grep, searching for a pattern

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1 Introduction

`grep` searches the input files for lines containing a match to a given pattern list. When it finds a match in a line, it copies the line to standard output (by default), or does whatever other sort of output you have requested with options.

Though `grep` expects to do the matching on text, it has no limits on input line length other than available memory, and it can match arbitrary characters within a line. If the final byte of an input file is not a newline, `grep` silently supplies one. Since newline is also a separator for the list of patterns, there is no way to match newline characters in a text.

2 Invoking grep

`grep` comes with a rich set of options from POSIX.2 and GNU extensions.

'`-c`'
'`--count`' Suppress normal output; instead print a count of matching lines for each input file. With the '`-v`', '`--invert-match`' option, count non-matching lines.

'`-e` *pattern*'
'`--regexp=`*pattern*'
: Use *pattern* as the pattern; useful to protect patterns beginning with a '`-`'.

'`-f` *file*'
'`--file=`*file*'
: Obtain patterns from *file*, one per line. The empty file contains zero patterns, and therefore matches nothing.

'`-i`'
'`--ignore-case`'
: Ignore case distinctions in both the pattern and the input files.

'`-l`'
'`--files-with-matches`'
: Suppress normal output; instead print the name of each input file from which output would normally have been printed. The scanning of every file will stop on the first match.

'`-n`'
'`--line-number`'
: Prefix each line of output with the line number within its input file.

'`-o`'
'`--only-matching`'
: Print only the part of matching lines that actually matches *pattern*.

'`-q`'
'`--quiet`'
'`--silent`'
: Quiet; do not write anything to standard output. Exit immediately with zero status if any match is found, even if an error was detected. Also see the '`-s`' or '`--no-messages`' option.

'-s'
'--no-messages'
Suppress error messages about nonexistent or unreadable files. Portability note: unlike GNU `grep`, traditional `grep` did not conform to POSIX.2, because traditional `grep` lacked a '-q' option and its '-s' option behaved like GNU `grep`'s '-q' option. Shell scripts intended to be portable to traditional `grep` should avoid both '-q' and '-s' and should redirect output to '/dev/null' instead.

'-v'
'--invert-match'
Invert the sense of matching, to select non-matching lines.

'-x'
'--line-regexp'
Select only those matches that exactly match the whole line.

2.1 GNU Extensions

'-A *num*'
'--after-context=*num*'
Print *num* lines of trailing context after matching lines.

'-B *num*'
'--before-context=*num*'
Print *num* lines of leading context before matching lines.

'-C *num*'
'--context=*num*'
Print *num* lines of output context.

'--colour[=*WHEN*]'
'--color[=*WHEN*]'
The matching string is surrounded by the marker specify in *GREP_COLOR*. *WHEN* may be 'never', 'always', or 'auto'.

'-*num*' Same as '--context=*num*' lines of leading and trailing context. However, grep will never print any given line more than once.

'-V'
'--version'
Print the version number of `grep` to the standard output stream. This version number should be included in all bug reports.

'--help' Print a usage message briefly summarizing these command-line options and the bug-reporting address, then exit.

'--binary-files=*type*'
If the first few bytes of a file indicate that the file contains binary data, assume that the file is of type *type*. By default, *type* is 'binary', and `grep` normally outputs either a one-line message saying that a binary file matches, or no message if there is no match. If *type* is 'without-match', `grep` assumes that a binary file does not match; this is equivalent to the '-I' option. If *type* is

'text', grep processes a binary file as if it were text; this is equivalent to the '-a' option. *Warning:* '--binary-files=text' might output binary garbage, which can have nasty side effects if the output is a terminal and if the terminal driver interprets some of it as commands.

'-b'
'--byte-offset'
Print the byte offset within the input file before each line of output. When grep runs on MS-DOS or MS-Windows, the printed byte offsets depend on whether the '-u' ('--unix-byte-offsets') option is used; see below.

'-D *action*'
'--devices=*action*'
If an input file is a device, FIFO or socket, use *action* to process it. By default, *action* is 'read', which means that devices are read just as if they were ordinary files. If *action* is 'skip', devices, FIFOs and sockets are silently skipped.

