EDITING AND SEGMENTING
DISPLAY FILES FOR COLOR GRAPHICS

by

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CHAPTER ONE: Introduction

A. OVERVIEW

This report describes two extensions of a system driver designed for the color graphics computer in the Computer Science Department. One extension allows the user to edit drawings or text as they are being developed. The second extension allows the user to create complex pictures which previously could not be done because of limited buffer space. This is accomplished by segmenting the create buffer and maintaining these segments on disk storage.

B. PAPER ORGANIZATION

This first chapter is an introduction which explains the rationale for the project, gives a short tutorial on what a create buffer is, explains where this project fits into current developments here at Kansas State University, and gives an overview of what was accomplished with its results and an evaluation based on how well the implementation works. The second chapter includes all information necessary for the person who wants to use the editing and/or segmenting portions of the driver developed for the Chromatics color graphics microcomputer. The third chapter provides the internal design to either duplicate the editing and segmenting processes or to modify them to include windows
other than 0. Appendices include the source code for the editing and segmenting sections within the system driver, and other materials that support or expand information found in the text of the paper.

C. AN EXPLANATION OF THE CREATE BUFFER

As shown in Figure 1, the user enters commands through the keyboard and possibly the tablet. The commands are first handled by the system driver originally developed by Dillinger (Dil80) which calls on the Chromatics routines.

The display file and the refresh memory can each receive the picture developed by the user. The display file is developed in the Chromatics CG1999 when the CREATE key has been turned "on." The commands which include all characters, mode codes, control characters, and plot submodes entered into the terminal are placed in the display file (create buffer is the

**Figure 1: Relationship of User, Chromatics, and the Programmed Driver**
THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

THIS IS AS RECEIVED FROM CUSTOMER.
term used by Chromatics). Chromatics uses ANSI ASCII code to represent the input. If the display file is saved, the picture can be recreated by stepping through the command sequence in the create buffer. Figure 2 provides a short example of entries in the create buffer when the user has pressed a sequence of keys to produce the drawing in Figure 3. A translation from ASCII to English is provided to help the user readily understand the input. Appendix A provides the complete ANSI ASCII chart.

<table>
<thead>
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<th>1</th>
<th>mode</th>
<th>roll off</th>
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<tr>
<td>38</td>
<td>p</td>
<td></td>
</tr>
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<td>mode</td>
<td>plot on</td>
</tr>
<tr>
<td>71</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>mode</td>
<td>background on</td>
</tr>
<tr>
<td>77</td>
<td>m</td>
<td></td>
</tr>
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<td>mode</td>
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</tr>
<tr>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>mode</td>
<td>white</td>
</tr>
<tr>
<td>67</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>7</td>
<td></td>
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<tr>
<td>1</td>
<td>mode</td>
<td>background off</td>
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<td>78</td>
<td>n</td>
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<td>1</td>
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<td>67</td>
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</tr>
<tr>
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<td>0</td>
<td></td>
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<td>12</td>
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<td></td>
</tr>
<tr>
<td>42</td>
<td>*</td>
<td>circle</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>x-coordinate</td>
</tr>
<tr>
<td>53</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>44</td>
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</tr>
<tr>
<td>50</td>
<td>2</td>
<td>y-coordinate</td>
</tr>
<tr>
<td>53</td>
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</tr>
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<tr>
<td>67</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>e</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>f</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>EOF</td>
<td>end of file</td>
</tr>
</tbody>
</table>

Column 1 gives the numbers found in the create buffer.

Column 2 gives the translation from ANSI ASCII (refer to Appendix A for further ANSI ASCII).

Column 3 gives added interpretation.

The horizontal lines divide the entries into separate commands. (i.e. by pressing the WHITE key--3 entries were made).

**Figure 2:** Entries in Create Buffer Which Produce the Picture in Figure 3
Figure 3: Picture produced by Commands in Figure 2
The refresh memory has four entries (blink/non-blink, red, blue, and green) for each dot on the screen. The screen is 512 dots by 512 dots (262,144 dots) in size. Because of its speed, the refresh memory is used by the machine to constantly replace the picture on the screen so the viewer does not see any decay of the picture (New79). Obviously the create buffer will take much less space in storage if the user wants to save the picture to be shown later.

If the user has turned CREATE "off," an end-of-file (EOF) marker is placed at the end of the commands in the create buffer. The picture can be continued by APPENDING to it. The extended system driver has simplified this task, the user merely presses the APPEND key. If the user should press the CREATE key again, the pointers are reinitialized and the create buffer starts at the beginning overwriting the previous picture.

D. RATIONALE FOR THIS PROJECT

1. Editing

Often in developing a picture, people have problems with misspelled text, the incorrect positioning of text or geometric figures, or unexpected results due to incorrect commands. With our current machine capabilities, the only options open to the user to correct the mistake are:

1) to start over, which can be extremely disheartening, especially in a detailed picture;
2) to remove the object or characters by blocking the area out by filling it in with background color, which works as long as there is no overlap of objects. However, as the picture is reproduced at a later time, the mistake and the cover up have been entered into the create buffer and are shown. The final "static" picture does not show the mistake but it is not possible to do away with lines or objects which overlap.

It would be extremely valuable to the users to be able to edit their input. Two kinds of editing are needed:

1) the ability to remove any figure(s)/character(s) from the picture. At this time, this particular capability is beyond the scope of this project.

2) the ability to remove the most immediate (last) entered figure/character one at a time as far back as the user wants to go. This is part of what this project does.

The editing capability needs to be easy to use so the novice user can have the capability readily available to him/her. One key needs to be defined for the editing function. By pushing the one key the user can remove the previous character/figure from the screen by drawing over it in the background color and removing the instructions from the create buffer. By pushing the key repeatedly, many character(s)/figure(s) can be removed. If any abnormalities develop in the design (see Figure 4) the user can press the REDRAW key built into the machine. When the REDRAW key is pressed, the screen is reinitialized and the picture which is stored in the create buffer is drawn on the screen. By having removed the character(s)/figure(s) from the create buffer, the picture is what it was before the last item(s) was entered.
Figure 4: Example of Holes Which Develop in Drawings
2. Segmenting

Another problem encountered by users is that the create buffer has limited size. Only 16K ASCII characters can fit at any one time. In making detailed pictures, especially if a BASIC program is already taking up part of the memory space, the memory locations are not available and an "out of memory error" results. As an example, Chromatics supplied several sample pictures with the machine. Most of them are very complex and will not fit into the create buffer if the BASIC interpreter has been entered into memory. Therefore, it is not possible to write a program having the samples shown in sequence. Likewise, if one desires overlays, movement, or stream input from the tablet, the space fills quickly. The solution to this was to have the machine maintain segments of the create buffer on disk space and then read through the segments as needed when producing the picture, thus extending the length of the create buffer to the number of segments which will fit on a disk.

E. THIS PROJECT IN RELATION TO CURRENT DEVELOPMENTS

A driver developed by Dillinger (Dil80) for the Chromatics CG 1999 has made many options available to the user in a much less complex manner. Using Chromatics commands under program control, the interface supresses keys which would put an end to the program while redefining some keys for new commands. The coordinate input for graphics primitives is accepted in any of four modes: 1) from the keyboard as
digit coordinates; 2) from the keyboard as a cursor position; 3) from
the tablet, positioning from the four-button cursor on the tablet; and
4) from the tablet, positioning from the cursor on the screen.

Included within the driver is an interface with a program developed
by Yee (refer to Part3 and Part4 in Appendices G and H) which extends
the primitives available to include: wide vectors, arrows, bubbles,
thickened rectangles, dotted lines, double head arrows, and slanted
rectangles (see Figure 5). This program is a further extension of the
driver to include editing and segmenting of the create buffer.

![Extended Primitives Diagram](image-url)
F. RESULTS AND EVALUATION

This project was chosen because I had taken the graphics course offered by the Computer Science Department at Kansas State University and readily recognized the need for the additions because of personal experience. The project was a learning experience because of several aspects; working with something already developed to make changes or extensions, working with reference manuals with errors and misleading information, and making the extension work in spite of the unforeseen obstacles.

It became quite evident that working with an already developed piece of software was a challenge especially when the editing extension was not planned for when the original driver was developed. The original software was written with concern for the product on the screen whereas the editing extension deals with both the product on the screen and with the manipulation of the display buffer. The tablet input compared to keyboard input is an example because a primitive entered as tablet input puts the primitive symbol in the create buffer twice whereas if entered through the keyboard the symbol is put in the create buffer only once. Had the editor been part of the original plan one edit key might have been enough.

The reference manuals (Chr78a), (Chr78b), (Chr79) had a great deal of information, but they were not written for the beginner. Also, some of the information is wrong or misleading. The Chromatics model owned by Kansas State University would not support the MOD function. The STR$ function placed a blank in front of the number which was being converted to a string. The INPUT statement would not enter the filename in the
segmentor. The machine would lock and could only be restored by
starting over and re-entering the BASIC program thereby losing the
picture.

When the first code was written for the editor, it was naively
short. Not all the "what if's" were taken into consideration, and there
are many. The editing code started out as a small section tacked onto
the bottom of the driver. It is now almost as large as the driver
itself.

By testing the extensions with five novice users, four of whom had
not previously seen the Chromatics machine, the extensions were found to
be fairly robust. Very little trouble was encountered in removing
character input. The editor takes cursor movements into consideration
and compensates for them. The one novice user who had used the
Chromatics in a very limited capacity had learned to draw pictures by
changing the background color and blocking out spaces with the space
bar. Since the editor treated the cursor movements as space finders, it
could back over an entire picture formed as previously mentioned without
finding a primitive or character. This was easily changed by making the
space bar appear to be a character. In many cases when instructions are
input which cannot be counteracted, the editor prints a message to press
REDRAW. When removing figure input, it was not possible to make all
editing successful with overdraws so it was necessary to put in
statements telling the user to press REDRAW. Not all of the situations
could be specified, so the user must be aware of what he/she has done
and press REDRAW if they have changed states or made movements which may
not be recorded in the display file. To be safe, the novice should do a
REDRAW whenever in doubt. It is not possible to back up for editing
purposes past the segment boundaries, so it is extremely important for the user to be correct at those boundaries. When using tablet input, it is necessary to turn the tablet "off" before editing. A message had to be added to tell the user to do so if they forgot. If the user presses the wrong edit key, the changes may not be what is expected but the user can recover easily by pressing REDRAW.

The segmentor works well in the environment of the driver; however, the system will not allow duplicate file names for BUF files. It is very important for the user not to duplicate a previous name when naming their file. Another inconvenience arises because a separate program is needed to DRAW the completed picture on the screen.

G. THE FUTURE

There are several further extensions which would be helpful. The most obvious need is the ability to perform DOS (Disk Operating System) commands from within the driver. This would provide the ability to DRAW the segmented files from within the driver without the need of an extra program or the need to know how many segments there are in a picture. To accomplish this task, it would be necessary to put a "header" at the beginning of each segment indicating whether or not another segment follows it. Also the DOS command would need to be implemented by defining a DOS key and collecting the necessary information to be able to carry out the command, i.e. DOS"DRAW XANADU.

Another extension would be to trap errors such as the error of
naming a file the same name as one already on the disk. Another need is the ability to segment files already on the disk so they can be shown with the BASIC interpreter and program in memory.

One immediate problem is the lack of space. The current driver is on the verge of using all the available memory space. The example of the file in the Appendices I and J with numerous comments will not run because an "out of memory" error will occur. Additional memory could be obtained by stripping out all comments and leaving out all blanks, but that would make the program extremely difficult to read, especially for someone who had not originally developed the program trying to extend or modify it.

H. SUMMARY

This chapter defined the problem and showed the need for editing and segmentation. Since the term "create buffer" is used throughout the paper, a short tutorial was given to explain what it is and to show examples of what is contained in it. One section showed where this project fits into current developments at Kansas State University. Another section provided an explanation and an evaluation of the results. Finally, some suggestions for further extensions which would be helpful to users were given. In the next chapter, the user will be given specific instructions which are necessary to use the previously described extensions.
CHAPTER TWO: Users' Guide

To draw pictures or enter text with the driver, refer to the User's Guide, Chapter 2, "System Driver for Color Graphics Computer" by Dillinger (Dil80). The following sections explain how to use the editor and segmentor.

A. THE EDIT AND TABLET EDIT KEYS

The key CRTOS has been redefined to be an EDIT key and will now do an overdraw of the last entered character/figure if one is using keyboard rather than tablet input. The user merely presses this key (see Figure 6). If the user wants to remove the next previously entered character/figure, the user presses the key again, and so on.

To be able to use this extension, be sure to enter the primitive command each time you enter the coordinates of a primitive because the editor goes backwards through the entries in the create buffer until it finds the entry which designates a primitive. If you have entered numerous circles without re-entering the CIRCLE command, the editor will erase the first circle entered after the CIRCLE command from the screen but will have removed all subsequent circles from the create buffer. If this happens, press REDRAW (see Figure 6) to bring the picture back to what is in the create buffer.

There are several instances when it is not readily possible to
KEYBOARD LAYOUT

Figure 6: Keyboard Layout

- indicates an illuminated key
lower case lettering indicates programmed driver changes
UPPER case lettering indicates CHROMATICS names
overdraw the figure/character on the screen. In these cases a message will appear on the screen telling the user to press REDRAW. If you have changed states (blink, fill, background, etc.) or color, changed from plot to character input, or produced holes in your picture, press REDRAW to get the picture to correspond with the entries in the create buffer.

The key CPUOS has been redefined to be a TABLET EDIT key (see Figure 6). To edit tablet input, turn the tablet "off" by pressing the TABLET/TEXT EDIT key, then press the TABLET EDIT key. If you have been entering concatenated vectors or dots through stream mode, more will be removed from the create buffer than shows on the screen so be sure to REDRAW the picture to correspond with the create buffer. To continue drawing with the tablet, press the TABLET key and continue.

Structured pseudocode of the action taken each time the EDIT/TABLET EDIT keys are pressed are represented in Figure 7. Figures 7A and 7B are expansions of sections in Figure 7.

