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HP-75

## USERS' LIBRARY SOLUTIONS Graphics



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## TABLE OF CONTENTS

1. LINE PLOT ..... 1Creates single or multiple line charts.The lines may be one of seven line typesand two pen colors. The programs arebased on original code by Tom Menshik.
2. BAR PLOT. ..... 44Creates single or multiple bar charts.The programs support six hatch typesand two pen colors. Based on originalcode by Tom Menshik.
3. PIE PLOT ..... 89
Creates single pie charts. The pie may contain slices in six hatch types and one pen color. Code by Tom Menshik.

## LINE CHART

What the Programs are Designed To Do:
The LINE CHART plotting package consists (as does each package in this Solutions Book) of two programs: a file creation/editing program and a plotting program. The editing program prompts the user for inputs by which data files that contain the information necessary to create plots using the HP 7470A plotter are created. The plot program translates these data files into the appropriate HP-GL* commands to create plots with the plotter. The programs are recorded on the included magnetic cards under the file names "LEDIT" and "LPLOT" respectively.

The package allows the user to plot single-page, single- or multiple-line charts. (The package should work with either the HP-IL option of the HP 7470A plotter or with other interface options if the appropriate interconnect device is used.) The axes are not movable: the x-axis is located at the bottom and the y-axis is at the extreme left side of the plot. The axes may be labeled, as may the plot as a whole (with a "main title" and "subtitle"), and the axes may be subdivided into numerically labeled segments using labeled tic marks. The user may select between six line types and two pen colors for use in plotting the line(s). Each line has a legend by which it may be described.

The programs interface nicely with mass storage and display devices. The programs work especially well with the HP 82163 Video Interface if it is specified as the DISPLAY IS device. Printers are not supported by the programs because of the nature of the plotter interface. The plotter must be addresses as the PRINTER IS device and therefore no other printer device may be accessed while running the programs.

* Hewlett-Packard Graphics Language - see your HP 7470A Interfacing and Programming Manual.

The following example assumes that the user has loaded the edit and the plot programs into memory under the file names＂LEDIT＂and＂LPLOT＂respec－ tively．The example also assumes that the file＂LINEDATA＂does not exist in memory，that the HP 7470A is on the HP－IL loop，that it has been assigned a device specifier and has been specified as the printer device（via the PRINTER IS command）．

## DISPLAY

KEYSTROKES
run＂ledit＂［RTN］
Line Plot File Creation
The initial prompts are straight forward．We would like to create a new plot file and will use the default data file name＂LINEDATA＂．

New，old file，quit（n／o／q）？n［RTN］
New data file name？LINEDATA［RTN］
Since the file is new，it is empty．We must supply values for the plot＇s titles，and set the $x$－and $y$－scale values． The titles used in this example are superfluous．The scale used for both the $x$－and $y$－axes is the range 0 to 100 in steps of 10 ．

Main title：Main Title［RTN］
Subtitle：Subtitle［RTN］
X axis title：$\quad X$ Axis［RTN］
$Y$ axis title：$\quad Y$ Axis［RTN］
$X$ min，max，inc．：0，0，0
0，100，10［RTN］
Y min，max，inc．：0，0，0
$0,100,10$［RTN］
Number of lines： 1
2 ［RTN］
Once the number of lines is specified，descriptive legends， line types and pen color must be chosen for each line．The legend titles in the example are superfluous．We will select line type 2 and default pen 1 （the left pen of the HP 7470）for line one．For line two we will select line type 7 and pen 2 （the right pen of the HP 7470A）．

Upper legend $⿰ ⿰ 三 丨 ⿰ 丨 三 一 1: ~$
Lower legend \＃1：

Upper legend \＃2：
Lower legend \＃2：
Line type \＆pen \＃2：1，1

Line 1 ［RTN］
［RTN］
2 ［RTN］
Line 2 ［RTN］
（second line）［RTN］
7，2［RTN］

Each line must contain points to be plotted and these are specified as xy coordinate pairs. Note that all of the points specified must fall within the range 0 to 100 for both x and y in accordance with the scales selected above. Values outside this range would be rejected by the program.

Line 1, \# of points? 2
Line 1, point 1: 0,0
Line 1, point 2: 0,0
Line 1, point 3: 0,0
Line 1, point 4: 0,0
Line 2, \# of points? 2
Line 2, point 1: 0,0
Line 2, point 2: 0,0
Line 2, point 3: 0,0
Line 2, point 4: 0,0
Line 2, point 5: 0,0

4 [RTN]
[RTN]
25,32 [RTN]
50,19 [RTN]
75,86 [RTN]

```
5 [RTN]
    [RTN]
    15,25 [RTN]
    30,45 [RTN]
    63.37 [RTN]
    92,78 [RTN]
```

Once all of the points for all of the lines are specified, the program cycles to permit either the creation of a new file or the editing of an old file. In this case, we will go back to modify the file just created. An existing file may reside on a mass storage device, so the program asks for the device specifier. No input for the device specifier indicates that the file exists in HP-75 memory. The file is found and its catalog information is displayed for user verification. ("tt:tt dd/dd/dd" in the example represents the time and date display corresponding to the file's creation time.)

New, old file, quit ( $\mathrm{n} / \mathrm{o} / \mathrm{q}$ )? n

- [RTN]

Old data file name? LINEDATA
[RTN]
Device specifier?
[RTN]
LINEDATA B 1021 tt:tt dd/dd/dd
The user is asked whether or not the plot titles and scales are to be edited. We answer "yes". The existing values are redisplayed for editing. The value for the main title is changed by typing the new title over the old. Existing values are retained by pressing [RTN] as they are displayed.

## KEYSTROKES

Edit titles \＆scale（ $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ）？ n
y［RTN］
Main title：Main Title
Fun and Games［RTN］
Subtitle：Subtitle
［RTN］
X axis title：X Axis
［RTN］
Y axis title：Y Axis
［RTN］
X min，max，inc．：0，100，10
［RTN］
Y min，max，inc．：0，100，10
［RTN］
Since we may not want to change the legends，line types and pens，the program prompts us．In this case we do：a value for lower legend 1 is added．The other values are retained by pressing［RTN］．

Number of lines： 2
Edit legends（ $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ）？ n
Upper legend \＃1：Line 1
Lower legend $⿰ ⿰ 三 丨 ⿰ 丨 三 一$ ：
Line type \＆pen \＃1：2，1
Upper legend \＃2：Line 2
Lower legend \＃2：（second line）
Line type \＆pen \＃2：7，2
［RTN］
y［RTN］
［RTN］
（first line）［RTN］
［RTN］
［RTN］
［RTN］
［RTN］

We opt not to change the values of the points in the lines．
Edit points（ $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ）？ n
［RTN］
The program recycles and we choose to quit．
New，old file，quit（n／o／q）？n
q［RTN］
Having created a data file，we choose to plot the infor－ mation．The default file name is that of our file（since we chose the default in the edit program）and it still exists in memory．We are given a choice of plotting speeds： fast，medium and slow．We choose fast．The program pro－ ceeds to generate the plot．

Line Plot
Data file name？LINEDATA
［RTN］
Device specifier？
［RTN］
LINEDATA B 1036 tt：tt dd／dd／dd
Plot speed（ $\mathrm{f} / \mathrm{m} / \mathrm{s}$ ）？s f［RTN］



CREATING A NEW FILE

DISPLAY

STEP (NEW) 1:
run "ledit" [RTN]
Line Plot File Creation

This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (NEW) 2:
New, old file, quit (n/o/q)? $n \quad n$, o or $q$ [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file. The prompt also gives the option of quitting the program without manipulating a data file. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared.

