mounted as the bs2fs container, i.e. as a file system which temporarily accommodates files from bs2fs file systems.

This option may only be specified for a single *ufs* file system. Any other *mount* commando with this option is rejected.

The *-r*, *-o ro*, *-o journal* and *-o remount* options may not be specified together with the *bs2fscontainer* option.

When the POSIX installation program is used, this option can be entered via the option line.

i This option can only be specified for a file system which was flagged as the bs2fs container when it was created with the POSIX installation program.
When the *append* function is applied to a ufs file system which is to be created or overwritten, the *bs2fscontainer* option must be specified in the option line for this purpose.
If this is not done, the mount is aborted with an error and the file system, together with its content, is retained.
The ufs file system that serves as the bs2fs container is expected to be an empty file system.
If it is not empty, its content is deleted using the *–o bs2fscontainer* option when the *mount* command is executed.
After a successful mount, two bs2fsd copy daemons are started automatically.

resource

specifies the file system which is to be mounted.

mountpoint

Specifies the local position for mounting *resource*. You must specify an absolute path name.

mount bs2fs file sytems

Format 4 **mount**[␣**-F**␣**bs2fs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]{␣resource␣|␣mountpoint␣}

Format 5 **mount**[␣**-F**␣**bs2fs**][␣**-V**][␣**-r**][␣**-o**␣spec_options]␣resource␣mountpoint

The descriptions of Format 4 and Format 5 have been combined, since they differ only in terms of the (optional) specifications *resource* and *mountpoint*.

Format 4 can be used only if an entry for the relevant file system already exists in the */etc/vfstab* file. The missing specification for *resource* or *mountpoint* is then added from this (see also the note on page 569).

Formats 4 and 5 can be entered only by the POSIX administrator.

A **prerequisite** for entering a *mount* command of Format 4 or 5 is that a bs2fs container is already mounted.

No option specified
mount displays a list of all mounted file systems.

-F␣bs2fs
Specifies *bs2fs* as the file system type.

-V Displays the entire command line on screen but does not execute the command. The command line is displayed together with the options and arguments entered by the user and with the values derived from */etc/vfstab*. This option allows you to check the general validity of the command line.

-r Mounts the file system with read access.

-o Specifies *bs2fs* file system-specific options. Multiple options should be comma-separated. If invalid options are specified a warning is issued and the invalid options are ignored. The following options may be selected:

rw | **ro**	Read/write or read only access. The default value is *rw*.
nosuid	The file system is mounted without setting the s bit for users. This option is enabled by default for bs2fs file systems and cannot be disabled.
remount	Is used together with *rw*. A file system which has been mounted with read access only can be remounted with read/write access. This option fails if the file system is not currently mounted or has been mounted with *rw*.

ftyp={**text**|**binary**|**textbin**}

This option has the same effect as the *ftyp* command when copying files using the *bs2cp* command. It defines whether BS2000 SAM files and text-type POSIX library elements (element type other than L) are interpreted in POSIX as text or binary files. PAM files are always interpreted as binary files, ISAM files always as text files.

This option should only be specified once. If it is specified more than once, the specification with the highest priority applies, where *ftyp=textbin* has the highest priority, *ftyp=text* the next highest priority and *ftyp=binary* the lowest priority.

The default is *ftyp=text*.

ftyp=text

SAM files and text-type library elements are interpreted as text files. When writing to a bs2fs file, end-of-line characters (X'15') are converted to a record change and tabulator characters (X'05') to the corresponding number of blanks.

ftyp=binary

SAM files and text-type library elements are interpreted as binary files. A 1:1 transfer takes place without interpreting and converting data (record change/end-of-line characters, tabulator/blanks, etc.).

ftyp=textbin

SAM files and text-type library elements are interpreted as binary text files. When writing to a bs2fs file, only end-of-line characters (X'15') are converted to a record change. Tabulator characters (X'05') are not converted to blanks.

resource

Defines which BS2000 files are to be mounted. The following syntax applies for the option:

`:cat:$user.filename-with-wild`

The option can be entered in upper- or lowercase or in a mixture of both. Special characters of the POSIX shell such as '$' or '*' must be escaped explicitly.

cat	Catalog ID
user	BS2000 user ID

filename-with-wild

BS2000 file name with wildcard symbols

*

Replaces an arbitrary (even empty) string.

/

Replaces precisely one arbitrary character.

Terminating period

Partially -qualified entry of a name.
Corresponds implicitly to the string "./*", i.e. at least one arbitrary character follows the period.

<s_x:s_y>

Replaces a string that meets the following conditions:

- It is at least as long as the shortest string (s_x or s_y)
- It is not longer than the longest string (s_x or s_y)
- It lies between s_x and s_y in the alphabetic collating sequence; numbers are sorted after letters (A…Z, 0…9)
- s_x can also be an empty string which is in the first position in the alphabetic collating sequence
- s_y can also be an empty string which in this position stands for the string with the highest possible code (contains only the characters X'FF')

<s_1,…>

Replaces all strings that match any of the character combinations specified by s. s can also be an empty string. Any such string can also be a range specification "s_x:s_y".

-s

Replaces all strings that do not match the specified s. The minus sign may only appear at the beginning of the string.

The file set defined with *resource* can consist of both existing files and files which are to be created. When a new file is to be created, the required file name must match the wildcard pattern of the corresponding *mount* command.

mountpoint

Specifies the local position for mounting *resource*. You must specify an absolute path name. If *mountpoint* is a symbolic reference then the file system is mounted in the directory to which the symbolic reference points rather than being mounted alongside the symbolic reference.

Hint

If an entry for the file system concerned exists in the */etc/vfstab* file, one of the options *resource* or *mountpoint* can be omitted (Format 2 or 4). When a bs2fs file system is used, the following must be observed in this case:

- If the *mountpoint* option is specified, an entry in */etc/vfstab* can then be identified unambiguously and the corresponding file system is mounted.
- If only the *resource* option is specified, multiple suitable entries for a bs2fs file system can be contained in the */etc/vfstab* file as this file system can be mounted in parallel at multiple locations. In this case only the **first** bs2fs file system entered in the */etc/vfstab* file is mounted.

  Only entries with an identical wildcard string are recognized as suitable entries. Entries with a different wildcard string are also not taken into account even if they define the same set of files.

File

/etc/mnttab
Table of mounted file systems.

/etc/dfs/fstypes
The default type of distributed file system.

/etc/vfstab
Table of automatically mounted file systems.

/etc/mnttab Table of mounted file systems

The file */etc/mnttab* contains information about all the file systems mounted on the local computer. This file contains information which is generated by the *mount* command.

Each line contains the following information; items are separated by any number of blanks and/or tabs:

Format

```
resource     mountp    fstype    spec-options    time
```

resource

Absolute path name of the mounted file system or, in the case of bs2fs file systems, mounted BS2000 files in wildcard syntax.

For bs2fs file systems the entry differs from the entry in the *mount* command as follows:
- It is converted completely into uppercase notation
- Escaped characters are displayed without the associated escape character

Example:

```
mount -F bs2fs -o ftyp=text :v70a:\$bach.sys\* /home/bach/bs2.1
```

generates the following entry in */etc/mnttab*:

```
:V70A:$BACH.SYS* /home/bach/bs2.1 bs2fs ftyp=text,suid,rw,noquota ...
```

mountp
Absolute path name of the mount point.

fstype File system type.

spec-options
Options as specified for the *mount* command.

time Mount time, given in seconds since 1.1.1970

Entries in the */etc/mnttab* file are deleted again if the *umount* or *umountall* command is executed for corresponding file systems or file system types.

Example

Enter the following in the POSIX shell: `cat /etc/mnttab`

```
/dev/root      /            ufs    rw,suid           802532552
/proc          /proc        proc   rw,               802532553
/dev/fd        /dev/fd      fdfs   rw                802532553
/dev/dsk/3     /var         ufs    suid,rw,noquota   802532558
/dev/dsk/2     /home1       ufs    suid,rw,noquota   802532588
SINTEST1:/nfs  /nfsclient   ufs    rw                802536261
```

/etc/vfstab Table of defined file systems

The */etc/vfstab* file describes every file system which is defined on the local computer. You can edit this file with an editor.

The file systems for which *yes* is entered in the *automnt* column of the */etc/vfstab* file are mounted automatically when POSIX starts of by the *mountall* command.

In addition, the entries in the file are used to complement any missing details for *resource* or *mountp* and *mount* options when a mount command is executed.

Corresponding entries are generated automatically in the */etc/vfstab* file for ufs file systems which are defined using the POSIX installation program. For all other file systems (e.g. bs2fs or nfs file systems) the entries must be created manually when required.

In contrast to the */etc/mnttab* file, execution of the *mount* and *umount* commands for the */etc/vfstab* file has no repercussions. Corresponding entries are retained.

The fields in the table are separated by blanks and/or tabs. A hyphen (–) indicates a blank entry in the relevant field. The table contains the following fields:

Format

```
special␣fsckdev␣mountp␣fstype␣fsckpass␣automnt␣mntopts
```

special	Describes the resource to be mounted. The following must be borne in mind in the case of (manual) entries for bs2fs file systems: – Letters may only be specified in uppercase notation – Special characters may not be escaped, nor is it permissible to enclose the string in quotes
fsckdev	Name of the block-oriented device or of the resource of the character-oriented device.
mountp	Mount point: absolute path name of the directory in which the resource is to be mounted.
fstype	File system type.
fsckpass	The pass number to be used for multiple *fsck* commands
automnt	Specifies whether (*yes*) or not (*no*) the resource is to be mounted automatically by *mountall* at POSIX startup time.
mntopt	List of options separated by commas for mounting the file system. The options are the same as the *specific_options* of the *mount* command.

Example

Enter the following in the POSIX shell: `cat /etc/vfstab`

```
/dev/root                /dev/rroot      /                       ufs     1    yes
     -
/proc                    -               /proc                   proc    -    no
     -
/dev/fd                  -               /dev/fd                 fdfs    -    no
     -
/dev/dsk/3               /dev/rdsk/3     /var                    ufs     1    yes
     -
172.25.86.64:/home2/froede/SHARE  -      /home/froede/RETSINA    nfs     -    no
     soft
PGOB0004:/home2/froede/SHARE      -      /home/froede/PGOB0004   nfs     -    no
     soft
/dev/dsk/4               /dev/rdsk/4     /home/froede            ufs     1    yes
     -
/dev/dsk/10              /dev/rdsk/10    /home/gast              ufs     1    yes
     -
/dev/dsk/13              /dev/rdsk/13    /mnt/ascii              ufs     1    no
     -
/dev/dsk/8               /dev/rdsk/8     /mnt/dat1               ufs     1    no
     -
/dev/dsk/23              /dev/rdsk/23    /bs2fscont              ufs     1    no
     -
/dev/dsk/24              /dev/rdsk/24    /home/bach/mount3       ufs     1    no
     -
/dev/dsk/25              /dev/rdsk/25    /home/bach/mountxxx     ufs     1    no
     -
/dev/dsk/26              /dev/rdsk/26    /home/bach/mountyyy     ufs     1    no
     -
/dev/dsk/5               /dev/rdsk/5     /home/bach              ufs     1    yes
     -
/dev/dsk/2               /dev/rdsk/2     /home/bach/mount99      ufs     1    yes
     -o
/dev/dsk/6               /dev/rdsk/6     /suderlan               ufs     1    no
     -
:V70A:$BACH.ASS.*.S      -               /home/bach/bs2.1        bs2fs   1    yes
     ftyp=binary
:V70A:$BACH.CCC.*.C      -               /home/bs2.2             bs2fs   1    yes
     ftyp=text
:V70A:$BACH.PLAMLIB*     -               /home/bach/bs2.2        bs2fs   1    yes
     ftyp=textbin
:V70A:$BACH.SEM*.C       -               /home/bs2000            bs2fs   1    yes
     -
```

Example 1 Displaying the mounted file systems (Format 1) and mounting a new file system (Format 2). This example was conducted under the POSIX system administrator's ID.

```
# mount
/ on /dev/root read/write/setuid on Thu Jun  4 09:17:49 2009
/proc on /proc read/write on Thu Jun  4 09:17:49 2009
/dev/fd on /dev/fd read/write on Thu Jun  4 09:17:49 2009
/tmp on /dev/dsk/2 setuid/read/write/noquota on Thu Jun 4 09:17:50 2009
/var on /dev/dsk/3 setuid/read/write/noquota on Thu Jun  4 09:17:49 2009
/home on /dev/dsk/4 setuid/read/write/noquota on Thu Jun  4 09:17:51 2009
/home1 on /dev/dsk/5 setuid/read/write/noquota on Thu Jun  4 09:17:51 2009
/home2 on /dev/dsk/6 setuid/read/write/noquota on Thu Jun  4 09:17:51 2009
# mount -p
/dev/root - / ufs - no rw,suid
/proc - /proc proc - no rw
/dev/fd - /dev/fd fdfs - no rw
/dev/dsk/2 - /tmp ufs - no suid,rw,noquota
/dev/dsk/3 - /var ufs - no suid,rw,noquota
/dev/dsk/4 - /home ufs - no suid,rw,noquota
/dev/dsk/5 - /home1 ufs - no suid,rw,noquota
# mount -v
/dev/root on / type ufs read/write/setuid on Thu Jun  8 09:17:49 2009
/proc on /proc type proc read/write on Thu Jun  4 09:17:49 2009
/dev/fd on /dev/fd type fdfs read/write on Thu Jun  4 09:17:49 2009
/dev/dsk/2 on /tmp type ufs setuid/read/write/noquota on Thu Jun  4 09:17:50
2009
/dev/dsk/3 on /var type ufs setuid/read/write/noquota on Thu Jun  4 09:17:49
2009
/dev/dsk/4 on /home type ufs setuid/read/write/noquota on Thu Jun 4 09:17:51
2009
/dev/dsk/5 on /home1 type ufs setuid/read/write/noquota on Thu Jun 4 09:17:51
2009
/dev/dsk/6 on /home2 type ufs setuid/read/write/noquota on Thu Jun 4 09:17:51
2009
# mount -F ufs /dev/dsk/17 /home3
# mount -p
/dev/root - / ufs - no rw,suid
/proc - /proc proc - no rw
/dev/fd - /dev/fd fdfs - no rw
/dev/dsk/2 - /tmp ufs - no suid,rw,noquota
/dev/dsk/3 - /var ufs - no suid,rw,noquota
/dev/dsk/4 - /home ufs - no suid,rw,noquota
/dev/dsk/5 - /home1 ufs - no suid,rw,noquota
/dev/dsk/6 - /home2 ufs - no suid,rw,noquota
/dev/dsk/17 - /home3 ufs - no suid,rw,noquota
```

Example 2 Mounting the bs2fs container and a bs2fs file system. The example executes under the POSIX administrator ID.

```
# mount -F ufs -o bs2fscontainer /bs2fscont
# mount -F bs2fs ':V70a:$sysaudit.sys.conslog.2007-06*'  /home/bs2.conslog
# mount
/ on /dev/root read/write/setuid on Tue Nov 27 11:31:04 2007
.
.
.
/bs2fscont on /dev/dsk/23 bs2fscontainer/setuid/read/write/noquota
   on Tue Nov 27 11:35:23 2007
/home/bs2.conslog on :V70A:$SYSAUDIT.SYS.CONSLOG.2007-06* ftyp=text/nosuid
   on Tue Nov 27 13:52:23 2007

#
```

See also *umount*, *mountall*
mount(), umount() [4]

mountall mount file systems

mountall is used to mount file systems on the basis of a *file_system_table* (*/etc/vfstab* is the default file system table). The special file name "-" reads from the standard input. If you specify the hyphen then the standard input must possess the same format as */etc/vfstab*.

Before the individual file systems are mounted, *fsck* performs a plausibility test to determine whether the system appears to be viable for mounting (not in the case of file systems of the type *bs2fs* or *nfs)*. If the system is not viable for mounting, *fsck* corrects it before an attempt is made to mount it.
If **only** *file_system_type* is specified then *mountall* applies only to file systems of the specified type.
The file systems are mounted in the order *ufs* - *bs2fs* - *nfs*. This ensures that when the bs2fs file systems are mounted, the bs2fscontainer file system required for this purpose is already mounted in ufs.

Syntax

mountall[␣**-F**␣file_system_type] [␣**-l** | ␣**-r**][file_system_table]

No option specified
mountall mounts all file systems for which the field *automnt* in the *file system table* is set to *yes*.

options

-F␣file_system_type **-F**␣file_system_type
Specifies the type of file system to be mounted.

-l Limits the process to local file systems (*ufs* and *bs2fs*).

-r Limits the process to remote file system types (*nfs*).

file_system_table
If *file_system_table* is not specified, *mountall* refers to */etc/vfstab*.

Hint

If the *-F* option is specified together with one or more of the options *-l*, *-r* and *-b* and the options are mutually compatible, the *-l*, *-r* and *-b* options have priority. For example, *mountall -F bs2fs -l* and *mountall -F ufs -l* have the same effect as *mountall -l*: all local file systems (i.e. all ufs and bs2fs file systems) are mounted. The entries *mountall -F bs2fs* and *mountall -b* also lead to the same result: all bs2fs file systems are mounted.

Error

If the file systems are viable for mounting and error-free, no message is output. Error and warning messages are issued by *fsck* and *mount* or by *mountall* in the case of incorrect syntax.

File */etc/vfstab*
Default file system table.

See also *fsck*, *mount*, *umountall*

mv move files

mv is used to change the name of a file, or to move a file from one directory to another within the file tree. To be able to use *mv* you have to have write permission for the directory in which the file resides or the directory to which you want to move it, as appropriate.

mv does not make copies of files that are moved or renamed within the same file system. Instead, it simply modifies the appropriate entries in the parent directory, retaining any links to other files.

If a file is moved to another file system, however, *mv* uses the *cp* command. In this case the original file is first copied and then deleted, and all links to other files are lost.

Syntax

Format 1: mv[␣**-f**][␣**-i**]␣file␣newfile

Format 2: mv[␣**-f**][␣**-i**]␣file␣....␣dir

Format 3: mv[␣**-f**][␣**-i**]␣dir␣newdir

Format 1 **Renaming a file**

mv[␣**-f**][␣**-i**]␣file␣newfile

No option specified

If you specify an existing file for *newfile* and do not have write permission for it, *mv* displays the mode of *newfile* and prompts you to confirm whether it should proceed. It only does so if your answer begins with *y*.

Caution!
If the standard input is not a terminal, no prompt for confirmation is displayed and *newfile* will not be overwritten).

options

-f If a file named *newfile* already exists, *mv* will overwrite the existing file even if you do not have write permission for it.

-i (interactive) If you specify an existing file for *newfile*, you will always be asked to confirm whether *mv* should really proceed.

If you enter more than one specification for *-f* or *-i* then no error occurs. The final option to be specified determines the behavior of *mv*.

file Name of the file to be renamed.

newfile
New name for the file; must not be the same as *file*. If a file named *newfile* already exists, it is overwritten by the contents of *file* if you have write permission for *newfile* (see also *-i*).

If you specify an existing file for *newfile* and do not have write permission for it, *mv* will display the mode of *newfile* and prompt you to confirm whether it should proceed. The existing *newfile* is not overwritten unless you answer *y*. If the *-f* option is specified, confirmation will not be requested and *newfile* will be overwritten.
If the standard input is not a terminal, confirmation will not be requested and *newfile* will not be overwritten

If the parent directory of *newfile* is writable but has the sticky bit (the t bit) set, one or more of the following conditions must be satisfied:
– the user must own the file
– the user must own the directory
– the user must have write permission for the file
– the user must be a privileged user

Format 2 **Moving files and directories to another directory**

mv[␣**-f**][␣**-i**]␣file␣...␣dir

option
see format 1

file Names of files or directories to be moved to directory *dir*. If you name a directory as source, all the files and directories under it are moved recursively.

dir Name of the directory to which the files and/or directories are to be moved.You need write permission for this target directory.

If *dir* is writable but has the t bit (sticky bit) set, one or more of the following conditions must be satisfied:
– the user must own the file
– the user must own the target directory
– the user must have write permission for the file
– the user must be a privileged user

Format 3 **Renaming a directory**

mv[␣**-f**][␣**-i**]␣dir␣newdir

option
: see format 1

dir
: Name of the directory to be renamed.

newdir
: New name for the directory.

dir and *newdir* must belong to the same physical file system; however, they do not have to share the same parent directory.

If a directory named *newdir* already exists, the directory named *dir* is moved to the *newdir* directory.
If *newdir/dir* already exists then *mv* only moves the directory *dir* if *newdir/dir* is empty.

Error

```
mv: Cannot rename <dir> to <newdir> : Permission denied
```

You do not possess write permission for the directory <dir> which is to be renamed.

```
mv: Cannot create <file> : Permission denied
```

You do not possess write permission for the directory to which <file> is to be moved.

Locale

The following environment variables affect the execution of *mv*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements used in the extended regular expressions defined for yes/no queries.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), the behavior of character classes used in extended regular expressions defined for yes/no queries.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The file *songs* in the current working directory is to be renamed *popsongs* and moved to the directory */home/joanne/arts/music*.

```
$ mv songs /home/joanne/arts/music/popsongs
```

Example 2 The files *daisy*, *rose* and *violet* in the current working directory are to retain their names and be moved to the directory */home/joanne/flowers*.

```
$ mv daisy rose violet /home/joanne/flowers
```

See also *chmod, cp, find, ln, rm*

newgrp change to a new group

The POSIX shell built-in *newgrp* overlays the current shell with */bin/newgrp*. The */bin/newgrp* command makes the specified group ID number your current group ID and overlays itself with a new shell. You terminate the shell in which you called *newgrp* by hitting the END key.

Caution!
If *newgrp* is killed with the DEL key while */bin/newgrp* is replacing the current shell, the shell from which *newgrp* was called is terminated as well.

The *newgrp* command can thus be used to switch to another user group. This means:
- your access permissions for existing files will be changed to those of the new group affiliation;
- group access permissions for new files that you create will be those of the group to which you have switched.

Only the variables that you exported earlier (see *export* on page 370) will be known in the (new) current shell after the group has been changed. Variables that have not been exported are either considered undefined or assigned a default value by the shell (see *sh* on page 697). Shell variables such as *PATH* and *HOME* are also assigned default values, unless they have already been exported by the system or were explicitly exported by you.

Before the call

The */etc/group* file must contain an entry for the group that you wish to switch to. Otherwise, *newgrp* will terminate with an error message.

The *newgrp* command can be used to switch to any group to which you belong, i.e. any group for which your login name appears in the */etc/group* file under the corresponding group entry.

If the error messages "Sorry" and/or "Unknown group" occur then *newgrp* aborts. In the event of any other error messages the shell terminates.

Syntax

Format 1: newgrp[␣**-l**][␣group]

Format 2: newgrp[␣**-**][␣group]

The two formats are described together since the option *-l* in format 1 is equivalent to option - in Format 2.

No argument specified
Changes you back to the group whose group ID (GID) has been entered for your login name in the */etc/passwd* file.

– or -l

The *newgrp* command overlays the current shell with a login shell. Before this shell displays its prompt, it first executes the */etc/profile* and your *$HOME/.profile* (if present) and switches to your home directory.

In other words, except for the fact that you are now a member of a new group (the one specified on invoking *newgrp*), you continue working in the same environment as the one that applied after you logged into the system.

– or *-l* not specified:
newgrp overlays the current shell with */bin/newgrp*. The current directory is not changed; however, the new shell will not be aware of variables that have not been explicitly exported. Unexported variables are either undefined or assigned a default value by the shell.

group

Name of the group you wish to switch to. There must be an entry for this group name in the */etc/group* file. The associated group ID (GID) must already be associated with a login name in the */etc/passwd* file.

If you are not a member of the specified group, there must be a password defined for the group in the */etc/group* file. *newgrp* expects you to enter this password before it switches groups.

If no password is entered for your login name then a password for the group must be present in the file */etc/group.* The command *newgrp* expects a password to be input before changing to the relevant group.

If you wish to change back to the user group which is entered for you, call *newgrp* without specifying a group name.

group not specified:
You change back to the group whose group ID (GID) is entered for your login name.

Exit status always 0

Error `Unknown group`
This name has not been entered in the */etc/group* file.

`Sorry`
You are not permitted to switch to this group, since you are not a member of the group, and no password has been defined for it either.

File */etc/group*
Defines a name for the entered group IDs and determines all the members of this group.

Locale

The following environment variables affect the execution of *newgrp*:

LANG
Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH
Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

Change to the group with the group name *council*:

```
$ newgrp council
$ >newfile
$ chmod 640 newfile
$ ls -lg newfile
-rw-r----- 1 ROSE   council      162 Mar 19 18:34 newfile
```

The new file (*newfile*) created after the group change is available to members of the *council* group as a read-only file.

See also

exec, *export*

nice invoke a utility with an altered system scheduling priority

Caution!
The *nice* command is supported only on grounds of compatibility. It has no effect on BS2000 task priorities. For that reason only the syntax chart is given here. The options, arguments and so forth are not described.

Syntax

Format 1: nice[␣**-n**␣incrementl]␣command[␣argument]

Format 2: nice[␣**-**increment]␣command[␣argument]

nl line numbering filter

The *nl* command reads lines from a file or the standard input and writes them on the standard output with line numbering.

nl views the text it reads in terms of logical pages. A logical page consists of a header, a body, and a footer section. Empty sections are valid.

The start of a header, body, and footer of a logical page is normally signaled by an input line containing nothing but one of the following strings:

\:\:\:	for start of header
\:\:	for start of body
\:	for start of footer

If the input text does not contain any delimiter characters, *nl* assumes that the text being read is in a single logical page body.

Line numbering is reset at the start of a logical page (exception: option *-p*). Different line numbering options are independently available for header, body, and footer (e.g. no numbering of header and footer lines, while numbering blank lines only in the body).

Syntax **nl**[␣option]...[␣file]

No option specified

nl numbers all logical page body lines that contain printable text, but not header and footer lines.
Line numbering is reset to 1 at the start of each logical page.
Within a logical page, *nl* numbers lines in increments of 1.
Each line number may be up to 6 positions long and is output right justified without leading zeros. A tab is used to separate line numbers from text.

option

The options must be entered individually, i.e. separated from other options by blanks. The name of the file may be specified before, between, or after the options. The position of the file name in the command line has no effect on the operation of the *nl* command.

Selecting the lines to be numbered

-b␣type

(b -body) Specifies which logical page body lines are to be numbered.

type can be any of: **a**, **n**, **p**reg_expr, or **t**.

a	All lines are numbered.
n	No lines are numbered.
preg_expr	Numbers all lines containing strings that match the given *reg_expr*. *reg_expr* is a simple regular expression (see *Tables and Dirctories,Regular POSIX shell expressions*). If the specified regular expression contains shell metacharacters, it must be enclosed in single quotes: **p'**reg_expr**'**.
t	All lines with printable text are numbered.

-b not specified:
Only the lines with printable text are numbered. Option *-b* with the *t* argument is thus the default.

-f␣type

(f- footer) Specifies which logical page footer lines are to be numbered.

type may be: **a**, **n**, **p**reg_expr, or **t**.

-f not specified:
Logical page footer lines are not numbered. Option *-f* with the *n* argument is thus the default.

-h␣type

(h - header) Specifies which logical page header lines are to be numbered.

type may be: **a**, **n**, **p**reg_expr, or **t**.

-h not specified:
Logical page header lines are not numbered. Option *-h* with the *n* argument is thus the default.

Restarting line numbering

-p Line numbering is not restarted at logical page delimiters.

-v␣startnum
Line numbering is restarted at *startnum* at the start of each logical page. *startnum* may be any number greater than or equal to 0.

-v not specified:
The line counter is reset to 1 at the start of each logical page.

Defining the increment

-i␣incr
incr is the increment value used to number logical page lines.

-i not specified:
The default increment is 1.

Defining the output format

-n␣format
format is the line numbering format.

The recognized values are: **ln**, **rn**, or **rz**.

ln	Prints line numbers left justified, suppressing leading zeros.
rn	Prints line numbers right justified, suppressing leading zeros.
rz	Prints line numbers right justified, but with leading zeros.

-n not specified:
Line numbers are printed right justified, without leading zeros. In other words, the *-n* option with argument *rn* is the default.

-s␣sep
Defines *sep* as the separator between line numbers and the corresponding text lines. *sep* may be one or more characters.

-s not specified:
By default, line numbers and text lines are separated by a tab character.

-w␣n
Defines *n* as the number of positions for line numbers.
The maximum value for *n* is 100. If you specify a higher value, a value of 100 is assumed.

-w not specified:
Individual line numbers may be up to 6 positions long.

Numbering blank lines

-l␣n

nl treats *n* consecutive blank lines as a single blank line.

Example

```
$ nl -b a -l 2
```

results in only every second blank line being numbered when there are several consecutive blank lines (none of the header and footer lines are numbered).

-l not specified:
Each blank line is interpreted as one full line (n = 1).

Defining delimiters for header, body and footer

-d␣x[y]

Changes the delimiter characters that specify the start of a header, body or footer section from \: to the string *xy*.
If a backslash (\) is to be specified for *x* or *y*, it must be escaped by single quotes or a second backslash, e.g. -d'*' or -d\\*.

y not specified:
The start of a header, body or footer section is identified by the string *x:* instead of \:, i.e. the second character retains its default value.

file

Name of the input file.

file not specified:
nl reads from standard input.

Locale The following environment variables affect the execution of *nl*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), the behavior of character classes within regular expressions, and for deciding which characters are in a certain character class for the *-b*, *-f* and *-h* options.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The file *poems* has the following contents:

```
\:\:\:
Taken from: Do you love me?
\:\:
The trouble with you
's you've lost a screw

I'm sorry it's you
but there's nothing to do

There'll be no abatements
there are no replacements

don't make a to-do
just say toodle-oo

I'm sorry I can't help you
you'd cost too much to redo

you'll have to be abolished
report to be demolished
\:
Ronald Laing
\:\:\:
Limerick
\:\:
A limerick packs laughs anatomical
into space that is short and economical;
But the good ones I've seen
so seldom are clean,
And the clean ones so seldom are comical.
\:
Author unknown
```

Call nl without options

```
$ nl poems

          Taken from: Do you love me?

      1   The trouble with you
      2   's you've lost a screw

      3   I'm sorry it's you
      4   but there's nothing to do

      5   There'll be no abatements
      6   there are no replacements

      7   don't make a to-do
      8   just say toodle-oo

      9   I'm sorry I can't help you
     10   you'd cost too much to redo

     11   you'll have to be abolished
     12   report to be demolished

          Ronald Laing

          Limerick

      1   A limerick packs laughs anatomical
      2   into space that is short and economical;
      3   But the good ones I've seen
      4   so seldom are clean,
      5   And the clean ones so seldom are comical.

          Author unknown
```

Number lines in increments of 10

```
$ nl -v10 -i10 poems

          Taken from: Do you love me?

      10  The trouble with you
      20  's you've lost a screw

      30  I'm sorry it's you
      40  but there's nothing to do

      50  There'll be no abatements
      60  there are no replacements

      70  don't make a to-do
      80  just say toodle-oo

      90  I'm sorry I can't help you
     100  you'd cost too much to redo

     110  you'll have to be abolished
     120  report to be demolished

          Ronald Laing

          Limerick

      10  A limerick packs laughs anatomical
      20  into space that is short and economical;
      30  But the good ones I've seen
      40  so seldom are clean,
      50  And the clean ones so seldom are comical.

          Author unknown
```

See also *ed*, *pr*

nm write the name list of an object file

The utility *nm* displays symbolic information appearing in the object file, executable file or object-file library named by *file*.

If no symbolic information is available for a valid input file, the *nm* utility will report that fact, but not consider it an error condition.

Syntax **nm**[␣**-APv**][␣**-efox**][␣**-g**|␣**-u**][␣**-t**␣format]␣file...

options:

-A Write the full pathname or library name of an object on each line.

-e Write only external (global) and static symbol information.

-f Produce full output. Write redundant symbols (.text, .data and .bss), normally suppressed.

-g Write only external (global) symbols.

-o Write numeric values in octal (equivalent to *-t␣o*)

-P Write information in a portable output file, as specified in Standard output.

-t␣format
Write each numeric value in the specified format. The format is dependent on the single character used as the *format* option-argument:

d	The offset is written in decimal (default)
o	The offset is written in octal (corresponds to *-o*)
x	The offset is written in hexadecimal (corresponds to *-x*)

-u Write only undefined symbols.

-v Sort output by value instead of alphabetically.

-x Write numeric values in hexadecimal (equivalent to *-t␣x*).

file
A pathname of an object file, executable file or object-file library.

Standard output

If symbolic information is present in the input files, for each file or for each member of an archive, the nm utility will write the following information to standard output:

- Library or object name, if *-A* is specified.
- Symbol name.
- Symbol type, which is one of the following single characters:

A	Global absolute symbol
a	Local absolute symbol
B	Global "bss" symbol
b	Local "bss" symbol
D	Global data symbol
d	Local data symbol
T	Global text symbol
t	Local text symbol
U	Undefined symbol

- Value of the symbol
- The size in bytes associated with the symbol, if applicable.

If the *-P* option is specified, the previous information is displayed using the following portable format. The three versions differ depending on whether was specified in decimal, octal or hexadecimal format.
If *-t* is not specified, the format is as if *-t␣ x* has been specified.

`"%s%s %s %d %d\n"`, *library-/object name* , *name* , *type* , *value* , *size*

`"%s%s %s %o %o\n"`, *library-/object name* , *name* , *type* , *value* , *size*

`"%s%s %s %x %x\n"`, *library-/object name* , *name* , *type* , *value* , *size*

where *library-/object name* is formatted as follows:

- If *-A* is not specified, *library-/objekt name* is an empty string.
- If *-A* is specified and the corresponding *file* operand does not name a library:
  `"%s:  "`, *file*
- If *-A* is specified and the corresponding *file* operand names a library. In this case, *object file* names the object in the library containing the symbol being described:
  `"%s[%s]:  "`, *file* , *objekt file*

Locale

The following environment variables affect the execution of *nm*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for character collation information for the symbol-name and symbol-value collation sequence.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also

ar
c89 [5]

nohup invoke a utility immune to hangups

nohup executes a command or shell script, ignoring the signals SIGHUP (signal number 1) and SIGQUIT (signal number 3). *nohup* can be used to prevent a process from being terminated when you log out from a terminal.

Before the call

If you wish to use *nohup* with a pipe or a list of commands, you must put the relevant pipeline or command list in a file and run the file as a shell script under *nohup*'s management.

Syntax

nohup␣command[␣argument...]

command[␣argument...]
Any command or shell script. You can pass arguments to *command* by entering them after the command as usual. If the standard output and standard error of *command* have not been redirected, they will be written to a file called *nohup.out* in the current directory.

If you are not permitted to create the file *nohup.out* in the current directory (i.e. you have no write permission for this directory) or if you do not have write permission for the file *nohup.out* in the current directory, the output will be redirected to the file *$HOME/nohup.out*.

If the file *nohup.out* or *$HOME/nohup.out* does not exist, a corresponding file is created and the file's permission bits will be set only for the calling user; otherwise, the output is appended to the existing file.

Exit status

126	The utility specified by *command* was found but could not be invoked.
127	An error occured in the *nohup* utility or the utility specified by *command* could not be found.

Error

```
nohup: cannot open/create nohup.out
```

You are not allowed to create a file called *nohup.out* in the current working directory or in *$HOME*, or you are not allowed to write to existing *nohup.out* files in those directories.

File

nohup.out
File located in the current directory which receives the standard output and standard error output from commands executed under *nohup.*

$HOME/nohup.out
The standard output and standard error output of commands executed under *nohup* are sent to this file if the *nohup.out* file in the current directory is write-protected or if you are not allowed to create this file in the current directory (because you do not have write permission there).

Variable *HOME*
The value of the environment variable HOME is used to determine the directory in which the file *nohup.out* is to be created in cases where *nohup.out* in the current directory is write-protected or where you are not allowed to create files in the current directory.

PATH
Determine the search path that will be used to locate the utility invoked.

Locale The following environment variables affect the execution of *nohup*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You initiate the following job and set it to run in the background:

```
$ nohup programm &
sending output to nohup.out
```

You then log out. *program* is not terminated, since it is immune to the quit signal. The output is written to a file called *nohup.out*.

See also *chmod*, *kill*, *nice*, *sh*
signal() [4]

od dump files in various formats

The *od* command dumps (i.e. writes the contents of) a file on the standard output in an output format that you select with command-line options.

The first column of each output line specifies the position of the first character in this line. Characters can be specified in octal, decimal or hexadecimal, depending on the indicated output format.

Syntax

Format 1: od[␣**-v**][␣**-A**␣addr_base][␣**-j**␣skip][␣**-N**␣count][␣**-t**␣type_string][␣file...]

Format 2: od[␣**-bcdDfFoOsSvxX**][␣file][␣[+]offset[.][b]]

Format 1

od[␣**-v**][␣**-A**␣addr_base][␣**-j**␣skip][␣**-N**␣count][␣**-t**␣type_string][␣file...]

-v (verbose) Shows all data.

-v not specified
All output lines which are identical to the immediately preceding output lines are replaced by a line which contains only an asterisk (*).

-A␣addr_base
Identifies the offset base for the input. *addr_base* is a character. The characters o, d and x mean that the offset base is written in octal, decimal or hexadecimal notation. The character n means that no offset is written.

-j␣skip
(j - jump) The next *skip* bytes from the start of the input are jumped. If the input is not at least *skip* bytes in length, an error message is output. By default, *skip* is interpreted as a decimal number. If *skip* begins with 0x or 0X then the offset is interpreted as a hexadecimal number. If *skip* begins with a leading zero then the offset is interpreted as an octal number. If this is followed by one of the characters b, k or m then the offset is interpreted as a multiple of 512, 1024 or 1048576 bytes.

-N␣count
Only *count* bytes of the input are formated. By default, *count* is interpreted as a decimal number. If *count* begins with 0x or 0X then the offset is interpreted as a hexadecimal number. If *count* begins with a leading zero then the offset is interpreted as an octal number. If fewer than *count* bytes are present, no error message is output and *od* simply formats the available input.

-t␣type_string
Identifies one or more output types. *type_string* consists of a string which identifies the types used for input. The string must consist of the type-specific characters a (named character), c (character), d (decimal), f (floating) , o (octal), u (unsigned decimal) und x (hexadecimal).

file
: Name of the file to be dumped.

  file not specified:
  od reads from standard input.

Format 2 **od**[␣**-bcdDfFoOsSvxX**][␣file][␣[+]offset[.][b]]

No option specified
: Each group of 2 bytes is interpreted as an unsigned octal number (same as option *-o*).

option
: If you use several options in order to combine different output formats, the option sign (-) may only be specified once, and the option names must be grouped together without intervening blanks, e.g: *od -bcs file*.

-b Interprets each byte as an octal number.

-c Interprets each byte in accordance with the current setting for *LC_CTYPE*.

-d Interprets each group of 2 bytes as an unsigned decimal number.

-D Interprets each group of 4 bytes as an unsigned decimal number.

-f Interprets each group of 4 bytes as a floating-point number.

-F Interprets each group of 8 bytes as an extended precision number.

-o Interprets each group of 2 bytes as an unsigned octal number.

-O Interprets each group of 4 bytes as an unsigned octal number.

-s Interprets each group of 2 bytes as a signed decimal number.

-S Interprets each group of 4 bytes as a signed decimal number.

-v (verbose) Shows all data.

-v not specified
All output lines which are identical to the immediately preceding output lines are replaced by a line which contains only an asterisk (*).

-x Each 2-byte sequence is interpreted as an unsigned hexadecimal number.

-X Each 4-byte sequence is interpreted as an unsigned hexadecimal number.

file
: Name of the file to be dumped.

  file not specified:
  od reads from standard input.

offset

The *offset* argument specifies the offset in the file where dumping is to commence. *offset* is normally interpreted in octal bytes. If a period (.) is appended to the *offset* argument, the offset is interpreted in decimal. If *b* is appended, the *offset* is interpreted in blocks of 512 bytes.
If the *file* argument is omitted, the *offset* argument must be preceded by a plus sign (+) to prevent it from being interpreted as a file name.

offset not specified:
Dumping commences at the start of the file.

Locale The following environment variables affect the execution of *od*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_NUMERIC	Determine the locale for selecting the radix character used when writing floating point formatted output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Unsigned octal dump of the contents of file *text*:

```
$ cat text
Keep a stiff upper lip.
$ od text
0000000 151205 102627 040201 040242 121611 103206 040244 113627
0000020 102631 040223 104627 012400
0000027
```

Example 2 Display the contents of the file *text* in octal form and as ASCII characters from the sixth byte onward:

```
$ od -bc text 5.
0000005 201 100 242 243 211 206 206 100 244 227 227 205 231 100 223 211
          a       s   t   i   f   f       u   p   p   e   r       l   i
0000021 227 025
          p  \n
0000023
```

See also *Tables and directories*, *EBCDIC character set*

paste merge corresponding or subsequent lines of files

paste can be used to horizontally merge the n-th corresponding lines from two or more input files (parallel merging, Format 1) or to successively merge all lines within a single file (serial merging, Format 2). The result is written to standard output.

Syntax

Format 1: paste[␣**-d**␣list]␣file␣...

Format 2: paste␣**-s**[␣**-d**␣list]␣file␣...

Format 1 **Joining the n-th lines of several files (parallel merging)**

paste[␣**-d**␣list]␣file␣...

paste concatenates the n-th line of each input file, treating each file as a column or columns of a table. The corresponding lines are pasted together horizontally and displayed on the standard output (see Example 1 on page 604).

No option specified
The tab character acts as a delimiter between columns

-d␣list
(delimiter) Uses a character from *list* as a delimiter between output columns.
The characters in *list* are used consecutively and circularly, i.e. *paste* returns to the top of the list after using the last character in it. In parallel merging, lines from the last input file are always terminated with a newline character, not with a character from the *list*.

Any string of arbitrary characters can be specified for *list*. The following escape sequences may also be used: \n (newline), \t (tab), \\ (backslash), and \0 (empty string, not a null character). If *list* contains escape sequences, blanks, or shell metacharacters, it must be enclosed in double quotes "...".

file
Name of the input file.
This format of *paste* is only meaningful if you specify several files.

If you use a dash (-) as the name for *file*, *paste* reads from standard input.

Format 2 **Joining successive lines (serial merging)**

paste␣**-s**[␣**-d**␣list]␣file␣...

-s (subsequent) For each input file, *paste* joins the lines together to form a single line and writes this line to standard output. By default, the lines from the input file are separated by tabs (see option *d*). Each output line is terminated by a newline character

-d␣list

(d - delimiter) One of the characters from *list* is used in the output line instead of a tab to mark the joins between the input lines.

The characters in *list* are used consecutively and circularly, i.e. *paste* returns to the top of the list after using the last character in it.

Any string of arbitrary characters can be specified for *list*. The following escape sequences may also be used: \n (newline), \t (tab), \\ (backslash), and \0 (empty string, not a null character). If *list* contains escape sequences, blanks, or shell metacharacters, it must be enclosed in double quotes "...".

file

Name of the input file. You may name more than one file.
If you use a dash (-) as the name for *file*, *paste* reads from standard input.

Error

`paste: line too long`
Output lines must not exceed 511 characters.

`paste: too many files - limit 12`
A maximum of 12 input files may be specified in format 1

`paste: cannot open` *file* `: no such files or directory`
file does not exist.

`paste: cannot open` *file* `: Permission denied`
User does not have read permission for *file*.

Locale The following environment variables affect the execution of *paste*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Examples of Format 1

Example 1 The corresponding lines from the files *numbers* and *letters* are to be pasted together:

The *numbers* file contains numbers from 1 to 100:

```
  1
  2
  3
  :
100
```

The *letters* file contains lowercase letters from a to z:

```
a
b
c
:
z
```

```
$ paste number letters
  1     a
  2     b
  3     c
  :     :
 25     y
 26     z
 27
  :
100
```

Example 2 The current directory contains the following files:

```
$ ls -C
corr        jokes           names           plan          probe
prog.c      tst             words
```

The following command numbers these files (see the *numbers* file in *Example 1*):

```
$ ls | paste numbers -
  1    corr
  2    jokes
  3    names
  4    plan
  5    probe
  6    prog.c
  7    tst
  8    words
  9
 10
  :
100
```

Example 3 The current directory contains the same files as in Example 2. The following command lists the contents of the current directory in three columns. However, the columns will only be justified properly if the individual file names do not extend beyond the next tab stop.

```
$ ls | paste - - -
corr    jokes   names
plan    probe   prog.c
tst     words
```

How is this output produced? Compare the above command with the command

```
$ paste file1 file2 file3
```

In this case, *paste* first reads the initial lines from all three files and pastes them into one line. When this is done, the second lines are read, etc.

In the command `ls | paste - - -`, the first file name that *paste* reads from standard input (*corr*) corresponds to the first line from *file1*; the second file name *jokes* corresponds to the first line from *file2* etc.

Example 4 The current directory contains the same files as in example 2. As in example 3, you now wish to display the file names in three columns, but the second and third columns are to be separated by a colon instead of a tab.

```
$ ls | paste -d"\t:" - - -
corr    jokes:names
plan    probe:prog.c
tst     words:
```

Example of Format 2

Example 5 The *customers* file contains the following:

```
hansen
smith
cologne
koch
schulz
london
tornio
meyer
perth
```

```
$ paste -s customers
hansen  smith   cologne koch    schulz  london  tornio  meyer   perth
```

The following command joins only three lines of the *customers* file at a time. This is because a newline character is specified as a delimiter after every third input line:

```
$ paste -s -d"\t\t\n" customers
hansen  smith   cologne
koch    schulz  london
tornio  meyer   perth
```

See also *cut*, *grep*, *pr*

patch apply changes to files

patch will take a patch file containing any of the three forms of difference listing (normal, with context or in the *ed* format), produced by the *diff* (1 program and apply those differences to an original file, producing a patched version. By default, the patched version is put in the place of the original. If you specify the *-b* option, the original file is stored under the same name with the extension ".orig".
You may also specify where you want the output to go with a *-o* option.

Upon startup, *patch* will attempt to determine the type of the diff listing, unless overruled by a *-c*, *-e* or *-n* option. Context diffs and normal diffs are applied by the *patch* program itself, while *-e* diffs are simply fed to the *ed* editor via a pipe.

patch will try to skip any leading extraneous material, apply the diff, and then skip any trailing extraneous material. If the entire diff is indented by a consistent amount, this will be taken into account.

Syntax **patch**[␣**-blNR**][␣**-c**|␣**-e**|␣**-n**][␣**-d**␣dir][␣**-D**␣define][␣**-i**␣patchfile][␣**-o**␣outfile]
[␣**-p**␣num][␣**-r**␣rejectfile][file]

options

-b saves all original files with a *.orig* suffix before the patch is applied. The backup file is overwritten if it already exists; if *patch* is executed several times, a backup file is only created on the first execution. The additional option *-o* does not save the original file, but saves the output file if it already exists.

-c Interprets the patch file as a context diff (output from *diff*, if *-c* or *-C* is specified).

-d␣dir
patch changes to the *dir* directory before further actions take place.

-D␣define
marks changes with the instruction

```
#ifdef define
...
#endif
```

Note that, unlike with the C compiler, there must be a space between the *-D* option and the argument.

-e Interprets the patch file as an *ed* script.

-i␣patchfile
patch reads the patch from the *patchfile* file. If you enter a dash for *patchfile*, *patch* reads from the standard input.

A patch file contains one or more patches and maybe some additional information. If a patch file contains several patches, each patch should contain information about filenames (like with *diff -c*), so that *patch* can find affected files automatically.

patch evaluates the following information:

`Index: pathname`
pathname names the file to be corrected

`*** pathname`
pathname specifies the "old" file on which the patch is based

`--- pathname`
pathname specifies the file to be corrected (has priority over *Index*:)

Each patch contains patch instructions, which correspond to one of the three kinds of diff.

-i not specified: *patch* reads from the standard input.

-l Any sequence of tabs and blanks in the patch file will match any sequence of tabs and blanks in the input file. However, normal characters must still match exactly.

-n Interprets the patch file as a normal diff.

-N Ignores patches that have already been applied. Such patch instructions are rejected by default.

-o␣outfile
The corrected version is written to *outfile*.Several corrected files are appended one after the other. If different patches affect the same original file, the following scripts are applied to a temporary file.
Several versions of the original file are then written to *outfile* accordingly.

-p␣num
Controls the handling of pathnames found in the patch file. *num* specifies how many slashes are to be stripped from the front of the pathname. (Any intervening directory names are also removed.) For relative pathnames, the search takes place in the current directory or in the directory specified by the *-d* option.

-p not specified:
Only the basic name, without path, is used.

Example

Supposing the filename in the patch file was
`/u/howard/src/blurfl/blurfl.c`

Setting the *-p␣0* option gives the entire pathname unmodifie, while the *-p␣1* option gives
`u/howard/src/blurfl/blurfl.c`

without the leading slash, the *-p␣4* option gives:
`blurfl/blurfl.c`

and not specifying the *-p* option at all just gives you `blurfl.c`.

-R *patch* swaps the patch instructions before they are applied to the original file. This is necessary if the old and new files were exchanged when creating the patch. *patch* attempts to swap each hunk before it is applied. Rejects are written to the error file in swapped format.
The *-R* option cannot be used for *ed* scripts, as the information is insufficient for reconstructing the swapped operation.

If the first hunk of a patch fails, *patch* swaps the patch instructions to see if they can be applied in this way. If this is possible, you are asked whether the *-R* option should be set. If this is not possible, *patch* enters the hunk in the error file and continues as normal. (Note: reversed patch instructions cannot be detected with this method in the case of a normal diff and where the first command is an append, i.e. it should in fact have been a delete.)

-r␣rejectfile
Specifies the file to which the rejected patchs should be sent.

-r not specified:
The rejected files are sent to one file, which has the same name as the output file, but with the suffix *.rej*.

file
Pathname of the file to be patched.

file not specified:
patch attempts to determine the filename from the leading extraneous material.

Hint Notes for patch senders

If you create patch files on a regular basis, it is recommended that the revision level be included as the first patch instruction. If you add the line "Prereq: " to the patch file, you can prevent users applying incorrect patches without being warned.

Check whether the filenames have been specified correctly in the context diff header or in the "Index:" line. If you wish to make corrections in a subdirectory, inform the patch user that the *-p* option must be set.

Avoid reversed patches where possible.

Place patches that need to be together in the event of an error in separate files where possible.

If patch files are created with rejected hunks, *patch* terminates with a non-zero exit status. If you want to apply a set of patches in a loop, you should check this exit status so that a subsequent patch will not be performed on a partly corrected file.

If code was duplicated (e.g. using "#ifdef OLDCODE ... #else ... #endif"), *patch* cannot correct both versions. If the command can be executed at all, it may correct the wrong version and inform you that the corrections have been made successfully.

If you use an already applied patch again, *patch* assumes that the patch in question is a reversed patch and offers to un-apply the patch.

