A FULL SCREEN EDITOR IMPLEMENTED IN PASCAL

by

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1. INTRODUCTION

SEDIT (for S creen EDIT or) is a full screen editor. This editor provides a CRT terminal user an efficient means of editing information displayed on the screen. This editor, in contrast to most editors, provides the user a visual machine interactive means to move, correct, change and manipulate displayed text files. Accordingly, full screen editors are much more efficent and effective then other usual types of editors.

SEDIT is written in PASCAL language and implemented on Perkin-Elmer OS/32 MTM operating system. PASCAL was chosen because of its portability to other machines and operating systems. PASCAL is also a program language that is easy to maintain and modify. SEDIT is designed to operate on a variety of terminals, including both dumb and smart CRT terminals. This versitility is achieved through a modular design such that selected modules can be resident in smart terminals thus reliving the central processor of part of the work. Other modules can be modified such that SEDIT is blind to venders differences in CRT terminal characteristics.

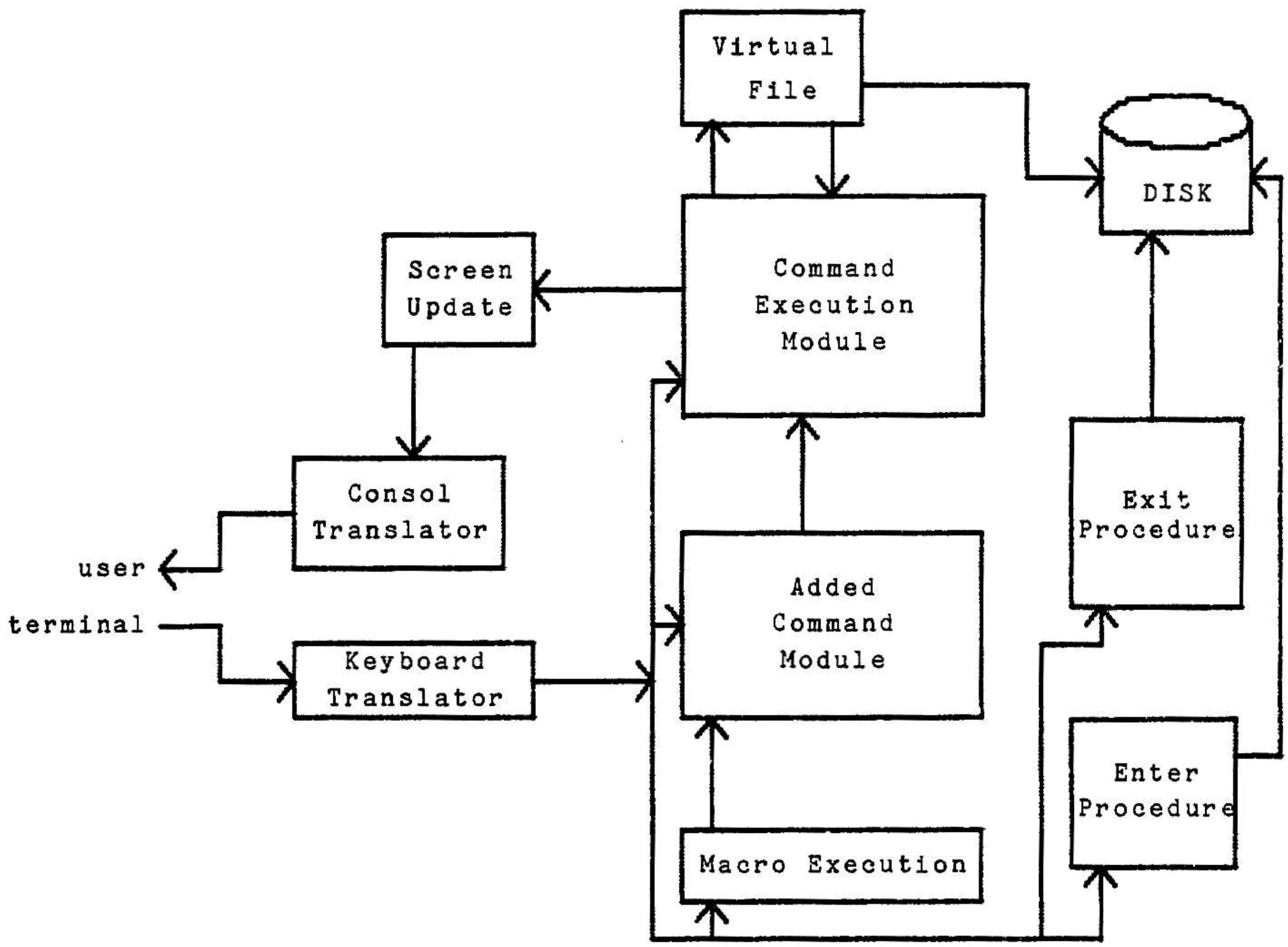
The following paragraphs provid a detailed description of SEDIT.

2. MODES OF SEDIT

SEDIT operates in two modes: Command and Modify mode. When in command are ignored. The modify mode is used to change or correct an existing text file. The modify mode too has a set of valid acceptable inputs. The terminal operator can easly change from one mode to the other by means of the terminals escape key or control-C key.

3. ORGANIZATION OF SEDIT

SEDIT is organized around a disk file and a set of modules and procedures as shown at figure 1. A discussion of the pertenant modules follows:



ORGANIZATION OF SEDIT

3.1 Command Execution Module

The main part of SEDIT is the Command Execution Module. It is a set of procedures that are the primitive operations that can be performed on a file. The Command Execution Module is not concerned with file management or details of screen update. Its purpose is to execute the command. Figure 1 shows the relation of the Command Execution Module to the rest of SEDIT.

3.2 Added Command Definition Module

The use and scope of SEDIT can be changed by adding new commands. The definition of these new commands are, in effect, production rules of a grammar which translates the new commands (nonterminals) into the primitive commands (terminals) found in the Command Execution Module. Each production rule is expressed as a block of Pascal code found in the Added Command Definition Module. See Figure 1 for the relation of the Added Command Definition Module to SEDIT. The system programmer can thus modify SEDIT with the full power of Pascal. The programmer will have access to global variables in SEDIT and will not be concerned with file management or details of screen update. The programmer will only have to be aware of useful global variables and procedure names (the primitive commands) from the Command Execution Module.

By the selection of added commands, the system programmer can cause SEDIT to act like another editor. Thus SEDIT can be tailored to look like an editor that is familar to the terminal operator.

3.3 Macro Execution Module

SEDIT contains a powerful macro definition facility. At any time during the execution of SEDIT the user can define and use commands called macros. These operations are processed by the Macro Execution Module (see Figure 1). The definitions include the name of the macro, may include repeat factors, and a series of other commands. These macro definitions further extend the flexibility of SEDIT and the ability to configure SEDIT to look like another editor. Once a Macro is defined, it is permenant for that file, and would be lost only upon EXIT of SEDIT. This is because of the capability of a Descripter File associated to each file. The Descripter Files are automatically created by SEDIT for each file that the user creates. More explanations are given in later sections. The name of the macro is not something like 'M1' but is whatever the user defines. The macro can be composed of any of the commands that are previously defined. It can contain nested parentheses and repeat factors. The macro can also contain variables to express a character string that is defined when the macro is executed.

3.4 Console And Keyboard Translators

SEDIT can be configured to different terminals with the Console And Keyboard Translators, (see Figure 1).

When SEDIT operates in full screen mode, ASCII code control characters are sent to the console to move the cursor on the screen. Because these control characters are not standard, SEDIT must account for the brand and kind of terminal being used. This is accomplished by means of a table of terminal characteristics. Then the proper file may be read to configure SEDIT output to the terminal. The table will have to be maintained by the system programmer. The file will contain information about both input from the key board and necessary output to the console screen.

3.5 Virtual Files System

Another feature of SEDIT is the hidden file manipulation routines. See the Figure 1. The user can page through a file of any size both forward and backward without having to use any commands to read or write to disk. This manipulation of the file should look to the user as if all of the user's file were in memory. The use of memory for buffer space can be minimized and the manipulation of large files is not different from the manipulation of small files. This is accomplished most simply by the following procedure:

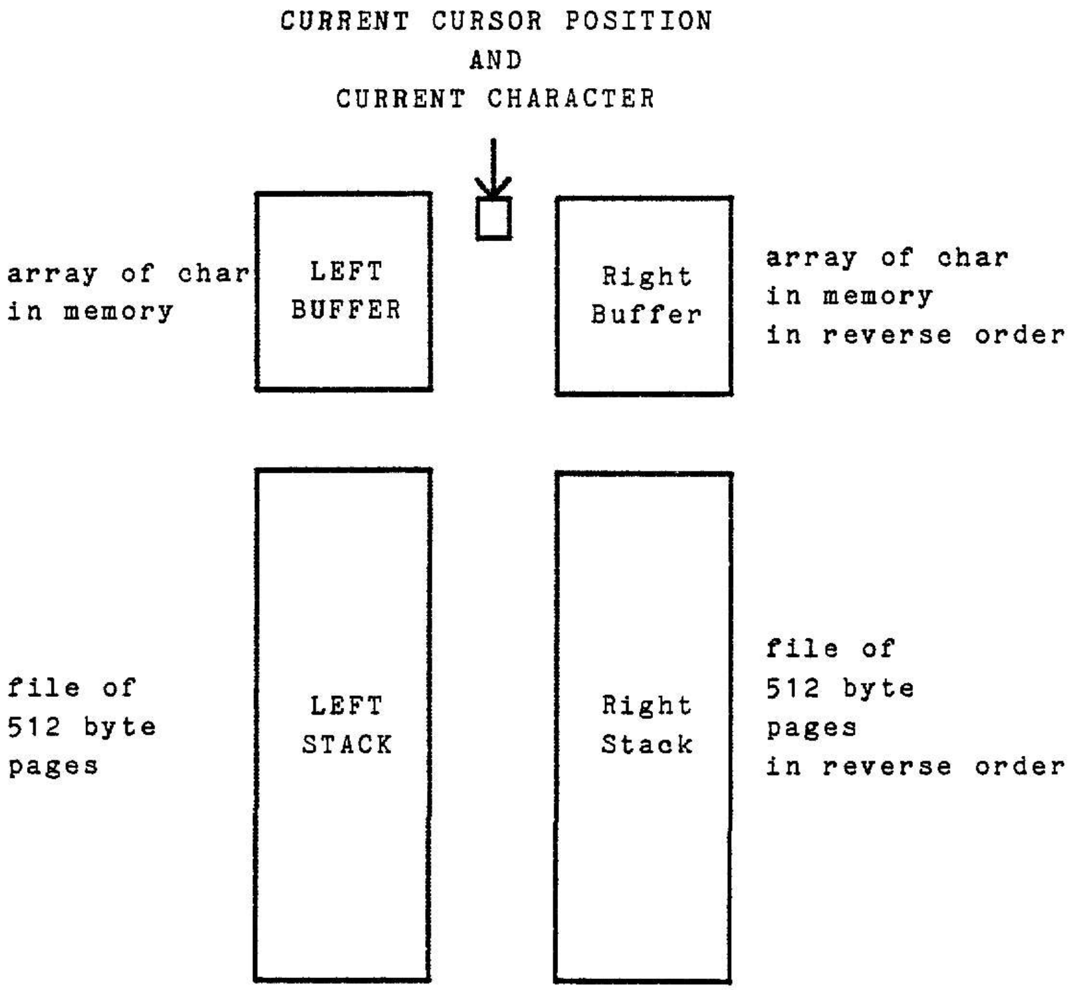
a) SEDIT first copies the file to be edited (if there is one) into a file called the Right File Stack. This file is written, a page at a time in reverse order. The last page of the user file is then the first page of the Right File Stack. See Figure 2.

b) Another file is allocated that is called the Left File Stack. This file is written a page at a time, but the pages are stored in first-to-last sequence.

c) There are also two buffers in memory called the Left Buffer Stack and Right Buffer Stack. Each buffer is a string of characters and the Right Buffer Stack contains the string in reverse order. The character at which the cursor is pointing is called the Current Character. The cursor position, or point of operation of commands, is always at the current character between the buffers.

d) When the user adds text, or moves the cursor down or to the left, characters are added to the Left Buffer Stack. When the Left Buffer

Stack is full, half of the buffer will be emptied by writing to the Left File Stack. This operation is hidden from the user. When the user is moving the cursor up or left, characters are taken from the Left Buffer Stack and placed into the Right Buffer Stack. When the Right Buffer Stack is full, it will be half emptied by writing to the Right File Stack. If at any time the Left or Right Buffer Stacks are emptied, they will be half filled by reading from the correct File Stack. This process will keep all disk I/O to a minimum and it will be done with efficient page oriented I/O.



RUN TIME EDIT BUFFERS

4. TERMINAL I/O

Output to the terminal is done with SVC1 calls that reside in the procedure SHIP_OUT which will output a line of known length. The output is done in Image mode.

Input is done with an SVC1 call in the Procedure INPUT. The call is Image mode Read. The echo back to the terminal is automatic and done by the programmable I/O device called a PASLA (Programmable Asynchronous Serial Line Adapter). This automatic echo is not desirable in this editor because it would prohibit the redefinition of characters. The function of echoing the character back is called ECHOPLEX. This function must be turned off when the editor is in use and turned on when done. The calls to control the echoplex should reside in the CSS file that evokes SEDIT. Then if SEDIT crashes (which is very unlikely) the execution of the CSS file will continue and the echoplex function will be enabled again.

The redefinition of the characters can occur in macro definations, consol translator or the keyboard translator.

5. FILE I/O

File I/O will be done with the prefix procedures OPEN, CLOSE, PUT, and GET. These procedures support page I/O.

6. FILE TYPES

SEDIT will support clean files. This means the files do not contain nonprinting characters, such as control characters, nor special characters such as paragraph indicators, that might be used for special purposes in some editors. The files are the same as files currently supported with other programs such as Script, PPP, and the Pascal compilers.

7. WORK FILE

SEDIT will support a workfile. A workfile will store the default values of status variables. It will keep the name of the file the user was last working on. The user will be asked if he wants SEDIT to read in the file that he last edited. If the user replies with a yes, the file will be read and its descriptor file will be read. If there is not a descriptor file associated with the indicated file, the default values of the workfile will be used.

8. DESCRIPTOR FILE

With each file the user uses, there will be an associated file called the file descriptor. It will have the same name as the file but a different extension. The default file descriptor is called the workfile. Like the workfile, the descriptor contains information about the SEDIT status variables that determine the environment of SEDIT and also contains information that pertains to that file.

9. STATUS VARIBLES

The status varibles are the global varibles in SEDIT that describe the current status of the editor. The command execution module and added command definition module will have access to these variables. Some commands will directly modify the status variables and some indirectly.

A list of the Status Variables follows:

Current screen column cursor position : integer

Current screen row cursor position : integer

Current line cursor position : integer

Current column in line cursor position : integer

Current character at cursor : char

eofc : boolean , if eofc is true the cursor is pointing at the last character in the file, end of file char.

tofc : boolean , if tofc is true the cursor is pointing at the first character in the file, top of file char.

eofl : boolean , if eofl is true the cursor is in the last line in the file, end of file line.

tofl : boolean , if tofl is true the cursor is in the first line in the file, top of file line.

left margin : integer , column number

right margin : integer , column number.

automatic indentation : boolean , if true and in insert mode the next line will begin at the same column as the last one.

last line starting column : integer

script : boolean , if true the text will automatically be adjusted in the left and right margins.

token definition : boolean , if true the search argument applies to words, if false it applies to character strings.

current date : integer

last date : integer , last data the file was updated.

current search argument : char string

current change string : char string

paragraph margin : integer , column number.

tab sets : array of integer , column numbers.

name of current file : char string

starting anchor : interger , absolute position in the file.

ending anchor : integer , absolute position in the file.

current direction : char

line mode : boolean , if true line numbers will be shown.

USERS MANUAL

1. ENTERING SEDIT

If the user types SEDIT [filename][.ext], where filename and the extension are optional, the full screen editor will be run. If the user types the filename and not the extension, .PAS will be tried first. If the file is not found then .TXT will be used. If the file is not found the following menu will be presented to the user.

Input [filename][.ext] file not found.
PAS and TXT was searched for.
T)ype new file name.
c)reate new file.

The [filename][.ext] is where the name typed by the user is echoed. If 'T' is typed, SEDIT will ask the user to enter the new file name. If 'C' is typed, the current file name and extention becomes the new file. If the extension was typed by the user the above menu will appear without the second line and the extension will be echoed.

If the user does not type in the file name, SEDIT will automatically read the default descriptor file called the work file. The file name is SEDIT.DES, and a copy exists on each account. The work file and descriptor files contain values necessary to configure SEDIT. The name of the last file the user edited with SEDIT is stored in this work file.

SEDIT then gives the user the following menu.

The file last edited was

filename.ext

touch return to use this file,

else type in the new file name.

SEDIT responds with the same search as discribed above, where the user does not have to type in the extension.

SEDIT will then search for the proper descriptor file which has the name filename.DES. If the file is found, it is read and the environment of SEDIT is set the way it was when SEDIT was last used with this file. If the file is not found, the default values from SEDIT.DES will be used and the user will be informed of this action. Once the file to be edited is specified or found, the following prompt line will be displayed:

```
>SEDIT: I(nsert D(elete Q(uit R(place J(ump F(ind P(age A(djust ?(more
```

The '>' on the left side of the prompt line indicates the current status of direction. If the user types '?' an extension of the prompt line will appear as follows;

```
>SEDIT: X(change M(argin C(opy S(et H(ex E(xamine V(erify
```

2. EXITING THE EDITOR

The user may exit the editor by typing 'Q' for QUIT. On entering the quit mode, the following prompt will be displayed.

>Quit:

U(pdate - the current file and leave

E(xit - without updating

R(eturn - to the editor without updating

W(rite - to a new file

P(rint - to an output device

One of the five options must be selected by typing the appropriate letter. The options are described below:

U(pdate - The Editor will replace the old file with the file just modified and output the file's descriptor file.

E(xit - The Editor leaves without making any changes to the file nor to the descriptor file.

R(eturn - The Editor returns without updating, the cursor is returned to the exact place in the file it occupied when 'Q' was typed.