B. THE SEGMENTING FACILITY

The ability to segment the create buffer will not be needed by most users, and it will require no user input unless the need to use it arises. Shortly before the create buffer runs out of space, a message will appear on the screen asking the user to enter a name for the picture (file). The user need only type in a name by following these
STOP THE CREATE BUFFER ENTRIES
FIND TOP AND BOTTOM OF PICTURE IN CREATE BUFFER

IF BOTTOM = TOP
THEN RETURN TO WAITING FOR INPUT
FI

DETERMINE COLOR STATUS
CHANGE FOREGROUND COLOR TO BACKGROUND COLOR

IF IN PLOT MODE
THEN LOOK THROUGH THE CREATE BUFFER STEPPING
BACKWARDS UNTIL A PRIMITIVE OR THE TOP
IS REACHED (ALONG THE WAY CANCEL OUT
COLOR CHANGES)

IF BOTTOM NOT EQUAL TO TOP
THEN REPRODUCE THE LAST PRIMITIVE
FI
ELSE REPRINT LAST CHARACTER
FI

RETURN COLOR TO ORIGINAL SETTING
PUT BOTTOM OF CREATE BUFFER POINTER BACK TO WHERE
LAST PRIMITIVE OR CHARACTER STARTED
RESTART THE PICTURE AT NEW BOTTOM

Figure 7: PSEUDOCODE FOR EDITING
WHILE TOP NOT EQUAL TO BOTTOM AND BOTTOM NOT EQUAL TO PRIMITIVE

START AT BOTTOM AND PEEK AT EACH LOCATION

IF CONTENTS OF BOTTOM NOT EQUAL TO A PRIMITIVE

THEN

IF CONTENTS EQUAL MODE

THEN PEEK AT BOTTOM + 1

IF CONTENTS = C

THEN POKE NULLS AT BOTTOM, BOTTOM+1, & BOTTOM+2

FI

FI

DECREMENT BOTTOM

FI

ENDWHILE

Figure 7A: EXPANSION OF PSEUDOCODE FOR (LOOKING THROUGH THE CREATE BUFFER STEPPING BACKWARDS UNTIL A PRIMITIVE OR THE TOP IS REACHED -- ALONG THE WAY CANCEL OUT ANY COLOR CHANGE)
WHILE LAST ENTRY WAS A MODE CHANGE
   IGNORE IT AND KEEP GOING BACK
ENDWHILE
IF BOTTOM NOT EQUAL TO TOP
   THEN
      BACKSPACE
      REPRINT CHARACTER
      BACKSPACE
   END
Figure 7B: EXPANSION OF PSEUDOCODE FOR (REPRINT LAST CHARACTER)
rules:

1. Names should begin with an alphabetic character.
2. Length of name must be no greater than 6 characters.
3. Use only alphanumeric characters.
4. If the user chooses a name previously used as a file name on the user's disk, an error will occur and the picture will be lost.

After typing in the name, press RETURN. At that time the driver will take care of saving the first segment for the user and will save the following segments automatically as the create buffer refills. See Figure 8 for the pseudocode for saving the segments.

The REDRAW key has been trapped and takes care of putting the segments in the create buffer in the proper order and redraws each segment in sequence. See Figure 9 for the pseudocode for REDRAWing the segments.

C. DRAWING SEGMENTED PICTURES WHICH ARE STORED ON DISK

The user must know the name of his/her file and how many segments it has. To check the directory:

user: press RESET, press BASIC
machine response: Memory size?
user: press RETURN
machine response: Chromatics DISK BASIC Ver 3.0
Copyright (C) 1978 by Microsoft
1191 Bytes free
ok
user: type DOS*DIR/n (n is disk drive number)
user: press RETURN
machine response: (the disk directory is produced on the screen)
WHEN CREATE FALG IS TURNED "ON" SET FLAG TO INDICATE
THIS IS NOT A SEGMENTED FILE, SET SEGMENT COUNT TO 1
WHEN CREATE FLAG IS TURNED "OFF" BY USER, IF SEGMENT
COUNT IS GREATER THAN 1 THEN GO TO THE STORE SEGMENT SECTION
CHECK FOR MAXIMUM SIZE BEFORE EACH RPIMITIVE/CHARACTER
IS ENTERED INTO THE CREATE BUFFER IF GETTING NEAR THE
END THEN GO TO THE STORE SEGMENT SECTION

PUT EOF AT END OF FILE

IF SEGMENT = 1

THEN

MOVE CURSOR TO TOP OF PAGE
SET CONDITIONS SO IT WILL PRINT CHARACTERS
PRINT "CREATE BUFFER SEGMENTING -- IF YOU WISH
TO CONTINUE, ENTER FILENAME"
STORE SEGMENT WITH FILENAME

ELSE

STORE SEGMENT FILENAME(SEGMENT#)

ELSE

INCREMENT SEGMENT #
START AT TOP OF CREATE BUFFER AND GO ON

Figure 8: PSEUDOCODE FOR SEGMENTING OF DISPLAY FILE
IF FILE HAS NOT BEEN SEGMENTED
   THEN
       REDRAW
   ELSE
       STORE CURRENT SEGMENT UNDER FILENAME(SEG #)
       LOAD FIRST SEGMENT OF FILENAME
       REDRAW FIRST SEGMENT
       SET COUNTER WHICH WILL ACT AS SEGMENT NUMBER
       WHILE FILENAME(COUNT) IS FOUND
           LOAD FILENAME(COUNT)
           REDRAW FILENAME(COUNT)
           INCREMENT COUNT
       ENDMETHOD
FIN
RETURN TO WAIT FOR NEW INPUT

Figure 9: PSEUDOCODE FOR REDRAWING SEGMENTS
You will see your filename and if it has been segmented it will also contain file(s) with number(s) preceding your filename.

Example: XANADU .BUF
        2XANADU .BUF
        3XANADU .BUF

You must also have SEGDRAW.BAS included in your directory. If it is not in the directory see Appendix B for code.

Assuming you are still in BASIC, the following interaction results in your picture being drawn on the screen.

user: type DOS\LOAD SEGDRAW
user: press RETURN
machine response: ok
user: type RUN; press RETURN
machine response: WHAT IS YOUR FILENAME?
user: type filename, press RETURN
machine response: HOW MANY SEGMENTS?
user: type number of segments; press RETURN
machine response: (your picture will be drawn on the screen)

D. SUMMARY

This chapter was designed as a users' guide. It explained how to use the editor and segmentor extensions. Pseudocode describing the editor and segmentor was provided to show the flow of logic in producing these extensions. The last section which told how to draw segmented pictures was needed because the stored pictures cannot be drawn from within the driver. The next chapter will give a more detailed explanation of how the editor and segmentor were added. It was written for the person who might want to duplicate or modify the extensions.
CHAPTER THREE: Implementation

A. INTRODUCTION

To be able to implement this project, a number of questions were addressed, several methods of reading input and output were learned, and Chromatics, Inc. (Chr80) was consulted for further documentation of the system. In the first section of this chapter, several questions and the information received from Chromatics are explored. Sections B and C describe the actual implementation.

1. Create Buffer Location and Size

One of the main purposes for developing the original driver was to make the Chromatics CG 1999 as easy for the novice user to operate as possible so the default command of carriage return is used when the machine asks for "memory size." In the default case, the maximum amount of space for the BASIC program is from &H43C0 to &H7FFF or 16K. This means that the create buffer will always begin at &H8000. Whether it starts at &H8000 or not, the create buffer will always end at &H7FFF, see Figure 10. In the editing extension the address of the top of the create buffer is read in case a user changed the memory size. Since the end of the create buffer will always be at the same place whether or not the starting point changes, a fixed address is used to determine how full the create buffer was getting.
Figure 10: Diagram of Memory Organization
2. **Reading the Create Buffer**

Being able to read what is in the create buffer is very important to the person trying to edit the create buffer. To be able to remove anything, it is first necessary to determine what is there. This kind of information is not readily available in the reference manuals. Also as the editor is being debugged, it is necessary to be able to see what you have changed or removed.

To read what is in the create buffer it is necessary to find out where it starts and where it ends. The starting location for window 0 is at 3B46 and 3B47 (see Figure 11). When PEEKing at those locations the operator finds an integer in each position. To translate these numbers into an address, multiply the contents of 3B47 by 256 then add the contents of 3B46. Likewise, to find the ending location of that picture for window 0 in the create buffer, one PEEKs at locations 3B44 and 3B45.

After finding the beginning and end of the picture, the operator can write a program which will PEEK at each location in the create buffer, translate it from ASCII code to English, then print out each of those entries. Appendix C is a program entitled "LISTER" written especially to do this process. As seen before, Figures 2 and 3 show an example of a picture and its list of what was in the create buffer.

3. **Reading the Color Byte**

One must be able to determine what colors are being used so the "overdraw" of the character/figure can be done in the background color. This will save time in drawing as long as holes do not develop in the
Figure 11: Diagram of locations of color byte and pointers to create buffer.
picture. After the "overdraw" has been done, the color setting will automatically be restored to what it was before the editing was done. If color changes were made during the last entry which was removed, the color either needs to be set to what the user wants to go on with or the REDRAW key pressed. Otherwise, the picture will continue on the screen in the color set from the color which has been removed but the picture in the create buffer will be the color preceding the color which was removed.

The color information for window 0 is contained at location 380D (refer to Figure 11). If the operator reads the contents of 380D by using the PEEK instruction, the resultant value when printed out is 0 through 255 in decimal integers. Appendix D gives the numbers with their corresponding meanings. This integer is a translation of the binary representation of "on" and "off" bits into decimal integers. The 8 bits each have the meaning shown in Figure 12.

![Color Byte Diagram](image)

<table>
<thead>
<tr>
<th>BLINK</th>
<th>RED</th>
<th>GREEN</th>
<th>BLUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREGROUND</td>
<td>BACKGROUND</td>
<td>FOREGROUND</td>
<td>BACKGROUND</td>
</tr>
<tr>
<td>1</td>
<td>∅</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

∅ denotes "off"  
1 denotes "on"  
In this example: foreground--blinking red  
background--red*green*blue=white

Figure 12: Diagram of Color Byte and What Each Bit Represents
Therefore, an example of 00100110 means no blink, red & blue=magenta foreground, and green background. The binary representation 00100110 translates to 38 in decimal.

In programming the editing function, it is necessary to take the number received from the PEEK operation and AND it with &H55. The results possible are shown in Figure 13 along with the color those numbers represent.

<table>
<thead>
<tr>
<th>Value of Color Byte AND &amp;H55</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>BLACK</td>
</tr>
<tr>
<td>1</td>
<td>BLUE</td>
</tr>
<tr>
<td>4</td>
<td>GREEN</td>
</tr>
<tr>
<td>5</td>
<td>CYAN</td>
</tr>
<tr>
<td>16</td>
<td>RED</td>
</tr>
<tr>
<td>17</td>
<td>MAGENTA</td>
</tr>
<tr>
<td>20</td>
<td>YELLOW</td>
</tr>
<tr>
<td>21</td>
<td>WHITE</td>
</tr>
</tbody>
</table>

**Figure 13:** Diagram of Color Byte AND &H55 Results and What They Represent

4. Determining the Machine State

When editing the create buffer, one must know whether the item being removed is a character in text or a geometric primitive. In the case of character removal the last character is removed. The only additional checking needed is to make sure the last item is a character and not part of a mode change or cursor movement. When removing geometric primitives, the create buffer must be looked through stepping backwards until the primitive is found.

The machine state information for window 0 is found at location 3B52 (refer to Figure 11, page 27). The operator reads the contents of that location using the PEEK operation. The machine states available at this location include blink/non-blink, fill/non-fill, roll/non-roll,
foreground/background, and character/plot. In editing, one must know whether the machine is in character or plot mode. By ANDing the value at 3B52 with &H4, a boolean is developed which is "true" if in plot mode and "false" if in character mode.

As a picture is being edited, it is possible to back over plot/character mode changes. MODE G in the create buffer turns plot "on" and ASCII 21 is a "mode cancel" which turns plot "off."

B. EDITING THE CREATE BUFFER

1. Changes to the Original Driver

In the driver developed by Dillinger (Dl80), an array is set up in Part1 (see Appendix E) to disable all the interrupts caused from pressing the special function keys on the upper three rows of the keyboard. A "bell" is entered for each key, then those keys which are used in the driver are re-enabled or changed. The numbers in the array corresponding to the special function keys are shown in Figure 14.

The CRTOS and CPUOS keys were not being used so they were selected to be the EDIT and TABLET EDIT keys. It was necessary to differentiate between regular editing and editing tablet input because the driver printed the primitive twice when using tablet input. Also it was not possible to use the tablet flag as a determining factor in editing each kind of input because the tablet had to be turned "off" to edit the picture.

Appendix I shows a copy of the "extended" Part2 with those
<table>
<thead>
<tr>
<th>Key</th>
<th>131</th>
<th>132</th>
<th>133</th>
<th>134</th>
<th>176</th>
<th>177</th>
<th>178</th>
<th>179</th>
<th>180</th>
<th>181</th>
<th>182</th>
<th>183</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROL</td>
<td>BLINK</td>
<td>LACK</td>
<td>FILL</td>
<td>BLACK</td>
<td>BLUE</td>
<td>GREEN</td>
<td>CYAN</td>
<td>RED</td>
<td>MAGENTA</td>
<td>YELLOW</td>
<td>WHITE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 14:** Diagram of Special Function Keys with Corresponding Chromatics Input Number
additions and changes shaded which are necessary to do editing. Code line 580 was added to take care of the problem which arises when the edit keys are pressed without having turned off the tablet. Code lines 590 and 600 were added to re-enable the CRTOS key as the EDIT key and the CPUOS key as the TABLET EDIT key.

In the "handle primitives" section of Part2, lines of code were added to print the primitives. For example, the code IF EF AND P=155 THEN PRINT CHR$(43); was added to print the rectangle if the edit flag is true and the last primitive found was a rectangle. In the original driver, the primitive handler returned to the point of waiting for the next keyboard interrupt. Line 1110 IF EF THEN RETURN returns control to the place from which it was called in the "last primitive found" section of the editor.

Changes were made to the "sub:coord" section, lines 1380 through 1430. This subroutine collects coordinates and stores them in arrays to be used in printing the primitive. If the edit flag is "true" then the collection is re-routed to the editor.