Locale The following environment variables affect the execution of *patch*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_TIME	Determine the locale for recognising the format of file timestamps written by the *diff* utility in a context-difference input file.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Exit status

0	Successful completion.
1	One or more rejected patch instructions were written to the error file.
>1	An error occurred.

See also *diff, ed*

pathchk check pathnames

The *pathchk* command checks that one or more pathnames are valid (i.e. they can be used to access or create a file without causing syntax errors) and portable (i.e. the name need not be adjusted). More extensive portability checks can be carried out *-p* option.

By default, the *pathchk* command checks the components of all *pathname* arguments based on the underlying file system. An error message is output for the *pathname* argument if:

- It is longer than the maximum permitted pathname length ({PATH_MAX} bytes).
- It contains a component that is longer than the maximum permitted filename length ({NAME_MAX} bytes) in the relevant directory.
- It contains a component in a directory that is not searchable.
- It contains a component with characters that are invalid in the directory.
- The name length of a file or directory in a bs2fs file system does not contradict the rules for a bs2fs file system.

pathchk does not consider it an error if one or more components of a *pathname* argument do not exist, as long as the file with the specified pathname can be created and does not violate any of the checks described above.

Syntax

pathchk[␣**-p**]␣pathname...

option

-p *pathchk* does not perform a check on the underlying file system, but on generic portability conditions. An error message relating to the *pathname* argument is output if:

- It is longer than the maximum permitted length for portable pathnames ({_POSIX_PATH_MAX} bytes).
- It contains a component longer than the maximum length for portable filenames ({_POSIX_NAME_MAX} bytes).
- It contains a component with characters not contained in the portable character set for filename.

pathname
The pathnames to be checked.

Locale

The following environment variables affect the execution of *pathchk*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Hint Using the *test* command you can check whether a certain pathname specifies an existing file. However there is no information about whether a component of the pathname was truncated (in a directory where the {`_POSIX_NO_TRUNC`} function is not activated. The *pathchk* command does not check for the existence of a file. It only checks if a certain pathname exists or if it can be created without truncating the name.

The *noclobber* option in the shell (compare with the description of *set*) can create a unique file.

Example You can check if all pathnames in an imported data interchange archive are legitimate and unambiguous on the current system as follows:

```
pax -f archive | sed -e \*(h0/ == .*/s///\*(h0 | xargs pathchk
if [ $? -eq 0 ]
then
    pax -r -f archive
else
    echo Investigate problems before importing files.
    exit 1
fi
```

You can check whether all files in the current directory hierarchy can be transferred to another system, that the general portability conditions are met, and that the *pax* command is available as follows:

```
find . -print | xargs pathchk -p
if [ $? -eq 0 ]
then
    pax -w -f archive .
else
    echo Portable archive cannot be created.
    exit 1
fi
```

You can check whether a specified pathname names a readable file and whether an application can create a file by extending the filename without truncating the pathname and without overwriting any existing files.

```
case $- in
    *C*)    reset="";;
    *)      reset="set +C"
            set -C;;
esac
test -r "$path" && pathchk "$path.out" &&
    rm "$path.out" > "$path.out"
if [ $? -ne 0 ]; then
    printf "%s: %s not found or %s.out fails \
creation checks.\n" $0 "$path" "$path"
    $reset  # reset the noclobber option in case a trap
            # on EXIT depends on it
    exit 1
fi
$reset
PROCESSING < "$path" > "$path.out"
```

This example is based on the following:

1. `PROCESSING` displays the code used by the application in order to use `$path` once a check has been made that `$path.out` meets the required conditions.
2. The state of the *noclobber* option is unknown if this code was called, and should be reset on exit to the state it was in when the code was called. (The *reset* variable is used to restore the initial state in this example.)
3. Note the usage of the following construction:
   `rm "$path.out" > "$path.out"`
   a) The *pathchk* command has by now already checked that `$path.out` is not truncated.
   b) If the *noclobber* option is set, the shell checks that `$path.out` does not already exist before *rm* is called.
   c) If the shell has successfully created `$path.out`, *rm* removes it again so that the application can create the file in the `PROCESSING` step.
   d) If the `PROCESSING` step wants the file to exist already when it is called, `rm "$path.out" > "$path.out"` should be replaced by `> "$path.out"`

      This confirms that the `$path.out` file does not exist yet, and it will be created for use by `PROCESSING`.

See also *test*

pax portable archive interchange

The *pax* command writes files to archive files, reads them or creates lists of these files and copies directory hierarchies. A number of archive formats are supported; see the *-x␣format* option.

The action executed depends on which of the *-r* and *-w* options are specified. The four possible combinations of *-r* and *-w* give the four operating modes: list mode, read mode, write mode, and copy mode, corresponding respectively to the four forms shown in the *Syntax*.

list	In list mode (i.e. neither *-r* nor *-w* is specified), *pax* reads an archive file from the standard input and writes the name of the stored files, whose pathnames match the specified *pattern*, to the standard output. If a specified file is a directory, the file hierarchy rooted at that file will be written out also.
read	In read mode (i.e. *-r* is specified, but not *-w*), *pax* reads an archive file from the standard input and extracts the files whose pathnames match the specified *pattern*. If the extracted file is a directory, the file hierarchy rooted at that file is also extracted. The extracted files are created relative to the current directory.
write	In write mode (i.e. *-w* is specified, but not *-r*), *pax* writes the contents of the *file* operands to the standard output in archive format. If no *file* operand is specified, a list of files to copy, one per line, is read from the standard input. When specifying a directory, all files in the file hierarchy rooted at that file are copied.
copy	In copy mode (i.e. both *-r* and *-w* are specified), *pax* copies the *file* operands to the destination directory *directory*. If no *file* operands are specified, a list of all files to be copied, one per line, is read from the standard input. When specifying a directory, all files in the file hierarchy rooted at that file are copied. The copying process runs as if the copied files were written to an archive file and subsequently extracted, except that there may be hard links between the original and the copied files.

If temporary directories are needed to extract a file in read or copy mode, these are created by *pax*.

At least one file must match the specified *pattern* or *file* operands, otherwise *pax* writes a diagnostic message to the standard message output for each operand that is unmatched, and terminates with a non-zero exit status.

The archive formats supported are automatically recognized when reading the file. The standard output format for archives when writing (no *-x* option specified) is the extended *tar* format.

An archive can span multiple files. The *pax* command determines what file to read or write as the next file.

If the selected archive format supports the specification of links between files, *pax* returns an error if no link can be created between these files during extraction.

Syntax

Format 1: pax[␣**-cdnv**][␣**-f**␣archive][␣**-s**␣instruction] ... [pattern...]

Format 2: pax␣**-r**[␣**-cdiknuv**][␣**-f**␣archive][␣**-p**␣string] ... [␣**-s**␣instruction] ... [pattern ...]

Format 3: pax␣**-w**[␣**-dituvX**][␣**-b**␣blocksize][␣**-a**][␣**-f**␣archive]
[␣**-s**␣instruction] ... [␣**-x**␣format][file ...]

Format 4: pax␣**-r**␣**-w**[␣**-diklntuvX**][␣**-p**␣string] ... [␣**-s**␣instruction] ... [file ...] directory

options

-r Reads an archive file from the standard input.

-w Writes files in the specified archive format to the standard input.

-a Appends files to the end of the archive.

-b␣blocksize
Puts the data in blocks in the archive file, and specifies the block size as a positive decimal integer. Devices and archive formats may impose restrictions on blocking. Blokking is automatically determined on input. Default blocking during the creation of archives depends on the archive format (see the *-x* option below). To maintain a portable archive, the block size may not be bigger than 32 KB.

-c Selects all files apart from those specified by the *pattern* or *file* operands.

-d The file hierarchy rooted at this file in a directory is not copied, read, or archived.

-f␣archive
Specifies the pathname of the input archive (in list or read mode) or the output archive (write mode). This archive is used instead of the standard input or output.

-i Renames files interactively. For every file archived whose name matches the *pattern* operand, or for every file that matches a *file* operand, a prompt is written to `/dev/tty`. This prompt contains the name of the file. A line is read from `/dev/tty`. If this line is blank, the file is skipped. If the line consists of a single period, the file is processed without the name being modified. Otherwise the name is replaced by the contents of the line. If an end-of-line character is found when reading a response, or if `/dev/tty` cannot be opened for reading or writing, the *pax* command terminates immediately with a non-zero exit status.

-k Prevents the overwriting of existing files.

-l Creates links between files. Hard links are created whenever possible between source and target file hierarchies.

-n Selects the first file archived that matches the *pattern* operand. Only one matching file is selected for every *pattern* operand (file hierarchies rooted at the directories are not affected by this restriction).

-p␣string
Determines file characteristics (privileges). The *string* argument contains the file characteristics that must be retained or ignored during extraction. The *string* consists of the *a, e, m, o* and *p* specification characters. Several characters can be concatenated in the same string, and the *-p* option can be specified more than once.
The specification characters mean the following:

a	Date and time of the last file access are set to the current date.
e	User ID, group ID, access permissions (see *chmod* on page 206), date and time of the last access and modification are preserved.
m	Date and time of the last file modification are not preserved.
o	User ID and group ID are preserved.
p	Access rights are preserved.

In the list above, "preserved" means that an attribute saved in the archive will be assigned to the extracted file, depending on the privileges of the invoking process. Otherwise, the attribute is defined as part of the normal file creation action.

pax does not set the s bits for the file mode.

If for any reason, one of these attributes cannot be preserved, *pax* writes a diagnostic message to the standard output. If an attribute cannot be preserved, the extracted file is not deleted, although it does effect the exit status.
If specification characters are duplicated in the string argument or are in conflict with the other arguments, the last argument entered has priority. If for example *-p␣eme* is specified, the date and time of the last file modification are preserved.

-s␣instruction
Modifies files specified by the *pattern* or *file* operands, according to the instruction . The syntax of *ed* is used for this. The concepts "address" and "line" mean nothing in the context of the *pax* command. The following format is used: `-s /old/new/[gp]`

As in *ed*, *old* is a simple regular expression and *new* can contain & signs, \n (where \n is a number), references, and subexpressions. The *old* string can also contain a newline character.

All characters can be used as delimiters (e.g. /). A number of *-s* expressions are allowed. The expressions are evaluated in the specified order ending with the first successful substitution. The optional trailing *g* is as defined in *ed*.
The optional trailing *p* writes successful substitutions to the standard error output.

Filenames replaced by a null string are ignored when reading and writing archives.

-t The date and time of the last access to archived files are set to the value they had before being accessed by *pax*.

-u Ignores files that are an older version (with an older last modification date/time) of a file of the same name that already exists. In read mode, an archived file that has the same name as a file in the file system is extracted if the archived file is more current than theone in the file system. A file is only saved in write mode if there is no more recent version with the same name.

-v In list mode, a detailed table of contents is written to the standard output. Otherwise the pathnames of the stored file are written to the standard output.

-x␣format
Specifies the archive output format. *pax* recognizes the following formats:

cpio	The extended *cpio* interchange format. The default block size for this character-oriented archive file format is 512. Implementations of *pax* support all values for the block size up to 32256 that are a multiple of 512.
ustar	The extended *tar* interchange format. The default block size for this character-oriented archive file format is 1024. Implementations of *pax* support all values for the block size up to 32256 that are a multiple of 512.

pax terminates immediately with a non-zero exit status if an attempt is made to append data to an archive file in a different format than the existing archive format.

-X *pax* will not switch to a directory in a different file system when traversing a file hierarchy specified by a pathname.

The options that operate on the names of files (*-c*, *-i*, *-n*, *-s*, *-u* and *-v*) are evaluated one after the other as described below:

In read mode, the files are selected according to *pattern* operands specified by the user, and the modifications made using the *-c*, *-n* and *-u* options. The *-s* and *-i* options in this order then modify the names of the selected files. The *-v* option outputs the names resulting from these modifications.

In write mode, the files are selected according to pathnames specified by the user, and the modifications performed using the *-n* and *-u* options. The *-s* and *-i* options then modify the names of the selected files. The *-v* option outputs the names resulting from these modifications.

If both the *-u* option and the *-n* option are specified, *pax* does not consider a file unless it is more current than the file to which it is compared.

directory
Pathname of the target directory for copy mode.

file
Pathname of the file to be copied or archived.

pattern
A pattern that matches one or more pathnames of archived files. By default (if no *pattern* is specified), all files in the archive are selected.

Standard input (stdin)

In write mode, the standard input is only used if no *file* operands are specified. The standard output must then be a text file containing a list of the pathnames. The file must contain one pathname per line, and there may be no preceding or trailing blank characters.
In list and read mode, the standard input must be an archive file.
Otherwise the standard input is not used.

File The input file specified by *archive* or the standard input if the archive is read from it, is a file formatted according to one of the archive formats listed in the *-x* option.

Prompts are written and responses read to or from *stdin*/*stdout*.

Standard output (stdout)

If *-f* is not specified in write mode, the standard output is the archive formatted according to one of the archive formats listed in the *-x* option.

In list mode, the table of contents of the selected files are written to the standard output in the following format:
```
"%s\n", pathname
```

If *-v* is specified in list mode, the table of contents of the selected files is written to the standard output in the following format:

Pathnames that represent hard links to previous files are written in this format:
```
"%s == %s\n", ls_-l_listing, linkname
```

All other pathnames are written in this format:
```
"%s\n", ls_-l_listing
```

*ls*_*-l*_listing is the format created by the *ls* command with the *-l* option.

Standard error (stderr)

If *-v* is specified in read, write or copy mode, *pax* writes the pathnames it processes to the standard error output in thefollowing format:
```
"%s\n", pathname
```

These pathnames are output at the start of file processing. The final newline character is output after the file is read or written.

If the *-s* option is specified, and there is a trailing *p* in the substitution string, substitutions are written to the standard error output in the following format:

```
"%s >> %s\n", original_pathname, new_pathname
```

Any messages about the archive format are also written to the standard error output.

Output files

In read mode, the files extracted or copied are of the archived file type.
In write mode, the output file named by the *-f* option is a file formatted according to archive formats listed in the *-x* option.

Consequence errors

If *pax* cannot create a file or a link when reading an archive, cannot find a file when writing an archive, or cannot preserve the user ID, group ID, or access rights with the *-p* option set, a diagnostic message is written to the standard error output and a non-zero exit status is returned. Processing is continued nonetheless. If *pax* cannot create a link to a file, by default it does not create a second copy of the file.

If the extraction of a file from an archive is prematurely ended by a signal or an error, *pax* may only have extracted a part of the file, or (if the *-n* option is not specified) a file under the name specified by the user, that is not the file the user wanted. Extracted directory access rights may also have additional bits from the file-creation mode mask as well as incorrect information about the date and time of the last file access and modification.

Locale The following environment variables affect the execution of *pax*:

LANG	Specifies a default value for the locale variables that are unset or null. If *LANG* is unset or null, the corresponding default value of the locale is used. If the locale variable contains an invalid setting, *pax* behaves as if no variable were set.
LC_ALL	If this variable has a value, i.e. is not empty, this value overwrites the values of all other locale variables.
LC_COLLATE	Determines the locale for the behavior of ranges, equivalence classes and collating elements used in the pattern matching expressions for the *pattern* operand, in the simple regular expression for the *-s* option, and in the extended regular expression defined for yes/no queries.
LC_CTYPE	Determines the locale for the interpretation of byte sequences (e.g. single-byte as opposed to multibyte characters in arguments and input files), for the behavior of character classes used in the extended regular expressions defined for yes/no queries, and for pattern matching.

LC_MESSAGES
Determines the locale for the processing of yes/no responses, as well as the format and language of diagnostic messages, output by *pax*.

LC_TIME Determines the format and the content of date and time specifications if the *-v* option is specified.

NLSPATH Determines the position of the message catalog for the processing of *LC_MESSAGES*.

Hint This hint is only for users who have created archives in SINIX using the SINIX tar and cpio commands.

The *-p* option was introduced to reconcile differences between the conventional *tar* and *cpio* implementations. In particular these two commands use *-m* in very different ways. The *-p* option also provides extended facilities for the consistent addressing of future file attributes, e.g. for extended security systems or high performance archives. Of the many combinations, only two modes are usually used:

-p␣e "Preserve everything" is used by the conventional superuser with all the appropriate privileges to preserve all file attributes as they are recorded in the archive. The e flag is the sum of o and p.

-p␣p "Preserve" the access rights. This is used by users with regular privileges who would like to preserve all file attributes apart from the owner. The file date and time specifications are preserved by default. However this can be deactivated with two other flags, and the date and time of extraction used.

Some of the functionalities described require appropriate privileges for whoever calls *pax,* particularly when creating block-oriented or character-oriented special files, when restoring the date and time of file access (*-t* option), provided that the user is not the owner of the file, or when preserving the group, and the mode (*-p* option).

Example The following command creates an archived named *archiv* containing the files *file1* through *filen* plus the directory *dir1* and all its subdirectories:

```
$ pax -w -f archiv file1...filen dir1
```

The following commands copy the *olddir* file hierarchy to *newdir*:

```
mkdir newdir
pax -rw olddir newdir
```

The following command reads the *a.pax* archive, whereby all file directories/files rooted in `/usr` in the archive relative to the current directory are extracted.

```
pax -r -s ',/old/*usr//*,,' -f a.pax
```

pdbl set up and manage user-specific program cache

Any user can call this command. This command enables the current user to set up, maintain and manage user-specific program caches. There are two scope types for user-specific program caches:

SESSIONWIDE	all the processes of a session are connected
USERWIDE	all the processes of a user ID are connected

Syntax

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-i**

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-e**␣size

pdbl{␣**-s**[␣sid]|␣**-u**}{␣**-a**|␣**-d**}

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-D**

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-b**␣path

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-l**[␣element]

pdbl{␣**-s**[␣sid]|␣**-u**}␣**-r**␣element

pdbl␣**-h**

options

-s sid
The program cache of a session (*SESSIONWIDE* scope) is selected. *sid* is the ID of the desired session. If *sid* is not entered, the current session will be automatically selected.

i If the option *-s* is selected, all the following options operate on the program cache of the selected or current session.

-u The program cache of the user ID (*USERWIDE* scope) is selected.

i If the option *-u* is selected, all the following options operate on the program cache of the current user.

-i The status of the program cache and statistical data about size and allocation percentages is written to standard output in the following format:

```
Cache name               CREATED: date time    STATE: status
                         SIZE: size  MB        ENTRIES: entries
                         FREE PAGES: pages
```

name	The name of the program cache is formed with the letters *DBL*, the scope (*S* for *SESSIONWIDE* or *U* for *USERWIDE*) and the corresponding ID of the session or the user. For example, the program cache of session *504* has the name *DBLS504*.
date	Date of program cache set-up.

time	Time of program cache set-up.
status	Current status of program cache (*active*, *inactive* or *in delete*).
size	Total cache size in megabytes.
entries	Current number of stored core images.
pages	Number of memory pages still available in cache. In the worst case, there is one memory page less available to core images because the extension of the cache catalog occupies one page.

-e size
The program cache is set up and activated in the *size* indicated (in megabytes). The maximum size of the cache is not determined by *pdbl* but by system- and task-specific settings. The size of the cache cannot exceed the ADDRESS-SPACE-LIMIT of the user ID.

-a The program cache is activated and used immediately in loading processes.

-d The program cache is deactivated and ignored immediately in loading processes.

The program cache is resolved if no currently stored core images are present (this is analogous to option -*D*). The program cache remains in the *inactive* status if core images are still present.

-D The program cache is resolved and no longer used in loading processes.

If the program cache is locked because the loading process has already started, it will remain in the *in delete* state until all current loading processes have been finished.

-b path
The core image of a program identified by its *path* is stored in the program cache. The program entered under *path* must be executable.

-l A list of all core images currently stored in the program cache is written to standard output in the following format:

element size date time library

element	Name of the program element in the PLAM library or the plain file name of the program in UFS.
size	Number of memory pages occupied by the core image.
date	date of the last access to the core image.
time	Time of the last access to the core image.
status	Current status of the program cache (*active*, *inactive* or *in delete*).
library	Name of the PLAM library from which the core image was loaded or the path name of the LLM in UFS.

-l element

Detailed information about the core image *element* in the program cache is written to standard output in the following format:

```
element         CREATED : cdate ctime     ACCESS: adate atime
                START AT: staddress        CACHESIZE: csize kB
                                           USECOUNT: number
                ____________________________________________
                SLICES  : sl LOADADDR:     SIZE:
                             loaddress     ssize kB
                             . . . . .     . . . . .
                ____________________________________________
info
```

Meaning of output

element	Name of the program element in the PLAM library or the plain file name of the program in UFS.
cdate	Creation date of the core image.
ctime	Creation time of the core image.
adate	Date of the last access to the core image.
atime	Time of the last access to the core image.
staddress	Start address of the core image during processing.
csize	Number of kilobytes occupied by the core image.
number	Number of load accesses to the core image.
sl	Number of slices.
loaddress	Load address of the slices.
ssize	Number of kilobytes occupied by the slices.
info	Information about the core image origin.

-r element

The core image *element* will be deleted from the program cache. All core images of the program cache will be deleted if "*" is indicated as an element.

-h An overview of all options and parameters is given.

Example

```
# pdbl -u -e 16         # set up program cache

# pdbl -u -i            # show status
Cache DBLU101           CREATED: 01/27/09 16:04:01       STATE: active
                        SIZE: 16 MB     ENTRIES: 0
                        FREE PAGES: 4095

# cd /usr/demo/bin

# ls -l hello           # show LLM in UFS
-rwxr-xr-x   1 ROOT     SYSROOT   364544 Feb 20 11:09 hello

# pdbl -u -b hello      # create and save core image

# pdbl -u -l            # show core images in program cache
hello           57 Jan 27 16:05:37 /usr/demo/bin/hello
```

ping send echo requests to network hosts

The *ping* command tests whether network components can be reached.

The command uses the ICMP or ICMPv6 protocol. It sends echo requests packets to specific network components to determine whether or not they can be reached via the network. These network components reply by returning echo reply packets.

Syntax

ping [**-nv**] host [timeout]

ping -s[**nv**] host [packetsize [packetcount]]

ping -l host

host
: Specifies the network component using the (FQDN) name, IPv4 address or IPv6 address.

-n
: The host address is displayed instead of the host name.

-v
: Verbose mode; when certain errors occur, additional messages are output.

-s
: Statistics display (1 echo request per second); the following information is displayed:

  – time until the network component replies,

  – size of the various data packets,

  – number of data packets sent, received and lost,

  – the shortest, longest and average reply times.

-l
: Outputs all the host's IPv4 and IPv6 addresses (lookup).

packetsize
: Size of the packet to be sent (default: 56 bytes, mnimum: 24 bytes, maximum: 1400 bytes); 8 bytes are added to the size for the header.

packetcount
: Number of packets to be sent; by default (*packetcount* = 0) as many bytes as necessary are sent until the *ping* command is interrupted by the `SIGINT` signal.

timeout
: Defines how long *ping* is to send new queries or to wait for an answer (default: 20 seconds).

Example 1 Successful *ping* call:

```
$ ping linux6
linux6 is alive
$
```

Example 2 Successful *ping* calls to an IPv4 address and to an IPv6 address with the *-s* option (packet size 72 bytes, 4 packets):

```
$ ping -s linux4 72 4
PING linux4: 72 data bytes
80 bytes from linux4 (172.17.29.15): icmp_seq=1 time=448.067 ms
80 bytes from linux4 (172.17.29.15): icmp_seq=2 time=33.339 ms
80 bytes from linux4 (172.17.29.15): icmp_seq=3 time=2.368 ms
80 bytes from linux4 (172.17.29.15): icmp_seq=4 time=2.834 ms

----linux4 PING Statistics----
4 packets transmitted, 4 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 2.368/121.652/448.067
$
```

```
$ ping -s linux6 72 4
PING linux6: 72 data bytes
80 bytes from linux6 (3ffe:1:1001:3000:230:5ff:fefb:54e7): icmp_seq=1
time=3.690 ms
80 bytes from linux6 (3ffe:1:1001:3000:230:5ff:fefb:54e7): icmp_seq=2
time=3.222 ms
80 bytes from linux6 (3ffe:1:1001:3000:230:5ff:fefb:54e7): icmp_seq=3
time=3.285 ms
80 bytes from linux6 (3ffe:1:1001:3000:230:5ff:fefb:54e7): icmp_seq=4
time=3.197 ms

----linux6 PING Statistics----
4 packets transmitted, 4 packets received, 0% packet loss
round-trip (ms)  min/avg/max = 3.197/3.348/3.690
$
```

Example 3 *ping* call to a host which does not answer

```
$ ping test
no answer from test.region.example.net
used IPv4 address:      172.25.92.53
$
```

Example 4 *ping* call to a host which does not exist

```
$ ping inexist.region.example.net
ping: unknown host inexist.region.example.net
$
```

Example 5 *ping* call to a host which does not answer. If any exist, alternative IPv4/IPv6 addresses are displayed at which the host can possibly be reached:

```
$ ping www.ct.de
ping: sendto: No route to host
used IPv6 address:      2a02:2e0:3fe:100::8
alternate addresses:
        193.99.144.80        (IPv4)
$
```

Example 6 *ping* call to determine the IP addresses of a host

```
$ ping -l www.ct.de
hostname: www.ct.de
        IPv6 address:   2a02:2e0:3fe:100::8
        IPv4 address:   193.99.144.80
$
```

pkginfo show information on software packages in POSIX

The *pkginfo* command shows information on software packages which are installed in POSIX. A software package installed in POSIX is defined by:

- the name of the software product
- the package from the software product (optional)
- the version of the software product
- the path under which the software product is installed (default: /)
- the BS2000 library (SINLIB) from which the software product was installed
- the date of the (last) installation.

Syntax

pkginfo[␣**-l**|**-q**][[␣**-v**␣version][␣**-P**␣package][␣**-I**␣ipath]␣product]

No option specified

An overview of all the installed software packages is output, see example 1.

options

-l (l - long) Detailed outputs

-q (q - quiet) No outputs; only the exit status is set

-v version

Only product(s) of the specified version are displayed

-P package

Only the specified package of a product is displayed

-I ipath

(I - Installation) Only products with the specified installation path are displayed

Exit status

0 Installed product(s) complying with the specifications have been found

1 No installed product complying with the specifications has been found

>1 Errors

Error

The */var/sadm/pkg/instlog* file cannot be read or does not match the expected format.

Errors reported by the runtime system (CRTE).

File

/var/sadm/pkg/instlog - Log file of the POSIX package installations

Hint The *pkginfo* command always outputs the information in English, regardless of the language set. This avoids problems which could otherwise occur during the analysis of outputs in shell scripts.

The names of the software product and package can be entered in upper or lower case.

Example 1 Outputting an overview of all the software packages installed:

```
$ pkginfo
PRODUCT                        PACKAGE         VERSION  INSTALLATION-PATH
POSIX-BC                       -               080      /
POSIX-SH                       -               070      /
NFS                            -               030      /
POSIX-NSL                      -               070      /
POSIX-SOCKETS                  -               070      /
CRTE                           -               028      /
IMON-BAS                       -               031      /
POSIX-HEADER                   -               018      /
TCP-IP-SV                      PRNGD           031      /opt/TCP-IP-SV/prngd
TCP-IP-SV                      OPENSSH         031      /opt/TCP-IP-
SV/openssh
SYMAPI                         -               066      /opt/emc
SBA-BS2                        -               062      /
SCCA-BS2                       -               020      /opt/emc/sccabs2
$
```

Example 2 Outputting details of all packages of a software product:

```
$ pkginfo -l tcp-ip-sv
PRODUCT NAME              : TCP-IP-SV
  PRODUCT PACKAGE         : PRNGD
  PRODUCT VERSION         : 031
  INSTALLATION PATH       : /opt/TCP-IP-SV/prngd
  INSTALLATION LIBRARY    : $TSOS.SINLIB.TCP-IP-SV.031.PRNGD
  INSTALLATION DATE       : Fri Oct 10 08:08:56 2008
PRODUCT NAME              : TCP-IP-SV
  PRODUCT PACKAGE         : OPENSSH
  PRODUCT VERSION         : 031
  INSTALLATION PATH       : /opt/TCP-IP-SV/openssh
  INSTALLATION LIBRARY    : $TSOS.SINLIB.TCP-IP-SV.031.OPENSSH
  INSTALLATION DATE       : Fri Oct 10 08:06:08 2008
$
```

Example 3 Outputting details of a particular package of a software product:

```
$ pkginfo -l -P openssh tcp-ip-sv
PRODUCT NAME                : TCP-IP-SV
  PRODUCT PACKAGE           : OPENSSH
  PRODUCT VERSION           : 031
  INSTALLATION PATH         : /opt/TCP-IP-SV/openssh
  INSTALLATION LIBRARY      : $TSOS.SINLIB.TCP-IP-SV.031.OPENSSH
  INSTALLATION DATE         : Fri Oct 10 08:06:08 2008
$
```

Example 4 Checking the installation of particular versions of a software product:

```
$ pkginfo -q -v 027 crte && echo "INSTALLED." || echo "NOT INSTALLED."
NOT INSTALLED.
$ pkginfo -q -v 028 crte && echo "INSTALLED." || echo "NOT INSTALLED."
INSTALLED.
$
```

posdbl set up and manage global program cache

Only the super user can call this command. A global program cache of scaleable size is kept to store ready-to-run core images of POSIX programs. These core images are stored implicitly during the call of a POSIX TOOL from the shell library or are stored explicitly using this command. The global program cache is available to all users to load a stored program.

Syntax

posdbl{␣**-s**|␣**-h**|␣**-S**|␣**-D**|␣**-n**}

posdbl{␣**-e**|␣**-d**}{**loader**|**linker**|**both**}

posdbl␣-b␣path

posdbl␣**-l**[␣element]

posdbl␣-r␣element

posdbl␣**-L**

posdbl␣**-A** library

posdbl␣**-R** library

options

-s The status of the global program cache, the implicit linker process and statistical data about size and allocation percentage is written to standard output in the following format:

```
POSIX-DBL              linker status       loader status
Cache POSIX@DBL        CREATED: date time
                       SIZE: size MB    ENTRIES: entries
                       FREE PAGES: pages
```

Meaning of output

status	Current status of the implicit linker and loader process (*ON*, *OFF*).
date	Creation date of the program cache.
time	Creation time of the program cache.
size	Total cache size in megabytes.
entries	Current number of stored core images.
pages	Number of memory pages still available in cache. In the worst case, there is one memory page less available to core images because the extension of the cache catalog occupies one page.

-h An overview of all options and parameters is output.

-S A script which enables the current content of the program cache to be restored is output to stdout.

-D The program cache is deleted.

-n A new, empty program cache is generated.

> **i** When a new program cache is generated, the two functions loader process (*loader*) and link process (*linker*) (see the *-e* / *-d* options) are not enabled. Loading of the programs from the cache and automatic caching are consequently not enabled.

-e / -d
The loader process (*loader*), the implicit linker process (*linker*) or both processes (*both*) are activated (option *-e*) or deactivated (option *-d*).

> **i** The implicit link process (*linker*) applies for all libraries for which automatic caching is enabled (see the *-A*, *-R* and *-L* options).

-b path
The core image of a program identified by its path name is stored in the program cache. The program indicated under *path* must be executable.

-l A list of all core images currently stored in the program cache is written to standard output in the following format:

element size date time library

element	Name of the program element in the PLAM library or the plain file name of the program in UFS. If the core image was saved with the command call `posdbl -b` *path* the name of the program element will be preceded by a plus sign (+).
size	Number of memory pages occupied by the core image.
date	Date of the last access to the core image.
time	Time of the last access to the core image.
status	Current status of the program cache (*active*, *inactive* or *in delete*).
library	Name of the PLAM library from which the core image was loaded or the path name of the LLM in UFS.

-l element

Detailed information about the core image *element* in the program cache is written to standard output in the following format:

```
element          CREATED : cdate ctime     ACCESS: adate atime
                 START AT: staddress        CACHESIZE: csize kB
                                            USERCOUNT: number
                 ______________________________________________
                 SLICES  : sl LOADADDR:     SIZE:
                              loaddress     ssize kB
                              . . . . .     . . . . .
______________________________________________
info
```

Meaning of output

element	Name of the program element in the PLAM library or the plain file name of the program in UFS.
cdate	Creation date of core image.
ctime	Creation time of core image.
adate	Date of the last access to the core image.
atime	Time of the last access to the core image.
staddress	Start address of the core image during processing.
csize	Number of memory pages occupied by the core image.
number	Number of load accesses to core image.
sl	Number of slices.
loaddress	Load address of the slices.
ssize	Number of memory pages occupied by the slices.
info	Information about the core image origin.

i Initially an attempt is made to find an element in the specified notation. If this proves unsuccessful, another search is made ignoring the use of uppercase/lowercase.

-r element

The core image *element* is deleted from the program cache. All core images of the program cache will be deleted if "*" is indicated as an element.

i Initially an attempt is made to find an element in the specified notation. If this proves unsuccessful, another search is made ignoring the use of uppercase/lowercase.

-A library

By default, only the SINLIB.POSIX-BC.*vvv*.SHELL and SINLIB.POSIX-SH.*vvv* libraries are taken into account for the implicit link operation. The *-A* option enable further libraries to be added to the list of libraries to be taken into account.

Only programs which are installed in the POSIX system as a reference to an element in a PLAM library and not as an LLM are automatically preloaded into the program cache. This is the case, for example, with all commands and tools which are supplied with POSIX-BC. Some well-defined programs (e.g. daemons and the *mount*, *umount* and *share* commands) are not automatically loaded into the cache.

As the CAT ID is ignored, only libraries which exist on the default pubset can be added.

i The specification of the library name is not case-sensitive.

```
posdbl -A \$TSOS.SINLIB.POSIX-BC.090.ROOT
```
The "$" character must be escaped.

```
posdbl -A SINLIB.POSIX-BC.090.ROOT
```
If the library's user ID is not specified, the user ID of the caller is used, for example:
$SYSROOT.SINLIB.POSIX-BC.090.ROOT

```
posdbl -A :DAT0:\$TSOS:SINLIB.POSIX-BC.090.ROOT
```
Specifying the catalog ID :DAT0: has no effect and is ignored. Consequently only libraries which are located on the user ID's default pubset can be added.

-R library

The *library* library is removed from the library list. All programs from *library* are now no longer automatically loaded into the program cache when they are executed, but must, if required, be added explicitly using the *-b* option.

i The same information applies as for the *-A* option.

-L

A list of libraries is displayed whose programs are automatically loaded into the program cache when they are called.

Example

```
# posdbl -s                # show status
POSIX-DBL:                 linker ON       loader ON
Cache POSIX@DBL            CREATED: 07/18/02 13:06:11
                           SIZE: 24 MB     ENTRIES: 9
                           FREE PAGES: 2688

# posdbl -d linker         # deactivate implicit load process
POSIX-DBL:                 linker OFF      loader ON

# posdbl -l                # show core images in program cache
 SH             202 Feb 19 11:05:14  $TSOS.SINLIB.POSIX-BC.090.SHELL
 RM              38 Feb 19 11:02:33  $TSOS.SINLIB.POSIX-BC.090.SHELL
 LS              40 Feb 19 10:56:15  $TSOS.SINLIB.POSIX-BC.090.SHELL
. . .
. . .

# cd /usr/demo/bin

# ls -l hello             # show LLM in UFS
-rwxr-xr-x   1 ROOT    SYSROOT   364544 Feb 20 11:09 hello

# posdbl -b hello         # generate and save core image

# posdbl -l               # show core images in program cache
 SH             202 Feb 19 11:05:14  $TSOS.SINLIB.POSIX-BC.090.SHELL
 RM              38 Feb 19 11:02:33  $TSOS.SINLIB.POSIX-BC.090.SHELL
 LS              40 Feb 19 10:56:15  $TSOS.SINLIB.POSIX-BC.090.SHELL
. . .
. . .
+hello           22 Feb 20 11:10:55 /usr/demo/bin/hello
```

pr prepare files for printing

The *pr* command formats and writes the contents of files on the standard output.

Output is either in single columns (default) or in multiple columns. Multi-column output can be produced by using either the - option or the *-m* option.

Syntax **pr**[␣option][␣file]...

No option specified

The files are divided into pages which are separated by a sequence of line feed characters. The page length is 66 lines, which includes 10 lines of header and trailer output.
Headers are made up of two blank lines, one line of text containing the page number, date and time that the file was last modified, and the file name, and two more blank lines. Trailers consist of five blank lines.

Files are output in single columns. Overlong lines are split.

If the standard output is associated with a terminal, error messages are not reported until all the specified files have been output.

Option overview

The following overview indicates the various options you can use to modify the output format:

+	Set first page to be displayed
-	Split text into columns
-a	Define how columns are to be filled
-w	Define page width for multi-column output
-s	Prevent truncation of lines in columns
-m	Output files simultaneously in columns
-d	Double-space the output
-e	Convert tabs to spaces
-i	Convert spaces to tabs
-n	Number lines
-o	Indent text
-l	Change page length
-h	Change file name in header

-p Display file one page at a time

-f Use form-feed characters to separate pages

-F Use form-feed characters to separate pages

-r Suppress error messages

-t Suppress output of header and trailer

Description of options in alphabetical order

+page_number
Starts output at the specified *page_number*.

+ not specified: Output begins at the first page.

-columns
Outputs the file in *columns* columns. Output appears as if *-e* and *-i* have been set with their default values.

This option cannot be combined with *-m*.

The columns of a page are filled with input lines from top to bottom.
This setting can be changed with *-a*.

The default page width for multi-column output is 72. This setting can be changed with *-w*.

pr determines the width of each column by dividing the page width by the number of columns. If a line is too long, it is truncated to the right. Truncation can be suppressed with *-s*.

- not specified: Single-column output.

-a (a - across) Arranges multi-column output across the page.

The number of columns must be greater than 1. This number can be defined with *-columns* or *-w*.

If a line is too long to fit in a column, it is truncated to the right. Truncation can be suppressed with *-s*.

The *-a* option cannot be combined with the *-m* option.

-a not specified: *pr* fills columns down the page from top to bottom.

-d (d - double-space) Double-spaces the output. Blank lines that result from double-spacing are deleted when they occur at the top of a page.

-e[tab_char][spacing]
Replaces each tab character in the input by an appropriate number of spaces.

tab_char Character which *pr* interprets as a tab character. May be any non-numeric character.

tab_char not specified:
pr uses the horizontal tab character (siehe section “ASCII character set (ISO 646)” on page 909).

spacing Spacing between tabs. The first tab stop in a line is always set in column 1. If *spacing* is 0, the default value of 8 characters is assumed.

spacing not specified:
The tab spacing is 8 characters.

-f (f - form feed) Uses a single form-feed character to separate output pages.

If the output is to a terminal, *pr* pauses before the first page and sounds the terminal bell. You then start the output by pressing ↵.

-f not specified:
Pages are separated by a sequence of line feed characters.

-F (F - form feed) Pages are separated by a single form feed character.

-F not specified:
Pages are separated by a sequence of line feed characters.

Caution:
In previous versions, the *-F* option had a different meaning. This is now supported by *pr* by default.

-h␣header
Writes a text of your choice in the header instead of the file name. This option is ignored if you also specify *-t* or *-l* with a page length of 10 or less.

-i[tab_char][spacing]
Replaces white space in the input text with the tab character *tabchar* at appropriate positions in the output text.

tab_char Character which *pr* interprets as a tab character. May be any non-numeric character.

tab_char not specified:
pr uses the horizontal tab character (siehe section “ASCII character set (ISO 646)” on page 909).

spacing Spacing between tabs. The first tab stop in a line is always set in column 1. If *spacing* is 0, the default value of 8 characters is assumed.

spacing not specified: The tab spacing is 8 characters.

-l␣length
Sets the length of an output page.

The page length includes a total of 10 lines for the header and footer. Consequently, if you specify a value of 10 or less for *length*, the header and trailer will not be output (see the *-t* option).

-l not specified:
Each page is made up of 66 lines.

-m Merges and outputs all named files simultaneously, one column per file. The maximum number of files that may be specified is nine.

-m cannot be used together with *-columns*.
Otherwise, the same rules apply as for *-columns*.

The *-m* option cannot be combined with the *-a* option.

-m not specified:
pr outputs files one after the other.

-n[separator][char_pos]
Numbers the lines. For multi-column output, the lines of each individual column are numbered. The line number occupies the first *char_pos*+1 character positions of each line or each column line.

separator Character used to separate the line number from the start of the line. May be any non-numeric character.

separator not specified:
A horizontal tab is used as the separator (see section “ASCII character set (ISO 646)” on page 909).

char_pos Number of character positions occupied by line numbers.

char_pos not specified:
Defaults to 5.

-o␣offset
Offsets (indents) each output line by *offset* character positions.

-p If the output is directed to a terminal, *pr* sounds the terminal bell and pauses before beginning each page. The page is displayed after you press the ↵ key.

-r Suppresses diagnostic reports if *pr* is unable to open a file.

-r not specified:
After completing the entire output, *pr* issues an error message to report files that could not be accessed.

-s[separator]
Separates columns by the single character *separator* instead of a tab. If you do not specify *-w* at the same time, *-s* also prevents the truncation of overlength lines (up to 512 character) on multi-column output.
separator: Character used to separate columns.

separator not specified:
The default separator is a horizontal tab (siehe section “ASCII character set (ISO 646)” on page 909).

-t Suppresses the headers and trailers. Terminates printing after the last line of each file instead of padding with spaces to the end of the page.

-w␣width
Sets the page width for multi-column output. Multi-column output can be produced with *-columns* or *-m*.
width: Number of characters in a line.

-w not specified:
The default page width for multi-column output is 72 characters.

file
Name of the file to be prepared for printing. You may specify more than one file.
If more than one file is specified, *pr* outputs them in succession.
If you use a dash as the name for *file*, *pr* reads from standard input.

If you use the *-m* option for multi-column output, no more than 9 files may be specified.

file not specified:
pr reads from standard input.

File
*/dev/tty**
*/dev/term/tty**
Special files for individual terminals.

If standard output is directed to one of the special files */dev/tty**, other output directed to this terminal is delayed until standard output is completed. This prevents error messages from being interspersed throughout the output.

Variable
TZ
Determine the timezone for use in writing header lines.

Locale The following environment variables affect the execution of *pr*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and which characters are defined as printable. Non-printable characters still will be written to standard output, but are not counted for the purpose for column-width and line-length calculations.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME Determine the format of date and time for use in writing header lines.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Print *file1* and *file2* sequentially in three-column format (*-3*) using the form-feed character (*-f*) at the end of each page so as to ensure that the output is independent of the printer type.

```
$ pr -3f file1 file2 | lp
```

Example 2 The tab spacing of 8 positions in *file1* is to be changed to 6 in *file2*. First you convert tabs in *file1* to spaces (*-e*; tab spacing = 8), then you reconvert the spaces back to tabs (*-i6*; tab spacing = 6), and then you write the result to *file2*. The *-t* option suppresses the header and trailer for both *pr* commands.

```
$ pr -et file1 | pr -i6t > file2
```

Example 3 The file *months* contains the name of a month in each line. This file is now to be displayed with *pr* in three columns (*-3*) with two-digit numbering (*-n2*). The columns are to be filled from left to right (*-a*):

```
$ pr -3n2a months

Jan 27 16:21 2009 months Page 1


 1      January          5      May              9      September
 2      February         6      June            10      October
 3      March            7      July            11      November
 4      April            8      August          12      December
```

See also *cat*, *fold*, *more*

print write arguments to standard output

print is the output mechanism of the POSIX shell.

Syntax

print[␣**-Rnprsu**[filedes]][␣arg]...

If it is invoked with no options or with the option - or --, the arguments are printed on standard output as explained in the *echo* command description.

option

-R or **-r**
In raw mode, the escape conventions of *echo* are ignored. The *-R* option prints all subsequent arguments and options except for the *-n* option.

-n No newline is added to the output.

-p The arguments are written to the pipe of the process spawned with |&, not to standard output.

-s The arguments are written to the history file, not to standard output.

-ufiledes
Arguments are written to the single-digit file descriptor *filedes*, not to standard output.

argument
see *echo*

Example 1 Various output possibilities for the string *abcdef*.

```
$ print "abc\tdef"
abc     def
$ print -r "abc\tdef"
abc\tdef
$ print -R "abc\tdef"
abc\tdef
$ print -n abc; print def
abcdef
```

Example 2 Output to a file via the file descriptor.

```
$ exec 4>print.out
$ prinf -u4 abc
$ cat print.out
abc
```

For further examples, see *echo*.

See also *echo, read*

printf formatted output

The *printf* command outputs the arguments you specify in formatted form. *printf* supports all format specifications for strings as in the *printf()* function in C.

Syntax

```
printf␣format[␣arg]...
```

format

Character string that can contain three different types of objects:

- plain characters, which are output without any modifications.
- Escape sequences for metacharacters, which are converted into the corresponding characters in the output, e.g. *n* is converted to a newline character.
- Format elements from which each one of the specified arguments *arg* is processed.

arg

String to be written to standard output in the format specified by *format*.
If there are fewer arguments than expected by *format*, the missing arguments are set to 0 or the null string. If there are more arguments than expected by *format*, *format* is applied more than once (unless *arg_no$* is specified, in which case the excess arguments are ignored).

arg not specified:
The result is undefined.

Metacharacters

The following metacharacters are interpreted by *printf*:

\\	Backslash (for distinguishing octal characters)
\a	Warning, alert *)
\b	Backspace *)
\f	Form Feed
\n	Newline
\r	Carriage Return
\t	Tab
\v	Vertical tab *)
\octal	Octal number, whereby *octal* consists of one, two, or three digits

*) These metacharacters are supported only on character terminals (i.e. if you are accessing the POSIX shell via rlogin)

Format elements

A format element comprises:

`%[arg_no$][field_width][.precision]conversion_character`

% Always located at the beginning of the format element. If the % character is not to be interpreted as a part of the format element but as an ordinary character to be output, it must be escaped by preceding it with another % (%%).

arg_no**$**
Decimal integer with which you specify the position of the argument to be processed. The number must be followed by a *$* character.

%arg_nr$ and % should not be used in combination.

arg_no not specified: The argument following the last converted argument is used.

i If you use *arg_nr$* for one argument, you should also use *arg_nr$* for all the other arguments.

field_width
Decimal integer with which you specify the minimum field width. If the string to be converted has fewer characters than *field_width*, it is padded on the left to the field width and output right-adjusted. If left-adjustment is desired, the decimal integer must be preceded by a dash (-). The padding is with blanks unless the *field_width* integer starts with a zero, in which case padding for right-adjusted output is done with zeros.
A *field_width* may also be indicated by an asterisk (*) instead of an integer. In this case, an integer argument supplies the field width. This argument must appear before the string to be converted. The asterisk does not work in combination with *arg_no$*.
If the string is longer than the field width, the field is automatically expanded.

.precision
Decimal integer with which you specify the maximum number of characters to be output from the string to be converted. This number must be preceded by a dot (.). If the precision argument is zero, nothing is output. The number of characters output is always controlled by the precision, even if some other value has been specified for the field width.
A *precision* may also be indicated by an asterisk (*) instead of an integer. In this case, an integer argument supplies the precision. This argument must appear before the string to be converted. The asterisk does not work in combination with *arg_no$*.

conversion_character
The following *konversion_characters* can be used for *printf*:

b	character string with metacharacters
c	single character
d	signed decimal integer

e	floating-point number in exponential notation, e.g. 5.234e+2
E	floating-point number in exponential notation, e.g. 5.234e+2
f	floating-point number, e.g. 52.34
g	%e or %f, whichever is shorter
G	%E or %f, whichever is shorter
o	signed octal integer (base 8)
s	character string
u	unsigned decimal integer
x	unsigned hexadecimal integer (base 16)

With *s* all characters from the character string are output until the number of characters specified for *precision* is reached. If *precision* is not specified, the entire character string is output.

With *b*, the character string in *arg* can contain metacharacters. *printf* supports all escape sequences interpreted by the *echo* command in this case, i.e. the escape sequences specified above with the exception of octal numbers specified as *\0octal*, and *\c*. *\c* causes *printf* to abort output at this point and not to terminate it with a newline character.

Locale

The following environment variables affect the execution of *printf*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_NUMERIC determine the locale for numeric formatting. It will affect the format of numbers written using the e, E, f, g and G conversion characters.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Output the string "Good Morning Helen" on the screen:

```
$ printf '%s %s %s\n' Good Morning Helen
```

The following command produces the same output:

```
$ printf '%2$s %3s %1$s\n' Helen Good Morning
```

Example 2 Output the first 6 characters of your home directory /usr/kathy with an appropriate message:

```
$ printf 'The first 6 characters of %s are %.6s.\n' $HOME $HOME
The first 6 characters of /usr/kathy are /usr/k.
```

Example 3 The examples that follow write a 4-digit number in an 8-character field right-adjusted, right-adjusted with leading zeros, and left-adjusted, respectively:

```
$ printf '%8s\n' 1860
    1860

$ printf '%08s\n' 1860
00001860

$ printf '%-8s\n' 1860
1860␣␣␣␣
```

See also *awk, bc, echo*
printf() [4]

ps report process status

ps outputs information about active processes. This report represents a snapshot of the system or process status at a given moment and could be outdated within a split-second, so it may not reflect the actual situation by the time it is displayed.

Syntax

ps[␣**-aAcdeflj**][␣**-g**␣grplist][␣**-G**␣grplist][␣**-n**␣namelist][␣**-o**␣format]...
[␣**-p**␣proclist][␣**-s**␣sesslist][␣**-t**␣termlist][␣**-T**][␣**-u**␣userlist][␣**-U**␣userlist]

No option specified

ps outputs information about processes associated with the current terminal. The output consists of a short listing comprising:

– the process ID (PID)
– the terminal identifier (TTY)
– the cumulative execution time (TIME)
– the command name (COMD).

The significance of the output columns is explained in the section entitled *Output*.

option

-a Outputs information about all processes associated with a terminal, except process group leaders.

-A Information about all own processes is output. This option is equivalent to the *-e* option. The POSIX administrator is shown information about all processes.

-c Also outputs information relating to process class and priority.

-d Outputs information about all processes associated with a terminal as well as those which are not. Process group leaders are not taken into account.

-e Outputs information about all own processes. This option is equivalent to the *-A* option.

BS2000:
Only the POSIX administrator is shown information about all processes.
If other users are also to obtain information on all the processes, the POSIX administrator must set the s bit for the */sbin/ps* file after POSIX-BC has been installed (command: *chmod +s /sbin/ps*).

-f (full list) Outputs a full listing with supplementary information on each process. The columns displayed in a full listing are explained in more detail in the section entitled *Output*.
If *-f* is specified, *ps* outputs the command name and arguments. However, the arguments are displayed only if the process belongs to the user who called *ps*, or if *ps* was called by the POSIX administrator.

If the command name for the process contains non-printing characters, the command name is enclosed within square brackets [...]. If the *-f* option is specified without other options, the information output refers to processes associated with the controlling terminal.

-g␣grplist
Restricts listing to data about processes whose process group leaders are given in *grplist*.

grplist
grplist is a list containing the process ID numbers of process group leaders. This list can be specified in one of two forms:

a comma-separated list of numbers,
or a list of numbers enclosed in double quotes with the numbers separated by commas and/or blanks.