'-d *action*'
'--directories=*action*'
If an input file is a directory, use *action* to process it. By default, *action* is 'read', which means that directories are read just as if they were ordinary files (some operating systems and filesystems disallow this, and will cause grep to print error messages for every directory or silently skip them). If *action* is 'skip', directories are silently skipped. If *action* is 'recurse', grep reads all files under each directory, recursively; this is equivalent to the '-r' option.

'-H'
'--with-filename'
Print the filename for each match.

'-h'
'--no-filename'
Suppress the prefixing of filenames on output when multiple files are searched.

'--line-buffered'
Set the line buffering policy, this can be a performance penality.

'--label=*LABEL*'
Displays input actually coming from standard input as input coming from file *LABEL*. This is especially useful for tools like zgrep, e.g. gzip -cd foo.gz |grep --label=foo something

'-L'
'--files-without-match'
Suppress normal output; instead print the name of each input file from which no output would normally have been printed. The scanning of every file will stop on the first match.

'-a'
'--text' Process a binary file as if it were text; this is equivalent to the '--binary-files=text' option.

‘`-I`’ Process a binary file as if it did not contain matching data; this is equivalent to the ‘`--binary-files=without-match`’ option.

‘`-w`’
‘`--word-regexp`’
: Select only those lines containing matches that form whole words. The test is that the matching substring must either be at the beginning of the line, or preceded by a non-word constituent character. Similarly, it must be either at the end of the line or followed by a non-word constituent character. Word-constituent characters are letters, digits, and the underscore.

‘`-r`’
‘`-R`’
‘`--recursive`’
: For each directory mentioned in the command line, read and process all files in that directory, recursively. This is the same as the ‘`--directories=recurse`’ option.

‘`--include=`*file_pattern*’
: When processing directories recursively, only files matching *file_pattern* will be search.

‘`--exclude=`*file_pattern*’
: When processing directories recursively, skip files matching *file_pattern*.

‘`-m` *num*’
‘`--max-count=`*num*’
: Stop reading a file after *num* matching lines. If the input is standard input from a regular file, and *num* matching lines are output, `grep` ensures that the standard input is positioned to just after the last matching line before exiting, regardless of the presence of trailing context lines. This enables a calling process to resume a search. For example, the following shell script makes use of it:

```
while grep -m 1 PATTERN
do
  echo xxxx
done < FILE
```

But the following probably will not work because a pipe is not a regular file:

```
# This probably will not work.
cat FILE |
while grep -m 1 PATTERN
do
  echo xxxx
done
```

When `grep` stops after NUM matching lines, it outputs any trailing context lines. Since context does not include matching lines, `grep` will stop when it encounters another matching line. When the ‘`-c`’ or ‘`--count`’ option is also used, `grep` does not output a count greater than *num*. When the ‘`-v`’ or ‘`--invert-match`’ option is also used, `grep` stops after outputting *num* non-matching lines.

'-y' Obsolete synonym for '-i'.

'-U'
'--binary'
Treat the file(s) as binary. By default, under MS-DOS and MS-Windows, grep guesses the file type by looking at the contents of the first 32kB read from the file. If grep decides the file is a text file, it strips the CR characters from the original file contents (to make regular expressions with ^ and $ work correctly). Specifying '-U' overrules this guesswork, causing all files to be read and passed to the matching mechanism verbatim; if the file is a text file with CR/LF pairs at the end of each line, this will cause some regular expressions to fail. This option has no effect on platforms other than MS-DOS and MS-Windows.

'-u'
'--unix-byte-offsets'
Report Unix-style byte offsets. This switch causes grep to report byte offsets as if the file were Unix style text file, i.e., the byte offsets ignore the CR characters which were stripped. This will produce results identical to running grep on a Unix machine. This option has no effect unless '-b' option is also used; it has no effect on platforms other than MS-DOS and MS-Windows.

'--mmap' If possible, use the mmap system call to read input, instead of the default read system call. In some situations, '--mmap' yields better performance. However, '--mmap' can cause undefined behavior (including core dumps) if an input file shrinks while grep is operating, or if an I/O error occurs.

'-Z'
'--null' Output a zero byte (the ASCII NUL character) instead of the character that normally follows a file name. For example, 'grep -lZ' outputs a zero byte after each file name instead of the usual newline. This option makes the output unambiguous, even in the presence of file names containing unusual characters like newlines. This option can be used with commands like 'find -print0', 'perl -0', 'sort -z', and 'xargs -0' to process arbitrary file names, even those that contain newline characters.