2. Variables and Flags Used

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNT</td>
<td>used in conjunction with BTM to keep track of which location in the create buffer is being examined</td>
</tr>
<tr>
<td>EF</td>
<td>&quot;0&quot; false boolean used as a flag to denote that the editor as been entered and then exited</td>
</tr>
<tr>
<td>BTM</td>
<td>address of the bottom (end) of the create buffer for window 0 computed from values in &amp;H3B44 and &amp;H3B45</td>
</tr>
</tbody>
</table>
TP address of the top (beginning) of the create buffer for window 0 computed from values in &H3B46 and &H3B47

B1 value representing the background color (refer to Figure 13)

T1 "0" false flag denoting that TABLET EDIT key has been pressed and first time being sent to editor
"-1" true

T2 "0" false flag denoting that TABLET EDIT key has removed first occurrence of primitive and this is the second time through the editor
"-1" true

L0 contents of location &H3B52 which contains state information for window 0

M ASCII representation found at specified

N locations in the create buffer

NN

J incremental counter

A, Z addresses used in the subroutine which replaces mode changes with nulls

P temporary variable which holds the value which represents keyboard input for each primitive

A variables used in calculating and holding

X% values which represent the address

Y% to be placed in the bottom pointer

NBTM address of new bottom of create buffer after last character/primitive is removed

C, D variables used to hold values found in &H3B44 and &H3B45

COL contents of &H380D which contains color information

3. Explanation of Code Sections in the Editor

In initializing the "editor," lines 1910 through 1940, values of CNT and EF are set. An end-of-file mark is put at the end of the create
buffer. The top and bottom of the buffer are determined.

Next the "editor" branches to the subroutine which saves the contents of the color byte and determines the background color and returns to the editor. The foreground color is set to the background color. The state of the machine is checked to see if it is in character or plot mode.

The "character editor" section checks the create buffer for the last character entered. It is necessary to check the last four entries each time to see if it might be part of a mode change or cursor movement. The ASCII representations (refer to Appendix A) 1 through 32 either have individual meanings or are not used. Except for 0 and 1 which are null and mode respectively, each entry is specific. Those instructions which can be counteracted by another instruction are counteracted. Those which have no corresponding opposite effect are singled out and a message is sent to the users to let them know they need to press REDRAW so the picture on the screen will correspond to what is the create buffer. In the case of 21 which is "mode change," the "character editor" switches control to the "primitive editor." The last two entries are looked at because most mode changes are made up of two entries, i.e. 1,77=ModeM=background on. The last three entries are taken into consideration because color changes require three entries, i.e. 1,67,49=ModeC2=blue. The last four entries must be inspected because changes in letter size require four entries, i.e. 1,88,51,44=ModeX3,=make the width of the letter three times the usual width.

The "primitive editor" section checks back through the create buffer looking for a primitive. If the combination 1, 77=ModeG=plot on
is encountered control is given to the "character editor" section. Mode and color changes are replaced by nulls (0). When a primitive is encountered, ASCII 33 through 43, see Figure 15, the control is given to the "primitive handler" of the "main driver" which draws the primitive in the background color.

<table>
<thead>
<tr>
<th>PRIMITIVE</th>
<th>CODE</th>
<th>ASCII CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>X - BAR</td>
<td>!</td>
<td>33</td>
</tr>
<tr>
<td>Y - BAR</td>
<td>&quot;</td>
<td>34</td>
</tr>
<tr>
<td>DOT</td>
<td>%</td>
<td>37</td>
</tr>
<tr>
<td>VECTOR</td>
<td>'</td>
<td>39</td>
</tr>
<tr>
<td>CONCATENATED VECTOR</td>
<td>(</td>
<td>40</td>
</tr>
<tr>
<td>CIRCLE</td>
<td>*</td>
<td>42</td>
</tr>
<tr>
<td>RECTANGLE</td>
<td>+</td>
<td>43</td>
</tr>
</tbody>
</table>

**Figure 15: BUILT-IN PRIMITIVES RECOGNIZED BY THE EDITOR**

After the last character or primitive has been overwritten, the pointers are changed so that the last entry is no longer part of the create buffer, the beginning color is reinstated, the edit flag is turned "off," APPEND is instated so the user can continue and the "main driver" resumes waiting for keyboard input.

Several subroutines are used by the editor. One collects the coordinates of the last primitive. One subroutine put nulls in the create buffer to replace mode changes. Another subroutine prints out a message to the user in a color different from the background color to "press REDRAW."
C. SEGMENTING THE CREATE BUFFER

1. Changes in the Original Driver

Part2 of the original driver by Dillinger(Dil80) (see Appendix F) does not consider the size of the create buffer. Refer to Appendix J for a copy of the extended Part2 with changes and additions pertaining to the segmenting process shaded.

Code line 470, SIZE=PEEK(&H3B45), checks to see where the bottom of the create buffer is located. In line 480, IF SIZE>254 THEN GOTO 2640, the address of the bottom of the create buffer entries is compared to an address near the bottom of the allowable space. If the entries in the create buffer have reached that address, the "main driver" sends control to the "segmentor."

Code line 440, IF SF THEN GOTO 2740 ELSE GOTO 450, was added to route keyboard input to the "segmentor" if the segmentor is in the process of naming the user's file, SF is the segment flag. Code line 760, IF K=215 AND SC=1 THEN PRINT CHR$(30);"M""C0""C2""2""Q7""J""H""L""E"; "W00000511511";CHR$(28);CHR$(15);CHR$(12);"P""X1""Y1""G""L"; CHR$(27);"W"; ELSE IF K=215 AND SC>1 THEN GOSUB 2970 takes care of initializing the screen to the beginning (default) conditions (see Figure 16) so the picture drawn will correspond to the one drawn by the user if the segment being redrawn is an unsegmented picture. If the picture is segmented, control is routed to the "redraw segmented files" section found in the "segmentor."

In the "handle status" section of the "main driver" changes were made to the results of pressing the CREATE key. If a new picture is being started, CREATE is pushed. At that time it is necessary to
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Screen Condition</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLORS</td>
<td>BACKGROUND BLACK; FOREGROUND GREEN</td>
<td>Mode M Mode C0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode N Mode C2</td>
</tr>
<tr>
<td>CURSOR</td>
<td>WHITE; VISBILE; IN HOME POSITION</td>
<td>Mode Q7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode J</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHR$(28)</td>
</tr>
<tr>
<td>CHARACTER MODE</td>
<td>HORIZONTAL; CHARACTER SIZE 1x1</td>
<td>Mode H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode X1, Mode Y1</td>
</tr>
<tr>
<td>A7</td>
<td>OFF</td>
<td>Control 0</td>
</tr>
<tr>
<td>BLINK</td>
<td>OFF</td>
<td>Mode 2</td>
</tr>
<tr>
<td>ROLL</td>
<td>OFF</td>
<td>Mode P</td>
</tr>
<tr>
<td>FILL</td>
<td>OFF</td>
<td>Mode L</td>
</tr>
<tr>
<td>BACKGROUND</td>
<td>OFF</td>
<td>Mode N</td>
</tr>
<tr>
<td>OVERSTRIKE</td>
<td>OFF</td>
<td>Mode L</td>
</tr>
<tr>
<td>COORDINATE INPUT</td>
<td>DECIMAL</td>
<td>Mode E</td>
</tr>
<tr>
<td>WINDOW SIZE</td>
<td>FULL SCREEN; CLEARED</td>
<td>Mode W 000 000 511 511</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHR$(12)</td>
</tr>
</tbody>
</table>

Figure 16: Default Conditions of the Screen
initialize the segment counter and the first file flag. If the picture is segmented and CREATE is pressed, the picture is being ended and it is necessary to route the processing to the segmentor to store that segment. Code lines 1140 and 1150 handle these operations. If a segmented file is APPENDED after CREATE is turned off it is necessary to remove the copy of the current segment from the disk, otherwise an error would result when an effort was made to put the appended segment on the disk.

2. Variables and Flags Used

SF  "0" false  segment flag denotes the segmentor
     "-1" true  has been entered and exited

SC  segment counter keeps track of how many segments
     in a picture; initialized to one (1) when a picture is started

LO  contents of location 3B52 which contains
     state information for window 0

K   keyboard input

SN$  filename entered by the user

S$  file number which is concatenated to the
     front of filename for second and subsequent files

C,D contents of addresses &H3B46 and &H3B47
        used to calculate the address of top of buffer

TP  the address of the top (beginning) of the
     create buffer calculated from C and D above

RD  "0" false  redraw flag denotes that
     "-1" true the segment, other than
     the first segment, has been stored already
3. Explanation of Code Sections in the Segmentor

Upon entering the segmentor, an "end of file" marker is put at the end of the file in the create buffer and a flag (SF) is set to denote entry. Next a check is made to see if the current segment is the first segment. If it is the first segment, the next action is to set conditions so a message is printed at the top of the screen informing the user that the create buffer is segmenting and she/he has to enter a filename to continue. The "segmentor" branches back to the "main driver" to receive keyboard input to collect the filename. After the message about segmenting is printed, it was necessary to put in a short FOR loop during which nothing is done. It merely takes up time so the user has a chance to realize something is happening. Otherwise, the user may end up with garbage as the filename.

The "collects filename" section of the "segmentor" is branched to from the "main driver" if the segmentor flag is true. The section accumulates letters for a filename until the carriage return is pressed. The section of code also takes into consideration backspaces so that if a typing error occurs, a change can be made. The LEN and LEFT$ functions were used to take letters off the filename if a backspace occurred.

After collecting the filename, the first file segment is put on the disk and the segment counter is incremented. If the file being saved is not the first segment, it is necessary to concatenate the segment number to the front of the filename. It was necessary to convert the segment number into a character string by using the STR$ function. Since the STR$ function puts a blank character in front of the number and since blanks cannot be part of a filename, it was necessary to perform the
MID$ function on the character string to remove the blank. If a portion of this particular segment has already been saved on the disk, it is necessary to KILL the segment before saving the updated file with the same name. The redraw flag is turned "off" to indicate that the segment is finished. The machine state is then determined, the segment is saved on the disk, and the segment number is incremented.

If the segment being saved is the first segment, it is necessary to reset initial machine conditions (refer to Figure 15) and to redraw the first segment to remove the message printed at the top of the screen.

To start a new segment, it is necessary to determine where the top of the file starts and then put that address in the location which stores the pointer to the bottom of the file. The picture is then appended to and the appended section starts at the top of the create buffer.

A need which was very apparent when dealing with segmented files was the need to change REDRAW. If the file has more than one segment and the user presses REDRAW, it is necessary to store the current segment. A flag is set to indicate that this file was stored, but since it is not finished, it will be necessary to store it again. The flag is necessary because the machine will not store a second BUF file with the same name. As mentioned previously the STR$ and MID$ functions are used to name the file. The first and subsequent segments are drawn by going through all the segments one at a time until the current segment has been redrawn.

After any redrawing of segmented files or storing of segmented files, the segment flag is turned "off," the states are reinstated, and control is resumed by the "main driver."
D. SUMMARY

This chapter was written for the person who is interested in duplicating or modifying the editing or segmenting extensions. In the introduction section, several ideas were addressed which must be understood before the extensions can be fully comprehended. The sections dealing directly with each extension first explained what changes had to be made to the "original driver." Then the variables and flags used in the extensions were listed and explained. Lastly, the code of the extensions was explained.
APPENDICES
APPENDIX A
ANSI ASCII CHART

<table>
<thead>
<tr>
<th>null 0</th>
<th>space 32</th>
<th>@ 48</th>
<th>a 64</th>
<th>P 80</th>
<th>` 96</th>
<th>p 112</th>
</tr>
</thead>
<tbody>
<tr>
<td>mode 1</td>
<td>! 33</td>
<td>1 49</td>
<td>A 65</td>
<td>Q 81</td>
<td>a 97</td>
<td>q 113</td>
</tr>
<tr>
<td></td>
<td>&quot; 34</td>
<td>2 50</td>
<td>B 66</td>
<td>R 82</td>
<td>b 98</td>
<td>r 114</td>
</tr>
<tr>
<td></td>
<td># 35</td>
<td>3 51</td>
<td>C 67</td>
<td>S 83</td>
<td>c 99</td>
<td>s 115</td>
</tr>
<tr>
<td></td>
<td>$ 36</td>
<td>4 52</td>
<td>D 68</td>
<td>T 84</td>
<td>d 100</td>
<td>t 116</td>
</tr>
<tr>
<td>one dot up 5</td>
<td>% 37</td>
<td>5 53</td>
<td>E 69</td>
<td>U 85</td>
<td>e 101</td>
<td>u 117</td>
</tr>
<tr>
<td>mode cancel 21</td>
<td>&amp; 38</td>
<td>6 54</td>
<td>F 70</td>
<td>V 86</td>
<td>f 102</td>
<td>v 118</td>
</tr>
<tr>
<td>delete character 6</td>
<td>( 39</td>
<td>7 55</td>
<td>G 71</td>
<td>W 87</td>
<td>g 103</td>
<td>w 119</td>
</tr>
<tr>
<td>one dot down 22</td>
<td>) 40</td>
<td>8 56</td>
<td>H 72</td>
<td>X 88</td>
<td>h 104</td>
<td>x 120</td>
</tr>
<tr>
<td>insert character 23</td>
<td>41</td>
<td>9 57</td>
<td>I 73</td>
<td>Y 99</td>
<td>i 105</td>
<td>y 121</td>
</tr>
<tr>
<td>back space 8</td>
<td>\ 42</td>
<td>58</td>
<td>J 74</td>
<td>Z 90</td>
<td>j 106</td>
<td>z 122</td>
</tr>
<tr>
<td>end of record for subbuffer 24</td>
<td>27</td>
<td>; 58</td>
<td>K 75</td>
<td></td>
<td>\ 123</td>
<td></td>
</tr>
<tr>
<td>tab 9</td>
<td>&lt; 43</td>
<td>58</td>
<td>L 76</td>
<td></td>
<td>&lt; 124</td>
<td></td>
</tr>
<tr>
<td>line feed 10</td>
<td>* 42</td>
<td>: 58</td>
<td>M 77</td>
<td></td>
<td>* 125</td>
<td></td>
</tr>
<tr>
<td>VT 11</td>
<td>ESC 27</td>
<td>+ 43</td>
<td></td>
<td></td>
<td>+ 126</td>
<td></td>
</tr>
<tr>
<td>erase page 12</td>
<td>home 28</td>
<td>- 44</td>
<td>\ 60</td>
<td>\ 92</td>
<td>\ 124</td>
<td></td>
</tr>
<tr>
<td>carriage return 13</td>
<td>cursor right 29</td>
<td>- 45</td>
<td>\ 61</td>
<td>\ 93</td>
<td>\ 125</td>
<td></td>
</tr>
<tr>
<td>A 7 on 14</td>
<td>EOF 30</td>
<td>- 46</td>
<td>\ 62</td>
<td>\ 94</td>
<td>\ 110</td>
<td>~ 126</td>
</tr>
<tr>
<td>A 7 off 15</td>
<td>one dot right 31</td>
<td>/ 47</td>
<td>? 63</td>
<td>o 79</td>
<td>- 95</td>
<td>o 111</td>
</tr>
</tbody>
</table>