-G␣grplist
Information is only output about processes whose real process leader is specified in *grplist*.

grplist
grplist is a list of the process ID numbers of process group leaders. *grplist* has the following format:

The numbers are separated by commas or the list is enclosed in quotes "...". In the latter case, the numbers may also be separated by commas and/or spaces.

-j Outputs the session ID and the process group ID.

-l (long list) Outputs a long listing with detailed information on each process. The output columns in a long listing are explained in the section entitled *Output*. If the *-l* option is specified without other options, the information output refers to processes associated with the controlling terminal.

-n␣namelist
The system file specified in *namelist* is used insead of the default file.

-o␣format
Outputs information in accordance with the definitions specified in *format* (see the section “User-defined output formats” on page 653).

-p␣proclist
Restricts listing to data about processes whose process ID numbers are given in *proclist*.

proclist
proclist is a list of process ID numbers.

The numbers must be separated by commas, or alternatively, the whole list can be enclosed in double quotes with the numbers separated by commas and/or blanks.

-s␣sesslist
Restricts listing to data about processes associated with a session listed in *sesslist*.

sesslist
sesslist is a list of session ID numbers. This list can be specified in one of two forms:

a comma-separated list of numbers,
or a list of numbers enclosed in double quotes with the numbers separated by commas and/or blanks.

-t␣termlist
Restricts listing to data about the processes associated with the terminals named in *termlist*.

termlist
termlist is a list of terminal identifiers which may be specified in one of two forms: either the device's file name (e.g. *term/tty04*) or, if the device's file name is constructed with *tty*, just the digit identifier (e.g. *004*).

The terminal identifiers must be separated by commas, or alternatively, the whole list can be enclosed in double quotes with the entries separated by commas and/or blanks.

-T The BS2000 TSN of the processes is also output. *-T* can be specified together with other options. *-T* is effective with all options except *-o*.

-u␣userlist
Restricts listing to data about processes whose process owner is given in *userlist*.

userlist
userlist is a list of user ID numbers or login names.

The entries in *userlist* must be separated by commas or, alternatively, the whole list can be enclosed in double quotes with the entries separated by commas and/or blanks.

-U␣userlist
Information is only output about processes whose real process leader is specified in *userlist*.

userlist
userlist is a list of user IDs or login names.

The specifications in *userlist* must be separated by commas, or alternatively, the whole list can be enclosed in double quotes with the entries separated by commas and/or blanks.

Output

The following describes the headings and meanings of the *ps* output columns if option *-o* is set. The letters in parentheses indicate the option that causes the corresponding column to appear. *all* means that the column appears for all options. Note that options *-c*, *-j*, *-f* and *-l* determine only what information is provided for a process; they do not determine which processes will be listed.

F (*l*)
: Flags (hexadecimal and additive) associated with the process. These flags are machine-dependent and have therefore been omitted here.

S (*l*)
: State of the process.

  0: process running

  S: Sleeping:
  process waiting for an event

  R: Runnable:
  process is runnable

  I: Idle:
  process being created

  Z: Zombie state:
  process is terminated, but its exit status has not yet been queried by the parent with a *wait()* system call

  T: Traced:
  traced process stopped by a parent process

  X: SXBRK state:
  process waiting for more memory

UID (*f, l*)
: (User ID) The user ID number of the process owner. If the *-f* option is set, the login name is output instead of the UID.

  Only the first 7 characters of the user ID are output.

PID (*all*)
: (Process ID) The process ID number of the process. Every process is assigned a unique PID when it is created. You can use this number in a *kill* command, for example, if you want to terminate a particular process.

TSN (*T*)
: Task sequence number of the BS2000 process (task).

PPID (*f, l*)
: (Parent Process ID) The process ID of the parent process.

PGID (*j*)
: Process group ID.

SID (*j*)
: Session ID.

C (*f, l*)
: Processor utilization for scheduling.

CLS (*c*)
: Scheduling class (processes handled by the scheduler).

PRI (*l,c*)
: Priority of the process. Higher numbers normally mean lower priority. However, if the *-c* option is specified, higher numbers mean higher priority.

NI (*l*)
: Nice value, i.e. value by which process priority was changed (see *nice*). Only processes in the *time-sharing* class have a nice value.

ADDR (*l*)
: Core address (physical page frame number) of the user area if resident; the disk address if swapped out.

SZ (*l*)
: Size in blocks of the core image of the process.

WCHAN (*l*)
: Address of the event for which the process is waiting. If the column is blank, the process is running.

STIME (*f*)
: Starting time of the process. The time is output within the first 24 hours; thereafter, the date.

TTY (*all*)
: The controlling terminal for the process. A question mark (?) is output when there is no controlling terminal.

TIME (*all*)
: The cumulative execution time for the process in minutes and seconds.

COMD (*all*)
: The command name. If the *-f* option is specified, the full command name and its arguments are output.

  Processes which have terminated, but whose exit status has not yet been queried by the parent with a *wait()* system call, is marked `<defunct>`.

If *termlist*, *proclist*, *userlist*, or *grplist* is not specified, *ps* will try to determine the controlling terminal by checking the standard input, standard output, and standard error in that order. It will then report on the processes associated with the controlling terminal. If the above three channels are all redirected, *ps* will not find a controlling terminal and hence not produce a report.

User-defined output formats

You can use the option *-o␣format* to define your own output (see also example 2). *format* is a list of variables which can be entered as individual arguments or separated by commas or blanks.

Each variable has a default header. The default header can be renamed, i.e. you can assign it a new text by appending to it the equals sign (=) and the new name.

The variables specified in *format* are written to the standard output where they appear next to each other. The individual field widths depend on the length of the default header. If the header text is void, e.g. -o user=, then at least the width of the default header is used.

You may specify the following variables in *format*, the default header shown in brackets is assigned to the variable if no further *-o* specifications are entered:

ruser (RUSER)
: the real login name of the process. If this can be determined and the field width permits it, this is displayed as text, otherwise in decimal form.

user (USER)
: the effective login name of the process. If this can be determined and the field width permits it, this is displayed as text, otherwise in decimal form.

rgroup (RGROUP)
: the real group ID of the process. If this can be determined and the field width permits it, this is displayed as text, otherwise in decimal form.

group (GROUP)
: the effective group ID of the process. If this can be determined and the field width permits it, this is displayed as text, otherwise in decimal form.

pid (PID)
: the decimal value of the process ID

ppid (PPID)
: the decimal value of the parent process ID

pgid (PGID)
: the decimal value of the parent group ID

pcpu (%CPU)
: the percentage value of utilized CPU time

vsz (VSZ)
: the decimal value of the storage space required by the process in kilobytes

nice (NI)
: the decimal value of the system scheduling priority

etime (ELAPSED)
: the time the process has been running, specified in [[dd-]hh:]mm:ss

time (TIME)
: the total period of CPU utilization for the process

tty (TT)
: name of the terminal on which the process is running

comm (COMMAND)
: name of the command which is being executed, specified in text form (it may contain spaces)

args (COMMAND)
: command with all spaces, in text form (it may contain spaces)

tsn (TSN)
: BS000 TSN (task sequence number) of the process

Variable *COLUMNS*
Override the system-selected horizontal screen size, used to determine the number of text columns to display.

Locale The following environment variables affect the execution of *ps*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

LC_TIME	Determine the format and contents of the date and time strings displayed.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 *ps* is called with the *-l* option to display a long listing of information on all active processes on the controlling terminal:

```
$ ps -l
 F S   UID   PID  PPID  C PRI NI     ADDR     SZ    WCHAN TTY      TIME CMD
10 S   110  1455  1453  0  30 20 c0fec9d8     23 d114f200 term/001  0:02 sh
10 O   110  1862  1455 12  50 20 c0fec870     60          term/001  0:00 ps
18 S   110  1858  1455 10  20 20 c0fecaf8     55 d115f280 term/001  1:03 find
```

The *find* command is now to be terminated by calling *kill* with the process ID number displayed in the PID column. A subsequent call to *ps* then confirms that the corresponding process no longer exists.

```
$ kill 1858
$ ps
   PID TTY      TIME COMD
  1455 tty004   0:02 sh
  1873 tty004   0:00 ps
  1858 Terminated
```

Example 2 User-defined output format of the ps command: output of USER, PID, PPID (if the new name is to contain FATHER) and output of arguments.

```
$ ps -o user,pid,ppid=FATHER -o args
   USER   PID     FATHER     COMMAND
 HELEN     62          0      [sh]
 HELEN    122         62      [ps]
```

Example 3 Only the BS2000 TSN of the current shell (without a header) is to be output.

```
$ ps -o tsn= -p $$
7R6C
```

By way of comparison:

```
$ ps -T
   PID   TSN TTY      TIME CMD
   180  7R69 term/002  0:00 ps
   148  7R6C term/002  0:11 sh
```

See also *kill, nice*

pwd return working directory name

The POSIX shell built-in *pwd* writes the absolute path name of the working (current) directory on the standard output.

Syntax

```
pwd
```

If the error message

```
Cannot open ...
```

or

```
Read error in ...
```

is displayed, a file system error has occurred. Inform the POSIX administrator.

Locale The following environment variables affect the execution of *pwd*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You want to define your current directory as the home directory:

```
$ pwd
/usr/art/cobol/prg
$ HOME=pwd`
$ echo $HOME
/usr/art/cobol/prg
```

See also *cd*

rcp remote file copy

The *rcp* can be used to copy files and directories

- from a local host to a remote host
- from a remote host to a local host
- between two remote hosts

You can use this command, for example, when you want to work with files located on a remote host. The *rcp* command can be used symmetrically by BS2000-POSIX and remote UNIX systems.

Format 1 of the command copies a single file from one host to a file on another host.

Format 2 of the *rcp* command copies multiple files or a directory of another host.

The *rcp* command can only be used by users with access authorization on the remote host. In other words, the *.rhosts* file in the *HOME* directory of the ID on the remote host must have an entry containing the name of the local host or a plus character (+) and the user ID. The user ID must have a standard account number for *rlogin* access. This standard account number can be assigned using the ADD-USER, MODIFY-USER-ATTRIBUTES or ADD-POSIX-USER command.

i The files */etc/hosts* and */etc/hosts.equiv* usually used in UNIX systems are not used in POSIX. The assignment of host names to IP addresses is handled via BCAM or DNS.

Syntax

Format 1: rcp[␣**-p**][␣**-b**]␣file1␣file2

Format 2: rcp[␣**-pr**][␣**-b**]␣file␣...␣dir

Format 1 **Copy individual files**

rcp[␣**-p**][␣**-b**]␣file1␣file2

No option specified
The modification and access times of each copy are set to the current time. The access permissions are set in accordance with *umask*.

-p Every copy receives the same modification and access times and the same access permissions as the original file.

-b The file is transferred in binary mode.

file1
is the file to be copied. This file may be stored on the local or remote host.
If the file is stored on the local host, it may be specified with *path*, where *path* is the pathname of *file1*. If *path* is not an absolute pathname, it is interpreted as a relative path to the current directory.

If the file is stored on a remote host, *file1* must be specified in the following format:

`login@remote_host:path` or

`remote_host:path` or

`login@remote_host.domain:path`

remote_host
: is the name of the remote host or its IP address in IPv4 or IPv6 dot notation:

```
IPv4: n.n.n.n         n = 0..255 (decimal)
IPv6:x:x:x:x:x:x:x:x  x = 0..FFFF (hexadecimal)
```

The alternative presentation methods described in RFC 2373 are permissible for IPv6 dot notation.
If for the name of the remote host its address is specified in IPv6 dot notation, this must be enclosed in square brackets, e.g.:
rcp test hansi@[::ffff:AC19:7D37]:hansi_test

Otherwise the first colon in the IPv6 address would be incorrectly interpreted as a separator between the host name and the path name.

login
: is the user ID on the remote host.

path
: is the pathname of *file1*.

domain
: is the name of the DNS domain to which the remote host belongs.

Pathnames may include the usual metacharacters (e.g. *, ?) for constructing file names. These metacharacters are evaluated on the local host. *path* must not contain a colon ":", and the string for *login@remote_host* must not include a slash "/".

file2
: is the file to which the source file is to be copied. This file may be placed on the local or remote host. If the file already exists, it will be overwritten.

The format is the same as for *file1*.

Format 2 **Copy multiple files or directories**

rcp[␣**-pr**][␣**-b**]␣file␣...␣dir

No option specified

The modification and access times of each copy are set to the current time. The access permissions are set in accordance with *umask*.

-p Every copy receives the same modification and access times and the same access permissions as the original file.

-r All subdirectories of *dir* are copied recursively. In this case, *file* must be a directory.

-b The file is transferred in binary mode.

file

may be
- a file,
- multiple files, or
- a directory (with *-r*)

on the local or remote host.

The following format applies on the local host:

```
filename ...
```

or

```
directory
```

filename is the respective name or pathname of one or more files.
directory is the respective name or pathname of the directory.

If *file* is located on the remote host, the following applies:

`login@remote_host:path` or

`remote_host:path` or

`login@remote_host.domain:path`

remote_host
is the name of the remote host.

login
is the user ID on the remote host.

path
is the pathname of *file1*.

domain
is the name of the DNS domain to which the remote host belongs.

Pathnames may include the usual metacharacters (e.g. *, ?) for constructing file names. These metacharacters are evaluated on the local host.

Example

```
$ rcp remote_host:path1/* path2/dir
```

copies all files that match the first pathname into the specified directory.

dir

is the directory to which the files or directories are to be copied. This directory may be located on the local or remote host. Files of the same name, if any, are overwritten.

The format for *dir* on the remote host is:

```
directory
```

The format for *dir* on the remote host is:

```
login@remote_host:directory
```

or

```
login@remote_host.domain:directory
```

Error

remote_host: `unknown host`
The host is not known to BCAM or only known under another alias.

remote_host: `Connection timed out`
No acknowledgment was received from the remote host within a specified period.

File

$HOME/.rhosts
List of host names and user IDs that can log on to them under those IDs.

Example 1

The POSIX user *john* wants to copy the file *test* from his current directory to the user *john* on the remote Solaris host *rainbow*. The copied file is to be named *john_test* on the remote host *rainbow*. The required access permissions for the copy operation are present.

```
$ rcp test john@rainbow:john_test
```

Example 2

The POSIX user *john* copies the directories *test* and *practice* from the Soloaris login name *john* on the host *rainbow* to the POSIX directory */home/john/solaris_copy*.

```
$ rcp -r john@rainbow:test john@rainbow:practice /home/john/solaris_copy
```

See also

rsh

read read a line from standard input

read is a POSIX shell built-in command that reads a line from standard input and sequentially assigns the individual input line arguments as values to the shell variables specified in the call.

The only argument separators that *read* recognizes are the characters assigned to the *IFS* shell variable, the defaults being blanks, tabs and newline characters.

If *read* appears in a shell script and standard input has not been redirected, the script halts execution in order to read your next input from standard input. The script resumes execution as soon as you enter a newline character (see also *Examples* on page 663).

Syntax **read**␣[-option][␣name**?**prompt][␣name]...

option

-p The command does not read from the standard input but from the pipeline for the process created using |*&*. When the end-of-file is reached in the pipeline, the input is cleared to permit |*&* to generate a new process.

-r In raw mode the backslash \ at line end has no special function, i.e. the line is not continued.

-s The input is written as a command to the *history* file.

-ufile_descriptor
The command reads from the single-figure *file_descriptor* instead of from the standard input. The file descriptor can be opened using the *exec* command. The default value of *file descriptor* is 0.

name
Name of the shell variable to which the corresponding input line argument is assigned. The first argument is assigned to the first name, the second argument goes to the second, and so on, with the last name assigned whatever remains on the input line.

The names of shell variables must start with a letter or an underscore (_) and must consist of letters, underscores and digits only.

Any leftover arguments in the input line are assigned to the last variable specified in the *read* command line.
Any leftover variables of the *read* command are assigned the null string.

If the first argument contains a *?*, the rest of the word is written to standard error as a prompt.

name not specified:
REPLY is used for *name*.

Exit status

0 when *read* executes successfully

>0 when no input is received, i.e. EOF is encountered.

Error

```
sh: text: not an identifier
```

This error message may have the following causes:

– either you did not specify a variable name on the command line, or
– the name you specified contains illegal characters.

```
read: missing arguments
```

You called *read* without arguments.

Variable

IFS
Input field separator (argument delimiter). The default values are blank, tab and newline.

PS2
Provide the prompt string that an interactive shell will write to standard error when a line ending with a backslash is read and the *-r* option was not specified, or if a here-document is not terminated after a newline character is entered.

Locale

The following environment variables affect the execution of *read*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The *read* command is invoked in a script named *readtest*, which contains the following:

```
: Invoked with sh readtest, halts for input
echo Please enter a customer name:
read customer1 customer2 customer3
if [ -z "$customer1" ]
then exit 5
else echo Customer1: $customer1
     echo Customer2: $customer2
     echo Customer3: $customer3
fi
```

Invocation of the *readtest* script file:

```
$ sh readtest
Please enter a customer name:
Shaw Bowden Pitman Potter
Customer1: Shaw
Customer2: Bowden
Customer3: Pitman Potter
```

After invocation, the shell script issues the message specified in the *echo* command and invokes *read*. The script halts, and the entered customer names are then read in.
The newline character terminates the input line for *read*. The third variable *customer3* is assigned two names, since four arguments were specified in the input line.

Example 2 Use of the *read* command to read in the first line from a file:

```
$ read line < /etc/group
$ echo $line
root::0:root
```

In this case, the first line of the file */etc/group* will always be read, even if *read* is invoked repeatedly.

Example 3 The following shell script makes use of the *read* command in order to read in lines from a file successively:

```
: Invoked with sh readinall
exec < /etc/group
for i in 1 2 3 4 5 6 7
do
  read record$i
  eval echo record$i: \$record$i
done
```

In the shell script *readinall*, the shell built-in *exec* redirects the standard input to the file */etc/group* for the following *read* command.
Owing to the *for* loop, *read* is invoked seven times in the script. Each invocation positions the read pointer on the next line, thus causing *echo* to output the first seven lines of the */etc/group* file in succession:

```
$ sh readinall
record1: root::0:root
record2: daemon::1:daemon
record3: sys::2:sys:
record4: bin::3:bin,admin
record5: uucp::4:
record6: ces::5:
record7: other::10:gast,mgast,tele
```

To evaluate the argument \$record$i correctly, the shell has to interpret the *echo* command line twice; hence the inclusion of *eval*. At the first attempt the shell only interprets $i, as the first dollar sign is escaped by the backslash. At the second attempt the shell interprets $record[1-7].

See also *exec*

readonly set read-only attributes for variables

The POSIX shell built-in *readonly* marks the specified shell variables as read-only, i.e. protects them from being changed by reassignment in the current shell. An error message is issued if any such attempt is subsequently made.

This protection only applies to the current shell. This means that the variable may be reassigned in a subshell or in a parent shell (i.e. when you terminate the current shell). Within the current shell, however, it is not possible to undo this protection.

If you invoke *readonly* without arguments, a list of all existing read-only variables in the current shell is written to standard output.

Syntax

Format 1: readonly[␣name[=value]]...

Format 2: readonly␣-p

Format 1 **readonly**[␣name[=value]]...

name
Name of the shell variable which you want to protect against change. You may enter any number of shell variables each separated by a space.

name not specified:
readonly writes the names of all shell variables which are protected in the current shell to the standard output. The output has the following form: `name=value`

Format 2 **readonly␣-p**

readonly writes the names of all shell variables which are protected in the current shell to the standard output. The output has the following form:

```
readonly name=value
    :
```

Error *name*`: is read only`
This error message is issued when you try to assign a value to a protected shell variable.

Locale The following environment variables affect the execution of *readonly*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Marking the shell variable *HOME* as read-only in the current shell:

```
$ readonly HOME
$ readonly
HOME=/USER1
$ sh
$ readonly
$ END bzw. @@d
$ readonly
HOME=/USER1
```

The *HOME* variable is not protected in the subshell.

See also *export, env, set, typeset*

renice set system scheduling priorities of running processes

Caution!
The *renice* command is supported only on grounds of compatibility. It has no effect on BS2000 task priorities. For that reason only the syntax chart is given here. The options, arguments and so forth are not described.

Syntax

Format 1: renice[␣**-n**␣increment][␣**-g**|␣**-p**|␣**-u**]␣ID...

Format 2: renice␣nice_value␣[**-p**]␣pid...[␣**-g**␣gid...][␣**-p**␣pid...][␣**-u**␣user]

Format 3: renice␣nice_value␣**-g**␣gid...[␣**-g**␣gid...][␣**-p**␣pid...][␣**-u**␣user]

Format 4: renice␣nice_value␣**-u**␣user...[␣**-g**␣gid...][␣**-p**␣pid...][␣**-u**␣user]

rm remove directory entries

rm removes the entry (link) for one or more files from a directory. You must have write permission for a directory before you can remove a file from it.

Syntax **rm**[␣option]␣file...

No option specified

If you have write permission for *file*, *rm* removes the entry without issuing a warning. If you do not have write permission for *file* and the standard input is a terminal, *rm* prompts you by displaying the permissions and a query ? and asking whether you want the file to be deleted. The entry is not deleted unless you answer the locale's equivalent of *yes*. No such confirmation is requested if the standard input is not a terminal.

options

-f Removes the entries without any questions. Files will not be removed if you do not have write permission for the directory.

-i *rm* removes files interactively, requesting confirmation for each write-protected file (or directory, if *-r* is in effect) before removing it. The *-i* option overrides the *-f* option and remains in effect even if the standard input is not a terminal.

-r Accepts a directory name as an argument for *file*. The usual error message is not issued. *rm* recursively deletes the entire contents of the directory and also removes the directory itself.
You cannot remove the parent directory (..) in this way. Symbolic links that are encountered with this option are not traversed.
If the removal of a non-empty, write-protected directory is attempted, the command will always fail (even if the *-f* option is used), resulting in an error message.

-R Analagous to *-r*.

file Name of the file that is to be removed. If you include the *-r* option, *file* may also be a directory. You can include a number of file/directory arguments.

If you specify a file that has several links, only the specified link is removed; the file itself remains intact (the link counter is decremented by one). The file itself is not deleted until you remove the final link.

You must have write permission for the directory before you can remove a file from it; but you need not have read or write permission for the file itself.

Locale

The following environment variables affect the execution of *rm*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_COLLATE Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements in extended regular expressions defined for yes/no queries.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and the behavior of character classes within regular expressions used in extended regular expressions defined for yes/no queries.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

Removal of all files that end in *.prog* with confirmation:

```
$ rm -i *.prog
exec.prog:? (y/n) y
code.prog:? (y/n) yuppie
input.prog:? (y/n) n
lucky.prog:? (y/n) no
a.prog:? (y/n) tomorrow
$
```

The links to files *exec.prog* and *code.prog* are removed; the others are retained.

Example 2

Removal of the directory *norm* with all files and subdirectories.

```
$ rm -r norm
```

See also

rmdir

rmdir remove directories

rmdir removes one or more empty directories. Directories containing files cannot be removed with *rmdir*. To remove a directory together with everything it contains you can use the *rm* command, specifying option *-r*.

Syntax **rmdir**[␣**-p**]␣directory␣...

No option specified
rmdir removes the specified directories.

option

-p (p - parents) The specified directory is removed, and all empty parent directories in the specified path are removed recursively.

directory
Name of the directory you want to remove.
You can name any number of directories.

Error

`rmdir:` *dir1*`: Directory not empty`
You have attempted to use *rmdir* to remove a directory *dir1* which still has files in it. You can use the *rm* command with option *-r* to remove directories that contain files.

`rmdir:` *dir1*`: Directory does not exist`
The directory named *dir1* does not exist.

```
rmdir: ../.: Can't remove current directory or ..
rmdir: ../dv1: Can't remove current directory or ..
```
The current directory or its parent cannot be removed. Change to the parent directory.

Locale The following environment variables affect the execution of *rmdir*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Removing the directories *pro* and *proc*.

Your current directory has the following contents:

```
drwxr-xr-x  11 SUSAN    other       5720   Nov 18 14:16 ./
drwxr-xr-x  13 ROOT     root        3380   Nov 04 11:48 ../
-rw-------   1 SUSAN    other         79   Jul 19 14:21 .profile
-rwx------   1 SUSAN    other        125   May 25 10:29 begin
drwx------   2 SUSAN    other         32   Oct 11 15:36 pro/
drwx--x--x   2 SUSAN    other         32   Nov 07 10:43 proc/
```

The directories *pro* and *proc* are empty, so you can remove them with *rmdir*.

```
$ rmdir pro proc
$ ls -lpa
drwxr-xr-x  11 SUSAN    other       5720   Nov 18 14:16 ./
drwxr-xr-x  13 ROOT     root        3380   Nov 04 11:48 ../
-rw-------   1 SUSAN    other         79   Jul 19 14:21 .profile
-rwx------   1 SUSAN    other        125   May 25 10:29 begin
```

See also *rm*

rmpart remove partition

The *rmpart* removes partition *unitnumber* from the partition table. The associated BS2000 file is not removed.

Syntax **rmpart**[␣**-V**]␣unitnumber

Caution!
The functionality of the *rmpart* command is incorporated in the POSIX installation program (see POSIX manual “Basics for Users and System Administrators” [1]), so it is not described in further detail here.

rsh remote shell

rsh can be used to execute a command on a remote UNIX system.

You can use this command if, for example:
– you want to determine the contents of a directory on a remote UNIX system, or
– you want to print a file on the remote UNIX system.

The *rsh* command can only be used by users with access authorization on the remote host. In other words, the *.rhosts* file in the *HOME* directory of the user ID on the remote UNIX system must have an entry containing the name of the local host or a plus character (+) and the user ID. The user ID must have a standard account number for *rlogin* access. This standard account number can be assigned using the ADD-USER, MODIFY-USER-ATTRIBUTES or ADD-POSIX-USER command.

The *rsh* command can be used symmetrically by BS2000-POSIX and remote UNIX systems.

i The files */etc/hosts* and */etc/hosts.equiv* usually used in UNIX systems are not used in POSIX. The assignment of host names to IP addresses is handled via BCAM or DNS.

The command can only be executed if the daemon *rshd* is active on the local and remote hosts. The daemon *rshd* is started by *inetd*.

The actual command interpreter called to execute the command on the remote host is determined by the entry of the user in the */etc/passwd* file.

If *rsh* is executed from a file that is not named *rsh*, it will use the name of that file as the remote host. In other words, if you create a symbolic link to *rsh* under the name of the remote host, you can call *rsh* by simply specifying that host name.

Stop signals interrupt only the *rsh* process on the local host.

The environment variables of the local host are not passed to the command interpreter on the remote host.

Syntax **rsh**␣host[␣**-n**][␣**-l**␣login][␣**-x**][␣command][␣option]

host
The BCAM or DNS name of the remote host on which a Shell command is executed. The name of the remote host must be known to local BCAM or to the DNS server.

Instead of the name of the remote host you can also specify its IP address in IPv4 or IPv6 dot notation. The IP address must be known to BCAM.

IPv4: n.n.n.n
  n = 0..255 (decimal)

IPv6: x:x:x:x:x:x:x:x
  x = 0..FFFF (hexadecimal)

The alternative presentation methods described in RFC 2373 are permissible for IPv6 dot notation.

-n Instructs the *rsh* command to not redirect its standard input to the command on the remote host. The standard input of *rsh* is redirected to */dev/null* instead.

This is useful, for example, if the output of the *rsh* command is being piped to a program that is itself reading from standard input (see Example 1).

Note, however, that *-n* is also required when an *rsh* command is started in the background.

For example, the call

```
rsh host dd if=/dev/nrmt0 bs=20b | tar xvpBf -
```

causes *tar* to terminate before *rsh*. The *rsh* command then tries to write to the broken pipe and competes with the command interpreter for the standard input instead of exiting. The *-n* option can prevent this from occurring.

This problem only occurs when *rsh* is located at the start of a pipe and is not reading from standard input. If you want *rsh* to actually read from standard input, you must not specify the *-n* option.

For example, if you call the command

```
tar cf - . | rsh host dd of=/dev/rmt0 obs=20b
```

with the *-n* option, *rsh* will incorrectly read from */dev/null* instead of the pipe.

-l␣login
The user ID (or login name) with which the user has logged on at the remote host. This user ID must be specified if you want to work on the remote host with a different user ID than on the local host.

-x
The *rsh* command returns the termination status of the remote command if the *rsh* server on the remote system also supports this feature (BS2000-POSIX, UNIX system).

command
    The command to be executed on the remote host.

    command not specified:
    rsh uses *rlogin* to log on at the remote host.

option
    Arguments to be used with the command on the remote host.

Mode of operation

The *rsh* command transfers

- its standard input to the command on the remote host
- the standard output of the command on the remote host to the standard output of the *rsh* command
- the standard error of the command on the remote host to the standard error of the *rsh* command

The *interrupt*, *quit* and *terminate* signals are passed on to the command on the remote host.

The current directory of the started command is set to the *HOME* directory of the user on the remote host.

Metacharacters (e.g. <, >, &) that have not been escaped are evaluated on the local host. Escaped metacharacters are interpreted on the remote host.

The *rsh* command exits on completion of the command on the remote host.

Screen-oriented programs such as ced, for example, cannot be activated with the *rsh* command. The command *rlogin* must be used instead.

Example 1 The POSIX user *john* wants to view the contents of the directory */home/john/test* on the remote host *rainbow*. The output is to be displayed on the screen in pages. The user ID *john* is also present on the remote host *rainbow*.

```
$ rsh rainbow -n ls -l /home/john/test | more
total 167232
drwxrwxr-x   2 john 99          1024 Mar 18 09:24 archive
drwxr-xr-x   2 john 99          1024 Apr 14 14:15 de
drwxr-xr-x   2 john 99          1024 Apr 22 08:19 en
 ...
--More--
```

Example 2 The POSIX *john* wants to append the contents of the remote file */home/john/hello_1* on the remote host *rainbow* to the local file *test_1*. The user ID *john* is also present on the remote host *rainbow*.

```
$ rsh rainbow cat /home/john/hello_1 >> test_1
```

Example 3 The POSIX *john* wants to append the remote file */home/john/travel_1* to the remote file */home/john/holland*. Both files are located on the host *rainbow*. The user ID *john* is also present on the host *rainbow*.

```
$ rsh rainbow cat /home/john/travel_1 ">>" /home/john/holland
```

Example 4 The POSIX *john* wants to print the remote file */home/emil/test* on the host *rainbow* at that host. The POSIX *john* has been entered in the */home/emil/.rhosts* file on the host *rainbow*.

```
$ rsh rainbow -l emil lpr /home/emil/test
```

Example 5 A POSIX user wants to print the local file */home/john/dat* on the remote host *rainbow*.

```
$ rsh rainbow lpr < /home/john/dat
```

File *\/$HOME/.rhosts*
List of host names and user IDs that can log on to the hosts under the listed IDs.

See also *rcp*

sed stream editor

sed is a non-interactive stream editor that provides a similar set of functions to the interactive line editor *ed*.

sed is a versatile tool that allows you to:

- perform multiple global editing functions efficiently in one pass through the input
- easily edit piped command output
- apply a sequence of editing commands that is too complicated for interactive input.

sed reads files sequentially, edits each line with *sed* commands you have specified in a *sed* script, and writes the results on the standard output. The *sed* script is either read straight from the command line or taken from a file. *sed* acts as a filter, i.e. it does not change the original input file. If you want to save the changes, you will have to redirect the standard output to a file.

Syntax

Format 1: sed[␣**-n**]␣script[␣file...]

Format 2: sed[␣**-n**][␣**-e**␣script]...[␣**-f**␣scriptfile]...[␣file...]

Format 1

sed[␣**-n**]␣script[␣file...]

-n Suppresses the default output, which is to pass every input line to the standard output after processing (see Example 6 on page 687).

-n not specified:
sed copies each processed input line to the standard output, even if the *sed* script does not contain an output command such as *p*. The commands in the *sed* script determine whether a line is modified by editing instructions. Input lines that are processed by an output command such as *p* are thus shown twice in succession. First, as part of the default output of all processed lines, and then as the output of the special editing command which causes them to be displayed again.

script
Uses the command-line *script* to edit the input file. If the script contains blanks, newlines, or shell metacharacters, it must be enclosed in single quotes: '*script*'.

file
Name of the file whose contents are to be processed by *sed*. The file must be a text file.

file not specified:
sed reads from standard input.

Format 2 **sed**[␣**-n**][␣**-e**␣script]...[␣**-f**␣scriptfile]...[␣file...]

-n Suppresses the default output, which is to pass every input line to the standard output after processing (see Example 6 on page 687).

-n not specified:
sed copies each processed input line to the standard output, even if the *sed* script does not contain an output command such as *p*. The commands in the *sed* script determine whether a line is modified by editing instructions. Input lines that are processed by an output command such as *p* are thus shown twice in succession. First, as part of the default output of all processed lines, and then as the output of the special editing command which causes them to be displayed again.

-e␣script
Uses the command-line *script* to edit the input file. If the script contains blanks, newlines, or shell metacharacters, it must be enclosed in single quotes: '*script*'.

The *-e script* option may be included a number of times with different scripts and may also be combined with the *-f scriptfile* option. In this case *sed* applies the commands from all scripts on each input line.

If the command line contains the *-e* option only once and does not include option *-f*, you may omit the *-e* when you specify *script*.

-f␣scriptfile
Reads editing instructions for the input file from the file named *scriptfile*.

You can include the *-f scriptfile* option a number of times with different script files and also combine it with *-e script*. *sed* then reads the *sed* commands from all specified *sed* scripts.

file
Name of the file whose contents are to be processed by *sed*. The file must be a text file.

file not specified:
sed reads from standard input.

Functionality

sed works on copies of the input lines, successively copying each line into a temporary work area called a "pattern space".

Each line of input is normally processed in the following cycle:

Step 1:	The next (or first) line of input is copied into the pattern space.
Step 2:	All *sed* script commands that select the pattern space (i.e. address the last line copied into it) are successively applied to its contents. Depending on the editing instruction in the script, the contents of the pattern space are then altered as required, or left unchanged.
Step 3:	The contents of the edited pattern space are then sent to standard output, and the pattern space is cleared.

This cycle is repeated until all input lines have been processed.

The pattern space may occasionally contain multiple lines (see commands *g*, *G*, *N*). However, it is always the address of the last line copied into the pattern space that serves as the pattern space address.

Some *sed* commands (*g*, *G*, *h*, *H*) copy text from the pattern space to a temporary storage area called the "hold space". The hold space saves all or part of the pattern space for subsequent retrieval.

Format of a sed script

A *sed* script consists of command lines in the form:

```
[range]sed_command[flags]...
```

or

```
[range]{sed_command[flags]...
        sed_command[flags]...
                .
                .
                .
        }
```

The braces are required only if you specify an address *range*.
The right brace must be positioned at the start of a line, i.e. only preceded by blanks or tabs.

No blanks are permitted between the *range* and the *sed_command*.

A *range* serves to select particular input lines and can be specified as one or two comma-separated addresses. When the given *range* "selects" the pattern space, i.e. addresses the last line copied to it, the associated *sed* command or command list is applied to the pattern space.

For *range* you can specify one address or two addresses separated by a comma.

range = address
: The pattern space that matches *address* is selected.

range = address1**,**address2
: An inclusive range from the first pattern space that matches *address1* through the next pattern space that matches *address2* is selected. However, if *address2* is a line number in the input file that comes before the one selected with *address1*, only one line is selected (*address1*).

range not specified:
The pattern space is always selected, i.e. the last input line copied to it is always addressed.

Addresses

$ last line of the last input file

n *n*th input line, where *n* is a positive integer. Input lines are numbered consecutively across all files.

/pattern/
: Input line containing a string matching the specified *pattern*. Any slash / appearing in *pattern* must be preceded by a backslash \ to escape it. *pattern* is a simple regular expression (see *Tables and Directories, Regular POSIX shell expressions*) with the following modifications:

  The construction *?regular expression?*, where *?* is any character, is identical to */regular expression/*. Note that in the address *xabc\xdefx*, for example, the second *x* is escaped and stands for itself, so that the regular expression is *abcxdef*.

  The escape sequence *n* matches a newline embedded in a pattern space.

  A period matches any character except the terminal newline of the pattern space.

sed commands

The following section contains a list of *sed* commands, described in alphabetical order. The square brackets [ ] are not to be entered; they merely indicate that the enclosed address or address range is optional.

The *text* argument consists of one or more lines. All but the final line must end with a backslash (\) to escape the terminating newline.

[address]**a**\
text

Append *text* to the pattern space that is output.

[range]**b**[label]

Branch to the *sed* command *:label* in the *sed* script.

label not specified:
Branch to the end of the *sed* script.

[range]**c**\
text

Change. Delete the selected pattern space, send *text* to the output and start the next cycle.

[range]**d**

Delete the contents of the pattern space and start the next cycle. Step 3 is dropped, i.e. the contents of the pattern space are not sent to standard output.

[range]**D**

Delete the initial segment of the pattern space up to (and including) the first newline and start the next cycle.

[range]**g**

Replace the contents of the pattern space by the contents of the hold space.

[range]**G**

Append the contents of the hold space to the pattern space.

[range]**h**

Replace the contents of the hold space by the contents of the pattern space.

[range]**H**

Append the contents of the pattern space to the hold space.

[address]**i**\
text

Insert *text* into the standard output before the contents of the pattern space.

[range]**l**

List the pattern space on the standard output, representing non-printing characters with replacement characters (e.g. tab characters as the greater-than sign >) or with their two-digit octal ASCII code equivalents in the form \nn (see section “ASCII character set (ISO 646)” on page 909). Long lines with more than 71 characters are split into two or more lines (folded). A backslash at the end of a screen line indicates that the text line continues in the next output line.

[range]**n**

Next. Copy the contents of the pattern space to the standard output and replace them with the next line of input. The address of the last line of input becomes the address of the pattern space.

[range]**N**

Append the next line of input to the pattern space with an embedded newline. The address of the last appended line becomes the address of the pattern space.

[range]**p**

Print the contents of the pattern space on the standard output. Non-printing characters are not represented.

[range]**P**

Print the initial segment of the pattern space, up to the first newline, on the standard output. Non-printing characters are not represented.

[address]**q**

Quit *sed*. If you have specified multiple *sed* scripts, *sed* quits at the first *q* encountered in any of the scripts.

[range]**r**␣rfile

Read the contents of *rfile* and send them to the standard output before copying the next input line to the pattern space. *rfile* must be separated from the *sed* command *r* by exactly one space and must come at the end of the command line.

[range]**s/**RE**/**repstring**/**[flags]

Substitute *repstring* for strings that match the regular expression *RE* in the pattern space. *RE* can be specified in the form of a simple regular expression (see section “Regular POSIX shell expressions” on page 897). The delimiter does not have to be /: most other characters are accepted. For a fuller description see the *s* command in *ed*.

flags

n	where *n* is an integer between 1 and 512. Substitute *repstring* for just the *n*th instance of *RE* in a line.
g	Globally substitute *repstring* for all instances of *RE* in a line.

p Print the contents of the pattern space on the standard output if a replacement was made. This applies even if *sed* was invoked with the *-n* option.

w␣wfile Write. Write the pattern space to the file *wfile* whenever a replacement is made. Any file named *wfile* that was already present before you called *sed* will be overwritten. If a number of *w* commands in a *sed* script write to the same *wfile*, the contents of the pattern space will be appended to the existing contents of *wfile* in each case. *wfile* must be separated from the *sed* command *w* by exactly one space and must come at the end of the command line. A maximum of 10 different files can be used for *wfile* in any one invocation of *sed*.

Caution!
If you use the name of your input file as *wfile*, you will destroy your input file!

No flags specified:
Only the first instance of *RE* in the line is replaced by *repstring*.

[range]**t**␣label
Test. Branch to the *sed* command *:label* in the *sed* script if any substitutions have been made since the last input line was copied to the pattern space or since the most recent execution of a *t* command.

label not specified: Branch to the end of the *sed* script.

[range]**w**␣wfile
Write. Write the pattern space to the file *wfile*. Any file named *wfile* that was already present before you called *sed* will be overwritten. If a number of *w* commands in a *sed* script write to the same *wfile*, the contents of the pattern space will be appended to the existing contents of *wfile* in each case. *wfile* must be separated from the *sed* command *w* by exactly one space and must come at the end of the command line. A maximum of 10 different files can be used for *wfile* in any one invocation of *sed*.

Caution!
If you use the name of your input file as *wfile*, you will destroy your input file!

[range]**x**
Exchange the contents of the pattern and hold spaces.

[range]**y**/string1/string2/
Transform. Replace each occurrence of a character in *string1* with the corresponding character in *string2*. *string1* and *string2* must be of the same length and must be specified explicitly. Regular expressions cannot be used.

[range]**!**command
[range]**!**{commandlist}

Don't command. Apply *command* to all lines *not* selected by the specified address *range*. *command* may be any *sed* command or a *sed* command list enclosed in braces {...}.

:label

Set a *label* for *b* and *t* commands to branch to. *label* is any string up to 8 characters long.

[address]**=**

Prints the current line number on the standard output on its own line.

```
[range]{sed_command
        sed-command
        .
        .
        .
        }
```

Successively execute all *sed* commands enclosed within the braces {} if the address *range* selects the current pattern space.
The { can be preceded with blank characters and can be followed with white space. The commands can be preceded by white space. The termination } must be preceded by a newline character and then zero or more blank characters.

↵ The newline character is treated as a null command and is ignored. This allows you to produce more transparent *sed* scripts by using blank lines.

# If # is the first character entered in the first line of a script file, the entire line is interpreted as a comment.

#n If the first line of a script file begins with the character sequence #*n*, the default output of the pattern space is suppressed (as with the *-n* option). The entire line is treated as a comment, i.e. not interpreted as an *sed* command.

Error

```
sed: command garbled: ...
```

The *sed* script contains a syntax error. The colon is followed by the script location at which *sed* terminated.

```
Can't open file
```

You have specified a nonexistent input file or a file for which you do not have read permission.

```
Unrecognized command: ...
```

The *sed* script contains an unknown command.

Locale

The following environment variables affect the execution of *sed*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and the behavior of character classes within regular expressions. *LC_CTYPE* also governs which characters the *sed* command *l* treats as non-printing.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

Write the string XXXXX in all blank lines of a file and redirect the output to another file:

```
$ sed '/^$/s/^/XXXXX/' file > newfile
```

/^$/ selects all blank lines, i.e. lines that contain nothing (not even a blank) between start of line and end of line. *sed* searches for the beginning of the line (^) and replaces it with the string XXXXX.

Example 2

Indent by 4 spaces all lines that begin with a digit, and redirect the output to another file:

```
$ sed '/^[0-9]/s/^/␣␣␣␣/' file > newfile
```

/^[0-9]/ selects all lines that begin with a digit. *sed* locates the start of the line (^) and replaces it with 4 blanks (␣␣␣␣), i.e. shifts the rest of the line 4 positions to the right, padding positions 1 to 4 with spaces.

Example 3

Print all the non-blank lines in a file:

```
$ sed '/^$/d' file
```

All blank lines are selected by /^$/ and deleted by *d*.

Example 4 Make a file double-spaced by adding a blank line after each line in the file:

```
$ sed 's/$/\ ↵
> /' file
```

Since no address is specified, *sed* searches for the end of the line ($) in *every* line and replaces it with a newline character ↵, thus adding a blank line after every line.

Example 5 Print the second and third column of a file in which individual columns are separated from one another by a colon. The third column is to be placed before the second:

```
$ sed 's/[^:]*:\([^:]*\):\([^:]*\):.*/\2:\1/' file
```

Explanation:

s/ / /
: The string between the first and second slash is searched for in each line and replaced by the string between the second and third slash.

[^:]*
: Any number (*) of characters other than a colon ([^:])

: Colon

\(\)
: Brackets off part of expression for reuse in the replacement string which is between the second and third slash.

\2 The replacement string is to begin with the part of the expression which is in the second bracket \(...\).

: There is to be a colon between the first and second part of the replacement string.

\1 The second part of the replacement string is to be the part of the expression which is in the first bracket \(...\).

Example 6 Filter all professions out of the file *personnel* and write them into the file named *professions* under a new heading. The following example works on the assumption that the used search key (Profession:) does not appear in the first line of the file.

The *personnel* file has the following format:

```
Name: John Miller
Marital status: Divorced
Profession : Journalist

Name: Catherine Baker
Marital status: Married
Profession: Programmer
etc.
```

sed program:

```
$ sed -n '1{s/^.*/Professions:/
           h
          }

          /^Profession:/{s/^Profession: *\(.*\)/\1/
                        H
          }

          ${g
           p
          }' personnel > professions

$ cat professions
Professions:
Journalist
Programmer
etc.
$
```

Explanation:

Line 1 in the pattern space is replaced by the string *Professions:* and then stored in the hold space by the *h* command.
Each line in the pattern space that begins with *Profession:* is replaced by the string that follows it and then appended to the hold space by the *H* command.
The last line of the file ($) is replaced in the pattern space by the entire contents of the hold space. Finally the pattern space is printed on the standard output by the *p* command.

The *-n* option changes the default output so that the input lines copied to the pattern space are not automatically sent to standard output after editing. Only the *p* command actually prints the pattern space.

See also *awk*, *ed*, *grep*
Tables and Directories, Regular POSIX shell expressions

set set or unset options and positional parameters

The POSIX shell built-in command *set* has three functions:

- If no operand is specified, *set* writes on standard output the names and values of allshell variables defined for the current shell.
  By contrast, the *env* command writes on standard output the names and values of all shell variables available to all commands and all subshells: variables such as *IFS, MAILCHECK, PATH, PS1* and *PS2* are not included unless they have been exported (with *export*).
- Any options assigned to *set* govern the behavior of the current shell.
  The same options are also available for the *sh* command, but in this case they govern the behavior of the subshell thus generated.
- Arguments used instead of an option or after the option list are handled by *set* as follows:
  - it assigns the first nine arguments to positional parameters *$1* through *$9*,
  - it assigns all the arguments to the shell parameters *$** and *$@*,
  - it assigns the number of arguments to the shell parameter *$#*.

  If there are fewer than nine arguments, the remaining positional parameters are set to the null string.
  To access the tenth and subsequent command-line arguments directly you need to use the *shift* command.

If you want to use *set* to control the execution of a shell script, you have to include *set* in the script. This is because shell scripts are always executed by a subshell.

Syntax

Format 1: set␣[**+**|**-AabCefhkmnuvx**][␣**-t**][␣**-o**␣option...][␣argument...]

Format 2: set␣**--**␣[␣argument...]

Format 3: set␣**-**␣[␣argument...]

Format 1

No operand specified
set writes on standard output the names and values of all shell variables defined for the current shell.

No option specified
set sequentially assigns the first nine arguments to positional parameters *$1* through *$9*. It assigns all command-line arguments collectively to the shell parameters $@ and $*; and it assigns the total number of arguments to the shell parameter $#. If there are fewer than nine arguments, the remaining positional parameters are set to the null string.
To access the tenth and subsequent command-line arguments directly you need to use the *shift* command.

option
The options govern the behavior of the current shell.

If you want to use more than one option, you have to group the code letters together with no spaces between them and with a single minus sign at the beginning.
The *--* option cannot be combined with other options.

You can use the command *echo $-* to find out which options have already been set with the *set* or *sh* command. Set options other than *-n* and *-t* can also be unset without the need to terminate the current shell.

The following options are available:

-A␣name
Assigns values to fields:
Deletes the value of the variable *name* and sequentially assigns it values from the *argument* list.

+A If you use the plus sign *+A*, the values are not deleted before assignment.

-a Automatically exports all shell variables that you define or redefine in the current shell.

-a not specified and not set previously:
Shell variables that you define or redefine in the current shell are not automatically exported. In other words, a shell variable will not be known in a subshell unless you explicitly export it using the shell built-in *export*.

+a Turns off option *-a*. Any shell variables defined earlier while the *-a* option was active will continue to be exported automatically.

-b (background) All background jobs are displayed. The following message is written to standard error output:

```
“[%d]%c %s%s\n“, <job-number>,<current>,<status>,<job-name>
```

<current>	The + sign identifies the job that would be used as a default for the fg or bg utilities; this job can also be specified using the job_id %+ or %%. The - sign identifies the job that would become the default if the current default job were to exit; this job can also be specified using the job_id %-. All other jobs are represented by a blank character. Only one job can be identified with a + and one with a - at any given time.
<job-number>	A number that can be used to identify the process group to the *wait*, *fg*, *bg* and *kill* utilities. Using these utilities, the job can be identified by prefixing the job number with %.

+b *-b* is reset.

-C Prevents files from being overwritten when output is redirected with ">". If the output is redirected using ">|" then the *noclobber* option is overridden for the file in question.

+C *-C* is reset.

-e (exit) The current shell exits immediately if a command returns a non-zero exit status.

-e not specified and not set previously:
An interactive shell exits when you press [END]. A shell running a shell script only exits prematurely if it encounters a syntax error. Otherwise it exits on reaching the end of the script, regardless of the exit status of individual commands.

+e Turns off option *-e*.

-f (file name) Disables the file name generation mechanism. The characters *, ? and [...] are not treated as metacharacters and expanded to generate all the matching file names.

-f not specified and not set previously:
Matching file names are substituted for the above patterns.

+f Turns off option *-f*.

-h (hash) This option changes the behavior of the current shell when you define shell functions:
The commands you include in a shell function are entered in the hash table at the time of function definition (see *hash*).

-h not specified and not set previously:
Commands used in a shell function are not entered in the hash table until the function is executed.

+h Turns off option *-h*.

-k (keyword) Variable assignments, i.e. arguments in the form *name=value*, are allowed at any point on the command line. The shell performs the assignment and makes the resultant keyword parameter available to the environment of the command (see Example 1 on page 694).

-k not specified and not set previously:
Variable assignments must precede the command name. The shell makes the appropriate keyword parameters available to the environment of the command.

+k Turns off option *-k*.

-m Background commands are executed in an individual process group. Command termination is reported in a line. The exit status of background jobs is acknowledged by a termination message. If the POSIX shell is inactive this option is automatically selected.

+m *-m* is reset.

-n (no execution) The current shell reads and interprets all commands but does not execute them, thus omitting the last step in the processing of a command line (see the section “Processing commands using the POSIX shell” on page 40).
The *-n* option can be used to check a shell script for syntax errors. The *-n* option is ignored in an interactive shell.

-n not specified and not set previously:
All commands are read, interpreted, and executed.

+n *-n* is reset (except in interactive shells).

-o␣argument
argument may be one of the following option names:

allexport	Corresponds to *-a*
errexit	Corresponds to *-e*
bgnice	All background jobs are executed with low priority. This is the default presetting.
ignoreeof	The POSIX shell is not terminated at end-of-file. To terminate the shell, use the built-in command.
keywords	Corresponds to *-k*
markdirs	All directories which are created when the file name is generated are terminated by a backslash */*.
monitor	Corresponds to *-m*
noclobber	No existing files are overwritten if output is redirected using *>*.
noexec	Corresponds to *-n*
noglob	Corresponds to *-f*
nolog	Function definitions are not stored in the *History* file.
nounset	Corresponds to *-u*
privileged	Corresponds to *-p*
verbose	Corresponds to *-v*
trackall	Corresponds to *-h*
vi	Depends on the value of the TERM variable. If TERM=BLOCK or if TERM is not set then the command assumes that a BS2000 block-mode terminal is in use and the argument *vi* is not supported. Any other value of TERM indicates a character-mode terminal.The

argument *vi* changes the input mode to that of a *vi* type line editor until you press [ESC]. This switches you to command mode. The line sends a newline character.

viraw Depends on the value of the TERM variable. If TERM=BLOCK or if TERM is not set then the command assumes that a BS2000 block-mode terminal is in use and the argument *vi* is not supported. Any other value of TERM indicates a character-mode terminal. If *vi* mode is active then the *viraw* argument causes each character to be processed as soon as it is typed.

xtrace corresponds to *-x*

-t (terminate) The current shell exits after executing one command, i.e. the command line that contains the *set -t* command.