W(rite - With this option, a further prompt appears:

>Quit: 'name of output file', <return>

The modified file will be written to the indicated file name and the descriptor file will be output. If it is an existing file, the modified file will replace it. SEDIT, however, warns the user of the existing file

>File xxx.xxx already existed. do you want to replace the file?

"N" will let the user to enter a different file name

"Y" will replace the file

The command can be aborted by entering a <return> instead of the file name; return will be to the Editor.

After the file has been written to the disk the prompt line will be:

>Quit:

Writing . . . . . .

Your file is nnnn bytes long.

Do you want to E(xit from of R(eturn to the Editor?

Typing "E" exits from the Editor. Typing "R" returns the cursor to the same position in the file as when the "Q" was typed.

Although not discussed above, the user will also be given the option to output a file with line numbers, and the option to output a file to a printer.

P(rint - A prompt will appear and the user may type in the name of the output device to print to. The user can have the lines numbered if she/he wishes.

3. PRIMITIVE COMMANDS

These commands are used for cursor movement, or modifying text. REPEAT FACTORS are allowed by some of these commands to repeat the action of the command as many times as indicated by the immediately proceding number. For example, entering

2 <down-arrow>

will cause the <down-arrow> command to be repeated twice, moving the cursor down two lines.

A slash (/) typed before the command indicates an infinite number of repeats.

Some commands are directional. If their direction is forward, they operate forward through the file; if backwards, they operate in the reverse.

3.1 MOVING COMMANDS

These commands move the cursor from one location to another, to position it for the next editing function.

The REPEAT FACTORS may be used with all of these commands. They include:

<ctrl>H, <left arrow>	moves cursor left
<ctrl>L, <right arrow>	moves curor right
<ctrl>K, <up arrow>	moves cursor up
<ctrl>J, <down arrow>	moves cursor down
"<"	changes the direction to backward
">"	changes the direction to forward
<space>	moves direction
<back-space>	moves left
<return>	moves to the beginning of the next line

Direction is always indicated by an arrow (> or <) in front of the prompt line. The direction is forward when the Editor is entered, but can be changed by typing the appropriate command whenever the "Edit:" prompt line is present.

Commands that do not have special function keys on the CRT keyboard are as follows:

3.1.1 JUMP

3.1.2 PAGE

3.1.3 FIND

3.1.1 JUMP

JUMP mode is entered by typing "J" for J(ump . When the JUMP mode is entered, the following prompt line will be displayed:

JUMP: B(eginning E(nd, <+n>, <-n>, <d>

"B" moves the cursor to the beginning of the file.

"E" moves the cursor to the end of the file

"<+n>" moves the cursor n lines forward

"<-n>" moves the cursor n lines backwards

"d" moves the cursor to line number d Note that n must be an integer, whereas d may be an integer or real number

3.1.2 PAGE

The PAGE command is executed in response to typing "P". PAGE moves the cursor one whole page up or down, depending on the direction of the arrow at the beginning of the prompt line. The cursor moves to the start of the top line. To move several pages at one time, the repeat factor may be used with this command.

3.1.3 FIND

FIND mode is entered by typing "F" . On entering FIND mode, one of the prompt lines below will appear:

>Find[n]: S(tring <target>=>

>Find[n]: W(ord <target>=>

FIND mode finds repeat factor [n] number of occurances of the <target> string. Text is scanned in the direction of the arrow on the prompt line. The target pattern can be found only if it appears in that section of the text.

In STRING mode, the Editor will look for any occurances of the target string, in WORD mode, it looks for an isolated occurance. Isolation means a string is surrounded by any combination of delimiters. To use the STRING mode, type "S" after the prompt line and before the target line, to use WORD, type "W". The default value found in the Environment may be overridden by typing "S" or "W".

The repeat factor can be used, and it must be typed before typing "F".

3.2 MODIFYING COMMANDS

The following operations are used to change the text of a file.

3.2.1 INSERT

3.2.2 DELETE

3.2.3 COPY

3.2.4 EXCHANGE

3.2.5 REPLACE

3.2.6 DISPLAY HEX

3.2.7 EXAMINE SPELLING

3.2.8 MARGIN

3.2.9 ADJUST

3.2.1 INSERT

INSERT mode is entered by typing "I" for I(nsert . The following prompt line will be displayed:

Insert: <bs> a char, <del> a line, <esc>, <ctrl>C

The user can simply start typing and the text will be inserted into the file at the point where the cursor is. The text to the right side of the cursor will shift to the right or to the next line.

"<bs> a char" a character is deleted by backspacing

"<del> a line" an entire line is deleted

"<esc>" all inserted information will be deleted

"<ctrl>C" all inserted information is put into the file, and put in the copy buffer. all previous information is the copy buffer is lost

3.2.2 DELETE

DELETE mode is entered by typing "D". The following prompt line will be displayed:

>Delete: <moving commands>, <esc>, <ctrl>C

When entering the delete mode, the cursor is positioned at the first character to be deleted. This position is called starting anchor. The user can move cursor around using the moving commands. The point at which the cursor is when the delete mode is exited is called the ending archor.

<esc> exits edit mode without any changes to the file

<ctrl>C exits edit mode, deletes the text between the starting and ending archors

3.2.3 COPY

COPY mode is entered by typing "C" for C(opy . When entering the COPY mode, the following prompt line appears:

>COPY: B(uffer F(ile <esc>

"B" copy text in the copy buffer into the file at the location of the cursor when "C" was typed.

On completion of the COPY, the cursor returns to a position immediately preceding the text that was copied, The use of the COPY does not change the contents of the copy buffer.

"F" copy text from another file.

The following prompt line will appear:

>COPY: ENTER THE FILE TO COPY FROM OR "END"

"file name"

>COPY: ENTER FIRST LINE OR "END"

"first line"

>COPY: ENTER LAST LINE OR "ALL"

"last line"

>COPY: ENTER THE FILE TO COPY FROM OR "END"

"end"

The "F" command allows the user to copy several files or different sections of different files.

The use of COPY does not change the contents of the file being copied.

3.2.4 EXCHANGE

EXCHANGE mode is entered by typing "X". On entering the EXCHANGE mode, the following prompt line appears:

EXCHANGE: TEXT <bs> a char, <esc>, <ctrl>C

EXCHANGE replaces one character in a file for each character of text entered. Backspacing one character will cause the original character in that position to reappear. Typing <esc> leaves the EXCHANGE mode without making any of the changes indicated since entering the mode. Typing <ctrl>C accept the changes as part of the file.

3.2.5 REPLACE

REPLACE mode is entered by typing "R". On entering the REPLACE mode, one of the following prompt lines will appear.

>Replace[n]: S(tring V(fy <target> <sub> =>

>Replace[n]: W(ord V(fy <target> <sub> =>

If repeat factor is used, it should be typed before "R". REPLACE mode finds the repeat factor [n] occurrance of the target string and replaces it with the substitute string.

The verify option V(fy allows examination of the target string (to the limit set by the repeat factor) to decide if it is to be replaced. Whenever REPLACE has found the target pattern in the file and verification has been requested, the following prompt line appears:

>Replace: <esc> aborts, 'r' replaces, ' ' doesn't

Typing an "R" will cause replacement, typing a space will cause a continuation of a search for the next occurance if the limit of the repeat factor has not yet been reached. The repeat factor counts the number of times an occurance is found, not the number of times "R" is entered. If a slash(/) is used as the repeat factor, every occurance of the target string will be replaced.

If the Editor cannot find the target string, the error message appears:

ERROR: Pattern not in the file. Press <space bar> to continue.

Example:

>REPLACE [2]: S(tring V(fy <target> <sub) => old-string/new-string/

>REPLACE [2]: S(tring V(fy <target> <sub> => W/old/new/

Note that the slash (/) is used here as a delimiter, you may use any other character as a delimiter besides "S", "W", and "V".

3.2.6 DISPLAY HEXDECIMAL

The command display hexadecimal is executed by the user typing 'H' for hex. The current line (which the cursor is in) is displayed. Followed by a line of the first digit of the hexidecimal number for each character. Followed by a line of the second digit of the hexidecimal number for each character.

An example follows.

```
  Contents of SEDIT
22466766772662544450
003F745E430F0035494A
```

3.2.7 EXAMIN SPELLING

SEDIT will contain a facility for the user to check spelling. When the user types 'E' for Examine Spelling the spelling of all the words from the current cursor position to the end of the current line will be checked. The repeat factor when used will cause more lines to be checked or the rest of the file. A word is defined as a character string delimited by spaces, where a sequence of hyphen-linefeed is ignored and a period is treated as a following delimitor. A word is said to be spelled correctly if it occurs in the dictionary. The dictionary is a file (DICTION.TXT) that SEDIT has access to that is just a list of words spelled correctly. If the word does not exist in the dictionary, or is spelled incorrectly the cursor is placed immediately following that word, and the user is queried with the prompt line.

Spelling error. C)orrect spelling, <ctrl>C continue, <esc> escape

If the user types 'C', this indicates that the word is spelled correctly and it is placed in the dictionary. If the user types the <esc> key, he then exits from the spelling mode and returns to SEDIT mode where he can correct the spelling. If the user types the control 'C' key, the spelling mode is continued and the next word is checked.

3.2.8 MARGIN

The MARGIN command is executed by typing "M". This command does not appear on the prompt line, MARGIN is Environment dependent and cannot be executed except when FILLING is set to true and AUTO-INDENT is set to false. See SET command to set the Environment.

Three parameters are used by margin: right-, left- and paragraph-margin. MARGIN deals with only one paragraph at a time. It realigns the text to compress it as much as possibe without violating the three margins. To set the margin values, see SET mode.

For purposes of formatting, a paragraph is defined as the lines of text occuring between two blank lines. To MARGIN a paragraph, move the cursor anywhere in the paragraph and type "M".

Any given line of text can be protected from being MARGINed if the command character appears as the first non-blank character on the line. The MARGIN treats that line as though it were entirely blank.

3.2.9 ADJUST

ADJUST mode is entered by typing "A". On entering the ADJUST mode, the following prompt line appears:

>Adjust: L(eft R(ight C(enter <left,right,up,down-arrow> <ctrl>C

ADJUST mode adjusts indentation on a line-by-line basis. On any line, the right-arrow and left-arrow commands move the whole line one space to the right or left, respectively, each time the arrow is typed. Type <ctrl>C when indentation is adjusted.

To adjust a sequence of lines, adjust one, then use the up-arrow and down-arrow commands to adjust the line above or below, respectively. Repeat factors can be used before any of the arrows.

"L" and "R" are used to left- and right-justify lines to margins set in the Environment. "C" will center the line between the set margins. Typing an up- or down-arrow will justify or center the line above or below to the same specification.

4. SETTING FORMAT AND MACROS

SEDIT allows for formatting of text. A SET command is used to set the Environment for each of the formatting commands.

The macro definitions are entered with the set command.

SET mode is entered by typing "S". This command does not appear on the prompt line. On entering the SET mode, the following prompt line appears:

>Set: E(nvironment, M(acros, <esc>

4.1 FORMAT CONTROL

Through SET mode, SEDIT enables the user to set the Environment needs of the editing to be done. When "E" for E(nvironment is typed, the following prompt appears:

```
>E(nvironment:  <options> <ctrl>C
     A(uto indent        true
     F(illing            false
     L(eft margin        0
     R(ight margin       79
     P(ara margin        5
     W(ord def           true
```

By typing the appropriate letter, any or all of the options may be changed. Each option is described below.

4.1.1 AUTO INDENT

AUTO ANDENT is set to true by typing "AT" and to false by typing "AF". Affects only the INSERT mode.

4.1.2 FILLING

FILLING is set to true by typing "FT" and to false by "FF". Affects the INSERT mode and allows the MARGIN command to function.

4.1.3 MARGINS

MARGINS are set by typing the appropriate letter ("L", "R" or "P") followed by a positive integer of less than 4 digits and a <space>. When Filling is true, the margins set here are the ones that affect INSERT and MARGIN and the center and justify commands in ADJUST.

4.1.4 WORD

WORD is set to true by typing "WT" and false by "WF". If true, word is the default, if false string is the default. Affects FIND and REPLACE.

4.2 MACRO DEFINATIONS

Through SET mode, SEDIT enables the user to define the macros. When "M" is typed for M(acro, the macros will be listed on the screen and the user will be given the option to change them if he wishes.

5. MISCELLANEOUS COMMANDS

5.1 VERIFY

The VERIFY command is executed in response to typing "V". The text is verified by redisplaying the text on the screen. The Editor attempts to adjust the window so the cursor is at the center of the screen.

PROGRAM DOCUMENTATION

1. INTRODUCTION

This editor is not a copy of the UCSD Full Screen L2 editor. It is intended to have a subset of commands equal to the UCSD editor. It also works, whereas the Reverse File Paging function of the UCSD Full Screen editor does not work. The interval structure of the UCSD Full Screen editor is unknown. Any similarities between the SEDIT program and the UCSD program are strictly coincidental.

The actual program to date is a working subset of the ideal described previously. This subset includes the following commands:

movement commands (up, down, left, right direction control, page, return, jump to beginning, and jump to end); verify command.

The following modes exist:

Insert, Delete, Exchange.

An additional mode has been added and is called Fix. Fix mode will let the user remove nonprinting characters (except for line feeds and tab) from his file.

The excessive use of global variables is considered to be a poor trait of large programs. This attitude was taken very seriously in the construction of SEDIT. In the 2700 line program, there are 7 global variables. The former sections of this document list many more global variables than were ever implemented. This eliminates the necessity of maintaining the value of these at all times, but makes it necessary to calculate the value when it is needed.

2. INPUT OUTPUT

A problem with SEDIT is the absence of appropritate IO interfaces. The Pascal routines Accept and Display are well- standardized single-character oriented IO. But the standardiza- tion is of the interface between Pascal and the operating system, not between Pascal and the user. On the 8/32 minicomputer under the MTM operating system with Robert Young's Pascal Driver the Accept and Display functions are buffered by the driver as line-oriented IO. This can be overcome with the use of SVC1 calls to the operating system with Image mode single character read and multiple character write. This method is very effective. In other operating systems Accept and Display might be adequate.

The prompts for IO to the console are disabled by the PROMPT command in the SEDIT.CSS file so that they will not interfere with the screen display.

The existing CRT driver will buffer input characters for the Pascal program only when the Pascal program is ready to Accept them. If the computer system is lightly used, SEDIT is almost always waiting for input. If SEDIT has a time-consuming task and is not asking the CRT driver for input, any characters the user types will be buffered as an MTM operating system command. Because the prompts are disabled, the user has no way of knowing when this state exists.

The desirable driver will buffer all input characters for the Pascal program, and give the user access to the MTM operating system only when he hits break. The driver could use a circular ring buffer or double buffers to implement this feature (called the type ahead feature).

2. DATA STRUCTURES

A common problem with editor data structures is with insertion and deletion. If the user's text is in memory in an array of characters or an array of lines, the inevitable occurs: in- formation will be inserted or deleted. This requires that all of the contents of the array on one side of the operation be shifted. Pointers may be used to keep track of the string of text. Pointers require much manipulation and make a program very hard to read. In effect, they are messy. Shifting the contents of arrays periodically requires large amounts of time

Another alternative is to implement the user's file as a string of characters that is broken at the current point of action. Each half of the string is started in a stack. A string such as "eat that cat" with the current point of action at the "c" will exist with "eat that" in the left stack and "at" in the right stack. The character "space" will be at the top of the left stack and the "a" will be at the top of the right stack. The character "c" will be in the current character buffer of type CHAR. Deletions can be done by removing information from the top of either stack. Additions can be done by adding characters to the top of either stack. This method greatly increases the ease of insertion and deletion, but also increases the overhead for moving through the user's file.

One of the major good points of SEDIT is that it will work with files of any length. The only limits are those imposed by the operating system. This is because of the data structures used to contain the user's file. An important point to realize is that the right stack must contain information in reverse order relative to the left stack.

To simplify the interface of the program with this data structure, only 4 procedure calls are used. The main program does not have access to any of the variables in these procedures other than the actual parameter CURRENT_CHAR . The procedures are:

Add(CURRENT_CHAR) which will add current character to the left stack.

Delete(CURRENT_CHAR) which will pop a character from the right stack and assign it to CURRENT_CHAR , destroying the original character.

MOVE.RIGHT(CURRENT_CHAR) which will push the CURRENT_CHAR onto the right stack and pop a character off of the left stack into CURRENT_CHAR .

MOVE.LEFT(CURRENT_CHAR) which will push the CURRENT_CHAR onto the left stack and pop a character off of the right stack into CURRENT_CHAR .

By using these 4 procedures the entire file can be examined and manipulated. The system is analogous to a Turring machine, where the CURRENT_CHAR is the position of the read head and the tape is the character string. When applied to cursor movement on the CRT screen, the current cursor position is analogous to the read head position. A major source of confusion when thinking about this is the concept of moving in a certain direction. For example, when the string "1234" is in the data structure and the MOVE.LEFT (CURRENT_CHAR) procedure is executed, if the CURRENT_CHAR had been "3" it is now "4". But if the user has "1234" on the screeen with the current cursor position on "3" and executes a left arrow, the new CURRENT_CHAR is "2". The Move procedure implies move- ment of the character string past a certain point. The cursor movement commands imply movement of the point along the character string.

The user's file when in SEDIT is a character string delimited by the following characters: EM NL character string NL EM. When manipulating the file, the procedures in SEDIT detect the starting or ending of the file when CURRENT_CHAR = EM.

The left and right stacks exist in memory; they are arrays of characters. Their size is static. When the user fills a stack, it is half-emptied into a file. The file for the right stack is called the right file, for the left stack the left file. When a stack is emptied it is half-filled from a file. The stacks in memory called buffer stacks are actually decks, implemented as a circular ring buffer that can be popped and pushed from both ends. The emptying and filling of the buffer stacks is done 4 pages at a time by popping or pushing on the bottom of the stacks. Boolean parameters in the procedure calls terminate filling a buffer if the file is empty.