Note: This chart shows codes in regular character set with A7 off. Entries with indicate unused ANSI ASCII codes.
APPENDIX B

"SEGDRAW" Program

100 INPUT "WHAT IS YOUR FILENAME"; F$
110 INPUT "HOW MANY SEGMENTS"; N
120 A$=F$
130 PRINT CHR$(12);
140 DOS"DRAW "+A$+".BUF
150 PRINT CHR$(27);"W";
160 FOR I=2 TO N
170 B$=MID$(STR$(I),2)
180 DOS"DRAW "+B$+A$+".BUF
190 PRINT CHR$(27);"W";
200 NEXT
APPENDIX C

"LISTER" Program

100 A=PEEK(&H3B47)
110 B=PEEK(&H3B46)
120 C=(A*256)+B
130 D=PEEK(&H3B45)
140 E=PEEK(&H3B44)
150 F=(D*256)+E
160 FOR X=C TO F
170 L=PEEK(X)
180 IF L=0 THEN PRINT "NULL"
190 IF L=1 THEN PRINT "MODE"
200 IF L=5 THEN PRINT "ONE DOT UP"
210 IF L=6 THEN PRINT "DELETE CHAR"
220 IF L=7 THEN PRINT "BELL"
230 IF L=8 THEN PRINT "BS"
240 IF L=9 THEN PRINT "TAB"
250 IF L=10 THEN PRINT "LF"
260 IF L=11 THEN PRINT "VT"
270 IF L=12 THEN PRINT "ERASE PAGE"
280 IF L=13 THEN PRINT "CR"
290 IF L=14 THEN PRINT "A7 ON"
300 IF L=15 THEN PRINT "A7 OFF"
310 IF L=21 THEN PRINT "MODE CANCEL"
320 IF L=22 THEN PRINT "ONE DOT DOWN"
330 IF L=23 THEN PRINT "INSERT CHAR"
340 IF L=25 THEN PRINT "ONE DOT LEFT"
350 IF L=27 THEN PRINT "ESC"
360 IF L=28 THEN PRINT "HOME"
370 IF L=29 THEN PRINT "CURSOR RIGHT"
380 IF L=30 THEN PRINT "EOF"
390 IF L=31 THEN PRINT "ONE DOT RIGHT"
400 IF L=32 THEN PRINT "SPACE"
410 IF L=33 THEN PRINT "X-BAR"
420 IF L=34 THEN PRINT "Y-BAR"
430 IF L=37 THEN PRINT "DOT"
440 IF L=39 THEN PRINT "VECTOR"
450 IF L=40 THEN PRINT "CONC VECTOR"
460 IF L=42 THEN PRINT "CIRCLE"
470 IF L=43 THEN PRINT "RECTANGLE"
480 IF L>43 THEN PRINT CHR$(L)
490 NEXT
500 RESUME
## APPENDIX D

### Color Byte Chart

#### BACKGROUND COLORS

<table>
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<tr>
<th></th>
<th>BLACK</th>
<th>BLUE</th>
<th>GREEN</th>
<th>CYAN</th>
<th>RED</th>
<th>MAGENTA</th>
<th>YELLOW</th>
<th>WHITE</th>
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<td>102</td>
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</table>

#### FOREGROUND COLORS

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<th>B</th>
<th>C</th>
<th>D</th>
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<tr>
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<td>213</td>
<td>107</td>
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<tr>
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<tr>
<td>WHITE</td>
<td>98</td>
<td>105</td>
<td>213</td>
<td>107</td>
</tr>
</tbody>
</table>

A = NON BLINK
B = BLINK FOREGROUND AND NON BLINK BACKGROUND
C = BLINK FOREGROUND AND BLINK BACKGROUND
D = NON BLINK FOREGROUND AND BLINK BACKGROUND
APPENDIX E

PART I - ORIGINAL DRIVER

10 MODEOFF
20 PRINT CHR$(27);"[aF";CHR$(27);"ID9";
30 PRINT CHR$(12);"-P-G";
40 CLEAR 2000
50 DIM P$(127),C(15),X(60),Y(60)
55 AH$="VAR";DC$="XD"
60 FOR I=0 TO 127
70 P$(I)=CHR$(7)
80 NEXT
90 FOR I=0 TO 24
100 READ J,P1$
110 P$(J-128)=P1$
120 NEXT
130 'DATA
140 DATA 176,""C0"
150 DATA 177,""C1"
160 DATA 178,""C2"
170 DATA 179,""C3"
180 DATA 180,""C4"
190 DATA 181,""C5"
200 DATA 182,""C6"
210 DATA 173,""C7"
220 DATA 149,""x"
230 DATA 145,""!"
240 DATA 151,""m"
250 DATA 155,""+"
260 DATA 154,""#"
270 DATA 146,""("
280 DATA 245,""U"
290 DATA 247,""W"
300 DATA 250,""Z"
310 DATA 160,""a"
320 DATA 161,""b"
330 DATA 162,""c"
340 DATA 163,""d"
350 DATA 164,""e"
360 DATA 165,""f"
370 DATA 166,""g"
380 DATA 167,""h"
390 DOS"CHAIN PART2"
APPENDIX F

PART 2—ORIGINAL DRIVER

410 '---- INTERRUPT HANDLER ----
420 ON ERROR 1 GOTO 440
430 GOTO 430
440 IF ERR=24 THEN K=INP(4H4A) ELSE ON ERROR 0 GOTO 0
450 IF K=4880 THEN PRINT CHR$(30);CHR$(27);"IA9";:STOP
460 LO=PEEK(493E52)
470 IF K=5 OR K=8 OR K=10 OR K=11 OR K=22 OR K=25 OR K=28
   OR K=29 OR K=31 THEN IF (LO AND 4H4) THEN PRINT CHR$(K);
   :GOTO 1140
480 IF NOT FL AND NC>0 THEN IF 48<K AND K<>57
   THEN ON CT+1 GOTO 1270,1280,1290
490 IF BF THEN IF 48<K AND K<>55 THEN BC=(K-48):BF=0:RESUME 1620
500 IF (FL=0 AND NC<>0 AND CT=0) THEN IF CHR$(K)="." THEN
   C(I)=CURCX(0):C(I+1)=CURSY(0):I=I+2:IF I>NC OR
   NC=999 THEN RETURN ELSE RESUME
510 IF NC=999 THEN IF K=146 OR K=149 THEN NC=0:PRINT CHR$(7);:RETURN
520 'CATCH FOR CB
530 IF K<>215 AND CR THEN PRINT CHR$(27);"Q";
540 IF FL AND K>208 THEN IF PM THEN SP$="O":PM=0:PF=0 ELSE SP$="P":PM=-1:PF=-1
550 IF K=129 AND K<>134 THEN ON K-128 GOTO 1000,1020,1040,1060,1080,1100
560 IF K<>176 AND K<>183 THEN PRINT P$(K-128):GOTO 1130
570 IF K>4 THEN DO$="D"
580 IF K<2 THEN AH$="FIX"
590 IF K<>3 AND NC<>0 THEN RETURN
600 IF NC<0 THEN GOTO 1130
610 IF K>160 AND K<>167 THEN PRINT "-U":PLOT CURSX(0),CURSY(0):
   PRINT CHR$(14);P$(K-128);CHR$(15);:GOTO 1130
620 IF K=216 THEN PRINT CHR$(7):GOTO 1120
630 IF (LO AND 4H4) AND K=34 THEN PR$=CHR$(K):PRINT CHR$(K):GOTO 800
640 IF K<>127 THEN PR$=P$(K-128):PRINT P$(K-128);CHR$(7);
   ELSE PRINT CHR$(K):GOTO 1130
650 IF K<>193 AND K<>196 THEN ON K-192 GOTO 1490,1500,1130,1520
660 IF K<>199 THEN GOTO 1510
670 IF K<>149 OR K<>146 THEN PRINT CHR$(7):GOTO 740
680 IF K<>151 AND K<>155 THEN ON K-150 GOTO 780,1130,1130,870,780
690 IF K<>145 THEN PRINT CHR$(7):GOTO 850
700 IF K<>244 THEN PRINT CHR$(7);CHR$(27);"Q";:CR=1
710 IF K<>215 THEN PRINT CHR$(30);CHR$(12);CHR$(27);"W";
720 GOTO 1130
730 '---- HANDLE PRIMITIVES ----
740 NC=999:GOSUB 1230:IF K=3 THEN NC=0:GOTO 980
750 IF CR THEN PRINT CHR$(27);"Q";
760 IF NOT FL AND NC<>0 THEN PLOT C(I-2),C(I-1):PRINT CHR$(30);
770 IF NC=999 THEN GOTO 740 ELSE IF FL THEN GOTO 420 ELSE RESUME 420
780 NC=4:GOSUB 1230:NC=0:IF K=3 THEN GOTO 980
790 GOTO 930
800 NC=4:GOSUB 1230:NC=0:IF K=3 THEN GOTO 980
810 IF CR THEN PRINT CHR$(27);"Q";
820 PLOT C(O),C(1),C(3)
830 IF CR THEN PRINT CHR$(30);
840 GOTO 980
850 NC=3:GOSUB 1230:NC=0:IF K=3 THEN GOTO 980
860 GOTO 930
870 NC=3:GOSUB 1230:NC=0:IF K=3 THEN GOTO 980
880 IF K>=48 AND K<=57 THEN 930 ELSE 890
890 IF CR THEN PRINT CHR$(27);"Q";
900 PLOT C(0),C(1):PLOT SQR((C(0)-C(2))^2+((C(1)-C(3))/SQR(2))^2)
910 IF CR THEN PRINT CHR$(30);
920 GOTO 980
930 FOR M=0 TO (I-1) STEP 2
940 IF CR THEN PRINT CHR$(27);"Q";
950 PLOT C(M),C(M+1)
960 IF CR THEN PRINT CHR$(30);
970 NEXT
980 IF FL THEN 420 ELSE RESUME 420
990 '-----HANDLE STATES-----
1000 IF CR THEN CR=0 ELSE PRINT CHR$(27);"C";"P";"G";:CR=-1
1010 GOTO 1130
1020 IF (LO AND &H4) THEN PRINT CHR$(21); ELSE PRINT "G";
1030 GOTO 1130
1040 IF (LO AND &H2) THEN PRINT "P"; ELSE PRINT "R";
1050 GOTO 1130
1060 IF (LO AND &H4) THEN BL$="XB";PRINT "2"; ELSE BL$="B";PRINT "1";
1070 GOTO 1130
1080 IF (LO AND &H1) THEN PRINT "N"; ELSE PRINT "M";
1090 GOTO 1130
1100 IF (LO AND &H8) THEN FI$="XF";PRINT "L"; ELSE FI$="F";PRINT "F";
1110 GOTO 1130
1120 IF FL THEN FL=0 ELSE FL=-1:IF TF=0 THEN GOTO 1160
1130 PRINT CHR$(30);CHR$(7);
1140 RESUME
1150 '-----FINISH MAIN-----
1160 '-----SUB: TABLET INIT-----
1170 SP$="C";FM=0
1180 PRINT CHR$(30);CHR$(27);"1C";CHR$(27);"0E5";CHR$(27);"IE5";
1190 IF CR THEN PRINT CHR$(27);"Q";
1200 TF=-1
1210 RESUME 420
1220 '-----SUB: COORD-----
1230 CT=0:I=0:F$="O":OX=0:OY=0:OF$="O"
1240 IF FL THEN 1310 ELSE 1260
1250 IF FL THEN 1310 ELSE 1260
1260 RESUME 430
1270 Z=100*(K-48):CT=CT+1:RESUME
1280 Z=Z+10*(K-48):CT=CT+1:RESUME
1290 C(I)=Z+(K-48):CT=0:I=I+1:IF I>=NC OR (NC=999 AND I=2)
1300 THEN RETURN ELSE RESUME
1300 '-----TABLET COORD-----
1310 PRINT "4";SP$;
1320 RESUME 1340
1330 IF NOT FM THEN INPUT "4";XX,YY,F$
1340 INPUT "4";XX,YY,F$
1350 PRINT ";S";
1360 X1=INT(XX/4.3):Y1=INT(YY/4.3)
1370 IF OX=X1 AND OY=Y1 AND OF$=F$ THEN 1450
1380 IF NC=999 AND F$="1" AND CR THEN PRINT CHR$(27);"Q";
1400 IF (NOT PF OR NOT OC) AND NC=999 THEN IF F$="1" THEN PLOT X1,Y1:
        PRINT CHR$(30);CHR$(7);:GOTO 1450
1410 IF F$="H" THEN NC=0:K=3:RETURN
1420 IF (NOT PF OR NOT OC) AND F$="1" THEN IF NOT PM THEN PRINT "%";
        :PLOT X1,Y1
1430 IF (NOT PF OR NOT OC) AND F$="1" THEN PRINT CHR$(7);:C(I)=X1:
        C(I+1)=Y1:I=I+2:IF I=NC THEN PRINT Pr$;:RETURN ELSE 1450
1440 PRINT "";:PLOT X1,Y1
1450 OX=X1:OY=Y1:OF$=FS$:PF=0:OC=-1
1460 PRINT #4;SP$;:GOTO 1340
1470 '    ----EXTENDED PRIMITIVES----
1480 CMD$="ARR":NC=5:GOTO 1530
1490 CMD$="REC":NC=6:GOTO 1530
1500 CMD$="VEC":NC=5:GOTO 1530
1510 CMD$="DAR":NC=5:GOTO 1530
1520 IF FL THEN IF CMD$="REC" THEN NC=8 ELSE NC=6
1540 IF K=3 THEN RESUME 420
1550 IF NOT FL AND CHR$(K)="." AND CMD$="REC" THEN NC=2:GOSUB 1230:
        NC=0:C(6)=C(0):C(7)=C(1)
1560 IF FL OR CHR$(K)="." THEN
        W=INT(SQR((C(2)-C(4))^2+((C(3)-C(5))/SQR(2))^2))
1570 IF FL OR CHR$(K)="." THEN IF CMD$="REC" THEN
        C(5)=INT(SQR((C(4)-C(6))^2+((C(5)-C(7))/SQR(2))^2))
1580 IF CMD$="REC" THEN HT=W=W=C(5)
1590 IF FL THEN 1610 ELSE RESUME 1610
1600 IF FS$="F" THEN BF=1:GOTO 430
1610 GOSUB 1660
1620 IF CMD$="VEC" OR CMD$="REC" THEN DOS "CHAIN PART3"
1630 IF CMD$="ARR" OR CMD$="DAR" THEN DOS "CHAIN PART4"
1640 '    ----SUB: SAVE BACKGROUND COLOR----
1650 COL=PEEK(&H380D)
1660 BG=COL AND &H55
1670 IF BG=0 THEN B1=0
1680 IF BG=1 THEN B1=1
1690 IF BG=4 THEN B1=2
1700 IF BG=5 THEN B1=3
1710 IF BG=16 THEN B1=4
1720 IF BG=17 THEN B1=5
1730 IF BG=20 THEN B1=6
1740 IF BG=21 THEN B1=7
1750 RETURN
1760 '
APPENDIX G