-t not specified:
An interactive shell exits when you press [END]. A shell running a shell script only exits prematurely if it encounters a syntax error. Otherwise it exits on reaching the end of the script.
If the *-e* option is set in the current shell, this shell exits immediately if a command returns a non-zero exit status.

-u (unset) Causes the current shell to issue an error message on encountering an unset shell variable in a command line. The command in question is not executed.
Shell scripts are terminated as soon as the shell encounters an undefined shell variable.

-u not specified and not set previously:
The shell does not issue an error message for an unset shell variable, but substitutes the null string as its value by default.

+u Turns off option *-u*.

-v (verbose) The current shell displays each subsequent input on standard error before executing the corresponding command.
In combination with the *-x* option, this option is useful for debugging shell scripts.

-v not specified and not set previously:
The current shell does not echo its input.

+v Turns off option *-v.*

-x (execute) The current shell interprets its input and writes it on the standard error, marking each command that it processes with a plus sign (+) at the start of the line. A command consisting solely of a variable assignment is output without the plus sign. The shell then executes the command.
In contrast to the output with option *-v*, the *-x* option shows you how the shell has replaced metacharacters and shell variables.

Thus you can test a shell script as follows:

– either include *set -xv* as the first command in your shell script, or
– run the shell script with the command *sh -xv script*.

-x not specified and not set previously:
The current shell does not echo its input.

+x Turns off option *-x*.

argument
Any string which is delimited by a space or a tab. The final argument is terminated by a command separator.

You may enter any number of arguments provided that each is delimited by at least one space or tab.

set assigns the first nine arguments to the positional parameters *$1, $2,* ... and *$9*. *set* also assigns all the specified arguments to the shell parameters *$** and *$@* and writes the total number of specified arguments to the shell parameter *$#*. If fewer than nine arguments are specified, empty strings are assigned to the remaining positional parameters.
Use *shift* to address the tenth and other remaining call arguments directly.

argument not specified:
The positional parameters and the shell parameters *$@, $** and *$#* are not modified.

Format 2 **set --** [␣argument...]

- - (Dashes) Not combinable with other options.

The first argument specified after *--* is not interpreted as an option, even if it begins with a minus sign. This enables you to use *set* to assign values beginning with a minus sign to positional parameters (see Example 3 on page 696).

set -- has no effect on any other options currently in effect.

argument
Any string delimited by blanks or tabs. The last argument is terminated by a command separator. You can include any number of arguments, with at least one blank or tab between them.

set sequentially assigns the first nine arguments to positional parameters *$1* through *$9*. It assigns all command-line arguments collectively to the shell parameters $@ and $*; and it assigns the total number of arguments to the shell parameter $#. If there are fewer than nine arguments, the remaining positional parameters are set to the null string.
To access the tenth and subsequent command-line arguments directly you need to use the *shift* command.

argument not specified:
The positional parameters and the shell parameters $@, $* and $# are left unchanged.

Format 3 **set -** [␣argument...]

- Options -x and -v are reset.

argument
set assigns the first nine arguments to the positional parameters *$1, $2,* ... and *$9*. If fewer than nine arguments are specified, empty strings are assigned to the remaining positional parameter.
Use *shift* to address the tenth and other remaining call arguments directly.

argument not specified:
The positional parameters are left unchanged.

Locale The following environment variables affect the execution of *set*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The shell script *archive* contains the following:

```
set | grep customer
echo $customer
```

The *-k* option is set in the current shell, and the shell script is then executed as follows:

```
$ set -k
$ sh archive customer=Meyer
customer=Meyer
Meyer
```

After *set -k*, the shell variable *customer* may be defined after the script name in the command line. This variable, which is accessed in the example by the *echo* and *set* commands, is only known in the subshell that runs the script.

When the script finishes, the subshell that runs it also exits. The variable *customer* is not known in the (now current) parent shell. The command below will therefore output nothing:

```
$ set | grep customer
```

If the *-k* option is now turned off with *+k* and the shell script is invoked as before, the *customer* variable will be undefined within the script. The *echo* command simply outputs a blank line. In other words, if the *-k* option is not set, the variable definition must precede the script name on the command line.

```
$ set +k
$ sh archive customer=Meyer
$ customer=Meyer sh archive
customer=Meyer
Meyer
```

Example 2 The shell script *evaltest* has the following contents:

```
set -xv
eval echo \$$#
echo $0
```

The *set* command sets the *-x* and *-v* options in the subshell that executes this shell script. The shell script is then called as shown below:

```
$ sh evaltest today is friday
eval echo \$$#
+ eval echo $3
+ echo friday
friday
echo $0
+ echo evaltest
evaltest
```

The *-v* option (verbose) causes each command to be displayed before it is processed. The *-x* option causes the shell to interpret each command line and output it with a + in the first column. The output shows that the command-line arguments of the *eval* command are interpreted twice by the shell.

Example 3 The following shell script counts all arguments read from the standard input. It is, however, somewhat slower than the *wc -w* command:

```
1  : sh count counts all arguments on standard input
2  num=0
3  while read line
4  do
5     set -- $line
6     num=`expr $num + $#`
7  done
8  echo $num
```

Line 3:
The *sh* built-in *read* reads a line from the standard input and assigns it to the variable *line*.

Line 5:
The *sh* shell built-in *set* assigns the arguments which make up the value of the variable *line* to the positional parameters *$1*, *$2* and so on; *$#* is the total number of arguments in *$line*.

In this example the -- option has two functions:
– Even if *$line* is empty, *set* still does not output the current environment.
– If *$line* starts with a minus sign, *set* does not interpret its first argument as an option.

Line 6:
For each line that is read, *expr* increments the value of the *num* variable by the number of arguments in the input line ($#).

The commands in lines 5 and 6 are repeated until the last input line has been read in by the *read* command. The *echo* command then outputs the value of the *num* variable, which is the total number of arguments read (total number of words).

See also *env, getopts, typeset*

sh shell, the standard command language interpreter

In the login shell, commands are read sequentially from the file */etc/profile* and then, if the files exist, either from the *.profile* of the current directory or from *$HOME/.profile*. Following this, commands are also read from the file whose name is defined by the value of the shell variable *ENV* following parameter substitution.

Syntax **sh**[␣option...][␣file][␣argument]...

No option specified

A subshell with the option -s is called. The shell process which was already current becomes the parent of the new shell. Depending on which terminal you are using, you can terminate the subshell either with END or @@d or with the *exit* command.

option

When called, *sh* interprets the options below as well as the options which are described under the POSIX shell built-in *set* command:

-c␣command_string

The commands are read from *command_string*.

-s If the option *-s* is specified or if *file* and *argument* are specified then the POSIX shell reads the commands from the standard input and writes output to the standard output. Only diagnostic messages are written to the standard error output.

-i If the option *-i* is specified or if the standard input and output are connected to a video display terminal then an interactive POSIX shell is called. In this case, TERM is ignored to prevent *kill 0* from terminating an interactive shell and INTR is intercepted and ignored so that *wait* can be interrupted. In all cases, the POSIX shell ignores QUIT.

-r The *-r* option calls a restricted POSIX shell, in which the following restrictions apply:

- The shell built-in command *cd* is rejected, which means you cannot leave your current working directory
- You cannot change the value of the PATH variable.
- Commands are rejected if the command file name contains a slash /. You can only execute commands which are in your current working directory or in directories on the paths assigned to the PATH shell variable.
- Commands are rejected if the command line includes > or >>. In other words, you cannot use > or >> to redirect command output to a file.

To exit a restricted subshell you use END or @@d or the *exit* command, depending on terminal type.

file

If option *-s* has not been specified but *file* has been, the shell procedure *file* is searched for at the location specified in the search path. The read permission must be set for the procedure. If the s-bit is set for the owner or group, then it is ignored. Commands are read as described below.

argument

You may enter commands as arguments. The command name is passed as argument zero. The commands are described below.
If the POSIX shell is called by means of the system call *exec* and if the first character of the zero argument is a hyphen -, then the shell is treated as a *login* shell.

Exit status

The POSIX shell normally returns the exit status of the last command executed (see *exit* on page 365). Errors detected by the POSIX shell (syntax errors for example) result in an exit status which is not equal to zero. If you are not using the POSIX shell interactively, processing of the script file is interrupted. If the POSIX shell detects runtime errors it reports these by outputting the command name and error conditions. If the line number of the line which contains the incorrect command is greater than one, the line number is output in square brackets *[...]* after the command or function name.

File

/etc/profile
/etc/suid_profile
$HOME/.profile
*/tmp/sh**
/dev/null

Variable

The following variables affect *sh*:
FCEDIT, HISTFILE, HISTSIZE, HOME, IFS, MAIL, MAIL, MAILCHECK, MAILPATH and PATH (description see the section “POSIX shell variables and parameter substitution” on page 48ff).

Locale

The following environment variables affect the execution of *sh*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within pattern matching.

LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files), which characters are defined as letters, and the behavior of character classes within pattern matching.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also *cat, cd, chmod, cut, echo, env, paste, stty, test, umask, vi,*
dup(), exec(), fork(), getrlimit(), ioctl(), lseek(), pipe(), signal(), umask(), ulimit(), wait(), rand() [4]

shift shift positional parameters

The POSIX shell built-in *shift* shifts the values of positional parameters over to the left. *shift* without arguments thus results in the following:

- Shell parameter *$0* (the command name) is unaffected.
- The original value of *$1* is lost; this value can no longer be accessed.
- Instead, *$1* takes the original value of *$2, $2* that of *$3*, and so on until *$8*, which takes the value of *$9*.
- The tenth command-line argument is passed to the last positional parameter *$9*.
- *$#* is reduced by one.
- *$** and *$@* contain all command-line arguments, starting with the new value of *$1*. The original value of *$1* is dropped.

By default, the shell provides positional parameters which give you direct access to only the first nine command-line arguments of a *set* command or a shell script. This restriction can be bypassed with *shift*, since it allows you to move values over to the left by the required number of places.

Syntax

```
shift[␣n]
```

n A positive integer; *shift* is executed *n* times. This means that positional parameter *$1* takes the value of the (*n*+1)th command line argument, etc.

If the value of *n* is too large, *shift* issues an error message as soon as no command-line argument is available for *$1*; i.e. *$#* is equal to 0.

n not specified:
shift is executed once.

If *$1* already contains the last argument, the next invocation of *shift* will result in an error message.

Error

```
sh: shift: bad number
```

This error message is issued if *number* >*$#*. As a result no value could be assigned to positional parameter *$1*.

Locale The following environment variables affect the execution of *shift*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The tenth command-line argument is to be accessed in a shell script:

```
:
arg1=$1
shift
arg10=$9
:
```

The original value of *$1* is assigned to the *arg1* variable. The value thus remains accessible even after the *shift* command.

Example 2 The following interactive session demonstrates the changes that take place in the values of the shell parameters *$1, $**, and *$#* when *shift* is invoked:

```
$ set 1 2 3 4 5 6 7 8 9 10 11 12
$ echo $1
1
$ echo $#
12
$ echo $*
1 2 3 4 5 6 7 8 9 10 11 12
$ shift 6
$ echo $1
7
$ echo $*
7 8 9 10 11 12
$ echo $#
6
```

See also *set*

show_pubset_export show file system affected by pubset export

This command supplies the system administrator with information on which file systems in POSIX are affected by the export of a pubset and must therefore be unmounted before the EXPORT-PUBSET command is executed.

This information is particularly helpful when bs2fs file systems are used. Unlike with the ufs and NFS file systems, it is not sufficient in this case to check whether the mount point of a file system is located on the pubset concerned.

With bs2fs file systems the location of the BS2000 files mounted by means of bs2fs is also relevant. The mount point of the bs2fs container also plays a role. If it is located on the pubset to be exported, all mounted bs2fs file systems are affected by the export, irrespective of their location.

Depending on the file system type, a file system is affected by EXPORT-PUBSET, if the objects shown in the following list are located on the pubset to be exported:

ufs:
  Mount point or container file

nfs:
  Mount point

bs2fs:
  Mount point or mounted BS2000 files or mount point/container file of the bs2fs container (cf. ufs)

Syntax

show_pubset_export cat-id

cat-id
  Catalog ID of the pubset which is to be checked (without enclosing colons ":"). The entry can be made in upper- or lowercase notation or a mixture of both; the check is performed with the *cat-id* converted to uppercase notation.

File

The following files are searched for the specified catalog ID in order to determine the file systems affected:

/etc/mnttab
Table of all mounted file systems

/etc/partitions
Table of all possible partitions
If the catalog ID entry is missing in this file, the default ID is determined via BS200 and used for the check.

SYSSSI.POSIX-BC.<version>

SYSSSI file of POSIX from BS2000
The BS2000 file name of the container file of the root file system is determined from this file (ROOTFSNAME parameter) as this name is not entered in the */etc/partitions* file.

Example The file systems affected by the export of the DATA pubset are determined. The container file of the ufs file system mounted under the home directory */home/bach* resides on the DATA pubset.

```
# show_export DaTa

the nfs filesystems on pubset DATA

nfs filesystem PGTR0157:/home4 mounted on /home/bach/nfs4
nfs filesystem PGTR0157:/home5 mounted on /home/bach/nfs5

the bs2fs filesystems on pubset DATA

bs2fs filesystem :DATA:$BACH.ASS.* mounted on /home/bach/bs2/mount.ass
bs2fs filesystem :V70A:$BACH.CCC.* mounted on /home/bach/bs2/mount.ccc
bs2fs filesystem :DATA:$BACH.PLAM* mounted on /home/bach/bs2/mount.plam

the ufs filesystems on pubset DATA

ufs filesystem /dev/dsk/4 mounted on /home/froede
ufs filesystem /dev/dsk/5 mounted on /home/bach
#
```

sleep suspend execution for an interval

The *sleep* command suspends the execution of the process that calls it for a user-defined period of time.
sleep is used mainly in shell scripts to delay the execution of the next command.

Syntax

sleep␣time

time
The time in seconds after which execution of the process is to resume.
time must be a non-negative decimal number.

Error

```
sleep: bad character in argument
```

You have used a negative integer or a non-numeric expression for *time*.

Locale

The following environment variables affect the execution of *sleep*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 This example makes use of *sleep* from the command line. You start a background process to remind yourself in 10 minutes (600 seconds) that you need to make a phone call:

```
$ (sleep 600; echo 'Call Mr. Jones!')&
696
```

Example 2 In this example, *sleep* is used within a shell script named *always*, which calls the *backup* program every two minutes:

```
$ cat always
while true
   do
      backup
      sleep 120
   done
```

If you run the *always* script as a background process, you will only be able to terminate it with *kill*, not with the DEL key.

See also *alarm()*, *sleep()* [4]

sort sort, merge or sequence check text files

sort sorts lines in an input file and writes the result on the standard output.

If you specify more than one file, *sort* sorts and merges the files in the same operation, i.e. the contents of all input files are sorted and printed together.

Sorting can be performed either by whole lines or by specific parts of lines, known as sort keys. If you wish to sort by whole lines, you do not specify any sort keys; one or more keys can be used to sort by particular portions of lines. A sort key is defined by specifying the positions of fields in a line in the form *+pos1 -pos2* (see "Defining specific sort keys" on page 709).

sort divides the lines of a file into fields. A field is a string of characters that is delimited by a field separator or a newline. Blanks and tabs are the default field separators. In a sequence of one or more default separators, all separators are part of the next field. Leading blanks at the beginning of a line thus by default form part of the first field.

Syntax

Format 1: sort[␣**-m**][␣**-o**␣output_file][␣**-bdfiMnru**][␣**-t**␣char]
[␣**-k**␣keydef...][␣**-z**␣recsz][␣**-y**[kmem]][␣**-T**␣directory][␣file...]

Format 2: sort␣**-c**[␣**-bdfiMnru**][␣**-t**␣char]
[␣**-k**␣keydef...][␣−**z**␣recsz][␣**-y**[kmem]][␣**-T**␣directory][␣file...]

Format 3: sort[␣**-m**][␣**-o**␣output_file][␣**-bdfiMnru**][␣**-t**␣char]
[␣**+**pos1[␣-pos2]][␣**-z**␣recsz][␣**-y**[kmem]][␣**-T**␣directory][␣file...]

Format 4: sort␣**-c**[␣**-bdfiMnru**][␣**-t**␣char]
[␣**+**pos1[␣-pos2]][␣**-z**␣recsz][␣**-y**[kmem]][␣**-T**␣directory][␣file...]

The formats are described together because

– options *-m* and *-o␣outpute_file* in formats 1 and 3 are substituted for option *-c* in formats 2 and 4,
– option *-k␣keydef* in formats 1 and 2 is substituted for option *+pos1[␣-pos2]* in formats 3 and 4.

No option specified
Input lines are sorted lexicographically by bytes (characters) in machine collating sequence.

Options that alter the behavior of sort

Multiple options may be used, provided they are specified individually, each preceded by a blank and a minus sign.

-c *sort* checks whether the input file is already sorted according to the current ordering rules. If it is, nothing is output; otherwise, the first line that does not match the ordering rules is displayed.

Only one file may be specified with option *-c*!

-m *sort* merges input files which are already sorted.

-o␣output_file
output_file is the name of a file to which the sorted contents of the input file are to be written. The file named as *output_file* can also be one of the input files, but in this case the original unsorted contents of the named file are overwritten.

-o output_file not specified:
sort writes on the standard output.

-T␣directory
Specifies a *directory* for temporary files.

-u (unique) Causes identical lines to be output once only. Lines with identical sort keys are considered identical lines.

-y[kmem]
Option *-y* defines the memory size that *sort* uses to start with. This initial size has a large impact on the speed with which the file is sorted. It is a waste of memory or of CPU time to sort a small file in a large amount of memory or a large file in a small amount of memory respectively.

kmem
Amount of memory (in Kbytes) initially assigned to *sort*. If you assign a value above the maximum of 1 Mbyte or below the minimum of 16 Kbyte, the corresponding extremum will be used. Thus if you define a value of 0 (*-y0*), for example, *sort* will start with minimum memory.

kmem not specified:
sort starts with maximum memory.

-y[kmem] not specified:
sort starts with a system default memory size (32 Kbytes), and continues to use more space if required.

-z␣recsz

With this option you allocate correctly sized buffers for the merge phase. You only need to do this if you are using option *-c* or *-m*, i.e. if you are not actually sorting the files:

If you are sorting the files, *sort* records the size of the longest line read in the sort phase so that buffers of the correct size can be allocated during the merge phase.

If you are not sorting the files, *sort* normally uses a default value for the buffer size. Lines longer than this will cause *sort* to terminate abnormally. Supplying the actual number of bytes in the longest line to be merged (or some larger value) will prevent abnormal termination.

Options that alter ordering rules

You have two possibilities to specify the following options:

– Before the first *+pos1* specification:

  They then apply globally to all sort keys specified with *+pos1*.

  Multiple options can either be specified as usual, each with a minus sign and delimiting blanks, or they can be grouped together without intervening spaces and with just one minus sign at the beginning.

– After a *+pos1* or *-pos2* specification:

  They then override global settings for the sort key to which they are attached, i.e. the altered ordering rule applies only to the preceding position specification.

  These options are directly appended to *+pos1* or *-pos2* without minus signs and blanks.

-b Ignores leading field separators when determining the start and end of a sort key. Note that the *b* option is only effective when sorting is based on sort keys (i.e. not on the whole line).

-d Performs a lexicographical sort, taking into account only the characters for which the C functions *isalnum()* and *isspace()* return a value of "true". These are the characters defined in the current locale as alphanumeric letters, digits, or characters producing white space, such as blanks or tabs.

-f Folds lowercase into uppercase before sorting, thus making no distinction between them.

-i In non-numeric comparisons, ignores all characters for which the C function *isprint()* returns a value of "false", i.e. all characters defined as non-printing in the current locale. If the collating sequence is based on the ASCII table, for example, characters 001 through 037 (octal) and character 0177 (octal) are ignored (see section “ASCII character set (ISO 646)” on page 909).

-M The first three characters of the sort key are converted to uppercase, treated as names of months, and collated in calendar order. The *-M* option implies the *-b* option.

-n Sorts numerically. A numeric value must come first in the sort key and may consist of: blanks, minus signs, digits 0-9, and a decimal point. The *-n* option implies the *-b* option, i.e. leading blanks are ignored.

-r Reverses the collating sequence (sorting order).

Option that alters field separators

This option must be specified separately with a minus sign.

-t␣char
Uses the character you specify for *char* as the field separator. Unlike default field separators, *char* is itself not part of a field. It may, however, be part of a sort key, for example if the sort key extends from the first to the third *x*-separated field. Every field separator *char* is significant, i.e. *charchar* delimits an empty field.

-t␣char not specified:
The default field separators apply (blanks and tabs). A sequence of one or more default field separators forms part of the following field.

Defining specific sort keys

When defining sort keys please note that sequences of letters defined as one collating element in the current locale count as a single letter. In a Spanish locale, for example, *ch* is a single collating element.

-k␣keydef
Defines the sort fields. *keydef* is defined as a sort field in the following form:

```
start_of_sort_field[type][,end_of_sort_field[type]]
```

where start_of_sort_field corresponds to *+pos1* and end_of_sort_field to *-pos2* (see description below). *type* corresponds to one of the options *b*, *d, f, i, n* or *r*.

+pos1[␣**-**pos2]
+pos1 and *-pos2* specify the start and end of a sort key on the basis of the fields in the input lines.
+pos1 is the position of the first character *in* the sort key;
-pos2 refers to the first character *after* it. *+pos1* must come before *-pos2*.

-pos2 not specified:
The sort key extends from *+pos1* to the end of the line.

The *pos1* and *pos2* arguments have the form:

m[.n]

where *m* and *n* are integers with the following significance:

m Skips *m* fields of the line, addressing field *m+1*.

.n Skips *n* characters plus the field separator as of the last character of field *m*, thus addressing character *n+1* within field *m+1*. If the *-b* option is in effect, field separators at the start of a field are not counted; thus, *+m.nb* refers to the *n+1*th non-whitespace character after field *m*.

.n not specified:
Is equivalent to .0 and refers to the first character after field *m*. If the *-b* option is in effect, field separators at the start of a field are not counted; thus, *+m.0b* refers to the first non-whitespace character in the *m+1*th field.

Example

To specify a sort key that begins with the fourth character in the second field and ends with this field, you enter:

```
sort +1.3 -2
```

Explanation:

```
         End         End     End
         Field1      Field2  Field3
               |           |       |
    030-456537 A.Mackenzie  Dublin
                   |       |
                  Sort key
```

+1.3 Skip field 1 and 3 characters:
the 4th character after field 1 is the 1st character in the sort key: M

-2 Skip field 2 and 0 characters:
the 1st character after field 2 is the 1st character after the sort field: blank.
Thus the character before is the last character in the sort key: n
Note that default field separators, unlike those defined with option *-t*, are part of the following field. Hence the first character of field 2 is the blank, the second character is the A, and so on.

When there are multiple sort keys, later keys are compared only after all earlier keys compare equal.

file
Name of the file you wish to sort.
You may name more than one file. All named files are sorted and merged, and the input lines from all of them together are sorted and written to standard output. In the input files, any letter sequence defined as a collating element in the current locale counts as

a single letter. Thus in a Spanish locale *ch* is a single collating element. When the last line in an input file is missing a newline character, *sort* appends one, issues a warning, and continues.

Only one file may be specified together with the *-c* option.

If you use a dash (-) as the name for *file*, *sort* reads from standard input.

file not specified:
sort reads from standard input.

Exit status The following exit status values may occur:

0	All input files were processed successfully. If option *-c* was set, then the input file was sorted correctly.
1	If -c was set the input file was not sorted as specified. If both -c and -u were set two identical input lines were found with the same sort field.
>1	An error has occurred.

Locale The following environment variables affect the execution of *sort*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Dertermine the preset collating sequence used by the *sort* command.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files). *LC_CTYPE* also governs how character classes are handled by the *-b*, *-d*, *-f* and *-i* options.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_NUMERIC	Determine the form of the radix character (decimal point) in conjunction with the *-n* option.
LC_TIME	Determine the currently valid month names, their abbreviations and their collating sequence in conjunction with option *-M*.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Sorting the contents of *input_file* with the second field as the sort key.

```
$ sort +1 -2 input_file
```

Example 2 You wish to sort the contents of *input_file1* and *input_file2* in reverse order on the second character of the second field (= 1st character which is not a space if fields are all separated by one space). The output is to be written to *output_file*.

```
$ sort -r -o output_file +1.0 -1.2 input_file1 input_file2
```

Example 3 Sorting the contents of *input_file1* and *input_file2* in reverse order, placing the output in *output_file*, and using the first character in the second field as the sort key.

```
$ sort -r -o output_file +1.0b -1.1b input_file1 input_file2
```

Example 4 Displaying the presorted file *input_file*, suppressing all but the first occurrence of lines having the same third field.

```
$ sort -u +2 -3 input_file
```

See also *comm*, *join*, *uniq*

split split a file into pieces

split divides a file into smaller segments, storing the segments in individual output files and leaving the original file unaltered.

The output files are automatically numbered; *split* uses a suffix comprising two lowercase letters (aa, ab ... zz) from the current internationalized environment for this purpose. The last file contains the remainder of the input file and may contain fewer lines than the number specified.

If the number of output files required exceeds the maximum length allowed by the suffix, *split* does not write the last file (as this would contain more lines than specified) and terminates with the exit status >0. The files that have already been created are not deleted.

Syntax

Format 1: split␣-b␣byte[␣**-a**␣number][␣file[␣name]]

Format 2: split[␣**-l**␣lines][␣**-a**␣number][␣file[␣name]]

Format 3: split[␣lines][␣**-a**␣number][␣file[␣name]]

No option specified
The output files are called `xaa`, `xab` etc. up to `xzz` in lexicographical sequence. In this case, *split* creates a maximum of 676 output files.

Format 1 **split␣-b␣**byte[␣**-a**␣number][␣file[␣name]]

-a␣number
The suffix for the output file consists of *number* letters. For example, *-a␣4* creates the output files `xaaaa`, `xaaab` etc. up to `xzzzz`.
Thus the maximum theoretically possible number of file names is 26^{number} for 0<*number*<8. If *number* is greater than 7, it defaults to *UINT_MAX*.

-a not specified:
The suffix consists of 2 letters.

-b␣bytes
split splits the input file into sections of size *bytes*. *bytes* can be specified as follows:

n	as the number of bytes
n k	as a multiple of 1024 bytes
n m	as a multiple of 1048576 bytes

file
Name of the input file you want to split.
If you use a dash (-) as the name for *file*, *split* reads from standard input.

file not specified:
split reads from standard input.

name

Name of the output files: The first output file is given the name *name***aa**, the second receives the name *name***ab**, and so on lexicographically, up to *name***zz**.
So *name* must be at least 2 characters shorter (or *number* characters shorter if *-a* is specified) than the maximum file name length ({`NAME_MAX`} bytes) allowed in the file system.

If you specify a value for *name*, the *file* argument is mandatory.

Format 2 **split**[␣**-l**␣lines][␣**-a**␣number][␣file[␣name]]

Format 3 **split**[␣lines][␣**-a**␣number][␣file[␣name]]

-l␣lines

split splits the input file into sections containing *lines* lines.

This corresponds to the old option *␣lines*, which is still supported.

-l not specified:
split splits the input file into sections containing 1000 lines.

-a␣number

The suffix for the output file consists of number letters. For example, *-a␣4* creates the output files `xaaaa`, `xaaab` etc. up to `xzzzz`.
Thus the maximum theoretically possible number of file names is 26^{number} for 0<*number*<8. If *number* is greater than 7, it defaults to *UINT_MAX*.

-a not specified:
The suffix consists of 2 letters.

file

Name of the input file you want to split.

If you use a dash (-) as the name for *file*, *split* reads from standard input.

file not specified:
split reads from standard input.

name

Name of the output files: The first output file is given the name *name***aa**, the second receives the name *name***ab**, and so on lexicographically, up to *name***zz**.
So *name* must be at least 2 characters shorter (or *number* characters shorter if *-a* is specified) than the maximum file name length ({`NAME_MAX`} bytes) allowed in the file system.

If you specify a value for *name*, the *file* argument is mandatory.

Locale The following environment variables affect the execution of *split*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The contents of the file *example* are to be split into several 20-line files:

```
$ split -l 20 example
$ ls
example
xaa
xab
xac
xad
```

Example 2 Every two lines from the standard input are to be written into files named *out*... Since the names of output files are explicitly specified (*out*) in this case, the minus sign (-) for standard input must not be omitted!

```
$ split -l 2 - out
What is true was always true
and will always remain true.
But what is not true, was never reality
and will never become reality.
END

$ ls
outaa
outab
```

See also *csplit*

start_bs2fsd start copy daemons

start_bs2fsd enables the system administrator to start additional copy daemons *bs2fsd*.

Syntax

```
start_bs2fsd [number]
```

No option specified
: *start_bs2fsd* provides information about the number of copy daemons currently running.

number
: Specifies how many copy daemons are to be started in addition to the copy daemons already started. Up to 8 copy daemons can execute.

Example

Check how many daemons are currently running

```
# start_bs2fsd
/sbin/start_bs2fsd: 2 bs2fs daemons are running
```

Start an additional daemon and repeat the check

```
# start_bs2fsd 1
/sbin/start_bs2fsd: start additional daemon 1 of 1
# start_bs2fsd
/sbin/start_bs2fsd: 3 bs2fs daemons are running
```

strings find printable strings in files

strings looks for strings in binary files and writes them on standard output. A string is by default any sequence of 4 or more printable ASCII characters ending with a newline or a null byte (see section “ASCII character set (ISO 646)” on page 909). *strings* is useful for identifying random object files and many other things.

Syntax

Format 1: strings[␣**-a**][␣**-o**][␣**-t**␣format][␣**-n**␣number][␣file...]

Format 2: strings[␣**-**][␣**-o**][␣**-t**␣format][␣**-**number][␣file...]

-a *strings* searches the entire file for printable strings.

This corresponds to the old option -, which is still supported.

-a not specified:
strings only looks in the initialized data space of object files.

-n␣number
Defines a strings as any sequence of *number* or more printable characters ending with a newline or a null byte.

This corresponds to the old option -*number*, which is still supported.

-n not specified:
A string is any sequence of 4 or more printable characters ending with a newline character or a null byte.

-o *strings* precedes each string by its offset in the file.

-t␣format
Each string is output preceded by its offset in the file. The *format* of the positioning specification is defined as follows:

d Decimal positioning specification

o Octal positioning specification

x Hexadecimal positioning specification

file
Name of the file in which *strings* is to look for printable strings.

Locale The following environment variables affect the execution of *strings*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and to identify printable strings.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Finding all printable strings in the executable binary file *a.out*:

```
$ strings a.out
L
LLM-UFS
~                       2009-01-27027 16:24:55
39UD2009-01-27027 16:24:55        39UD2009-01-27027 16:24:55-
2009-01-27027 16:24:552009-01-27027 16:24:55
:
halli hallo
~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~
~~~~
C(BS2000) COMPILER: V03.2B00,COMPILATION DATE: 2009-01-27,REP AREA:
:
```

This could be the output for a file that originally held the following source code:

```
#include <stdio.h>

main()
{
printf("Hallo, user\n");
}
```

See also *nm, od*

stty check and change terminal options (set terminal type)

stty can be used to check or change terminal options.

i Depending on the implementation, some *stty* options such as *parext*, *iexten* and *stflush* are accepted but not interpreted by the driver, so these options will not have any effect.

The *stty* command is only useful when you are accessing the POSIX shell via rlogin. The *stty* command has no effect on BS2000 block-mode terminals; *stty* can only be used to change the options on character-mode terminals.

Syntax **stty**[␣option]...

No option specified
stty reports some of the option settings for the device that is its current standard input.

Options for defining the scope of the output

-a (a - all) Reports all currently valid terminal option settings.

-g Reports current settings in a form that can be used as input to another *stty* command.

Options for setting input/output characteristics

The following section describes the various options available when setting I/O characteristics for the terminal that is *stty*'s current standard input. The I/O options are listed in five main groups:

- Data transfer control options
- Input control options
- Output control options
- Local features
- Control assignments.

An additional group constitutes combinations of options from these five groups.

Explanations related to parenthesized options are also indicated within parentheses.

Note that even though many combinations of options make no sense, *stty* does no sanity checking.

Data transfer control options

As serial lines are not supported on BS2000, the data transfer control options do not work. They are summarized here for reasons of completeness:

parenb
Enable parity generation and detection

parext
Extended parity generation and detection

parodd
Odd parity

csize
Define character size: *cs5, cs6, cs7* or *cs8*

ispeed number
Set terminal input baud rate to *number*

ospeed number
Set terminal output baud rate to *number*

number
Set baud rate to *number*

hupcl
Hang up connection on last *close()*

hup
Same as *hupcl*

cstopb
Use two stop bits per character

cread
Enable receiver

clocal
Modem control signals not supported

Input control options

The following options can be used to control the input of data:

ignbrk (**-ignbrk**)
Ignore (do not ignore) break on input.

brkint (**-brkint**)
Send (do not send) SIGINT on break.

ignpar (**-ignpar**)
Ignore (do not ignore) parity errors.

parmrk (**-parmrk**)
Mark (do not mark) characters with parity errors.

inpck (**-inpck**)
Enable (disable) parity checking on input.

istrip (**-istrip**)
Mask (do not mask) input characters to 7 bits.

inlcr (**-inlcr**)
Map (do not map) newline character to carriage return on input.

igncr (**-igncr**)
Ignore (do not ignore) carriage returns on input.

icrnl (**-icrnl**)
Map (do not map) carriage return to newline character on input.

iuclc (**-iuclc**)
Map (do not map) uppercase letters to lowercase on input.

ixon (**-ixon**)
Enable (disable) START/STOP output control. Output is stopped by sending an ASCII DC3 and started by sending an ASCII DC1.

ixany (**-ixany**)
Allow any character (only the ASCII character DC1) to restart output.

ixoff (**-ixoff**)
Request that the system send (not send) START/STOP characters when the input queue is nearly empty/full.

Output control options

The following options can be used to control the output of data:

opost (**-opost**)
: Post-process output in accordance with the other specified options (do not post-process output: ignore all other output control options).

olcuc (**-olcuc**)
: Map (do not map) lowercase letters to uppercase on output.

ocrnl (**-ocrnl**)
: Map (do not map) carriage return to newline character on output.

onocr (**-onocr**)
: Do not (do) output carriage return in column 0.

onlret (**-onlret**)
: A newline character also performs (does not perform) the carriage return function on output.

ofill (**-ofill**)
: Use fill characters (use timing) for data transmission delays.

ofdel (**-ofdel**)
: Use abort character DEL 0x7f (null character NUL 0x0) as fill character.

cr0 cr1 cr2 cr3
: Select extent of delay for carriage returns on output.

nl0 nl1
: Select extent of delay for newline characters on output.

tab0 tab1 tab2 tab3
: Select extent of delay for horizontal tabs on output.

bs0 bs1
: Select extent of delay for backspaces on outpu).

ff0 ff1
: Select extent of delay for form feeds on output.

vt0 vt1
: Select extent of delay for vertical tabs on output.

Local features

isig (**-isig**)
Enable (disable) the checking of each input character against the special control characters intr, quit, and swtch (see "Control assignments" on page 724). If a match is found, the function associated with the control character is executed (not executed).

icanon (**-icanon**)
Enable (disable) canonical input, i.e. the special functions of the characters erase and kill are (are not) performed on input.

xcase (**-xcase**)
Enable (disable) canonical uppercase/lowercase presentation.

echo (**-echo**)
Echo back (do not echo back) every character typed.

echoe (**-echoe**)
Echo (do not echo) erase characters as a backspace-space-backspace string.

Setting the *echoe* option will erase the character overwritten with erase on many terminals; however, since this mode does not keep track of the column position, problems may arise with escaped characters, tabs, and backspaces.

echok (**-echok**)
Output (do not output) an additional newline after a kill character.

echonl (**-echonl**)
Output (do not output) newline characters.

noflsh (**-noflsh**)
Disable (enable) the flushing of input and output queues on detection of an intr, quit, or swtch signal.

tostop (**-tostop**)
Send (do not send) SIGTTOU when background processes write to the terminal.

iexten (**-iexten**)
Enable (disable) special control characters not currently controlled by *icanon, isig, ixon* or *ixoff*.

Control assignments

control-character c
: Set *control-character* to *c*, where *control-character* can be: *ctab, discard, dsusp, eof, eol, eol2, erase, intr, kill, lnext, quit, reprint, start, stop, susp, swtch, werase, min* or *time* (*min* and *time* are used with *-icanon*; *ctab* is used with *-stappl*). If *c* is preceded by the ^ character, then the value used is the corresponding CTRL character (e.g. ^D corresponds to CTRL D). ^? is interpreted as DEL, and ^- is interpreted as undefined.

min number/**time** number
: Set the value of *min* or *time* to *number*. *min* and *time* are used with *-icanon* (see *termio()* [4]).

line i
: Set line discipline to *i* (0 < *i* < 127).

Combination modes

The following combination modes may be used to control the terminal:

evenp or **parity**
: Enable *parenb* and *cs7*.

oddp
: Enable *parenb*, *cs7*, and *parodd*.

-parity or **-evenp**
: Disable *parenb*, and enable *cs8*.

-oddp
: Disable *parenb* and *parodd*, and enable *cs8*.

raw (**-raw** or **cooked**)
: Enable (disable) raw input and output; raw mode is equivalent to: *cs8*, with no erase, kill, intr, quit, swtch, eof, or output post-processing, and no parity bit.

nl (**-nl**)
: Disable (enable) *icrnl*, and *onlcr*. In addition, *-nl* disables *inlcr*, *igncr*, *ocrnl*, and *onlret*.

lcase (**-lcase**)
: Enable (disable) *xcase*, *iuclc*, and *olcuc.*

LCASE (**-LCASE**)
Same as *lcase* (*-lcase*).

tabs (**-tabs** or **tab8**)
Preserve tabs (expand to spaces) when printing.

ek Reset control characters erase and kill back to system-specific default values.

sane
Reset all terminal options to some reasonable values.

Locale

The following environment variables affect the execution of *stty*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and which characters are printable.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Check current settings (only on access to POSIX shell via rlogin):

```
$ stty -a
speed 38400 baud;
intr = DEL; quit = ^\; erase = ^h; kill = ^x;
eof = ^d; eol = <undef>; eol2 = <undef>; swtch = <undef>;
start = ^q; stop = ^s; susp = ^z; dsusp = <undef>;
rprnt = ^r; flush = ^o; werase = ^w; lnext = ^v;
-parenb -parodd cs8 -cstopb hupcl cread -clocal -loblk -parext
-ignbrk brkint ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl -iuclc
ixon -ixany -ixoff -imaxbel
isig icanon -xcase echo echoe echok -echonl -noflsh
-tostop -echoctl -echoprt -echoke -defecho -flusho -pendin -iexten
opost -olcuc onlcr -ocrnl -onocr -onlret -ofill -ofdel -tabs
```

Example 2 If you have inadvertently performed an action that causes inputs not to be shown on the screen, you can restore the screen display by entering the following command:

```
$ stty echo
```

The input of the above command will, however, not be displayed.

Example 3 Reset all terminal settings to reasonable values:

```
$ stty sane
```

Example 4 The terminal settings can also be reset with the aid of the *-g* option:

```
$ STATUS=`stty -g `
```

The above command defines a variable with the current settings of the terminal (which may differ from those of *stty sane*). The existing terminal settings can now be changed by resetting them with:

```
$ stty $STATUS
```

See also *ioctl()* [4]

su substitute user ID

su starts a new shell under another user ID.

Syntax

su [**-**] [user]

- The new shell is started as a login-shell, i.e. the scripts */etc/profile* and *$HOME/.profile* are executed.

user Name of the user id for the new shell; default: TSOS.

Hint

su can only be executed successfully if a default account for rlogin tasks is defined for the user ID specified (see operand POSIX-RLOGIN-DEFAULT in command MODIFY-USER-ATTRIBUTES)..

File

/var/adm/sulog
File that records all executions of the *su* command, successful or not.

Example 1 Successful call of *su*

```
$ su
Password (TSOS):
# id
uid=0(TSOS) gid=0(SYSROOT) groups=0(SYSROOT)
# exit
$
```

Record in the sulog file:

```
   SU 2011/05/10 13:56:26 + pts/0      FROEDE-TSOS
```

Example 2 Rejected call of *su*

```
$ su - sysaudit
Password (SYSAUDIT):
Sorry
$ id
uid=109(FROEDE) gid=2001(OS315) groups=2001(OS315),7777(dialout)
$
```

Record in the sulog file:

```
   SU 2011/05/10 13:56:23 - pts/0      FROEDE-SYSAUDIT
```

sum print checksum and block count of a file

sum calculates and prints a checksum for the named file, and also prints the space used by the file, in 512-byte blocks. The output is written to standard output.
sum may be useful for checking that a file has arrived complete and unchanged after a file transfer.

Syntax

```
sum[␣-r][␣file]...
```

-r Uses an alternate algorithm to compute the checksum and prints a different checksum.

file
Name of the file whose checksum is to be calculated. Both ordinary files and directories may be specified. You may name more than one file.

file not specified:
sum reads from standard input.

Caution!
The algorithms used in computing the checksum may not be portable. Different checksums may thus be produced for the same file when *sum* is run on different systems.

Locale

The following environment variables affect the execution of *sum*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Checksum of the file *months* using the first algorithm:

```
$ sum months
6658 1 month
```

Example 2 Checksum of the file *months* using the second algorithm:

```
$ sum -r months
62412     1 month
```

See also *cksum, wc*

sync flush system buffers

sync causes all system buffers not yet written to hard disk or floppies to be flushed out to disk, thus assuring that all file updates up to that point are saved.

A system buffer is an internal buffer that serves to improve system performance. It is not accessible to users.

Syntax

```
sync
```

Application usage

sync will only write local buffers to local disks; you cannot use *sync* to force buffers to be written out to disk on remote machines.

tabs set terminal tabs

i This command is only available to users accessing the POSIX shell via *rlogin*.

tabs sets the tab stops on the user's terminal, clearing any previous settings. For *tabs* to be effective, the terminal must have hardware tabs that can be set remotely using escape sequences.
The lowest column number is 1. For *tabs*, column 1 refers to the leftmost column on the screen, even on terminals whose column markers begin at 0.

Syntax **tabs**[␣**-T**␣type][␣**+m**n][␣tabspec]

-T␣type
Terminal type, which needs to be known for margin setting. *type* is a name listed in */usr/share/lib/terminfo* (siehe *term* [13]).

-T␣type not specified:
tabs uses the value of the *TERM* environment variable. If *TERM* is not defined in the current environment (see *environ* [13]), *tabs* uses a type whose attributes are valid for many terminals.

+mn
All tabs are moved *n* columns to the right, with *n+1* becoming the left margin. If *n* is omitted, a value of 10 is assumed. For a TermiNet, the first value in the tab list should be 1, or the margin will move even further to the right. Normally, the leftmost margin is set with *+m0*. On most terminals, the margin is reset further to the right only when *+m* is specified explicitly.

tabspec
Four different types of tab specification are permitted:

-code	tabs in a predefined pattern (*canned*)
-n	tabs at regular intervals (*repetitive*)
--file	tabs in a pattern defined in *file* (*file*)
n1[,n2...]	tabs at freely selectable positions (*arbitrary*)

-code You determine the pattern of tabs on a line by specifying one of the following:

-a Tab stops in columns 1,10,16,36,72.
This corresponds to Assembler, IBM S/370, first format.

-a2 Tab stops in columns 1,10,16,40,72.
This corresponds to Assembler, IBM S/370, second format.

-c Tab stops in columns 1,8,12,16,20,55.
This corresponds to COBOL normal format.

-c2 Tab stops in columns 1,6,10,14,49.
This corresponds to COBOL compact format. Columns 1-6 are omitted. The first character typed corresponds to card column 7, one space takes you to column 8, and a tab reaches column 12. Files using this tab setup should include a format specification as follows (see *fspec* [13]):
`<:t -c2 m6 s66 d:>`

-c3 Tab stops in columns 1,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,67.
This corresponds to COBOL compact format with additional tabs. Columns 1-6 are omitted. The first character typed corresponds to card column 7, one space takes you to column 8, and a tab reaches column 12. Files using this tab setup should include a format specification as follows (see *fspec* [13]):
`<:t -c3 m6 s66 d:>`.
This is the recommended format for COBOL.

-f Tab stops in columns 1,7,11,15,19,23.
This corresponds to FORTRAN format.

-p Tab stops in columns 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61.
This corresponds to PL/I format.

-s Tab stops in columns 1,10,55.
This corresponds to SNOBOL format.

-u Tab stops in columns 1,12,20,44.
This corresponds to UNIVAC 1100 Assembler format.

-n The number specified causes tab stops to be set in columns 1+*n*,1+2*n*,1+3*n*. Specifying 8 eight gives you the UNIX system standard tab setting. Specifying 0 clears all tab stops.

--file *tabs* reads the first line of the file, searching for a format specification (see *fspec* [13]). If it finds one, it sets the tab stops accordingly. Otherwise, the default value *8* is assumed. This type of format may be used to ensure that a tabbed file is printed with the correct tab settings, with *tabs* being used in conjunction with *pr* (see *pr*).

n1[,n2,...] You can freely select the columns for the tab stops by means of a list containing up to 64 numbers in ascending order. A number preceded by a plus sign is added to the value of the previous number. This does not apply to the first number. The format *1,10,20,30*, for example, can be specified as *1,10,+10,+10*.

The numbers are separated by a comma, or the list is enclosed in quotes, whereby the numbers are separated by a comma and/or a blank. *n1[,n2,...]* must be specified as the last argument in the command line.

tabspec not specified:
tabs uses the default setting *-8*, which corresponds to the UNIX system standard tab setting.

Hint The mechanisms for clearing tab stops and setting the left margin are not the same on every terminal. *tabs* can set a maximum of 64 tab stops, but will only clear 20.

Error `illegal tabs`
When setting arbitrary tab stops you failed to maintain ascending order or you specified a zero.

`illegal increment`
When setting arbitrary tab stops you specified a zero or omitted an increment.

`unknown tab code`
The code you specified as *tabspec* cannot be found.

`can't open`
The file you specified as *tabspec* cannot be opened.

`file indirection`
The format specification in the file specified as *tabspec* points to another file. Indirect references of this sort are not permitted.

`tabs cannot be set for this terminal`
You are running the command on an unknown terminal type, e.g. on a block-mode terminal.

File *\/usr/share/lib/terminfo/?/**
Files used to name and define terminals

Variable *TERM*
Terminal type

Locale

The following environment variables affect the execution of *tabs*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1

Setting tab stops in COBOL normal format.

```
$ tabs -c
```

Example 2

Set a tab in every sixth column, i.e. in columns 1,7,13,19,...

```
$ tabs -6
```

Example 3

Set tabs in columns 1, 8 and 36.

```
$ tabs 1,8,36
```

This has the same effect as

```
$ tabs 1,+7,+28
```

Example 4

Setting tab stops in accordance with the first line (format specification) of your file *$HOME/tabspec.list/file1*.

```
$ tabs --$HOME/tabspec.list/file1
```

See also

pr, *tput*
environ, *fspec*, *term*, *terminfo* [13]

tail deliver the last part of a file

tail prints the contents of the specified file on standard output beginning at a designated place. If no file name is specified, *tail* outputs the contents of standard input.

If *tail* is used with a character-oriented special file a problem may occur.

Syntax

Format 1: tail[␣**-f**][␣**-c**␣place | ␣**-n**␣place][␣file]

Format 2: tail[␣**-f**][␣**+**[place]|␣**-**[place][**l**|**b**|**c**]][␣file]

Format 1 **tail**[␣**-f**][␣**-c**␣place | ␣**-n**␣place][␣file]

-f (follow) If the input file is not a pipe, the program will not terminate after the last line of the input file has been displayed, but will enter an endless loop, wherein it sleeps for at least a second and then attempts to read and copy further records from the input file. You could thus use this option to monitor the growth of a file that is being written by some other process.
-f is ignored if no file is specified *file* and the standard input is a pipe.

-c␣place
(character) The output of the *tail* starts at the character defined by *place*.
You use *place* to specify the position in the input file at which you want output to start:

[[**+**|**-**]number]

number can be specified as any decimal integer value. *+number* is calculated relative to the beginning of the file; *-number* is calculated relative to the end of the file.

Caution!
Tails relative to the end of the file are buffered by *tail* and are thus restricted to a maximum of 4 Kbytes.

+|- not specified:
tail calculates relative to the end of the file.

number not specified:
The default value of 10 is assumed.

place not specified:
The default value for *place* is -10, i.e. 10 lines from the end of the file.

-n␣place
(number) This option is equivalent to *-c place* except that the output is counted line by line not byte by byte.

file
Name of the input file to be displayed by *tail*.

file not specified:
tail reads from standard input.

Format 2 **tail**[␣**-f**][␣**+**[place]|␣**-**[place][**l**|**b**|**c**]][␣file]

-f (follow) If the input file is not a pipe, the program will not terminate after the last line of the input file has been displayed, but will enter an endless loop, wherein it sleeps for at least a second and then attempts to read and copy further records from the input file. You could thus use this option to monitor the growth of a file that is being written by some other process.

place
You use *place* to specify the position in the input file at which you want output to start. Enter a decimal integer value for *place*. If you enter +[*place*] counting starts at the beginning of the file. If you enter -[*place*] the command counts from the end of the file.

Caution!
tail buffers sections which are read from the end of the file. The size of this buffer is limited to 4 kbytes.

place not specified:
The default value is 10, i.e. 10 units counted from the start or from the end of the file.

No space character is allowed between +[*place*] or -[*place*] and the unit (**l**,**b** or **c**).

-l (line) Starts display at the line defined by *place*.

-b (block) Starts display at the block defined by *place*. A block is a 512-byte unit.

-c (character) Starts display at the character defined by *place*.

file
Name of the input file to be displayed by *tail*.

file not specified:
tail reads from standard input.

Locale The following environment variables affect the execution of *tail*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The file *months* contains the name of a month in each line. The following two calls to *tail*:

```
$ tail -n 5 months
```

```
$ tail -n +8 months
```

will result in the same output:

```
August
September
October
November
December
```

Example 2 To observe the effect of the *-f* option, create a shell script that writes data to a file in an endless loop and run this script in the background.

The shell script *neverend* with the following contents would serve the purpose:

```
while true
do {
   date >>anne
   sleep 5
   }
done
```

You can now run this script in the background and then call *tail* with option *-f* and the file *anne* as its argument:

```
$ neverend&
656
$ tail -n -5 -f anne
These five
lines
were already
in the file
before any additions.
FRI JAN 23 11:40:35 MEZ 2009
FRI JAN 23 11:40:40 MEZ 2009
.
.
.
```

tail first displays the last five lines of the file *anne*, followed by the data written to this file by the script *neverend*. The process generated with *tail -f* can be terminated by pressing the DEL key (or the key combination @@c) in the case of block terminals).

See also *cat*, *head*, *more*

talk talk to another user

i This command is only available to users accessing the POSIX shell via *rlogin*.

talk enables you to communicate with another user working at a terminal on the same or a different host. *talk* copies input lines from your terminal to the recipient's terminal. *talk* is architecture dependent; it works only between machines that have the same architecture.

Syntax **talk**␣loginname[␣ttyname]

loginname
: Login name of the user you want to communicate with. If this user is logged in more than once, the *ttyname* argument may be used to indicate the appropriate terminal.

If the user is working on another system, you have to enter:

loginname@systemname

ttyname
: Name of the terminal on which the user with whom you want to talk is working. You need only enter *ttyname* if the recipient *loginname* is logged in more than once. The *who* command enables you to see which terminals *loginname* is logged in on.

Functionality

In a *talk* conversation, there is an originator and a recipient. The user who calls *talk* is the originator, while the user whose login name is specified is the recipient.

When the originator calls *talk*, the following appears on the recipient's terminal:

```
Message from TalkDaemon@target_system at time
talk: connection requested by originator@source_system
talk: respond with: talk originator@source_system
```

and the following on the originator's:

```
Waiting for your party to respond
```

This is on condition that the recipient's login name is defined, the recipient is logged in and the connection could be set up successfully.

At this point, the recipient can accept the call by entering:

```
talk originator@source_system
```

The screens of the originator and the recipient then divide into two windows, the upper for writing messages, the lower for reading messages. Both parties can read and write messages simultaneously.

To refuse a call, the recipient presses DEL, at which point the shell prompt appears and the user can continue working normally.

Once communication is established, during conversation

– printable characters are passed through to the other party
– the bell character is passed thtough to the other party
– you can redraw the screen with CTRL L,
– you can terminate communication by pressing DEL. The message

  ```
  Connection closing. Exiting
  ```

  is output and the shell prompt appears at the bottom of the screen, followed by the cursor.

You can use the *mesg* command to grant (*mesg -y*) or deny (*mesg -n*) other users permission to set up a communication connection to your terminal with *talk*. The default setting for *mesg* is *y*. Certain commands, such as *pr*, automatically disallow messages in order to prevent messy output.

Error

```
No connection yet
```

The connection with the recipient could not be set up yet. It is advisable to wait a while, and then try again if the message *Waiting for your party to respond* does not appear on your screen after a few seconds.

