

# GNU 'ed' Manual

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## The GNU ed line editor

This manual is for GNU ed (version 1.16, 20 February 2020).

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## 1 Overview

GNU ed is a line-oriented text editor. It is used to create, display, modify and otherwise manipulate text files, both interactively and via shell scripts. A restricted version of ed, red, can only edit files in the current directory and cannot execute shell commands. Ed is the 'standard' text editor in the sense that it is the original editor for Unix, and thus widely available. For most purposes, however, it is superseded by full-screen editors such as GNU Emacs or GNU Moe.

GNU ed is based on the editor algorithm described in Brian W. Kernighan and P. J. Plauger's book "Software Tools in Pascal", Addison-Wesley, 1981.

If invoked with a file argument, then a copy of file is read into the editor's buffer. Changes are made to this copy and not directly to file itself. Upon quitting ed, any changes not explicitly saved with a 'w' command are lost.

Editing is done in two distinct modes: command and input. When first invoked, ed is in command mode. In this mode commands are read from the standard input and executed to manipulate the contents of the editor buffer. A typical command might look like:

```
,s/old/new/g
```

which replaces all occurrences of the string old with new.

When an input command, such as 'a' (append), 'i' (insert) or 'c' (change), is given, ed enters input mode. This is the primary means of adding text to a file. In this mode, no commands are available; instead, the standard input is written directly to the editor buffer. A line consists of the text up to and including a <newline> character. Input mode is terminated by entering a single period ('.') on a line.

All ed commands operate on whole lines or ranges of lines; e.g., the 'd' command deletes lines; the 'm' command moves lines, and so on. It is possible to modify only a portion of a line by means of replacement, as in the example above. However even here, the 's' command is applied to whole lines at a time.

In general, ed commands consist of zero or more line addresses, followed by a single character command and possibly additional parameters; i.e., commands have the structure:

```
[address[,address]]command[parameters]
```

The addresses indicate the line or range of lines to be affected by the command. If fewer addresses are given than the command accepts, then default addresses are supplied.

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## 2 Introduction to line editing

ed was created, along with the Unix operating system, by Ken Thompson and Dennis Ritchie. It is the refinement of its more complex, programmable predecessor, QED, to which Thompson and Ritchie had already added pattern matching capabilities (see Regular expressions).

For the purposes of this tutorial, a working knowledge of the Unix shell sh and the Unix file system is recommended, since ed is designed to interact closely with them. (See the bash manual for details about bash).

The principal difference between line editors and display editors is that display editors provide instant feedback to user commands, whereas line editors require sometimes lengthy input before any effects are seen. The advantage of instant feedback, of course, is that if a mistake is made, it can be corrected immediately, before more damage is done. Editing in ed requires more strategy and forethought; but if you are up to the task, it can be quite efficient.

Much of the ed command syntax is shared with other Unix utilities.

As with the shell, <RETURN> (the carriage-return key) enters a line of input. So when we speak of "entering" a command or some text in ed, <RETURN> is implied at the end of each line. Prior to typing <RETURN>, corrections to the line may be made by typing either <BACKSPACE> to erase characters backwards, or <CONTROL>-u (i.e., hold the CONTROL key and type u) to erase the whole line.

When ed first opens, it expects to be told what to do but doesn't prompt us like the shell. So let's begin by telling ed to do so with the <P> (prompt) command:

```
$ ed
P
*
```

By default, ed uses asterisk (\*) as command prompt to avoid confusion with the shell command prompt ('\$').

We can run Unix shell (sh) commands from inside ed by prefixing them with <!> (exclamation mark, aka "bang"). For example:

```
*!date
Mon Jun 26 10:08:41 PDT 2006
```

```

!
*!for s in hello world; do echo $s; done
hello
world
!
*
```

So far, this is no different from running commands in the Unix shell. But let's say we want to edit the output of a command, or save it to a file. First we must capture the command output to a temporary location called a buffer where ed can access it. This is done with ed's <r> command (mnemonic: read):

```

*r !cal -m
137
*
```

Here ed is telling us that it has just read 137 characters into the editor buffer - i.e., the output of the cal command, which prints a simple ASCII calendar. To display the buffer contents we issue the <p> (print) command (not to be confused with the prompt command, which is uppercase!). To indicate the range of lines in the buffer that should be printed, we prefix the command with <,> (comma) which is shorthand for "the whole buffer":

```

*,p
      June 2006
Mo Tu We Th Fr Sa Su
           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

*
```

Now let's write the buffer contents to a file named 'junk' with the <w> (write) command:

```

*w junk
137
*
```

Need we say? It's good practice to frequently write the buffer contents, since unwritten changes to the buffer will be lost when we exit ed.