The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "new", "old" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $n$, o or q) will generate an error and cause the prompt to be repeated. Select "n" to create a new file (" $n$ " is the default, so just press [RTN]).

STEP (NEW) 3:
New data file name? LINEDATA
8 character string [RTN]
This prompt requests the name of the data file to be created. Any string of up to 8 characters, upper or lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. An invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "LINEDATA" will be displayed any time the program is RUN or the program has cycled and "LINEDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

If a file of the same name exists in memory, the catalog information of existing file will be displayed and the user will be asked if the file is to be purged.
'filename' exists in memory, purge ( $y / n$ )? $n$

An affirmative response will purge the file and continue the program at step (NEW) 4. A negative response will cycle the program to step (NEW) 2 of the User Instructions without affecting the existing file. ("filename" in the above example will be replaced by the actual file name.)

STEP (NEW) 4:
Main Title:
up to 50 characters [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted parallel to the x-axis along the top of the graph. Pressing [RTN] with no input is acceptabel and will cause no title to be plotted.

STEP (NEW) 5:
Subtitle:
up to 50 characters [RTN]
The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted parallel to the $x$-axis immediately below the main title (or immediately below the place the
main title would be). Pressing [RTN] with no input is acceptable and will cause no subtitle to be plotted.

STEP (NEW) 6:
X axis title:
up to 50 characters [RTN]
The program is asking for the title of the $x$-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately below the x-axis. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 7:
Y axis title: up to 50 characters [RTN]
The program is asking for the title of the $y$-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately to the left of the y-axis. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 8:
$X$ min,max,inc.: $0,0,0$
3 numeric values [RTN]
This prompt requests the scaling of the $x$-axis and requires three numeric inputs separated by commas. The first value to be input is the leftmost $x$ value to be plotted. It may be negative or positive, integer or real. The second input value is the rightmost $x$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest $x$ values, respectively. The program will allow the leftmost point on the $x$-axis ( $x$-min) to be larger than the rightmost point ( $x$-max). A plot in which the x-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $x$-min and $x$-max is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

## KEYSTROKES

The third input value is the $x$ increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of $x-m i n$ and $x$-max. The magnitude of the increment must be less than or equal to the distance between $x-m i n$ and $x-m a x$. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $x$-max is greater than that of $x \rightarrow m i n$ (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $x-m i n$ is greater than that of $x-m a x$ (a decrease), the increment must be negative. A valid example is 5,-5,-1. The increment value cannot be zero.

All tics will be labeled with their x-coordinate. Tics should be spaced wide enough that the labels do not overlap.

STEP (NEW) 9:
$Y$ min,max,inc.: 0,0,0 3 numeric values [RTN]
This prompt requests the scaling of the y-axis and requires three numeric inputs separated by commas. The first value to be input is the bottommost $y$ value to be plotted. It may be negative or positive, integer or real. The second input value is the topmost $y$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest y values, respectively. The program will allow the bottommost point on the $y$-axis ( $y-m i n$ ) to be larger than the topmost point (y-max). A plot in which the y-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $y-m i n$ and $y$-max is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

The third input value is the $y$ increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of

## KEYSTROKES

$y-m i n$ and $y-m a x$. The magnitude of the increment must be less than or equal to the distance between $y-m i n$ and y-max. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $y$-max is greater than that of $y$-min (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $y-m i n$ is greater than that of $y$-max (a decrease), the increment must be negative. A valid example is 5,-5,-1. The increment value cannot be zero.

All tics will be labeled with their y-coordinate. Tics should be spaced wide enough that the labels do not overlap.

STEP (NEW) 10:
Number of lines: 1 an integer [RTN]
The program is asking for the number of lines to be plotted. Valid input is a single integer between 1 and 50. All other inputs will generate an error and cause the prompt to be repeated. The program can store up to 50 different lines, but the physical limitations of the plot will not support this extreme. For example, more than 10 or 12 lines will cause crowding of the legends and with 2 pens and 7 line types only 14 distinct lines can be drawn.

STEP (NEW) 11:

Upper legend \#1:
up to 50 characters [RTN]
The program is asking for the first half of the descriptive label for line 1. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. It will be plotted parallel to and immediately below the subtitle. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no upper legend to be plotted. Note that to prevent crowding, fewer than 50 characters should be used based on the number of legends to be plotted.

## KEYSTROKES

STEP (NEW) 12:
Lower legend \#1:
up to 50 characters [RTN]
The program is asking for the second half of the descriptive label for line 1. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. It will be plotted parallel to and immediately below the upper legend. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no lower legend to be plotted. Note that to prevent crowding, fewer than 50 characters should be used based on the number of legends to be plotted.

STEP (NEW) 13:

2 integers [RTN]
The program is asking for the line type and pen number. Valid line type values are integers between 1 and 7 while valid pen numbers are 1 and 2. All other inputs will generate an error and cause the prompt to be repeated. A list of the line types can be found on page 6. Pen \#1 is the left-hand pen on the HP 7470 plotter while pen 非2 is the right-hand pen.

Steps (NEW) 11 through 13 will be repeated for each line as specified by step (NEW) 10.

STEP (NEW) 14:
Line 1, \# of points? 2 integer [RTN]
The program is requesting the number of data points to be used in plotting the line. Since a line consists of a minimum of 2 points, this is the minimum and the default input. The program will accept up to 50 points per line. Any number of points, from 2 to 50 may be input. Any other input will generate an error and the prompt will be repeated. Once specified, the user must enter a value for each point. Mismatching the number specified here and the number of points actually entered will cause a variety of undesirable results.

## DISPLAY

## KEYSTROKES

STEP (NEW) 15:
Line 1, point 1: 0,0 2 real numbers [RTN]
The program is asking for the $x$ - and $y$-coordinates of the first point to be plotted. Two real valued numbers must be specified that are within the scales specified in User Instruction steps (NEW) 8 and 9. Values outside these ranges will generate an error and cause the prompt to be repeated, as will non-numeric values and too few or too many inputs.

This step will be repeated for each data point in the line as specified in step (NEW) 14. Steps (NEW) 14 and 15 will be repeated for each line as specified in step (NEW) 10.

When all of the points in all of the lines have been specified, the program will cycle back to step (NEW) 2.

## EDITING AN EXISTING FILE

STEP (OLD) 1:
run "ledit" [RTN]
Line Plot File Creation
This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (OLD) 2:
New, old file, quit ( $n / o / q$ )? $n \quad n$, o or $q$ [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file. The prompt also gives the option of quitting the program without manipulating a data file. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared.

The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "new", "old" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $n$, o or q) will generate an error and cause the prompt to be repeated. Select "o" to edit an existing file.

STEP (OLD) 3:
Old data file name? LINEDATA
8 character string [RTN]
This prompt requests the name of the data file to be manipulated. Any string of up to 8 characters, upper or

## USER INSTRUCTIONS

lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. A string that represents an invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "LINEDATA" will be displayed any time the program is RUN or if the program has cycled and "LINEDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

STEP (OLD) 4:
Device specifier?
":" \& 2 characters [RTN]

Since the old file may exist on some external mass storage device and not in memory, the program asks for the device specifier of the mass storage device. If no device specifier is input, the file is assumed to exist in memory. Device specifiers are of the form ":ab" where "a" is any alphabetical character and "b" is any alphanumeric character. The prompt will accept any input of up to 3 characters.

Any invalid input (string too long, commas, semicolons or quotation marks, first character not ":") will generate an error and cause the prompt to be repeated. An invalid device specifier will not be detected until the program tries to access the device. At such a time, an error will be generated and control will be passed to step (OLD) 2. There is an unavoidable hazard that exists if an invalid device specifier is input or the file does not exist on the specified device and does exist in memory. The program will not detect the invalid device specifier or the nonexistent external file until it has detected the duplicate file name in memory. The catalog information of the existing file will be displayed and the user will be asked if the file is to be purged.