4. INITIALIZATION

The initialization of a file involves reading it into memory and outputing it into the right file so that the pages in the right file stack are in reverse order. Next, the line numbers are added by moving the character left through the CURRENT_CHAR. When an NL character is detected, the line number characters are added. When the EM character is reached, the process is stopped, all of the file is shifted back to the right side of CURRENT_CHAR , and the screen is filled with the Verify procedure.

5. PROGRAM FILE NAMES

Line numbers are present ing the workin subset. The inhibiting of line number display has been provided for with the global Boolean variable SHOW-LINE.NUMBERS, although this has not been tested.

Line numbers are manipulated and created in a manner like Pedit. To make handling of line numbers simple, they are inserted into the runtime character string which is in the users file. The manipulation of the cursor by the user is limited to the text outside the line number field. This field exists after every character except the last one. Each field is 8 characters wide; four for the integer, one for the decimal point, two for decimal digits and one space.

The current version of SEDIT proves to be an effective means for editing a file. However, the time involved in initializing and terminating the use of a large file decreases the attractive-
ness to the user. On the existing minicomputer with hard disks the initialization of a 1000-line file may take 60 seconds; stepping from the beginning of the file to the end while editing may take 30 seconds. Of course, small steps are instantaneous.

The SEDIT program exists in 3 files: the PREFIX and SVC types are in SYSMAC.PAS , the data buffer management routines are in MACRO.PAS , the main program is in SEDIT1.PAS . These programs are lested in the appendix.

Class types are used for convenience; they are available with the PASCAL used in this computer science department. The classes can be omitted with the use of an editor and a few hours' time of a knowledgable programmer to gain portability to other operating systems.

APPENDIX

SEDIT Commands

Command	Operation
SEDIT [filename][.ext]........	entering SEDIT
Q...........................	exiting SEDIT
<ctrl>H,<left arrow>..........	move cursor left*
<ctrl>L,<right arrow>.........	move cursor right*
<ctrl>K,<up arrow>............	move cursor up*
<ctrl>J,<down arrow>..........	move cursor down*
<...........................	change direction to backwards
>...........................	change direction to forwards
<space>......................	move direction*
<back-space>.................	move against direction*
<return>.....................	move to next line
A...........................	adjust line in margins
C...........................	copy from buffer or file
D...........................	delete text
E...........................	examine spelling
F...........................	find a string or word*
H...........................	display a line in hexidecimal*
I...........................	insert text
J...........................	jump to a differnt place in the text
M...........................	margin adjustment of a paragraph

P............................ page thru the text*

R............................ replace a string with another*

S............................ set format control and macro definations

V............................ verify text, fill screen

X............................ exchange text with what is typed

* These commands may be preceded with a repeat factor.

PROGRAM LISTINGS

Pascal Prefix, file name SYSMAC.PAS

```
"%MACRO FULL_PREFIX"


"$EJECT"
"PER BRINCH HANSEN                    *   AS MODIFIED FOR THE INTERDATA
                                      *      8/32 UNDER OS/32-MT AT
 INFORMATION SCIENCE                  *   DEPARTMENT OF COMPUTER SCIENCE
 CALIFORNIA INSTITUTE OF TECHNOLOGY   *      KANSAS STATE UNIVERSITY
                                      *
 UTILITY PROGRAMS FOR                 *
 THE SOLO SYSTEM                      *
                                      *
 18 MAY 1975                          *            1 DEC 1976"


"###########
#  PREFIX  #
###########"


CONST NL = '(:10:)';   FF = '(:12:)';   CR = '(:13:)';   EM = '(:25:)';

CONST PAGELENGTH = 512;
TYPE PAGE = ARRAY (.1..PAGELENGTH.) OF CHAR;

CONST LINELENGTH = 132;
TYPE LINE = ARRAY (.1..LINELENGTH.) OF CHAR;

CONST IDLENGTH = 12;
TYPE IDENTIFIER = ARRAY (.1..IDLENGTH.) OF CHAR;

TYPE FILE = 1..5;

TYPE FILEKIND = (EMPTY, SCRATCH, ASCII, SEQCODE, CONCODE);

TYPE FILEATTR = RECORD
                  KIND: FILEKIND;
                  ADDR: INTEGER;
                  PROTECTED: BOOLEAN;
                  NOTUSED: ARRAY (.1..5.) OF INTEGER
                END;

TYPE IODEVICE =
  (TYPEDEVICE, DISKDEVICE, TAPEDEVICE, PRINTDEVICE, CARDDEVICE);

TYPE IOOPERATION = (INPUT, OUTPUT, MOVE, CONTROL);

TYPE IOARG = (WRITEEOF, REWIND, UPSPACE, BACKSPACE);
```

```
TYPE IORESULT =
  (COMPLETE, INTERVENTION, TRANSMISSION, FAILURE,
   ENDFILE, ENDMEDIUM, STARTMEDIUM);

TYPE IOPARAM = RECORD
                 OPERATION: IOOPERATION;
                 STATUS: IORESULT;
                 ARG: IOARG
               END;

TYPE TASKKIND = (INPUTTASK, JOBTASK, OUTPUTTASK);

TYPE ARGTAG =
  (NILTYPE, BOOLTYPE, INTTYPE, IDTYPE, PTRTYPE);

TYPE POINTER =  BOOLEAN;

TYPE ARGTYPE = RECORD
                 CASE TAG: ARGTAG OF
                   NILTYPE, BOOLTYPE: (BOOL: BOOLEAN);
                   INTTYPE: (INT: INTEGER);
                   IDTYPE: (ID: IDENTIFIER);
                   PTRTYPE: (PTR: POINTER)
               END;

CONST MAXARG = 10;
TYPE ARGLIST = ARRAY (.1..MAXARG.) OF ARGTYPE;

TYPE ARGSEQ = (INP, OUT);

TYPE PROGRESULT =
  (TERMINATED, OVERFLOW, POINTERERROR, RANGEERROR, VARIANTERROR,
   HEAPLIMIT, STACKLIMIT, CODELIMIT, TIMELIMIT, CALLERROR);

PROCEDURE READ(VAR C: CHAR);
PROCEDURE WRITE(C: CHAR);

PROCEDURE OPEN(F: FILE; ID: IDENTIFIER; VAR FOUND: BOOLEAN);
PROCEDURE CLOSE(F: FILE);
PROCEDURE GET(F: FILE; P: INTEGER; VAR BLOCK: UNIV PAGE);
PROCEDURE PUT(F: FILE; P: INTEGER; VAR BLOCK: UNIV PAGE);
FUNCTION LENGTH(F: FILE): INTEGER;

PROCEDURE MARK(VAR TOP: INTEGER);
PROCEDURE RELEASE(TOP: INTEGER);

PROCEDURE IDENTIFY(HEADER: LINE);
PROCEDURE ACCEPT(VAR C: CHAR);
PROCEDURE DISPLAY(C: CHAR);

PROCEDURE READPAGE(VAR BLOCK: UNIV PAGE; VAR EOF: BOOLEAN);
PROCEDURE WRITEPAGE(BLOCK: UNIV PAGE; EOF: BOOLEAN);
PROCEDURE READLINE(VAR TEXT: UNIV LINE);
```

```
PROCEDURE WRITELINE(TEXT: UNIV LINE);
PROCEDURE READARG(S: ARGSEQ; VAR ARG: ARGTYPE);
PROCEDURE WRITEARG(S: ARGSEQ; ARG: ARGTYPE);

PROCEDURE LOOKUP(ID: IDENTIFIER; VAR ATTR: FILEATTR; VAR FOUND: BOOLEAN);

PROCEDURE IOTRANSFER
  (DEVICE: IODEVICE; VAR PARAM: IOPARAM; VAR BLOCK: UNIV PAGE);

PROCEDURE IOMOVE(DEVICE: IODEVICE; VAR PARAM: IOPARAM);

FUNCTION TASK: TASKKIND;

PROCEDURE RUN(ID: IDENTIFIER; VAR PARAM: ARGLIST;
              VAR LINE: INTEGER; VAR RESULT: PROGRESULT);

PROCEDURE RESET( LU : INTEGER);

PROCEDURE BREAKPT ( LN : INTEGER );

"%ENDMACRO FULL_PREFIX"


"%MACRO PREFIX"
CONST NL='(:10:)';  FF='(:12:)';  CR='(:13:)';  EM='(:25:)';
CONST PAGELENGTH=512;  LINELENGTH=132;
TYPE  PAGE=ARRAY [1..PAGELENGTH] OF CHAR;
      LINE=ARRAY [1..LINELENGTH] OF CHAR;
PROCEDURE READ(VAR C: CHAR);
PROCEDURE WRITE(C: CHAR);

PROCEDURE OPEN(FILE:INTEGER; ID:UNIV LINE; VAR FOUND:BOOLEAN);
PROCEDURE CLOSE(FILE:INTEGER);
PROCEDURE GET(FILE:INTEGER; PAGE_NO:INTEGER; VAR BLOCK: UNIV PAGE);
PROCEDURE PUT(FILE:INTEGER; PAGE_NO:INTEGER; VAR BLOCK: UNIV PAGE);
FUNCTION LENGTH:INTEGER; "NOT IMPLEMENTED"

PROCEDURE MARK(VAR TOP: INTEGER);
PROCEDURE RELEASE(TOP: INTEGER);

PROCEDURE IDENTIFY;   "NOT IMPLEMENTED"
PROCEDURE ACCEPT(VAR C: CHAR);
PROCEDURE DISPLAY(C: CHAR);

"%ENDMACRO PREFIX"
"%MACRO SVC_TYPES"

"*******************************************************************"
"                                                                   "
"          OS/32MT3 SVC INTERFACE ROUTINE TYPES                     "
"                                                                   "
"*******************************************************************"
```

```
"MISCELLANEOUS DATA TYPES"

TYPE CHAR1 = PACKED ARRAY [1..1] OF CHAR;
TYPE CHAR3 = PACKED ARRAY [1..3] OF CHAR;
TYPE CHAR8 = PACKED ARRAY [1..8] OF CHAR;
TYPE CHAR4 = PACKED ARRAY [1..4] OF CHAR;
TYPE CHAR16 = ARRAY [1..16] OF CHAR;
TYPE CHAR28 = ARRAY [1..28] OF CHAR;

"SVC1 PARAMETER BLOCK"

TYPE SVC1_BLOCK = RECORD
      SVC1_FUNC: BYTE;            "FUNCTION CODE"
      SVC1_LU: BYTE;              "LOGICAL UNIT NUMBER"
      SVC1_STAT: BYTE;            "DEV-INDEP STATUS"
      SVC1_DEV_STAT: BYTE;        "DEV-DEPENDENT STATUS"
      SVC1_BUFSTART: INTEGER;     "ADDRESS(BUFFER)"
      SVC1_BUFEND: INTEGER;       "ADDRESS(BUFFER)+SIZE(BUFFER)-1"
      SVC1_RANDOM_ADDR: INTEGER;  "RANDOM ADDRESS FOR DASD"
      SVC1_XFER_LEN: INTEGER;     "TRANSFER LENGTH"
      SVC1_RESERVED: INTEGER;     "RESERVED FOR ITAM USE"
     END;

"SVC 1 FUNCTION CODES"

CONST SVC1_DATA_XFER = #00;      SVC1_COMMAND   = #80;
      SVC1_READ      = #40;      SVC1_WRITE     = #20;
      SVC1_TESTSET   = #60;      SVC1_TESTIO    = #00;
      SVC1_ASCII     = #00;      SVC1_BINARY    = #10;
      SVC1_PROCEED   = #00;      SVC1_WAIT      = #08;
      SVC1_SEQL      = #00;      SVC1_RANDOM    = #04;
      SVC1_CWAIT     = #00;      SVC1_UNC_PROC  = #02;
      SVC1_FORMAT    = #00;      SVC1_IMAGE     = #01;

      SVC1_REW       = #40;      SVC1_BSR       = #20;
      SVC1_FSR       = #10;      SVC1_WFM       = #08;
      SVC1_FSF       = #04;      SVC1_BSF       = #02;
      SVC1_RESV_FN   = #01;

"SVC 1 DEVICE-INDEPENDENT STATUS CODES"

CONST SVC1_OK        = #00;      SVC1_ERROR      = #80;
      SVC1_ILGFN     = #40;      SVC1_DU         = #20;
      SVC1_EOM       = #10;      SVC1_EOF        = #08;
      SVC1_UNRV      = #04;      SVC1_RECV       = #02;
      SVC1_ILGLU     = #01;      SVC1_DEVBUSY    = #7F;


"FILE DESCRIPTOR FOR SVC7 REQUESTS"

TYPE FD_TYPE = PACKED RECORD
      VOLN: CHAR4;                "VOLUME NAME"
      FN: CHAR8;                  "FILE NAME"
      EXTN: CHAR3;                "EXTENSION"
```

```
         ACCT: CHAR;                    "ACCOUNT NUMBER CODE"
        END;

"SVC 7 PARAMETER BLOCK"

TYPE SVC7_BLOCK = RECORD
         SVC7_CMD: BYTE;                "COMMAND"
         SVC7_MOD: BYTE;                "MODIFIER/DEVICE TYPE"
         SVC7_STAT: BYTE;               "STATUS"
         SVC7_LU: BYTE;                 "LOGICAL UNIT NUMBER"
         SVC7_KEYS: SHORTINTEGER;       "READ/WRITE KEYS"
         SVC7_RECLEN: SHORTINTEGER;"LOGICAL RECORD LENGTH"
         SVC7_FD: FD_TYPE;              "FILE DESCRIPTOR"
         SVC7_SIZE: INTEGER;            "FILE(/INDEX) SIZE"
        END;

"SVC 7 COMMAND CODES"


CONST SVC7_ALLOC        = #80;      SVC7_ASSIGN     = #40;
      SVC7_CHAP         = #20;      SVC7_RENAME     = #10;
      SVC7_REPROT       = #08;      SVC7_CLOSE      = #04;
      SVC7_DELETE       = #02;      SVC7_CHECKPT    = #01;
      SVC7_FETCH_ATTR   = #00;

"SVC 7 MODIFIER CODES - ACCESS PRIVILEGES"

CONST SVC7_AP_SRO       = #00;      SVC7_AP_ERO     = #20;
      SVC7_AP_SWO       = #40;      SVC7_AP_EWO     = #60;
      SVC7_AP_SRW       = #80;      SVC7_AP_SREW    = #A0;
      SVC7_AP_ERSW      = #C0;      SVC7_AP_ERW     = #E0;

"SVC 7 MODIFIER CODES - BUFFERING/FILE TYPE"

CONST SVC7_BUF_DEFAULT  = #00;      SVC7_BUF_PHYS   = #08;
      SVC7_BUF_LOG      = #10;      SVC7_BUF_SVC15  = #18;
      SVC7_FTYPE_CONTIG = #00;      SVC7_FTYPE_CHAIN= #01;
      SVC7_FTYPE_INDEX  = #02;      SVC7_FTYPE_ITAM = #07;


"%ENDMACRO SVC_TYPES"

"%MACRO STANDARD_EXTERNS"
PROCEDURE BREAKPNT(LINENO:INTEGER);EXTERN;
PROCEDURE SVC1(VAR BLOCK:SVC1_BLOCK);EXTERN;
PROCEDURE SVC3(RETURN_CODE:INTEGER);EXTERN;
PROCEDURE SVC7(VAR BLOCK:SVC7_BLOCK);EXTERN;
"%ENDMACRO STANDARD_EXTERNS"
```