The sample sessions below illustrate some basic concepts of line editing with ed. We begin by creating a file, 'sonnet', with some help from Shakespeare. As with the shell, all input to ed must be followed by a <newline> character. Commands beginning with '#' are taken as comments and ignored. Input mode lines that begin with '#' are just more input.

```
$ ed
# The 'a' command is for appending text to the editor buffer.
a
No more be grieved at that which thou hast done.
Roses have thorns, and filvers foutians mud.
Clouds and eclipses stain both moon and sun,
And loathsome canker lives in sweetest bud.
.
# Entering a single period on a line returns ed to command mode.
# Now write the buffer to the file 'sonnet' and quit:
w sonnet
183
# ed reports the number of characters written.
q
$ ls -l
total 2
-rw-rw-r--  1 alm          183 Nov 10 01:16 sonnet
$
```

In the next example, some typos are corrected in the file 'sonnet'.

```
$ ed sonnet
183
# Begin by printing the buffer to the terminal with the 'p' command.
# The ',,' means "all lines".
,p
No more be grieved at that which thou hast done.
Roses have thorns, and filvers foutians mud.
Clouds and eclipses stain both moon and sun,
And loathsome canker lives in sweetest bud.
# Select line 2 for editing.
2
Roses have thorns, and filvers foutians mud.
# Use the substitute command, 's', to replace 'filvers' with 'silver',
# and print the result.
s/filvers/silver/p
Roses have thorns, and silver foutians mud.
# And correct the spelling of 'fountains'.
s/utia/untai/p
```

```

Roses have thorns, and silver fountains mud.
w sonnet
183
q
$

```

Since ed is line-oriented, we have to tell it which line, or range of lines we want to edit. In the above example, we do this by specifying the line's number, or sequence in the buffer. Alternatively, we could have specified a unique string in the line, e.g., '/filvers/', where the '/'s delimit the string in question. Subsequent commands affect only the selected line, a.k.a. the current line. Portions of that line are then replaced with the substitute command, whose syntax is 's/old/new/'.

Although ed accepts only one command per line, the print command 'p' is an exception, and may be appended to the end of most commands.

In the next example, a title is added to our sonnet.

```

$ ed sonnet
183
a
  Sonnet #50
.
,P
No more be grieved at that which thou hast done.
Roses have thorns, and silver fountains mud.
Clouds and eclipses stain both moon and sun,
And loathsome canker lives in sweetest bud.
  Sonnet #50
# The title got appended to the end; we should have used '0a'
# to append "before the first line".
# Move the title to its proper place.
5m0p
  Sonnet #50
# The title is now the first line, and the current address has been
# set to the address of this line as well.
,P
  Sonnet #50
No more be grieved at that which thou hast done.
Roses have thorns, and silver fountains mud.
Clouds and eclipses stain both moon and sun,
And loathsome canker lives in sweetest bud.
wq sonnet
195
$

```

When ed opens a file, the current address is initially set to the address of the last line of that file. Similarly, the move command 'm' sets the current address to the address of the last line moved.

Related programs or routines are vi (1), sed (1), regex (3), sh (1). Relevant documents are:

Unix User's Manual Supplementary Documents: 12 -- 13

B. W. Kernighan and P. J. Plauger: "Software Tools in Pascal", Addison-Wesley, 1981.

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### 3 Invoking ed

The format for running ed is:

```
ed [options] [file]
red [options] [file]
```

file specifies the name of a file to read. If file is prefixed with a bang (!), then it is interpreted as a shell command. In this case, what is read is the standard output of file executed via sh (1). To read a file whose name begins with a bang, prefix the name with a backslash (\). The default filename is set to file only if it is not prefixed with a bang.

ed supports the following options:

- h--help** Print an informative help message describing the options and exit.
- V--version** Print the version number of ed on the standard output and exit. This version number should be included in all bug reports.
- G--traditional** Forces backwards compatibility. This affects the behavior of the ed commands 'G', 'V', 'F', 'I', 'm', 't' and '!!'. If the default behavior of these commands does not seem familiar, then try invoking ed with this switch.
- l--loose-exit-status** Don't exit with bad status if a command happens to "fail" (for example if a substitution command finds nothing to replace). This can be useful when ed is invoked as the editor for crontab.