```
Your party is not logged on
```

The login name you specified as recipient is not defined, or the user is currently not logged in.

```
Your party is refusing messages
```

Permission to write messages to the recipient’s terminal is denied (see *mesg*).

File

/etc/hosts
This file is required to locate the recipient’s system.

/var/adm/utmp
This file is required to locate the recipient’s terminal. All users who are logged in are recorded in this file.

Locale The following environment variables affect the execution of *talk*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 You want to communicate with the user *walter* who is working on the same system as you:

```
$ talk walter
...
```

Example 2 You want to communicate with the user *lindsay* who is working at terminal tty003 on the system *munich*:

```
$ talk lindsay@munich tty003
...
```

See also *mailx, mesg, pr, who, write*

tar file archiver

The *tar* command is used to process archive files. Archive files can only be placed on the POSIX file system, not on magnetic tapes and cartridges.

The actions to be performed are defined by the *mainkey* operand.

i The *tar* command has been withdrawn from the XPG4 standard and replaced by the command *pax*.

Consequently, only the *pax* command should be used in the future, since *tar* is now supported only for compatibility reasons.

Syntax

```
tar␣mainkey[modifier...][␣file]...
```

Main keys

mainkey consists of a “function character”, which may be specified with or without a hyphen (-).
It may be immediately followed by one or more additional options called modifiers (see page 743).

mainkey can be one of the following characters:

[-]c (create) A new archive is created. The specified *file* or files are written at the start of the archive.

[-]r (replace) The specified *file* or files are appended to the end of the archive.

[-]u (update) The specified *file* or files are added to the archive if not already present in it or if the last modification time of the file to be archived is later than that of the archived file.

[-]t (table) *tar* prints a table, showing the contents of the archive.

If one or more existing files from the archive files are specified, the names of the specified *file* or files are written to standard output.

If no files are specified, the names of all files located in the archive are written to standard output.

[-]x (extract) The specified *file* or files are extracted from the archive.

Files that are stored in the archive with relative pathnames are extracted to the current directory.

Files that are stored in the archive with absolute pathnames are extracted to the corresponding directory (if such a directory exists).

If the specified file is a directory, all subdirectories contained in it are extracted recursively.

If the specified file does not exist in the directory in which the extracted file is to be placed, it is created as a new file with the following attributes:
– The user ID and group ID of the owner and the last modification time are taken from the archived file.
– Access permissions are set as defined with *umask*.
  The s-bit is taken into account only if *tar* is called by a user with system administrator privileges.

If the file already exists, the access permissions are not changed.

If one or more files of the same name already exist in the archive, the last extracted file will overwrite all such files.

Modifiers

The characters listed below can be directly appended to the *main key* as a *modifier*, provided the following rules are observed:
– First enter all modifiers without intervening blanks.
– Then enter the individual arguments, which must be separated by blanks. The order of the arguments is determined by the order in which the associated modifiers were entered.

+v (verbose) The name of each processed file is written to standard error. Each name is preceded by one of the characters below, which indicates the type of processing:

– a for the main keys c, r and u, or

– x for the main key x.

The individual file names are then followed by the corresponding file size (in blocks).

If the *modifier* **v** is used with the *mainkey* **[-]t**, the access permissions and the owner and group of the file are also displayed.

w (what) For each file, *tar* waits for a confirmation before executing the corresponding function specified with *mainkey*. *tar* displays the following:

```
mainkey filename:
```

and expects you to enter your input after the colon. It is only after you enter your confirmation (with y or `j`, depending on the language) that the action will be executed.

If **w** is not specified, the requested actions are performed without confirmation.

f (file) The first specified *file* operand (or the second if **b** has already been specified) is interpreted as the name of the archive to be processed.

If the specified name is '**-**' (a hyphen), the archive will be written to standard output or read from standard input. This makes it possible to use *tar* at both ends of a command pipe:

– If **f** is specified with the main keys **-c**, **-r** or **-u** and the associated *file* operand is '**-**', the archive is written to standard output.
– If **f** is specified in connection with the *mainkey* **-t** or **-x** and the associated *file* operand is '**-**' (a hyphen), the archive is read from standard input.

If **f** is not specified, the default archive file defined by the shell variable *TAPE* is used.

h *tar* follows symbolic links.

If **h** is omitted, *tar* will process only the symbolic link, but not the associated file.

l (link) *tar* issues a message when a reference to another file cannot be resolved.

If **l** is omitted, no messages displayed.

m (modification date/time) On copying the specified file from the archive, *tar* sets the time of last modification for the copy to the current date and time.

If **m** is omitted, the original date and time that was recorded in the archive are retained.

o (owner) The file copied from the archive is assigned the same owner as the user who called *tar*.
The file is also assigned the group of that user.

If **o** is omitted, the original owner and group that was recorded in the archive are retained.

file
Pathname of a file or directory that is to be written to the archive (*mainkey* **-c**,**-r** or **-u**), read from an archive (*mainkey* **-x**), or listed (*mainkey* **-t**).

If *file* is the name of a directory, the corresponding actions are applied (recursively) on all files and subdirectories of that directory.

If the *modifier* **f** is specified, the first *file* operand is interpreted as the archive name.

Variable *TAPE*
Determines the name of the archive to be used if the *modifier* **f** is not specified.

Locale
The following environment variables affect the execution of *tar*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_COLLATE	Determine the collating sequence.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1
Create an archive file:
All files contained in the current directory (**.**) and its subdirectories are to be written to the archive file *$HOME/archive/example1.TAR*.

```
$ tar cvf $HOME/archive/example1.TAR .
a ./.sh_history 8 Blocks
a ./.profile 1 Blocks
a ./test.proc 1 Blocks
a ./pos_examp/file1 1 Blocks
a ./pos_examp/file2 1 Blocks
a ./pos_examp/file3 8 Blocks
tar: ./example1.TAR : same as archive file
```

Example 2
List the contents of an archive file on standard output:

```
$ tar tvf $HOME/archive/example1.TAR
Tar: blocksize = 20
USTAR format archive
rw------- 632/-993   3866 May 26 18:12 2008, ./.sh_history
rwxr-xr-x 632/-993     48 Mar 20 12:40 2008, ./.profile
rw-r--r-- 632/-993     29 Apr 23 13:31 2008, ./test.proc
rw-r--r-- 632/-993     29 May 26 18:05 2008, ./pos_examp/file1
rw-r--r-- 632/-993     52 May 26 18:07 2008, ./pos_examp/file2
rw------- 632/-993   3602 May 26 18:07 2008, ./pos_examp/file3
```

Example 3 Read files from an archive file of another user into the current directory:
The files stored in the archive file have a different user ID and group ID than that of the user who calls the *tar* command. On reading the files from the archive, this user also wants the file ownership to be changed to his/her user ID and group ID, respectively:

```
$ id ——————————————————————————————————————————————————————— (1)
uid=3010(VSC0) gid=3030(VSCG0)
$ tar tvf /home/vsx/vsx1/km/example.TAR ——————————————————— (2)
Tar: blocksize = 20
USTAR format archive
rw-r--r-- 3001/3002    883 May 28 13:29 2008, ./pos_examp/file1
rw-r--r-- 3001/3002   1766 May 28 13:30 2008, ./pos_examp/file2
rw-r--r-- 3001/3002   2649 May 28 13:30 2008, ./pos_examp/file3
$ tar xvfo  /home/vsx/vsx1/km/example.TAR ————————————————— (3)
Tar: blocksize = 20
USTAR format archive
tar: . : exists - no update
x ./pos_examp/file1, 883 bytes, 2 tape blocks
x ./pos_examp/file2, 1766 bytes, 4 tape blocks
x ./pos_examp/file3, 2649 bytes, 6 tape blocks
$ ls -lR ——————————————————————————————————————————————————— (4)
total 8
drwxr-xr-x   2 VSC0     VSCG0       2048 May 28 13:42
pos_examp
./pos_examp:
total 24
-rw-r--r--   1 VSC0     VSCG0        883 May 28 13:29 file1
-rw-r--r--   1 VSC0     VSCG0       1766 May 28 13:30 file2
-rw-r--r--   1 VSC0     VSCG0       2649 May 28 13:30 file3
```

(1) The user VSC0 begins by displaying his/her own user ID and group ID.

(2) A table of contents of the archive file *example.TAR*, which is owned by some other user, is displayed. This indicates that the files and directories in the archive have a different user ID and group ID than that of the user VSC0.

(3) The user VSC0 sets the *-o* option in the *tar* command to have his/her user ID and group ID transferred on unpacking the archive file to the current directory.

(4) To verify that the new user ID and group ID have actually been entered, the user VSC0 issues the *ls* command.

Hint **Exchanging *tar* archives between UNIX systems and BS2000**

In UNIX systems, *tar* archives are created in ASCII format. Since POSIX processes files in EBCDIC format by default and no normal ASCII-EBCDIC conversion of archive files is possible, the exchange of archive files can only occur via ASCII file systems. The following two variants briefly explain how this can be achieved:

Variant 1 (with NFS)

The *tar* archive is stored on the UNIX system and can be accessed in POSIX (mounted via NFS). If the shell variable *IO_CONVERSION* is set to *YES*, the *tar* archive can be upacked with automatic conversion to the POSIX file system.

Variant 2 (without NFS)

An ASCII file system must be created in POSIX (see the description for *POSIX filesystem marker = n* under *Install POSIX subsystem* in the POSIX manual “Basics for Users and System Administrators” [1]. Setting the shell variable *IO_CONVERSION=YES* causes the files in such a file system to be treated as ASCII files.
The *tar* archive must now be copied from the UNIX system to the POSIX file system by means of a binary transfer. It can then be automatically converted to a POSIX EBCDIC file system when it is unpacked.

See also *ar*, *cpio*, *pax*

tee join pipes and make copies of input

tee transcribes data from standard input to standard output and simultaneously copies this data to the specified file

Syntax **tee**[␣**-ai**][␣file...]

-a (append) *tee* appends its output to the original contents of *file* if *file* already exists when *tee* is invoked.

-a not specified:
If *file* exists when *tee* is invoked, the original contents of *file* are overwritten.

-i (ignore) The signal SIGINT (see *kill*) is ignored.

file
Name of the file to which *tee* is to write its output. If *file* does not exist when you call *tee*, a new file is created; if it does exist, *tee* either overwrites its contents or appends the output to it, depending on whether or not the *-a* option is used. If you specify more than one file, *tee* writes its entire output to each file.

file not specified:
tee writes its output to standard output only.

Locale The following environment variables affect the execution of *tee*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Use of the *tee* command in a pipe:

```
$ (date; who) | tee security| wc -l
       3
$ cat security
Mon Mar 9 16:19:41 MEZ 1995
QM212JNA   term/003     Mar 8 14:06:28
user2      pts/0        Mar 9 16:02:54
```

The *date* and *who* commands send the current date and information on all users currently logged in to standard output. The first pipe redirects this output to *tee*'s standard input. *tee* reads this input and copies it to the file *security* and to standard output. The second pipe sends the standard output of *tee* to the standard input of the *wc -l* command; *wc -l* writes the number of read lines to standard output: 3 (2 users logged in and 1 line for the date).

test evaluate expression

The POSIX shell built-in *test* is used to check whether specific conditions are satisfied. Such conditions may be:

– file attributes,
– characteristics and comparisons of strings, and
– algebraic comparisons of integers.

Conditions can be negated and several conditions may be combined with one another.

Depending on the exit status, you can execute various commands, terminate loops, etc.

The POSIX shell built-in *test* has two forms (see syntax below). The effect is the same in both cases..

Syntax

test[␣expression]
[[␣expression␣**]]**

[␣expression␣]
The square brackets as well as the delimiting blanks before and after *expression* are mandatory. This is an alternative method of executing the POSIX shell built-in *test*.

expression
One or more primary expressions which may be combined (see the section "Combining conditions" on page 754).

test checks the following conditions:

File attributes

-r␣file
(read) true if *file* exists and you have read permission.

-w␣file
(write) true if *file* exists and you have write permission.

-x␣file
(execute) true if *file* exists and you have execute permission.

-f␣file
(file) true if *file* exists and is a regular file.

-d␣file
(directory) true if *file* exists and is a directory.

-e␣file
true if *file* exists.

-h␣file
true if *file* exists and is a symbolic link. Normally symbolic links are followed by all other conditions.

-c␣file
(character device) true if *file* exists and is a character special file.

-b␣file
(block device) true if *file* exists and is a block special file.

-p␣file
(pipe) true if *file* exists and is a named pipe (FIFO).

-u␣file
(set user ID) true if *file* exists and its set-user-id bit is set.

-g␣file
(set group ID) true if *file* exists and its set-group-id bit is set.

-k␣file
(stic**k**y bit) true if *file* exists and its sticky bit is set.

-s␣file
(size) true if *file* exists and is not empty.

-t[␣filedescr]
(terminal) true if the specified *file descriptor* is open and assigned to a terminal.

filedescr not specified:
The file descriptor 1 is taken by default.

file
Name of the file or directory whose attributes are to be tested. Relative or absolute path names may also be specified.
If you use shell metacharacters in the file names, *test* only checks the first file that matches this name.

If you specify the null string for *file*, i.e. a pair of single quotes ” or double quotes "", *test* interprets *file* as the name of your current directory.

If you do not specify *file*, *test* issues an error message and terminates with exit status 1.

A shell parameter may also be specified for *file*. This parameter should always be enclosed in double quotes "...". If the corresponding shell variable has not been defined, the null string will be passed as an argument to *test*. The quotes thus guarantee that *test* is always supplied an argument during parameter substitution.

Characteristics and comparisons of strings

Any arbitrary sequence of characters may be specified as a string. Blanks and tabs included in the string must be escaped. If the string is to be protected from interpretation by the shell, the relevant metacharacters can be escaped by preceding them with a backslash \ or by enclosing the entire string within single or double quotes.

The null string can be specified by a pair of consecutive double quotes or single quotes. If you do not specify a string, *test* issues an error message and terminates with exit status 1.

A shell parameter may also be specified as a string. This parameter should always be enclosed in double quotes. If the corresponding shell variable has not been defined, the null string will be passed as an argument to *test*. The double quotes thus guarantee that *test* is always supplied an argument during parameter substitution.

[**-n**␣]string
: (non zero) true if the specified *string* is not the null string, i.e. has a non-zero length. This option allows you to test whether there is a value assigned to a shell variable. The corresponding shell parameter must be enclosed within double quotes.

  -n not specified:
  The meaning is the same as above, but the condition is easier to read if *-n* is specified.

-z␣string
: (zero) true if the specified *string* is the null string, i.e. has a length of zero.
  This enables you to test whether there is no value assigned to a shell variable. The corresponding shell parameter must be enclosed within double quotes.

string1␣**=**␣string2
: True if the two strings are identical. The blanks before and after the equals sign are mandatory, since *test* expects this character as an independent argument. If you are comparing shell parameters, they should be enclosed within double quotes.

string1␣**!=**␣string2
: True if the two specified strings are not identical. The blanks surrounding the != (not equal to) sign are required, since *test* expects this character as an independent argument. If shell parameters are being compared, they must be quoted.

string
: True if *string* is not the null string.

Algebraic comparison of integers

Integers can either be specified directly or as values of shell variables. There is no limit to the size of integer values you can specify, nor to the size of values you can define for a shell variable.
If you specify a shell parameter as a number, you should always enclose it within double quotes "..". This ensures that *test* receives the null string as an argument if the corresponding shell variable has not been defined.
Quoting thus guarantees that an argument will be supplied to *test* when parameter substitution is performed.

int1␣op␣int2
The two integers *int1* and *int2* are algebraically compared by *test* on the basis of the operator specified in *op*.
test expects operators as independent arguments; they must therefore be given between two blanks.

op can be any of the following:

-eq	(equal) true if the two integers are algebraically equal.
-ne	(not equal) true if the two integers are algebraically not equal.
-ge	(greater than or equal) true if *int1* is algebraically greater than or equal to *int2*.
-gt	(greater than) true if *int1* is algebraically greater than *int2*.
-le	(less than or equal) true if *int1* is algebraically less than or equal to *int2*.
-lt	(less than) true if *int1* is algebraically less than *int2*.

Negating conditions

!␣condition
True if the specified condition is not satisfied. The exclamation mark must be followed by a blank.

Example

```
$ ! -r file
```

test returns an exit status of 0 (i.e. true) if you are not permitted to read the specified file.

Combining conditions

Primary conditions can be linked with one another to form a *compound expression*. The condition itself can also be negated.
Since the corresponding relational operators are expected as independent arguments by *test*, they must be enclosed by one blank on either side.

The *find* command searches directories for files that satisfy given conditions. Conditions for *test* are combined in a similar way.

The following operators can be used to combine conditions:

condition␣**-a**␣condition
(and) Logical AND operator, i.e true if all conditions combined in this way are satisfied. Each *-a* operator must be preceded and followed by a blank.

condition␣**-o**␣condition
(or) Logical OR operator, i.e true if at least one of the conditions is satisfied. Each *-o* operator must be preceded and followed by a blank.

\(␣compexpr␣**\)**
compexpr represents a compound expression comprising two or more arbitrarily grouped conditions. The operator that precedes conditions grouped within parentheses applies to the whole compound expression (i.e. all conditions) and not just to the condition that immediately follows it.
As the shell has its own interpretation of parentheses, they should be escaped with a backslash when used within *test*. Each operator and expression in the compound expression *compexpr* must be separated from one another by blanks.

Example

```
$  ! \( -r file -o -w file \)
                 |
                OR
```

The expression within parentheses is true if you have read or write permission for the specified file. The negation operator (!) negates the whole expression. Thus, if you have neither read nor write permission for the specified file, *test* will return an exit status of zero (true).

Precedence of operators

The order of precedence for operators used with *test* is as follows:

Parentheses over negation over AND over OR.

The conditions within parentheses in the preceding example are thus evaluated first and then negated.

Exit status

0 If the specified expression is true

1 Although the specified expression is syntactically correct, its evaluation returns the value false. Alternatively, you have not entered an expression.

>1 Error (e.g. syntactically incorrect expression)

Error

```
test: argument expected
```

This error message is issued if you have failed to specify a condition fully, i.e. if a file, string, or number is missing in the specification.
Shell parameters must therefore always be enclosed within double quotes. Otherwise, an argument will be missing whenever the corresponding shell variable is undefined.

Locale

The following environment variables affect the execution of *test*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following shell script tests whether the specified positional parameter is the name of a file or of a directory.

```
if test -f "$1"                # or: if [ -f "$1" ]
   then
   echo $1 is a file
   elif test -d "$1"           # or: elif [ -d "$1" ]
      then
      echo $1 is a directory
fi
```

Since the *$1* positional parameter has been quoted, *test* substitutes the current directory for it if you call the shell script without further arguments.
If the quotes were omitted in this case, *test* would terminate with an error message.

Example 2 The following script makes use of the operator *-gt* to test whether the first file specified in the command line, i.e. *$1*, contains more lines than the one specified after it (*$2*):

```
if [ ` wc -l "$1"`  -gt ` wc -l "$2"`  ]
     then echo $1 contains more lines than $2
fi
```

cat passes on the contents of the file as input for the *wc -l* command via a pipe. The *wc -l* command counts and outputs the number of lines in each of the two files. The shell substitutes the specification in the backquotes for the appropriate number of lines.

Example 3 A test is to be performed to check whether a value has been assigned to the shell variable *TAPE*. This can be done in various ways:

Method A

```
if [ ! -z "$TAPE" ]
    then echo a value is assigned to the TAPE variable
    else ....
fi
```

Method B

```
if [ -n "$TAPE" ]
    then echo a value is assigned to the TAPE
    else ....
fi
```

The *-n* is optional and may be dropped.

The shell parameter *$TAPE* is enclosed within double quotes to prevent *test* from issuing an error message in case no value has been assigned to the corresponding variable.

See also *find*

time time a simple command

time can be used to measure the execution time of a program or a shell script. After the program or shell script is executed, *time* writes the following times to standard error: real, user, sys.

- *real* is the elapsed time during the invoked process and its child processes, i.e. the time between program call and program termination.
- *user* is the time spent by the process or one of its child processes when executing user code. A process executes user code when it executes machine instructions from its own code segment.
- *sys* is the time spent by the process or one of its child processes when executing system code. A process executes system code when it executes machine instructions from system calls.

The output format for *time* is hh:mm:ss.tt, where *hh* stands for hours, *mm* for minutes, *ss* for seconds, and *tt* for tenths of a second.

Syntax **time**[␣**-p**]␣prog[␣arg]...

-p Writes the results of the measurement to the standard error output.

prog
Name of the program (or shell script) to be timed.

arg
Optional arguments that may be passed to *prog* exactly as if *prog* were called without *time*.

i If *time* is called on a multiprocessor system, the sum of user and system time may be greater than real time. A figure of more than 100% for the apparent CPU load is the result of child processes being split between a number of processors.

Exit status Corresponds to the exit status of *prog*.

1-125	Error in *time.*
126	*prog* cannot be executed.
127	*prog* was not found.

Variable *PATH*
Determine the search path that will be used to locate the utility to be invoked.

Locale

The following environment variables affect the execution of *time*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

Measure the execution time of the *ls* command. The standard output of *ls* is redirected to the file *list*.

```
$ time ls -l >list
real    0m0.04s
user    0m0.57s
sys     0m0.08s
```

See also

times
time(), times() [4]

times write process times

The built-in *times* command in the POSIX shell *sh* outputs the total time consumed by the processes which the shell has started so far. The time required for child processes is also output.
The time is subdivided into shell user time and system time (1st line) and child process user time and system time (2nd line). The time is specified in minutes (m) and seconds (s).
The user time is the time which has elapsed during the user phase of processes, while the system time is the time which has elapsed during the system phase.
Use *time* if you want to know the time consumed by a particular command.

Syntax

```
times
```

Locale

The following environment variables affect the execution of *times*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

Finding out the accumulated user and system times of all processes run from the current shell:

```
$ times
0m8.68s 0m2.5s
0m22.74s 0m10.14s
```

In the shell user phase, the processes have taken 8.68 seconds and in the shell system phase 2.5 seconds. The child user phase has so far taken 22.74 seconds and the child system phase 10.14 seconds.

See also

times
time(), times() [4]

touch change file access and modification times

touch is used to set the access and modification times of files to the current or specified date.

Syntax

Format 1: touch[␣**-acm**][␣**-r**␣ref_file |␣**-t**␣time]␣file␣...

Format 2: touch[␣**-acm**][␣MMDDhhmm[yy]]␣file␣...

Format 1 **touch**[␣**-acm**][␣**-r**␣ref_file|␣**-t**␣time]␣file␣...

No option specified

touch sets the last modification and access times for the specified files to the specified or current date. If a file does not yet exist then *touch* creates it. *touch* without an option therefore has the same effect as *touch -am*.

option

-a (access time) *touch* sets the the last access time for the specified files to the specified or current date.

If neither *-a* nor *-m* is specified:
touch sets the access and modification times of the named files to the specified or current date.

-c *touch* does not create files which do not exist. In such a case, no message is output.

-m (modification time) *touch* sets the last modification time for the specified files to the specified or current date.

Neither *-a* nor *-m* specified:
touch sets the last access and modification time for the specified files to the specified or current date.

-r␣ref_file
Instead of the current time, *touch* uses the corresponding date and time from *ref_file*.

-t␣time
Instead of the current time, *touch* uses the time specified in *time*. *time* is output as a decimal number with the following format:
[[CC]YY]MMDDhhmm[.SS]

CC:	The first two figures of the year specification (century). The century specification is optional. If you do not specify a century, the current century is used.

YY:	The last two figures of the year specification (decade and year). The decade and year specification is optional. If no decade and year are specified, the current decade and year are used.
	If the decade and year are specified but the century *CC* is not, then *CC* is calculated as follows:
	for 69≤YY≤99 CC is 19
	for 00≤YY≤38 CC is 20

MM:	Month (01-12)
DD:	Day (01-31)
hh:	Hours (00-23)
mm:	Minutes (00-59)
SS:	Seconds (00-61). The seconds specification is optional. If you do not specify *SS* then the value 00 is used. If you wish to specify the seconds, the value of *SS* must be in the range 00-61 (instead of the usual range 00-59). The values 60 and 61 should be considered as reserve seconds.

The highest date you can specify for *time* is:

```
20380119031407
CCYYMMDDhhmmss
```

file

Name of the input file. *touch* processes all types of files, including directories. Several file names may be specified in one call.
Completely numeric file names may cause problems, as *touch* may interpret them as date arguments.

Format 2 **touch**[␣**-acm**][␣MMDDhhmm[yy]]␣file␣...

No option specified

touch sets the access and modification times of the named files to the specified or current date. If a file does not exist, it is created. Calling *touch* without options is thus equivalent to *touch -am*.

option

-a (access time) updates only the access time of the named files to the specified or current date.

If neither *-a* nor *-m* is specified:
touch sets the access and modification times of the named files to the specified or current date.

-c Prevents *touch* from creating a file if the named file did not previously exist. No corresponding message is issued.

-m (modification time)Updates only the modification time of the named files to the specified or current date.

If neither *-a* nor *-m* is specified:
touch sets both the access and modification times of the named files to the specified or current date.

MMDDhhmm[YY]
Date and time to which the access and/or modification times of the specified files are to be set. The date/time argument comprises eight to ten digits with the following significance:
month (MM) - day (DD) - hour (hh) - minute (mm) - year (YY)

If you specify the year *YY* but not the millennium *CC*, *CC* is inferred as follows:

with 69≤YY≤99, CC is 19
with 00≤YY≤38, CC is 20

The highest date you can specify for *time* is:

```
0119031438
MMDDhhmmYY
```

YY not specified:
touch assumes you mean the current year.

MMDDhhmm[YY] not specified:
The access and/or modification times of each named file are set to the current date and time by default.

file
Name of the input file. *touch* processes all types of files, including directories. Several file names may be specified in one call.
Completely numeric file names may cause problems, as *touch* may interpret them as date arguments.

Error `date: bad date conversion`
You have specified an illegal date, e.g. 13010000.

Variable *TZ*
Determine the timezone to be used for interpreting the *time* option argument.

Locale The following environment variables affect the execution of *touch*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Set the access and modification times of *file* to the current date. No new file is to be created if this file does not exist.

```
$ touch -c file
```

The *ls -l* command can be used to display the time of the last modification; *ls -lu* outputs the access time.

Example 2 Set the access time of *file* to 9 o'clock on 8/26:

```
$ touch -a 08260900 file
$ ls -lu file
-rw-r--r--   1 BERT    qm2         736  Aug 26 09:00 file
```

See also *date*, *ls*
utime() [4]

tput change terminal characteristics

i This command is only helpful for users accessing the POSIX shell via *rlogin*.

You can use *tput* to
- indicate one capability of a terminal (Format 1)
- list a number of capabilities of a terminal (Format 2)
- initialize a terminal (Format 3)
- reset a terminal (Format 4)
- display the long name of a terminal (Format 5)
- clear the screen (Format 6).

Syntax

Format 1: tput[␣**-T**␣type]␣capname[␣parameter...]

Format 2: tput␣-S

Format 3: tput[␣**-T**␣type]␣**init**

Format 4: tput[␣**-T**␣type]␣**reset**

Format 5: tput[␣**-T**␣type]␣**longname**

Format 6: tput[␣**-T**␣type]␣**clear**

Format 1 **Indicating one capability of a terminal**

tput[␣**-T**␣type]␣capname[␣parameter...]

tput indicates capabilities of a terminal as defined in the *terminfo* database (see "System administrator's reference manual" [13], *terminfo()*).

-T␣type
type indicates the type of terminal whose capabilities are to be queried.
If the *-T␣type* option is specified, the shell variables *LINES* and *COLUMNS* and the layer size will not be referenced.

-T␣type not specified
type defaults to the value of the environment variable *TERM*.

capname
(*capability name*) *capname* is the alias (abbreviated form) of a terminal capability as defined in the *terminfo* source file. To find out whether your terminal has a particular capability (attribute), you specify the appropriate alias *capname* (see "System administrator's reference manual" [13], *terminfo()*).

Depending on the type of attribute, *tput* responds as follows:

– Boolean type attribute: *tput* simply sets an exit status (0 for *true* is the terminal has the attribute, 1 for *false* if it does not). In the POSIX shell you can inspect the exit status with *echo $?*.

– string type attribute: *tput* returns the appropriate string.

– integer type attribute: *tput* returns an integer.

If *capname* is an attribute for which no value is assigned to the specified terminal type in the *terminfo* database, *tput* returns -1.

parameter
If the *capname* attribute is a string that takes parameters, you can enter the parameters in *parameter*. *capname* and *parameter* are passed to *tput* as a compound string. An all numeric parameter is passed as a number.

Format 2 **Listing a number of capabilities of a terminal**

tput␣-S

tput can be used to list multiple capabilities of the user's terminal. You pass the capabilities from standard input rather than from the command line (see *Example 4*). Only one terminal capability is permitted per line. If the *-T␣type* option is specified, the shell variables *LINES* and *COLUMNS* will not be referenced. The meanings of the exit statuses 0 and 1 change (see *Error* on page 768).

capname
(*capability name*) *capname* is the alias (abbreviated form) of a terminal capability as defined in the *terminfo* source file. To find out whether your terminal has a particular capability (attribute), you specify the appropriate alias *capname* (see "System administrator's reference manual" [13], *terminfo()*). Depending on the type of attribute, *tput* responds as follows:

– Boolean type attribute: *tput* simply sets an exit status (0 for *true* is the terminal has the attribute, 1 for *false* if it does not). In the POSIX shell you can inspect the exit status with *echo $?*.
– string type attribute: *tput* returns the appropriate string.
– integer type attribute: *tput* returns an integer.
– simple input redirection is possible:

```
tput -S < filename
```

Each line in *filename* is assumed to contain an entry in the form *capname[␣parameter]*.

If only *tput -S* is specified, DEL or @@d must be used to indicate the end of input.

If *capname* is an attribute for which no value is assigned to the specified terminal type in the *terminfo* database, *tput* returns -1.

parameter
: If the *capname* attribute is a string that takes parameters, you can enter the parameters in *parameter*. *capname* and *parameter* are passed to *tput* as a compound string. An all numeric parameter is passed as a number.

Format 3 **Initializing a terminal**

tput[␣**-T**␣type]␣**init**

If the *terminfo* database contains an entry for the user's terminal, *tput* initializes the terminal in accordance with the terminal type specified in *-T␣type*. *tput* performs the following individual activities:

- If present, the terminal's initialization strings are output (*capname is1*, *is2*, *is3*, *if*, *iprog*)
- Any delays (e.g. newline) specified in the entry are set in the terminal driver.
- Tabs expansion is turned on or off according to the specification in the entry.
- If tabs are not expanded, the standard tabs are set (every 8 spaces).

If the *terminfo* entry does not contain the information needed for any of these activities, that activity is silently skipped.

-T␣type
: This indicates the type of terminal whose capabilities you want to use to initialize your terminal.

  -T␣type not specified:
  type defaults to the value of the environment variable *TERM*.

Format 4 **Resetting a terminal**

tput[␣**-T**␣type]␣**reset**

tput outputs the terminal's reset strings (*capname rs1*, *rs2*, *rs2*, *rf*). If the reset strings are not present but initialization strings are, the initialization strings are output. Otherwise, *reset* behaves identically to *init*.

-T␣type
: This indicates the type of terminal whose capabilities you want to use to reset your terminal.

  -T␣type not specified:
  type defaults to the value of environment variable *TERM*.

Format 5 **Displaying the long name of a terminal**

tput[␣**-T**␣type]␣**longname**

If the *terminfo* database is present and contains an entry for the user's terminal (see Format 1, *-T␣type* option), the long name of the terminal is output. This name is the last name in the first line of the description of the terminal in the *terminfo* database (see "System administrator's reference manual" [13], *terminfo()*).

Format 6 **Clearing the screen**

tput[␣**-T**␣type]␣**clear**

tput outputs the clear-screen sequence.

-T␣type
This indicates the type of terminal whose capabilities you want to use to reset your terminal.

-T␣type not specified:
type defaults to the value of environment variable *TERM*.

Exit status When *capname* is of type boolean and the *-S* option is not set:

0 if the specified terminal type has the capability

1 if the specified terminal type does not have the capability

When *capname* is of type string and the *-S* option is not set:

0 if the *capname* capability is defined for the terminal type

1 if the *capname* capability is not defined for the terminal type (nothing is written to standard output)

When *capname* is of type boolean or string and the *-S* option is set:

0 if all lines could be processed succesfully

1 exit status 1 can never occur as no indication of which line failed can be given

When *capname* is of type integer:

0 The exit status is always 0. You can test the value of the standard output to determine whether *capname* is defined for the specified terminal type or not. -1 on standard output indicates that *capname* is not defined.

Error situations are indicated by an exit status of 2, 3 or 4.

Error

Depending on the exit status, *tput* issues one of the following error messages:

```
tput: unknown terminal type
```

terminal type *type* unknown or no *terminfo* database present, exit status 3

```
tput: unknown terminfo capability capname
```

Self-explanatory, exit status 4

Variable

TERM
Default value used for the type of terminal when *-T␣type* is not specified.

File

*/usr/share/lib/terminfo/?/**
Directory containing binary versions of the terminal type descriptions.

/usr/include/curses.h
curses() header file

/usr/include/term.h
terminfo() header file

*/usr/lib/tabset/**
Information on tab handling (see "System administrator's reference manual" [13], *terminfo(), Tabs and initialization*)

Locale

The following environment variables affect the execution of *tput*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Initializing a terminal

```
$ tput init
```

A sequence of control characters that initializes the screen is passed to the user's terminal. The sequence used is the one appropriate to the terminal type defined in the *TERM* environment variable.

Example 2 Displaying the number of columns for the current terminal:

```
$ tput cols
80
```

Example 3 Indicating whether the current terminal is a hardcopy terminal:

```
$ tput hc
$ echo $?
1
```

Since *hc* is a Boolean type value, *tput* simply returns an exit status, which you can inspect with *echo $?*. The returned value of 1 indicates that the terminal is not a hardcopy terminal.

Example 4 Displaying several capabilities in one *tput* invocation

```
$ tput -S <<here
> clear
> cup 10 10
> bold
> here
```

The screen is cleared, the cursor moved to position 10,10 and bold (extra bright) mode turned on. The list is terminated by *here* in the last line.

Example 5 The file *input* has the following contents:

```
cols
lines
```

Using this file as input to *tput* for terminals of types 97801 and 97808 would, for example, produce the following result:

```
$ tput -S < input
89
24
$
```

See also *stty*, *tabs*

tr translate characters

tr reads an input text from standard input, replaces (Format 1 and 2) or deletes (Format 3 and 4) selected characters from it, and writes the result to standard output.

Syntax

Format 1: tr[␣**-cs**]␣string1␣string2

Format 2: tr␣**-s**[␣**-c**]␣string1

Format 3: tr␣**-d**[␣**-c**]␣string1

Format 4: tr␣**-ds**[␣**-c**]␣string1␣string2

If you specify more than one option in the command line for either of these formats, these options can be preceded by a single minus sign with no intervening blanks (e.g. *-cs* or *-dc*).

Replace characters

Format 1 **tr**[␣**-cs**]␣string1␣string2

Format 2 **tr**␣**-s**[␣**-c**]␣string1

tr reads the input text, replacing characters that appear in *string1* with the corresponding characters in *string2*. In other words, the nth character in *string1* is replaced in the input text by the nth character in *string2*. If *string2* contains fewer characters than *string1*, those characters in *string1* which have no corresponding character in *string2* are not replaced (see Example 1 on page 774).

-c Complements *string1* with respect to the currently applicable character set (octal values 001 through 377). The complemented *string1* then then contains all characters of the currently applicable character set except for those specified in the original *string1*.
tr then replaces the nth character of the input text in the complemented *string1* with the nth character in *string2*.

-s (squeeze) After replacement, *tr* reduces all strings of repeated output characters in *string2* to a single character (see Example 2 on page 775).

string1␣[string2]
In *string1* you specify the characters to be replaced; *string2* provides the replacement string.

The characters in both strings must be specified without intervening blanks or other delimiters.

If a string contains metacharacters that have a special meaning for the shell, these metacharacters must be escaped by enclosing the entire string in single quotes ’...’ or by preceding each such character with a backslash \.

The strings can contain the following specifications:

character any printable character.

\octal_number
whereby *octal_number* is a one, two, or three-digit octal number. The backslash must be escaped so that the digits are recognized as an octal number.

tr also processes the NUL character (000 in octal).
Warning: In previous versions, the NUL character was always deleted as an input character.

metacharacters
as escape sequences (same as for the *printf* command). You can enter the following escape sequences:

\\	Backslash (for distinguishing octal numbers)
\a	Warning, alert *)
\b	Backspace *)
\f	Form Feed
\n	New Line
\r	Carriage Return
\t	Tab
\v	Vertical tab *)
*)	These metacharacters are supported only on character-mode terminals (i.e. if you are accessing the POSIX shell via rlogin)

a-z or **[a-z]**
Stands for the set of characters from *a* to *z* inclusive. Characters are sorted in the currently applicable collating sequence. Unlike in internationalized regular expressions, a and z must be ordinary characters, i.e. not equivalence class expressions [=c=] or collating symbols [.cc.].

In the current collating sequence (see *LC_COLLATE*), the character used for *a* must precede the character used for *z*.

"b-a" is an illegal range and is rejected.

In the notation without brackets, "a-a" stands for "a" and so on, but "---" is interpreted as three "-" characters. In the notation with brackets, "[a-a]" and "[---]" lead to undefined results.

Depending on the locale, "a-c" means "abc" or "aäbc", "n-p" means "nop" or "noöp" or "nöop", "t-v" means "tuv" or "tuüv" or "tüuv", and "r-t" can mean "rst", "rsßt" or "rßst".

[:class:] *class* specifies a character class, similar to internationalized regular expressions. The following values are possible for *class*:

```
alnum, alpha, blank, cntrl, digit, graph, lower, print,
punct, space, upper, xdigit
```

Character classes must not be specified in a replacement string. Exception: The classes *lower* and *upper* are permitted if the corresponding character class is specified on the same side in *string1*.

[=equivalence=]
equivalence specifies an equivalence class, similar to internationalized regular expressions.

Equivalence classes must not be specified in a replacement string.

[a*n**]** Stands for *n* repetitions of the *a*, e.g. [a*3] stands for aaa.
Only useful in a replacement string.

If the first digit of *n* is 0, *n* is considered octal; otherwise, it is taken to be decimal.
If *n* is 0 or is omitted, it is taken to be "huge", meaning that the preceding character is to be repeated as often as required to pad *string2* to the length of *string1* (see *Example 1*).

string2 not specified:
string1 (possibly complemented, see *-c*) is used for *string2*.

string1 and *string2* not specified:
string1 is the null string. Either the null string (without option *-c*) or the entire current character set (with option *-c*) is taken for *string2*.

Delete characters

Format 3 **tr**␣**-d**[␣**-c**]␣string1

Format 4 **tr**␣**-ds**[␣**-c**]␣string1␣string2

This format is only useful when *string1* is specified. If the *-s* option is not set, *string2* will be ignored.

-d (d - delete) Deletes all input characters that appear in *string1*.
If the *-s* option is not specified, *string2* is ignored.

-c Complements *string1* with respect to the current character set. The complemented *string1* then contains all characters of the current character set except for those specified in the original *string1*.
tr then deletes all input characters which occur in the complemented *string1*.

-s (squeeze) *tr* reduces all strings of repeated output characters in *string2* to a single character. The *-s* option is meaningless if *string2* is not specified.

string1␣[string2]
In *string1* you specify the characters to be deleted; *string2* contains the characters that are to be reduced to a single character if they appear two or more times in succession in the output (see option *-s*).

Details with respect to how these strings are to be specified are given with *Format 1* on page 770.

string1 and *string2* not specified:
If the *-c* option is not specified, all input characters are copied unaltered to standard output. If option *-c* is specified, *tr* deletes all input characters, i.e. prints nothing on standard output.

Locale The following environment variables affect the execution of *tr*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of range expressions and equivalence classes (eg. *[a-z]*).
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and the behavior of character classes. *LC_CTYPE* also specifies which characters are included in the currently valid character set in conjunction with the *-c* option.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Hint

Ranges of uppercase and lowercase letters cannot always be unambiguously mapped to each other in locales which contain the ’ß’ character (see above under "Replace characters"). The ranges “a-z” and “A-Z” are exceptions here and are treated separately as of this POSIX version.

Nevertheless, do not try to convert lowercase letters to uppercase using the command below. The result is not defined in a locale other than the POSIX or C locale and can vary in older POSIX versions or on other platforms:

$ tr 'a-z' 'A-Z' <file

Instead, use the following character classes to convert lowercase letters to uppercase (or vice versa):

$ tr '[:lower:]' '[:upper:]' <file

$ tr '[:upper:]' '[:lower:]' <file

However, *LC_CTYPE* and *LC_COLLATE* must refer to the same locale for conversion to work correctly. You can ensure that they do by assigning *LANG* or *LC_ALL*.

Example **Replace characters (Format 1)**

Example 1 *tr* without options: simple examples to demonstrate how *tr* works:

```
$ cat days
Monday Tuesday Wednesday Thursday Friday Saturday Sunday
$ tr TS ts <days
Monday tuesday Wednesday thursday Friday saturday sunday
```

Here *tr* replaces all occurrences of *T* with *t* and of *S* with *s*.

```
$ tr TSF ts <days
Monday tuesday Wednesday thursday Friday saturday sunday
```

The second string has fewer characters than the first in this case. *tr* replaces *T* by *t* and *S* by *s*, but leaves *F* unaltered.

Now let us try replacing all lowercase letters with *x*. The following solution is *not* suitable:

```
$ tr '[a-z]' x <days
Mondxy Tuesdxy Wednesdxy Thursdxy Fridxy Sxturdxy Sundxy
```

tr has clearly only replaced occurrences of *a* with *x*. To replace all lowercase letters, we need to call *tr* as follows:

```
$ tr '[a-z]' '[x*]' <days
Mxxxxx Txxxxxx Wxxxxxxxx Txxxxxxx Fxxxxx Sxxxxxxx Sxxxxx
```

Each character in string 1 now has a corresponding *x* in string 2, as the asterisk (*) causes string 2 to be padded with *x* as often as required. The single quotes are essential, since the strings include shell metacharacters.

Example 2 We want to create a list of all the words that appear in *textfile*, one word to a line, a word being defined as any consecutive string consisting only of letters.

```
$ cat textfile

"When shall we three meet again?
In thunder, lightning, or in rain?"