'-z'
'--null-data'
Treat the input as a set of lines, each terminated by a zero byte (the ASCII NUL character) instead of a newline. Like the '-Z' or '--null' option, this option can be used with commands like 'sort -z' to process arbitrary file names.

Several additional options control which variant of the grep matching engine is used. See Chapter 4 [Grep Programs], page 7.

2.2 Environment Variables

Grep's behavior is affected by the following environment variables.

A locale LC_*foo* is specified by examining the three environment variables LC_ALL, LC_*foo*, and LANG, in that order. The first of these variables that is set specifies the locale. For example, if LC_ALL is not set, but LC_MESSAGES is set to 'pt_BR', then Brazilian Portuguese is used for the `LC_MESSAGES` locale. The C locale is used if none of these environment variables are set, or if the locale catalog is not installed, or if `grep` was not compiled with national language support (NLS).

`GREP_OPTIONS`
: This variable specifies default options to be placed in front of any explicit options. For example, if `GREP_OPTIONS` is '`--binary-files=without-match --directories=skip`', `grep` behaves as if the two options '`--binary-files=without-match`' and '`--directories=skip`' had been specified before any explicit options. Option specifications are separated by whitespace. A backslash escapes the next character, so it can be used to specify an option containing whitespace or a backslash.

`GREP_COLOR`
: This variable specifies the surrounding markers use to highlight the matching text. The default is control ascii red.

`LC_ALL`
`LC_COLLATE`
`LANG`
: These variables specify the `LC_COLLATE` locale, which determines the collating sequence used to interpret range expressions like '`[a-z]`'.

`LC_ALL`
`LC_CTYPE`
`LANG`
: These variables specify the `LC_CTYPE` locale, which determines the type of characters, e.g., which characters are whitespace.

`LC_ALL`
`LC_MESSAGES`
`LANG`
: These variables specify the `LC_MESSAGES` locale, which determines the language that `grep` uses for messages. The default C locale uses American English messages.

`POSIXLY_CORRECT`
: If set, `grep` behaves as POSIX.2 requires; otherwise, `grep` behaves more like other GNU programs. POSIX.2 requires that options that follow file names must be treated as file names; by default, such options are permuted to the front of the operand list and are treated as options. Also, POSIX.2 requires that unrecognized options be diagnosed as "illegal", but since they are not really against the law the default is to diagnose them as "invalid". `POSIXLY_CORRECT` also disables `_`*N*`_GNU_nonoption_argv_flags_`, described below.

`_`*N*`_GNU_nonoption_argv_flags_`
: (Here *N* is `grep`'s numeric process ID.) If the *i*th character of this environment variable's value is '`1`', do not consider the *i*th operand of `grep` to be an option, even if it appears to be one. A shell can put this variable in the environment for each command it runs, specifying which operands are the results of file name wildcard expansion and therefore should not be treated as options. This behavior is available only with the GNU C library, and only when `POSIXLY_CORRECT` is not set.

3 Diagnostics

Normally, exit status is 0 if selected lines are found and 1 otherwise. But the exit status is 2 if an error occurred, unless the '`-q`' or '`--quiet`' or '`--silent`' option is used and a selected line is found.

4 `grep` programs

`grep` searches the named input files (or standard input if no files are named, or the file name '`-`' is given) for lines containing a match to the given pattern. By default, `grep` prints the matching lines. There are four major variants of `grep`, controlled by the following options.

'`-G`'
'`--basic-regexp`'
: Interpret the pattern as a basic regular expression. This is the default.

'`-E`'
'`--extended-regexp`'
: Interpret the pattern as an extended regular expression.

'`-F`'
'`--fixed-strings`'
: Interpret the pattern as a list of fixed strings, separated by newlines, any of which is to be matched.

'`-P`'
'`--perl-regexp`'
: Interpret the pattern as a Perl regular expression.

In addition, two variant programs EGREP and FGREP are available. EGREP is the same as '`grep -E`'. FGREP is the same as '`grep -F`'.