- p string--prompt=string** Specifies a command prompt string and turns prompting on. Showing the prompt string may be toggled on and off with the 'P' command.
  
- r--restricted** Run in restricted mode. This mode disables editing of files out of the current directory and execution of shell commands.
  
- s--quiet--silent** Suppresses diagnostics, the printing of byte counts by 'e', 'E', 'r' and 'w' commands, and the '!' prompt after a '!' command. This option may be useful if ed's standard input is from a script.
  
- v--verbose** Verbose mode; prints error explanations. This may be toggled on and off with the 'H' command.

Exit status: 0 if no errors occurred; otherwise >0.

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## 4 Line addressing

An address represents the number of a line in the buffer. ed maintains a current address which is typically supplied to commands as the default address when none is specified. When a file is first read, the current address is set to the address of the last line of the file. In general, the current address is set to the address of the last line affected by a command.

One exception to the rule that addresses represent line numbers is the address '0' (zero). This means "at the beginning of the buffer", and is valid wherever it makes sense.

An address range is two addresses separated either by a comma (',') or a semicolon (';'). In a semicolon-delimited range, the current address ('.') is set to the first address before the second address is calculated. This feature can be used to set the starting line for searches if the second address contains a regular expression. The value of the first address in a range cannot exceed the value of the second.

Addresses can be omitted on either side of the comma or semicolon separator. If only the first address is given in a range, then the second address is set to the given address. If only the second address is given, the resulting address pairs are '1,addr' and ';addr' respectively. If a n-tuple of addresses is given where n > 2, then the corresponding range is determined by the last two addresses in the n-tuple. If only one address is expected, then the last address is used. It

is an error to give any number of addresses to a command that requires zero addresses.

A line address is constructed as follows:

- . The current line (address) in the buffer.
- \$ The last line in the buffer.
- n The nth line in the buffer, where n is a number in the range '0,\$'.
- +n The nth next line, where n is a non-negative number.
- n The nth previous line, where n is a non-negative number.
- + The next line. This is equivalent to '+1' and may be repeated with cumulative effect.
- The previous line. This is equivalent to '-1' and may be repeated with cumulative effect.
- , The first through last lines in the buffer. This is equivalent to the address range '1,\$'.
- ; The current through last lines in the buffer. This is equivalent to the address range ',\$'.
- /re/ The next line containing the regular expression re. The search wraps to the beginning of the buffer and continues down to the current line, if necessary.
- ?re? The previous line containing the regular expression re. The search wraps to the end of the buffer and continues up to the current line, if necessary.
- 'x The apostrophe-x character pair addresses the line previously marked by a 'k' (mark) command, where 'x' is a lower case letter from the portable character set '[a-z]'.

Addresses can be followed by one or more address offsets, optionally separated by whitespace. Offsets are constructed as follows:

- '+' or '-' followed by a number adds or subtracts the indicated number of lines to or from the address.
- '+' or '-' not followed by a number adds or subtracts 1 to or from the address.
- A number adds the indicated number of lines to the address.

It is not an error if an intermediate address value is negative or greater than the address of the last line in the buffer. It is an error if the final address value is negative or greater than the address of the last line in the buffer. It is an error if a search for a re fails to find a matching line.

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## 5 Regular expressions

Regular expressions are patterns used in selecting text. For example, the ed command

```
g/string/
```

prints all lines containing string. Regular expressions are also used by the 's' command for selecting old text to be replaced with new text.

In addition to specifying string literals, regular expressions can represent classes of strings. Strings thus represented are said to be matched by the corresponding regular expression. If it is possible for a regular expression to match several strings in a line, then the left-most match is the one selected. If the regular expression permits a variable number of matching characters, the longest sequence starting at that point is matched.