$ tr -cs '[A-Z][a-z]' '[\025*]' <textfile

When
shall
we
three
meet
again
In
thunder
lightning
or
in
rain
```

Delete characters (Format 2)

Example 3 Deleting a non-printing character from a file (*tr -d*)

```
$ tr -d '\016' <file
```

tr deletes from the file the character with the octal code 016 and displays the result on the standard output.

See also *ed*, *sh*, *sed*

trap trap signals

The POSIX shell built-in *trap* is used to define how the current shell is to react to subsequent signals received. You can thus use *trap* in shell scripts to have specific "clean-up" tasks performed before the script terminates, or to define positions at which no interrupts are to take place. *trap* has two functions:

- *trap* defines how the shell is to react to a signal:
  - The shell executes the commands specified in the *trap* command line.
    Any command possibly terminated earlier will not be resumed after the command list is executed. Shell scripts are resumed with the command that follows the one that was interrupted.
  - The shell ignores the specified signal.
  - The shell reverts to default actions for the specified signals. *trap* can be used to reset signal handling to the default behavior.
- *trap* displays all signals for which signal handling defaults were modified in the current shell.

Syntax

```
trap[␣command_list␣signal_number|␣signal_name...]
```

command_list
determines how the shell is to react to the signals specified, i.e. whether it is to
- execute commands if the signal specified is received
- ignore the specified signal
- revert to default actions for the signal specified.

Executing commands

You can specify one or more commands for *command_list*. These commands are to be executed if the signal specified is received. If you specify more than one command, you should separate these by semicolons. The semicolon must be quoted to prevent immediate interpretation by the shell.

The command list must be a single argument, so it must always be enclosed in single quotes '...' or double quotes "..." if argument separators or semicolons appear in it.

If the given *command_list* is not a null string, the signal handling behavior it defines will only be valid in the current shell. *trap* must be explicitly called in each subshell; otherwise, default actions are automatically restored (see the section "Signal handling in the shell" on page 778).

It is relevant to note here that the specified commands are interpreted twice by the shell:
- once when the shell sets the *trap*, and
- once when the corresponding signal occurs, and the shell invokes *trap* to execute the defined commands.

It can thus make a difference whether single or double quotes are used:

'*command_list*'
Special characters are not interpreted until the shell actually invokes *trap* and executes the commands. Shell variables are thus evaluated only when the *trap* routines are executed.

"*command_list*"
The characters $, \, and ` ...` are interpreted by the shell when the *trap* is set. Shell variables are often still undefined at this stage, however.

If you want to prevent the shell script from being executed further when a signal has been received, specify *exit* as the last command in the command list.

Ignoring signals

If a null string ("" or '') is specified for *command_list* the specified signals are ignored.

The corresponding signals are also ignored in every subshell.

Resetting signal handling to default

If *command_list* is not specified the shell reverts to default actions for the signals specified (see the section “Signal handling in the shell” on page 778).

signal_number | signal_name
Number or name identifying the signal for which the shell is to execute the defined actions (see *signal()* [4]). Several blank-separated signals may be specified. *command_list* will then be executed as soon as any one of these signals is received.

The following signals (signal number/signal name) are relevant for the shell:
0 / EOF (Terminate the shell)
1 / SIGHUP
2 / SIGINT
3 / SIGQUIT
15 / SIGTERM

If 0 is specified for *signal_number* this causes the specified *command_list* to be executed on exiting the current shell; 0 is not a signal. This means
– if you have called *trap* interactively, *command_list* will be executed as soon as you press the END key.
– if *trap* is specified in a shell script, *command_list* will be executed after this script.

Signal 9 (SIGKILL) always kills the process, so *trap ''9* will not work.

No argument specified

The *trap* command with no arguments prints the list of commands associated with each signal number for which signal handling has been altered in the current shell. The list is written to standard output in the following format:

```
signal_number: command_list
.
.
.
```

Note, however, that only the signal numbers for which the default actions were modified earlier (with the command *trap*) are displayed (see the section "Signal handling in the shell" below).

Signal handling in the shell

A process can receive a signal at any time during its execution. Such signals may either be generated by the process itself, by another process or by the user at the terminal (e.g. by pressing [DEL]. The shell then reacts to the signal in one of the following ways:

– It ignores the incoming signal.
– It terminates.
– It calls a function to deal with the signal.

The following signals (number/name) are relevant to users who have used *rlogin* to access the POSIX shell:

1 / SIGHUP
: Disconnection of link to terminal

2 / SIGINT
: [DEL]

3 / SIGQUIT
: [CTRL] [\]

9 / SIGKILL
: The command *kill -9 PID*, where *PID* is the process identification number of the corresponding shell

15 / SIGTERM
: The command *kill -15 PID*, where *PID* is the process identification number of the corresponding shell

Depending on whether or not you have defined signal handling with *trap*, the interactive shell (IS) or the shell script in the background (SSB) will react to these signals as follows:

Signal number 1
IS: ignore
SSB: abort

Signal number 2
IS: take defined action after next command or after ↵, otherwise: ignore
SSB: ignore

Signal number 3
IS: take defined action after next command or after ↵, otherwise: ignore
SSB: ignore

Signal number 9
IS: abort
SSB: abort

Signal number 15
IS: ignore
SSB: ignore

Depending on whether or not you have defined signal handling with *trap*, a shell script (shs) or the current foreground process in a shell script (fgp) will react as follows (where *PID* is the process ID of the shell script):

– Signal handling undefined for shell script and current foreground process in shell script

kill -1 PID
shs: abort immediately
fgp: continue running

kill -2 PID
shs: abort after normal termination of foreground process
fgp: continue running

DEL
shs: abort immediately
fgp: abort immediately

kill -3 PID
shs: abort after normal termination of foreground process
fgp: continue running

CTRL \
shs: abort immediately
fgp: abort immediately, writing core dump to disk

kill -9 PID
  shs: abort immediately
  fgp: continue running

kill -15 PID
  shs: abort after normal termination of foreground process
  fgp: continue running

– Signal handling undefined for shell script, defined for current foreground process in shell script

kill -1 PID
  shs: abort immediately
  fgp: continue running

kill -2 PID
  shs: abort after normal termination of foreground process
  fgp: take defined action

DEL
  shs: abort after normal termination of foreground process
  fgp: take defined action

kill -3 PID
  shs: abort after normal termination of foreground process
  fgp: take defined action

CTRL \
  shs: abort after normal termination of foreground process
  fgp: take defined action

kill -9 PID
  shs: abort immediately
  fgp: continue running

kill -15 PID
  shs: abort after normal termination of foreground process
  fgp: take defined action

– Signal handling defined for shell script, undefined for current foreground process in shell script

kill -1 PID
  shs: take defined action after normal termination of foreground process; then resume execution
  fgp: continue running (signal not delivered)

kill -2 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

DEL
shs: take defined action; then resume execution
fgp: abort immediately

kill -3 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

CTRL \\
shs: take defined action; then resume execution
fgp: abort immediately, writing core dump to disk

kill -9 PID
shs: abort immediately
fgp: continue running

kill -15 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

– Signal handling defined for shell script and current foreground process in shell script

kill -1 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

kill -2 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

DEL
shs: take defined action; then resume execution
fgp: take defined action; then resume execution

kill -3 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

CTRL \
shs: take defined action; then resume execution
fgp: take defined action; then resume execution

kill -9 PID
shs: abort immediately
fgp: continue running

kill -15 PID
shs: take defined action after normal termination of foreground process; then resume execution
fgp: continue running (signal not delivered)

The *signal()* function can be used in C programs to define how signal handling is to be implemented (see *signal()* [4]).

Locale The following environment variables affect the execution of *trap*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 To ensure that signal 2 is ignored in a shell script, the following line is included in it:

```
trap '' 2
```

The two single quotes, i.e. the null string, cause signal 2 to be ignored. This means that the shell script cannot be terminated externally by the DEL key or by the command *kill -2 process_id*.

Example 2 Use of the command *trap* in an interactive shell:

```
$ trap 'echo Last logged out: `date` >>$HOME/logfile' 0
$ trap
0, echo Last logged out: `date` >>$HOME/logfile
$ END
.
.
.
login: rose
Password:
$ cat logfile
Last logged out: Mon Mar 9 18:17:23 MEZ 2009
```

The *trap* in the above example defines that a message is to be written to the file *$HOME/logfile* on exiting the current shell. The command list must be enclosed in single quotes here, since *date* is only to be executed when the shell terminates.

Example 3 The shell script *traptest* illustrates how temporary files can be deleted if signals are received during execution. The script contains the following lines (without the line numbers):

```
1  TMP=/usr/rtmp/$$
2  trap "rm -f $TMP; trap 0; exit 1" 1 2 3 15
3  trap "rm -f $TMP; exit 0" 0
4  ls > $TMP
   .
   .
   .
```

Line 1:
 The file name */usr/rtmp/$$* is assigned to the variable TMP. The shell substitutes the process ID of the current shell for *$$*, thus creating a unique file name.

Line 2:
 The command list is enclosed in double quotes, since the TMP variable has already been assigned a value. The following actions are defined for signals 1, 2, 3, and 15: delete the file */usr/rtmp/$$*, reset the end of script definition (0) (see line 3), and terminate the script with exit status1.

Line 3:
0 is the only signal-number specified, i.e. the definition for the end of the script is: delete the file */usr/rtmp/$$*, and terminate the script with exit status 0. This definition must be reset in line 2 with *trap 0*, since the command *exit* terminates the shell script. Otherwise, line 3 would cause the script to terminate with exit status 0.

Line 4:
The file /usr/rtmp/$$ is created. This line must not precede the *trap* command; otherwise, if the script terminates before the shell executes the first *trap* command, the file will not be deleted.

In this case the command *exit* should be explicitly invoked at the end of the command list, otherwise the commands that follow *trap* in the script could execute in an undefined state.

See also *exit*, *kill*
signal() [4]

true return true value

The *true* command simply returns a zero exit status and does nothing else.

You can use *true* in shell scripts to generate the condition *true*.
You can use the companion command *false* to generate the condition *false* (non-zero exit status).

Syntax **true**

Exit status 0

Example The following shell script initiates an endless loop which you can terminate by pressing DEL:

```
while true
do
.
.
.
done
```

See also *false*, *:* (colon)

tsort topological sort

The *tsort* utility writes to standard output a totally ordered list of items consistent with a partial ordering of items containing in the input.

The input consists of pairs of items (non-empty strings) separated by blanks. Pairs of different items indicate ordering. Pairs of identical items indicate presence, but not ordering.

The actions of *tsort* are not affected by the locale *LC_COLLATE*.

Syntax

```
tsort␣[file]
```

file
: Name of the file to order.

  file not specified:
  The standard input is used.

Error
`Odd data`: There is an uneven number of fields in the input file.

Locale
The following environment variables affect the execution of *tsort*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

The command

```
$ tsort <<@@d
> a b c c d e
> g g
> f g e f
> g g
> h h
@@d
```

produces the output:

```
a
b
c
d
e
f
g
h
```

tty output path name of current terminal

tty outputs the path name of the terminal with which the process is linked. The exit status indicates whether or not standard input is a terminal.

If the process is linked with a virtual terminal, *tty* returns the name of the virtual terminal, not the real terminal.

Syntax **tty**[␣**-s**]

-s Inhibits output of the terminal path name, returning the exit status only.

-s not specified:
tty reports an error if standard input is not a terminal.

Exit status

0 Standard input is a terminal.

1 Standard input is not a terminal.

>1 An invalid option was specified.

Error

```
not a tty
```

The standard input is not a terminal and the *-s* option was not specified.

Locale The following environment variables affect the execution of *tty*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the default locale will be used. If any of the variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Output the name of the current terminal:

```
$ tty
/dev/term/003
```

Example 2 The following script is to send output to the screen even if standard output is redirected to a file:

```
  .
  .
echo 'Output to the terminal' > `tty`
  .
  .
```

Example 3 The following script is to generate an error message if standard input is not the terminal:

```
  :
  if tty -s
then
read input
  .
  .
else
echo 'Standard input is not a terminal' >&2
fi
  :
```

type write a description of command type

The POSIX shell built-in *type* is used to indicate how the shell would interpret a given name if it were entered as a command. The command type (and some other information) is written to standard output.

In the POSIX shell *sh*, *type* is an exported alias for *whence -v*; *whence* is a POSIX shell built-in command.

Syntax

type␣name␣...

name
: Name of the command whose type is to be queried. Several blank-separated names may be specified at a time

  If *name* is neither a shell function nor a POSIX shell built-in, the shell searches for an executable file with this name in the directories whose path names are defined in the *PATH* variable.

  The *type* command indicates whether *name* is a shell function or a POSIX shell built-in. If *name* designates an executable file, the absolute path name or a path name in the form *./name* is displayed.
  If *name* is a shell function, *type* will additionally print the function definition. In the POSIX shell, the definition is not shown.

  If *name* is not an executable file, *type* issues an error message. The same error message is also output if *name* does not exist in the directories whose path names are assigned to the *PATH* variable.

Error

```
name not found
```

This error message means:
- either there is no file with this name in the directories that can be accessed via the *PATH* variable
- or the file with this name is not executable.

Variable

PATH
Determine the location of *name*.

Locale The following environment variables affect the execution of *type*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The following series of commands illustrates the kind of information supplied by the shell built-in *type*:

```
$ type mount
mount is /etc/mount
$ type echo
echo is a shell builtin
$ type ls
ls is a tracked alias for /usr/bin/ls
$ type typetest
typetest is ./typetest
```

See also *whence, file*

typeset set attributes for variables

The *typeset* command can be used for two purposes:

– to list variable names and other optional information on standard output
– to set attributes and values for shell variables.

Syntax **typeset**[␣option][␣name[**=**value]]...

If neither *option* nor *name*[*=value*] is given, the names and attributes of all variables are listed on standard output.
If there are options but no *name* arguments, all variables which have these options set are listed along with their attributes.
Using a plus sign instead of a minus sign stops the values from being printed.

option can be used to assign one or more attributes to the variable *name*[*=value*]. When *typeset* is invoked inside a function, a new instance of the variable *name* is created. The value and its attribute are restored when the function completes.
Using a minus sign before the option letters turns on the corresponding attributes; a plus sign turns them off.

You may enter the following list of attributes as options:

-L[num]
Left-justifies *value* and removes leading blanks.
If *num* is non-zero, it defines the length of the field; otherwise, the field length is determined by the length of the first value assignment.
This length is used for subsequent assignments. When the variable is reassigned, it is padded to the right with blanks or truncated as necessary.
Leading zeros are removed if the *-Z* option is also set. The *-L* option turns off the *-R* option.

-R[num]
Right-justifies *value* and pads it with leading blanks.
If *num* is non-zero, it defines the length of the field; otherwise, the field length is determined by the length of the first value assignment. This length is used for subsequent assignments.
When the variable is reassigned, the field is either padded to the left with blanks or truncated from the end.
The *-R* option turn off the *-L* option.

-Z[num]
Right-justifies the *value* and pads it with leading zeros if the first non-blank character is a digit and the *-L* option has not been set. If *num* is non-zero, it defines the length of the field; otherwise, the field length is determined by the length of the first value assignment.

-f The names refer to function names rather than variable names. The POSIX shell stores the functions in the *.sh_history* file. Consequently, you cannot display a function definition on the screen if *.sh_history* does not exist or if the *nolog* option was not set when the function was read. No assignments can be made, and the only other valid options in combination with *-f* are:

-t	Turns on execution tracing for the function.
-u	Causes the function to be marked undefined. The *FPATH* variable is searched to find the function definition the next time the function is referenced.
-x	Allows the function definition to remain in effect across POSIX shell scripts invoked by name. In other words, the function is exported.

-i[num]
The variable is an integer. This option makes arithmetic faster. If *num* is non-zero, it defines the output arithmetic base; otherwise, the first assignment determines the output base.

-l All uppercase characters are converted to lowercase. The *-u* option is turned off.

-r The given variables are marked readonly, which means that their values cannot be changed by subsequent assignment.

-t Tags the variables. Tags are user-definable and have no special meaning to the POSIX shell.

-u All lowercase characters are converted to uppercase characters. The *-l* option is turned off.

-x The given names are marked for automatic export to any new environment.

Error

```
sh: variable: bad number
```

if the number assigned to the variable in the *-i* option was not an integer.

Example

```
$ typeset -L var1="␣␣31"
$ typeset -L
..
var1='31␣␣'
...
$ typeset -l var2=VALUE2
$ typeset -l
var2=value2
```

See also *readonly, export, set, env*

ulimit set or report file size limit

The POSIX shell built-in *ulimit* enables you to

– check the file size limits imposed for the current shell and its child processes

– set or change the individual file size limits for the current shell and all its child processes. Normal users without POSIX administrator privileges may decrease this limit, but not increase it. The new limits apply to files written by the current shell and all its child processes.

  You cannot increase a limit that has been decreased until you have terminated the shell in which you have decreased the limit.

Syntax

Format 1: ulimit[␣**-H**][␣**-S**][␣option]...

Format 2: ulimit[␣**-H**][␣**-S**][␣option]␣limit

Format 1

Check limits

ulimit[␣**-H**][␣**-S**][␣option]...

ulimit writes the limits checked by *option* to standard output.

-H Checks a *hard* limit.

-S Checks a *soft* limit.

Neither **-H** nor **-S** specified:
ulimit writes the *soft* limits to standard output.

option
You can use options to specify the limits to be checked. You can combine the options however you want.

No option specified:
ulimit uses the *-f* option (see *Format 2* below).

-a Checks all limits.

The other options are described under *Format 2* below.

Format 2

Set limits

ulimit[␣**-H**][␣**-S**][␣option]␣limit

ulimit sets the limit defined by *option* to *limit*. You can only set one new limit per command call.

-H Sets a *hard* limit. Normal users without POSIX administrator privileges may reduce any *hard* limit. However, only the POSIX administrator may increase a *hard* limit.

-S Sets a *soft* limit. Any user can set a *soft* limit to a value less than the *hard* limit.

Neither **-H** nor **-S** specified :
ulimit sets *hard* and *soft* limits to the specified value.

option
You can use options to specify the limits to be set. The following limits, described in more detail under *getrlimit()* [4], are available for your current shell and all its child processes:

-a (all) Query all limit values.

-f (file size) Maximum file size (in 512-byte blocks) that you may create (write); there is no limit on reading. If *file size* is 0, no files can be created. If you exceed the default value, you either receive an error message from the appropriate command (depending on the command you have used to create the file) or the new file only contains as much data as the imposed limit can accommodate.

Example for file size

After the command *ls -lR >file*, *file* will contain as many bytes as are permitted by the current size limit.
The command *cp*, on the other hand, will issue an error message if the file to be copied exceeds the currently set file size limit.

-m (memory)Maximum size of the data segment or *heap* (in Kbytes) in a process.

-n (number of filedescriptors) Maximum number of (open) file descriptors permitted in a process plus 1.

-t (time) Maximum CPU time (in seconds) permitted for a process.

No option specified:
ulimit uses the *-f* option.

limit
Sets the size limit for the current shell and all its child processes in accordance with the specified option. Normal users without POSIX administrator privileges may only specify values less than the current size limit defined for *limit*. As a POSIX administrator, however, you may also increase this limit with *limit*. If you specify the string *unlimited* for *limit*, the limit is set to the maximum possible value.

Error
```
sh: ulimit; exceeds allowable limit
```
You have tried to increase the currently set file size limit. This privilege is reserved for POSIX administrators only.

Exit status

0	If the command is executed successfully
>0	Rejection of higher limit or error

Locale The following environment variables affect the execution of *ulimit*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The current soft limit value for the maximum number of file descriptors is increased. All users may do this provided that the new limit value remains below the hard limit value. The new limit value is also valid in a subshell.

```
$ ulimit -Sn 80
$ ulimit -Sn
80
```

Example 2 You want to check and then reduce the maximum file size.
This limit can only be increased again by the POSIX administrator.

```
$ ulimit
unlimited
$ ulimit 20000
$ sh
$ ulimit
20000
```

The new limit is also valid in subshells. From now on, only files smaller than 20,000 * 512 bytes can be created.

See also *getrlimit(), signal(), ulimit()* [4]

umask get or set the file mode creation mask

The POSIX shell built-in *umask* sets or displays the current user file-creation mode mask. This mask defines the access permissions to be assigned to all new files and directories which you subsequently create in the current shell or in one of its subshells.

Changes made in the file-creation mode mask remain in effect until a new value is set with *umask* or the shell in which *umask* was originally called is terminated.

The POSIX administrator can use *umask* to define the value of the file-creation mode mask in the */etc/profile* file. Since */etc/profile* is executed by every login shell, the access permissions set in this way are valid for every used logged in on the system (see Example 1 on page 799).

Syntax **umask**[␣**-S**][␣mask]

-S The mask is symbolically output in the following form:
`u=<access permissions>,g=<access permissions>,o=<access permissions>`
where u = user, g = group, o = others and access permissions = r, w, x

mask
Three octal digits comprising the file-creation mode mask. This mask defines the permissions to be assigned to all new files or directories that the user subsequently creates in the current shell or in any of its subshells (see „Setting permissions with the file-creation mode mask“ below).

Since *umask* can only withhold existing permissions from the base settings, you cannot use it to have execute permissions directly assigned to files, regardless of what you specify for *mask*. Use the command *chmod* instead.

mask not specified:
umask displays the current user file-creation mode mask in the following output format `0nnn` (`0` indicates octal notation and `nnn` indicates the current file-creation mode mask in octal).

Setting permissions with the file-creation mode mask

When creating files and directories the following permissions are generally assigned as base settings (see *open()* [4]):

- `rw-rw-rw-` to files, i.e. 110110110 in binary notation
- `rwxrwxrwx` to directories, i.e. 111111111 in binary notation

umask is only capable of withholding existing permissions from these base settings. This means that you cannot use *umask* to have execute permission automatically assigned to new files. You may, however, set the appropriate x-bit with the *chmod* command.

The file-creation mode mask comprises three octal digits, which are specified when calling *umask*. The permissions they refer to are derived as follows:

1. Convert the digits in the mask to their binary equivalents.
2. Create the complement to each of these binary numbers, i.e. replace the zeros by ones, and ones by zeros.
3. Add this binary complement to the binary value of the base mode setting by logically ANDing the two; the result thus only contains ones in positions where both pairs have ones; in all other positions it contains zeros.

Example

The file-creation mode mask 022 changes permissions as follows:

– Files:
  The base mode setting for files is `110110110`.

```
1. The binary equivalent of octal 022 is   000010010
2. The complement of this value is         111101101
3. AND operation:                          111101101
                                           110110110
                                           ---------
                                           110100100
```

  The permissions for all newly created files will thus be `rw-r--r--`

– Directories:
  The base mode setting for directories is 111111111.

```
AND operation:   111101101
                 111111111
                 ---------
                 111101101
```

  All new directories created will thus have the permissions `rwxr-xr-x`

File */etc/profile*
File executed by each login shell; used to set a shell environment.
The POSIX administrator normally defines one mask value for users without special privileges and one for *root* in this file.

Locale The following environment variables affect the execution of *umask*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following lines are often included in the */etc/profile* file:

```
if [ "$USER" != "admin" -a "$USER" != "root" ]
then
        umask 066
fi
```

Since every login shell executes the */etc/profile* file, the file-creation mode mask 066 applies to all users except *root* and *admin*.

The following permissions are thus assigned by default:
– for new files created: `rw-------`
– for new directories created: `rwx--x--x`

Example 2 Change the file-creation mode mask and display it:

```
$ umask 033
$ > new
$ mkdir newdir
$ ls -ld new newdir
-rw-r--r--   1 ANNE     other          0   Mar 22 09:49 new
drwxr--r--   2 ANNE     other        520   Mar 22 16:40 newdir
$ umask
0033
```

The output of the *ls -ld* ... command shows which access permissions are assigned to new files and directories when the file-creation mode mask has been set to the value 033.

See also *chmod*
chmod(), *creat()*, *open()*, *umask()* [4]

umount unmount a file system

The command *umount* unmounts a file system which was mounted using *mount*. The file system entry is deleted from the table */etc/mnttab*.

Syntax **umount**[␣**-V**]␣{resource | mountpoint}

option

-V Outputs the entire command line on screen but does not execute the command. The command line is generated with all the options and arguments specified by the user as well as the values taken from */etc/vfstab*. You should select this option in order to subject a command line to a general check and validity check.

resource

Specifies the resource which is to be unmounted. Format as for *mount*.

For bs2fs file systems the option must be specified in UPPERCASE in accordance with the entry in the internal tables. Special characters of the POSIX shell such as '$' or '*' must be escaped explicitly.

In the case of an NFS resource this is replaced by the name of the source server. This must be followed by a colon and the path name of the resource.

mountpoint

Specifies the local position at which *resource* must be unmounted. You must specify an absolute path name.

Hint Specification of the *mountpoint* option is always recommended for unmounting bs2fs file systems. If a bs2fs file system is mounted in multiple positions in the POSIX file system (i.e. identical *resource* specification in *mount*) and only *resource* is specified for *umount*, only the file system mounted last is unmounted. However, if *mountpoint* is specified, the corresponding file system is always unmounted.

The *umount* command is rejected if it refers to a file system mounted using the *bs2fscontainer* option and at least one bs2fs file system is still mounted. In the case of a successful *umount* for the bs2f container, the bs2fsd copy daemons are terminated automatically.

File */etc/mnttab*
Table of mounted file systems.

/etc/vfstab
Table of automatically mounted file systems.

See also *mount, umountall*
mount, umount [4]

umountall unmount file systems

umountall unmounts all mounted file systems with the exception of *root*, */proc*, */var* and */usr*. If **only** *file_system_type* is specified, *umountall* relates only to file systems of the specified type. The file systems are unmounted in the order *nfs* - *bs2fs* - *ufs*. This ensures that the bs2fscontainer file system required for bs2fs file systems is only unmounted in the ufs when it is no longer needed, i.e. when no further bs2fs file systems are mounted.

Syntax **umountall**[␣**-F**␣file_system_type][␣**-k**][␣**-l** |␣**-r**]

-F Specifies the file system type to be unmounted.

-k Sends the SIGKILL signal to processes which have opened files in the file system.

-l Limits the operation to local file systems (*ufs* and *bs2fs*).

-r Limits the operation to remote file systems (*nfs*).

-b Limits the operation to bs2fs file systems.

Error If the file systems can be unmounted no message is output. Error and warning messages are issued by *fsck* and *mount*.

Hint If the *-F* option is specified together with one or more of the options *-l*, *-r* and *-b* and the options are mutually compatible, the *-l*, *-r* and *-b* options have priority. For example, *mountall -F bs2fs -l* and *mountall -F ufs -l* have the same effect as *mountall -l*: all local file systems (i.e. all ufs and bs2fs file systems) are unmounted. The entries *mountall -F bs2fs* and *mountall -b* also lead to the same result: all bs2fs file systems are unmounted.

File *\/etc/mnttab*
Table of mounted file systems.

/etc/vfstab
Table of automatically mounted file systems.

See also *fsck, mount, mountall, umount*

unalias remove alias definitions

The built-in *unalias* command in the POSIX shell *sh* deletes the alias variables entered using *alias*.

Syntax

Format 1: unalias␣name␣...

Format 2: unalias␣-a

Format 1 **unalias␣**name␣...

name
The alias definition specified in *name* is deleted.

Format 2 **unalias␣-a**

-a All alias definitions are deleted.

Exit status

0 The command was executed successfully.

>0 Error or one of the *name* operands is an invalid alias name.

Locale The following environment variables affect the execution of *unalias*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The existing alias definitions are output and the alias variable defined with the name lx is deleted.

```
$ alias
autoload='typeset -fu'
cat=/usr/bin/cat
command='command '
false='let 0'
functions='typeset -f'
hash='alias -t -'
history='fc -l'
integer='typeset -i'
ll='ls -al'
local=typeset
ls=/usr/bin/ls
lx='ls -l'
nohup='nohup '
...
$ unalias lx
$ alias
autoload='typeset -fu'
cat=/usr/bin/cat
command='command '
false='let 0'
functions='typeset -f'
hash='alias -t -'
history='fc -l'
integer='typeset -i'
ll='ls -al'
local=typeset
ls=/usr/bin/ls
nohup='nohup '
...
```

See also *alias*

uname return system name

The *uname* command writes information related to the current operating system to standard output.

Syntax

uname[␣option]...

No option specified
The name of the operating system is output, e.g. *POSIX-BC*.

option

-a (all) Outputs the following information: the name of the operating system, the system's node name, the version number of the operating system, the revision status of the operating system version, the machine hardware name and the processor type, e.g. *POSIX-BC D016ZE07 09.0A A43 BS2000 /390*

-m (machine type) Outputs the machine hardware name, e.g. *BS2000*.

-n (node) Outputs the node name of the operating system. This is the name by which a system is known in a communication network, e.g. *D016ZE07*.

-p (processor type) Outputs the processor family of the system that you are currently using, e.g. */390*.

-r (release) Outputs the version number of the operating system, e.g. *09.0A*.

-s (system) Outputs the name of the operating system. This is the name by which the operating system is known in the local installation, e.g. *POSIX-BC*.

-v (version) Outputs the revision status of the POSIX system version, e.g. *A43*.

Locale The following environment variables affect the execution of *uname*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You want to find out the node name of the operating system as well as the version number of the operating system you are running:

```
$ uname -nr
D016ZE07 09.0A
```

See also *uname()* [4]

uncompress expand compressed files

uncompress expands files compressed by *compress* and restores them to their original form. If the calling process has the appropriate privileges, the owner, access permissions, and the access and modification times are not changed.

Whenever possible, each file specified is replaced by a file with the same name but without the *.Z* extension.

Expansion is not performed if

– the file to be created already exists and *uncompress* is running in the background
– the specified file was compressed with a higher value for *maxbits* (see *compress -b* on page 228) than your current system can process.
– there are links to the compressed file.

Syntax **uncompress**[␣**-cfv**][␣file...]

No option specified
The specified files are expanded.

-c *uncompress* writes the expanded files to standard output. No files are modified or created. *uncompress -c* has exactly the same effect as *zcat*.

-f (force) *file.Z* is expanded even if a file named *file* already exists. *file* is overwritten.

-f not specified:
uncompress asks whether the existing file should be overwritten or not. You are not asked for confirmation, however, when *uncompress* is running in the background. The specified file is not expanded.

-v (verbose) *uncompress* issues a message confirming successful expansion.

```
file.Z: -- replaced with file
```

file
Name of a file compressed with *compress*. You can specify more than one file. Each file name must include a *.Z* suffix which you do not have to specify when invoking *uncompress*. The expanded file is assigned the name *file*. *file.Z* is deleted after being successfully expanded (unless the *-c* option is specified). Access permissions, access and modification dates, and the owner of the file remain unchanged.

Error
```
file.Z: not in compressed format
```
The specified file is not available in compressed format or is a directory.

```
file.Z: compressed with xxbits, can only handle yybits
```
The specified file was compressed with too high a value for *maxbits* (see *compress -b* on page 228). The system on which you called *uncompress* cannot process this value. Compress the file again using the value specified as *yy* in the error message or with a lower value.

`file.Z: -- has xx other links: unchanged`
There are *xx* links to the specified file. The file is not expanded.

`uncompress: corrupt input`
The SIGSEGV signal (segmentation violation; an addressing error caused by unauthorized segment access) was received, which normally indicates that the input file is corrupted.

Locale The following environment variables affect the execution of *uncompress*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example You want to expand the file *topsecret.Z*. The same directory already contains a file called *topsecret*, but this can be overwritten.

```
$ ls -l
total 62
-rw-------  1  felix    group1    4862 Mar 12 10:16 topsecret
-rw-------  1  felix    group1   26326 Feb 08 10:27 topsecret.Z

$ uncompress -v topsecret.Z
topsecret already exists; do you wish to overwrite topsecret (y or n)? y
topsecret.Z: -- replaced with topsecret

$ ls -l
total 138
-rw-------  1  felix    group1   69845 Feb 08 10:27 topsecret
```

See also *compress*, *zcat*

unexpand convert spaces to tabs

The *unexpand* command writes files or the standard input to the standard output. Blanks at the beginning of each line are converted to the maximum number of tabs, followed by the minimum number of blanks needed to pad the line to the next tab stop, which were originally filled by the converted characters.

A tab stop is set after every 8 column positions by default. All backspace characters are copied to the output and cause the column position count for for tab stop calculations to be decremented. The column position count will not be decremented below zero.

Syntax **unexpand**[␣**-a**|␣**-t**␣tablist][␣file...]

-a Not only are the blanks at the start of each line converted, but also all sequences of two or more blanks directly in front of a tab stop are converted into the maximum number of tabs followed by the minimum number of blanks needed to pad the line to the next tab stop, which were originally filled by the converted characters.

-t␣tablist
Specifies the tab stops. The argument *tablist* must consist of one or more numbers, separated by blanks or commas, in ascending order. A list separated by blanks must be enclosed in quotes. If only one number is specified, the tab stops will be set to *tablist* column positions instead of the default 8 column positions.
If multiple numbers are given, the tabs will be set at the specified column positions.

Each tab stop position *N* must be an integer value greater than zero, and the specifications must be in ascending order. This means that tabbing from the start of the line of output to position *N* causes the next character output to be in the (*N*+1)th column position in that line.

For characters that are one position behind the last position defined in a list with multiple tab stops, there is no conversion of blanks into tabs.

If *-t* is specified, conversion of blanks is not restricted to the leading blanks. *-a* is ignored in this case.

file
The file whose blanks are to be replaced by tab characters.

Locale The following environment variables affect the execution of *unexpand*:

LANG	Specifies a default value for the internationalization variables that are unset or null. If *LANG* is unset or null, the corresponding default value from the internationalized environment is used. If one of the internationalization variables contains an invalid setting, the command behaves as if none of the variables have been defined.
LC_ALL	If this variable has been assigned a value, i.e. it is not a null string, this value overrides the values of all the other internationalization variables.
LC_CTYPE	Determines the internationalized environment for the interpretation of byte sequences (e.g. single-byte characters as opposed to multi-byte characters in arguments and input files). The internationalized environment for the processing of tab characters and blanks and for the specification of the width in column positions each character would occupy on a constant-width output device.
LC_MESSAGES	Determines the format and contents of error messages.
NLSPATH	Determines the position of message catalogs for the processing of *LC_MESSAGES*.

Standard output (stdout)

The standard output is equivalent to the input files with blanks converted into the appropriate number of tabs.

Hint The default behavior of *unexpand*, whereby only leading blanks are taken into consideration, may not be desired in some cases. Users who always want to convert all blanks in a file should use an alias definition to create a version of *unexpand* that is always called with the options *-a* or *-t␣8*.

See also *expand*, *tabs*

uniq report or filter out repeated lines in a file

The command *uniq* searches a file for sequences of identical lines, and writes the file to standard output, removing all but one of repeated lines in the process. Note that repeated lines must be adjacent in order to be found, i.e. the input file must be sorted.

Syntax

Format 1: uniq[␣**-c**|␣**-d**|␣**-u**][␣**-n**][␣**+m**][␣input_file[␣output_file]]

Format 2: uniq[␣**-c**|␣**-d**|␣**-u**][␣**-f**␣field][␣**-s**␣char][␣input_file[␣output_file]]

The two formats are defined together since option *-n* in format 1 is equivalent to the option *-f␣field* in format 2 and option *+m* in format 1 is equivalent to option *-s␣char* in format 2.

No option specified
The named *input_file* is output without repeated lines.

option

-c Outputs all lines without repetitions, starting each line with a decimal number to indicate how often it occurred repeatedly in *input_file*. *uniq* ignores the *-u* and *-d* options if set with the *-c* option.

-d Outputs one copy each of only those lines that are repeated in *input_file*.

-u Outputs only the lines that are not repeated in *input_file*.

-n Causes the first *n* characters from the beginning of the line to be ignored when comparing for duplicates. If the *-n* option is combined with the *-m* option, the first *n* characters after the *m*th field are ignored. Blanks following the *m*th field are not ignored: they must be allowed for in the value of *n*.

-n not specified:
Lines are compared from the beginning of the line or beginning with field *m+1*.

Option *-n* is equivalent to option *-f␣field* in format 2.

+m Ignores the first *m* fields from the beginning of the line, plus any tabs or blanks located in front of a field, when comparing for duplicates. A field is a string of non-blank characters separated from its neighbors by tabs or blanks.
Option *+m* is equivalent to option *-s␣char* in format 2.

-m not specified:
Lines are compared from the beginning of the line or beginning with character *n+1*.

input_file
Name of the file that is to be examined.

input_file not specified:
uniq reads from standard input.

output_file
Name of the file to which the output is to be written.
output_file not specified: *uniq* writes to standard output.

Locale The following environment variables affect the execution of *uniq*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files) and which characters constitute a blank character in the current locale.
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 You want to search a file for identical lines, regardless of where they are located in the file. A count showing how often each of these lines occurs is also to be output.

```
$ sort file | uniq -c
```

Example 2 You want to output the 10 most frequently occurring words in the file *text*.

```
$ cat text \
>    | sed 's/  */ /g' \
>    | tr ' ' '\n' \
>    | sed '/^$/d' \
>    | sort \
>    | uniq -c \
>    | while read N W; do printf "%06d %s\n" $N "$W"; done \
>    | sort -r \
>    | head -n 10
```

Explanation:

- *sed* generates a list from *text* in which one or more blanks are replaced by one blank.
- *tr* replaces blanks in this list by newline characters.
- *sed* removes empty lines from this list.
- *sort* sorts this list according to EBCDIC.
- *uniq -c* outputs all lines without repetitions and in front of each one enters how frequently it occurs.
- The *while* loop replaces the frequency by a 6-digit number with leading zeros.
- *sort -r* sorts this frequency list backward, i.e. the most frequent line is contained in the first line.
- *head* outputs the first 10 lines of this list.

See also *comm*, *sort*

unset unset values and attributes of variables and functions

The POSIX shell built-in *unset* removes the specified shell function or shell variable from the current environment.

The built-in environment variables *IFS, MAILCHECK, PATH, PS1*, and *PS2* cannot be deleted using *unset*.

Syntax

unset[␣**-f**][␣**-v**]␣name␣...

-f If option *-f* is specified, *name* refers to a shell function.

-v If option *-v* is specified, *name* refers to a shell variable. Read-only shell variables cannot be deleted.

If neither *-f* nor *-v* is specified, *name* refers to a shell variable. If there is no variable with a corresponding name then it is possible that any function having the same name may be deleted.

name
Name of the shell variable or function to be removed from the current environment. Several blank-separated names may be specified in a single command line.

Exit status

0 All shell variables or shell functions have been successfully deleted.

>0 At least one shell variable or shell function could not be deleted.

Locale

The following environment variables affect the execution of *unset*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Remove the shell function *ll*:

```
$ type ll
ll is a function
ll(){
ls -al $* | pg
}
$ unset ll
$ ll
ll not found
```

See also *set*

usp set POSIX control parameters dynamically

This command can only be issued by the superuser. The *usp* command has the following functions:

- Displays the current values of all POSIX control parameters (*-s* option).
- Modifies the current values of the following POSIX control parameters: *DBLPOOL*, *FORCEDTERM*, *HDSTNI*, *HDPTNI*, *HEAPSZ*, *MAXTIMERC*, *MAXUP*, *NOSTTY*, *NOTTY* and *NPROC*.
  Depending on the option specified (*-p* or *-P),* the modification is either only valid until the POSIX subsystem is terminated or also the next time POSIX is started.
- Checks whether a value specification is permitted for a selected control parameter (*-c* option).

Syntax

usp␣**-h**

usp␣**-s**[␣parameter]

usp␣**-c**␣parameter **-v**␣value

usp␣**-p**␣parameter **-v**␣value

usp␣**-P**␣parameter **-v**␣value

Options

-h (h - help) The syntax of the *usp* command and a list of all POSIX control parameters are output. In addition to the names and the meanings of the POSIX control parameters, this list also specifies whether the modification of a parameter is supported by the *usp* command (`SUPPORTED`) or not (`unsupported`).

-s (s - show) The current value of the control parameters specified with *parameter* is output. If *parameter* is not specified, the current values of **all** (supported and unsupported) control parameters are output.

parameter
Name of the control parameter. Only the control parameters *DBLPOOL*, *FORCEDTERM*, *HDSTNI*, *HDPTNI*, *HEAPSZ*, *MAXTIMERC*, *MAXUP*, *NOSTTY*, *NOTTY* and *NPROC* which can be modified with the support of the *usp* command can be specified using the *-c*, *-p* and *-P* options. **All** control parameters can be specified with the *-s* option. The specification can be in uppercase or lowercase characters. You can also obtain the information regarding whether or not the modification of a control parameter is supported by the *usp* command using `usp -h`.

-c (c - check) Checks whether the value specified using the *-v* option is within the limits permitted for *parameter* (minimum value ≤ *value* ≤ maximum value).

-p The current value of the control parameter specified using *parameter* is replaced by the value specified using the *-v* option provided this value is legal (see the *-c* option). The condition (*value* > current value) must also be fulfilled for the following control parameters: *HDSTNI*, *HDPTNI*, *HEAPSZ*, *MAXUP*, *NOSTTY*, *NOTTY* and *NPROC*. The modification only applies for the current POSIX subsystem session. After the POSIX subsystem has been restarted, the value from the POSIX information file SYSSSI.POSIX-BC.<version> applies again.

i A modification to the control parameter *DBLPOOL* only becomes effective the next time the *posdbl* command is issued. The contents of the global program cache are not saved. A combination of the *usp* and *posdbl* commands is therefore required to modify the size of the global program cache; for details on this, see the POSIX manual "Basics for Users and System Administrators" [1].

-P (like *-p* option). The new value is also entered in the POSIX information file SYSSSI.POSIX-BC.<version> and consequently also applies after the POSIX subsystem has been restarted.

Before the modification is made in the POSIX information file, a backup copy is created with the name SYSSSI.POSIX-BC.<version>.SAVE.<date>.<time>.

-v value
(v -value) Specifies the value which is to be set or checked.

Hint You are recommended to enter the modified values in the SYSSSI file (e.g. with the *–P* option) and to use them the next time the system is started. This makes it unnecessary to adjust them dynamically again during the system session.

When the maximum value *HDPTNI* (number of local file systems) is increased and used, the new value must be contained in the POSIX information file SYSSSI.POSIX-BC.<version> the next time POSIX is started. If more local file systems are entered in the management tables (e.g. `/etc/vfstab`) than the value in the POSIX information file permits, the start of the POSIX subsystem is aborted with an error.

All dynamic modifications to control parameters are documented by means of logging in POSIX. Each modification that is made to a value is documented on the console. In addition, all modifications are recorded in the POSIX file `/var/adm/messages`.

uudecode decode a binary file

uuencode and *uudecode* are used in combination to send a text or binary file via *mailx*. You can send the file either directly or via a *mailx* chain linking a series of directly linked systems.

uudecode reads an encoded file and recreates the original file with the access permissions (file modes) and name specified in the encoding information (see *uuencode* on page 819).

You must have write permission for the encoded file.

uudecode runs with the user ID assigned to *uucp*. Thus permission to use *uudecode* may be denied in a directory where there is no write permission for "others".

Refer to *uuencode* for further information.

Syntax

uudecode[␣file]

file
: File to be decoded.

  file not specified:
  uudecode reads from standard input.

Locale

The following environment variables affect the execution of *uudecode*:

LANG
: Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL
: If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE
: Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
: Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH
: Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

User *bill* has been mailed an encoded file:

```
$ mailx
From john Wed Mar 11 14:42 MET 2009
Content_Length

begin 744 scrpt
M9F]R(&YA;64@*:6X@*@ID;R @:68@6R M9" B)&YA;64B(%T*(" @('!H)&X@
M)&-H;R B*&1V>BD@)&YA;64B" @("!;'-E(&%C:&\@(B!@;',@+7,@)&YA
1;65@(@H@(" @)FD*9&]N90HB

end
? q
```

The header line of the encoded message contains the word *begin* followed by the file mode (744) and the name of the file (scrpt). The file is now to be restored to its original condition and have the specified name *scrpt*:

```
$ mailx | uudecode
$ cat scrpt
for name in *
do  if [ -d "$name" ]
    then echo "(dir) $name"
    else echo " `ls -s $name`"
    fi
done
```

See also *mailx*, *uuencode*

uuencode encode a binary file

uuencode and *uudecode* are used in combination to send a text or binary file via *mailx*. You can send the file either directly or via a *mailx* chain linking a series of directly linked systems.

uuencode takes the named source file or the data from standard input and produces an encoded version of it on the standard output. Only printing ASCII characters are used for encoding, which among other things enables the transfer of 8-bit data over systems that are not 8-bit transparent. The encoding includes the file mode (permissions) and destination file name for recreating the file on the remote system.

Syntax **uuencode**[␣source-file]␣destination-file

source-file
File to be encoded.

source-file not specified:
uuencode reads from standard input.

destination-file
Name of the destination file. Here you specify a path name which refers to the remote system.

Hint *uuencode* and *uudecode* should be used as follows:

You call *uuencode*:

```
uuencode [source-file] destination-file | mailx system1!system2! ..!user
```

The encoded file is sent to the specified *user* on the remote system, who can then decode it with *uudecode*. The user on the remote system must have write permission for the file.

The encoded file produced by *uuencode* is a normal text file and can be edited with any text editor to change the file mode or the name of the destination file.

Encoding the source file expands it by 35% (3 bytes become 4 plus control information) and thus increases the time required to transmit it.

Locale The following environment variables affect the execution of *uuencode*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example A file called *letter* is to be sent in encoded form to user *bill* working on system *roland*. Once decoded the file is to be called *scrpt*

```
$ uuencode letter scrpt | mailx roland!bill
```

See also *mailx*, *uudecode*

uuname list names of known systems

uuname lists the names of the local system.

Syntax **uuname**[␣**-l**]

-l Returns the local system name in the format `"%s\n", <system name>`
This name may differ from the system name output by the *uname -n* command.

-l not specified:
uuname returns the exit status 0.

Locale The following environment variables affect the execution of *uuname*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Querying the exit status and displaying the local system name

```
$ uuname
$ echo $?
0
$ uuname -l
D016ZE07
```

See also *uname*

vi screen oriented (visual) display editor

vi is a display-oriented text editor.

i Only users who have accessed the POSIX shell via *rlogin* can use *vi* (except in line mode).

If you call *vi* on a block-mode terminal, the *ex* editor will automatically be started instead.

Layout of this description

The description of *vi* is divided into eight main parts:

- Command overview (extract) (on page 823ff)
- Introduction (on page 826)
- *vi* modes (on page 827)

  Command mode
  Input mode
  Last line mode
  ex command mode
  ex input mode
- Programm invocation (on page 830)
- Screen layout (on page 833)
- Functionality (on page 834)

  Saving the editor buffer and quitting *vi*
  Text buffers
  Movement commands
- Commands (on page 839)

  Definitions
  Control commands
  Commands of the *vi* command mode
- Adapting *vi* to the terminal (on page 858)

  Customizing the *vi* environment
  Environment variables

Command overview

The following overview summarizes the most common *vi* commands, grouping them together by function. In the section entitled *Commands* you will find a detailed description of the commands in alphabetical order.

- **Invoking vi**

vi ↵	Call *vi* with empty editor buffer
vi *file* ↵	Call *vi* and load *file*

- **Quitting vi**

ZZ	Quit *vi*, writing editor buffer out to current file; as *:wq* ↵
:w ↵	Write editor buffer to current file
:w *file* ↵	Write editor buffer to *file*
:q ↵	Quit *vi* if changes saved
:q! ↵	Quit *vi*, discarding unsaved changes
:wq ↵	Quit *vi*, writing editor buffer out to current file; as *ZZ*

- **Positioning the cursor**

h	One character to left
j	One line down in same column
+	One line down and to start of line
↵	One line down and to start of line
k	One line up in same column
-	One line up and to start of line
l	One character to right
H	Top of screen
M	Middle of screen
L	Bottom of screen
0	Left edge of screen
|	Left edge of screen
$	Last character in line
^	First non-whitespace character in line
w	Start of next word

e	End of next word
b	Start of previous word
W	Start of next word (extended word)
E	End of next word (extended word)
B	Start of previous word (extended word)

- **Positioning the window**

CTRL **d**	Half a screen down
CTRL **u**	Half a screen up
CTRL **f**	One screen down
CTRL **b**	One screen up
CTRL **e**	One line down
CTRL **y**	One line up
z↵	Current line to top of screen
z.	Current line ot middle of screen
z-	Current line to bottom of screen
1G	Start of file
n**G**	Line *n* to middle of screen
G	End of file

- **Deleting and restoring text**

x	Delete character at cursor position
X	Delete character to left of cursor
dd	Delete current line
dG	Delete from current line to end of file
dH	Delete from start of file to current line inclusive
D	Delete rest of line from cursor position
u	Restore deleted text from standard buffer
U	Restore current line
p	Write buffer contents after current cursor position
P	Write buffer contents before current cursor position

- **Changing text**

r	Replace current character with next character entered
R	Overwrite text starting at current character
o	Insert blank line below current line
O	Insert blank line above current line
a	Append text after current character
A	Append text to end of line
i	Insert text before current cursor position
I	Insert text at start of line

- **Copying**

Y	Yank current line
yy	Yank current line
Yp	Duplicate current line
yyp	Duplicate current line
:10,13**t** 20	Copy lines *10* through *13* below line *21*
:.t.	Duplicate current line
:t.	Duplicate current line
:r *file*	Copy contents of *file* below current line

- **Cut and paste**

3**dd**	Delete *3* lines including current line
p	Insert saved lines
"a3**dd**	Delete *3* lines and save in buffer *a*
"ap	Insert saved line below current line

- **Search and replace**

/xyz	Search forward for *xyz*
/xyz␣␣**/**	Search for *xyz* and 2 blanks
:s/xyz**/**abc**/**	Replace *xyz* with abc in current line
:/old**/s/**old**/new**	Find *old*, then replace *old* with *new*
:1,$s/old**/**new**/g**	Globally replace *old* with *new*

Introduction

vi displays a maximum of 23 lines of the file being edited. You can look at different parts of the file by moving this window. *vi* offers a wide range of text editing options. You can

- create, modify, copy and delete text
- position the cursor using simple commands (e.g. at the beginning or end of a word, line, sentence, paragraph, or the file)
- search and replace text patterns using regular expressions
- call a subshell
- process a range of the current file with a POSIX command
- edit multiple files during the same session and copy text from one file to another
- recover a file after an interrupted session.

vi is an enhanced version of the *ex* line editor (see *ex*). You can switch between the two editors while editing and you can execute *ex* commands from within *vi*.

vi modes

The *vi* editor provides you with a number of modes in which you can operate:

- *vi* command mode
- *vi* input mode
- *vi* last line mode
- *ex* command mode
- *ex* input mode.

When invoked, the editor always comes up in the *vi* command mode, from which you can switch to other modes if required. The mode of the editor determines how keystrokes are interpreted.

vi command mode

When *vi* is invoked, it comes up in the *vi* command mode. No text can be entered in this mode. Keystrokes are immediately interpreted as *vi* commands, without being displayed on the screen. If the entered command is legal, it is executed, and the result is immediately displayed on the screen.

vi input mode

The input mode allows you to enter or modify text in the editor buffer. The editor switches to this mode when you enter one of the *vi* commands *A, a, C, c, I, i, O, o, S, s* or *R* (see the section entitled “Commands of the vi command mode” on page 845). All following input characters, including various non-printing characters, are written to the buffer and the screen.
Most *vi* commands cannot be used in input mode. There are, however, a few *vi* commands that have a special significance in input mode. These include:

ESC
  Exit input mode; return to *vi* command mode.

DEL
  Terminate input mode; return to *vi* command mode.

↵
  Newline.

CTRL @
  Repeat last text input. You enter this command immediately after switching to input mode. *vi* inserts the last text entered in input mode provided this text consists of no more than 128 characters. Control is immediately switched back to command mode.

[CTRL]**d**
: If you have defined automatic indentation, you can use [CTRL]d to move the margin one tab stop to the left. You can set the shift width with the *shiftwidth* option. This command is only relevant at the beginning of a new input line and with the *autoindent* option set.

[CTRL]**h**
: Go back one character.

[CTRL]**t**
: One tab to the right in accordance with the value of *shiftwidth*. This command may only be entered at the start of a new input line.

[CTRL]**v**
: Insert a non-printing character.

[CTRL]**w**
: Go back one word.

\ Escape for rubout character.

vi last line mode

In the *vi* last line mode, you can enter *vi*, *ex*, and POSIX commands in the status line. The last line mode is activated by the input of a colon (:), slash (/), or question mark (?). Another method is to enter an exclamation mark (!), followed by a cursor movement command to a line. Commands entered in the last line mode must be terminated with [↵] or [ESC]. The input of a command can be aborted by pressing [DEL].

Caution!
Entering [ESC] in the *vi* last line mode does not delete a command just entered, but causes it to be executed instead. In *vi* last line mode you must use [DEL] to delete an entered command.

: Entering a colon in the *vi* command mode causes all following input up to the next [ESC] or [↵] to be interpreted as an *ex* command. (All *ex* commands are described under *ex*, *ex commands*.) After the colon is entered, the cursor moves to the status line at the bottom of the screen, and the colon as well as the input command are displayed there. Almost all *ex* commands can now be used, except for those that would switch *ex* to the *ex* input mode.
The percent character (%) represents the name of the file currently in the buffer; the hash character (#) stands for the name of the file last processed during the same session. (see section “Current and alternate file” on page 334).

Example

```
:! diff # %↵
```

vi writes the differences between the previously edited file and the current file on standard output. Neither of the two files is changed.

/ or **?**
When a slash or question mark is entered, the cursor moves to the status line, allowing you to specify a regular expression for a forward search (with /) or a backward search (with ?). The *vi* command *n* repeats the search in the same direction; *N* repeats the search in the reverse direction.

! When an exclamation point is entered in the *vi* command mode and a movement command specifying a line is given to indicate the scope, the cursor moves to the status line. The exclamation mark is then displayed at the start of the status line. If you enter a second exclamation mark as the movement command, the position is the current line. The movement command is not displayed. You can now enter a POSIX command, which must be terminated with ↵ or ESC. The scope, i.e. the range from the current line to the specified position, becomes the input of the POSIX command (if it reads from standard input) and is replaced by its output (standard output and standard error). If no output is provided by the command (e.g. *true*), the specified range is deleted, i.e. replaced by a "null" string.

ex command mode

You switch to *ex* command mode by entering the command *Q* in *vi* command mode. You thus quit the display-oriented *vi* and switch to the line-oriented *ex* editor. Entering the command *vi*↵ in *ex* command mode returns you to *vi*.

ex input mode

You switch to the *ex* input mode by entering the command *a, i* or *c* in the *ex* command mode. All input in this mode is written to the editor buffer. To terminate this mode you enter a single period in the first column of a line.

Most *ex* commands can be entered in one of two ways:

– from within *vi* command mode, by entering the *vi* command colon : followed by the *ex* command required.

– from within *ex* command mode.

Program invocation

When invoked, the *vi* editor comes up in the *vi* command mode. If you have switched to *vi* input mode, pressing ESC (or DEL) will take the editor back to the *vi* command mode.

Syntax **vi**[␣option]...[␣file]...

option

-t␣tag
The file containing the *tag* is loaded for editing. The editor positions the line containing the definition of the tag in the center of the screen. A tags file containing the search strings for the definition must be in the same directory. This option is typically used by for C programmers who want the editor to be positioned on the definition of a function or macro as soon as the file is opened. The *tags* file needed for this purpose must previously have been created with the *ctags* command.

-l The lisp mode is activated, and the text is correspondingly indented to comply with typical Lisp programming conventions.
The following *vi* commands have special meanings in lisp mode: *(*, *)*, *{*, *}*, *[[* and *]]*.

-r[␣file]
Restores a *vi* session if the *vi* editor or the system crashed during your previous session.
Changes that are only in the editor buffer are not copied to the edited file after an editor or system crash. The POSIX operating system does, however, try to back up the buffer contents by creating a copy of the buffer, if possible. The *file* containing changes made prior to the crash is recovered and retrieved into the *vi* buffer. You can now continue editing the file or write the changes to another file.

-L Lists the names of all the files saved following a system or editor crash.

-R Opens the named *file* in read-only mode. This mode prevents the original *file* from being accidentally overwritten.

Caution!
The file can still be overwritten with the *ex* command *w!*

-w␣n
Sets the window size to *n* text lines.

-w␣n not specified:
The window size is set to the value of the *LINES* environment variable. If this variable has not been defined, the default value is as set in the *terminfo* definition for the terminal.

-c␣command

This option enables you to invoke *vi* and directly execute an *ex* command or use a *vi* movement command to position the editor at a specific line of the file being edited. If you use a movement command, the line required will be displayed in the center of the screen. By contrast, if you execute an *ex* command, the editor will be positioned at the last line of the file after the command is executed, unless the *ex* command you specify (e.g. search) positions the editor itself.

command not specified:
vi issues a usage message and aborts.

command specified:
command may be specified as a line number (*n*), a search command (*/pattern*, see the section entitled *Commands of the vi command mode*), or any other *ex* command ("*ex command*" or '*ex command*'). The specified command is executed when *vi* is loaded.

n
: *n* is an integer. *vi* is positioned to the *n*th line of the file.

/pattern
: *vi* is positioned to the line containing *pattern*. *pattern* is a simple regular expression (see *Tables and directories, Regular expressions*). If the specified *pattern* includes metacharacters, you must escape such characters with a backslash \ or enclose *pattern* in single quotes '*pattern*', so that the shell does not interpret the metacharacters.

'ex-command' or "ex-command"
: *ex-command* can be any arbitrary *ex* command. The *ex* command must be quoted (using single or double quotes) in order to prevent it from being interpreted by the shell. If the editor is not already positioned as a result of an *ex* command, *vi* will position to the last line of the file.

Example

When *vi* is called with:

```
vi -c "set number showmode" appointments
```

the file *appointments* is opened, the cursor is position on the last line of the file, and the line numbers and the *vi* mode are displayed on the screen (see example in *ex* description).

file

Name of the file you want to edit. If you give a number of files, *vi* begins with the first file specified. The *ex* command *n* can be used to switch to the next file (see also *ex* commands *rew* and *ar*).

file not specified:
If you invoke *vi* without a file name, an empty buffer is initially provided. If required, the contents of this buffer can be later written to a named *file* by using the *ex* command *w file*.

Acoustic signal (not for block-mode terminals)

An acoustic signal is sent to the terminal when

– you press the $\boxed{\text{ESC}}$ or $\boxed{\text{DEL}}$ keys in command mode

– you use an illegal command

– *vi* receives a SIGINT signal.

If the *vi* editor receives a SIGINT signal ($\boxed{\text{DEL}}$) during text input, or during the input of a command on the bottom line, the input is terminated (or the command cancelled) and the editor returns to the command mode. The receipt of a SIGINT signal in the command mode produces an acoustic signal.

Screen layout

A character screen on a terminal is generally made up of 24 lines and 80 columns. By default, the first 23 screen lines are used to display the text of the file being edited. In xterm sessions more than 24 lines can be displayed. In this case the number of screen lines that *vi* uses is determined automatically.

The last line on the screen is a status and command line. The status line is used to enter commands and to display information and messages from the *vi* editor.
Text lines that do not fit on the screen are continued in the next line.

vi uses two special characters as markers in column 1 to identify the line status.

~ The tilde (~) identifies lines that are present on the screen but not in the editor buffer. These are lines past the end of the file. If the last text line of a file is located in the middle of the screen, for example, all lines thereafter will be marked with ˜. The tilde disappears as soon as you enter text into the first such marked line. When you invoke *vi* with a new or empty file, all screen lines except for the first and last line (status line) are marked with this character.

@ The commercial at (@) marker indicates lines which *vi* cannot display correctly on the screen. There are two possible causes:

- A text line may extend over more than one line on the screen. This means that text lines may be present in the editor buffer, but the space on the screen after the last fully displayed text line does not suffice for another full line of text.
- Deleting individual lines from a file can mean that what appears on the screen no longer matches the contents of the editor buffer. In this case, the *vi* command CTRL L can be used to redraw the screen.

The last line on the screen is the status line. It is used:

- to enter *vi* commands that begin with **/**, **?**, **!** or **:**
- to display messages
- for the output of *ex* commands
- to display the mode (the command mode is not displayed).

Functionality

vi always works on a buffer, not on files. When you start a *vi* session, a copy of the file you are editing is read into the editor buffer. If you omit the file name or specify a name that does not exist, you will begin with an empty buffer. All your editing changes will initially be recorded in this buffer; the original file is not changed until you copy the buffer contents back to it. This is done by explicitly saving the buffer during the session (with the *ex* command *w*) or while quitting the *vi* editor (with the *ex* commands *wq*, *x*, or the *vi* command *ZZ*). Use the *ex* command *q!* if you prefer to quit *vi* without modifying the original file. If you are creating a new file, it will not be created until you explicitly save the buffer contents to this file.

Saving the editor buffer and quitting vi

vi must be in *vi* command mode in order to save the editor buffer or quit *vi*.

You save the contents of your editor buffer to the edited file or to a specified file by means of the following *ex* command (see *Functionality of vi, Entering ex commands*):

:w[␣file]
(write, *ex* command) The contents of the editor buffer are saved to the specified file.

file not specified:
The contents of the editor buffer are saved to the edited file.

You have the following ways of quitting *vi*:

:q	(quit, *ex* command) Quit *vi*. This command functions only if no changes have yet been made to the editor buffer or if the modified editor buffer was saved to a file.
:q!	(quit, *ex* command) Quit *vi*. Changes made to the editor buffer are lost.
:x	(exit, *ex* command) Quit *vi* and write the modified editor buffer to the current file.
ZZ	(*vi* command) Quit *vi* and write the modified editor buffer to the current file.
:wq[␣file]	(write and quit, *ex* command) Quit *vi* and write the editor buffer to the specified *file*. *file* not specified: The contents of the editor buffer are written to the current file.

Text buffers

The *vi* editor makes use of

– one temporary buffer

– 9 numbered buffers

– 26 named buffers

The contents of these buffers can be accessed by using *vi* commands in the *vi* command mode.

Temporary buffer

The last change that you make in the editor buffer is stored by *vi* in the temporary buffer. If, for example, you have deleted a line, the buffer will contain this line. It is used by the *vi* commands *U* and *u* (*undo*). The *u* command therefore allows you to reverse the effect of the last command that changed the editor buffer. *u* also reverses the effect of *u*.

If the last *vi* command was a copy (*y*), delete (*d*), or replace (except *R* and *r*) command, the temporary buffer can also be accessed by using the *vi* commands *P* and *p* (*put*).

P and *p* copy the contents of the temporary buffer before (*P*) or after (*p*) the current line. Unlike *U* (*u*), *P* (*p*) does not modify the temporary buffer. This allows you to use *P* (*p*) several times in order to insert the same text at multiple locations in the file.

Caution!
The contents of the temporary buffer are overwritten by each command that changes the editor buffer. The temporary buffer cannot therefore be used to copy text from one file to another.

The only commands that may be used between a copy, delete, or replace command and the *vi* command *P* (*p*) are cursor movement commands (see “Movement commands” on page 837). This is because other commands would change the contents of the temporary buffer.

If *vi* is in input mode and you use one of the arrow keys, the *vi* command *U* (*u*) cannot be subsequently used to undo editing changes.

Numbered buffers

When you delete one or more lines (*vi* command *d*), the text you delete is copied to the first of nine numbered buffers. If you now delete some more lines, the contents of buffer 1 are copied to buffer 2, and the most recently deleted lines are again preserved in buffer 1. Thus, buffer 1 always contains the most recently deleted material, buffer 2, the text from the previous delete, and so on, until buffer 9, which contains the material deleted nine steps ago.

The contents of numbered buffers can be retrieved using the *vi* commands *P* and *p*. Numbered buffers are referenced by a double quote and the number of the buffer in question. For example: `"4P`

This *vi* command inserts the contents of buffer number 4 before the current line (or current position of the cursor).
The *vi* dot (.) command recovers the contents of the buffer from the next numbered buffer, provided your last *vi* command also retrieved text from a numbered buffer. In the above example, you would thus retrieve the contents of buffer number 5. The contents of numbered buffers are not lost when you switch files (with *ex* command *n* or *e*).

Named buffers

A copy (*y*) or delete (*d*) command can be used to write text into one of the twenty-six named buffers. These buffers are designated in lowercase from *a-z* or uppercase from *A-Z*. Lowercase and uppercase letters refer to the same buffer, however, with the following difference.
When you use a lowercase letter, the old buffer contents are overwritten by the new text, i.e. are deleted. By contrast, when uppercase letters are used, the old buffer contents are retained, and the new text is appended to the old. The *vi* editor does not change the contents of a named buffer during an editor session unless you explicitly overwrite its contents. *vi* writes text into a named buffer when you enter a double quote, followed by the buffer name and one of the *vi* commands *d* or *y*.

Examples

`"A10dd`
Delete (*dd*) the current line and 9 additional lines (10) and append them to the contents of buffer *A*.

`"by4w`
Copy (*y*) the current and the next three words (*4w*) into buffer *b*.

`"cCstring`ESC
Overwrite (*C*) the current line from the cursor position to the end of the line with *string*, and save the overwritten text in buffer *c*.

`"Ap`
Recover the text from buffer *A* and insert (*p*) into the file after the current line or position.

Movement commands

vi provides you with a large number of commands, including search commands, which control the position of the cursor on the screen. These "movement" commands are entered in the *vi* command mode. The following overview lists the most important movement commands. The definitions of paragraph, section, sentence, word and extended word are given in the section *"Definitions" on page 839*.

Character-oriented positioning

[n] $\boxed{\text{CTRL}}$ **h**	**n** characters to the left
[n]**h**	*n* characters to the left
[n]**l**	*n* characters to the right
0	to the start of a line
^	to the first non-whitespace character in the line
[n]|	to the first or *n*th column of the line
$	to the last character in the line
[n]**f**char	forward to the *n*th instance of *char*
[n]**F**char	back to the *n*th instance of *char*
[n]**t**char	forward to the position to the left of the *n*th instance of *char*
[n]**T**char	back to the position to the right of the *n*th instance of *char*

Word-oriented positioning

[n]**b**	back to the beginning of the *n*th previous word
[n]**B**	back to the beginning of the *n*th previous extended word
[n]**e**	forward to the end of the *n*th word
[n]**E**	forward to the end of the *n*th extended word
[n]**w**	forward to the beginning of the *n*th word
[n]**W**	forward to the beginning of the *n*th extended word

Line-oriented positioning

[n]**k**	up *n* lines in the same column
[n]**j**	down *n* lines in the same column
[n] $\boxed{\text{CTRL}}$ **J**	down *n* lines in the same column

[n]↵	down *n* lines to the first non-whitespace character
[n]**+**	down *n* lines to the first non-whitespace character
[n]**-**	up *n* lines to the first non-whitespace character
[line]**G**	to the specified *line* number or end of file (if no *line* is given)
[n]**$**	to the last character of the *n*th line

Positioning by sentences, paragraphs, and sections

[n]**(**	back to beginning of *n*th previous sentence
[n]**)**	forward to beginning of *n*th sentence
[n]**{**	back to beginning of current paragraph
[n]**}**	forward to beginning of next paragraph
[n]**[[**	back to *n*th previous section boundary
[n]**]]**	forward to *n*th section boundary
%	to the matching parenthesis or brace in C source programs.

Screen-oriented positioning

[n]**H**	to the first character in the *n*th text line on the screen
M	to the middle of the screen
[n]**L**	to the first character in the last text line on the screen
[line]**z+**	current line or specified *line* to top of screen
[line]**z.**	current line or specified *line* to middle of screen
[line]**z-**	current line or specified *line* to bottom of screen

Searching for patterns and markers

/pattern	forward to *pattern*
?pattern	back to *pattern*
'marker	to marked line (beginning of line)
` marker	to *marker*.

Commands

When invoked, the *vi* editor comes up in the *vi* command mode. If you have switched to *vi* input mode, pressing the ESC (or DEL) key will take the editor back to the *vi* command mode.

As described above, you can enter *ex* commands either in *vi* command mode or in *ex* command mode. Only the *vi* commands are described below. *ex* commands are described under *ex*.

Hitting ESC or DEL in the *vi* command mode cancels a partial command. ESC sounds an acoustic signal for character terminals if the editor is not in input mode or if there is no partially entered command.

Caution!
Entering ESC in the *vi* last line mode does not delete a command just entered, but causes it to be executed instead. In *vi* last line mode you must use the DEL key to delete an entered command.

Unless otherwise specified, the commands are valid only in *vi* command mode and have no special effect in input mode.

Definitions

Extended word
: The term "extended word" refers to any sequence of characters which does not include any blanks, tabs, or newline characters. See *Word*.

Paragraph
: A paragraph is defined by the value of the *ex* option *paragraphs*. Blank lines and lines in which a section begins are also treated as paragraph boundaries.

Section
: A section is defined by the value of the *ex* option *sections*. Lines that begin with the form-feed character (CTRL L) or a left brace { are also treated as section boundaries.

  If the *ex* option *lisp* has been set, any left parenthesis at the start of a line is also treated as a section boundary.

Sentence

A sentence end is defined by

a period (.),
an exclamation point (!), or
a question mark (?)

followed by at least *two* spaces (to avoid confusion with abbreviations) or a newline character. To allow for quotations, any right parentheses, right square brackets, or single or double quotes between the punctuation and the newline character or spaces are ignored.

Word

A word is either any sequence of alphanumeric characters or a string of special characters. A word is terminated by a blank, tab, newline character or the following word.
See *Extended word* on page 839.

Examples

((!!++;-.	is one word
me&you2	are 3 words (me & you2), but one extended word.

String

Any sequence of characters.

Control commands

To enter a control command, you hold down CTRL and press the key for the command required. Many control commands can be prefixed by a positive integer which specifies a *count*. The square brackets in the description signify that the specification of a *count* is optional. You must not press CTRL whilst entering *count*. The specified *count* is not displayed, but influences the effect of the subsequent command. If you specify an incorrect value, you can cancel your input by pressing ESC. The *count* is used to:

– indicate the range of text to be affected in a movement command, e.g.

  `5`CTRL`U`
  scrolls back the screen by five lines.

– specify a repetition factor, e.g.

  `4`CTRL`B`
  scrolls four screen pages back.

Unless explicitly stated otherwise, the default value for *count* is one.

CTRL **@**
In *vi* input mode:
If you enter this and nothing else, the last text input is repeated at the position at which you enter CTRL @. Afterwards, control is automatically returned to command mode.

CTRL @ only functions for a maximum of 127 characters.

[count] CTRL **b**
(backward) Scrolls backward by 21 screen lines to display the window above the current one. A *count* can be used to indicate the number of windows the editor should go back. If possible, two overlapping lines from the previous screen are displayed in the new window.

[count] CTRL **d**
In *vi* command mode:
count not specified:
count = 11, or last *count* used with CTRL *d* or CTRL *u*
(down) Causes the screen to scroll forward by half a window. The *count* specifies the number of text lines to be scrolled, and will be remembered during your *vi* session for future CTRL D and CTRL U commands.

In *vi* input mode:
count not specified:
In input mode, this command causes the cursor to back up by *shiftwidth* spaces over the indentation provided by the ex option *autoindent* or CTRL t (see *ex*, *ex* options). CTRL d only functions in a line in which no characters have been entered as yet.

count can also be: ^ or *0*

^CTRL d Cancels automatic indentation for this line.

0CTRL d Terminates the automatic indentation feature.

[count] CTRL **e**
Scrolls forward by the number of lines given in *count*, leaving the cursor where it is if possible.

[count] CTRL **f**
(forward) Scrolls forward by 21 screen lines. A *count* may be used to indicate how many screen pages to scroll forward.

CTRL **g**
Displays the following information in the status line:
- the current file name
- possibly a status entry such as *[Modified]* if the file has been changed since the last time it was saved with the *ex* command *w*
- the current line number
- the total number of all text lines in the editor buffer
- the percentage of the current line to the total length of the file in lines.

This command is equivalent to the *ex* command *f*.

[*count*] CTRL **h**
(same as rubout character)

In *vi* command mode:
The cursor is moved by *count* characters to the left but no further than the left margin (see also the *vi* command *h*).

In *vi* input mode:
A *count* cannot be specified.

The cursor is then moved by one character to the left but stops at the beginning of the text just entered.

[count] CTRL **j**
(same as MENU and ↓)
Moves the cursor *count* lines down in the same column.

This command is equivalent to CTRL n and *j*.

CTRL **l**
Clears and redraws the current screen. This command can be used when messages or reports are displayed on the screen (e.g. as a result of a *write*).

[count] CTRL **m**
(same as ↵)
Moves the cursor to the first character in the next line that is not a blank or tab. A *count* specifies the number of lines to go forward.

[count] CTRL **n**

This command is equivalent to CTRL j and *j*.

[count] CTRL **p**

Moves the cursor *count* lines up in the same column.

This command is equivalent to the *vi* command *k*.

CTRL **r**

(refresh) The current screen is cleared and redrawn. Previously deleted lines marked with @ are removed. See CTRL l.

CTRL **t**

In *vi* input mode:
(tabulator) Inserts white space, defined by the value specified in the *ex* option *shiftwidth* (see section "ex options" on page 352). The white space will, however, not be "visible" until the *vi* input mode is terminated. The inserted space can only be backed over by using the CTRL d command.

[count] CTRL **u**

count not specified:
count = 11, or last *count* used with CTRL d or CTRL u
(up) Scrolls up a half-window of text. A *count* can be specified to scroll a specific number of lines. The *count* is remembered during the *vi* session for future CTRL d and CTRL u commands.

CTRL **v**

In *vi* input mode:
"Quotes" or "escapes" a special character so that it can be placed in the text (e.g. escape or control characters). For instance, the sequence CTRL v ESC places the ESC character into the file.

CTRL **w**

In *vi* input mode:
(word) Backs up to the start of the previous word, but cannot be used to move beyond the text just entered. The backed over words remain displayed on the screen but are deleted from the buffer and must be re-entered, if required.

[count] CTRL **y**

Scrolls backward by *count* lines (towards the beginning of the file), leaving the cursor where it is, if possible.

CTRL **[**

(equivalent to ESC)

In *vi* command mode:
Cancels a partially entered command; sounds an acoustic signal if there is none.

In *vi* last line mode:
Terminates input of a command just entered and executes it.

In *vi* input mode:
Terminates *vi* input mode.

ESC

See CTRL [.

Commands of the vi command mode

Most *vi* commands accept a preceding number as an argument. Unless explicitly stated otherwise, the default value is one. This number, or count, is shown within square brackets in the description, which indicates that the entry is optional. The specified count is not displayed, but influences the effect of the following command. If you specify an incorrect count, you can cancel your input by pressing ESC.

The following cases must be differentiated:

[count]**command**

Here, *count* specifies how many times the command is to be executed. *count* must be a positive integer. *count* cannot be zero since 0 is also a *vi* command.

count not specified:
vi assumes a value of 1 for *count*.

[line]**z**

vi places the line with the specified *line* number at the top, bottom, or center of the screen (see detailed description of the *vi* command *z*).

line not specified:
vi places the current line at the top, center, or bottom of the screen.

[column]**I**

Specifies the column to which you position the cursor.

The following *vi* commands can be followed by a movement command *movecmd* to indicate the range to be affected by the command:

c, d, y, <, >, !, and =.

The <, >, !, and = commands, which only process whole lines, affect all lines that are fully or partially included in the specified range.

The range processed by the *c, d*, and *y* commands extends from (and including) the current cursor position to the position specified by the movement command. It is thus significant whether the cursor position is set by line or by word. For example, if the cursor position is set by line, all lines (including the current line) are processed as complete lines. If the cursor position is set by word, the processed range extends till the position before or after the word, depending on whether the cursor was set to the beginning or end of the word.

[count]**a**

(append) Switches to *vi* input mode, appending the entered text after the current cursor position. A *count* can be used to specify how many times the inserted text is to be replicated, but only if the inserted text is limited to one line.

[count]**A**

(append) Switches to *vi* input mode, appending the entered text at the end of the current text line. If the inserted text is all on one line, a *count* can be used to specify how many times the inserted text is to be replicated, but only if the inserted text is limited to one line. This command is equivalent to *$a*.

[count]**b**

(back) Backs up to the beginning of a previous word, where *count* specifies how many words to back up.

[count]**B**

(back) Backs up to the beginning of a previous "extended" word, where *count* specifies how many words to move.

[count]**c**movecmd

(change) Overwrites, i.e. changes a range of text. This command must be followed by a movement command.

- If the position specified by *movecmd* is in the current line, this position is marked by a $ character, and the editor enters the *vi* input mode to replace the range between the cursor and the $ by the entered replacement text.
- If the position specified by *movecmd* is in a new text line, the behavior of *c* depends on whether the scope of the change is defined by line or not. If the scope is defined by line, all fully or partially affected lines are deleted. However, if *movecmd* defines the scope by word, only the affected range is deleted. In both cases, *vi* switches to input mode to replace the deleted text by the new text entered. *vi* saves the deleted text in the temporary buffer, which means that it can be recovered with *P* or *"lp*, for example.

count

A count can be passed through to the movement command.

[count]**cc**

The command *countcc* causes the whole of the current line (or *count* lines) to be changed, regardless of the cursor position in the current line.

[count]**C**

(change) Changes the rest of the current line. This command is equivalent to *countc$*.

[count]**d**movecmd
[count]**dd**

(delete) Deletes a range of text.

This command must be followed by a movement command. *d* deletes the range from the current cursor position to the end of the indicated range. If more than part of a single line is affected, the deleted text is saved in the numbered buffers 1 - 9, which means that it can be recovered with *p*.

count	A count can be passed through to the movement command which indicates the range.
d	The *countdd* deletes the whole of the current line (or *count* lines).

"buffer[count]**d**movecmd
"buffer[count]**dd**

Deletes and stores in named buffers.
The text from the current cursor position to the end of the indicated range is deleted from the file and stored in a named buffer. *buffer* is a single uppercase or lowercase letter.

D (delete) Deletes the rest of the current line. This command is equivalent to *d$*.

[count]**e**

(end) Moves the cursor forward to the end of the *count*th word.

[count]**E**

(end) Moves the cursor forward to the end of the *count*th extended word.

[count]**f**char

(find) *f* must be followed by a single character. *vi* scans the rest of the current line (from left to right) for that character and moves the cursor to it if found. A *count* is equivalent to repeating the search that many times.

A semicolon repeats the search in the same direction, while a comma repeats it in the reverse direction.

[count]**F**char

(find) *F* must be followed by a single character. *vi* scans backward in the current line (i.e. from right to left) for that character and moves the cursor to it if found. A *count* is equivalent to repeating the search that many times.

A semicolon repeats the search in the same direction, while a comma repeats it in the reverse direction.

[line]**G**

(go to) *vi* moves the cursor to the beginning of the line specified by line number *line*.

line not specified:
The cursor position is set to the last line of the file.

[count]**h**
(home) Moves the cursor by *count* characters to the left, but only in the current line.

[count]**H**
(home) Moves the cursor to the top line of the screen. If a *count* is given, the cursor is moved to that line on the screen, counting from the top. In both cases, the cursor is placed on the first non-whitespace character on the line.

[count]**i**
(insert) Switches to *vi* input mode, inserting the entered text before the current cursor position. If the new text is limited to one line, a *count* can be specified to indicate how many times the text is to be replicated.

[count]**I**
(insert) Switches to *vi* input mode, inserting the entered text before the first character of the current line. If specified, a *count* repeats the effect (see above).

[count]**j**
Moves the cursor down by *count* text lines in the same column.
This command is equivalent to CTRL j and CTRL n.

[count]**J**
Joins the current line with the next one, supplying appropriate white space: one space between words, two spaces after a period, and no spaces at all if the first character of the next line is a right parenthesis *)*. A *count* can be used to specify the number of lines to be joined.

[count]**k**
Moves the cursor up by *count* text lines in the same column.
This command is equivalent to CTRL P.

[count]**l**
Moves the cursor by *count* characters to the right, but only in the current line.
This command is equivalent to *space*.

[count]**L**
(last) Moves the cursor to the first non-whitespace character of the last text line on the screen. If specified, a *count* moves to that line counting from the bottom.

Example

`d3L` deletes all lines from (and including) the current line up to (and including) the third text line from the bottom.

mmarker
(mark) Marks the current cursor position. *m* must be followed by a *marker*, which can be any single lowercase letter.

Addressing

\` marker	A backquote moves the cursor to the exact position of *marker*.
’marker	A single quote moves the cursor to the first character in the line containing *marker*.

M (middle) Moves the cursor to the middle line on the screen, at the first non-whitespace position on the line.

n Repeats the last / or ? scanning command.

N Repeats the last / or ? scanning command, but in reverse direction.

o (open) Switches to *vi* input mode and opens (i.e. inserts) a line below the current line.

O (open) Switches to *vi* input mode and opens a new line above the current line.

p Fetch text from temporary buffer

(put) Writes text from the temporary buffer after the cursor. If the text was saved by *vi* commands as a whole line (e.g. *dd*, *Y*), it is inserted in a line below the current cursor position.

"buffer**p**
(put) Fetch text from numbered or named buffer

You can specify the *buffer* as:
– a digit from 1-9 to retrieve text from the buffer with the corresponding number
– a letter, to retrieve text from the named buffer with the corresponding name

P
"buffer**P**
(put) Similar to *p*, but putting the text before (or above) the current cursor position.

Q (quit) Quits *vi* mode and enters *ex* command mode. You must enter the *vi*↵ command to return to the *vi* command mode.

[count]**r**char
(replace) Must be followed by a single character *char*; the character under the cursor is replaced by the specified one. If a count is specified, the next *count* characters are replaced with the single character given.

R (replace) Replaces several characters; *vi* enters the replace (or typeover) mode at the current cursor position. The characters on the screen are overwritten by the characters entered, until the input is terminated with ESC.

[count]**s**

(substitute) Deletes the single character under the cursor and enters *vi* input mode; the entered text replaces the deleted character. A count specifies how many characters from the current line are changed. The last character to be changed is marked with a $, as in *c*.

Example

```
5sblah blah blah ESC
```

replaces the character under the cursor and the next four characters to its right by the string *blah blah blah*. The same effect can be achieved with:

```
c5lblah blah blah ESC
```

[count]**S**

(substitute) Switches to *vi* command mode. Whole lines are substituted (same as *cc*). A *count* can be used to indicate how many lines to replace.

[count]**t**

(to) *t* must be followed by a single character. *vi* scans forward through the remainder of the current line for the specified character. If it finds the character, it places the cursor on the character which precedes it. A count is equivalent to searching for the *count*th occurrence of the character. Using , or ; to repeat the search is not meaningful.

[count]**T***char*

(to) *T* must be followed by a single character. *vi* scans backwards through the current line for the specified character. If it finds the character, it places the cursor on the character which comes after it. A count is equivalent to searching for the *count*th occurrence of the character. Using , or ; to repeat the search is not meaningful.

u (undo) Reverses the last change made to the temporary buffer. If repeated, will alternate between these two states, thus is its own inverse.

Example

`d3w`	deletes three words from the current cursor position onward
`u`	puts back the three words
`u`	deletes the three words again.

The contents of the temporary buffer can be accessed by using the *p* and *P* commands.

If *u* is used after an *insert* command that inserted at least one new text line, the text deleted with *u* is saved in numbered buffer 1.

U (undo) Restores the current line to its state before the cursor was last moved to it. *U* only functions as long as you have not left the current line.

[count]**w**
: (word) Moves forward to the beginning of the next word; a *count* specifies how many words to move.

[count]**W**
: (word) Moves forward to the beginning of the next extended word; a *count* specifies how many words to move.

[count]**x**
: Deletes the character at the current cursor position. With a *count*, deletes *count* characters forward from the current cursor position, but only on the current line.

[count]**X**
: Deletes the character before the cursor. A *count*, if specified, deletes that many characters before the cursor on the current line.

[count]**y**movecmd
[count]**yy**
: Saves text in the temporary buffer

(yank) This command must be followed by a movement command to indicate the range. The specified text range is copied (yanked) into the temporary temporary buffer.

count	A *count* copies the specified range that many times.
y	The *yy* command causes the whole of the current line to be yanked into the buffer.

Examples

`yw`	yanks the text from the cursor position to the end of the next word into the temporary buffer.
`4y3w`	yanks 12 words into the temporary buffer.
`4yy`	yanks the current text line and the three lines below it into the temporary buffer.

"buffer[count]**y**movecmd
"buffer[count]**yy**
: Yank text into named buffers

(yank) If the *y* command is preceded by the name of an named buffer (*"buffer*), the text will also be copied into this buffer. *buffer* must be specified as an uppercase or lowercase letter.

Examples

`"a4yy`	yank the current text line and the three lines below it into named buffer *a*.
`"ap`	put back the contents of *a* after the current cursor position.

[count]**Y**
Yank line(s) into temporary buffer

(yank) Yanks a copy of the current line or *count* lines into the temporary buffer (same as *yy*).

"buffer[count]**Y**
Yank line(s) into named buffers

(Y - yank) Yanks a copy of the current line (or *count* lines) into the named buffer given in *buffer*, where buffer is an uppercase or lowercase letter. This format corresponds to *"bufferyy*.

[line]**z**[count]char
/pattern**/z**[count]char
Moves the text line specified by *line* or *pattern* to the screen position defined by *char*.

char must follow *z* and may assume the following values:

↵ or plus sign (+)
Specifies the top of the screen

dot (.) Specifies the center of the screen

minus sign (-)
Specifies the bottom of the screen

line indicates the line number of the text line to be positioned.

line not specified:
The current line is used by default.

pattern identifies the line in which *pattern* first occurs.

count is an integer between 1 and 23 that may be given after *z* to specify the lines to be redrawn.

count not specified: *count* = 23.

ZZ Exits the *vi* editor, writing out the buffer contents to the file with the current file name (see *ex* command, *f*) if the buffer was changed since the last save (with the *ex* command *w*). This command is equivalent to the *ex* command *x*.

[count]**space**
The cursor is moved by *count* characters to the right (stops at the end of the line). This command is equivalent to *l*.

[count]**!**movecmd

An ! with a movement command allows you to switch to the *vi* last line mode to process text lines with a POSIX command. The ! must be followed by a movement command to indicate the scope, which must go beyond the current line. The specified line range (from the current position to the one given by the movement command) is then passed as the standard input of the POSIX command and is replaced by the output (standard output and standard error) of the system command. Lines are always passed as complete text lines.

The cursor does not move to the status line until the movement command has been entered. The POSIX command to be executed must be terminated with the ↲ key.

movecmd
Movement command to a particular line. Here are some examples:

3j	move down 3 lines
lineG	go to the line number given in *line*
L	move to the last screen line.

A second ! can also be specified for *movecmd*; this passes the current line as standard input to the POSIX command. The second exclamation mark can be preceded by a count to indicate the number of lines to be passed to the POSIX command, starting with the current line.

count
Serves as a repetition factor.

Examples

```
!!wc ↲
```
Passes the current line to *wc* as input and replaces it by the output of *wc*.

```
!1Gsort ↲
```
Sorts the range from the current line to the start of the file.

```
3!$tr a b ↲
```
Replaces all occurrences of *a* by *b* in the entire current line and the two following lines.

[count]**$**

Moves the cursor to the end of the current line. A *count* specifies the number of lines to go forward (e.g. *2$* moves the cursor to the end of the next line).

" Precedes the name of a named or numbered buffer. See the *vi* commands *d*, *p*, and *y*.

% Moves the cursor to the parenthesis, brace, or bracket that matches the one at the current position. Left and right parentheses ( ), square brackets [ ], and braces { } represent matching pairs.

& Repeats the last *ex* command *s*; is equivalent to the *ex* command *&*.

’marker
(single quote)

Move cursor to marked line

’marker moves the cursor to first non-whitespace character in the marked line. *marker* is a lowercase letter that was set as a marker with the *vi* command *m*.

If the ’ command is used as a movement command for some other command, all lines in the specified range are treated as whole lines, including the current and the marked line.

Example

```
d'a
```
Deletes all lines from the current line up to the marked line, including both extremes.

' ' (two single quotes)

Move cursor to previous current line

The ’ ’ command moves the cursor to the beginning of the line in which it was located prior to the execution of one of the *vi* commands below.

H, L, M, n, N, %, ’, (,), [[,]], ` , {, },

/pattern ↵,
?*pattern* ↵.

If the ’ ’ command is used as a movement command for some other command, all lines in the specified range are treated as whole lines, including the current and the marked line.

Example

```
d' '
```
Deletes the range from the current line to the previous current line. You should first use ’ ’ to verify the location of the previous current line. If none exists, *vi* deletes the range from the current line to the beginning of the file. The deleted text can be retrieved with *u*.

[count]**(**
Moves the cursor back to the beginning of a sentence; a *count* moves back that many sentences.

If the *ex* option *lisp* is set, moves to the beginning of a *lisp s*-expression (see section “ex options” on page 352). Sentences also begin at paragraph and section boundaries (see { and [[).

[count]**)**
Moves forward to the beginning of the *count*th sentence.

[count]**+**
Moves the cursor to the first non-whitespace character in the next line. Use a *count* to move more than a line (as in CTRL m).

[count]**,**
Reverses the last *vi* search command (for a single character):
f, *F*, *t*, or *T*,
searching in the opposite direction in the current line. A *count* can be used as a repetition factor.

[count]**-**
(hyphen) Moves the cursor backward to the first non-whitespace character in the preceding line. A *count* specifies how many lines to move back.

[count]**.**
(dot) Repeats *count* times the last *vi* command which changed the buffer.

If the last command given was used to output the contents of a numbered buffer, a following dot command retrieves the contents of the next numbered buffer in sequence.

/pattern ↵
The / immediately takes you to the command line (*vi* last line mode) where you can specify a regular expression for *pattern*. The search begins when you terminate *pattern* with ↵. *vi* then scans forward for the next occurrence of a matching string and moves the cursor to it. If no string matching *pattern* is found, the cursor remains in the current position. The interrupt signal SIGINT can be given to terminate the search.

Since the *ex* option *wrapscan* (abbreviated to *ws*) is set by default, the search wraps around at the end of the file and continues downward from the start of the file to the current cursor position. The *ex* command *set nows* causes the search to terminate at the end of the file (see the *ex* command *set* and the section on "*ex* options" under *ex*).

The *vi* commands *n* and *N* repeat the search in the same and reverse directions, respectively.

If the / is used as a movement command with some other command to specify an extent of text, the defined region is from (and including) the current cursor position to just before the matched string.

Example

If a line contains the following text:

```
Larry Speakes, the Speaker of the House, spoke well.
```

And the cursor is positioned at the comma after Speakes, entering the command:

```
d/ spoke↵
```

will leave:

```
Larry Speakes spoke well.
```

? Scans backwards; the reverse of / (see /).

0 Moves the cursor to the first character on the current line. The zero is not interpreted as a *vi* command when preceded by a non-zero digit.

: The *vi* command colon (:) switches to *vi* last line mode, allowing you to enter an *ex* command. The *ex* command is terminated by entering ↵.

If the *ex* command you wish to enter is longer than one input line, you will need to switch to the *ex* command mode with *Q*.

[count]**;**
Repeats the previous *vi* search command (for a single character):
f, *F*, *t*, or *T*.
A *count* can be used for a number of repetitions.

[count]**<**movecmd
Must be followed by a movement command to another line; shifts the inclusive range from the current to the specified line by *shiftwidth* columns to the left. See section "ex options" on page 352. A *count* is passed through to the movement command.

A second < character can also be specified as *movecmd*; << causes the current line to be shifted to the left (or *count* lines, including the current line).

[count]**=**movecmd
Must be followed by a movement command to another line. If the *ex* option *lisp* is set, the specified lines are re-indented as if they had been typed in with the *autoindent* option set. A *count* can be used to specify how many lines are to be processed. *movecmd* may also be a second equals sign, which causes only the current line (or *count* lines) to be indented.

[count]**>**movecmd
This *vi* command shifts specified lines by *shiftwidth* characters to the right (see <).

` marker
: (backquote)

Move cursor to set marker

marker is a lowercase letter which identifies a marker that was set with the *vi* command *m*. ` *marker* places the cursor at the exact character position marked.

If the ` command is used as a movement command with some other command to specify its scope, the defined region extends from (and including) the current cursor position up to just before the previous current position.

Example

```
d` a
```

Deletes the range from the current cursor position up to the marker *a*.

`` (double backquotes)
Move marker to previous current position

The `` command moves the cursor to the position it occupied before one of the *vi* commands listed below was executed.

H, L, M, n, N, %, ”, (,), [[,]], `` , {, },
/*pattern* ↵,
?*pattern* ↵.

If the `` command is used as a movement command with some other command to specify its scope, the defined region extends from (and including) the current cursor position up to just before the previous current position.

[count]**[[**
Backs up to the section boundary given by *count*.

[count]**]]**
Moves forward to the section boundary given by *count*.

^ Moves the cursor to the first non-whitespace character on the current line.

[count]**{**
Moves back to the beginning of the current paragraph. You can use a *count* to indicate how many paragraphs to move.

[count]**}**
Moves forward to the beginning of the next paragraph. A *count* can be used to indicate how many paragraphs to move.

[column]I
Moves the cursor to the specified *column*, if possible.

column not specified:
column = 1

~ Case shifting; converts the character at the current cursor position from uppercase to lowercase or vice versa as appropriate, and moves the cursor one character to the right.

Adapting vi to the terminal

The output of the *vi* program depends on the type of terminal used. The *vi* editor need not be adapted in the POSIX environment.

vi uses the value of the environment variable *TERM* to locate the required terminal information in a database (*/usr/lib/terminfo/*/**). If *TERM* has not been defined or if you are working at some other type of terminal, you must reset the value of *TERM*. You can do this in a number of ways:

– set and export the shell variable *TERM*.

– define and export TERM in your *.profile*.

– use the *ex* command *set term* (in *ex* command mode only).

– enter the *ex* command *set term* in the *.exrc* file.

– define and export the *EXINIT* environment variable in your *.profile*.

– if all else fails, consult your system administrator.

Caution!
Make sure you only specify the actual name of your terminal for *TERM*. The use of other names may cause your terminal to malfunction.

Customizing the vi environment

Default values are set using *ex* options. The available options are described under “ex options” on page 352.

The *ex* command *set all* displays a list of all the current values. For example:

directory=/tmp	Directory for the editor buffer
nonumber	Line numbers are not displayed
report=5	A message is issued when more than 5 lines are changed
scroll=11	The screen is scrolled by 11 lines when CTRL D is entered
noshowmode	The *vi* mode is not displayed

term=97801	Terminal type
window=23	Number of screen lines for the text window
wrapmargin=0	No automatic wraparound.

There are two types of option, those with Boolean values and those with non-Boolean values. *showmode* is an example of a Boolean type option. If it is set, *set all* displays the string *showmode*. If it is not set, *set all* displays *noshowmode*. With non-Boolean types, *set all* displays the option name and the value to which it is set. *scroll* is an example of a non-Boolean option.

i If you have trouble with the arrow keys in *vi* (for example, if pressing an arrow key switches you from input to command mode), you should switch off the *timeout* option (*set notimeout*).

The *vi* environment can be customized to suit your requirements and working habits. For example, *vi* can be made to display line numbers of the current mode of operation in the status line.

There are three ways of changing the default values for *vi*:
– during a *vi* session
– by using the *EXINIT* environment variable
– by using the *.exrc* file

Let us assume, for example, that you want to have the line numbers and the *vi* mode displayed.

– During a *vi* session:
  To display the line numbers, use the *ex* command *set number* during a *vi* session. The *ex* command *set showmode* causes *vi* to indicate when it is in input mode. The customized environment will only be effective for the duration of the session.

– By using the *EXINIT* environment variable:
  You must write the following lines into the *.profile* file in your *HOME* directory:
```
EXINIT='set number showmode'
export EXINIT
```
  Using the command . *.profile* you make known the new variable to your shell (see . (dot) command). If you now call *vi*, line numbers will be displayed, and *vi* will inform you when you are in the input mode. This default setting is always effective.

– By using the *.exrc* file:
  You must create this file yourself. The *.exrc* file can be used to define permanent *vi* settings. To ensure that *vi* displays line numbers and the mode, you must enter the following line into this file:
```
set number showmode
```
  The *.exrc* file has to be in your *HOME* directory. For security reasons, *vi* does not evaluate *.exrc* files in subdirectories. The *.exrc* in the *HOME* directory is always read.

The default values defined for *vi* are also valid for *ex*.

It is possible to combine the various methods, but on certain conditions.
Values set within a *vi* session have the highest priority. You may therefore change the current values at any time during a session by means of the *ex* command *set*.
If *EXINIT* is set, the *$HOME/.exrc* file is not executed.

File

$HOME/.exrc
File containing default values for *ex* and *vi*. These default values are overridden by values set using *EXINIT* or during a vi session.

Variable

COLUMNS
Number of columns per screen.

LINES
Number of lines per screen.

SHELL
Determine the preferred command-line interpreter for use in !, *shell*, *read* and other commands with an operand of the form *!string*. For the *shell* command the program will be invoked with the single argument *-i*, for all others it will be invoked with the two arguments *-c* and *string*. If this variable is null or not set, *sh* will be used.

TERM
The type of terminal used.

EXINIT
Environment variable with default values for *ex* and *vi*.

PATH
Determine the search path for the shell command specified in the editor commands *shell*, *read* and *write* and the visual-mode command !

Locale The following environment variables affect the execution of *vi*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_COLLATE	Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements within regular expressions.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also *edit*, *ex*
"el Lozy, M.: Editing in a UNIX Environment The vi/ex Editor Prentice-Hall, 1985" [18]

wait await process completion

The POSIX shell built-in *wait* causes the shell to wait

- until a previously started background process is complete (if you call *wait* with the required process ID), or
- until all previously started background processes terminate (if you call *wait* without arguments).

When a command is run in the background (with &), the interactive shell does not normally wait for it to finish before prompting you for a new command. By contrast, if a command is started as a foreground process, the shell will always wait for it.

This also applies with respect to shell scripts. Thus, if a script contains a command that is to process the output of a previously started background command, *wait* can be used to ensure that the background command terminates first.

If the error message `fork failed - too many processes` appears when you try to run a process in the background, you may be able to lessen the system load by running *wait*. If this has no effect, it may be that the system table is full or that there are too many active foreground processes.

Hint

If a pipeline has 3 or more stages, the shell groups processes into pairs and spawns a process to control each pair. Hence the original processes are not child processes of the shell. *wait* cannot wait for processes which are not children of the shell.

Syntax

wait[␣process_ID...]

process_ID

Process identification number of the background process whose completion is to be waited for by the shell.

Only one process ID may be specified. If more than one process ID is given in the command line, *wait* will only consider the first one and will ignore the rest without issuing an error message.
The exit status returned by *wait* is that of the specified background process. If the process you specify is not active, *wait* behaves as it does if you do not specify a PID (see below).

The shell always assigns the process ID of the last command run in the background to the *!* (exclamation point) variable. The contents of this variable can be accessed with *$!*.

process_ID not specified:
wait waits for all your shell's currently active background processes to complete and returns an exit status of 0.

Exit status If you have called *wait* without an argument and all known process IDs have terminated, the exit status is always 0.

1-126	Error
127	The command for the last process ID is unknown.

Locale The following environment variables affect the execution of *wait*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The shell is to wait for an active background process:

```
$ find / -name tst -print 2>/dev/null &
3456
$ wait 3456
home/martin/PASCAL/tst
:
```

Example 2 The shell script *patience* illustrates how to wait for a specific background command to terminate. The contents of this shell script are as follows:

```
: Invocation with sh patience
sort list > sorted &
pid1=$!
tar cvf /dev/dsk/f0t /home/anne &
pid2=$!
:
wait $pid1
pg sorted
```

The process IDs of the two background command are stored in the variables *pid1* and *pid2*, respectively. These process IDs are thus available for future use, as the *!* variable always holds the process ID of the last background command started.

The *wait* command causes the script to wait for the *sort* command to complete before displaying the contents of *sorted* with the *pg* command.

See also *waitpid*() [4]

wc word, line and byte or character count

wc counts the number of lines, words and characters contained in files and writes the results to standard output.

Syntax

wc[␣**-c**|␣**-m**][␣**-lw**][␣file...]

No option specified
wc outputs three numeric values for the number of lines, words, and characters.

option

-c *wc* outputs the number of bytes. Spaces, tabs and newline characters are counted. The option *-c* acts exactly like the option *-m* since one byte corresponds to one character.

-m *wc* outputs the number of characters. Spaces, tabs and newline characters are counted. The option *-m* acts exactly like the option *-c* since one character corresponds to one byte.

-l Reports the number of lines, based on the number of newline characters counted by *wc*.

-w Reports the number of words. A word is defined as a non-empty string delimited by whitespace characters. Whitespace characters are blanks, tabs and newline characters.

file
Name of the file whose lines, words, and characters are to be counted. The file name will be printed along with the counts.
More than one file may be specified. If several files are named, *wc* prints an additional line with a grand total of the individual values for all specified files.

file not specified:
wc reads from standard input.

Locale

The following environment variables affect the execution of *wc*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments). *LC_CTYPE* defines which characters are treated as whitespace characters.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Listing line, word, and character counts for the files *logic*, *plan* and *rem*.

```
$ wc logic plan rem
     27    139    1077  logic
      5     15     140  plan
      3      6      51  rem
     35    160    1268  total
```

Example 2 Checking the number of files in the current directory.

```
$ ls | wc -l
       31
```

Example 3 Checking the number of users working on the system.

```
$ who | wc -l
        6
```

Example 4 Counting the number of unique words in a file.

```
$ cat file | sed 's/ ␣␣*/\
> /g' | sort -u | wc -l
```

Explanation:

sed creates a list of all words in *file* by replacing one or more blanks by newline characters. *sort -u* sorts this list, removing all repetitions. *wc -l* then counts the lines in this list and prints the total.

whence query command type

The built-in *whence* command in the POSIX shell *sh* specifies how each name is to be specified as a command name.

Syntax **whence**[␣**-pv**]␣name␣**...**

-v produces a more detailed report.

-p does a path search for *name* even if *name* is an alias, a function, or a reserved word.

name
Name of the command to be interpreted.

Exit status

0 The command was executed correctly.

>0 No command named *name* was found.

Example Various *whence* output possibilities

```
$ whence echo
echo
$ whence -pv echo
echo is /usr/bin/echo
$ whence -v echo
echo is a shell builtin
$ whence -v cat
cat is a tracked alias for /usr/bin/cat
```

See also *type*

who display who is on the system

who provides information on:
- the login and terminal name under which you are currently working
- the login name, login time, and terminal name for each current system user
- the process ID of the command interpreter (shell) being used
- the last time a terminal was used
- when logins, logouts, and system breakdowns have taken place since the */var/adm/wtmp* file was cleared by the system administrator.
- the last time the system clock was changed
- the processes spawned by the *init* process

Hint *who* normally gets its information from the */var/adm/utmp* file. The information in this file is brought up to date every time a login is performed. In single-user mode no logins are performed. Thus after a shutdown to single-user mode *who* may not be able to supply accurate information about the current login status. Use *who am i* instead.

Syntax

Format 1: who[␣**-mu**]␣**-s**[␣**-bHlprt**][␣file]

Format 2: who[␣**-mTu**][␣**-abdHlprt**][␣file]

Format 3: who␣**-q**[␣**-n**␣number][␣file]

Format 4: who␣**am**␣**i**

Format 5: who␣**am**␣**I**

List detailed information

Format 1 **who**[␣**-mu**]␣**-s**[␣**-bHlprt**][␣file]

Format 2 **who**[␣**-mTu**][␣**-abdHlprt**][␣file]

No option specified

who lists the following for every system user currently logged in:
- login name under which the user logged in
- name of the terminal on which the user logged in
- login time.

The columns in the output are described below in *Output*.

options

-a (all) Turns on options *-b*, *-d*, *-l*, *-p*, *-r*, *-t*, *-T* and *-u*.

-b (boot) Shows the date and time of the last reboot.

-d (dead) Shows all processes that have terminated and not been respawned by *init*. The terminated processes are output together with their exit status (*EXIT* field) and the number of the signal which terminated the process. This may be useful in determining why a process died.

-H (headings) Prints headings above the output columns.

-l (login) Lists the processes where the system is waiting for someone to log in. In such cases the entry in the *NAME* field is the name of the program (or *LOGIN*) and the *STATE* field does not appear. The other fields have their usual meanings.

-m *who* only outputs information on the active terminal.

-p (process) Shows all processes spawned by the *init* process. The *NAME* field shows the name of the program executed by *init*. The *LINE* field is irrelevant in conjunction with the *-p* option, so only a dot is output in this field.

-r (run level) Shows the current run level of the *init* process. The *LINE* field indicates the current run level, the *TIME* field the date it was entered. *IDLE* shows the current run level in numeric form, *PID* shows how often the system has been in this state before, and *COMMENT* indicates the system's previous run level. The *NAME* field has no meaning with the *-r* option.

-s (standard) Lists the users who are currently logged in. The *NAME* field gives the login name, *LINE* is the device name (without the /*dev*/) of the terminal on which the user logged in. *TIME* shows when the user logged in.
This option is the default. *-s* can not be combined with *-a*, *-d* or *-T*.

-T (terminal) The terminal state is output in addition to the default values.
The *STATE* field shows whether other users can write to the terminal: a plus sign + indicates that they can, a minus sign – means that they cannot. The POSIX administrator can write to any terminal. If it is not possible for the system to obtain this information, a query ? appears in this field.

-t (time) Shows the last time the system administrator changed the system clock (using the *date* command).

-u (user) Lists those users who are currently logged in. The *NAME* field is the user's login name. *LINE* is the device name (without the /*dev*/) of the terminal on which the user logged in. *TIME* shows when the user logged in.
The *IDLE* field provides information on the last time there was activity on the terminal in question: a dot (.) indicates activity within the last minute. If the terminal has not been used for over 24 hours or since the system was last booted, the entry is marked *old*.
The *PID* field indicates the process ID of the command interpreter (shell) the user is working with.

file
: Name of the file from which *who* obtains its information. *file*, if given, will typically be */var/adm/wtmp*. *who* then provides information about logins, logouts and system breakdowns that have taken place since this file was last cleared by the system administrator.

  file not specified:
  who obtains its information from the file */var/adm/utmp*.

Output

The following section lists the headings of the columns output by *who* and discusses the information displayed in each column. The special information produced by the *-b*, *-d*, *-p*, *-r* and *-t* options is explained above in the detailed option description.

NAME
: The *NAME* field indicates the user's login name.

STATE
: The *STATE* indicates whether other users can write to the terminal: a plus sign + indicates that they can, a minus sign – means that they cannot. The system administrator can write to any terminal. A query in this field indicates that the line is defective.

LINE
: The *LINE* field gives the device name (without the */dev/*) of the terminal on which the user logged in.

TIME
: The *TIME* field shows when the user logged in.

IDLE
: The *IDLE* field provides information on the last time there was activity on the terminal in question: a dot (.) indicates activity within the last minute. If the terminal has not been used for over 24 hours or since the system was last booted, the entry is marked *old*.

PID
: The *PID* field indicates the process ID of the command interpreter (shell) the user is working with.

COMMENT
: The *COMMENT* field indicates the system's previous run level.

EXIT
: The *EXIT* column (exit status) is a list of dead processes together with the number of the signal which terminated each process. This may be useful in determining why a process died.

The *NAME*, *LINE* and *TIME* information is produced by options *-a*, *-l*, *-s*, *-T* and *-u*.
STATE is shown only by *-T*, *IDLE*, *PID* by *-a*, *-l* and *-u*. The *-a* option also provides information on the exit status (*EXIT*).

Format 3 **List concise information**

who␣**-q**[␣**-n**␣number][␣file]

-q (quick) *who* only outputs the names and number of users currently logged on. Additional options, with the exception of *-n,* are ignored.

-n␣number
who displays *number* users per line. *number* must be at least 1.

-n␣number not specified:
by default *who* displays users per line.

file
see Format 1

List information on the invoking user

Format 4 **who␣am␣i**

Format 5 **who␣am␣I**

The formats 4 and 5 are identical to *who -m*.

who lists:
- the login name under which you logged in
- the device name (without the */dev/*) of the terminal on which you logged in
- the login time.

File */var/adm/utmp*
File from which *who* obtains its information by default. This file records the latest status.

/var/adm/wtmp
This file can be used as an alternative to */var/adm/utmp*. This file is regularly cleared by the system administrator.

Locale The following environment variables affect the execution of *who*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
LC_TIME	Determine the format and contents of date and time strings.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 Listing general information on all users currently logged in by calling *who* without options.