## USER INSTRUCTIONS

```
'filename' exists in memory,
    purge ( \(\mathrm{y} / \mathrm{n}\) )? n
```

An affirmative response will purge the memory file before the program has verified the existence or nonexistence of the external file. The user should therefore be relatively certain that the file specifier inputs are accurate. ("filename" in the above example will be replaced by the actual file name.) A response of " $n$ " will cycle the program to step (OLD) 2.

If the program has cycled and a device specifier has previously been input, the last used device specifier will be put into the display - even if it has caused an error. This default may be modified or removed before pressing [RTN] to accept the input.

STEP (OLD) 5:

Edit titles \& scale (y/n/q)? n y, n or q [RTN]
Since the user may not desire to alter the values of the titles or scales, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or $q$ ) will generate an error and cause the prompt to be repeated.

A response of "y" will cause the program to continue at step (OLD) 6 while that of " $n$ " will continue at step (OLD) 12.

STEP (OLD) 6:

Main Title: old title
up to 50 characters [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters.

## KEYSTROKES

Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted parallel to the $x$-axis along the top of the graph. Pressing [RTN] with no input will accept the old title (represented by "old subtitle" in the example above). The main title may be omitted by clearing the input display.

STEP (OLD) 7:
Subtitle: old subtitle
up to 50 characters [RTN]
The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted parallel to the x-axis immediately below the main title (or immediately below the place the main title would be). Pressing [RTN] with no input will accept the old subtitle (represented by "old subtitle" in the example above). The subtitle may be omitted by clearing the input display.

STEP (OLD) 8:
X axis title: old x-axis title
up to 50 characters [RTN]

The program is asking for the title of the x-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately below the x-axis. Pressing [RTN] with no input will accept the old title (represented by "old x-axis title" in the example above). The title may be omitted by clearing the input display.

STEP (OLD) 9:
Y axis title: old y-axis title
up to 50 characters [RTN]
The program is asking for the title of the y-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters.

> Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately to the left of the y-axis. Pressing [RTN] with no input will accept the old title (represented by "old y-axis title" in the example above). The title may be omitted by clearing the input display.

STEP (OLD) 10:
$X \min , \max , i n c .: \min , \max , i n c$.
3 numeric values [RTN]
This prompt requests the scaling of the $x$-axis and requires three numeric inputs separated by commas. The first value to be input is the leftmost $x$ value to be plotted. It may be negative or positive, integer or real. The second input value is the rightmost $x$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest $x$ values, respectively. The program will allow the leftmost point on the $x$-axis ( $x-\min$ ) to be larger than the rightmost point ( $x$-max). A plot in which the x-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $x$-min and $x$-max is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

The third input value is the x increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of $x-m i n$ and $x$-max. The magnitude of the increment must be less than or equal to the distance between $x$-min and $x$-max. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $x$-max is greater than that of $x-\min$ (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $x-\min$ is greater than that of $x-m a x$ (a decrease), the increment must be negative. A valid example is $5,-5,-1$. The increment cannot be zero.

All tics will be labeled with their x-coordinate. Tics should be spaced wide enough that the labels do not overlap.

Pressing [RTN] with no input will accept the existing values (represented by "min,max,inc." in the example above).

## USER INSTRUCTIONS

STEP (OLD) 11:
$Y$ min,max,inc.: min, max,inc. 3 numeric values [RTN]
This prompt requests the scaling of the y-axis and requires three numeric inputs separated by commas. The first value to be input is the bottommost $y$ value to be plotted. It may be negative or positive, integer or real. The second input value is the topmost $y$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest $y$ values, respectively. The program will allow the bottommost point on the $y$-axis ( $y-m i n$ ) to be larger than the topmost point (y-max). A plot in which the y-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $y$-min and $y$-max is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

The third input value is the $y$ increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of $y$-min and $y$-max. The magnitude of the increment must be less than or equal to the distance between $y-m i n ~ a n d ~$ $y$-max. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $y$-max is greater than that of $y$-min (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $y-m i n$ is greater than that of $y-m a x$ (a decrease), the increment must be negative. A valid example is $5,-5,-1$. The increment cannot be zero.

All tics will be labeled with their y-coordinate. Tics should be spaced wide enough that the labels do not overlap.

Pressing [RTN] with no input will accept the existing values (represented by "min,max,inc." in the example above).

STEP (OLD) 12:
Number of lines: old \# of lines integer [RTN]
The program is asking for the number of lines to be plotted. Valid input is a single integer between 1 and 50. All other inputs will generate an error and cause the

## USER INSTRUCTIONS

prompt to be repeated．The program can store up to 50 different lines，but the physical limitations of the plot will not support this extreme．For example，more than 10 or 12 lines will cause crowding of the legends and with 2 pens and 7 line types only 14 distinct lines can be drawn．

Pressing［RTN］with no input will accept the existing values（represented by＂old \＃of lines＂in the example above）．

STEP（OLD）13：
Edit legends（ $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ）？ n
$y, n$, or $q$［RTN］
Since the user may not desire to alter the values of the legends，line types or pen，the program gives you the choice of skipping them or of quitting all together．If the latter option is selected，both the HP－75＇s display and the specified DISPLAY IS device are cleared．The prompt will accept any input string of up to 4 characters．Only the first character is used in the evaluation of the response．Therefore，responses such as＂yes＂，＂no＂and ＂quit＂are acceptable．The strings may be entered in either upper or lower case．Any invalid input（string too long，commas or semicolons，first character not $y, n$ ，or q） will generate an error and cause the prompt to be repeated．

Note that an increase in the number of lines in step（OLD） 12 will disallow this option and execution will continue with step（OLD） 14.

A response of＂y＂will cause the program to continue at step（OLD） 14 while that of＂ n ＂will continue at step（OLD） 17.

STEP（OLD）14：
Upper legend $⿰ ⿰ 三 丨 ⿰ 丨 三 一 1: ~ o l d ~ l e g e n d ~$
up to 50 characters［RTN］
The program is asking for the first half of the descriptive label for line 1．This may be any string of text，excluding commas，semicolons and quotation marks，of up to 50 characters． It will be plotted parallel to and immediately below the sub－ title．Erroneous inputs（containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated．Pressing［RTN］with no input will accept the current value（represented by＂old legend＂in the example above）． The legend may be omitted by clearing the input display．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．

## USER INSTRUCTIONS

## STEP（OLD）15：

Lower legend \＃1：old legend
up to 50 characters［RTN］
The program is asking for the second half of the descriptive label for line 1．This may be any string of text，excluding commas，semicolons and quotation marks，of up to 50 characters． It will be plotted parallel to and immediately below the upper legend．Erroneous inputs（containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated．Pressing［RTN］with no input will accept the current value（represented by＂old legend＂in the example above）． The legend may be omitted by clearing the input display．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．

STEP（OLD）16：
Line type \＆pen $⿰ ⿰ 三 丨 ⿰ 丨 三 一$ 1：line，pen
2 integers［RTN］
The program is asking for the line type and pen number．Valid line type values are integers between 1 and 7 while valid pen numbers are 1 and 2．All other inputs will generate an error and cause the prompt to be repeated．A list of the line types can be found on page 6．Pen 非1 is the left－hand pen on the HP 7470 plotter while pen $⿰ ⿰ 三 丨 ⿰ 丨 三 一$ 2 is the right－hand pen．Pressing ［RTN］with no input will accept the current value（represented by＂line，pen＂in the example above）．

Steps（OLD） 14 through 16 will be repeated for each line as specified by step（OLd） 12.