A null re is equivalent to the last re encountered.

The following symbols are used in constructing regular expressions:

**c** Any character c not listed below, including '{', '}', '(', ')', '<' and '>', matches itself.

**\c** Any backslash-escaped character c, other than '{', '}', '(', ')', '<', '>', 'b', 'B', 'w', 'W', '+' and '?', matches itself.

**.** Matches any single character.

**[char-class]** Matches any single character in char-class. To include a ']' in char-class, it must be the first character. A range of characters may be specified by separating the end characters of the range with a '-', e.g., 'a-z' specifies the lower case characters. The following literal expressions can also be used in char-class to specify sets of characters:

```
[:alnum:] [:cntrl:] [:lower:] [:space:]
[:alpha:] [:digit:] [:print:] [:upper:]
[:blank:] [:graph:] [:punct:] [:xdigit:]
```

If '-' appears as the first or last character of char-class, then it matches itself. All other characters in char-class match themselves.

Patterns in char-class of the form:

```
[.col-elm.]
[=col-elm=]
```

where col-elm is a collating element are interpreted according to 'locale (5)'. See 'regex (7)' for an explanation of these constructs.

**[^char-class]** Matches any single character, other than newline, not in char-class. char-class is defined as above.

^ If '^' is the first character of a regular expression, then it anchors the regular expression to the beginning of a line. Otherwise, it matches itself.

\$ If '\$' is the last character of a regular expression, it anchors the regular expression to the end of a line. Otherwise, it matches itself.

**\(re\)** Defines a (possibly null) subexpression re. Subexpressions may be nested. A subsequent backreference of the form '\n', where n is a number in the range [1,9], expands to the text matched by the nth subexpression. For example, the regular expression '\(a.c\)1' matches the string 'abcabc', but not 'abcadc'. Subexpressions are ordered relative to their left delimiter.

**\*** Matches zero or more repetitions of the regular expression immediately preceding it. The regular expression can be either a single character regular expression or a subexpression. If '\*' is the first character of a regular expression or subexpression, then it matches itself. The '\*' operator sometimes yields unexpected results. For example, the regular expression 'b\*' matches the beginning of the string 'abbb', as opposed to the substring 'bbb', since a null match is the only left-most match.

**\{n,m\}\{n,\}\{n\}** Matches the single character regular expression or subexpression immediately preceding it at least n and at most m times. If m is omitted, then it matches at least n times. If the comma is also

omitted, then it matches exactly  $n$  times. If any of these forms occurs first in a regular expression or subexpression, then it is interpreted literally (i.e., the regular expression `'\{2\}'` matches the string `'{2}'`, and so on).

`\<\>` Anchors the single character regular expression or subexpression immediately following it to the beginning (in the case of `'\<'`) or ending (in the case of `'\>'`) of a word, i.e., in ASCII, a maximal string of alphanumeric characters, including the underscore (`_`).

The following extended regular expression operators are preceded by a backslash `'\'` to distinguish them from traditional ed syntax. They may be unavailable depending on the particular regex implementation in your system.

`\`\'` Unconditionally matches the beginning `'\`'` or ending `'\`'` of a line.

`\?` Optionally matches the single character regular expression or subexpression immediately preceding it. For example, the regular expression `'a[bd]\?c'` matches the strings `'abc'`, `'adc'` and `'ac'`. If `'\?'` occurs at the beginning of a regular expressions or subexpression, then it matches a literal `'?'`.

`\+` Matches the single character regular expression or subexpression immediately preceding it one or more times. So the regular expression `'a\+'` is shorthand for `'aa*'`. If `'\+'` occurs at the beginning of a regular expression or subexpression, then it matches a literal `'+'`.

`\b` Matches the beginning or ending (null string) of a word. Thus the regular expression `'\bhello\b'` is equivalent to `'\<hello\>'`. However, `'\b\b'` is a valid regular expression whereas `'\<\>'` is not.

`\B` Matches (a null string) inside a word.

`\w` Matches any character in a word.

`\W` Matches any character not in a word.

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## 6 Commands

All ed commands are single characters, though some require additional parameters. If a command's parameters extend over several lines, then each line except for the last must be terminated with a backslash (`'\'`).