5 Regular Expressions

A *regular expression* is a pattern that describes a set of strings. Regular expressions are constructed analogously to arithmetic expressions, by using various operators to combine smaller expressions. `grep` understands two different versions of regular expression syntax: "basic"(BRE) and "extended"(ERE). In GNU `grep`, there is no difference in available functionality using either syntax. In other implementations, basic regular expressions are less powerful. The following description applies to extended regular expressions; differences for basic regular expressions are summarized afterwards.

The fundamental building blocks are the regular expressions that match a single character. Most characters, including all letters and digits, are regular expressions that match themselves. Any metacharacter with special meaning may be quoted by preceding it with a backslash.

A regular expression may be followed by one of several repetition operators:

'.' The period '.' matches any single character.

'?' The preceding item is optional and will be matched at most once.

'*' The preceding item will be matched zero or more times.

'+' The preceding item will be matched one or more times.

'{*n*}' The preceding item is matched exactly *n* times.

'{*n*,}' The preceding item is matched n or more times.

'{*n*,*m*}' The preceding item is matched at least *n* times, but not more than *m* times.

Two regular expressions may be concatenated; the resulting regular expression matches any string formed by concatenating two substrings that respectively match the concatenated subexpressions.

Two regular expressions may be joined by the infix operator '|'; the resulting regular expression matches any string matching either subexpression.

Repetition takes precedence over concatenation, which in turn takes precedence over alternation. A whole subexpression may be enclosed in parentheses to override these precedence rules.

5.1 Character Class

A *bracket expression* is a list of characters enclosed by '[' and ']'. It matches any single character in that list; if the first character of the list is the caret '^', then it matches any character **not** in the list. For example, the regular expression '[0123456789]' matches any single digit.

Within a bracket expression, a *range expression* consists of two characters separated by a hyphen. It matches any single character that sorts between the two characters, inclusive, using the locale's collating sequence and character set. For example, in the default C locale, '[a-d]' is equivalent to '[abcd]'. Many locales sort characters in dictionary order, and in these locales '[a-d]' is typically not equivalent to '[abcd]'; it might be equivalent to '[aBbCcDd]', for example. To obtain the traditional interpretation of bracket expressions, you can use the C locale by setting the `LC_ALL` environment variable to the value 'C'.

Finally, certain named classes of characters are predefined within bracket expressions, as follows. Their interpretation depends on the `LC_CTYPE` locale; the interpretation below is that of the C locale, which is the default if no `LC_CTYPE` locale is specified.

'[:alnum:]'
: Alphanumeric characters: '[:alpha:]' and '[:digit:]'.

'[:alpha:]'
: Alphabetic characters: '[:lower:]' and '[:upper:]'.

'[:blank:]'
: Blank characters: space and tab.

'[:cntrl:]'
: Control characters. In ASCII, these characters have octal codes 000 through 037, and 177 (`DEL`). In other character sets, these are the equivalent characters, if any.

‘[:digit:]’
: Digits: 0 1 2 3 4 5 6 7 8 9.

‘[:graph:]’
: Graphical characters: ‘[:alnum:]’ and ‘[:punct:]’.

‘[:lower:]’
: Lower-case letters: a b c d e f g h i j k l m n o p q r s t u v w x y z.

‘[:print:]’
: Printable characters: ‘[:alnum:]’, ‘[:punct:]’, and space.

‘[:punct:]’
: Punctuation characters: ! " # $ % & ' ( ) * + , - . / : ; < = > ? @ [\ ] ^ _ ` { | } ~.

‘[:space:]’
: Space characters: tab, newline, vertical tab, form feed, carriage return, and space.

‘[:upper:]’
: Upper-case letters: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z.

‘[:xdigit:]’
: Hexadecimal digits: 0 1 2 3 4 5 6 7 8 9 A B C D E F a b c d e f.

For example, ‘[[:alnum:]]’ means ‘[0-9A-Za-z]’, except the latter depends upon the C locale and the ASCII character encoding, whereas the former is independent of locale and character set. (Note that the brackets in these class names are part of the symbolic names, and must be included in addition to the brackets delimiting the bracket list.)

Most metacharacters lose their special meaning inside lists.

‘]’
: ends the list if it's not the first list item. So, if you want to make the ‘]’ character a list item, you must put it first.

‘[.’
: represents the open collating symbol.

‘.]’
: represents the close collating symbol.

‘[=’
: represents the open equivalence class.