STEP（OLD）17：

Edit points（ $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ）？ n

$$
\mathrm{y}, \mathrm{n}, \text { or } \mathrm{q}[\mathrm{RTN}]
$$

Since the user may not desire to alter the values of the points，the program gives you the choice of skipping them or of quitting all together．If the latter option is selected，both the HP－75＇s display and the specified DISPLAY IS device are cleared．The prompt will accept any input string of up to 4 characters．Only the first character is used in the evaluation of the response． Therefore，responses such as＂yes＂，＂no＂and＂quit＂are acceptable．The strings may be entered in either upper or

## USER INSTRUCTIONS

lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or q) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of lines in step (OLD) 12 will disallow this option and execution will continue with step (OLD) 19.

A response of "y" will cause the program to continue at step (OLD) 18 while that of "n" will continue at step (OLD) 2.

STEP (OLD) 18:

Edit line $1(y / n / q) ? n \quad y, n$, or $q$ [RTN]
Since the user may not desire to alter the values of the points in line 1, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or $q$ ) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of lines in step (OLD) 12 will disallow this option and execution will continue with step (OLD) 19.

A response of "y" will cause the program to continue at step (OLD) 19 while that of " $n$ " will continue at step (OLD) 2.

STEP (OLD) 19:

Line 1, \# of points? old number integer [RTN]

The program is requesting the number of data points to be used in plotting the line. Since a line consists of a minimum of 2 points, this is the minimum and the default input. The program will accept up to 50 points per line. Any number of points, from 2 to 50 may be input. Any other input will generate an error and the prompt will be
repeated. Once specified, the user must enter a value for each point. Mismatching the number specified here and the number of points actually entered will cause a variety of undesirable results. Pressing [RTN] with no input will accept the current value.

STEP (OLD) 20:

Line 1, point 1: x, y
2 real numbers [RTN]
The program is asking for the $x$ - and y-coordinates of the first point to be plotted. Two real valued numbers must be specified that are within the scales specified in User Instruction steps (OLD) 10 and 11. Values outside these ranges will generate an error and cause the prompt to be repeated, as will non-numeric values and too few or too many inputs. Pressing [RTN] with no input will accept the current values (represented by "x, $y$ " in the example above).

This step will be repeated for each data point in the line as specified in step (OLD) 19. Steps (OLD) 19 and 20 will be repeated for each line as specified in step (OLD) 12.

When all of the points in all of the lines have been specified, the program will cycle back to step (OLD) 2.

## PLOTTING

DISPLAY

STEP (PLOT) 1:
run "lplot" [RTN]

## Line Plot

This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (PLOT) 2:
Data file name? LINEDATA
8 character string [RTN]
This prompt requests the name of the data file to be manipulated. Any string of up to 8 characters, upper or lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. A string that represents an invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "LINEDATA" will be displayed any time the program is RUN or if the program has cycled and "LINEDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input. No input indicates that you want to quit the program. If the input display is empty when you press [RTN], the display(s) are cleared and the program ends.

Since the file may exist on some external mass storage device and not in memory, the program asks for the device specifier of the mass storage device. If no device specifier is input, the file is assumed to exist in memory. Device specifiers are of the form ":ab" where "a" is any alphabetical character and "b" is any alphanumeric character. The prompt will accept any input of up to 3 characters.

Any invalid input (string too long, commas, semicolons or quotation marks, first character not ":") will generate an error and cause the prompt to be repeated. An invalid device specifier will not be detected until the program tries to access the device. At such a time, an error will be generated and control will be passed to step (PLOT) 2. There is an unavoidable hazard that exists if an invalid device specifier is input or the file does not exist on the specified device and does exist in memory. The program will not detect the invalid device specifier or the nonexistent external file until it has detected the duplicate file name in memory. The catalog information of the existing file will be displayed and the user will be asked if the file is to be purged.
'filename' exists in memory, purge ( $\mathrm{y} / \mathrm{n}$ )? n

An affirmative response will purge the memory file before the program has verified the existence or nonexistence of the external file. The user should therefore be relatively certain that the file specifier inputs are accurate. ("filename" in the above example will be replaced by the actual file name.) A response of " n " will cycle the program to step (OLD) 2.

If the program has cycled and a device specifier has previously been input, the last used device specifier will be put into the display - even if it has caused an error. This default may be modified or removed before pressing [RTN] to accept the input.

STEP (PLOT) 4:
Plot Speed ( $\mathrm{f} / \mathrm{m} / \mathrm{s}$ )? $\mathrm{s} \quad \mathrm{f}, \mathrm{m}$ or s [RTN]
The program is asking whether it should plot fast, medium or slow. The selection is mostly user preference, but a slow speed may be required to prevent pen skipping on such things as slides for overhead projectors. Only "f", "m" and "s" are allowed inputs. All other inputs will generate an error and cause the prompt to be repeated.

The program continues from here to generate the plot. When finished, execution will continue at step (PLOT) 2.

## PROGRAM DETAIL

## ERROR MESSAGES

| Number | Message | Description |
| :---: | :---: | :---: |
| 16 | Not enough memory. | Not enough memory exists in order to create or expand the data file. |
| 33 | Data type. | The information read from the data file is not of the correct type. |
| 34 | No data. | The program tried to read from the data file at a location in which no data is stored. |
| 42 | String too long. | The text the user has input is longer than that allowed by the prompt. |
| 43 | Numeric input. | The user entered text in response to a numeric prompt. |
| 44 | Too many inputs. | Either too many numeric inputs were specified or commas or semicolons were entered in a text string. |
| 51 | PRINT \# to runfile. | The plot file specified is actually the current program file. |
| 57 \& 58 | I/O error. | An error occurred when trying to access the HP-IL interface. |
| 62 | File not found. | The specified data file was not found either in memory or on the specified mass storage device. |
| 63 | Invalid filespec. | Reported only by the plot program: the file name or device specifier is not legal. |

## PROGRAM DETAIL

| Number | Message | Description |
| :---: | :---: | :---: |
| 63-68 | File error. | An error occurred when trying to access the data file. |
| 92-97 | Mass storage error. | The mass storage device has malfunctioned. |
| 98 | Not a plot file. | The data file specified is not recognized as being a plot file. |
| 99 | Invalid parameter. | The value input is not in the range required by the prompt. |
| $n n$ | Unable to run. | This is the default message when an error occurs that is not one of those listed above. The error number is reported so that the associated HP-75 error message can be determined. |

## PROGRAM DETAIL

Length in bytes:
LEDIT $=5183$
LPLOT $=4440$

Variables:
the edit program

| A\$ [4] | the user's response to yes/no/quit and new/old/quit questions. |
| :---: | :---: |
| $B \$[50]$ | contains the currently accessed title information. |
| C\$[50] | contains the lower legend text. |
| D\$[3] | the device specifier. |
| E\$[20] | the error message. |
| F\$[8] | the file name. |
| E | an integer variable containing the current error number. |
| I | an integer variable used as an index in several instances. |
| L | an integer variable containing the number of lines to be plotted. |
| LO | an integer variable containing the line type. |
| N | an integer variable used as a flag to indicate whether or not the file is new. $1=$ new, $0=$ old. |
| 0 | an integer variable that contains the previous number of lines. |
| P | an integer variable containing the pen number. |
| S | an integer variable containing the number of points to be plotted. |