In general, at most one command is allowed per line. However, most commands accept a print suffix, which is any of 'p' (print), 'l' (list), or 'n' (enumerate), to print the last line affected by the command. It is not portable to give more than one print suffix, but ed allows any combination of non-repeated print suffixes and combines their effects. If any suffix letter is given, it must immediately follow the command.

The 'e', 'E', 'f', 'r', and 'w' commands take an optional file parameter, separated from the command letter by one or more whitespace characters.

An interrupt (typically <Control-C>) has the effect of aborting the current command and returning the editor to command mode.

ed recognizes the following commands. The commands are shown together with the default address or address range supplied if none is specified (in parenthesis).

(.)**a** Appends text to the buffer after the addressed line. The address '0' (zero) is valid for this command; it places the entered text at the beginning of the buffer. Text is entered in input mode. The current address is set to the address of the last line entered or, if there were none, to the addressed line.

(.,.)**c** Changes lines in the buffer. The addressed lines are deleted from the buffer, and text is inserted in their place. Text is entered in input mode. The current address is set to the address of the last line entered or, if there were none, to the new address of the line after the last line deleted; if the lines deleted were originally at the end of the buffer, the current address is set to the address of the new last line; if no lines remain in the buffer, the current address is set to zero. The lines deleted are copied to the cut buffer.

(.,.)**d** Deletes the addressed lines from the buffer. The current address is set to the new address of the line after the last line deleted; if the lines deleted were originally at the end of the buffer, the current address is set to the address of the new last line; if no lines remain in the buffer, the current address is set to zero. The lines deleted are copied to the cut buffer.

**e file** Edits file, and sets the default filename. If file is not specified, then the default filename is used. Any lines in the buffer are deleted before the new file is read. The current address is set to the address of the last line in the buffer.

If file is prefixed with a bang (!), then it is interpreted as a shell command whose output is to be read, (see shell escape command '!' below). In this case the default filename is unchanged.

A warning is printed if any changes have been made in the buffer since the last 'w' command that wrote the entire buffer to a file.

**E file** Edits file unconditionally. This is similar to the 'e' command, except that unwritten changes are discarded without warning.

**f file** Sets the default filename to file. If file is not specified, then the default unescaped filename is printed.

**(1,\$)g/re/command-list** Global command. The global command makes two passes over the file. On the first pass, all the addressed lines matching a regular expression re are marked. Then, going sequentially from the beginning of the file to the end of the file, the given command-list is executed for each marked line, with the current address set to the address of that line. Any line modified by the command-list is unmarked. The final value of the current address is the value assigned by the last command in the last command-list executed. If there were no matching lines, the current address is unchanged.

The first command of command-list must appear on the same line as the 'g' command. The other commands of command-list must appear on separate lines. All lines of a multi-line command-list except the last line must be terminated with a backslash ('\'). Any commands are allowed, except for 'g', 'G', 'v', and 'V'. The '.' terminating the input mode of commands 'a', 'c', and 'i' can be omitted if it would be the last line of command-list. By default, a newline alone in command-list is equivalent to a 'p' command. If ed is invoked with the command-line option '-G', then a newline in command-list is equivalent to a '+1p' command.

**(1,\$)G/re/** Interactive global command. Interactively edits the addressed lines matching a regular expression re. For each matching line, the line is printed, the current address is set, and the user is prompted to enter a command-list. The final value of the current address is the value assigned by the last command executed. If there were no matching lines, the current address is unchanged.

The format of command-list is the same as that of the 'g' command. A newline alone acts as a null command list. A single '&' repeats the last non-null command list.

**h** Help. Prints an explanation of the last error.

**H** Toggles the printing of error explanations. By default, explanations are not printed. It is recommended that ed scripts begin with this command to aid in debugging.

- (.)**i** Inserts text in the buffer before the addressed line. The address '0' (zero) is valid for this command; it places the entered text at the beginning of the buffer. Text is entered in input mode. The current address is set to the address of the last line entered or, if there were none, to the addressed line.
  
- (.,.+1)**j** Joins the addressed lines, replacing them by a single line containing their joined text. If only one address is given, this command does nothing. If lines are joined, the lines replaced are copied to the cut buffer and the current address is set to the address of the joined line. Else, the current address is unchanged.
  