Class types, file name MACRO.PAS

```

"%MACRO CLASS_TYPES"
(*********************************************************************
 * SVC7 CALLS FOR ALLOCATE, RENAME ,AND ASSIGN.                      *
 *********************************************************************)

  ; TYPE SVC7_CALLS
      = CLASS

        ; VAR SVC7_B : SVC7_BLOCK

        ; PROCEDURE SVC7 ( SVC7B : SVC7_BLOCK )
          ; EXTERN

        ; PROCEDURE ENTRY ALLOCATE_FILE
            ( P_VOLN : CHAR4
            ; P_FN : CHAR8
            ; P_EXTN : CHAR3
            ; VAR ALREADY_THERE : BOOLEAN
            )

          ; BEGIN
              WITH SVC7_B
              DO BEGIN
                SVC7_CMD := SVC7_ALLOC
              ; SVC7_MOD := SVC7_AP_SREW + SVC7_FTYPE_INDEX
              ; SVC7_STAT := 0
              ; SVC7_KEYS := 0
              ; SVC7_RECLEN := 512
              ; WITH SVC7_FD
                DO BEGIN
                  VOLN := P_VOLN
                ; FN := P_FN
                ; EXTN := P_EXTN
                ; ACCT := 'P'
                END
              END
            ; SVC7 ( SVC7_B )
            ; IF SVC7_B . SVC7_STAT = 4
              THEN ALREADY_THERE := TRUE
            END

        ; PROCEDURE ENTRY RENAME_FILE
            ( P_LU : BYTE ; P_FN : CHAR8 ; P_EXTN : CHAR3 )

          ; BEGIN
              WITH SVC7_B
              DO BEGIN
                SVC7_CMD := SVC7_RENAME
              ; SVC7_LU := P_LU
              ; WITH SVC7_FD
                DO BEGIN
```

```
         FN := P_FN
        ; EXTN := P_EXTN
        ; ACCT := 'P'
        END
       END
      ; SVC7 ( SVC7_B )
      END

    ; PROCEDURE ENTRY ASSIGN_DEVICE
      ( P_LU : BYTE ; P_VOLN : CHAR4 )

     ; BEGIN
       WITH SVC7_B
       DO BEGIN
        SVC7_CMD := SVC7_ASSIGN
       ; SVC7_LU := P_LU
       ; WITH SVC7_FD
        DO BEGIN
         VOLN := P_VOLN
        ; FN := '        '
        ; EXTN := '   '
        END
       END
      ; SVC7 ( SVC7_B )
      END

    ; PROCEDURE ENTRY DELETE_FILE
      ( P_VOLN : CHAR4 ; P_FN : CHAR8 ; P_EXTN : CHAR3 )

     ; BEGIN
       WITH SVC7_B
       DO BEGIN
        SVC7_CMD := SVC7_DELETE
;WITH SVC7_FD DO BEGIN
       ; VOLN := P_VOLN
       ; FN := P_FN
       ; EXTN := P_EXTN
END
       ; SVC7_KEYS := 0000
       END
      ; SVC7 ( SVC7_B )
      END

    ; BEGIN END

(*****************************************************************
 * TERMINAL INPUT AND OUTPUT                                     *
 *****************************************************************)

 ; TYPE TERMINAL_IO
   = CLASS

    ; VAR SVC1_IN , SVC1_OUT : SVC1_BLOCK
     ; C : CHAR
```

```
        ; OUT_LINE : LINE
        ; SVC1_OUTPUT_LENGTH : INTEGER

      ; PROCEDURE SVC1 ( SVC1_OUT : SVC1_BLOCK )
        ; EXTERN

      ; PROCEDURE SET_SVC1_INPUT

        ; BEGIN
            WITH SVC1_IN
            DO BEGIN
              SVC1_FUNC := SVC1_READ + SVC1_WAIT + SVC1_IMAGE
            ; SVC1_LU := 0
            ; SVC1_STAT := 0
            ; SVC1_DEV_STAT := 0
            ; SVC1_BUFSTART := ADDRESS ( C )
            ; SVC1_BUFEND := ADDRESS ( C ) + 1 - 1
            END
          END

      ; PROCEDURE SET_SVC1_OUTPUT

        ; BEGIN
            WITH SVC1_OUT
            DO BEGIN
              SVC1_FUNC := SVC1_WRITE + SVC1_WAIT + SVC1_IMAGE
            ; SVC1_LU := 0
            ; SVC1_STAT := 0
            ; SVC1_DEV_STAT := 0
            ; SVC1_BUFSTART := ADDRESS ( OUT_LINE )
            END
          ; SVC1_OUTPUT_LENGTH := 0
          END

      ; PROCEDURE SHIP_OUT_

        ; BEGIN
            SVC1_OUT . SVC1_BUFEND
            := SVC1_OUT . SVC1_BUFSTART + SVC1_OUTPUT_LENGTH - 1
          ; SVC1 ( SVC1_OUT )
          ; SVC1_OUTPUT_LENGTH := 0
          END

      ; PROCEDURE ENTRY SHIP_OUT

        ; BEGIN IF SVC1_OUTPUT_LENGTH <> 0 THEN SHIP_OUT_ END

      ; PROCEDURE ENTRY INPUT ( VAR CURRENT_CHAR : CHAR )

        ; BEGIN
            SVC1 ( SVC1_IN )
          ; CURRENT_CHAR := CHR ( ORD ( C ) MOD 128 )
          END
```

```
    ; PROCEDURE OUTPUT_ ( CC : CHAR )

     ; BEGIN
       SVC1_OUTPUT_LENGTH := SUCC ( SVC1_OUTPUT_LENGTH )
      ; OUT_LINE [ SVC1_OUTPUT_LENGTH ] := CC
      ; IF SVC1_OUTPUT_LENGTH = 79
        THEN SHIP_OUT_
      END

    ; PROCEDURE ENTRY OUTPUT ( CC : CHAR )

     ; BEGIN OUTPUT_ ( CC ) END

    ; PROCEDURE ENTRY OUTPUT_LINE ( ALINE : LINE )

     ; VAR I : INTEGER

     ; BEGIN
       I := 1
      ; WHILE ALINE [ I ] <> '$'
       DO BEGIN
        OUTPUT_ ( ALINE [ I ] )
       ; I := I + 1
       END
      ; SHIP_OUT_
      END

    ; BEGIN  (* INIT STATEMENT OF TERMINAL IO *)
      SET_SVC1_OUTPUT
     ; SET_SVC1_INPUT
     END

(*******************************************************************
 * BUFFER STACK CLASS, IN MEMORY BUFFERS FOR TEXT DATA             *
 *******************************************************************)

 ; TYPE BUFFER_STACK
   = CLASS

    ; VAR BUFFER_ARRAY : ARRAY [ 1 .. BUFFER_SIZE ] OF CHAR
     ; HEAD , TAIL , LENGTH , I : INTEGER

    ; PROCEDURE ENTRY PUSH ( C : CHAR ; VAR FULL : BOOLEAN )

     ; BEGIN
       BUFFER_ARRAY [ HEAD ] := C
      ; LENGTH := LENGTH + 1
      ; FULL := ( LENGTH = BUFFER_SIZE )
      ; HEAD := ( HEAD MOD BUFFER_SIZE ) + 1
      END

    ; PROCEDURE ENTRY POP ( VAR C : CHAR ; VAR EMPTY : BOOLEAN )

     ; BEGIN
```

```
              HEAD := ( HEAD + BUFFER_SIZE - 2 ) MOD BUFFER_SIZE + 1
            ; LENGTH := LENGTH - 1
            ; EMPTY := ( LENGTH = 0 )
            ; C := BUFFER_ARRAY [ HEAD ]
            END

        ; PROCEDURE PUSH_ON_BOTTOM ( C : CHAR )

          ; BEGIN
              BUFFER_ARRAY [ TAIL ] := C
            ; LENGTH := LENGTH + 1
            ; TAIL := ( TAIL + BUFFER_SIZE - 2 ) MOD BUFFER_SIZE + 1
            END

        ; PROCEDURE POP_OFF_BOTTOM
            ( VAR C : CHAR ; VAR EMPTY : BOOLEAN )

          ; BEGIN
              TAIL := ( TAIL MOD BUFFER_SIZE ) + 1
            ; LENGTH := LENGTH - 1
            ; C := BUFFER_ARRAY [ TAIL ]
            ; EMPTY := ( LENGTH = 0 )
            END

        ; PROCEDURE ENTRY PUSH_PAGE ( P : PAGE ; REVERSE : BOOLEAN )

          ; BEGIN
              IF REVERSE
              THEN FOR I := 1 TO 512 DO PUSH_ON_BOTTOM ( P [ I ] )
              ELSE FOR I := 512 DOWNTO 1 DO PUSH_ON_BOTTOM ( P [ I ] )
            END

        ; PROCEDURE ENTRY POP_PAGE
            ( VAR P : PAGE ; REVERSE : BOOLEAN ; VAR EMPTY : BOOLEAN )

          ; BEGIN
              IF REVERSE
              THEN FOR I := 512 DOWNTO 1
                DO POP_OFF_BOTTOM ( P [ I ] , EMPTY )
              ELSE BEGIN
                I := 0
              ; REPEAT I := I + 1
                ; POP_OFF_BOTTOM ( P [ I ] , EMPTY )
                UNTIL ( I = 512 ) OR EMPTY
              END
            END

        ; BEGIN TAIL := BUFFER_SIZE ; HEAD := 1 ; LENGTH := 0 END

(*******************************************************************
 * FILE STACK CLASS,  ON DISK FILE SPACE                            *
 *******************************************************************)

 ; TYPE FILE_STACK
```

```
        = CLASS ( FILE_NUMBER : FILE )

          ; VAR PAGE_NUMBER : INTEGER

          ; PROCEDURE ENTRY PUSH ( VAR PAGE_IN : PAGE )

            ; BEGIN
                PUT ( FILE_NUMBER , PAGE_NUMBER , PAGE_IN )
              ; PAGE_NUMBER := PAGE_NUMBER + 1
              END

          ; PROCEDURE ENTRY POP
              ( VAR PAGE_OUT : PAGE ; VAR FILE_EMPTY : BOOLEAN )

            ; BEGIN
                PAGE_NUMBER := PAGE_NUMBER - 1
              ; GET ( FILE_NUMBER , PAGE_NUMBER , PAGE_OUT )
              ; FILE_EMPTY := ( PAGE_NUMBER = 1 )
              END

          ; BEGIN PAGE_NUMBER := 1 END

(*********************************************************************
 * LEFT AND RIGHT BUFFER STACK MANAGMENT                             *
 *********************************************************************)

   ; TYPE BUFFER_MANAGEMENT
        = CLASS ( IO : TERMINAL_IO )

(*
 THE BUFFER_MANAGMENT CLASS IS GIVEN ACCESS TO THE
 TERMINAL IO CLASS TO THAT IT CAN PUT DOTS AND COLINS
 ON THE CONSOL SO THE USER KNOW THAT SOMETHING IS
 HAPPENING.
*)

          ; VAR LEFT , RIGHT : BUFFER_STACK
            ; LF , RF : FILE_STACK
            ; I , J : INTEGER
            ; P : PAGE
            ; RIGHT_EMPTY , RIGHT_FULL , LEFT_EMPTY , LEFT_FULL
              : BOOLEAN

          ; PROCEDURE ADD_LEFT ( C : CHAR )

            ; VAR NOTUSED : BOOLEAN

            ; BEGIN
                LEFT . PUSH ( C , LEFT_FULL )
              ; IF LEFT_FULL
                THEN FOR I := 1 TO NO_PAGES_IN_BUFFER DIV 2
                  DO BEGIN
                    LEFT . POP_PAGE ( P , FALSE , NOTUSED )
                  ; LF . PUSH ( P )
```

```
                END
            END

        ; PROCEDURE POP_RIGHT ( VAR CURRENT_CHAR : CHAR )

          ; VAR EMPTY : BOOLEAN

          ; BEGIN
            ; RIGHT . POP ( CURRENT_CHAR , RIGHT_EMPTY )
            ; IF RIGHT_EMPTY AND ( CURRENT_CHAR <> EM )
              THEN BEGIN
                I := 0
              ; REPEAT I := I + 1
                ; RF . POP ( P , EMPTY )
                ; RIGHT . PUSH_PAGE ( P , TRUE )
                UNTIL ( I = NO_PAGES_IN_BUFFER DIV 2 ) OR EMPTY
              END
            END

        ; PROCEDURE ENTRY MOVE_LEFT ( VAR CURRENT_CHAR : CHAR )

          ; BEGIN
              ADD_LEFT ( CURRENT_CHAR )
            ; POP_RIGHT ( CURRENT_CHAR )
            END

        ; PROCEDURE ADD_RIGHT ( C : CHAR )

          ; VAR NOTUSED : BOOLEAN

          ; BEGIN
            ; RIGHT . PUSH ( C , RIGHT_FULL )
            ; IF RIGHT_FULL
              THEN FOR I := 1 TO NO_PAGES_IN_BUFFER DIV 2
                DO BEGIN
                  RIGHT . POP_PAGE ( P , TRUE , NOTUSED )
                ; RF . PUSH ( P )
                END
            END

        ; PROCEDURE POP_LEFT ( VAR CURRENT_CHAR : CHAR )

          ; VAR EMPTY : BOOLEAN

          ; BEGIN
            ; LEFT . POP ( CURRENT_CHAR , LEFT_EMPTY )
            ; IF LEFT_EMPTY AND ( CURRENT_CHAR <> EM )
              THEN BEGIN
                I := 0
              ; REPEAT I := I + 1
                ; LF . POP ( P , EMPTY )
                ; LEFT . PUSH_PAGE ( P , FALSE )
                UNTIL ( I = NO_PAGES_IN_BUFFER DIV 2 ) OR EMPTY
              END
```

```
        END

  ; PROCEDURE ENTRY MOVE_RIGHT ( VAR CURRENT_CHAR : CHAR )

    ; BEGIN
        ADD_RIGHT ( CURRENT_CHAR )
      ; POP_LEFT ( CURRENT_CHAR )
      END

  ; PROCEDURE ENTRY ADD ( C : CHAR )

    ; BEGIN ADD_LEFT ( C ) END

  ; PROCEDURE ENTRY DELETE ( VAR CURRENT_CHAR : CHAR )

    ; BEGIN POP_RIGHT ( CURRENT_CHAR ) END

  ; PROCEDURE ENTRY FIND_NO_OF_PAGES
      ( FILE_NO : INTEGER ; VAR NO_OF_PAGES : INTEGER )

    ; VAR END_OF_FILE : BOOLEAN
      ; COUNT_OF_DOTS : INTEGER

    ; BEGIN
        NO_OF_PAGES := 0
      ; COUNT_OF_DOTS := 12
      ; END_OF_FILE := FALSE
      ; WHILE NOT ( END_OF_FILE )
        DO BEGIN
          NO_OF_PAGES := NO_OF_PAGES + 1
        ; GET ( FILE_NO , NO_OF_PAGES , P )
        ; IO . OUTPUT ( '.' )
        ; IO . SHIP_OUT
        ; COUNT_OF_DOTS := COUNT_OF_DOTS + 1
        ; IF COUNT_OF_DOTS > 80
          THEN BEGIN
            COUNT_OF_DOTS := 1
          ; IO . OUTPUT ( NL )
          ; IO . OUTPUT ( CR )
          ; IO . SHIP_OUT
          END
        ; FOR I := 1 TO PAGELENGTH
          DO BEGIN
            IF ( P [ I ] = EM )
            THEN END_OF_FILE := TRUE
          END
        END
      END

  ; PROCEDURE ENTRY INIT_RIGHT_STACK
      ( FILE_NO , LAST_PAGE_NO : INTEGER )

    ; VAR COUNT_OF_COLINS : INTEGER
```

```
              ; BEGIN
                 COUNT_OF_COLINS := 1
               ; IO . OUTPUT ( NL )
               ; IO . OUTPUT ( CR )
               ; IO . SHIP_OUT
               ; FOR I := LAST_PAGE_NO DOWNTO 1
                 DO BEGIN
                   GET ( FILE_NO , I , P )
                 ; COUNT_OF_COLINS := COUNT_OF_COLINS + 1
                 ; IO . OUTPUT ( ':' )
                 ; IO . SHIP_OUT
                 ; IF COUNT_OF_COLINS > 80
                   THEN BEGIN
                     IO . OUTPUT ( NL )
                   ; IO . OUTPUT ( CR )
                   ; IO . SHIP_OUT
                   ; COUNT_OF_COLINS := 1
                   END
                 ; RF . PUSH ( P )
                 END
               END

            ; PROCEDURE ENTRY FILL_LEFT_STACK

              ; VAR EMPTY : BOOLEAN

              ; BEGIN
                 REPEAT
                   LEFT . POP_PAGE ( P , FALSE , EMPTY )
                 ; LF . PUSH ( P )
                 UNTIL EMPTY
               END

            ; BEGIN
               INIT LEFT , RIGHT , LF ( 3 ) , RF ( 2 )
             ; ADD_RIGHT ( NL )
             END

(*****************************************************************************
 *   COPY BUFFER STACK MANAGMENT                                             *
 *****************************************************************************)

   ; TYPE COPY_BUFFER_MANAGEMENT
       = CLASS

            ; VAR COPYB : BUFFER_STACK
              ; COPYF : FILE_STACK
              ; I : INTEGER
              ; EMPTY , BUFFER_EMPTY , BUFFER_FULL , NOTUSED : BOOLEAN
              ; P : PAGE

            ; PROCEDURE ENTRY COPY_PUSH ( C : CHAR )

              ; BEGIN
```

```
              COPYB . PUSH ( C , BUFFER_FULL )
            ; IF BUFFER_FULL
              THEN FOR I := 1 TO NO_PAGES_IN_BUFFER DIV 2
                DO BEGIN
                  COPYB . POP_PAGE ( P , FALSE , NOTUSED )
                ; COPYF . PUSH ( P )
                END
            END

        ; PROCEDURE ENTRY COPY_POP ( VAR C : CHAR )

          ; BEGIN
              COPYB . POP ( C , BUFFER_EMPTY )
            ; IF BUFFER_EMPTY AND ( C <> EM )
              THEN BEGIN
                I := 0
              ; REPEAT I := I + 1
                ; COPYF . POP ( P , EMPTY )
                ; COPYB . PUSH_PAGE ( P , FALSE )
                UNTIL ( I = NO_PAGES_IN_BUFFER DIV 2 ) OR EMPTY
              END
            END

        ; BEGIN
            INIT COPYB , COPYF ( 4 )
          ; COPYB . PUSH ( EM , NOTUSED )
          ; COPYB . PUSH ( EM , NOTUSED )
          END
"%ENDMACRO CLASS_TYPES"
```