PART3-ORIGINAL DRIVER

10 'AUTHOR-MAXINE YEE
20 'PROGRAM-EGP(EXTENDED GRAPHIC PRIMITIVES)
30 'LANGUAGE-CROMATICS BASIC VERSION 3.0
40 'PLACE-KANSAS STATE UNIVERSITY, DEPT. OF COMPUTER SCIENCE
50 'DATE-DEC., 1979
60 'THIS IS A PROGRAM FOR THE GENERATION OF EXTENDED GRAPHIC PRIMITIVES
70 SQ=SQR(2)
80 IF BL$="B" THEN PRINT ""1"; ELSE PRINT ""2"
90 IF CMD$="VEC" THEN GOSUB 130: GOTO 110
100 IF CMD$="REC" THEN GOSUB 780
110 IF CR THEN PRINT CHR$(27); "Q";
120 DO$="XD"; W=1: PRINT ""M""; CHR$(48+B1); ""N""; CHR$(30); : DOS"CHAIN PART2
130 ' THIS IS A SUBROUTINE FOR DRAWING WIDE VECTORS
150 I=1
160 IF DO$="D" THEN GOSUB 360: RETURN
170 YS=YS/SQ: YN=YN/SQ
180 X=XN-XS
190 Y=YN-YS
200 L=SQR(X^2+Y^2)
210 X(I+2)=X(I+1)-X/N
220 Y(I+2)=Y(I+1)-Y/N
230 X(I+1)=XN-(X/N)
240 Y(I+1)=YN-(Y/N)
250 Y(I+2)=Y(I+1)^2
260 Y(I+1)=Y(I+1)^2
270 YS=YS*SQ: YN=YN*SQ
280 IF FL$<"F" THEN GOSUB 1280 ELSE GOSUB 1360
290 IF DO$="D" THEN GOTO 310 (WHY IS THIS LINE IN HERE? IT'S A COMMENT!)
300 PRINT CHR$(27); "Q"; : PLOT XS,YS,XN,YN
310 PRINT CHR$(27); "Q"; : PLOT XS,YS,XN,X(I+1),Y(I+1)
320 PLOT X(I+1), Y(I+1), X(I+2), Y(I+2)
330 PLOT X(I+1), Y(I+1), XS,YS; PRINT CHR$(30);
340 IF FL$="F" THEN XM+=(XS+X(I+1))/2: YM+=(YS+Y(I+1))/2: GOSUB 1400
350 RETURN
360 ' THIS IS A SUBROUTINE FOR DRAWING DOTTED LINES
380 YS=YS/SQ: YN=YN/SQ
390 J=1
400 X(J)=XS
410 Y(J)=YS
420 XB=XS: YB=YS
430 D=12
440 SEG=D
450 SP=SEG\2
460 L1=SQR((XS-XS)^2+(YN-YS)^2)
470 IF L1<SP AND CMD$="VEC" THEN RETURN
480 CO#=(XS-XS)/L1
490 SN#=(YN-YS)/L1
500 K2=(L1\(SP+SEG))\2+1
510 FOR J=1 TO K2 STEP 1
520 X(J+1)=XB+D*(CO#)
530 Y(J+1)=YB+D*(SN#)
' THIS SECTION OF CODE TESTS THE VARIOUS END POINTS OF A GIVEN LINE
E=J MOD 2
IF E=0 THEN IF (L1-D) < SEG
    THEN D=L1:NEXT J
    ELSE D=D+SEG:NEXT J
ELSE GOSUB 1280

IF W<=1 THEN Y(J)=Y(J)*SQ:Y(J+1)=Y(J+1)*SQ:GOSUB 740
IF W>1 THEN GOSUB 660
IF (L1-D)<=SP AND CMD$="VEC" THEN RETURN 'REMAINING SEG TOO SHORT TO PLOT
D=D+SP
IF E=1 AND L1-D<=SP THEN RETURN
NEXT J
RETURN

'THIS IS A SUBROUTINE FOR DRAWING DOTTED WIDE LINES
XN=X(J+1)
YN=Y(J+1)
XS=X(J)
YS=Y(J)
GOSUB 170
RETURN

'THIS IS A PLOTTING SUBROUTINE FOR A SINGLE DOTTED LINE
PRINT CHR$(27);"Q";:PLOT X(J),Y(J),X(J+1),Y(J+1):PRINT CHR$(30);
RETURN

'THIS IS A SUBROUTINE FOR DRAWING RECTANGLES
YS=YS/SQ:YN=YN/SQ
XS=XS-XS
YN=YN-YS
L=SQR((X^2+Y^2))
CO$=X/L
SN$=Y/L
CAL LENGTH OF GIVEN LINE
CAL COSINE OF AN ANGLE
CAL SINE OF AN ANGLE

' FOLLOWING SECTION OF CODE CALCULATES THE VARIOUS COORD. OF THE RECTANGLE
I=1
X(I)=XS+W*CO$
Y(I)=YS+W*SN$
X(I+1)=X(I)-W*SN$
Y(I+1)=Y(I)+W*CO$
X(I+2)=X(I)+(W-HT)*SN$
Y(I+2)=Y(I)+(HT-W)*CO$
X(I+3)=XS-HT*SN$
Y(I+3)=YS+HT*CO$
X(I+4)=XS+(L-W)*CO$
Y(I+4)=YS+(L-W)*SN$
X(I+5)=X(I+4)-W*SN$
Y(I+5)=Y(I+4)+W*CO$
X(I+6)=X(I+4)+(W-HT)*SN$
Y(I+6)=Y(I+4)+(HT-W)*CO$
X(I+7)=XS-HT*SN$
Y(I+7)=YN+HT*CO$

1050 YS=YS*SQ: YN=YN*SQ
1060 Y(I)=Y(I)*SQ
1070 Y(I+1)=Y(I+1)*SQ
1080 Y(I+2)=Y(I+2)*SQ
1090 Y(I+3)=Y(I+3)*SQ
1100 Y(I+4)=Y(I+4)*SQ
1110 Y(I+5)=Y(I+5)*SQ
1120 Y(I+6)=Y(I+6)*SQ
1130 Y(I+7)=Y(I+7)*SQ
1140 GOSUB 1280: GOSUB 1160
1150 RETURN
1160 '
1170 'THE FOLLOWING SECTION OF CODE PLOTS THE RECTANGLE
1180 PRINT CHR$(27);"Q":PLOT XS,YS,XN,YN
1190 PLOT XN,YN,X(I+7),Y(I+7)
1200 PLOT X(I+7),Y(I+7),X(I+3),Y(I+3)
1210 PLOT X(I+3),Y(I+3),XS,YS
1220 PLOT X(I+1),Y(I+1),X(I+5),Y(I+5)
1230 PLOT X(I+5),Y(I+5),X(I+6),Y(I+6)
1240 PLOT X(I+6),Y(I+6),X(I+2),Y(I+2)
1250 PLOT X(I+2),Y(I+2),X(I+1),Y(I+1):PRINT CHR$(30);
1260 IF FI$="F" THEN XM$=(XS+X(I+1))/2: YM$=(YS+Y(I+1))/2: GOSUB 1400
1270 RETURN
1280 '
1290 'THIS IS A SUBROUTINE TO HANDLE THE PLOTTING ENVIRONMENT AND SET COLOR
1300 PRINT CHR$(27);"Q";M$;
1310 PRINT CHR$(1);"C";CHR$(48+BC); 'SET BACKGROUND COLOR
1320 PRINT "N"; 'BACKGROUND LIGHT OFF
1330 PRINT "G";
1340 PRINT "I";CHR$(30);
1350 RETURN
1360 '
1370 'THIS IS A SUBROUTINE TO HANDLE THE PLOTTING ENVIRONMENT
1380 PRINT CHR$(27);"Q";G$;CHR$(30);
1390 RETURN
1400 '
1410 'THIS SUBROUTINE COMPLEX FILLS AN OBJECT
1420 PRINT CHR$(27);"U":PLOT XM$,YM$ 'MOVE CURSOR TO COORD
1430 PRINT "J";
1440 PRINT "M"; 'BACKGROUND LIGHT ON
1450 PRINT CHR$(1);"C";CHR$(48+BC); 'SET BACKGROUND COLOR
1460 PRINT "N"; 'BACKGROUND LIGHT OFF
1470 PRINT "">";CHR$(32);CHR$(30); 'FILL OBJECT WITH SOLID COLOR
1480 RETURN
1490 '
APPENDIX H

PART4-ORIGINAL DRIVER

10 I=1
20 SQ=SQR(2)
30 IF BX$="B" THEN PRINT "1" ELSE PRINT "2"
40 IF CMD$="ARR" THEN GOSUB 570:GOTO 55
50 IF CMD$="DAR" THEN GOSUB 1200
55 IF CR THEN PRINT CHR$(27);"Q";
60 DO=="XD";AH$="VAR";W=1:PRINT "MC";CHR$(48+B1);"N";CHR$(30):DOS"CHAIN PART2
70 IF DO$="D" THEN GOSUB 240:RETURN
80 X=XN-XS
90 Y=YN-YS
100 L=SQR(X^2+Y^2)
110 X(I+1)=XS-(W*Y)/L
120 Y(I+1)=YS+(W*X)/L
130 X(I+1)=XN-(W*Y)/L
140 Y(I+1)=YN+(W*X)/L
150 IF F1$<>"F" THEN GOSUB 2100 ELSE GOSUB 2070
155 IF CR THEN PRINT CHR$(27);"Q";
160 IF DO$="D" THEN GOTO 180
170 PLOT XS,YS,XN,YN
180 PLOT XN,YN,X(I+1),Y(I+1)
190 PLOT X(I+1),Y(I+1),X(I+2),Y(I+2)
200 PLOT X(I+2),Y(I+2),XS,YS
200 PRINT CHR$(30);
210 IF F1$="F" THEN XM$=(XS+X(I+1))/2;YM$=(YS+Y(I+1))/2:GOSUB 2090
220 IF DO$="D" THEN RETURN
230 RETURN
240 J=1
250 X(J)=XS
260 Y(J)=YS
270 XB=XS:YB=YS
280 D=12
290 SEG=0
300 SP=SEG\2
310 L1=SQR((XN-XS)^2+(YN-YS)^2)
320 IF L1<SP AND CMD$="ARR" THEN RETURN
330 IF L1<SP AND CMD$="DAR" THEN RETURN
340 CO$=(XN-XS)/L1
350 SN$=(YN-YS)/L1
360 K=(L1\(SP+SEG))\*2+1
370 FOR J=1 TO K STEP 1
380 X(J+1)=XB+D*(CO$)
390 Y(J+1)=YB+D*(SN$)
400 E=J MOD 2
410 IF E=0 THEN IF (L1-D)<SEG THEN D=L1:NEXT J ELSE D=D+SEG:NEXT J ELSE GOSUB 2100
420 IF CR THEN PRINT CHR$(27);"Q";
430 PRINT "";
440 PLOT X(J),Y(J),X(J+1),Y(J+1)
445 PRINT CHR$(30);
450 IF W>1 THEN GOSUB 510
460 IF (L1-D)<SP THEN RETURN
470 D=D+SP
480 IF E=1 AND L1-D<SP THEN RETURN
490 NEXT
500 RETURN
510 XN=X(J+1)
520 YN=Y(J+1)
530 XS=X(J)
540 YS=Y(J)
550 GOSUB 80
560 RETURN
570 X=XN-XS
580 Y=YN-YS
590 L2=SQR((XN-XS)^2+(YN-YS)^2)
600 W1=W/2
610 SI#1=Y/L2
620 CS#1=X/L2
630 IF AH$="FIX" AND W1<=1 THEN GOSUB 870: GOTO 740
640 IF AH$="FIX" AND W1>1 THEN GOSUB 870
650 IF AH$="FIX" AND DO$="D" THEN 750
660 P=2
670 X(P)=XS+9/10*X
680 Y(P)=YS+9/10*Y
690 X(P+1)=X(P)-Y/10
700 Y(P+1)=Y(P)+X/10
710 X(P+4)=X(P)+Y/10
720 Y(P+4)=Y(P)-X/10
730 IF DO$="D" AND W1<=1 THEN 960
740 IF W1<=1 THEN GOSUB 2010:GOSUB 1000:RETURN
750 X(P+2)=X(P)-W1*SI#
760 Y(P+2)=Y(P)+W1*CS#
770 X(P+3)=X(P)+W1*SI#
780 Y(P+3)=Y(P)-W1*CS#
790 X(P+5)=XS-W1*SI#
800 Y(P+5)=YS+W1*CS#
810 X(P+6)=XS+W1*SI#
820 Y(P+6)=YS-W1*CS#
830 IF DO$="D" AND AH$="FIX"THEN 980
840 IF DO$="D" AND AH$="VAR"THEN 980
850 GOSUB 2010:GOSUB 1060:GOSUB 1040:RETURN
860 RETURN
870 H=10
880 P=2
890 X(P)=XS+(L2-H)*CS#
900 Y(P)=YS+(L2-H)*SI#
910 X(P+1)=X(P)-H*SI#
920 Y(P+1)=Y(P)+H*CS#
930 X(P+4)=X(P)+H*SI#
940 Y(P+4)=Y(P)-H*CS#
950 IF DO$="D" THEN 740
960 IF W1<=1 THEN GOSUB 2010:GOSUB 1010:XN=X(P);YN=Y(P);GOSUB 240:RETURN
970 IF AH$="FIX" THEN 750
980 IF W1>1 THEN GOSUB 2010:GOSUB 1010:GOSUB 1140:GOSUB 280:RETURN
990 RETURN
1000 PRINT CHR$(27);"Q";: PLOT XS,YS,X(P),Y(P)
1010 PRINT CHR$(27);"Q";: PLOT X(P+1),Y(P+1),X(P+4),Y(P+4)
1020 PLOT X(P+4),Y(P+4),XN,YN
1030 PLOT XN,YN,X(P+1),Y(P+1):PRINT CHR$(30);  
1040 IF PI$="F" THEN XM$=(X(P)+XN)/2:YM$=(Y(P)+YN)/2:GOSUB 2090
1590  Y(P+1)=Y(P)+H*CS#
1600  X(P+4)=X(P)+H*SI#
1610  Y(P+4)=Y(P)-H*CS#
1620  X(P+5)=X+H*CS#
1630  Y(P+5)=Y+H*SI#
1640  X(P+6)=X+H*SI#-H*SI#
1650  Y(P+6)=Y+H*CS#-H*SI#
1660  X(P+9)=X+H*SI#
1670  Y(P+9)=Y+H*SI#
1680  IF DC$="D" THEN GOSUB 2010:GOSUB 1710:GOSUB 1440
1690  RETURN
1700  PRINT CHR$(27);"Q";: PLOT X(P+5),Y(P+5),X(P),Y(P)
1710  PRINT CHR$(27);"Q";: PLOT X(P+1),Y(P+1),XN,YN
1720  PLOT XN,YN,X(P+4),Y(P+4)
1730  PLOT X(P+4),Y(P+4),X(P+1),Y(P+1)
1740  PLOT X(P+6),Y(P+6),X(P+9),Y(P+9)
1750  PLOT X(P+9),Y(P+9),XS,YS
1760  PLOT XS,YS,X(P+6),Y(P+6):PRINT CHR$(30);
1770  IF FI$="F" THEN XM$=(X(P)+XN)/2:YM$=(Y(P)+YN)/2:GOSUB 2090
1780  IF FI$="F" THEN XM$=(X(P)+XS)/2:YM$=(Y(P)+YS)/2:GOSUB 2090
1790  RETURN
1800  PRINT CHR$(27);"Q";: PLOT X(P+2),Y(P+2),X(P+1),Y(P+1)
1810  PLOT X(P+1),Y(P+1),XN,YN
1820  PLOT XN,YN,X(P+4),Y(P+4)
1830  PLOT X(P+4),Y(P+4),X(P+3),Y(P+3)
1840  PLOT X(P+3),Y(P+3),X(P+8),Y(P+8)
1850  PLOT X(P+8),Y(P+8),X(P+9),Y(P+9)
1860  PLOT X(P+9),Y(P+9),XS,YS
1870  PLOT XS,YS,X(P+6),Y(P+6)
1880  PLOT X(P+6),Y(P+6),X(P+7),Y(P+7)
1890  PLOT X(P+7),Y(P+7),X(P+2),Y(P+2):PRINT CHR$(30);
1900  IF FI$="F" THEN XM$=(X(P)+XN)/2:YM$=(Y(P)+YN)/2:GOSUB 2090
1910  RETURN
1920  IF W1<1 THEN 1980
1930  XS=X(P+8):YS=Y(P+8)
1940  XN=X(P+3):YN=Y(P+3)
1950  XE=X(P+8):YE=Y(P+8)
1960  J=1:X(J)=X(P+8):Y(J)=Y(P+8)
1970  RETURN
1980  XS=X(P+5):YS=Y(P+5)
1990  XN=X(P):YN=Y(P)
2000  GOSUB 310:RETURN
2010  PRINT CHR$(27);"Q"-M";
2020  PRINT CHR$(1);"C";CHR$(48+BC);
2030  PRINT "N";
2040  PRINT "G";
2050  PRINT "I";CHR$(30);
2060  RETURN
2070  PRINT CHR$(27);"Q"-G";CHR$(30);
2080  RETURN
2090  PRINT CHR$(27);"Q"-U";: PLOT XM#,YM#
2100  PRINT "J";
2110  PRINT "M";
2120  PRINT CHR$(1);"C";CHR$(48+BC);
2130  PRINT "N";
2140  PRINT "->";CHR$(32);CHR$(30);
APPENDIX I
EXTENDED PART 2—WITH EDITOR SHAD ED