## PROGRAM DETAILL

S0
$X(50,2)$

X0

X1

X2
an integer variable containing the old number of points to be plotted.
a real array containing the data points for the line.
a real variable containing either the value of $x-m i n$ or $y-m i n$.
a real variable containing either the value of $x-m a x$ or $y-m a x$.
a real variable containing the value of either the $x$ - or y-increment.
the plot program

| A\$[4] | the user's response to yes/no/quit and new/old/quit questions. |
| :---: | :---: |
| $B \$[50]$ | contains the currently accessed title information. |
| D\$[3] | the device specifier. |
| E \$[20] | the error message. |
| F \$ [8] | the file name. |
| E | an integer variable containing the current error number. |
| F | a real variable that contains the multiplication factor used to convert the $x$-axis scale to absolute plotter units. |
| F1 | a real variable that contains the multiplication factor used to convert the y-axis scale to absolute plotter units. |
| I | an integer variable used as an index in several instances. |

## PROGRAM DETAIL

J

K

L
an integer variable used as an index in several instances.
an integer variable containing the number of points to be plotted.
an integer variable containing the number of lines to be plotted.
an integer variable containing the line type.
an integer variable containing the pen number.
an integer variable containing the containing the plotting offset in characters.
an integer variable containing the plot speed.
a real variable containing the $x$-coordinate of the current point.
a real variable containing the value of $x-m i n$.
a real variable containing the value of $x$-max.
a real variable containing the value of the $x$-increment.
a real variable containing the y-coordinate of the current point.
a real variable containing either the value of $y-m i n$.
a real variable containing the value of $y$-max.
a real variable containing the value of the $y$-increment.

Functions: (only the plot program contains user defined functions)
FNL (H,X,Y,P\$,P,S\$[50],R1,R2)
This function generates all of the labels used in the plot. The parameter $H$ specifies the relative size of the characters. $X$ and $Y$ are the coordinates of the label in absolute plotter units. $\mathrm{P} \$$ is either "C", "L", or "R" indicating whether the label is to be centered, left justified or right justified with respect to the

## PROGRAM DETAIL

coordinates. $P$ is the offset in character heights of the label from the coordinates. $S \$$ is the text to be plotted. $R 1$ and R2 are the rise and run of the label (i.e., the angle between R1 and R2 is the slope on which the label is plotted).

FNM (X,Y)
This function moves the pen (in the up position) to the absolute plotter coordinates specified by $X$ and $Y$.

FND (X,Y)
This function puts the pen down and draws a line to the absolute plotter coordinates specified by $X$ and $Y$.

All of the above function return 1 if an error was generated and 0 if they terminate normally.

## Data files:

A plot data file is organized as follows:
Line 1 = contains the character "l" used to identify the file as a line plot file.

Line 2 = contains the main title text.

Line 3 = contains the subtitle text.
Line 4 = contains the $x$-axis title text.

Line 5 = contains the y-axis title text.
Line 6 = contains the $x$-axis scale values.
Line 7 = contains the y-axis scale values.

Lines 9 through 8 + the number of lines - each line contains the legend text, line type and pen number for the corresponding plot line.

Lines 51 through 50 + the number of lines - each line contains the number of points to be plotted in the corresponding line.

Lines 100 through 100 * the number of lines - the 100 element array representing the xy pairs for each line is stored beginning on each of these lines. The arrays will always take up more than one line, so several lines immediately following each of these lines (line numbers incremented by 1) may contain portions of the array.

```
    10!
    O ! Line plot file creation progrem
    30 ! HFW%GO Graphic:= Solutions Eook
    40 ! February 198%
    50 !
    bO DATA "Main title"""Subtitle","x a<i
    s titue";"Y axis titte"
    70 DTSF CHFs(27)%"Elune Flot File Erea
    tion"
    BO OFTTON EASE I
```




```
    IOO TNTEGEF E,I,L,LO,N,O,F,S,GO
    11O FEAL X (5O,2) XO,X1,X2
    12O F悉"MTNEDATA" G D%=":"
    130 !
    140 ! file query routime
    150 !
    160 EOSUE 1920 G GOSUE 1670 ! G]ear di
    splay, set error trap.
    17% INFUT "NEw:, old file, quit: (n/o/q)
    ? ","口"!At
    180 ON FOS("NOQ",UFFC&(A⿻⿱口口丨心\1,17))+1 GOT
    0 150,190,190,1960
190 !
200 TF UFRC&(A&[1, 17)="N" THEN N=1 ELS
E N=O
21O DN EFFOF GOSUE 172O E GOTO 2OO
2\varrhoO IF N THEN DISF "NEw":ELSE DISF "O]
d":
2SO INFUT " date file name? ",F安F串
240 ON EFFOF GOSUE 1720 E GOTO 250
2S IF NOT N THEN TNFUT "Device speciff
ier" "!D*%D事 ELSE 2BO
26O IF D婁="" THEN उ5O
27O IF FOS(Dक,":")井 THEN E=6S G GOSUE
    1750 E GOTO 250
280 E=O G ON EFFOF: E=EFFN
29O IF N THEN CAT Fक ELSE COFY D& TO F
$
OOO DFF EFFOR
Z1O IF N AND NOT E THEN GOSUE 1590 ! D
uplicate file
3O TF N THEN उ7O
SO IF E#64 AND E THEN EOSUE 175O E GO
TO 1SO ! If not duplicate file error."
340 IF E THEN GOSUE 1590 E GOTO 280
SO GOSUA 1670 ! Set: error trap.
SO CAT F方
30 GOSUE 1670 ! Set error trap.
3BO ASSIGN # 1. TO F$, BASIC
390 IF N THEN FRINT # 1: "1" G GOTO 4
4%
```

Data for title loop
Identify program，clear DISPLAY IS device
Option base used by $\mathrm{X}(50,2)$
String variables
Integer variables
Real variables
Initialize file name，device spec

Determine selected routine based on input from line 170

Set new file flag
Set error trap for file name input

Set error trap for device spec input

If memory resident file，skip tests Test for a bad device specifier

If new file，skip nonexistent error If not duplicate file，report error

If duplicate file，prompt to purge
Display copied file information
Create and／or address data file
If new file，store line plot
ident，skip ident segment

## PROGRAM LISTING

4OO FEAD \＃ 1 ：A
 GOTO IFO
40 ！
4 （\％）Frompt for titles
44 O ！
45 TF N THEN EOO
$46 \mathrm{ON} E F F O F$ GOSUE $17 \% 0$ ब GOTO 470
470 GOsuF 1920 ！©lear display
48O NNFUT＂Edit titles \％swele（y／n／q）
＂＂ッ＂ワ＂！※

O $470,500,750,1760$

splay，restore prompt deten
E1OFOF $=2 T O$
GO GOQue 1670 ！Set eror trap
GO TF NOT N THEN FEAD 相 1，T ：E\％ELEE

54 FEADEt
$55 O$ ON EFFOF GOSUE $17 \pi 0$ GOTO 66

G70 GOSUF 1670 ！Set error trap．
580 FFTNT \＃1．
59 NEXT T
6め ！
6lo ！Frompt for＝walimg
बे ！
6 O FOF $\mathrm{I}=6$ TO 7
64 O T NOT $N$ THFN FEAD \＃1， I a XO，XI，$X$
2 $\mathrm{FLSE} \times 0, \times 1, \times 2=0$
OFO ON EFFOF GOSUE $17 \sigma O$ GOTO 660
6 OOF TFO THFN DTSF＂X＂FLSE DTSF＂Y＂ $:$