Sedit main program, file name SEDIT1.PAS

```
(*#####################################################################
 *                                                                    *
 *      SSSS      EEEEEEEE    DDDDDDD       IIIIII     TTTTTTTT       *
 *     SSSSSS     EEEEEEEE    DDDDDDDD      IIIIII     TTTTTTTT       *
 *    SSS   SS    EE          DD    DD        II       T  TT  T       *
 *    SSS         EE          DD    DD        II          TT          *
 *     SSSSS      EEEEEE      DD    DD        II          TT          *
 *        SSS     EEEEEE      DD    DD        II          TT          *
 *     SS  SSS    EE          DD    DD        II          TT          *
 *    SS   SSS    EE          DD    DD        II          TT          *
 *    SSSSSSSS    EEEEEEEE    DDDDDDDD      IIIIII        TT          *
 *     SSSSSS     EEEEEEEE    DDDDDDD       IIIIII       TTTT         *
 *                                                                    *
 *                                                                    *
 *                                                                    *
 *                                                                    *
 * SEDIT VERSION 1                                                    *
 * MADE BY THEODORE JOHN SOCOLOFSKY                                   *
 * AS A PROJECT FOR CIS                                               *
 * IN THE SUMMER OF 1981                                              *
 #####################################################################*)
"%INCLUDE SVC_TYPES"
(**********************************************************************)
(*                                                                    *)
(*          OS/32MT3 SVC INTERFACE ROUTINE TYPES                      *)
(*                                                                    *)
(**********************************************************************)
"%INCLUDE FULL_PREFIX"
(*#########
 # PREFIX #
 #########*)
  PROGRAM SEDIT
    ( PARAM : LINE ) (*************************************)

  ; TYPE FILE = 1 .. 5

  ; CONST ETX = '(:3:)'
    ; BEL = '(:7:)'
    ; BS = '(:8:)'
    ; HT = '(:9:)'
    ; TAB = '(:9:)'
    ; VT = '(:11:)'
    ; CR = '(:13:)'
    ; SUB = '(:26:)'
    ; ESC = '(:27:)'
    ; RS = '(:30:)'
    ; DEL = '(:127:)'
    ; PAD = '(:127:)'
    ; SET_OF_DIGITS = [ '0' .. '9' ]
    ; SET_OF_UPPERCASE_LETTERS = [ 'A' .. 'Z' ]
    ; SET_OF_LOWERCASE_LETTERS = [ 'a' .. 'z' ]
```

```
      ; SET_OF_PRINTING_SPECIAL_CHARACTERS
        = [ ' ' .. '/' , ':' .. ' ' , '[' .. '`' ]
      ; SET_OF_VALID_INPUT_CHARACTERS
        = SET_OF_DIGITS
          + SET_OF_UPPERCASE_LETTERS
          + SET_OF_LOWERCASE_LETTERS
          + SET_OF_PRINTING_SPECIAL_CHARACTERS
      ; SET_OF_INVALID_INPUT_CHARACTERS
        = [ '(:0:)' .. '(:31:)' , '(:127:)' ]
      ; NO_PAGES_IN_BUFFER = 8
      ; BUFFER_SIZE = NO_PAGES_IN_BUFFER * PAGELENGTH

"%INCLUDE CLASS_TYPES"
(* MAIN ****************************************************)

    ; VAR IO : TERMINAL_IO
      ; B_M : BUFFER_MANAGEMENT
      ; S7 : SVC7_CALLS
      ; C_B_M : COPY_BUFFER_MANAGEMENT
      ; SHOW_LINE_NUMBERS , SECOND_EDIT_PROMPT_ON : BOOLEAN
      ; CURSOR_ROW , CURSOR_COL : INTEGER
      ; SAVED_CURSOR_ROW , SAVED_CURSOR_COL : INTEGER
      ; DIRECTION_CHAR : CHAR

    ; PROCEDURE CLEAR_SCREEN

      ; BEGIN
          IO . OUTPUT ( SUB )
        ; IO . OUTPUT ( PAD )
        ; IO . OUTPUT ( PAD )
        ; IO . SHIP_OUT
        ; CURSOR_ROW := 1
        ; CURSOR_COL := 1
        END

    ; PROCEDURE HOME_CURSOR

      ; BEGIN
          IO . OUTPUT ( RS )
        ; IO . OUTPUT ( PAD )
        ; IO . OUTPUT ( PAD )
        ; IO . SHIP_OUT
        ; CURSOR_ROW := 1
        ; CURSOR_COL := 1
        END

    ; PROCEDURE MOVE_CURSOR ( ROW , COL : INTEGER )

      ; VAR TROW , TCOL : INTEGER

      ; BEGIN
          TROW := ROW
        ; TCOL := COL
        ; IO . OUTPUT ( ESC )
```

```
        ; IO . OUTPUT ( '=' )
        ; IF ROW < 1
          THEN TROW := 1
        ; IF ROW > 24
          THEN TROW := 24
        ; IF COL < 1
          THEN TCOL := 1
        ; IF COL > 80
          THEN TCOL := 80
        ; IO . OUTPUT ( CHR ( TROW + 31 ) )
        ; IO . OUTPUT ( CHR ( TCOL + 31 ) )
        ; CURSOR_ROW := TROW
        ; CURSOR_COL := TCOL
        ; IO . SHIP_OUT
        END

    ; PROCEDURE SAVE_CURSOR_POSITION

      ; BEGIN
          SAVED_CURSOR_ROW := CURSOR_ROW
        ; SAVED_CURSOR_COL := CURSOR_COL
        END

    ; PROCEDURE UNSAVE_CURSOR_POSITION

      ; BEGIN
          CURSOR_ROW := SAVED_CURSOR_ROW
        ; CURSOR_COL := SAVED_CURSOR_COL
        END

    ; PROCEDURE MOVE_TO_END_OF_CURRENT_LINE
        ( VAR CURRENT_CHAR : CHAR ; VAR LENGTH : INTEGER )

      ; BEGIN
          LENGTH := 0
        ; WHILE CURRENT_CHAR <> NL
          DO BEGIN
            B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; LENGTH := LENGTH + 1
          END
        END

    ; PROCEDURE MOVE_TO_END_OF_PREVIOUS_LINE
        ( VAR CURRENT_CHAR : CHAR ; VAR LENGTH : INTEGER )

      ; BEGIN
          LENGTH := 0
        ; WHILE CURRENT_CHAR <> NL
          DO BEGIN
            B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; LENGTH := LENGTH + 1
          END
        END
```

```
; PROCEDURE OUTPUT_REST_OF_LINE
    ( VAR CURRENT_CHAR : CHAR ; VAR LENGTH : INTEGER )

  ; VAR I , J : INTEGER

  ; BEGIN
      IF NOT SHOW_LINE_NUMBERS
      THEN BEGIN
        MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , I )
      ; IF I > 9
        THEN LENGTH := I
        ELSE LENGTH := 9
      ; J := 0
      ; WHILE ( J < LENGTH ) AND ( CURRENT_CHAR <> EM )
        DO BEGIN
          J := J + 1
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        END
      ; IF CURRENT_CHAR = EM
        THEN B_M . MOVE_RIGHT ( CURRENT_CHAR )
      END
    ; LENGTH := 0
    ; WHILE CURRENT_CHAR <> NL
      DO BEGIN
        IF CURSOR_COL + LENGTH <= 80
        THEN IO . OUTPUT ( CURRENT_CHAR )
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; LENGTH := LENGTH + 1
      END
    ; IF CURSOR_COL + LENGTH <= 80
      THEN CURSOR_COL := CURSOR_COL + LENGTH
      ELSE BEGIN
        CURSOR_COL := 80
      ; IF CURSOR_COL + LENGTH > 80
        THEN BEGIN
          MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
        ; IO . OUTPUT ( '!' )
        END
      END
    ; IF LENGTH <> 0
      THEN IO . SHIP_OUT
    END

; PROCEDURE MOVE_TO_BEGINNING_OF_TEXT ( VAR CURRENT_CHAR : CHAR )

  ; VAR I : INTEGER

  ; BEGIN
      REPEAT
        B_M . MOVE_RIGHT ( CURRENT_CHAR )
      UNTIL CURRENT_CHAR = EM
    ; FOR I := 1 TO 10 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
    END
```

```
      ; PROCEDURE MOVE_TO_END_OF_TEXT ( VAR CURRENT_CHAR : CHAR )

        ; BEGIN
            REPEAT
              B_M . MOVE_LEFT ( CURRENT_CHAR )
            UNTIL CURRENT_CHAR = EM
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          END

      ; PROCEDURE OUTPUT_REST_OF_SCREEN
          ( VAR CURRENT_CHAR : CHAR
          ; VAR LENGTH , NUMBER_OF_LINES : INTEGER
          )

        ; VAR TLENGTH : INTEGER

        ; BEGIN
            LENGTH := 0
          ; NUMBER_OF_LINES := 0
          ; WHILE ( CURRENT_CHAR <> EM ) AND ( CURSOR_ROW <= 24 )
            DO BEGIN
              MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
            ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , TLENGTH )
            ; LENGTH := LENGTH + TLENGTH + 1
            ; NUMBER_OF_LINES := NUMBER_OF_LINES + 1
            ; B_M . MOVE_LEFT ( CURRENT_CHAR )
            ; CURSOR_COL := 1
            ; CURSOR_ROW := CURSOR_ROW + 1
            END
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; LENGTH := LENGTH - 1
          END

      ; PROCEDURE VERIFY ( VAR CURRENT_CHAR : CHAR )

        ; VAR I , LENGTH , TLENGTH , NUMBER_OF_LINES : INTEGER

        ; BEGIN
            NUMBER_OF_LINES := 0
          ; LENGTH := 0
          ; REPEAT MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , TLENGTH )
            ; LENGTH := LENGTH - TLENGTH - 1
            ; B_M . MOVE_LEFT ( CURRENT_CHAR )
            ; NUMBER_OF_LINES := NUMBER_OF_LINES + 1
            UNTIL ( NUMBER_OF_LINES = 12 ) OR ( CURRENT_CHAR = EM )
          ; NUMBER_OF_LINES := 1
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; LENGTH := LENGTH + 2
          ; REPEAT MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , TLENGTH )
            ; LENGTH := LENGTH + TLENGTH + 1
            ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; NUMBER_OF_LINES := NUMBER_OF_LINES + 1
            UNTIL ( NUMBER_OF_LINES = 24 ) OR ( CURRENT_CHAR = EM )
```

```
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; LENGTH := LENGTH - 2
          ; CLEAR_SCREEN
          ; MOVE_CURSOR ( 2 , 1 )
          ; OUTPUT_REST_OF_SCREEN
              ( CURRENT_CHAR , TLENGTH , NUMBER_OF_LINES )
          ; FOR I := 1 TO TLENGTH - LENGTH
            DO BEGIN
              B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; IF CURRENT_CHAR = NL
              THEN NUMBER_OF_LINES := NUMBER_OF_LINES - 1
            END
          ; LENGTH := 0
          ; IF CURRENT_CHAR = NL
            THEN BEGIN B_M . MOVE_RIGHT ( CURRENT_CHAR ) ; LENGTH := 1 END
          ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , TLENGTH )
          ; LENGTH := LENGTH + TLENGTH
          ; FOR I := 1 TO LENGTH DO B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; IF LENGTH > 80
            THEN LENGTH := 80
          ; NUMBER_OF_LINES := NUMBER_OF_LINES + 1
          ; MOVE_CURSOR ( NUMBER_OF_LINES , LENGTH )
          END

      ; PROCEDURE MOVE_RIGHT_1_LINE
          ( VAR CURRENT_CHAR : CHAR ; VAR J : INTEGER )

        ; VAR L : INTEGER
          ; END_WAS_FOUND : BOOLEAN

        ; BEGIN
            L := 0
          ; IF CURRENT_CHAR = NL
            THEN BEGIN
              B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; L := 1
            ; IF CURRENT_CHAR = EM
              THEN BEGIN B_M . MOVE_LEFT ( CURRENT_CHAR ) ; L := 0 END
            END
          ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
          ; L := L + J
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR = EM
            THEN BEGIN
              B_M . MOVE_LEFT ( CURRENT_CHAR )
            ; END_WAS_FOUND := TRUE
            END
            ELSE END_WAS_FOUND := FALSE
          ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
          ; J := 1
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; WHILE ( J < L ) AND ( CURRENT_CHAR <> NL )
            DO BEGIN
```

```
        J := J + 1
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      END
    ; IF END_WAS_FOUND
      THEN J := 0
    END

; PROCEDURE MOVE_LEFT_1_LINE
    ( VAR CURRENT_CHAR : CHAR ; VAR I : INTEGER )

  ; VAR L , J : INTEGER

  ; BEGIN
      L := 0
    ; IF CURRENT_CHAR = NL
      THEN BEGIN
        B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; L := 1
      ; IF CURRENT_CHAR = EM
        THEN BEGIN B_M . MOVE_LEFT ( CURRENT_CHAR ) ; L := 0 END
      END
    ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , I )
    ; L := L + I
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    ; MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , I )
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    ; I := 1
    ; IF CURRENT_CHAR = EM
      THEN BEGIN
        B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , I )
      ; FOR J := 1 TO L DO B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; I := 0
      END
      ELSE WHILE ( CURRENT_CHAR <> NL ) AND ( I < L )
        DO BEGIN
          I := I + 1
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        END
    END

; PROCEDURE EDIT_PROMPT ( DIRECTION_CHAR : CHAR )

  ; VAR SROW , SCOL : INTEGER

  ; BEGIN
      SROW := CURSOR_ROW
    ; SCOL := CURSOR_COL
    ; MOVE_CURSOR ( 1 , 1 )
    ; IO . OUTPUT ( DIRECTION_CHAR )
    ; IO . OUTPUT_LINE
        ( 'SEDIT: I(nsert D(elete Q(uit P(age J(ump$' )
    ; IO . OUTPUT_LINE
```

```
        ( ' X(change F(ix V(erify                ? $' )
      ; MOVE_CURSOR ( SROW , SCOL )
      END

  ; PROCEDURE UP_ARROW ( VAR CURRENT_CHAR : CHAR ; VAR TOF : BOOLEAN )

    ; VAR I : INTEGER

    ; BEGIN
        CURSOR_ROW := CURSOR_ROW - 1
      ; MOVE_RIGHT_1_LINE ( CURRENT_CHAR , I )
      ; IF CURSOR_ROW = 1
        THEN BEGIN
          IF I <> 0
          THEN BEGIN
            CURSOR_COL := I
          ; VERIFY ( CURRENT_CHAR )
          ; EDIT_PROMPT ( DIRECTION_CHAR )
          END
          ELSE MOVE_CURSOR ( 2 , CURSOR_COL )
        END
        ELSE IF I <> 0
          THEN MOVE_CURSOR ( CURSOR_ROW , I )
          ELSE MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
      ; IF I = 0
        THEN TOF := TRUE
        ELSE TOF := FALSE
      END

  ; PROCEDURE DOWN_ARROW
      ( VAR CURRENT_CHAR : CHAR ; VAR BOF : BOOLEAN )

    ; VAR I , J : INTEGER

    ; BEGIN
        MOVE_LEFT_1_LINE ( CURRENT_CHAR , J )
      ; IF J <> 0
        THEN BEGIN
          CURSOR_ROW := CURSOR_ROW + 1
        ; IF CURSOR_ROW = 25
          THEN BEGIN
            FOR I := 1 TO J - 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; IO . OUTPUT ( NL )
          ; MOVE_CURSOR ( 24 , 1 )
          ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , I )
          ; EDIT_PROMPT ( DIRECTION_CHAR )
          ; FOR I := 1 TO I - ( J - 1 )
            DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; CURSOR_ROW := 24
          END
        ; MOVE_CURSOR ( CURSOR_ROW , J )
        END
      ; IF J = 0
        THEN BOF := TRUE
```

```
      ELSE BOF := FALSE
    END

; PROCEDURE LEFT_ARROW
    ( VAR CURRENT_CHAR : CHAR ; VAR TOF : BOOLEAN )

  ; VAR J , I : INTEGER

  ; BEGIN
      TOF := FALSE
    ; IF CURSOR_COL = 80
      THEN BEGIN
      ; IF CURRENT_CHAR = NL
        THEN BEGIN B_M . MOVE_RIGHT ( CURRENT_CHAR ) ; I := 1 END
        ELSE I := 0
      ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
      ; J := J + I
      ; FOR I := 1 TO J DO B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; IF ( J > 88 ) OR ( ( J > 80 ) AND SHOW_LINE_NUMBERS )
        THEN CURSOR_COL := CURSOR_COL + 1
      END
    ; CURSOR_COL := CURSOR_COL - 1
    ; IF ( CURSOR_COL < 1 )
         OR ( SHOW_LINE_NUMBERS AND ( CURSOR_COL < 9 ) )
      THEN BEGIN
        IF CURRENT_CHAR = NL
        THEN BEGIN B_M . MOVE_RIGHT ( CURRENT_CHAR ) ; I := 1 END
        ELSE I := 0
      ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
      ; J := J + I
      ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; IF CURRENT_CHAR <> EM
        THEN BEGIN
          MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
        ; CURSOR_ROW := CURSOR_ROW - 1
        END
        ELSE BEGIN
          FOR I := 1 TO J + 1 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; IF SHOW_LINE_NUMBERS
          THEN J := 8
          ELSE J := 0
        ; TOF := TRUE
        END
      ; IF SHOW_LINE_NUMBERS
        THEN CURSOR_COL := J + 1
        ELSE CURSOR_COL := J - 7
      END
      ELSE B_M . MOVE_RIGHT ( CURRENT_CHAR )
    ; IF CURSOR_COL > 80
      THEN CURSOR_COL := 80
    ; IF CURSOR_ROW = 1
      THEN BEGIN
```

```
        VERIFY ( CURRENT_CHAR )
      ; EDIT_PROMPT ( DIRECTION_CHAR )
      END
      ELSE MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