- (.)**kx** Marks a line with a lower case letter 'x'. The line can then be addressed as 'x' (i.e., a single quote followed by 'x') in subsequent commands. The mark is not cleared until the line is deleted or otherwise modified. The current address is unchanged.
  
- (.,.)**l** List command. Prints the addressed lines unambiguously. The end of each line is marked with a '\$', and every '\$' character within the text is printed with a preceding backslash. Special characters are printed as escape sequences. The current address is set to the address of the last line printed.
  
- (.,.)**m**(.) Moves lines in the buffer. The addressed lines are moved to after the right-hand destination address. The destination address '0' (zero) is valid for this command; it moves the addressed lines to the beginning of the buffer. It is an error if the destination address falls within the range of lines to be moved. The current address is set to the new address of the last line moved.
  
- (.,.)**n** Number command. Prints the addressed lines, preceding each line by its line number and a <tab>. The current address is set to the address of the last line printed.
  
- (.,.)**p** Prints the addressed lines. The current address is set to the address of the last line printed.
  
- P** Toggles the command prompt on and off. Unless a prompt string is specified with the command-line option '-p', the command prompt is by default turned off. The default prompt string is an asterisk ('\*').

**q** Quits ed. A warning is printed if any changes have been made in the buffer since the last 'w' command that wrote the entire buffer to a file.

**Q** Quits ed unconditionally. This is similar to the 'q' command, except that unwritten changes are discarded without warning.

**( $\$$ )r file** Reads file and appends it after the addressed line. If file is not specified, then the default filename is used. If there is no default filename prior to the command, then the default filename is set to file. Otherwise, the default filename is unchanged. The address '0' (zero) is valid for this command; it reads the file at the beginning of the buffer. The current address is set to the address of the last line read or, if there were none, to the addressed line.

If file is prefixed with a bang (!), then it is interpreted as a shell command whose output is to be read, (see shell escape command '!' below). In this case the default filename is unchanged.

**(.,.)s/re/replacement/** Substitute command. Replaces text in the addressed lines matching a regular expression re with replacement. By default, only the first match in each line is replaced. The 's' command accepts any combination of the suffixes 'g', 'count', 'l', 'n', and 'p'. If the 'g' (global) suffix is given, then every match is replaced. The 'count' suffix, where count is a positive number, causes only the countth match to be replaced. 'g' and 'count' can't be specified in the same command. 'l', 'n', and 'p' are the usual print suffixes. It is an error if no substitutions are performed on any of the addressed lines. The current address is set to the address of the last line on which a substitution occurred. If a line is split, a substitution is considered to have occurred on each of the new lines. If no substitution is performed, the current address is unchanged. The last line modified is copied to the cut buffer.

re and replacement may be delimited by any character other than <space>, <newline> and the characters used by the form of the 's' command shown below. If the last delimiter is omitted, then the last line affected is printed as if the print suffix 'p' were specified. The last delimiter can't be omitted if the 's' command is part of a 'g' or 'v' command-list and is not the last command in the list, because the meaning of the following escaped newline would become ambiguous.

An unescaped '&' in replacement is replaced by the currently matched text. The character sequence '\m' where m is a number in the range [1,9], is replaced by the mth backreference expression of the matched text. If the corresponding backreference expression does not match, then the character sequence '\m' is replaced by the empty string. If replacement

consists of a single '%', then replacement from the last substitution is used.

A line can be split by including a newline escaped with a backslash ('\') in replacement. Each backslash in replacement removes the special meaning (if any) of the following character.

**(.,.)s** Repeats the last substitution. This form of the 's' command accepts the 'g' and 'count' suffixes described above, and any combination of the suffixes 'p' and 'r'. The 'g' suffix toggles the global suffix of the last substitution and resets count to 1. The 'p' suffix toggles the print suffixes of the last substitution. The 'r' suffix causes the re of the last search to be used instead of the re of the last substitution (if the search happened after the substitution).

**(.,.)t(.)** Copies (i.e., transfers) the addressed lines to after the right-hand destination address. If the destination address is '0' (zero), the lines are copied at the beginning of the buffer. The current address is set to the address of the last line copied.