GOSUE 1750 GOTO 660
670 IF AES（x2）AES（x1－xO）DF $x 0=x 1 \quad$ OF
NOT $X$ THEN E＝97 E GOSUE 1760 G GOTO $\theta$
60
700 巨0su® 167\％！Set error trepn
710 FFTNT \＃1， $\mathrm{I}: \times 0, \times 1, \times 2$
720 NEXT I
7 OO ！
740 ！Frompt for \＃of linties
$750!$
760 ©0SuF 1920 ！©lear display．
770 IF NOT $N$ THEN FEAD \＃ $1.8: 1 . E E E$ $1=1$
$780 \square=1$
790 ON EFFOF EOSUE 1780 GOTO 760

Verify that file is plot file

If new file，skip edit option
Set error trap for error query

Determine routine to branch to based on input from step 4808

Loop to read titles
If not new file，read old values
Read prompt string
Set error trap for title input
Set fatal error trap
Store title

Loop to read scales
If not new file，read／initialize
Set error trap for scale input First pass is $x$ scale，second is y

If increment not right direction， report error
If increment larger than scale or $=0$ of $\min =\max$ then report error

Set fatal error trap
Store the scales values

If not new file，read number of lines，else number of lines $=1$ Store old number of lines
Set error trap

## PROGRAM LISTING

BOO INFuT＂Number of IAnes：＂STFक（1）： L．．．
ब10 TF L OI OF $1.5 O$ THEN E＝99 E GOSUE 1 750 60TO 760
820 бOSUB 1670 ！Set error trap
日SO FFTNT \＃ $1,8: 1$
$840!$
850 ！Clear old data．
B6O FOF I＝＝1＋1 TO
870 GOSUF 1670 ！Set error trap．
B6O FRINT \＃1．I＋ 8 E FFINT \＃ $1 . \mathrm{I}+50$
$890 \mathrm{~J}=\mathrm{O}$ E ON EFFOF GOTO 9 O
甲OO FESTORE \＃1．I＊IOO＋J G FRINT \＃1．，I＊ $100+J$
$910 \quad \mathrm{~J}=\mathrm{J}+1$
920 GOTO 900
930 NEXT J
940
950 ！Frompt for legends：line type．p en
960
970 IF $\angle \mathrm{O}$ OF $N$ THEN 1020
980 ON EFFOF GOSUE 1790 G GOTO 990
990 GOSUE 1920 ！Clear display．
1000 INFUT＂Edit leqends（ $y / n / q$ ）？＂：＂n ＂：A和
1010 ON FOS（＂YNQ＂，UFFC\＆（A末［1，1］））＋1 GO TO 990，1020，1150，1960
1020 FOR $\mathrm{I}=1 \mathrm{TO} \mathrm{L}$
1030 GOSUE 1920 E GOSUE 1670 ！Clear d isplay．set error trap．
1040 IF NOT $N$ AND $I \&=0$ THEN FEEAD \＃ $1, I$

1050 ON EFFOR GOSUE 1730 IG GOTO 1060
1060 DISF＂Upper legend \＃＂\＆STR $⿻$（I）：E INFUT＂：＂，Eक；Bक
1070 ON EFFOR GOSUE 1730 G GOTO 1080
1080 DISF＂Lower legend \＃＂\＆STF串（I）；正 INFUT＂：＂，Cक：C
1090 DISF＂Line type \＆pen \＃＂\％GTFio（I）：
 F
1100 IF LO＜1 OF LOS7 OF F区1 OF FY2 THE N E＝99 G GOSUE 1750 G GOTO 1090

1120 NEXT I
1130 ！
1140 ！Frompt for data points
1150 ！
1160 IF 1.9 OF $N$ THEN 1210
1170 ON ERFOR GOSUB 1730 G GOTO 1180

If number of lines is out of range， report error
Set fatal error trap

Loop to clear unnecessary line data Set fatal error trap
Clear legends／data points for unused lines
Clear unused data points

If new file／lines skip cond edit
Set error trap for edit prompt

Determine routine to branch to based on input from line 1000 Loop for line legend input

If old data，read it，else initialize values
Set error trap for upper legend

Set error trap for lower legend

If line type or pen out of range， report error Store values

If new lines，skip conditional edit Set error trap for edit prompt


1190 INFUT "Edit points (y/n/q)?":"n"
4 A

TO $1180,1210,1560,1960$
$1210 \mathrm{FEAD} \# 1,6 \quad \mathrm{XO}_{4} \times 1, \times 2$
$12 \varnothing$ FEAD \# 1.7 \% YO.YI.YZ
1 于
1240 FOF $\mathrm{I}=1 \mathrm{TO} 1$
1 WO TF I SO OF N THEN 1 OOO
1260 UN EFFOF GOSUR 1730 G GOTO $1 \Rightarrow 7 \%$
1270 GПऽue 1920 ! Clear displayn

丁 " (y/n/q)? ","п": А象

TG $1270,180,1540,1960$

i ¢play set error trep.
1.10 IH NO N AND $\because=0$ THIN RFAD H .


1830

$t=" \pi$ تNFUT "? "STFs (S) "

1760 区 $\square T 0 ~ 1 区 区 ~$
1 उF GOSUE 1670 ! ©et error trap.

THEN FFTNT \# 1』T*1OO \#
$1 \Xi 70$ TF NOT $N$ AND $T=O$ THFN FESTOFE \#

NEXT J
1970 FOF $\quad]=1$ TO $\quad$
1400 ON FFFOF GOSUE 1730 GOTO 1410

下下事(J):

$x(3,2) ; \times(3,1), x(3,2)$
14 O IF XOXX THEN 1450
$1440 \mathrm{TF} \times(3,1)$ © OO OF $X(3,1) \times X 1$ THEN E $=$
99 GOSUE 1750 GOTO 1410 ELSE 1460
$1450 \mathrm{TF} \times(\mathrm{T}, 1) \times \times \mathrm{OF} X(J, 1) \times X 1$ THEN E=
99 GOSUE 1750 曰 GOTO 1410
1460 TF YOYY THEN 1480
4,0 TF $x(1,2)$ \& YO OF $x(1,2) \times Y$ THEN $E=$
1480 TF $x(J, 2) \times Y O$ OF $X(J, 2)$ Y THEN $E=$
99 EOSUE 1750 G GOTO 1410
1490 IF NOT MOD (J. 10 ) THEN GOSUE 1920
150 NEXT J
1510 FOF $9=5+1$ TO 60 区 $\times(1), \times(1,2)=0$
IG NEXT J

Determine routine to branch to based on input from line 1100
Read $x$－axis scale
Read y－axis scale
Loop for line data input
If new lines，skip conditional edit Set error trap for edit prompt

Determine routine to branch to based on input from line 1280

If exists，read old number of points
Store old number of points，set error trap for points input

If number of points is out of range， report error
Set fatal error trap
Store number of points，or
initialize file for their storage If points exist，read and skip array initialization routine Clear array

Loop for data point input

1430－1480：test to see if data point falls between scale minimum and maximum

If display is nearly full，clear it
Clear unused points

 （9）
1540 NEXT T
155 ASSIGN \＃ 1 TO＊
1560 GOTO 150 ！Bewt to the begimming． $1570!$
1580 ！Frompt to purge duplicete file 1590 ！
16 O TF NOT N THEN CAT Fis
1610 ON EFFOF GOSUE 1720 E EOTO 1620