    END

; PROCEDURE RIGHT_ARROW
    ( VAR CURRENT_CHAR : CHAR ; VAR BOF : BOOLEAN )

  ; VAR I , J : INTEGER

  ; BEGIN
      BOF := FALSE
    ; CURSOR_COL := CURSOR_COL + 1
    ; IF CURRENT_CHAR = NL
      THEN BEGIN
        IF SHOW_LINE_NUMBERS
        THEN BEGIN
          B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; IF CURRENT_CHAR <> EM
          THEN BEGIN
            CURSOR_ROW := CURSOR_ROW + 1
          ; CURSOR_COL := 9
          ; IF CURSOR_ROW = 25
            THEN BEGIN
              IO . OUTPUT ( NL )
            ; MOVE_CURSOR ( 24 , 1 )
            ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , I )
            ; FOR J := 1 TO I - 8
              DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; CURSOR_COL := 9
            ; EDIT_PROMPT ( DIRECTION_CHAR )
            END
            ELSE FOR J := 1 TO 8 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
          END
          ELSE BEGIN
            CURSOR_COL := CURSOR_COL - 1
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; BOF := TRUE
          END
        END
        ELSE BEGIN
          B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; IF CURRENT_CHAR <> EM
          THEN BEGIN
            CURSOR_ROW := CURSOR_ROW + 1
          ; CURSOR_COL := 1
          ; IF CURSOR_ROW = 25
            THEN BEGIN
              IO . OUTPUT ( NL )
            ; MOVE_CURSOR ( 24 , 1 )
            ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , I )
            ; FOR J := 1 TO I DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; CURSOR_COL := 1
```

```
                ; EDIT_PROMPT ( DIRECTION_CHAR )
                END
              END
              ELSE BEGIN
                CURSOR_COL := CURSOR_COL - 1
              ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
              END
            END
          END
          ELSE B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; IF CURSOR_COL = 81
          THEN CURSOR_COL := 80
        ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
        END

    ; PROCEDURE RETURN ( VAR CURRENT_CHAR : CHAR )

      ; VAR I , J , L : INTEGER
        ; NEW_LINE : BOOLEAN

      ; BEGIN
          NEW_LINE := FALSE
        ; MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , L )
        ; IF SHOW_LINE_NUMBERS
          THEN BEGIN
            B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR <> EM
            THEN BEGIN
              CURSOR_ROW := CURSOR_ROW + 1
            ; CURSOR_COL := 9
            ; IF CURSOR_ROW = 25
              THEN BEGIN
                IO . OUTPUT ( NL )
              ; MOVE_CURSOR ( 24 , 1 )
              ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , I )
              ; FOR J := 1 TO I - 8 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
              ; CURSOR_COL := 9
              ; NEW_LINE := TRUE
              END
              ELSE FOR J := 1 TO 8 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
            END
            ELSE BEGIN
              CURSOR_COL := CURSOR_COL + L
            ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
            END
          END
          ELSE BEGIN
            B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR <> EM
            THEN BEGIN
              CURSOR_ROW := CURSOR_ROW + 1
            ; CURSOR_COL := 1
            ; IF CURSOR_ROW = 25
              THEN BEGIN
```

```
                IO . OUTPUT ( NL )
              ; MOVE_CURSOR ( 24 , 1 )
              ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , I )
              ; FOR J := 1 TO I DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
              ; CURSOR_COL := 1
              ; NEW_LINE := TRUE
              END
            END
            ELSE BEGIN
              CURSOR_COL := CURSOR_COL + L
            ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
            END
          END
        ; WHILE ( CURRENT_CHAR = ' ' ) AND ( CURSOR_COL < 80 )
          DO BEGIN
            CURSOR_COL := CURSOR_COL + 1
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          END
        ; IF NEW_LINE
          THEN EDIT_PROMPT ( DIRECTION_CHAR )
          ELSE MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
        END

    ; PROCEDURE MOVE_PAGE
        ( VAR CURRENT_CHAR : CHAR ; DIRECTION_CHAR : CHAR )

      ; VAR I , J : INTEGER

      ; BEGIN
          IF DIRECTION_CHAR = '<'
          THEN BEGIN
            MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
          ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR <> EM
            THEN BEGIN
              FOR I := 1 TO J + 1 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
            ; FOR I := 1 TO 23 DO MOVE_RIGHT_1_LINE ( CURRENT_CHAR , J )
            ; CURSOR_COL := J
            ; VERIFY ( CURRENT_CHAR )
            ; EDIT_PROMPT ( DIRECTION_CHAR )
            END
            ELSE FOR I := 1 TO J + 1 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
          END
        ; IF DIRECTION_CHAR = '>'
          THEN BEGIN
            MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR <> EM
            THEN BEGIN
              FOR I := 1 TO J + 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; FOR I := 1 TO 23 DO MOVE_LEFT_1_LINE ( CURRENT_CHAR , J )
            ; CURSOR_COL := J
            ; VERIFY ( CURRENT_CHAR )
            ; EDIT_PROMPT ( DIRECTION_CHAR )
```

```
          END
          ELSE FOR I := 1 TO J + 1
            DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
        END
      END

  ; PROCEDURE ADD_LINE_NUMBERS ( VAR CURRENT_CHAR : CHAR )

    ; VAR LINE_NUMBER , NUMBER , J , I : INTEGER
      ; INTEGER_STRING : ARRAY [ 1 .. 4 ] OF CHAR

    ; BEGIN
"CHECK FOR BUFFER CONTAINING EM NL EM
IF IT DOES ADD A NL CHARACTOR. THEN MOVE BACK TO LEFT EM."
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; IF CURRENT_CHAR = EM
        THEN BEGIN
          B_M . ADD ( NL )
        ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
        END
      ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; IO . OUTPUT ( NL )
      ; IO . OUTPUT ( CR )
      ; IO . SHIP_OUT
      ; LINE_NUMBER := 0
      ; REPEAT WHILE CURRENT_CHAR <> NL
          DO B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; IF CURRENT_CHAR <> EM
          THEN BEGIN
            LINE_NUMBER := ( LINE_NUMBER + 1 ) MOD 10000
          ; NUMBER := LINE_NUMBER
          ; IF NUMBER MOD 10 = 0
            THEN BEGIN
              IO . OUTPUT ( '<' )
            ; IO . SHIP_OUT
            ; IF NUMBER MOD 800 = 0
              THEN BEGIN
                IO . OUTPUT ( NL )
              ; IO . OUTPUT ( CR )
              ; IO . SHIP_OUT
              END
            END
          ; FOR I := 4 DOWNTO 1
            DO BEGIN
              INTEGER_STRING [ I ] := CHR ( NUMBER MOD 10 + 48 )
            ; NUMBER := NUMBER DIV 10
            END
          ; I := 1
          ; WHILE ( INTEGER_STRING [ I ] = '0' ) AND ( I < 4 )
            DO BEGIN
              B_M . ADD ( ' ' )
```

```
              ; I := I + 1
              END
            ; FOR J := I TO 4 DO B_M . ADD ( INTEGER_STRING [ J ] )
            ; FOR J := 1 TO 4 DO B_M . ADD ( ' ' )
            END
          UNTIL CURRENT_CHAR = EM
        ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
                                                "MOVE BACK TO BEGINNING."
        ; LINE_NUMBER := 1
        ; IO . OUTPUT ( NL )
        ; IO . OUTPUT ( CR )
        ; IO . SHIP_OUT
        ; REPEAT B_M . MOVE_RIGHT ( CURRENT_CHAR )
          ; IF CURRENT_CHAR = NL
            THEN BEGIN
              LINE_NUMBER := LINE_NUMBER + 1
            ; IF LINE_NUMBER MOD 10 = 0
              THEN BEGIN
                IO . OUTPUT ( '>' )
              ; IO . SHIP_OUT
              ; IF LINE_NUMBER MOD 800 = 0
                THEN BEGIN
                  IO . OUTPUT ( NL )
                ; IO . OUTPUT ( CR )
                ; IO . SHIP_OUT
                END
              END
            END
          UNTIL CURRENT_CHAR = EM
        ; FOR I := 1 TO 10 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
        END

    ; PROCEDURE INSERT_PROMPT

      ; VAR SROW , SCOL : INTEGER

      ; BEGIN
          SROW := CURSOR_ROW
        ; SCOL := CURSOR_COL
        ; MOVE_CURSOR ( 1 , 1 )
        ; IO . OUTPUT_LINE
            ( 'INSERT: [left arrow] a char, [del] a li$' )
        ; IO . OUTPUT_LINE
            ( 'ne, [esc] to abort, [ctrl<c>] to exit   $' )
        ; MOVE_CURSOR ( SROW , SCOL )
        END

    ; PROCEDURE OUTPUT_FRONT_OF_LINE ( VAR CURRENT_CHAR : CHAR )

      ; VAR I , L : INTEGER

      ; BEGIN
          IF CURRENT_CHAR = NL
          THEN BEGIN B_M . MOVE_RIGHT ( CURRENT_CHAR ) ; I := 1 END
```

```
        ELSE I := 0
      ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , L )
      ; L := L + I
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; MOVE_CURSOR ( CURSOR_ROW , 1 )
      ; FOR I := 1 TO L - 1
        DO BEGIN
          IO . OUTPUT ( CURRENT_CHAR )
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        END
      ; CURSOR_COL := L
      ; IO . SHIP_OUT
      END

  ; PROCEDURE SPREAD_END_OF_LINE ( VAR CURRENT_CHAR : CHAR )

    ; VAR I , J , L , NUMBER_OF_SPACES : INTEGER

    ; BEGIN
        MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
      ; FOR I := 1 TO J DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; NUMBER_OF_SPACES := 80 - J - CURSOR_COL + 1
      ; IF NUMBER_OF_SPACES > 1
        THEN BEGIN
          SAVE_CURSOR_POSITION
        ; IF CURRENT_CHAR <> NL
          THEN BEGIN
            FOR I := 1 TO NUMBER_OF_SPACES DO IO . OUTPUT ( ' ' )
          ; FOR I := 1 TO J
            DO BEGIN
              IO . OUTPUT ( CURRENT_CHAR )
            ; B_M . MOVE_LEFT ( CURRENT_CHAR )
            END
          ; FOR I := 1 TO J DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
          END
        ; UNSAVE_CURSOR_POSITION
        ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
        END
      END

  ; PROCEDURE SPREAD_CURRENT_LINE
      ( VAR CURRENT_CHAR : CHAR ; VAR NUMBER_OF_SPACES : INTEGER )

    ; VAR I , L , J : INTEGER

    ; BEGIN
        MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
      ; FOR I := 1 TO J DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; NUMBER_OF_SPACES := 80 - J - CURSOR_COL + 1
      ; IF NUMBER_OF_SPACES > 1
        THEN BEGIN
          SAVE_CURSOR_POSITION
        ; OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
        ; IF CURRENT_CHAR <> NL
```

```
            THEN BEGIN
              FOR I := 1 TO NUMBER_OF_SPACES DO IO . OUTPUT ( ' ' )
            ; FOR I := 1 TO J
              DO BEGIN
                IO . OUTPUT ( CURRENT_CHAR )
              ; B_M . MOVE_LEFT ( CURRENT_CHAR )
              END
            ; FOR I := 1 TO J DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
            END
          ; UNSAVE_CURSOR_POSITION
          ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
          END
        END

    ; PROCEDURE SPLIT_CURRENT_LINE ( VAR CURRENT_CHAR : CHAR )

      ; VAR I , J , L , K : INTEGER

      ; BEGIN
          OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
        ; SAVE_CURSOR_POSITION
        ; FOR I := CURSOR_COL TO 80 DO IO . OUTPUT ( ' ' )
        ; WHILE CURSOR_ROW < 23
          DO BEGIN
            CURSOR_ROW := CURSOR_ROW + 1
          ; MOVE_CURSOR ( CURSOR_ROW , 1 )
          ; FOR I := 1 TO 80 DO IO . OUTPUT ( ' ' )
          ;
          END
        ; MOVE_CURSOR ( CURSOR_ROW + 1 , 1 )
        ; MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
        ; FOR I := 1 TO J DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
        ; IF J > 81
          THEN K := 81
          ELSE K := J
        ; FOR I := 1 TO 80 - K DO IO . OUTPUT ( ' ' )
        ; FOR I := 1 TO K
          DO BEGIN
            IO . OUTPUT ( CURRENT_CHAR )
          ; B_M . MOVE_LEFT ( CURRENT_CHAR )
          END
        ; FOR I := 1 TO K DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
        ; UNSAVE_CURSOR_POSITION
        ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
        END

    ; PROCEDURE INSERT_A_NL_AND_LINE_NO ( VAR CURRENT_CHAR : CHAR )

      ; VAR I , J : INTEGER
        ; INTEGER_STRING : ARRAY [ 1 .. 4 ] OF CHAR
        ; DECIMAL_STRING : ARRAY [ 1 .. 2 ] OF CHAR
        ; INT , DEC : INTEGER

      ; BEGIN
```

```
    IF CURRENT_CHAR = NL
    THEN BEGIN B_M . MOVE_RIGHT ( CURRENT_CHAR ) ; I := 1 END
    ELSE I := 0
  ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
  ; J := I + J
  ; B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; INT := 0
  ; FOR I := 1 TO 4
    DO BEGIN
      INTEGER_STRING [ I ] := CURRENT_CHAR
    ; IF CURRENT_CHAR <> ' '
      THEN INT := INT * 10 + ORD ( CURRENT_CHAR ) - 48
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    END
  ; B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; DEC := 0
  ; FOR I := 1 TO 2
    DO BEGIN
      IF CURRENT_CHAR <> ' '
      THEN DEC := DEC * 10 + ORD ( CURRENT_CHAR ) - 48
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    END
  ; FOR I := 1 TO J - 8 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
  ; B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; IF CURRENT_CHAR = EM
    THEN BEGIN
    ; FOR I := 1 TO J + 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
    ; B_M . ADD ( NL )
    ; C_B_M . COPY_PUSH ( NL )
    ; INT := INT + 1
    ; FOR I := 4 DOWNTO 1
      DO BEGIN
        INTEGER_STRING [ I ] := CHR ( INT MOD 10 + 48 )
      ; INT := INT DIV 10
      END
    ; I := 1
    ; WHILE ( INTEGER_STRING [ I ] = '0' ) AND ( I < 4 )
      DO BEGIN
        B_M . ADD ( ' ' )
      ; C_B_M . COPY_PUSH ( ' ' )
      ; I := I + 1
      END
    ; FOR J := I TO 4
      DO BEGIN
        B_M . ADD ( INTEGER_STRING [ J ] )
      ; C_B_M . COPY_PUSH ( INTEGER_STRING [ J ] )
      END
    ; FOR J := 1 TO 4
      DO BEGIN
        B_M . ADD ( ' ' )
      ; C_B_M . COPY_PUSH ( ' ' )
      END
    END
```

```
      ELSE BEGIN
      ; FOR I := 1 TO J + 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; B_M . ADD ( NL )
      ; C_B_M . COPY_PUSH ( NL )
      ; FOR I := 1 TO 4
        DO BEGIN
          B_M . ADD ( INTEGER_STRING [ I ] )
        ; C_B_M . COPY_PUSH ( INTEGER_STRING [ I ] )
        END
      ; DEC := DEC + 1
      ; B_M . ADD ( '.' )
      ; C_B_M . COPY_PUSH ( '.' )
      ; FOR I := 2 DOWNTO 1
        DO BEGIN
          DECIMAL_STRING [ I ] := CHR ( DEC MOD 10 + 48 )
        ; DEC := DEC DIV 10
        END
      ; FOR I := 1 TO 2
        DO BEGIN
        ; B_M . ADD ( DECIMAL_STRING [ I ] )
        ; C_B_M . COPY_PUSH ( DECIMAL_STRING [ I ] )
        END
      ; B_M . ADD ( ' ' )
      ; C_B_M . COPY_PUSH ( ' ' )
      END
    END

; PROCEDURE OUTPUT_CURRENT_LINE ( VAR CURRENT_CHAR : CHAR )

  ; VAR L , J , I : INTEGER

  ; BEGIN
      IF CURRENT_CHAR = NL
      THEN BEGIN L := 1 ; B_M . MOVE_RIGHT ( CURRENT_CHAR ) END
      ELSE L := 0
    ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
    ; L := L + J - 1
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    ; MOVE_CURSOR ( CURSOR_ROW , 1 )
    ; OUTPUT_REST_OF_LINE ( CURRENT_CHAR , J )
    ; FOR I := J TO 80 DO IO . OUTPUT ( ' ' )
    ; IF SHOW_LINE_NUMBERS
      THEN BEGIN
        CURSOR_COL := L + 1