**u** Undoes the effect of the last command that modified anything in the buffer and restores the current address to what it was before the command. The global commands 'g', 'G', 'v', and 'V' are treated as a single command by undo. 'u' is its own inverse; it can undo only the last command.

**(1,\$)v/re/command-list** This is similar to the 'g' command except that it applies command-list to each of the addressed lines not matching the regular expression re.

**(1,\$)V/re/** This is similar to the 'G' command except that it interactively edits the addressed lines not matching the regular expression re.

**(1,\$)w file** Writes the addressed lines to file. Any previous contents of file are lost without warning. If there is no default filename, then the default filename is set to file, otherwise it is unchanged. If no filename is specified, then the default filename is used. The current address is unchanged.

If file is prefixed with a bang (!), then it is interpreted as a shell command and the addressed lines are written to its standard input, (see shell escape command '!' below). In this case the default filename is unchanged. Writing the buffer to a shell command does not prevent the warning to the user if an attempt is made to overwrite or discard the buffer via the 'e' or 'q' commands.

- (1,\$)wq file** Writes the addressed lines to file, and then executes a 'q' command.
- (1,\$)W file** Appends the addressed lines to the end of file. This is similar to the 'w' command, except that the previous contents of file are not clobbered. The current address is unchanged.
- (.)x** Copies (puts) the contents of the cut buffer to after the addressed line. The current address is set to the address of the last line copied.
- (.,.)y** Copies (yanks) the addressed lines to the cut buffer. The cut buffer is overwritten by subsequent 'c', 'd', 'j', 's', or 'y' commands. The current address is unchanged.
- (.+1)zn** Scroll. Prints n lines at a time starting at addressed line, and sets window size to n. If n is not specified, then the current window size is used. Window size defaults to screen size minus two lines, or to 22 if screen size can't be determined. The current address is set to the address of the last line printed.
- !command** Shell escape command. Executes command via sh (1). If the first character of command is '!', then it is replaced by the text of the previous '!command'. Thus, '!!' repeats the previous '!command'. ed does not process command for backslash ('\') escapes. However, an unescaped '%' is replaced by the default filename. When the shell returns from execution, a '!' is printed to the standard output. The current address is unchanged.
- (.,.)#** Begins a comment; the rest of the line, up to a newline, is ignored. If a line address followed by a semicolon is given, then the current address is set to that address. Otherwise, the current address is unchanged.
- (\$)=** Prints the line number of the addressed line. The current address is unchanged.
- (.+1)<newline>** Null command. An address alone prints the addressed line. A <newline> alone is equivalent to '+1p'. The current address is set to the address of the printed line.

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## 7 Limitations

If the terminal hangs up, ed attempts to write the buffer to the file ed.hup or, if this fails, to \$HOME/ed.hup.

ed processes file arguments for backslash escapes, i.e., in a filename, any character preceded by a backslash ('\') is interpreted literally. For example, 'ed 'hello\tworld'' will edit the file 'hellotworld'.

If a text (non-binary) file is not terminated by a newline character, then ed appends one on reading/writing it. In the case of a binary file, ed does not append a newline on reading/writing. A binary file is one containing at least one ASCII NUL character. If the last line has been modified, reading an empty file, for example /dev/null, prior to writing prevents appending a newline to a binary file.

In order to keep track of the text lines in the buffer, ed uses a doubly linked list of structures containing the position and size of each line. This results in a per line overhead of 2 'pointer's, 1 'long int', and 1 'int'.

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## 8 Diagnostics

When an error occurs, if ed's input is from a regular file or here document, then it exits, otherwise it prints a '?' and returns to command mode. An explanation of the last error can be printed with the 'h' (help) command.

If the 'u' (undo) command occurs in a global command list, then the command list is executed only once.

Attempting to quit ed or edit another file before writing a modified buffer results in an error. If the command is entered a second time, it succeeds, but any changes to the buffer are lost.

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## 9 Reporting bugs

There are probably bugs in ed. There are certainly errors and omissions in this manual. If you report them, they will get fixed. If you don't, no one will ever know about them and they will remain unfixed for all eternity, if not longer.

If you find a bug in ed, please send electronic mail to [bug-ed@gnu.org](mailto:bug-ed@gnu.org). Include the version number, which you can find by running 'ed --version'.

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