‘=]’
: represents the close equivalence class.

‘[:’
: represents the open character class followed by a valid character class name.

‘:]’
: represents the close character class followed by a valid character class name.

‘-’
: represents the range if it's not first or last in a list or the ending point of a range.

‘^’
: represents the characters not in the list. If you want to make the ‘^’ character a list item, place it anywhere but first.

5.2 Backslash Character

The ‘\’ when followed by certain ordinary characters take a special meaning :

‘‘`\b`’’ Match the empty string at the edge of a word.

‘‘`\B`’’ Match the empty string provided it’s not at the edge of a word.

‘‘`\<`’’ Match the empty string at the beginning of word.

‘‘`\>`’’ Match the empty string at the end of word.

‘‘`\w`’’ Match word constituent, it is a synonym for ‘`[[:alnum:]]`’.

‘‘`\W`’’ Match non word constituent, it is a synonym for ‘`[^[:alnum:]]`’.

For example , ‘`\brat\b`’ matches the separate word ‘`rat`’, ‘`c\Brat\Be`’ matches ‘`crate`’, but ‘`dirty \Brat`’ doesn’t match ‘`dirty rat`’.

5.3 Anchoring

The caret ‘`^`’ and the dollar sign ‘`$`’ are metacharacters that respectively match the empty string at the beginning and end of a line.

5.4 Back-reference

The back-reference ‘*n*’, where *n* is a single digit, matches the substring previously matched by the *n*th parenthesized subexpression of the regular expression. For example, ‘`(a)\1`’ matches ‘`aa`’. When use with alternation if the group does not participate in the match, then the back-reference makes the whole match fail. For example, ‘`a(.)|b\1`’ will not match ‘`ba`’. When multiple regular expressions are given with ‘`-e`’ or from a file ‘`-f file`’, the back-referecences are local to each expression.

5.5 Basic vs Extended

In basic regular expressions the metacharacters ‘`?`’, ‘`+`’, ‘`{`’, ‘`|`’, ‘`(`’, and ‘`)`’ lose their special meaning; instead use the backslashed versions ‘`\?`’, ‘`\+`’, ‘`\{`’, ‘`\|`’, ‘`\(`’, and ‘`\)`’.

Traditional `egrep` did not support the ‘`{`’ metacharacter, and some `egrep` implementations support ‘`\{`’ instead, so portable scripts should avoid ‘`{`’ in ‘`egrep`’ patterns and should use ‘`[{]`’ to match a literal ‘`{`’.

GNU `egrep` attempts to support traditional usage by assuming that ‘`{`’ is not special if it would be the start of an invalid interval specification. For example, the shell command ‘`egrep '{1'`’ searches for the two-character string ‘`{1`’ instead of reporting a syntax error in the regular expression. POSIX.2 allows this behavior as an extension, but portable scripts should avoid it.

6 Usage

Here is an example shell command that invokes GNU `grep`:

```
grep -i 'hello.*world' menu.h main.c
```

This lists all lines in the files '`menu.h`' and '`main.c`' that contain the string '`hello`' followed by the string '`world`'; this is because '`.*`' matches zero or more characters within a line. See Chapter 5 [Regular Expressions], page 7. The '`-i`' option causes `grep` to ignore case, causing it to match the line '`Hello, world!`', which it would not otherwise match. See Chapter 2 [Invoking], page 1, for more details about how to invoke `grep`.

Here are some common questions and answers about `grep` usage.

1. How can I list just the names of matching files?

   ```
   grep -l 'main' *.c
   ```

   lists the names of all C files in the current directory whose contents mention '`main`'.

2. How do I search directories recursively?

   ```
   grep -r 'hello' /home/gigi
   ```

   searches for '`hello`' in all files under the directory '`/home/gigi`'. For more control of which files are searched, use `find`, `grep` and `xargs`. For example, the following command searches only C files:

   ```
   find /home/gigi -name '*.c' -print | xargs grep 'hello' /dev/null
   ```

   This differs from the command:

   ```
   grep -r 'hello' *.c
   ```

   which merely looks for '`hello`' in all files in the current directory whose names end in '`.c`'. Here the '`-r`' is probably unnecessary, as recursion occurs only in the unlikely event that one of '`.c`' files is a directory.