畐 DTSF＂purge（y／n）＂：
ワ＂：A

$01620,1660,1640$
164 O FURGE F安
165 OETUFN
1660 FOF G GOTO 1 a ！EEwape the subro utime．
1670 ！
1680 ！Set error trap．
1690 ON EFFOF GOCUE $17 \boxed{O}$ E GOTO 150
1760 FETUFN
1710
1720 ！error detertion
1730 ！
$1740 \quad E=E F F N$
1750 ！
1760 E牛＝＂Unable to rum＂
1770 TF E＝16 THEN E $=1$＂Not Enough memor $y^{\prime \prime}{ }^{\prime \prime}$
1780 TF E＝S区 THEN E象＂Date typen＂
1790 TF E $=34$ THEN E $\mathrm{O}=$＂No datan＂
180 OF E＝42 THEN E象：＂String too 1ong．
＂
1810 TF E＝4天 THEN Eq＝＂Numerj 1820 IF E＝44 THEN E $\$=$＂Too many inputs． ＂
$18 \div 0$ TF E＝51 THEN ES＝＂FFTNT \＃to runfi 1e＂＂
1840 TF $E=57$ OF $E=58$ THEN ES＝＂T／O erro $r^{\prime \prime}{ }^{\prime \prime}$
1850 TF $E=62$ THEN E $=$＝$=$ File not found．＂ 1860 TF ESO AND ECG9 THEN ED＝＂File er ror＂＂
1870 IF E991 AND E 98 THEN E\％＝MMESS $s t$ orage error＂＂
1880 TF E＝98 THEN E事＂Not a plot file． ＂

1890 TF E＝99 THEN E $=$＝＂Imvalid paramete $!^{\prime \prime}{ }^{\prime \prime}$

Set fatal error trap Store data point array

Close file

Display duplicate file catalog Set error trap for file purge prompt

Determine which routine to branch to based on input from line 1620
Purge duplicate memory file
Don＇t accumulate return address on return stack if its not to be used

Set fatal error trap
Report error and restart program

Error report routine

## PROGRAM LISTING

190 EEEF 10 OO GTSF "Error " 8 BTF (E)
\%": "\%Eक WATT 2
1910 FETUFN
1720 !
190 ! Clear display


1950 RETUFN
1960 !
1970 ! End program
1980 DISF CHF象(27)8"E"\&WHFw (27) 8"H"; 1990 ASSIEN \# 1 TO * 2000 END

Clear ext display from second line

Clear display(s) and close data file

## PROGRAM LISTING

```
10 !
20 : Line plot program
OO HF-."5 Graphics Solutions Eook
40 ! February 198%
6% !
60 DTSF CHF%(27)%"Eline Flot"
7O OFTION EASE 1
80 !
```



```
1OO INTEGEFE E,T,J,F,L,LO,F,FI,S
11O FEAL. F, FI, X, XO, X1, X2, Y, YO, Y1, Y2
12O Fक="LTNEDATA" G Dक=""
130!
```



```
    label
150 FNL=O ON EFFOF FNL=1
160 FFTNT "FU:SF"8STF要(H*.24)%","%STFक
(H/2)8"""
170 FRTNT "DI"8STF手(F1)%"""&STF&(F2)%"
#"
180 FI=-1EN(S*)
190 TF F婁="F"" THEN FI=\cdotsF1
2OO TF Fक="C" THEN FI=F1/2
```



```
220 FFTNT "CF"&STF事(F1)8","&STF婁(F)8",
2\XiO FFTNT "LE"&S&&CHF%(Z)
240 END DEF
50 !
26O DEF FNM(X,Y) ! Move
270 FNN=O G ON EFFOF FNN=1.
280 FRTNT "FU"&STF名(X)&","&STR多(Y)&":"
290 END DEF
30!
S1O DEF FND (X,Y) ! Draw
SO FND=O O ON EFFOF FND=1.
SO STANDFY ON
#40 FFTNT "FD"&STFक(X)%":"8.STF串(Y)&":F
U!"
SGO STANDEY OFF
3O END DEF
30 !
380 GOSUR 1660 ! Clear display
390 GOSUB 1630 ! Set error trap.
400 INPUT "Data file name? ",F婁;F主
410 T.F F$="" THEN 1690 ! Duit on no in
put.
42O ON ERFOF GOSUE 1.490 E GOTO 4TO
4zO INPUT "Device sperifier"? ",Dक!D$
440 TF D串"" AND POS(D&,":")#1 THEN E=
GZ GOSUE 15NO G GOTO 4SO
4GO E=O TO ON EFFOF E=EFFFN
```

Identifies program and clears HP82183A specified as DISPLAY IS device（via control E）
Allocates string variables
Allocates integer variables
Allocates the real variables
Initialize file name and device specifier
Label function

No error：return 0；error：return 1
Send to plotter：pen up，set
relative character dimensions
Send to plotter：set label direction
180－200：determine label offset from coordinates in characters

Plotter：absolute coordinates X，Y
Send to plotter：offset from coordinates in character spacing
Send to plotter：plot text string

Move function
No error：return 0 ；error：return 1 Send to plotter：pen up，move to absolute coordinates $X, Y$

Draw function
No error：return 0；error：return 1
HP－IL timeout off for long lines
Send to plotter：pen down，move to absolute coordinates $X, Y$ ，pen up Restore timeout trap

If no file name，quit program

Set error trap for device specifier input
Test for invalid device specifier

46O TF Dक＝＂＂THEN WAT Fक ELSE OOFY D＊
TVF
470 DFF ERFOF
48 TF Dक＝＂＂ANO E THEN GOSUE 1510 E
OTO 280
490 TF Dक＝＂＂OF NOT E THEN 66
GOO TF E\＃64 THEN GOSUE 1510 GOTG TOO
！If not cuplicete file．
G10 CAT FS G ON EFFOF GOSUE 1490 G GOT $0 \quad 00$
曰 DTSF＂purge（y／n）＂： ＂A A

$20,580,540$
F40 FuFCF F
50 GOTO 4 EO ！Fetry comy
EO GOSU日 16 O ！Set error trep．
57\％ASSTGN \＃ 1 TO Fक FASIG
GO FEAD \＃ 1 ：A
 G0T0 उ母O

## 600 ！


 s


 बOTO 660
 SE $5=$

670 ！
б日，Flot titles．frame graph．
$67 \mathrm{FEAD} \# \mathrm{~A}$ E EW

○）THEN GOSUE 1470 G GTO 370
710 GOSUE 16 O ！Set error trap．
7 OO FEAD \＃ 1 E E

○）THEN GOSUE 1490 G GOTO 370
740 TF FNM（18OO， 7 FO ）THEN EOSUE 1490 世 GOTO
750 TF FND（ $1 \mathrm{OO} O 15 O)$ THEN GOSUE 1490
区 GOTO 7 O
760 IF FND（9900．6150）THEN GOSUF 1490
G EOTO Z 70
770 IF FNO（99OO， 7 FO ）THEN GOSUE 1490 世 GOTO $7 \%$
760 TF FNO（ $\mathrm{OO}, 7 \mathrm{FO}$ ）THEN EOSUE 1490 世 GOTM F


Test for file existence or attempt to copy

If memory file specified and not in memory，report error
If memory file，skip error routine If error other than dup file， report error
Display duplicate file catalog，set error trap for purge prompt

Determine routine to branch to based on input from line 520
Purge memory file
Set fatal error trap
Assign channel to data file
Read（supposed）file identifier If file is not line plot file，
report error and restart program

If not valid plot speed input， report error
640－650：determine plot speed

Send to plotter：initialize，plot absolute，select velocity，select pen 1
Read main title
Plot main title
Set fatal error trap
Read subtitle
Plot subtitle
740－780：frame plot

## PROGRAM LISTING

GOT FEAD \＃ 1 ：Eक

THN GOSUE 1490 G GOTO צ70
日е GOSUE 16 SO ！Set error trep．
日 O FEAD \＃ 1 \＃Eक

THEN GOSUE 1490 G GOTO 370
த50 EПSU日 16 O ！Set error trap．
B6O FEAD \＃ 1 ： $\mathrm{O}_{4} \times 1, \mathrm{Xe}_{4} \mathrm{YO}_{4} Y \mathrm{Y}$
870 ！