400 '-----INTERRUPT HANDLER-----
410 ON ERROR#1 GOTO 430
420 GOTO 420
430 IF ERR=24 THEN K=INP(&H4A) ELSE ON ERROR #0 GOTO 0
432 '-----CHECK--IF IN SEGMENTOR, THEN ROUTE INPUT TO SEGMENTOR----
440 IF SP THEN GOTO 2740 ELSE GOTO 450
450 IF K=&H80 THEN PRINT CHR$(30);CHR$(27);"IAG";:STOP
455 '-----CHECK SIZE OF CREATE BUFFER-----
470 SIZE=PEEK(&H3B45)
480 IF SIZE>254 THEN GOTO 2640 'SIZE WAS 128 FOR TESTING'
490 LO=PEEK(&H3B52)
500 IF K=5 OR K=8 OR K=10 OR K=11 OR K=22 OR K=25 OR K=28 OR K=29
510 OR K=31 THEN IF (LO AND &H4) THEN PRINT CHR$(K);:GOTO 1290
510 IF NOT FL AND NC<>0 THEN IF 48<K AND K<>57 THEN ON CT+1
520 GOTO 1410,1420,1430
520 IF BF THEN IF 48<K AND K<>55 THEN BC=(K-48):BF=0:RESUME 1740
530 IF (FL=0 AND NC<>0 AND CT=0) THEN IF CHR$(K)="." THEN
530 C(I)=CURSX(0):C(I+1)=CURSY(0):I=I+2:IF I>=NC OR NC=999 THEN
540 RETURN ELSE RESUME
540 IF NC=999 THEN IF K=146 OR K=149 THEN NC=0:PRINT CHR$(7);:RESUME
550 'CATCH FOR CB
560 IF K=215 AND CR THEN PRINT CHR$(27);"Q";
570 IF FL AND K=208 THEN IF PM THEN SP$="O";PM=0;PF=0 ELSE SP$="P";PM=-1;PF=-1
580 IF K=129 AND K=134 THEN ON K=128 GOTO 1140,1170,1190,1210,1230,1250
580 IF (K=212 OR K=218) AND FL THEN PRINT CHR$(21);CHR$(30);CHR$(15);"T"
585 RETURN OFF TABLET BEFORE TRYING TO EDIT."";"G";CHR$(27);"Q";:RESUME
590 IF K=212 THEN GOTO .1910
600 'GOSUB T1:=1:GOSUB 1910:T2:=1:GOTO 2270 
610 IF K>176 AND K=183 THEN PRINT P$(K-128);:GOTO 1280
620 IF K=4 THEN DO$="D"
630 IF K=2 THEN AH$="FIX"
640 IF K=3 AND NC<>0 THEN RETURN
650 IF NC<>0 THEN GOTO 1280
660 IF K=160 AND K<167 THEN PRINT ":U";:PRINT CURSX(0),CURSY(0):
660 PRINT CHR$(14);P$(K-128);CHR$(15);:GOTO 1280
670 IF K=216 THEN PRINT CHR$(7);:GOTO 1270
680 IF (LO AND &H4) AND K=34 THEN PR$=CHR$(K):PRINT CHR$(K);:GOTO 890
690 IF K=127 THEN PR$=P$(K-128);PRINT P$(K-128);CHR$(7); ELSE
690 PRINT CHR$(K);:GOTO 1280
700 IF K=193 AND K=196 THEN ON K=192 GOTO 1610,1620,1280,1640
710 IF K=199 THEN GOTO 1630
720 IF K=146 THEN PRINT CHR$(K-116);CHR$(7);:GOTO 790
725 IF K=149 THEN PRINT CHR$(7);:GOTO 790
730 IF K=151 AND K<155 THEN ON K=150 GOTO 850,1280,1280,980,850
740 IF K=145 THEN PRINT CHR$(7);:GOTO 950
750 IF K=244 THEN PRINT CHR$(7);CHR$(27);"Q";:CR=-1
760 IF K=215 AND SC>1 THEN PRINT CHR$(30);"M";CHR$(28);CHR$(27);CHR$(12);"P";CHR$(27);"W"; ELSE IF K=215 AND SC>1 THEN GOSUB 2970
1300 '-----FINISH MAIN-----
1310 '-----SUB: TABLET INIT
1320 SP$="0"; PM=0
1330 PRINT CHR$(30);CHR$(27);"R1C";CHR$(27);"CE5";CHR$(27);"TE5";
1340 IF CR THEN PRINT CHR$(27);"Q";
1350 TF=-1
1360 RESUME 410
1370 '-----SUB: COORD
1380 CT=0; I=0; F$="0"; OX=0; OY=0; OF$="0"
1390 IF FL THEN 1440 ELSE IF EF THEN GOTO 2540 ELSE 1440
1400 RESUME 420
1410 Z=100*(K-48); CT=CT+1; IF EF THEN GOTO 2580 ELSE RESUME
1420 Z=Z+10*(K-48); CT=CT+1; IF EF THEN GOTO 2580 ELSE RESUME
1430 C(I)=Z*(K-48); I=I+1; IF EF AND I<NC THEN GOTO 2580 ELSE IF I>NC OR (NC=999 AND I=2) THEN RETURN ELSE RESUME
1440 '-----TABLET COORD
1450 PRINT #4; SP$;
1460 RESUME 1470
1470 IF NOT PM THEN INPUT #4; XX, YY, F$
1480 INPUT #4; XX, YY, F$
1490 PRINT #4; "S"
1500 X1=INT(XX/4.3); Y1=INT(YY/4.3)
1510 IF OX=X1 AND OY=Y1 AND OF$=F$ THEN 1580
1520 IF NC=999 AND F$="1" AND CR THEN PRINT CHR$(27); "Q";
1530 IF (NOT PF OR NOT OC) AND NC=999 THEN IF F$="1" THEN PLOT X1, Y1:
1540 PRINT CHR$(30); CHR$(7); GOTO 1580
1550 IF F$="4" THEN NC=C; K=3; RETURN
1560 IF (NOT PF OR NOT OC) AND F$="1" THEN IF NOT PM THEN PRINT CHR$(30); "S"; CHR$(27); "Q"; PLOT X1,Y
1570 IF (NOT PF OR NOT OC) AND F$="1" THEN PRINT CHR$(7); C(I)=X1:
1580 C(I+1)=Y1; I=I+2; IF I>NC THEN PRINT PR$; RETURN ELSE 1580
1590 PRINT "U"; PLOT X1, Y1
1600 '-----EXTENDED PRIMITIVES
1610 CMD$="ARR"; NC=5: GOTO 1650
1620 CMD$="REC"; NC=6: GOTO 1650
1630 CMD$="VEC"; NC=5: GOTO 1650
1640 CMD$="DAR"; NC=5: GOTO 1650
1650 IF FL THEN IF CMD$="REC" THEN NC=8 ELSE NC=6
1660 GOSUB 1370: NC=0; XS=C(0); YS=C(1); XN=C(2); YN=C(3); W=C(4)
1670 IF K=3 THEN RESUME 410
1680 IF NOT FL AND CHR$(K)="." AND CMD$="REC" THEN NC=2: GOSUB 1370:
1690 IF FL OR CHR$(K)="." THEN
1700 W=INT(SQR((C(2)-C(4))^2+(C(3)-C(5))/SQR(2))^2))
1710 IF FL OR CHR$(K)="." THEN IF CMD$="REC" THEN
1720 C(5)=INT(SQR((C(4)-C(6))^2+(C(5)-C(7))/SQR(2))^2))
1730 IF CMD$="REC" THEN HT=W; W=C(5)
1740 IF FL THEN 1730 ELSE RESUME 1730
1750 IF F$="F" THEN BF=-1: GOTO 420
1760 GOSUB 1770
1770 IF CMD$="VEC" OR CMD$="REC" THEN DOS"CHAIN PART3
1780 IF CMD$="ARR" OR CMD$="DAR" THEN DOS"CHAIN PART4
1770 '-----SUB: SAVE BACKGROUND COLOR
1780 COL=PEEK(&H380D)
1790 BG=COL AND &H55
1800 IF BG=0 THEN B1=0
1810 IF BG=1 THEN B1=1
1820 IF BG=4 THEN B1=2
1830 IF BG=5 THEN B1=3
1840 IF BG=16 THEN B1=4
1850 IF BG=17 THEN B1=5
1860 IF BG=20 THEN B1=6
1870 IF BG=21 THEN B1=7
1880 RETURN
1885
1890 '-----EDITORS-----Mitchell{
1900 ' #1910 CNT=1:PRINT CHR$(30);:EF=-1
1920 BTM=(PEEK(&H3B45)*256)+PEEK(&H3B44)
1930 If==PEEK(&H3B47)*256)+PEEK(&H3B46)
1940 IF BTM=1 THEN GOTO 2510
1945 ' #1950 ----CHANGE PG COLOR TO BG COLOR
1960 GOSUB 1790:PRINT"C";MID$(STR$(B1),2);
1970 '----PLOT AN CHARACTER MODE{
1980 IF (LO AND &H4) THEN GOTO 2270
1985 ' #1990 '-----CHARACTER EDITORS
2000 M=PEEK(BTM-CNT)
2010 IF BTM-CNT=TP+3 THEN GOTO 2510
2020 N=PEEK(BTM-(CNT+1))
2030 IF M=21 THEN CNT=CNT+T:PRINT "C":GOTO 2270
2040 IF N=1 THEN CNT=CNT+2:GOTO 2000
2050 NN=PEEK(BTM-(CNT+2))
2060 IF M=67 AND NN=1 THEN A=BTM-(CNT+2):Z=BTM-CNT:CNT=CNT+3
2070 GOSUB 2650:GOTO 2000:ELSE GOTO 2100
2080 MN=PEEK(BTM-(CNT+3)):MM=PEEK(BTM-(CNT+4))
2090 IF MN=1 THEN IF NN=68 OR NN=89 THEN IF N=48 AND N<=57 THEN
2095 IF M=4 THEN A=BTM-(CNT+3):Z=BTM-CNT:CNT=CNT+4:GOSUB 2660:"PRINT"X",Y1,";GOTO 2000 ELSE GOTO 2100
2100 ' "PRINT"X1",Y1",":GOTO 2000 ELSE GOTO 2100
2105 ' IF M=0 OR M=7 THEN GOTO 2240
2110 IF M=5 THEN PRINT CHR$(22);:GOTO 2240
2120 IF M=8 THEN PRINT CHR$(32);:GOTO 2240
2130 IF M=6 OR M=9 OR M=12 OR M=13 OR M=23 OR M=27 OR M=28
2135 THEN PRINTCHR$"C";MID$(STR$(B1+1),2);CHR$(15)
2139 "USER NEEDS TO PRESS REDRAW ":CHR$"C";MID$(STR$(B1),2);:GOTO 2240
2140 IF M=10 THEN PRINT CHR$(11);:GOTO 2240
2150 IF M=11 THEN PRINT CHR$(10);:GOTO 2240
2160 IF M=14 THEN PRINT CHR$(15);:GOTO 2240
2170 IF M=15 THEN PRINT CHR$(14);:GOTO 2240
2180 IF M=22 THEN PRINT CHR$(5);:GOTO 2240
2190 IF M=25 THEN PRINT CHR$(31):GOTO 2240.
2200 IF M=29 OR M=32 THEN PRINT CHR$(8):GOTO 2240.
2210 IF M=31 THEN PRINT CHR$(25):GOTO 2240.
2220 IF M>33 THEN PRINT CHR$(8);CHR$(M);CHR$(8);:GOTO 2470.
   ELSE CNT=CNT+1:GOTO 2000.
2230 GOTO 2470.
2240 CNT=CNT+1:GOTO 2000.
2250 '  
2260 '------PRIMITIVE EDITOR------
2270 J=BTM-CNT.
2280 IF J=IP+3 THEN GOTO 2510.
2290 M=PEEK(J).
2300 IF M=7 THEN POKE J,0.
2310 IF M>32 AND M<44 THEN GOTO 2360.
2320 IF M=1 THEN N=PEEK(J+1) ELSE 2350.
2340 IF N=67 THEN A=BTM-CNT;Z=BTM-(CNT-2):GOSUB 2600 ELSE A=BTM-CNT.
   Z=BTM-(CNT-1):GOSUB 2600.
2350 CNT=CNT+1:GOTO 2270.
2355 '  
2360 '------LAST PRIMITIVE FOUND------
2370 IF T2 THEN GOTO 2440.
2380 IF M=33 THEN P=145:GOSUB 950:GOTO 2440.
2390 IF M=34 THEN CNT=CNT+2:GOSUB 950:GOTO 2440.
2400 IF M=37 THEN P=149:GOSUB 2610:GOTO 2440.
2405 IF M=40 THEN GOSUB 2610:GOTO 2440.
2410 IF M=42 THEN P=154:GOSUB 980:GOTO 2440.
2420 IF M=43 THEN P=155:GOSUB 850:GOTO 2440.
2430 IF M=39 THEN P=151:GOSUB 850:GOTO 2440.
2435 '  
2440 '-------CHANGE POINTERS & REPLACE COLOR-------
2450 IF T1 THEN T1=0:CNT=CNT+1:RETURN.
2460 IF T2 THEN T2=0.
2470 NBTM=BTM-CNT.
2480 A=NBTM/256:X%=X.
2490 Y%=NBTM-(256*X%)
2500 POKE 15172,X%:POKE 15173,Y%:POKE 14349,COL.
2510 PRINT CHR$(27);"Q";:EF=0.
2520 RESUME 420.
2525 '  
2530 '------SUB: COLLECT THE COORD OF THE PRIMITIVE------
2540 FOR J=BTM-CNT TO BTM-1.
2550 M=PEEK(J).
2560 IF M=0 THEN GOTO 2580.
2570 IF M=48 AND M<57 THEN K=M:ON CT+1 GOTO 1410,1420,1430.
2580 NEXT.
2585 '  
2590 '------SUB: PUT NULLS IN CB TO REPLACE MODE CHANGES------
2600 FOR J=A TO Z:POKE J,0: NEXT: RETURN.
2602 '  
2605 '------SUB: CHANGE COLOR & TELL USER TO PRESS REDRAW------
2610 PRINT CHR$(1);CHR$(21);"C";MID$(STR$(B1+1),2);CHR$(15);'USER NEEDS TO PRESS REDRAW";:RETURN.
2620 '----SEGMENTOR----Mitchell
2630'
2640 PRINT CHR$(30);:SF=-1
2650 IF SC<1 THEN GOTO 2840
2660 PRINT "*2;CHR$(15);""X1,","Y1,"L";  'INITIALIZE SCREEN CONDITIONS SO
2670 PRINT CHR$(28);"M"CO"N"C7";  'MESSAGE WILL APPEAR AT TOP LEFT
2680 LO=PEEK(&H3B52)
2690 IF (LO AND &H4) THEN PRINT CHR$(21);
2700 PRINT "CREATE BUFFER SEGMENTING   If you wish to continue,
name your file ";
2710 FOR I=1 TO 500:NEXT                   'DELAY
2720 RESUME 420
2730'
2740 '----COLLECTS THE FILENAME
2750 PRINT CHR$(K);
2760 IF K=13 THEN 2810
2770 IF K=8 THEN L=LEN(SN$):SN$=LEFT$(SN$,L-1):RESUME 420
2780 SN$=SN$+CHR$(K)
2790 RESUME 420
2800'
2810 '----PUT FIRST FILE ON DISK
2820 DOS"BUFF "+SN$++.BUF"
2830 SC=SC+1:GOTO 2900
2840 SC=SC+1:GOTO 2900
2850'
2860 '----PUT SUBSEQUENT FILES ON DISK
2870 S$=MID$(STR$(SC),2)
2880 LO=PEEK(&H3B52)
2890 IF RD THEN DOS"KILL "+S$+SN$++.BUF":RD=0  'REMOVES PREVIOUS FILE WITH
2900 DOS"BUFF "+S$+SN$++.BUF"  'SAME NAME IF STORED WITHIN
2910 RC=RC+1
2920 SC=SC+1
2930 GOTO 2910
2940'
2950 '----SET INITIAL CONDITIONS FOR FIRST FILE
2960 PRINT CHR$(12);"M"CO"N"C2"2":CHR$(15);"P"X1,"Y1,"G"L;
CHR$(27);"W";
2970
2980 '----DETERMINE TOP OF CREATE BUFFER AND START A NEW FILE
2990 C=PEEK(&H3B46):D=PEEK(&H3B47)
3000 POKE 15172,C:POKE 15173,D
3010 PRINT CHR$(27);"Q";
3020 GOTO 3070
3050'
3060 '----REDRAW OF SEGMENTED FILES
3070 PRINT CHR$(30);CHR$(12);
3080 IF RD THEN DOS"KILL "+S$+SN$++.BUF"
3090 S$=MID$(STR$(SC),2):DOS"BUFF "+S$+SN$++.BUF"
3100 IF NOT RD THEN RD=-1
3110 DOS"DRAW "+SN$++.BUF"
3120 PRINT CHR$(27);"W";
3130 FOR I=2 TO SC
3140 S$=MID$(STR$(I),2)
3150 DOS"DRAW "+S$+SN$++.BUF"
3160 PRINT CHR$(27);"W";
3170 NEXT
3180
3190 '----TURN SEGMENTOR FLAG OFF, RETURN STATES, GO TO NEW INPUT
3200 SF=0:POKE 9651,LO:RESUME 420
APPENDIX J
EXTENDED PART 2—WITH SEGMENTOR SHADED