      ; FOR I := J DOWNTO L + 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
      END
      ELSE BEGIN
        CURSOR_COL := L - 7
      ; FOR I := J + 8 DOWNTO L DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
      END
    ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
    END

; PROCEDURE INSERT_MODE ( VAR CURRENT_CHAR : CHAR )
```

```

      ; VAR C , CC : CHAR
        ; I , J , L , SAVED_COPY_COUNT , COPY_COUNT , NUMBER_OF_SPACES
          : INTEGER
        ; SPREAD , SPLIT : BOOLEAN

      ; BEGIN
          INSERT_PROMPT
        ; IO . INPUT ( C )
        ; IF NOT ( C IN [ ETX , ESC ] )
          THEN BEGIN
            REPEAT C_B_M . COPY_POP ( CC ) UNTIL CC = EM
          ; C_B_M . COPY_PUSH ( EM )
          ; COPY_COUNT := 0
          ; SPLIT := FALSE
          ; SPREAD := TRUE
          ; SPREAD_CURRENT_LINE ( CURRENT_CHAR , NUMBER_OF_SPACES )
          ; IF NUMBER_OF_SPACES < 2
            THEN BEGIN
              SPLIT_CURRENT_LINE ( CURRENT_CHAR )
            ; SPLIT := TRUE
            ; SPREAD := FALSE
            END
          ; REPEAT IF C = CR
              THEN BEGIN
                IF SPREAD
                THEN BEGIN
                  FOR I := CURSOR_COL TO 80 DO IO . OUTPUT ( ' ' )
                ; IF ( CURSOR_ROW = 24 ) OR ( CURSOR_ROW = 23 )
                  THEN BEGIN
                    IO . OUTPUT ( NL )
                  ; IF SHOW_LINE_NUMBERS
                    THEN CURSOR_COL := 9
                    ELSE CURSOR_COL := 1
                  ; CURSOR_ROW := 24
                  ; INSERT_PROMPT
                  ; COPY_COUNT := COPY_COUNT + 9
                  ; INSERT_A_NL_AND_LINE_NO ( CURRENT_CHAR )
                  ; SPREAD_CURRENT_LINE
                      ( CURRENT_CHAR , NUMBER_OF_SPACES )
                  END
                  ELSE BEGIN
                    CURSOR_ROW := CURSOR_ROW + 1
                  ; COPY_COUNT := COPY_COUNT + 9
                  ; INSERT_A_NL_AND_LINE_NO ( CURRENT_CHAR )
                  ; SPREAD := FALSE
                  ; SPLIT := TRUE
                  ; SPLIT_CURRENT_LINE ( CURRENT_CHAR )
                  END
                END
                ELSE IF SPLIT
                  THEN BEGIN
                    IF CURSOR_ROW < 23
                    THEN BEGIN
```

```
          CURSOR_ROW := CURSOR_ROW + 1
        ; COPY_COUNT := COPY_COUNT + 9
        ; INSERT_A_NL_AND_LINE_NO ( CURRENT_CHAR )
        ; OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
        END
        ELSE BEGIN
        ; COPY_COUNT := COPY_COUNT + 9
        ; INSERT_A_NL_AND_LINE_NO ( CURRENT_CHAR )
        ; MOVE_CURSOR ( 24 , 1 )
        ; IF CURRENT_CHAR <> NL
          THEN FOR I := 1 TO 80 DO IO . OUTPUT ( ' ' )
        ; FOR I := 1 TO 19 DO IO . OUTPUT ( NL )
        ; MOVE_CURSOR ( 24 , 9 )
        ; SPREAD_END_OF_LINE ( CURRENT_CHAR )
        ; INSERT_PROMPT
        ; CURSOR_ROW := 5
        ; CURSOR_COL := 1
        ; OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
        END
      END
  END
  ELSE IF C IN SET_OF_VALID_INPUT_CHARACTERS
    THEN BEGIN
      B_M . ADD ( C )
    ; C_B_M . COPY_PUSH ( C )
    ; COPY_COUNT := COPY_COUNT + 1
    ; CURSOR_COL := CURSOR_COL + 1
    ; IO . OUTPUT ( C )
    ; IO . SHIP_OUT
    ; IF SPREAD
      THEN BEGIN
        NUMBER_OF_SPACES := NUMBER_OF_SPACES - 1
      ; IF NUMBER_OF_SPACES < 2
        THEN BEGIN
          IF CURSOR_ROW = 24
          THEN BEGIN
            IO . OUTPUT ( NL )
          ; CURSOR_ROW := CURSOR_ROW - 1
          ; INSERT_PROMPT
          END
        ; SPLIT_CURRENT_LINE ( CURRENT_CHAR )
        ; SPLIT := TRUE
        ; SPREAD := FALSE
        END
      END
    END
; IF ( COPY_COUNT > 0 )
     AND ( ( ( ( CURSOR_COL = 1 )
               OR ( SHOW_LINE_NUMBERS AND ( CURSOR_COL = 9 )
                  )
             )
             AND ( C = BS )
           )
           OR ( C = DEL )
```

```
       )
THEN BEGIN
  L := CURSOR_COL
; B_M . MOVE_RIGHT ( CURRENT_CHAR )
; WHILE ( COPY_COUNT > 0 ) AND ( CURRENT_CHAR <> NL )
  DO BEGIN
    B_M . DELETE ( CURRENT_CHAR )
  ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
  ; COPY_COUNT := COPY_COUNT - 1
  ; C_B_M . COPY_POP ( CC )
  ; CURSOR_COL := CURSOR_COL - 1
  END
; IF ( COPY_COUNT = 0 ) AND ( CURRENT_CHAR <> NL )
  THEN BEGIN
  ; B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; IF SPREAD
    THEN BEGIN
      SPREAD_CURRENT_LINE
        ( CURRENT_CHAR , NUMBER_OF_SPACES )
    ; IF CURRENT_CHAR = NL
      THEN FOR I := CURSOR_COL TO 80
        DO IO . OUTPUT ( ' ' )
    END
    ELSE BEGIN
      MOVE_CURSOR ( CURSOR_ROW , 9 )
    ; FOR I := 9 TO 80 DO IO . OUTPUT ( ' ' )
    ; OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
    END
  END
  ELSE BEGIN
    MOVE_CURSOR ( CURSOR_ROW , 1 )
  ; FOR I := 1 TO L DO IO . OUTPUT ( ' ' )
  ; B_M . DELETE ( CURRENT_CHAR )
  ; COPY_COUNT := COPY_COUNT - 1
  ; C_B_M . COPY_POP ( CC )
  ; IF CURRENT_CHAR = NL
    THEN BEGIN
      I := 1
    ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
    END
    ELSE I := 0
  ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
  ; J := J + I
  ; FOR I := 1 TO J DO B_M . MOVE_LEFT ( CURRENT_CHAR )
  ; CURSOR_COL := J
  ; CURSOR_ROW := CURSOR_ROW - 1
  ; IF CURSOR_ROW = 1
    THEN BEGIN
      CURSOR_ROW := 2
    ; OUTPUT_FRONT_OF_LINE ( CURRENT_CHAR )
    END
    ELSE MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
  END
END
```

```
          ELSE IF ( C = BS ) AND ( COPY_COUNT > 0 )
            THEN BEGIN
              COPY_COUNT := COPY_COUNT - 1
            ; C_B_M . COPY_POP ( CC )
            ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; B_M . DELETE ( CURRENT_CHAR )
            ; IF CURSOR_COL < 81
              THEN BEGIN
                IO . OUTPUT ( BS )
              ; IO . OUTPUT ( ' ' )
              ; IO . OUTPUT ( BS )
              END
              ELSE IO . OUTPUT ( ' ' )
            ; CURSOR_COL := CURSOR_COL - 1
            ; IO . SHIP_OUT
            END
        ; IO . INPUT ( C )
        UNTIL C IN [ ESC , ETX ]
      ; IF C = ESC
        THEN "DELETE COPY_COUNT OF CHAR BACKWORDS." BEGIN
          IF COPY_COUNT > 0
          THEN BEGIN
            FOR I := COPY_COUNT DOWNTO 1
            DO BEGIN
              B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; IF CURRENT_CHAR = NL
              THEN SPLIT := TRUE
            ; B_M . DELETE ( CURRENT_CHAR )
            END
          END
        END
      ; IF SPLIT
        THEN VERIFY ( CURRENT_CHAR )
        ELSE OUTPUT_CURRENT_LINE ( CURRENT_CHAR )
      END
    END

; PROCEDURE DIRECTION ( VAR COMMAND_CHAR , DIRECTION_CHAR : CHAR )

  ; BEGIN
      IF COMMAND_CHAR IN [ '<' , ',' ]
      THEN BEGIN
        DIRECTION_CHAR := '<'
      ; SAVE_CURSOR_POSITION
      ; MOVE_CURSOR ( 1 , 1 )
      ; IO . OUTPUT ( '<' )
      ; UNSAVE_CURSOR_POSITION
      ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
      END
    ; IF COMMAND_CHAR IN [ '>' , '.' ]
      THEN BEGIN
        DIRECTION_CHAR := '>'
      ; SAVE_CURSOR_POSITION
      ; MOVE_CURSOR ( 1 , 1 )
```

```
          ; IO . OUTPUT ( '>' )
          ; UNSAVE_CURSOR_POSITION
          ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
          END
        END

    ; PROCEDURE DELETE_PROMPT ( DIRECTION_CHAR : CHAR )

      ; VAR SROW , SCOL : INTEGER

      ; BEGIN
          SROW := CURSOR_ROW
        ; SCOL := CURSOR_COL
        ; MOVE_CURSOR ( 1 , 1 )
        ; IO . OUTPUT ( DIRECTION_CHAR )
        ; IO . OUTPUT_LINE
            ( 'DELETE: [moving commands], [esc] to abor$' )
        ; IO . OUTPUT_LINE
            ( 't, [ctrl<c>] to exit                    $' )
        ; MOVE_CURSOR ( SROW , SCOL )
        END

    ; PROCEDURE BLANK_RIGHT
        ( VAR CURRENT_CHAR : CHAR
        ; VAR J : INTEGER
        ; VAR BOF : BOOLEAN
        )

      ; VAR I : INTEGER

      ; BEGIN
          IF CURRENT_CHAR = NL
          THEN BEGIN
            RIGHT_ARROW ( CURRENT_CHAR , BOF )
          ; IF NOT BOF
            THEN BEGIN
              J := J + 9
            ; C_B_M . COPY_PUSH ( NL )
            ; IF SHOW_LINE_NUMBERS
              THEN BEGIN
                MOVE_CURSOR ( CURSOR_ROW , 1 )
              ; IO . OUTPUT_LINE ( '        $' )
              ; CURSOR_COL := 9
              END
            ; FOR I := 8 DOWNTO 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; FOR I := 1 TO 8
              DO BEGIN
                C_B_M . COPY_PUSH ( CURRENT_CHAR )
              ; CURRENT_CHAR := ' '
              ; B_M . MOVE_LEFT ( CURRENT_CHAR )
              END
            END
          END
          ELSE BEGIN
```

```
              J := J + 1
            ; C_B_M . COPY_PUSH ( CURRENT_CHAR )
            ; CURRENT_CHAR := ' '
            ; IO . OUTPUT ( ' ' )
            ; RIGHT_ARROW ( CURRENT_CHAR , BOF )
            END
          END

      ; PROCEDURE BLANK_LEFT
          ( VAR CURRENT_CHAR : CHAR
          ; VAR J : INTEGER
          ; VAR TOF : BOOLEAN
          )

        ; VAR I : INTEGER

        ; BEGIN
            IF ( SHOW_LINE_NUMBERS AND ( CURSOR_COL = 9 ) )
               OR ( CURSOR_COL = 1 )
            THEN BEGIN
              LEFT_ARROW ( CURRENT_CHAR , TOF )
            ; IF NOT TOF
              THEN BEGIN
                J := J - 9
              ; IF SHOW_LINE_NUMBERS
                THEN BEGIN
                  SAVE_CURSOR_POSITION
                ; CURSOR_ROW := CURSOR_ROW + 1
                ; MOVE_CURSOR ( CURSOR_ROW , 1 )
                ; IO . OUTPUT_LINE ( '        $' )
                ; UNSAVE_CURSOR_POSITION
                ; MOVE_CURSOR ( CURSOR_ROW , CURSOR_COL )
                END
              ; FOR I := 0 TO 8 DO B_M . MOVE_LEFT ( CURRENT_CHAR )
              ; FOR I := 8 DOWNTO 1
                DO BEGIN
                  B_M . MOVE_RIGHT ( CURRENT_CHAR )
                ; C_B_M . COPY_PUSH ( CURRENT_CHAR )
                ; CURRENT_CHAR := ' '
                END
              ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
              ; C_B_M . COPY_PUSH ( NL )
              END
            END
            ELSE BEGIN
              J := J - 1
            ; LEFT_ARROW ( CURRENT_CHAR , TOF )
            ; C_B_M . COPY_PUSH ( CURRENT_CHAR )
            ; IO . OUTPUT ( ' ' )
            ; IO . OUTPUT ( BS )
            ; IO . SHIP_OUT
            ; CURRENT_CHAR := ' '
            END
          END
```

```
; PROCEDURE RECOVER_LEFT
    ( VAR CURRENT_CHAR : CHAR ; VAR J : INTEGER )

  ; VAR I : INTEGER
    ; NOTUSED : BOOLEAN

  ; BEGIN
      IF ( SHOW_LINE_NUMBERS AND ( CURSOR_COL = 9 ) )
         OR ( CURSOR_COL = 1 )
      THEN BEGIN
        J := J - 9
      ; FOR I := 8 DOWNTO 1
        DO BEGIN
          B_M . MOVE_RIGHT ( CURRENT_CHAR )
        ; C_B_M . COPY_POP ( CURRENT_CHAR )
        ; IF SHOW_LINE_NUMBERS
          THEN BEGIN
            IO . OUTPUT ( BS )
          ; IO . OUTPUT ( CURRENT_CHAR )
          ; IO . OUTPUT ( BS )
          ; IO . SHIP_OUT
          END
        END
      ; LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
      ; C_B_M . COPY_POP ( CURRENT_CHAR )
      END
      ELSE BEGIN
        J := J - 1
      ; LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
      ; C_B_M . COPY_POP ( CURRENT_CHAR )
      ; IF CURSOR_COL <> 80
        THEN BEGIN
          IO . OUTPUT ( CURRENT_CHAR )
        ; IO . OUTPUT ( BS )
        END
        ELSE IO . OUTPUT ( '!' )
      ; IO . SHIP_OUT
      END
    END

; PROCEDURE RECOVER_RIGHT
    ( VAR CURRENT_CHAR : CHAR ; VAR J : INTEGER )

  ; VAR I : INTEGER
    ; NOTUSED : BOOLEAN

  ; BEGIN
      IF CURRENT_CHAR = NL
      THEN BEGIN
        J := J + 9
      ; C_B_M . COPY_POP ( CURRENT_CHAR )
      ; RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
      ; FOR I := 8 DOWNTO 1 DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
```

```
   ; IF SHOW_LINE_NUMBERS
    THEN MOVE_CURSOR ( CURSOR_ROW , 1 )
   ; FOR I := 1 TO 8
    DO BEGIN
     C_B_M . COPY_POP ( CURRENT_CHAR )
    ; IF SHOW_LINE_NUMBERS
     THEN IO . OUTPUT ( CURRENT_CHAR )
    ; B_M . MOVE_LEFT ( CURRENT_CHAR )
    END
   ; CURSOR_COL := 9
   ; IO . SHIP_OUT
   END
   ELSE BEGIN
    J := J + 1
   ; C_B_M . COPY_POP ( CURRENT_CHAR )
   ; IO . OUTPUT ( CURRENT_CHAR )
   ; RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
   END
  END

; PROCEDURE DELETE_MODE_DOWN
  ( VAR CURRENT_CHAR : CHAR
  ; VAR COPY_COUNT , P_TARGET_COL : INTEGER
  )

 ; VAR BOF : BOOLEAN
  ; TARGET_COL : INTEGER

 ; BEGIN
  ; TARGET_COL := P_TARGET_COL
  ; IF COPY_COUNT > - 1
   THEN BEGIN
    BOF := FALSE
   ; WHILE ( CURRENT_CHAR <> NL ) AND NOT BOF
    DO BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
   ; IF NOT BOF
    THEN BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
   ; WHILE NOT BOF
       AND ( CURRENT_CHAR <> NL )
       AND ( CURSOR_COL < TARGET_COL )
    DO BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
   END
   ELSE BEGIN
   ; WHILE ( CURRENT_CHAR <> NL ) AND ( COPY_COUNT <> 0 )
    DO RECOVER_RIGHT ( CURRENT_CHAR , COPY_COUNT )
   ; IF COPY_COUNT = 0
    THEN BEGIN
     WHILE ( CURRENT_CHAR <> NL ) AND NOT BOF
     DO BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
    ; IF NOT BOF
     THEN BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
    ; WHILE NOT BOF
        AND ( CURRENT_CHAR <> NL )
        AND ( CURSOR_COL < TARGET_COL )
```

```
     DO BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
    END
    ELSE BEGIN
     RECOVER_RIGHT ( CURRENT_CHAR , COPY_COUNT )
    ; WHILE ( COPY_COUNT < 0 )
        AND ( CURRENT_CHAR <> NL )
        AND ( CURSOR_COL < TARGET_COL )
     DO RECOVER_RIGHT ( CURRENT_CHAR , COPY_COUNT )
    ; WHILE ( CURRENT_CHAR <> NL )
        AND ( CURSOR_COL < TARGET_COL )
     DO BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , BOF )
    END
   END
  END

; PROCEDURE DELETE_MODE_RETURN
  ( VAR CURRENT_CHAR : CHAR ; VAR COPY_COUNT : INTEGER )

 ; VAR COL : INTEGER

 ; BEGIN
   IF SHOW_LINE_NUMBERS
   THEN BEGIN
    COL := 9
   ; DELETE_MODE_DOWN ( CURRENT_CHAR , COPY_COUNT , COL )
   END
   ELSE BEGIN
    COL := 1
   ; DELETE_MODE_DOWN ( CURRENT_CHAR , COPY_COUNT , COL )
   END
  END

; PROCEDURE DELETE_MODE_UP
  ( VAR CURRENT_CHAR : CHAR ; VAR COPY_COUNT : INTEGER )

 ; VAR TOF : BOOLEAN
  ; TARGET_COL : INTEGER

 ; BEGIN
   TARGET_COL := CURSOR_COL
  ; IF COPY_COUNT < 1
   THEN BEGIN
    TOF := FALSE
   ; WHILE ( CURRENT_CHAR <> NL ) AND NOT TOF
    DO BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
   ; IF NOT TOF
    THEN BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
   ; WHILE NOT TOF AND ( CURSOR_COL > TARGET_COL )
    DO BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
   END
   ELSE BEGIN
    WHILE ( CURRENT_CHAR <> NL ) AND ( COPY_COUNT <> 0 )
    DO RECOVER_LEFT ( CURRENT_CHAR , COPY_COUNT )
   ; IF COPY_COUNT = 0
```

```
                THEN BEGIN
                  WHILE ( CURRENT_CHAR <> NL ) AND NOT TOF
                  DO BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
                ; IF NOT TOF
                  THEN BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
                ; WHILE CURSOR_COL > TARGET_COL
                  DO BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
                END
                ELSE BEGIN
                  RECOVER_LEFT ( CURRENT_CHAR , COPY_COUNT )
                ; WHILE ( COPY_COUNT > 0 )