3. What if a pattern has a leading '`-`'?

   ```
   grep -e '--cut here--' *
   ```

   searches for all lines matching '`--cut here--`'. Without '`-e`', `grep` would attempt to parse '`--cut here--`' as a list of options.

4. Suppose I want to search for a whole word, not a part of a word?

   ```
   grep -w 'hello' *
   ```

   searches only for instances of '`hello`' that are entire words; it does not match '`Othello`'. For more control, use '`\<`' and '`\>`' to match the start and end of words. For example:

   ```
   grep 'hello\>' *
   ```

   searches only for words ending in '`hello`', so it matches the word '`Othello`'.

5. How do I output context around the matching lines?

   ```
   grep -C 2 'hello' *
   ```

   prints two lines of context around each matching line.

6. How do I force grep to print the name of the file?

   Append '`/dev/null`':

   ```
   grep 'eli' /etc/passwd /dev/null
   ```

   gets you:

```
/etc/passwd:eli:DNGUTF58.IMe.:98:11:Eli Smith:/home/do/eli:/bin/bash
```

7. Why do people use strange regular expressions on `ps` output?

   ```
   ps -ef | grep '[c]ron'
   ```

   If the pattern had been written without the square brackets, it would have matched not only the `ps` output line for `cron`, but also the `ps` output line for `grep`. Note that some platforms `ps` limit the ouput to the width of the screen, grep does not have any limit on the length of a line except the available memory.

8. Why does `grep` report "Binary file matches"?

   If `grep` listed all matching "lines" from a binary file, it would probably generate output that is not useful, and it might even muck up your display. So GNU `grep` suppresses output from files that appear to be binary files. To force GNU `grep` to output lines even from files that appear to be binary, use the '`-a`' or '`--binary-files=text`' option. To eliminate the "Binary file matches" messages, use the '`-I`' or '`--binary-files=without-match`' option.

9. Why doesn't '`grep -lv`' print nonmatching file names?

   '`grep -lv`' lists the names of all files containing one or more lines that do not match. To list the names of all files that contain no matching lines, use the '`-L`' or '`--files-without-match`' option.

10. I can do OR with '`|`', but what about AND?

    ```
    grep 'paul' /etc/motd | grep 'franc,ois'
    ```

    finds all lines that contain both '`paul`' and '`franc,ois`'.

11. How can I search in both standard input and in files?

    Use the special file name '`-`':

    ```
    cat /etc/passwd | grep 'alain' - /etc/motd
    ```

12. How to express palindromes in a regular expression?

    It can be done by using the back referecences, for example a palindrome of 4 chararcters can be written in BRE.

    ```
    grep -w -e '\(.\)\(.\).\2\1' file
    ```

    It matches the word "radar" or "civic".

    Guglielmo Bondioni proposed a single RE that finds all the palindromes up to 19 characters long.

    ```
    egrep -e '^(.?)(.?)(.?)(.?)(.?)(.?)(.?)(.?)(.?).?\9\8\7\6\5\4\3\2\1$' file
    ```

    Note this is done by using GNU ERE extensions, it might not be portable on other greps.

13. Why are my expressions whith the vertical bar fail?

    ```
    /bin/echo "ba" | egrep '(a)\1|(b)\1'
    ```

    The first alternate branch fails then the first group was not in the match this will make the second alternate branch fails. For example, "aaba" will match, the first group participate in the match and can be reuse in the second branch.

14. What do `grep, fgrep, egrep` stand for ?

    grep comes from the way line editing was done on Unix. For example, `ed` uses this syntax to print a list of matching lines on the screen.

```
global/regular expression/print
g/re/p
```

`fgrep` stands for Fixed `grep`, `egrep` Extended `grep`.

7 Reporting bugs

Email bug reports to `bug-grep@gnu.org`.

Large repetition counts in the '`{n,m}`' construct may cause `grep` to use lots of memory. In addition, certain other obscure regular expressions require exponential time and space, and may cause grep to run out of memory. Back-references are very slow, and may require exponential time.

8 Copying

GNU grep is licensed under the GNU GPL, which makes it *free software*.

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Concept Index

This is a general index of all issues discussed in this manual, with the exception of the `grep` commands and command-line options.

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Index

This is an alphabetical list of all `grep` commands, command-line options, and environment variables.

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