400 '---- INTERRUPT HANDLER ----
410 ON ERROR#1 GOTO 430
420 GOTO 420
430 IF ERR=24 THEN K=INF($H44) ELSE ON ERROR #0 GOTO 0
432
435 '--- CHECK IF IN SEGMENTOR, THEN ROUTE INPUT TO SEGMENTOR ---
440 IF SF THEN GOTO 2740 ELSE GOTO 450
450 IF K=$H80 THEN PRINT CHR$(30); CHR$(27); "IA9"; : STOP
455
460 '--- CHECK SIZE OF CREATE BUFFER ---
470 SIZE=PEEK($H3B45)
480 IF SIZE>254 THEN GOTO 2640 'SIZE WAS 128 FOR TESTING
490 LO=PEEK($H3B52)
500 IF K=5 OR K=8 OR K=10 OR K=11 OR K=22 OR K=25 OR K=28 OR K=29
510 OR K=31 THEN IF (LO AND $H4) THEN PRINT CHR$(K); : GOTO 1290
520 IF NOT FL AND NCC<0 THEN IF 48<K AND K<57 THEN ON CT+1
530 GOTO 1410, 1420, 1430
540 IF BF THEN IF 48<K AND K<55 THEN BC=(K-48): BF=0: RESUME 1740
550 IF (PL=0 AND NCC<0 AND CT=0) THEN IF CHR$(K)="." THEN
560 C(I)=CURSX(0): C(I+1)=CURSY(0): I=I+2: IF I>NC OR NC<999 THEN
570 RETURN ELSE RESUME
580 IF NC<999 THEN IF K=146 OR K=149 THEN NC=0: PRINT CHR$(7); : RESUME
590 ' CATCH FOR CB
600 IF K>215 AND CR THEN PRINT CHR$(27): "Q";
610 IF FL AND K=208 THEN IF PM THEN SP$="0": PM=0: PF=0 ELSE SP$="F": PM=1: PF=1
620 IF K=129 AND K=134 THEN ON K-128 GOTO 1140, 1170, 1190, 1210, 1230, 1250
630 IF (K>212 OR K=218) AND FL THEN PRINT CHR$(21); CHR$(30); CHR$(15);
640 " TURN OFF TABLET BEFORE TRYING TO EDIT "; "G"; CHR$(27); "Q"; : RESUME
650 IF K<212 THEN GOTO 1910
660 IF K=218 THEN T1=-1: GOSUB 1910: T2=-1: GOTO 2270
670 IF K=176 AND K=183 THEN PRINT P$(K-128): GOTO 1280
680 IF K<4 THEN DO$="D"
690 IF K=2 THEN AH$="FX"
700 IF K=3 AND NC<0 THEN RETURN
710 IF NC<0 THEN GOTO 1820
720 IF K>160 AND K=167 THEN PRINT "U"; PLOT CURSX(0), CURSY(0):
730 PRINT CHR$(14); P$(K-128); CHR$(15); GOTO 1280
740 IF K=216 THEN PRINT CHR$(7): GOTO 1270
750 IF (LO AND $H4) AND K=34 THEN PR$=CHR$(K): PRINT CHR$(K): GOTO 890
770 PRINT CHR$(K): GOTO 1280
780 IF K<193 AND K=196 THEN ON K-192 GOTO 1610, 1620, 1280, 1640
790 IF K=199 THEN GOTO 1630
800 IF K=146 THEN PRINT CHR$(K-116): CHR$(7): GOTO 790
810 IF K=149 THEN PRINT CHR$(7): GOTO 790
820 IF K=151 AND K=155 THEN ON K-150 GOTO 850, 1280, 1280, 980, 850
830 IF K=145 THEN PRINT CHR$(7): GOTO 950
840 IF K<214 THEN PRINT CHR$(7): CHR$(27): "Q": CR=-1
850 IF K=215 AND SC=1 THEN PRINT CHR$(30): "N-CO\n-C2\n-2\n-Q7\n-H\n\nE\n\nW\n\nO\n\nO\n\n0\n\nS\n\n5\n\n1\n\n511\n\n1\n\n511\n\nC\n\nR$(26); CHR$(15); CHR$(12); "P\n1\n1\n1\n1\nG\nL\nCHR$(27): "W": ELSE IF K=215 AND SC>1 THEN GOSUB 2970;
770 GOTO 1280
780 '-----HANDLE PRIMITIVES
790 NC=999:GOSUB 1370:IF EF AND P=149 THEN PRINT CHR$(37);
800 IF EF AND P=146 THEN PRINT CHR$(34);
810 IF K=3 THEN NC=0:GOTO 1120
820 IF CR THEN PRINT CHR$(27);"Q";
830 IF NOT FL AND NC>0 THEN PLOT C(I-2),C(I-1);PRINT CHR$(30);
840 IF NC=999 THEN GOTO 790 ELSE IF FL THEN GOTO 410 ELSE RESUME 410
850 NC=4:GOSUB 1370:NC=0:IF EF AND P=155 THEN PRINT CHR$(43);
860 IF EF AND P=151 THEN PRINT CHR$(39);
870 IF K=3 THEN GOTO 1120
880 GOTO 1060
890 NC=4:GOSUB 1370:NC=0:IF EF THEN PRINT CHR$(34);
900 IF K=3 THEN GOTO 1120
910 IF CR THEN PRINT CHR$(27);"Q";
920 PLOT C(0),C(1),C(3)
930 IF CR THEN PRINT CHR$(30);
940 GOTO 1120
950 NC=3:GOSUB 1370:NC=0
960 IF EF AND P=145 THEN PRINT CHR$(33);
970 IF EF AND P=146 THEN PRINT CHR$(34);
980 IF K=3 THEN GOTO 1120
990 GOTO 1060
990 NC=3:GOSUB 1370:NC=0:IF EF THEN PRINT CHR$(42);
1000 IF K=3 THEN GOTO 1120
1010 IF K=46 AND K<=57 THEN 1060 ELSE 1020
1020 IF CR THEN PRINT CHR$(27);"Q";
1030 PLOT C(0),C(1):PLOT SQR((C(0)-C(2))^2+((C(1)-C(3))/SQR(2))^2)
1040 IF CR THEN PRINT CHR$(30);
1050 GOTO 1120
1060 FOR M=0 TO (I-1) STEP 2
1070 IF CR THEN PRINT CHR$(27);"Q";
1080 PLOT C(M),C(M+1)
1090 IF CR THEN PRINT CHR$(30);
1100 NEXT
1110 IF EF THEN RETURN
1120 IF FL THEN 410 ELSE RESUME 410
1130 '-----HANDLE STATES
1140 IF CR THEN CR=0:PRINT CHR$(30);ELSE PRINT CHR$(27);"C"="G";
1150 :CR=-1:IF SC=1 THEN SC=1-
1160 GOTO 2840
1170 IF (LO AND &H4) THEN PRINT CHR$(21);ELSE PRINT "-G";
1180 GOTO 1280
1190 IF (LO AND &H2) THEN PRINT "-P";ELSE PRINT "-R";
1200 GOTO 1280
1210 IF (LO AND &H40) THEN BL$="X":PRINT "-2";ELSE BL$="B";PRINT "-1";
1220 GOTO 1280
1230 IF (LO AND &H1) THEN PRINT "-N";ELSE PRINT "-M"2;
1240 GOTO 1280
1250 IF (LO AND &H80) THEN FI$="X":PRINT "-L";ELSE FI$="F";PRINT "-F";
1260 GOTO 1280
1270 IF FL THEN FL=0 ELSE FL=-1:IF TF=0 THEN GOTO 1310
1280 PRINT CHR$(30);CHR$(7);
1290 RSINI'MR
1300 '-----FINISH MAIN-----
1310 '-----SUB: TABLET INIT
1320 SP$="00":FM=0
1330 PRINT CHR$(30):CHR$(27):"R1C":CHR$(27):"OE5":CHR$(27):"IE5":
1340 IF CR THEN PRINT CHR$(27):"Q";
1350 IF=1
1360 RESUME 410
1370 '-----SUB: COORD
1380 CT=0:I=0:FS$="O";OX=0:OY=0:OF$="0"
1390 IF FL THEN 1440 ELSE IF EF THEN GOTO 2540 ELSE 1400
1400 RESUME 420
1410 Z=100*(K-48):CT=CT+1:IF EF THEN GOTO 2580 ELSE RESUME
1420 Z=Z+10*(K-48):CT=CT+1:IF EF THEN GOTO 2580 ELSE RESUME
1430 C(I)=Z+(K-48):CT=0:I=I+1:IF EF AND I<NC THEN GOTO 2580 ELSE
1440 IF I=NC OR (NC=999 AND I=2) THEN RETURN ELSE RESUME
1450 '-----TABLET COORD
1460 PRINT #4;SP$;
1470 RESUME 1470
1480 IF NOT PM THEN INPUT #4;XX,YY,F$;
1490 INPUT #4;XX,YY,F$;
1500 PRINT #4:"S";
1510 X=INT((XX+4.3)):Y=INT((YY+4.3))
1520 IF OX=O AND OY=Y AND OF$="F" THEN 1580
1530 IF NC=999 AND F$="1" AND CR THEN PRINT CHR$(27):"Q";
1540 IF F$="4" THEN NC=C=K=3:RETURN
1550 IF (NOT PF OR NOT OC) AND NC=999 THEN IF F$="1" THEN PLOT X1,Y1:
1560 IF NC=999 THEN IF F$="1" THEN PRINT CHR$(30):CHR$(7):;GOTO 1580
1570 IF F$="4" THEN NC=C=K=3:RETURN
1580 IF (NOT PF OR NOT OC) AND F$="1" THEN IF NOT PM THEN PRINT CHR$(30):
1590 IF NC=999 THEN IF F$="1" THEN PRINT CHR$(7):;C(I)=X1:
1600 IF NC=999 THEN PRINT "I":PLOT X1,Y1
1610 PRINT #4;SP$;GOTO 1470
1620 '-----EXTENDED PRIMITIVES
1630 CMD$="ARR":NC=5:GOTO 1650
1640 CMD$="REC":NC=6:GOTO 1650
1650 CMD$="VEC":NC=5:GOTO 1650
1660 CMD$="DAR":NC=5:GOTO 1650
1670 IF K<3 THEN RESUME 410
1680 IF NOT FL AND CHR$(K)="" THEN CMD$="REC" THEN NC=2:GOSUB 1370:
1690 IF FL OR CHR$(K)="" THEN
1700 IF FL OR CHR$(K)="" THEN IF CMD$="REC" THEN
1710 IF CMD$="REC" THEN HT=W=W=C(5)
1720 IF FL THEN 1730 ELSE RESUME 1730
1730 IF FS$="F" THEN BF=-1:GOTO 420
1740 GOSUB 1770
1750 IF CMD$="VEC" OR CMD$="REC" THEN DOS"CHAIN PART3
1760 IF CMD$="ARR" OR CMD$="DAR" THEN DOS"CHAIN PART4
1770 '----SUB: SAVE BACKGROUND COLOR
1780 COL=PEEK(&H380D)
1790 BG=COL AND &H55
1800 IF BG=0 THEN B1=0
1810 IF BG=1 THEN B1=1
1820 IF BG=4 THEN B1=2
1830 IF BG=5 THEN B1=3
1840 IF BG=16 THEN B1=4
1850 IF BG=17 THEN B1=5
1860 IF BG=20 THEN B1=6