                        AND ( CURRENT_CHAR <> NL )
                        AND ( CURSOR_COL > TARGET_COL )
                  DO RECOVER_LEFT ( CURRENT_CHAR , COPY_COUNT )
                ; WHILE CURSOR_COL > TARGET_COL
                  DO BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , TOF )
                END
              END
            END

        ; PROCEDURE DELETE_MODE ( VAR CURRENT_CHAR : CHAR )

          ; VAR C , CC : CHAR
            ; NL_FOUND : BOOLEAN
            ; COPY_COUNT , J , I , L , SAVED_COPY_COUNT : INTEGER
            ; NOTUSED : BOOLEAN

          ; BEGIN
              DELETE_PROMPT ( DIRECTION_CHAR )
            ; IO . INPUT ( C )
            ; IF NOT ( C IN [ ESC , ETX ] )
              THEN BEGIN
                REPEAT C_B_M . COPY_POP ( CC ) UNTIL CC = EM
              ; C_B_M . COPY_PUSH ( CC )
              ; COPY_COUNT := 0
              ; REPEAT IF ( C = BS )
                          OR ( ( C = ' ' ) AND ( DIRECTION_CHAR = '<' ) )
                  THEN IF COPY_COUNT < 1
                    THEN BLANK_LEFT ( CURRENT_CHAR , COPY_COUNT , NOTUSED )
                    ELSE RECOVER_LEFT ( CURRENT_CHAR , COPY_COUNT )
                ; IF ( C = FF )
                     OR ( ( C = ' ' ) AND ( DIRECTION_CHAR = '>' ) )
                  THEN IF COPY_COUNT > - 1
                    THEN BLANK_RIGHT ( CURRENT_CHAR , COPY_COUNT , NOTUSED )
                    ELSE RECOVER_RIGHT ( CURRENT_CHAR , COPY_COUNT )
                ; IF C = NL
                  THEN DELETE_MODE_DOWN
                      ( CURRENT_CHAR , COPY_COUNT , CURSOR_COL )
                ; IF C = VT
                  THEN DELETE_MODE_UP ( CURRENT_CHAR , COPY_COUNT )
                ; IF C = CR
                  THEN DELETE_MODE_RETURN ( CURRENT_CHAR , COPY_COUNT )
                ; IF C IN [ 'V' , 'v' ]
                  THEN BEGIN
```

```
      VERIFY ( CURRENT_CHAR )
    ; DELETE_PROMPT ( DIRECTION_CHAR )
    END
  ; IF C IN [ '>' , '<' , '.' , ',' ]
    THEN DIRECTION ( C , DIRECTION_CHAR )
  ; IO . INPUT ( C )
  UNTIL C IN [ ESC , ETX ]
; IF C = ESC
  THEN BEGIN
    SAVED_COPY_COUNT := COPY_COUNT
  ; WHILE COPY_COUNT < 0
    DO RECOVER_RIGHT ( CURRENT_CHAR , COPY_COUNT )
  ; WHILE COPY_COUNT > 0
    DO RECOVER_LEFT ( CURRENT_CHAR , COPY_COUNT )
  ; IF SAVED_COPY_COUNT < 0
    THEN BEGIN
      FOR I := - 1 DOWNTO SAVED_COPY_COUNT
      DO BEGIN
        B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; C_B_M . COPY_PUSH ( CURRENT_CHAR )
      END
    ; FOR I := - 1 DOWNTO SAVED_COPY_COUNT
      DO B_M . MOVE_LEFT ( CURRENT_CHAR )
    END
  ; IF SAVED_COPY_COUNT > 0
    THEN BEGIN
      FOR I := 1 TO SAVED_COPY_COUNT
      DO BEGIN
        C_B_M . COPY_PUSH ( CURRENT_CHAR )
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      END
    ; FOR I := 1 TO SAVED_COPY_COUNT
      DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
    END
  END
; IF C = ETX
  THEN BEGIN
    NL_FOUND := FALSE
  ; IF COPY_COUNT < 0
    THEN FOR I := - 1 DOWNTO COPY_COUNT
      DO BEGIN
        IF CURRENT_CHAR = NL
        THEN NL_FOUND := TRUE
      ; B_M . DELETE ( CURRENT_CHAR )
      END
  ; IF COPY_COUNT > 0
    THEN FOR I := 1 TO COPY_COUNT
      DO BEGIN
        B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; IF CURRENT_CHAR = NL
        THEN NL_FOUND := TRUE
      ; B_M . DELETE ( CURRENT_CHAR )
      END
  ; IF NL_FOUND
```

```
          THEN VERIFY ( CURRENT_CHAR )
          ELSE OUTPUT_CURRENT_LINE ( CURRENT_CHAR )
        END
      END
    ; EDIT_PROMPT ( DIRECTION_CHAR )
    END

; PROCEDURE EXCHANGE_PROMPT

  ; VAR SROW , SCOL : INTEGER

  ; BEGIN
      SROW := CURSOR_ROW
    ; SCOL := CURSOR_COL
    ; MOVE_CURSOR ( 1 , 1 )
    ; IO . OUTPUT_LINE
        ( 'EXCHANGE: to return characters [left arr$' )
    ; IO . OUTPUT_LINE
        ( 'ow], to exit [ctrl<c>], to abort [esc]  $' )
    ; MOVE_CURSOR ( SROW , SCOL )
    END

; PROCEDURE EXCHANGE_MODE ( VAR CURRENT_CHAR : CHAR )

  ; VAR C : CHAR
    ; COPY_COUNT , I : INTEGER
    ; NOTUSED : BOOLEAN

  ; BEGIN
      COPY_COUNT := 0
    ; EXCHANGE_PROMPT
    ; IO . INPUT ( C )
    ; WHILE NOT ( C IN [ ESC , ETX ] )
      DO BEGIN
        IF ( C IN SET_OF_VALID_INPUT_CHARACTERS )
           AND ( CURRENT_CHAR <> NL )
        THEN BEGIN
          C_B_M . COPY_PUSH ( CURRENT_CHAR )
        ; COPY_COUNT := COPY_COUNT + 1
        ; CURRENT_CHAR := C
        ; IO . OUTPUT ( CURRENT_CHAR )
        ; RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
        END
      ; IF ( C = FF ) AND ( CURRENT_CHAR <> NL )
        THEN BEGIN
          C_B_M . COPY_PUSH ( CURRENT_CHAR )
        ; COPY_COUNT := COPY_COUNT + 1
        ; RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
        END
      ; IF C = BS
        THEN BEGIN
          IF ( COPY_COUNT = 0 )
          THEN LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
        ; IF COPY_COUNT > 0
```

```
          THEN BEGIN
            LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
          ; C_B_M . COPY_POP ( CURRENT_CHAR )
          ; COPY_COUNT := COPY_COUNT - 1
          ; IO . OUTPUT ( CURRENT_CHAR )
          ; IO . OUTPUT ( BS )
          ; IO . SHIP_OUT
          END
        END
      ; IO . INPUT ( C )
      END
    ; IF C = ETX
      THEN FOR I := 1 TO COPY_COUNT DO C_B_M . COPY_POP ( C )
    ; IF C = ESC
      THEN BEGIN
        FOR I := 1 TO COPY_COUNT
        DO BEGIN
          LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
        ; C_B_M . COPY_POP ( CURRENT_CHAR )
        ; IO . OUTPUT ( CURRENT_CHAR )
        END
      ; IO . SHIP_OUT
      END
    END

; PROCEDURE QUIT_MODE
    ( VAR DONE : BOOLEAN ; VAR CURRENT_CHAR : CHAR )

  ; VAR I , COUNT : INTEGER

  ; BEGIN
      DONE := TRUE
    ; MOVE_CURSOR ( 24 , 1 )
    ; IO . OUTPUT ( NL )
    ; IO . SHIP_OUT
    ; IO . OUTPUT_LINE ( 'QUITTING$' )
    ; WHILE CURRENT_CHAR <> EM DO B_M . MOVE_RIGHT ( CURRENT_CHAR )
    ; FOR I := 1 TO 10 DO B_M . DELETE ( CURRENT_CHAR )
    ; COUNT := 90
    ; IO . OUTPUT ( '''' )
    ; IO . SHIP_OUT
    ; REPEAT WHILE CURRENT_CHAR <> NL
        DO B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; B_M . MOVE_LEFT ( CURRENT_CHAR )
      ; IF CURRENT_CHAR <> EM
        THEN BEGIN
          FOR I := 1 TO 8 DO B_M . DELETE ( CURRENT_CHAR )
        ; COUNT := COUNT + 1
        ; IF COUNT MOD 10 = 0
          THEN BEGIN
            IO . OUTPUT ( '''' )
          ; IO . SHIP_OUT
          ; IF COUNT MOD 800 = 0
            THEN BEGIN
```

```
                  IO . OUTPUT ( NL )
                ; IO . OUTPUT ( CR )
                ; IO . SHIP_OUT
                END
              END
            END
          UNTIL CURRENT_CHAR = EM
        ; B_M . MOVE_LEFT ( CURRENT_CHAR )
        ; B_M . FILL_LEFT_STACK
        ; IO . OUTPUT ( NL )
        ; IO . OUTPUT ( CR )
        ; IO . SHIP_OUT
        END

    ; PROCEDURE SPACE ( VAR CURRENT_CHAR , DIRECTION_CHAR : CHAR )

      ; VAR NOTUSED : BOOLEAN

      ; BEGIN
          IF DIRECTION_CHAR = '<'
          THEN LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
        ; IF DIRECTION_CHAR = '>'
          THEN RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
        END

    ; PROCEDURE JUMP_PROMPT

      ; VAR SROW , SCOL : INTEGER

      ; BEGIN
          SROW := CURSOR_ROW
        ; SCOL := CURSOR_COL
        ; MOVE_CURSOR ( 1 , 1 )
        ; IO . OUTPUT_LINE
            (
'JUMP: E(nd B(eginning L(ine number,  to exit [space,ctrl<c>,or esc]$'
            )
        ; IO . OUTPUT_LINE ( '            $' )
        ; MOVE_CURSOR ( SROW , SCOL )
        END

    ; PROCEDURE JUMP_MODE ( VAR CURRENT_CHAR : CHAR )

      ; VAR C : CHAR

      ; BEGIN
          JUMP_PROMPT
        ; REPEAT IO . INPUT ( C )
          ; IF C IN [ 'E' , 'e' ]
            THEN BEGIN
              B_M . MOVE_LEFT ( CURRENT_CHAR )
            ; IF CURRENT_CHAR = EM
              THEN B_M . MOVE_RIGHT ( CURRENT_CHAR )
              ELSE BEGIN
```

```
                MOVE_TO_END_OF_TEXT ( CURRENT_CHAR )
              ; VERIFY ( CURRENT_CHAR )
              END
            END
          ; IF C IN [ 'B' , 'b' ]
            THEN BEGIN
              B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
            ; IF CURRENT_CHAR = EM
              THEN BEGIN
                B_M . MOVE_LEFT ( CURRENT_CHAR )
              ; B_M . MOVE_LEFT ( CURRENT_CHAR )
              END
              ELSE BEGIN
                MOVE_TO_BEGINNING_OF_TEXT ( CURRENT_CHAR )
              ; VERIFY ( CURRENT_CHAR )
              END
            END
          UNTIL ( C IN [ ' ' , ESC , ETX , CR , 'E' , 'e' , 'B' , 'b' ]
                )
        END

  ; PROCEDURE FIX_PROMPT

    ; BEGIN
      ; CLEAR_SCREEN
      ; IO . OUTPUT_LINE
          ( 'FIX: Fix mode will let you rid your file of$' )
      ; IO . OUTPUT_LINE ( ' unwanted characters.(:10:)(:13:)$' )
      ; IO . OUTPUT_LINE
          ( '(:10:)Type a  G  or  g  to start the search$' )
      ; IO . OUTPUT_LINE
          ( ' from the current cursor position.(:10:)(:13:)$' )
      ; IO . OUTPUT_LINE
          (
   '(:10:)All nonprinting characters except linefeed and(:10:)(:13:)$'
          )
      ; IO . OUTPUT_LINE
          ( '(:10:)tab characters will be deleteted.(:10:)(:13:)$' )
      ; IO . OUTPUT_LINE
          ( '(:10:)All trailing blanks will be deleted.(:10:)(:13:)$'
          )
      ; IO . OUTPUT_LINE ( '(:10:)Type anything else to continue.$' )
      END

  ; PROCEDURE FIX_MODE ( VAR CURRENT_CHAR : CHAR )

    ; VAR C : CHAR
      ; J , I : INTEGER

    ; BEGIN
        FIX_PROMPT
      ; IO . INPUT ( C )
      ; IF C IN [ 'G' , 'g' ]
```

```
   THEN BEGIN
   ; IO . OUTPUT_LINE ( ' GO.(:10:)(:8:)(:8:)(:8:)WORKING.$' )
   ; REPEAT IF CURRENT_CHAR = NL
     THEN BEGIN
      B_M . MOVE_RIGHT ( CURRENT_CHAR )
     ; MOVE_TO_END_OF_PREVIOUS_LINE ( CURRENT_CHAR , J )
     ; FOR I := 1 TO J DO B_M . MOVE_LEFT ( CURRENT_CHAR )
     ; WHILE ( CURRENT_CHAR = ' ' ) AND ( J > 8 )
      DO BEGIN
       B_M . DELETE ( CURRENT_CHAR )
      ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
      ; J := J - 1
      END
     ; B_M . MOVE_LEFT ( CURRENT_CHAR )
     ; B_M . MOVE_LEFT ( CURRENT_CHAR )
     END
     ELSE IF CURRENT_CHAR
         IN SET_OF_VALID_INPUT_CHARACTERS + [ TAB ]
      THEN B_M . MOVE_LEFT ( CURRENT_CHAR )
      ELSE BEGIN
       B_M . DELETE ( CURRENT_CHAR )
      ; IO . OUTPUT_LINE
        ( '(:10:)(:13:)BAD CHARACTER FOUND!$' )
      END
    UNTIL CURRENT_CHAR = EM
   ; B_M . MOVE_RIGHT ( CURRENT_CHAR )
   ; IO . OUTPUT_LINE ( '(:10:)(:10:)(:13:)DONE$' )
   ; IO . OUTPUT_LINE
     ( '(:10:)(:13:)Type any key to continue.$' )
   ; IO . INPUT ( C )
   END
  END

; PROCEDURE SECOND_EDIT_PROMPT ( DIRECTION_CHAR : CHAR )

 ; VAR SROW , SCOL : INTEGER

 ; BEGIN
   IF SECOND_EDIT_PROMPT_ON
   THEN BEGIN
    EDIT_PROMPT ( DIRECTION_CHAR )
   ; SECOND_EDIT_PROMPT_ON := FALSE
   END
   ELSE BEGIN
    SECOND_EDIT_PROMPT_ON := TRUE
   ; SROW := CURSOR_ROW
   ; SCOL := CURSOR_COL
   ; MOVE_CURSOR ( 1 , 1 )
   ; IO . OUTPUT ( DIRECTION_CHAR )
   ; IO . OUTPUT_LINE
     ( 'SEDIT:   < > [movement commands]         $' )
   ; IO . OUTPUT_LINE
     ( '                                         $' )
   ; MOVE_CURSOR ( SROW , SCOL )
```

```
         END
       END

   ; PROCEDURE EXECUTE_COMMAND
       ( VAR CURRENT_CHAR , COMMAND_CHAR , DIRECTION_CHAR : CHAR
       ; VAR DONE : BOOLEAN
       )

     ; VAR NOTUSED : BOOLEAN
       ; J , N : INTEGER

     ; BEGIN
         CASE COMMAND_CHAR
         OF
           BS : LEFT_ARROW ( CURRENT_CHAR , NOTUSED )
         ; FF : RIGHT_ARROW ( CURRENT_CHAR , NOTUSED )
         ; VT : UP_ARROW ( CURRENT_CHAR , NOTUSED )
         ; NL : DOWN_ARROW ( CURRENT_CHAR , NOTUSED )
         ; CR : RETURN ( CURRENT_CHAR )
         ; 'I' , 'i'
           : BEGIN
             INSERT_MODE ( CURRENT_CHAR )
           ; EDIT_PROMPT ( DIRECTION_CHAR )
           END
         ; 'D' , 'd' : DELETE_MODE ( CURRENT_CHAR )
         ; 'X' , 'x'
           : BEGIN
             EXCHANGE_MODE ( CURRENT_CHAR )
           ; EDIT_PROMPT ( DIRECTION_CHAR )
           END
         ; 'Q' , 'q' : QUIT_MODE ( DONE , CURRENT_CHAR )
         ; 'V' , 'v'
           : BEGIN
             VERIFY ( CURRENT_CHAR )
           ; EDIT_PROMPT ( DIRECTION_CHAR )
           END
         ; 'P' , 'p' : MOVE_PAGE ( CURRENT_CHAR , DIRECTION_CHAR )
         ; '<' , '>' , ',' , '.'
           : DIRECTION ( COMMAND_CHAR , DIRECTION_CHAR )
         ; ' ' : SPACE ( CURRENT_CHAR , DIRECTION_CHAR )
         ; 'J' , 'j'
           : BEGIN
             JUMP_MODE ( CURRENT_CHAR )
           ; EDIT_PROMPT ( DIRECTION_CHAR )
           END
         ; 'F' , 'f'
           : BEGIN
             FIX_MODE ( CURRENT_CHAR )
           ; VERIFY ( CURRENT_CHAR )
           ; EDIT_PROMPT ( DIRECTION_CHAR )
           END
         ; '/' , '?' : SECOND_EDIT_PROMPT ( DIRECTION_CHAR )
         ; '1' : OUTPUT_REST_OF_LINE ( CURRENT_CHAR , J )
         ; '2' : MOVE_TO_END_OF_CURRENT_LINE ( CURRENT_CHAR , J )
```

```
          ; '3' : SPREAD_CURRENT_LINE ( CURRENT_CHAR , J )
          ; '4' : SPLIT_CURRENT_LINE ( CURRENT_CHAR )
          ; '5' : MOVE_TO_END_OF_TEXT ( CURRENT_CHAR )
          ; '6' : OUTPUT_REST_OF_SCREEN ( CURRENT_CHAR , J , N )
          ; '7' : MOVE_RIGHT_1_LINE ( CURRENT_CHAR , J )
          ; '8' : MOVE_LEFT_1_LINE ( CURRENT_CHAR , J )
          ; '9' : OUTPUT_CURRENT_LINE ( CURRENT_CHAR )
          ; ELSE : BEGIN END
          END
        END

    ; PROCEDURE INITIALIZE_WITH_FILE
        ( FILE_LOGICAL_UNIT_NUMBER : INTEGER ; VAR CURRENT_CHAR : CHAR )

      ; VAR NO_OF_PAGES : INTEGER

      ; BEGIN
        ; IO . OUTPUT_LINE ( 'INITIALIZING$' )
        ; B_M . FIND_NO_OF_PAGES
            ( FILE_LOGICAL_UNIT_NUMBER , NO_OF_PAGES )
        ; B_M . INIT_RIGHT_STACK
            ( FILE_LOGICAL_UNIT_NUMBER , NO_OF_PAGES )
        ; CURRENT_CHAR := EM
        ; ADD_LINE_NUMBERS ( CURRENT_CHAR )
        END

    ; PROCEDURE GO

      ; VAR CURRENT_CHAR , COMMAND_CHAR : CHAR
        ; DONE : BOOLEAN

      ; BEGIN
          CLEAR_SCREEN
        ; IO . OUTPUT_LINE ( 'SEDIT VERSION 1(:10:)(:10:)(:13:)$' )
        ; INITIALIZE_WITH_FILE ( 1 , CURRENT_CHAR )
        ; VERIFY ( CURRENT_CHAR )
        ; DIRECTION_CHAR := '>'
        ; EDIT_PROMPT ( DIRECTION_CHAR )
        ; DONE := FALSE
        ; REPEAT
  "ACCEPT_COMMAND"
            IO . INPUT ( COMMAND_CHAR )
          ; EXECUTE_COMMAND
              ( CURRENT_CHAR , COMMAND_CHAR , DIRECTION_CHAR , DONE )
          UNTIL DONE
        END

    ; BEGIN
        INIT IO , B_M ( IO ) , S7 , C_B_M
      ; SHOW_LINE_NUMBERS := TRUE
      ; SECOND_EDIT_PROMPT_ON := FALSE
      ; GO
      END
  .
```

A FULL SCREEN EDITOR IMPLEMENTED IN PASCAL

by

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ABSTRACT

A Full Screen Editor has been built. This editor provides a CRT terminal user an efficient means of editing information displayed on the screen. This editor, in contrast to most editors, provides the user a direct visual image of the contents of a text file, and a means to move, correct, change and manipulate displayed text files. Accordingly, full screen editors are much more efficent and effective then other usual types of editors. The editor was written in PASCAL language which was choosen because of its portability to other machines and operating systems.