```
$ who
CMPQD004   term/002     Mon Aug 18 16:48:21 MSZ 2008
QM212JNA   term/003     Mon Aug 18 17:24:54 MSZ 2008
```

Example 2 Listing detailed information with column headings on all users currently logged in by calling *who* with the *-H* and *-u* options.

```
$ who -Hu
NAME       LINE         TIME          IDLE    PID
CMPQD004   tty001       Mar  7 10:53   .     6252
QM212JNA   tty002       Mar  7 11:10  0:22   6289
```

Example 3 Listing concise information on all users currently logged in by calling *who* with the *-q* option.

```
$ who -q
CMPQD004 QM212JNA
# users=2
```

Example 4 Listing information on the invoking user with *who am i*.

```
$ who am i
 QM212JNA   term/003     Mon Aug 18 17:24:54 MSZ 2008
```

See also *date*, *last*, *mesg*
wait() [4]

write write to another user

i To receive messages you must be working on a character-mode terminal; in other words, you must be accessing the POSIX shell via *rlogin*.
In contrast, all users can send messages, including those working on block-mode terminals.

write is used to send messages to another user. *write* reads one line at a time from standard input and echoes the lines read as messages on the specified user's terminal. When *write* is invoked, a message header initially appears on the recipient's terminal indicating the name of the sender, the terminal, and the time at which the message is sent. This is followed by the actual messages.
Users may communicate interactively by sending messages to each other with *write* (see "Two-way conversations" on page 874).

Before the call

Users who have denied other users permission to write to their terminals (with *mesg -n*) or who are working on block-mode terminals cannot be written to with *write*. A user with POSIX administrator privileges can write to any terminal.

Syntax

write␣recipient[␣ttyname]
text
. ...
...
... CTRL D

recipient
Login name of a user logged in to a terminal. You can also send yourself messages. If a user is logged in to more than one terminal at the same time, the appropriate terminal can be specified as well.
The command *who* lists all currently logged-in users and their terminals.

ttyname
Number of the terminal on which the recipient is logged in.

ttyname not specified:
write searches the file */var/adm/utmp* for the terminal. If several entries exist because a user is logged in more than once, *write* uses the first entry recorded in the file. The following message is displayed:

```
user is logged on more than one place.
You are connected to "ttyname".
Other locations are:
ttyname
```

text

Text to be sent as a message. *write* reads from standard input one line at a time up to an end-of-file signal:

- A line that begins with an exclamation mark (!) is interpreted as a command; *write* passes everything that follows the ! in the line to the shell. The command is then executed, while *write* remains in an active state. Any output that the command writes to standard output will be included in the text to be sent as a message.
- All other normal lines are sent to the recipient as a message.
- When *write* encounters the end-of-transmission character ("EOT \n"), it displays this character on the other terminal and then exits.
- Non-printing characters (with the exeception of *d*, *v,* *n,* *r* and *a*) are converted before they are sent.
  Control characters will appear as caret ^<uppercase-letter> . <uppercase-letter> is the letter which results when the 7th bit is set in the ASCII character set.
  For example, '\003' is displayed as '^C'.

Two-way conversations

Users may communicate interactively by sending messages to each other with *write*. Conversation between two users proceeds as follows:

1. User A invokes *write* with the login name of user B. User B receives an announcement (message header) informing him or her that user A wishes to communicate something.

   ```
   Message from sender (terminal) [time]
   ```

   User A hears two bell tones to indicate that the connection has been set up and that user B is able to receive.

2. User B therefore calls *write* with the login name of user A.

   ```
   write  sender [terminal]
   ```

   The message header received by user A serves as an acknowledgement.

3. Both users can now communicate with one another. Each user should end a message with a distinctive signal so that the other knows when to reply. There should also be a distinctive signal to indicate when the conversation is to be terminated.

4. The conversation can be terminated by pressing CTRL D or DEL.
   The command *mesg -n* can then be used if other users are to be denied permission to write further messages.

Error
`user is not logged on.` or `user is not at "tty"`
The addressed user has not logged in.

`Permission denied.`
The addressed user has denied other users permission to write to his/her terminal (see *mesg*) or his/her terminal is a blockterminal.

`Warning: You have your terminal set to "mesg -n". No reply possible.`
Your terminal cannot receive messages from other users (see *mesg*).

`Warning: You are on a Block terminal. No reply possible.`
Your terminal cannot receive messages from other users (see *mesg*).

`Can no longer write to ttyname`
The user of the other terminal has withdrawn write permission since transmission started (see *mesg*).

File
/var/adm/utmp
The file in which all logged in users are registered.

/usr/bin/sh
Command interpreter for lines beginning with !.

Exit status

0 Successful completion

>0 The addressed user is not logged on or the addressed user denies permission.

Locale
The following environment variables affect the execution of *write*:

LANG Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.

LC_ALL If set to a non-empty string value, override the values of all the other internationalization variables.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error and informative messages written to standard output.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example Send a message to user *karen*:

```
$ write karen
!date
Mon Oct 13 19:00:13 MET 2008
Today, at 15.10,
I decided to quit
smoking! CTRL D
```

See also *mailx*, *mesg*, *pr*, *sh*, *talk*, *who*

xargs construct argument list(s) and execute command

xargs combines command-line arguments with arguments that it reads from standard input and executes the specified command one or more times. The number of arguments read for each command invocation and the manner in which they are combined can be determined by the options specified.

Arguments read in from standard input are defined to be contiguous strings of characters delimited by one or more blanks, tabs, or newline characters; empty lines are discarded. Blanks and tabs may be embedded as part of an argument only if they are either escaped with a backslash \ or if the argument is enclosed in single or double quotes ('...' or "..."). Otherwise, they are interpreted as separators between arguments. The usual quoting mechanisms apply as well, i.e. metacharacters are also escaped as mentioned above.

Syntax **xargs**[␣option]...[␣command[␣initial_argument]...]

Options *-I* (or *-i)*, *-L* (or *-l)* and *-n* determine how the command-line arguments and the arguments read from standard input are to be selected for each invocation of *command*.

If none of the *-I* (or *-i)*, *-L* (or *-l*) or *-n* options are used:
The initial arguments specified in the *xargs* command line are followed by arguments read continuously from standard input until an internal buffer is full. *command* is then executed with the accumulated arguments. This process is repeated until there are no more arguments.

If combinations of the *-I* (or *-i)*, *-L* (or *-l*) or *-n* options are used:
When there are conflicts (e.g. *-l* and *-n*), the last specified option takes effect.

-I␣repstr (or **-i**[repstr])
Insert mode; *command* is executed for each line read from standard input, taking each line as an argument and inserting it for each occurrence of *repstr* in the list of initial arguments specified when *xargs* was called.
A maximum of 5 arguments in the list of initial arguments may each contain one or more instances of *repstr*. Blanks and tabs at the beginning of each line are ignored. Constructed arguments may not grow larger than 255 characters.

The *-I* option automatically also sets the *-x* option.

This corresponds to the old option *-i*, which is still supported. For *repstring* , braces *{}* are assumed in the case of *-i* if not explicitly specified.

-L␣number (or **-l**[number])
command is executed for every *number* non-empty argument lines that *xargs* reads from standard input. If fewer than *number* lines remain when *command* is invoked for the last time, *command* will be executed with these lines.
A line is considered to end with the first newline character in it unless the last character in the line is a blank or a tab. A trailing blank or tab signals continuation to the next non-empty line.

The *-L* option automatically also sets the *-x* option.

This corresponds to the old option *-l*, which is still supported. If *number* is not specified for *-l*, the value 1 is assumed.

-n␣number
Executes *command* using as many standard input arguments as possible (up to a maximum of *number*). Fewer arguments will be used if their total size is greater than *maxsize* characters (see *-s* option). If fewer than *number* arguments remain for the last invocation, these arguments will be used. If option *-x* is also set, each *number* arguments must not exceed the maximum limitation specified with *maxsize* (see option *-s*), as otherwise *xargs* will terminate execution.

-E␣eofstr (or **-e**[eofstr])
Defines *eofstr* as the logical end-of-file string. *xargs* reads from standard input until either the actual end-of-file or the logical *eofstr* is encountered.

Specify a string of *eofstr*. This string is interpreted as the logical end-of-file string when *xargs* is executed.

This corresponds to the old option *-e*, which is still supported. If *-e* is specified without *eofstr*, a logical end-of-file string is no longer specified. The underscore _ has no special meaning and is processed as a normal character.

Neither *-E* nor *-e* specified:
The underscore (_) is interpreted as the logical end-of-file.

-p Prompt mode; the user is asked whether to execute *command* at each invocation. In addition, the trace mode (option *-t*) is turned on to print the invoked *command*, followed by a *?...* prompt.

-s␣maxsize
Sets the maximum number of characters in each argument list to *maxsize* (an argument list is a combination of arguments formed on the basis of rules defined by the *-I* (or *-i)*, *-L* (or *-l)*, or *-n* options). Note that the character count for *maxsize* includes one extra character for each argument and the count of characters in the command name.

-t Trace mode; the *command* and each constructed argument list are echoed to standard error just prior to their execution.

-x Causes *xargs* to terminate if any argument list would exceed the specified maximum of *maxsize* characters (see option *-s*).

The *-x* option is forced when options *-I* (or *-i)* and *-L* (or *-l)* are set.
When none of the *-I* (or *-i)*, *-L* (or *-l)* or *-n* options are coded, the execution of *xargs* is terminated if the total length of all arguments exceeds *maxsize* characters (see option *s*).

command
Any command may be specified for *command*. *xargs* will terminate if it receives an exit status of 255 from *command* or cannot execute it. If *command* is a shell script, it should include an *exit* command which explicitly returns a suitable exit status so as to avoid accidentally returning with 255 (e.g. *exit -1*).

command not specified:
The command *echo* is assumed for *command*.

initial_argument
Argument lists are constructed (as described above) by combining initial arguments specified on the *xargs* command line with arguments read from the standard input (see options *-I* (or *-i)*, *-L* (or *-l)* and *-n*). The specified *command* is then executed with these argument lists.
The initial arguments always appear at the beginning of an argument list, except when the *-I* or *-i* option is set.

initial_argument not specified:
Argument lists are only constructed from arguments read from the standard input.

Exit status

0	Each call of *command* returned the exit status 0.
1-125	The arguments could not be combined as requested, or at least one call of *command* returned a non-zero exit status or a further error occurred.
126	The specified *command* exists, but cannot be executed.
127	The specified *command* cannot be found.

Locale The following environment variables affect the execution of *xargs*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.

LC_COLLATE Determine the locale for the behavior of ranges, equivalence classes and multicharacter collating elements used in extended regular expressions defined for the yes/no queries.

LC_CTYPE Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments) and the behavior of character classes used in extended regular expressions defined for the yes/no queries.

LC_MESSAGES
Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.

NLSPATH Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example 1 The following shell script named *relocate* moves files with names that do not begin with a period (.) from one directory to another:

```
$ cat relocate
ls $1 | xargs -I {} -t mv $1/{} $2/{}
$ relocate dir1 dir2
mv dir1/file1 dir2/file1
mv dir1/file2 dir2/file2
mv dir1/file3 dir2/file3
```

The two positional parameters *$1* and *$2* are assigned the values of the arguments specified (*dir1* and *dir2*) when *relocate* is invoked. The command *ls $1* displays the contents of the *dir1* directory with one file name in each line. These file names are sequentially inserted for *{}* (option *-I {}*). Each *mv* command is echoed with its argument list (option *-t*) just before it is invoked.

Example 2 The following shell script named *who_and_when* collects the output of the parenthesized commands (...) in one line and appends this line to the end of the file *log*:

```
$ cat who_and_when
(logname; date; echo $0 $*) | xargs >>log
$ cat log
michael Mon Mar 9 14:21:06 MEZ 2009 who_and_when
```

Example 3 The following shell script named *archive* places files in the current directory whose names do not begin with a period (.) in an archive named *archive.a* (see *ar*):

```
$ cat archive
ls | xargs -p -L 1 ar r archive.a
$ archive
ar r archive.a file1 ?... y
ar: creating archive.a
ar r archive.a file2 ?... n
ar r archive.a file3 ?... y
ar r archive.a file4 ?... n
$ ar t archive.a
file1
file3
```

ls displays the contents of the current directory on standard output with one file name in each line. *xargs* then calls *ar* with the arguments *r*, *archive.a*, and each file name returned by *ls*. Since the *-p* option has been set, you are asked whether or not the corresponding *ar* command is to be executed in each case. If you respond with a "y" the first time, *ar* creates the archive file *archive.a*, issues a corresponding message, and saves the current file in it. Your subsequent responses to each prompt will then determine which files are to be stored in *archive.a*. If required, the contents of *archive.a* can be listed at the end with the *ar t* command.

See also *echo*

yacc yet another compiler-compiler

The command *yacc* (yet another compiler-compiler) converts decontextualized grammar into a set of tables for a simple automaton ###, which runs an *LALR(1)* syntax analysis algorithm. The grammar may be ambiguous. Certain rules are applied to resolve these ambiguities.

The C compiler must compile the output file *y.tab.c* (or *file_prefix.tab.c*, if option *-b* was specified) in order to create a program *yyparse*. This program must be linked to a lexical analysis program *yylex* as well as to *main* and *yyerror*, an error handling routine. These routines must be provided by the user. The command *lex* is used to create lexical analyzers which can be used by *yacc*.

Syntax **yacc**␣[␣**-dltv**][␣**-b**␣file_prefix][-p␣sym_prefix]|␣**-y**␣driver_file][␣**-V**][␣**-Q[y**|**n]**][␣file ...]

You may specify the following options when calling *yacc*:

-d Generates the file *y.tab.h* with the *#define* statements which associate the token codes assigned by `yacc` with the token names allocated by the user. This means that source files other than *y.tab.c* can access the token codes.

-l Specifies that the code generated in *y.tab.c* (or *file_prefix.tab.c*, if option *-b* was specified) contains no *#line* statements. Use this option only if the grammar and associated actions have been fully tested and are error-free.

-t By default this option compiles code to support runtime error detection. Although the error detection code is always generated in *y.tab.c* (or *file_prefix.tab.c*, if option *-b* was specified), it is subject to conditional compiler control. By default, this is not included when *y.tab.c* is compiled. Irrespective of whether or not the option *-t* is set, provision of the code for runtime error detection is controlled by the preprocessor symbol `YYDEBUG`. If `YYDEBUG` has a value other than zero the error detection code is linked. If the value is zero, the code is not linked. Programs created without error detection code are smaller and execute more quickly than programs with error detection code.

-v Prepares the *y.output* (or *file_prefix.output*, if option *-b* was specified) file. This contains a description of the syntax analysis tables and a message about conflicts which have resulted from ambiguities in the grammar.

-b␣file_prefix
The output files begin with the prefix *file_prefix* instead of y. The other files required by *yacc,* such as *y.tab.c*, *y.tab.h* and *y.output* are then also assigned the file names *file_prefix*.tab.c, *file_prefix*.tab.h and *file_prefix*.output.

-p␣sym_prefix
All external names generated by *yacc* start with the name *sym_prefix* instead of yy. This also applies to the functions *yyparse()*, *yylex()* and *yyerror()* and the variables *yylval*, *yychar* and *yydebug*. Internal names may also be affected by the option *-p*. However, the *-p* option does not affect #define symbols which are generated by *yacc*.

-Q[y/n]
Defines whether version information concerning the generated *yacc* version is to be written to *y.tab.c* (or *file_prefix.tab.c*, if option *-b* was specified) (y) or not (n).

y|*n* stands for a yes/no argument in whatever language environment is set. In an English-language environment you enter *-Qy* to have version information written to *y.tab.c* and *-Qn* to suppress the version information. In a German-language environment, for example, you would use *-Qj* or *-Qn* (for *ja* or *nein*).
By default, no version information is output.

-V Prints the version information for *yacc* to the standard error output.

-y␣driver_file
Defines a personal *yaccpar* file.

File
y.output, y.tab.c
y.tab.h Definitions of token names
(*file_prefix.* is used instead of *y.* if option *-b* was specified)
yacc.tmp, yacc.debug, yacc.acts Temporary files
/usr/lib/yaccpar Analysis algorithm prototype for C programs
/usr/ccs/lib/liby.a for linking the required modules

Exit status
The number of reduce/reduce and read/reduce conflicts is reported at the standard error output; a detailed report can be found in the *y.output* (or *file_prefix.output*, if option *-b* was specified) file. A message is also output if certain rules cannot be accessed from the start symbol.

Hint
As the file names are usually determined by default (i.e. option *-b* is not specified), no more than one *yacc* process can be active at any one time in a given directory.

If *c89* [5] is used to link a *yacc* program, *-ly* must be specified as the library parameter.

Locale The following environment variables affect the execution of *yacc*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments and input files).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

See also *lex*

zcat expand and concatenate compressed data

zcat takes files that have been compressed with *compress* and copies them to standard output in their original form. The compressed file remains compressed. Files compressed with *compress* can be restored to their original form with the *uncompress* command.

zcat, together with *compress* and *uncompress*, forms a group of commands used to compress and expand files and to display files in expanded form. *zcat* ist identical to *uncompress -c*.

Syntax

```
zcat[␣file...]
```

file
: Name of the compressed file to be output in its original form. You can name any number of files.
You may enter the name of the file with or without the *.Z* extension; if you omit the extension, *zcat* automatically searches for the appropriate *.Z* file.

Error

The following errors result in the failure of the *zcat* command.

filename: `no such file or directory`
The file you specified does not exist.

filename: `not in compressed format`
The file you specified was not compressed using *compress*.

filename: `compressed with xxbits, can only handle yybits`
The file was compressed by a program which could handle more bits than the compression code on this machine. You may be able to recompress the file with a smaller number of bits.

`uncompress: corrupt input`
There has been a SIGSEGV signal (addressing error due to segmentation violation). This usually means that the input file is corrupted.

Locale The following environment variables affect the execution of *zcat*:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example The file *zcat_ex* is printed with *cat*, compressed with *compress*, and then output again with *zcat*.

```
$ cat zcat_ex
I have still not been compressed!

$ compress -fv zcat_ex
zcat_ex: Compression: -16.12% -- replaced with zcat_ex.Z

$ zcat zcat_ex.Z
I have still not been compressed!
```

See also *cat, compress*, *uncompress*

: return true value

The POSIX shell built-in *:* (colon) returns zero exit status and does nothing else. It is used in shell scripts in the following ways:

– Without command-line arguments, it does exactly the same as the *true* command. This means that you can also create the condition *true* using the shell built-in *:*.

– If you include arguments, the shell interprets all metacharacters that appear in them. This method of using the shell built-in *:* enables you to assign a default value to free shell variables without initiating any other action.

– If you do not use any shell metacharacters in the command-line arguments, or if you escape them, the shell built-in *:* has the same function as the hash character *#*, i.e. it introduces comments. With *:*, though, unlike *#*, the next unescaped command separator terminates the comment

Syntax

```
:[␣argument]...
```

argument
Any string delimited by blanks or tabs. The last argument must be terminated by a command separator.

You can specify any number of arguments, provided they are separated by at least one tab or blank.

As with every other command, the string is first interpreted by the shell (see *sh* on page 697). The shell built-in *:* returns only a zero exit status.

argument not specified:
The shell built-in *:* returns only a zero exit status and does nothing else.

Exit status 0 in every case

Example 1 You can use the shell built-in *:* to fill in a branch of an *if* or *case* construct if you do not want anything to happen in that branch. Suppose the shell script *not_x* contains the following:

```
if test -x $1
then :
else echo $1 is not executable!
fi
```

This shell script tests the file that you name as your first command-line argument. If the file is executable, the shell script does nothing; otherwise, the message “*file* is not executable!” is issued.

Example 2 The following shell script assigns the process ID of the current shell process to the shell variable *name* if this variable is undefined or contains the null string:

```
: ${name:=$$}
echo $name
```

See also *true*

. execute commands in current environment

The POSIX shell built-in . (dot) executes the specified shell script in the current shell.

If you define new shell variables in the shell script or modify the values of existing shell variables, these variables take effect in the current shell environment.
If you set or unset shell options in the shell script with the shell built-in *set*, these options are set/unset in the current shell.

When you call the shell script, you can pass keyword parameters to it, but you cannot redefine the positional parameters. However, within the script you can access the positional parameters of the current shell.
If you use *set* to redefine the positional parameters **within** the script, the new values apply in the current shell.

Syntax

```
.␣file
```

file
Name of the shell script to be executed in the current shell. The shell searches for *file* in all directories whose path names have been assigned to the *PATH* variable.

Read permission is required for the specified file.

Variable

PATH
Search path of the shell

Locale

The following environment variables affect the execution of .:

LANG	Provide a default value for the internationalization variables that are unset or null. If *LANG* is unset of null, the corresponding value from the implementation-specific default locale will be used. If any of the internationalization variables contains an invalid setting, the utility will behave as if none of the variables had been defined.
LC_ALL	If set to a non-empty string value, override the values of all the other internationalization variables.
LC_CTYPE	Determine the locale for the interpretation of sequences of bytes of text data as characters (for example, single- as opposed to multi-byte characters in arguments).
LC_MESSAGES	Determine the locale that should be used to affect the format and contents of diagnostic messages written to standard error.
NLSPATH	Determine the location of message catalogs for the processing of *LC_MESSAGES*.

Example

When you create or modify your *$HOME/.profile* file, the commands and assignments contained in it are normally not executed until you next log in (open a login shell).
The dot command enables you to make these changes effective in the current shell itself, provided that the current directory is assigned to the *PATH* variable:

```
$ . .profile
```

See also

sh

[␣␣] evaluate expression

The POSIX shell built-in *[␣␣]* is used to check whether specific conditions are satisfied. Such conditions may be:
– file attributes,
– characteristics and comparisons of strings, and
– algebraic comparisons of integers.

Conditions can be both combined and negated.

[␣␣] returns the following results::
– Exit status 0 (true) if the condition is satisfied.
– Exit status 1 (false), if the condition is not satisfied or was not fully defined. A false exit status is also returned if you do not specify any condition.

Depending on the exit status, you can execute various commands, terminate loops, etc.

The shell built-in *[␣␣]* has two forms (see syntax). The effect is the same in both cases.

Syntax

test[␣expression]
[[␣expression␣**]]**

See the shell built-in *test* for the syntax description.

Example

The shell script *dr* produces a customized listing of the contents of the current directory. It tests each entry in the directory with the command *[-d "$name"]* to find out whether it is a subdirectory. Depending on the result of this test, it lists the name preceded either by the label *"(dir)"* or by the size of the file in blocks:

```
$ cat dr
for name in *
do if [ -d "$name" ]
   then echo "(dir) $name"
   else echo " `ls -s $name`"
   fi
done
$ dr
    2 order
(dir) letters
    2 dr
    2 notes
(dir) cards
(dir) docoments
```

For further information and examples refer to the *test* command.

See also *test*

5 Tables and directories

5.1 Summary of command XPG4 conformity

Commands which conform fully to the XPG4 standards

asa, at, awk, basename, batch, bc, cal, cancel, cmp, comm, compress, cp, csplit, cut, dd, dirname, du, env, expand, expr, fold, getconf, head, join, locale, localedef, logger, logname, mesg, mkdir, mkfifo, mv, nice, nm, nohup, paste, patch, pathchk, pax, pr, printf, renice, rm, rmdir, sed, sleep, split, sum, tabs, talk, tee, time, tput, tr, tsort, tty, touch, uncompress, unexpand, uniq, uudecode, uuencode, wc, who, write, xargs, zcat

Commands which differ from the XPG4 standard

Most of the differences result from additional options.

POSIX command	Additional option(s)	Other differences
ar	-S, -V	
cat	-s	
chgrp	-h	
chmod		When <perm> is specified then the entry of l (lock) and t (t bit) as well as u, g and o is supported in addition to the XPG4 standard.
chown	-h	
cksum	-C	
crontab	-l|-r|-e [user]	
date	-a	The system clock can only be adjusted by seconds or fractions of seconds
df	-F, -n, -b, -c, -e, -g, -l, -v, -V, -o	
diff	-a, -h, -i, -l. -n, -s, -t, -w, -D, -S	
ed	-W	

POSIX command	**Additional option(s)**	**Other differences**
egrep	-b, -h	
ex	-r, -L	
fc	-s	
fgrep	-b, -h	
file	-c, -f, -h, -m	
find	-follow, -fstype -local, -mount	+/-<num>(instead of <num> alone) is permitted for the options -links, -size, -atime, -ctime, -mtime and -size. A symbolic reference is also permitted for -type <char>.
gencat	-l, -m	
grep	-b, -h, -r	
iconv		Additional conversion between ISO646 and EDF03 (from ASCII 7-bit to EBCDIC).
id	-a[<user>]	
lex	-V, -Q(y/n)	
ln	-n	Additional syntax compared to XPG4 standard: ln -s <name><reference> ln -s <name>...<directory>
lp		The -m and -w options of the XPG4 standard are not supported.
lpstat		The -v option of the XPG4 standard is not supported. For the -u option you can only specify your own login name.
ls	-L, -b	
mailx	-F, -i, -n -V	In send mode In read mode
make	-b, -d	
man	-k, -x	
more	-d, -f, +<char>, +<line_number>, +/-<pattern>	The -t option of the XPG4 standard is not supported.
nice		Has no effect on BS2000 task priorities
nl	-f␣type	
od	-f, -D, -F, -O, -S, -X	
ps	-c, -j, -s, -T	
renice		Has no effect on BS2000 task priorities

POSIX command	**Additional option(s)**	**Other differences**
sh		Built-in XPG4 functions in the shell: ., :, [<expr>], alias, bg, break, case, cd, command, continue, do, echo, else, eval, exec, exit, export, false, fc, fg, for, getopts, hash, if, jobs, kill, newgrp, pwd, read, readonly, return, set, shift, test, times, trap, true, type, ulimit, umask, unalias, unset, until, wait, while Other built-in functions in the shell: edt, let, print, typeset, whence
sort	-M, -T␣<tempdir>	
strings	-o	
tail	-r	
tput	-S	
uname	-p	
uuname		Only the local system name is displayed.
vi	-r, -L	
yacc	-V, -Q(y/n) y driver-file	

Commands which are not (or no longer) defined in the XPG4 standard

POSIX command	**Function**
bs2cmd	execute BS2000 command
bs2cp	copy BS2000 files
bs2do	call BS2000 procedures from the POSX shell
bs2file	set BS2000 file attributes
bs2lp	send files to a printer
bs2pkey	set P keys
cpio	copy in and out
debug	debug POSIX programs
dumpfs	dump file system
edt, edtu	process file with EDT (BS2000)
fsck	check consistency of a file system and make corrections interactively
fsexpand	expand existing file systems
ftyp	define processing mode for BS2000 files
fuser	display file users

POSIX command	**Function**
hd	hex dump
info	online diagnostic tool
ipcrm	remove inter-process communication facilities
ipcs	inter-process communication status
last	display last logged in users
logrotate	change logging files of the syslog daemon
mkfs	make a filesystem
mknod	make an inode
mkpart	hard disk maintenance utility
mount	mount a file system
mountall	mount file systems
pdbl	set up and manage user-specific program cache
ping	send echo requests to network hosts
pkginfo	display information on software packages in POSIX
posdbl	manage POSIX loader
rcp	remote file copy
rsh	remote shell
rmpart	remove partition
show_pubset_export	show file systems affected by EXPORT-PUBSET
start_bs2fsd	start copy daemons
su	substitute user ID
sync	flush system buffers
tar	file archiver
umount	unmount a file system
umountall	unmount file systems

5.2 Regular POSIX shell expressions

Regular expressions are a tool for scanning a text for strings which match a defined pattern. A regular expression stands for a set of character strings. A member of this set of strings is said to be matched by the regular expression. A pattern is constructed from one or more regular expressions.

Regular expressions comprise a string of characters, which can be further classified into:

– ordinary characters, and

– metacharacters.

All alphanumeric characters (all letters and digits) and most other characters are ordinary characters. Within a pattern, ordinary characters match themselves, i.e. the pattern *abc* will match only those strings that contain the character sequence *abc* anywhere in them.

There is, however, a small set of characters, known as metacharacters, which have special meanings when encountered in patterns. These characters are described below.

There are two forms of regular expression:

– simple regular expressions

– extended regular expressions

The syntax of these forms of regular expression is described in the following sections.

The following table shows which commands support regular expressions:

Command	**Regular expression form**
awk	extended
ed	simple
egrep	extended
ex	*)
expr	simple
grep	simple
lex	extended
nl	simple
sed	simple
vi	*)

*) The *ex* and *vi* commands process regular expressions which differ in certain respects from simple regular expressions. These differences are described under *ex* and *vi*.

Simple regular expressions

Simple regular expressions are constructed as follows

No.	Regular expression	Stands for	Example	Matching strings
1	c	The character *c*, where *c* is not a special character (metacharacter).	a	a
2	\ c	The character *c*, where *c* can be any character other than ( ) { } 1 2 3 4 5 6 7 8 9.	\\ a	a
		Regular expressions in this form are meaningful if c is a metacharacter. \c then stands for character *c* itself, as the backslash escapes its special meaning as a metacharacter.	\\ *	*
3		Any single character	.	a, x, *, ...
4	**[**s**]**	Any character from s, where s is a set of characters.	[mz]	m, z
		If a right square bracket] is to be one of the characters in the set, it has to be placed first in the set.	[]a]	], a
		If a hyphen - is to be one of the characters in the set, it has to be placed first or last.	[-a] [a-]	-, a -, a
		If a caret ^ is to be one the characters in the set, it can be placed anywhere but first.	[a^]	a, ^
	[c1**-**c2**]**	Any character in the range *c1* to *c2*, in accordance with the EBCDIC sort sequence (inclusive of limits *c1* and *c2*).	[a-m]	a, m and any character in between in the EBCDIC collating sequence
		c1 must come before c2 in the EBCDIC collating sequence. If it does not, c1-c2 does not denote a range but simply stands for the characters c1 and c2.	[m-a]	m, a
		The two forms can be combined: **[**s1c1**-**c2s2**]**	[ado-qxz]	a, d, o, q, x, z and any character coming between o and q in the EBCDIC collating sequence

No.	Regular expression	Stands for	Example	Matching strings
5	**[^s]**	Any character not included in set s.	[^xyz]	any character except x, y, z
	[^c1-c2]	Any character not in the range between c1 and c2 inclusive. Refer also to [c1-c2].	[^0-9]	any character except 0, 9 and all characters coming between 0 and 9 in the EBCDIC collating sequence)
		The two forms can be combined: [^s1c1-c2s2]	[^a0-9b]	any character except a, b, 0, 9 and all characters coming between 0 and 9 in the EBCDIC collating sequence
6	r*	Zero, one or more occurrences of regular expression r. r has to be of form 1 - 5, 12, 15 or 16.	a*	nothing, a, aa, aaa, ...
7	**r\ {m,n\ }**	At least *m* and at most *n* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a\ {1,2\ }	a or aa
	r\ {m\ }	Precisely *m* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a\ {3\ }	aaa
	r\ {m,\ }	At least *m* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a\ {3,\ }	aaa, aaaa, aaaaa, ...
8	rx	(Concatenation) An occurrence of regular expression *r* followed by an occurrence of regular expression *x*. *r* and *x* can be any regular expressions.	[ab].	ax, a3, a*, bz, ...
9	^r	An occurrence of regular expression *r* appearing at the start of a line, i.e. straight after a newline character or at the start of the file. *r* can be a regular expression in any form other than number 9.	^[aA]pple	apple or Apple at the start of a line

No.	**Regular expression**	**Stands for**	**Example**	**Matching strings**
10	**r$**	An occurrence of regular expression *r* at the end of a line, i.e. directly before a newline character. *r* can be a regular expression in any form other than number 10.	[bB]arge$	barge or Barge at the end of a line
11	**\ (r\ )**	Occurrences of regular expression *r*. *r* can be any regular expression. Only useful together with number 12	\ ([aA]pple\ )	apple, Apple
12	**** n	n is an integer in the range from 1 to 9. \n appearing in a concatenated regular expression stands for regular expression x, where x is the *n*th regular expression enclosed in \(and \) sequences that appeared earlier in the concatenated regular expression.	\ (a\ (b\ )\ )\ 2 s\ (illy\ )b\ 1 \ (ab\ )x\ 1*	abb sillybilly abx, abxab, abxabab, ...

Precedence

The precedence of operators in regular expressions is as shown in the following table.

Operator	**Precedence**
[. .] [= =] [: :]	high precedence
\<char>	.
[ ]	.
( )	.
* ? + \{m,n\}	.
Concatenation	.
^ $	.
|	low precedence

Metacharacters

Metacharacter	**The character to the left has a special meaning if**
\	– it is not preceded by a backslash \
. [	– it is not preceded by a backslash \ and – it does not appear between [and]
*	– it is not preceded by a backslash \, – it does not appear between [and], – it is not the first character in a pattern and – it does not come after \)
$	– it is the last character in a pattern
^	– it is the first character in a pattern – it is the first character in square brackets [...]
-	– it is in square brackets but not placed first or last
Regular expression delimiter such as /.../	– it is not preceded by a backslash \
[. [= [:	Character pairs to the left are special characters if they occur within a bracket expression (in square brackets). They will need to be closed by the corresponding character pair .], =] or :]. Example: [[:upper:]] indicates all uppercase letters.

Extended regular expressions

Extended regular expressions include the regular expressions with the following exception:

The construction used for simple regular expressions \(...\) has *no* special significance for extended regular expressions, for example the extended regular expression \(*ab*\) represents the string (*ab*).

Moreover,extended regular expressions provide the following syntax elements for pattern creation:

No.	Regular expression	Stands for	Example	Matching stings
7	r **{**m**,**n **}**	At least *m* and at most *n* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a {1,2 }	a or aa
	r **{**m**}**	Precisely *m* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a {3}	aaa
	r **{**m**, }**	At least *m* occurrences of regular expression *r*. *r* has to be of form 1 - 5, 12, 15 or 16.	a {3, }	aaa, aaaa, aaaaa, ...
13	r**+**	One or more occurrences of regular expression *r*. *r* has to be of form 1 - 5, 15 or 16.	u+	u, uu, uuu, ...
14	r**?**	Zero or one occurrence of regular expression *r*. *r* has to be of form 1 - 5, 15 or 16.	u?	nothing or u
15	**(**r**)**	Strings matching regular expression *r*. *r* can be any regular expression.	(ok(abc)) (au)*	okabc nothing or au, auau, ...
16	**(**r1/r2**)**	Strings matching regular expression *r1* or regular expression *r2*.	(ok?ko)	ok or ko

Precedence

The precedence of operators in extended regular expressions is as shown in the following table.

Operator	**Precedence**
[. .] [= =] [: :]	high precedence
\<char>	.
[ ]	.
( )	.
* ? + {m,n}	.
Concatenation	.
^ $	.
|	low precedence

Examples

1. Simple regular expressions

Pattern	**Meaning**	**Matching strings**
ab.d	a - b - any one character - d	abcd, abXd, ab*d, ...
ab.*d	a - b - any string (including the null string) - d	abd, abxd, abX*Yd, ...
ab[xyz]d	a - b - either x or y or z - d	abxd, abyd, abzd
ab[^c]d	a - b - any character other than c - d	abbd, abXd, ab*d, ...
^abcd$	a line containing only the string abcd	

2. Extended regular expressions

Pattern	**Meaning**	**Matching strings**
ab.+d	a - b - any sequence of one or more characters - d	abjd, abX*Yd, ...
abc?d	a - b - c or nothing - d	abd, abcd
(abc|xyz)	abc or xyz	abc, xyz

5.3 Metacharacters for the POSIX shell

Argument and command separators

Metacharacter	**Meaning**
Blank Newline Tab	Argument separators, depending on the value of the IFS variable
Newline	End of command
|	Pipe symbol
;	End of command
&	End of command; a command terminated with this symbol is run as a background process
| |	ORIF; the next command is executed only if the preceding command returns a non-zero exit status
&&	ANDIF; the next command is executed only if the preceding command returns an exit status of zero

Command grouping

Metacharacter	**Meaning**
(command_list**)**	Execute command_list in a subshell
{ command_list**;}**	Collect the output of all commands from command_list

Execute command and replace with output

Metacharacter	**Meaning**
\` command\`	Replace command with its output
$(command)	Replace command with its output

File name generation

Metacharacter	Meaning
*****	As a pattern on its own: replaced by the list of all file names in the current directory that do not begin with a period (.). As part of a pattern: replaced by no, one or more character(s) depending on the file names which match the pattern.
?	As a pattern on its own: replaced by the list of all file names in the current directory that consist of exactly one character, except for a period (.). As part of a pattern: replaced by no, one or more character(s) depending on the file names which match the pattern.
[s**]**	Replaced by exactly one of the characters which are not contained in the string s depending on the file names which match the pattern.
[c1**-**c2**]**	Replaced by any one character from the range between *c1* and *c2* inclusive to match file names in the current directory. *c1* and *c2* must be ordinary characters. The characters which collate between *c1* and *c2* are determined by the EBCDIC collating sequence. Expressions of type [*s*] and type [*c1-c2*] can be combined: [*s1c1-c2s2*]
[!s**]**	Replaced by exactly one of the characters which are not contained in the string s depending on the file names which match the pattern.
[!c1**-**c2**]**	Replaced by exactly one of the characters which do not lie in the range *c1* to *c2* depending on the file names which match the pattern (see [*c1-c2*]). Expressions of type [!*s*] and type[!*c1-c2*] can be combined: [!*s1c1-c2s2*]

Redirection of standard output

Metacharacter	Meaning
[n]**>** file	Redirect standard output [or file descriptor *n*] to *file*, deleting original contents
[n]**>>** file	Redirect standard output [or file descriptor *n*] to *file*, retaining original contents (append)
[n]**> &**digit	Redirect standard output [or file descriptor *n*] to the file associated with file descriptor *digit*
[n]**> &-**	Close standard output [or file descriptor *n*]

Redirection of standard input

Metacharacter	**Meaning**
[n] **<**file	Redirect standard input [or file descriptor *n*] to *file*
[n]**<<**argument	Start a "here" document or redirect to file descriptor *n*
[n] **<<-**argument	Start a "here" document or redirect to file descriptor *n*; stripping leading tabs
[n] **<&**digit	Redirect standard input to the file [or file descriptor *n*] associated with file descriptor *digit*
[n] **<&-**	Close standard input [or file descriptor *n*]
[n] **<>**file	*file* [or file descriptor n] is opened as the standard input for reading and writing

Shell variables and parameters

Metacharacter	**Meaning**
name**=**value	Assign a value to the variable *name*
$name	Value of the variable *name*; keyword parameter
${name**}**	Like *$name*; the braces separate the variable name from following figures or characters
${name**-**default_value**}**	Replace with *default_value* if name is undefined
${name**=**default_value**}**	Assign *default_value* if *name* is undefined
${name**?**default_value**}**	Shell terminates process execution with error message *parameter : default_value* if *name* is undefined
${name**+**default_value**}**	Replace with the null string if *name* is undefined; replace with *default_value* if *name* is defined
${name**:-**default_value**}**	Replace with *default_value* if *name* is undefined or if its value is the null string
${name**:=**default_value**}**	Assign *default_value* if *name* is undefined or if its value is the null string
${name**:?**default_value**}**	Shell terminates process execution with error message *parameter : default_value* if *name* is undefined or if its value is the null string
${name**:+**default_value**}**	Replace with the null string if *name* is undefined or if its value is the null string; replace with *default_value* if *name* is undefined or if its value is the null string
${#name**}**	Replace with the length of the string formed by *name*. If *name* is one of the characters * or commercial at @ then the substitution is undefined

Metacharacter	**Meaning**
${name**%**pattern**}**	If the POSIX shell pattern *pattern* matches the end of the value of *name*, then the substitute text is formed from the value of *name* without the deleted segment which corresponds to *pattern*. The shortest matching pattern is deleted.
${name**%%**pattern**}**	If the POSIX shell pattern *pattern* matches the end of the value of *name*, then the substitute text is formed from the value of *name* without the deleted segment which corresponds to *pattern*. The shortest matching pattern is deleted.
${name**#**pattern**}**	If the POSIX shell pattern *pattern* is to match the start of the value of *name*, then the substitute text is formed from the value of *name* from which the segment which corresponds to *pattern* has been deleted. The shortest matching pattern is deleted.
${name**##**pattern**}**	If the POSIX shell pattern *pattern* is to match the start of the value of *name*, then the substitute text is formed from the value of *name* from which the segment which corresponds to *pattern* has been deleted. The shortest matching pattern is deleted.
$0	0th command-line argument, i.e. the name of the command, the shell script or the current shell
$1, $2, ... , $9	Positional parameters
$* "$*"	All command-line arguments All command-line arguments as a single argument
$@ **"$@"**	All command-line arguments All command-line arguments as separate arguments
$#	Number of command-line arguments, excluding $0
$$	Process ID (PID) of the current shell
$!	PID of the last command run in the background
$?	Exit status of the last executed command that was not run in the background
$-	All options set in the current shell

Shell functions

Metacharacter	**Meaning**
name**()** **{** command_list**;}**	Shell function; when *name* is invoked, the commands from *command_list* are executed

Quoting metacharacters

Metacharacter	**Meaning**
\	Escapes the following metacharacter
' ...'	Escapes all metacharacters between quotes; treat as a single argument
"..."	Does not escape the metacharacters $ \`...\` \\ Treat as a single argument

Miscellaneous

Metacharacter	**Meaning**
# **;;**	Comment character in shell scripts Command list terminator within *case* constructs
~ **~-** **~+**	Tilde substitution
(( )) **$((expression))**	Arithmetic evaluation
[[ ]]	Conditional expressions

5.4 ASCII character set (ISO 646)

The following table combines the international version of the ISO 646 character set, the US version (equivalent to the 7-bit US ASCII coded character set), the British version and the German version.

decimal	**octal**	**hex**		Meaning	Control
0	00	00	NUL	No operation	@
1	01	01	SOH	Start of Heading	A
2	02	02	STX	Start of Text	B
3	03	03	ETX	End of Text	C
4	04	04	EOT	End of Transmission END key	D
5	05	05	ENQ	Enquiry	E
6	06	06	ACK	Acknowledge	F
7	07	07	BEL	Bell	G
8	10	08	BS	Backspace	H
9	11	09	HT	Horizontal Tabulation	I
10	12	0A	LF	Line Feed	J
11	13	0B	VT	Vertical Tabulation	K
12	14	0C	FF	Form Feed	L
13	15	0D	CR	Carriage Return	M
14	16	0E	SO	Shift Out	N
15	17	0F	SI	Shift In	O
16	20	10	DLE	Data Link Escape	P
17	21	11	DC1	Device Control 1 (turn output on)	Q
18	22	12	DC2	Device Control 2	R
19	23	13	DC3	Device Control 3 (turn output off)	S
20	24	14	DC4	Device Control 4	T
21	25	15	NAK	Negative Acknowledge	U
22	26	16	SYN	Synchronous Idle	V
23	27	17	ETB	End of Transmission Block	W
24	30	18	CAN	Cancel	X
25	31	19	EM	End of Medium (Signal3)	\ or |
26	32	1A	SUB	Substitute Character	Z
27	33	1B	ESC	Escape	
28	34	1C	FS	File Separator	\

decimal	**octal**	**hex**		Meaning	Control
29	35	1D	GS	Group Separator	]
30	36	1E	RS	Record Separator	^
32	40	20	SP	SPACE	
33	41	21	!		
34	42	22	"		
35	43	23	#	see 1)	
36	44	24	$	see 2)	
37	45	25	%		
38	46	26	&		
39	47	27	'		
40	50	28	(		
41	51	29	)		
42	52	2A	*		
43	53	2B	+		
44	54	2C	,		
45	55	2D	-		
46	56	2E	.		
47	57	2F	/		
48	60	30	0		
49	61	31	1		
50	62	32	2		
51	63	33	3		
52	64	34	4		
53	65	35	5		
54	66	36	6		
55	67	37	7		
56	70	38	8		
57	71	39	9		
58	72	3A	:		
59	73	3B	;		
60	74	3C	<		
61	75	3D	=		
62	76	3E	>		

decimal	**octal**	**hex**		Meaning	Control
63	77	3F	?		
64	100	40	@		
65	101	41	A		
66	102	42	B		
67	103	43	C		
68	104	44	D		
69	105	45	E		
70	106	46	F		
71	107	47	G		
72	110	48	H		
73	111	49	I		
74	112	4A	J		
75	113	4B	K		
76	114	4C	L		
77	115	4D	M		
78	116	4E	N		
79	117	4F	O		
80	120	50	P		
81	121	51	Q		
82	122	52	R		
83	123	53	S		
84	124	54	T		
85	125	55	U		
86	126	56	V		
87	127	57	W		
88	130	58	X		
89	131	59	Y		
90	132	5A	Z		
91	133	5B	[	see 1); German: Ä	
92	134	5C	\	see 1); German: Ö	
93	135	5D	]	see 1); German: Ü	
94	136	5E	^		
95	137	5F	_		

decimal	**octal**	**hex**		Meaning	Control
96	140	60	`		
97	141	61	a		
98	142	62	b		
99	143	63	c		
100	144	64	d		
101	145	65	e		
102	146	66	f		
103	147	67	g		
104	150	68	h		
105	151	69	i		
106	152	6A	j		
107	153	6B	k		
108	154	6C	l		
109	155	6D	m		
110	156	6E	n		
111	157	6F	o		
112	160	70	p		
113	161	71	q		
114	162	72	r		
115	163	73	s		
116	164	74	t		
117	165	75	u		
118	166	76	v		
119	167	77	w		
120	170	78	x		
121	171	79	y		
122	172	7A	z		
123	173	7B	{	see 1); German: ä	
124	174	7C	|	see 1); German: ö	
125	175	7D	}	see 1); German: ü	
126	176	7E		see 1); German: ß	
127	177	7F	DEL	Delete / Interrupt (Signal2)	

1)	ASCII:	as international variant (see table)	2)	ASCII:	~
	British:	as international variant (see table)		British:	~
	German:	umlauts (see table)		German:	ß

5.5 EDF04 character set

EBCDIC.DF.04 code table

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0					SP	&	-	ø	Ø	°	µ	¢	ù	¦	Ù	0
1					NBSP	é	/	É	a	j	¯	£	A	J	÷	1
2					â	ê	Â	Ê	b	k	s	¥	B	K	S	2
3					ä	ë	Ä	Ë	c	l	t	•	C	L	T	3
4					à	è	À	È	d	m	u	©	D	M	U	4
5					á	í	Á	Í	e	n	v	§	E	N	V	5
6					ã	î	Ã	Î	f	o	w	¶	F	O	W	6
7					å	ï	Å	Ï	g	p	x	$^{1}/_{4}$	G	P	X	7
8					ç	ì	Ç	Ì	h	q	y	$^{1}/_{2}$	H	Q	Y	8
9					ñ	ß	Ñ	¨	i	r	z	$^{3}/_{4}$	I	R	Z	9
A					`	!	^	:	<<	ª	;	¬	SHY	^{1}	^{2}	^{3}
B					.	$	,	#	>>	º	¿	[	ô	û	Ô	{
C					<	*	%	@	ð	æ	Đ	\	ö	ü	Ö	Ü
D					(	)	_	‘	ý	,	Ý	]	ò	Û	Ò	}
E					+	;	>	=	Þ	Æ	þ	´	ó	ú	Ó	Ú
F					|		?	“	±	¤	®	×	õ	ÿ	Õ	~

EBCDIC.DF.03 code table (international variant)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	NUL	DLE			SP	&	-									0	0
1	SOH	DC1					/		a	i			A	J		1	1
2	STX	DC2		SYN					b	k	s		B	K	S	2	2
3	ETX	DC3							c	l	t		C	L	T	3	3
4									d	m	u		D	M	U	4	4
5	HT		LF						e	n	v		E	N	V	5	5
6		BS	ETB						f	o	w		F	O	W	6	6
7	DEL		ESC	EOT					g	p	x		G	P	X	7	7
8		CAN							h	q	y		H	Q	Y	8	8
9		EM							i	r	z		I	R	Z	9	9
A					‘	!	^	:									A
B	VT				.	$	,	#				[				{	B
C	FF	FS		DC4	<	*	%	@				\					C
D	CR	IS3	ENQ	NAK	(	)	_	´				]				}	D
E	SO	RS	ACK		+	;	>	=									E
F	SI	IS1	BEL	SUB	|		?	"								~	F
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	

Related publications

You will find the manuals on the internet at *http://manuals.ts.fujitsu.com*. You can order manuals which are also available in printed form at *http://manualshop.ts.fujitsu.com*.

[1] **POSIX** (BS2000/OSD)
Basics for Users and System Administrators
User Guide

[2] **POSIX** (BS2000/OSD)
BS2000 filesystem bs2fs
User Guide

[3] **POSIX** (BS2000/OSD)
SOCKETS/XTI for POSIX
User Guide

[4] **C Library Functions** (BS2000/OSD)
for POSIX Applications
Reference Manual

[5] **C/C++** (BS2000/OSD)
POSIX Commands of the C/C++ Compiler
User Guide

[6] **CRTE (BS2000/OSD)**
Common Runtime Environment
User Guide

[7] **EDT** (BS2000/OSD)
Statements
User Guide

[8] **EDT** (BS2000/OSD)
Unicode Mode Statements
User Guide

[9] **NFS** (BS2000/OSD)
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[10] **JV** (BS2000/OSD)
Job Variables
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[11] **BS2000/OSD-BC**
Commands
User Guide

[12] **Reliant UNIX**
User's Reference Manual
Reference manual (only online)

[13] **Reliant UNIX**
System administrator's reference manual
Reference manual (only online)

[14] **SINIX**
Programmer's Guide: Internationalization - Localization
Porgrammer's Guide

Other publications

[15] XBD, Issue 4
X/Open CAE Specification, August 1994
System Interfaces Definitions, Issue 4, Version 2
(ISBN: 1-85912-036-9, C434)
X/Open Company Limited

[16] XSH, Issue 4
X/Open CAE Specification, August 1994
System Interfaces and Headers, Issue 4, Version 2
(ISBN: 1-85912-037-7, C435)
X/Open Company Limited

[17] XSH, Issue 4
X/Open CAE Specification, August 1994
Commands and Utilities, Issue 4, Version 2
(ISBN: 1-85912-034-2, C436)
X/Open Company Limited

[18] el Lozy, M.:
Editing in a UNIX Environment
The vi/ex Editor
Prentice-Hall, 1985

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