1870 IF BG=21 THEN B1=7
1880 RETURN
1885 '
1890 '----EDITOR------Mitchell
1900 '
1910 CNT=1:PRINT CHR$(30);:EF=1
1920 BTH=PEEK(&H3B45)*256)+PEEK(&H3B44)
1930 TP=(PEEK(&H3B47)*256)+PEEK(&H3B46)
1940 IF BTH=1-TP THEN GOTO 2510
1945 '
1950 '----CHANGE FG COLOR TO BG COLOR
1960 GOSUB 1780:PRINT"";MID$(STR$(B1),2);
1970 '----PLOT OR CHARACTER MODE
1980 IF (LO AND &H4) THEN GOTO 2270
1985 '
1990 '----CHARACTER EDITOR
2000 M=PEEK(BTM-CNT)
2010 IF BTM-CNT=TP+3 THEN GOTO 2510
2020 N=PEEK((BTM-(CNT+1))
2030 IF M=21 THEN CNT=CNT+1:PRINT "";GOTO 2270
2040 IF N=1 THEN CNT=CNT+2;GOTO 2000
2050 NN=PEEK((BTM-(CNT+2))
2060 IF N=67 AND NN=1 THEN A=BTM-(CNT+2):Z=BTM-CNT:CNT=CNT+3:
GOSUB 2600:GOTO 2000 ELSE GOTO 2100
2070 MN=PEEK((BTM-(CNT+3)):M=M=PEEK((BTM-(CNT+4))
2080 IF MN=1 THEN IF NN=88 OR NN=89 THEN IF N>=48 AND N<=57 THEN
IF M=44 THEN A=BTM-(CNT+3):Z=BTM-CNT:CNT=CNT+4:GOSUB 2600:
PRINT"";X1;""Y1,"":GOTO 2000 ELSE GOTO 2100
2090 IF MM=1 THEN IF MN=88 OR MN=89 THEN IF NN>=48 AND NN<=57 THEN
IF N>48 AND N<57 THEN IF M=44 THEN A=BTM-(CNT+4):
Z=BTM-CNT:CNT=CNT+5:GOSUB 2600:PRINT"";X1;""Y1,"":GOTO 2000
ELSE GOTO 2100
2100 IF M=0 OR M=7 THEN GOTO 2240
2110 IF M=5 THEN PRINT CHR$(22);:GOTO 2240
2120 IF M=8 THEN PRINT CHR$(32);:GOTO 2240
2130 IF M=6 OR M=9 OR M=12 OR M=13 OR M=23 OR M=27 OR M=28
THEN PRINT"";C";MID$(STR$(B1+1),2);CHR$(15);
"USER NEEDS TO PRESS REDRAW ";"C";MID$(STR$(B1),2):GOTO 2240
2140 IF M=10 THEN PRINT CHR$(11);:GOTO 2240
2150 IF M=11 THEN PRINT CHR$(10);:GOTO 2240
2160 IF M=14 THEN PRINT CHR$(15);:GOTO 2240
2170 IF M=15 THEN PRINT CHR$(14);:GOTO 2240
2180 IF M=22 THEN PRINT CHR$(5);:GOTO 2240
2190 IF M=25 THEN PRINT CHR$(31);:GOTO 2240
2200 IF M=29 OR M=32 THEN PRINT CHR$(8);:GOTO 2240
2210 IF M=31 THEN PRINT CHR$(25);:GOTO 2240
2220 IF M>=33 THEN PRINT CHR$(8):CHR$(M):CHR$(8);:GOTO 2470
   ELSE CNT=CNT+1:GOTO 2000
2230 GOTO 2470
2240 CNT=CNT+1:GOTO 2000
2250 '-----PRIMITIVE EDITOR
2260 J=BTM-CNT
2270 IF J=TP+3 THEN GOTO 2510
2280 M=PEEK(J)
2290 IF M=7 THEN POKE J,0
2300 IF M>=32 AND M<44 THEN GOTO 2360
2310 IF M=1 THEN N=PEEK(J+1) ELSE 2350
2320 IF N=71 THEN CNT=CNT+1:GOSUB 2610:PRINT"C";MID$(STR$(B1),2);:GOTO 2000
2330 IF N=67 THEN A=BTM-CNT:Z=BTM-(CNT-2):GOSUB 2600 ELSE A=BTM-CNT:
   Z=BTM-(CNT-1):GOSUB 2600
2340 CNT=CNT+1:GOTO 2270
2350 '-----LAST PRIMITIVE FOUND
2360 IF T2 THEN GOTO 2440
2380 IF M=33 THEN P=145:GOSUB 950:GOTO 2440 'X-BAR'
2390 IF M=34 THEN CNT=CNT+2:GOSUB 950:GOTO 2440 'Y BAR'
2400 IF M=37 THEN P=149:GOSUB 2610:GOTO 2440 'DOT'
2405 IF M=40 THEN GOSUB 2610:GOTO 2440 'CONC VECT'
2410 IF M=42 THEN P=154:GOSUB 2610:GOTO 2440 'CIRCLE'
2420 IF M=43 THEN P=155:GOSUB 850:GOTO 2440 'RECTANGLE'
2430 IF M=39 THEN P=151:GOSUB 850:GOTO 2440 'VECTOR'
2435 '-----CHANGE POINTERS & REPLACE COLOR
2450 IF T1 THEN T1=0:CNT=CNT+1:RETURN
2460 IF T2 THEN T2=0
2470 NBTM=BTM-CNT
2480 A=NBTM/256:X%=A
2490 Y%=NBTM-(256*X%)
2500 POKE 15172,Y%;POKE 15173,X%;POKE 14349,COL
2510 PRINT CHR$(27);"Q";:EF=0
2520 RESUME 420
2525 '-----SUB: COLLECT THE COORD OF THE PRIMITIVE
2540 FOR J=BTM-CNT TO BTM-1
2550 M=PEEK(J)
2560 IF M=0 THEN GOTO 2580
2570 IF M>=48 AND M<=57 THEN K=M:ON CT+1 GOTO 1410,1420,1430
2580 NEXT
2585 '-----SUB: PUT NULLS IN CB TO REPLACE MODE CHANGES
2600 FOR J=A TO Z: POKE J,0: NEXT: RETURN
2602 '-----SUB: CHANGE COLOR AND TELL USER TO PRESS REDRAW---
2610 PRINT CHR$(1);CHR$(21);"C";MID$(STR$(B1+1),2);CHR$(15);
   "USER NEEDS TO PRESS REDRAW ";:RETURN
2620 ****** SEGMENTOR - Mitchell L.
2630  
2640 PRINT CHR$(30);: SF=-1
2650 IF SC<1 THEN GOTO 2840
2660 PRINT "**2":CHR$(15);"F"X1,"Y1","L";  
  "INITIALIZE SCREEN CONDITIONS SC;
2670 PRINT CHR$(28);"H"CO"N"C7";  
  "MESSAGE WILL APPEAR AT TOP LEFT
2680 LO=PEEK(AH3B52)
2690 IF (LO AND &H4) THEN PRINT CHR$(21)
2700 PRINT "CREATE BUFFER SEGMENTING 
  "If you wish to continue,
  "name your file ";
2710 FOR I=1 TO 500: NEXT
2720 RESUME 420
2725  
2730 ***** COLLECTS THE FILENAME 
2740 PRINT CHR$(K)
2750 IF K=13 THEN 2810
2760 IF K=8 THEN L=LEN(SN$):SN$=LEFT$(SN$,L-1):RESUME 420
2770 SN$=SN$+CHR$(K)
2780 RESUME 420
2790  
2800 ***** PUT FIRST FILE ON DISK 
2810 DOS"BUFF "+SN$+".BUF",
2820 SC=SC+1:GOTO 2900
2825  
2830 ***** PUT SUBSEQUENT FILES ON DISK 
2840 S$=MID$(STR$(SC),2)
2850 LO=PEEK(AH3B52)
2855 IF RD THEN DOS"KILL "+S$+SN$+".BUF":RD=0  
  "REMOVES PREVIOUS FILE WITH
2860 DOS"BUFF "+S$+SN$+".BUF"
2870 SC=SC+1
2880 GOTO 2910
2885  
2890 ***** SET INITIAL CONDITIONS FOR FIRST FILE 
2890 PRINT CHR$(12);"H"CO"N"C2"2":CHR$(15);"F"X1,"Y1","G,L";
2900 CHR$(27);"W";
2905
2910 ***** DETERMINE TOP OF CREATE BUFFER AND START A NEW FILE 
2920 C=PEEK(&H3B46):D=PEEK(&H3B47)
2930 POKE 15172,C:POKE 15173,D
2940 PRINT CHR$(27);"Q";
2950 GOTO 3070
2955  
2960 ***** REDRAW OF SEGMENTED FILES 
2970 PRINT CHR$(30);CHR$(12)
2975 IF RD THEN DOS"KILL "+S$+SN$+".BUF"
2980 S$=MID$(STR$(SC),2):DOS"BUFF "+S$+SN$+".BUF"
2985 IF NOT RD THEN RD=-1
2990 DOS"DRAW "+S$+SN$+".BUF"
3000 PRINT CHR$(27);"W";
3005 FOR I=2 TO SC
3010 SS=MID$(STR$(I),2)
3020 DOS"DRAW "+SS+SN$+".BUF"
3030 PRINT CHR$(27);"W";
3040 NEXT
3050  
3060 ***** TURN SEGMENTOR FLAG OFF, RETURN STATES, GO TO NEW INPUT 
3070 SF=0:POKE 9651,LO:RESUME 420
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EDITING AND SEGMENTING
DISPLAY FILES FOR COLOR GRAPHICS

by

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AN ABSTRACT OF A MASTER'S REPORT

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requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

KANSAS STATE UNIVERSITY
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ABSTRACT

This report describes two extensions of a system driver designed for the color graphics computer in the Computer Science Department. One extension allows the user to edit drawings or text as they are being developed. This extension is needed to remove misspelled or incorrect positioning of text and incorrect or unexpected geometric figures. Two keys are redefined as the EDIT and TABLET EDIT keys which are used to remove the most recently entered character(s)/figure(s). The second extension allows the user to create complex pictures which previously could not be done because of limited buffer space. This is accomplished by segmenting the display file and maintaining these segments on disk storage. The segmenting facility will not require any action on the part of the user unless the need for segmentation arises.