890 $F=8600 / A E S(x 1-\times 0) \quad \mathrm{a}=0$
900 FOF $I=1$ 区O TO 9900 STEF ABS（Xe＊F）
910 TF FNW（I，75O）THEN GOSUE 1510 E GO
TO 70
920 FFTNT＂XT＂

\％，1．O）THEN GOSUE $1 E 10$ GOTO 30
$940 \quad 7=7+1$
950 NEXT I
960
970！Flot $\gamma-\cdots+j=8$ tic labels．
980 GOSUE 16xO ！Set error trapn
$990 \mathrm{FI}=540 \mathrm{O} / \mathrm{ARS}(\mathrm{Y} 1-\mathrm{YO})$ 区 $\mathrm{J}=\mathrm{O}$
$100 \mathrm{FOF} \mathrm{T}=7 \mathrm{FO} \mathrm{TO} 615 \mathrm{OTEF}$ AES（Yอ＊F1）

60TO 370
10めの FFTNT＂YT＂

Y＊J），I．O）THEN GOSUE 1510 G GOTO 70
$1040 \quad J=\mathrm{J}+\mathrm{I}$
1OFO NEXT I
1060
1070 ！F1ot 1egends \％1．ines．
1080 GOSUE 16 SO ！Set：error trapu
1090 FEAD \＃ 1 ：
1100 FOF $T=1 . T O \quad 1$
1110 GOSUE 1630 ！Set error trapa
11 O FESTOFE \＃1．T＋G
11 OO FEAD \＃ 1 B
1140 FFINT＂SF141．．＂
1150 TF FNL（2． $0.1300+T *(6600 \backslash(1+1)), 68$ OO，＂C＂，O，Ew，1．O）THEN GOSUE 1490 G GOT 0370
1160 б05uF 1630 ！Set error trap．
1170 FEAD \＃ 1 B $\boldsymbol{H}_{4} 1 \mathrm{O}_{4} \mathrm{~F}$
1180 TF FNL（2， $6,1300+\mathrm{T} *(86001(\mathrm{~L}+1)), 68$
 TO 570
 8＂＂

Read $x$－axis title
Plot x－axis title
Reset fatal error trap
Read y－axis title
Plot y－axis ttile
Reset fatal error trap
Read $x$－and $y$－scale values

Scale factor／label value counter
Loop to plot and label x－tics
Move to tic location
Send to plotter：plot x－tic Label tic

Increment label value counter

Reset fatal error trap
Scale factor／label value counter
Loop to plot and label y－tics
Move to tic location
Send to plotter：plot y－tic
Label tic
Increment label value counter

Reset fatal error trap
Read \＃of lines
Loop to plot lines and line legends
Reset fatal error trap
Read upper legend
Pen 1，solid line
Plot upper legend

Reset error trap
Lower legend，line type，pen value
Plot lower legend

Plotter：select line type and pen

## PROGRAM LISTING

120 TF FNM（1000＋T＊（8600（1＋1）），6400）
THEN GOSUE 1490 GOTO $\triangle 70$
1210 IF FND（ $1600+1 *(8600(1+1)), 6400)$
THEN GOSUE 1490 G GOTO $\because 70$
1220 ！
12उO GOSUE 1630 ！Set error trap．
1240 FEAD \＃1，$I+50$ ：
1250 FEAD \＃ $1, I * 100: X_{4} Y$
1260 IF XO2X1 THEN 1500
1270 IF YO＜Y1 THEN 1290
1280 TF FNM（AES（XO－X）＊F＋1300． $6150-\mathrm{AES}$（
Y（1－Y）＊FI）THEN GOSUB 1490 G GOTO $\because 70$ E
LSE 1340
1290 IF FNM（ABS（XO－X）＊F＋1300． $750+A E S(Y$ O－Y）＊F1）THEN GOSUE 1490 G GOTO 370 EL SE $1 \leq 40$
130 IF YOYI THEN 1 OO
1310 IF FNM（9900－AES（X1－X）＊F，6150－AES（
Y1．－Y）＊F1）THEN GOSUE 1490 G GOTO 77 E
LSE 1340
1320 IF FNM（9900－AES（X1－X）＊F，750＋AES（Y
O－Y）＊F1）THEN GOSUE 1490 G GOTO 370 EL．
SE 1340
130 ！
1340 FOR J＝1 TO ド－ 1
1350 GOSUB 1630 ！Set error trap．
1360 FEAD \＃ $1: X_{n} Y$
1370 IF $\times 0 . \times 1$ THEN 1410
1380 IF YOYY1 THEN 1400
1390 IF FND（ABS（XO－X）＊F＋13OO， $6150-A E S($
$Y(\cdots-\cdots)$＊F1）THEN GOSUE 1490 G GOTO $\because 70$ E
LSE 1440
1400 IF FND（ABS（XO－X）＊F＋13OO， $750+A B S$（Y O－Y）＊F1）THEN GOSUE 1490 EOTO $\because 70$ EL SE 1440
1410 IF YOYY THEN 1430
1420 IF FND（ $9700 \mathrm{AES}(X 1-X) * F, 6150 \cdots \mathrm{ABS}($
Y1－Y）＊F1）THEN GOSUE 1490 G GOTO $\because 70$ E
LSE 1.440
1430 JF FND（ $9700 \cdots \mathrm{AES}(X 1 \cdots X) * F, 750+A E S(Y$ O－－Y）＊F1）THEN GOSLIE 1490 G GOTO 370 EL．
SE 1440
1440 NEXT J
1450 NEXT I
1460 ！
1470 FRINT＂FUO，O；SF；＂
1480 GOTO 1690 ！Clear display，end．
1490 ！
1500 E＝ERFKN
1510 ！
1520 E $\$$ x＂Unable to run．＂
1530 IF E＝3．3 THEN E虹＂Data type．＂


1200－1210：sample line for legend

Reset fatal error trap
Read \＃of data points Read first data pair 1260－1320：move to scaled location

Loop to plot data points
Reset fatal error trap
Read next data pair
1370－1430：plot scaled location

Plotter：absolute coordinates 0,0 End program Error report routine

## PROGRAM LISTING

```
|FO TF E=4% THEN Es="String too lomg.
|
156O IF E=4% THEN E$="Numeric: inmuta"
157O TF E=44 THEN E%="Too many inputs."
"
158O TF E=62 THEN Eक="Fine not foumd:"
IE9O TF E=6\Xi THEN Eb="Invelid fi lespec
""
16OO TF E=99 THFN E变="Tmvelid paramete
r" "'
1610 BEEF 10OO E DTSF "Error "夕巨TF% (E)
*": "%Eक 要 WATT ?
1620 FETUFN
16%O!
164O ON EFFOF GOSUE 149O G EOTO उ8O
165O FETUFN
1660 !
1670 DTSF CHF#(27)8"%"%CHF* (O)8CHFक(2)
%CHFक(27)%"J"%
1680 FETUFN
1690 !
1700 DTSF CHF*(27) %"E"8CHF$(27)%"H"#
1710 ASSTGN # 1 TO *
17%O FND
```

Fatal error routine Report error，restart program

Clear external display second line

Clear display（s），close data file

# PROGRAM DESCRIPTION 

## BAR CHART

What the Programs are Designed To Do:
The BAR CHART plotting package consists (as does each package in this Solutions Book) of two programs: a file creation/editing program and a plotting program. The editing program prompts the user for inputs by which data files that contain the information necessary to create plots using the HP 7470A plotter are created. The plot program translates these data files into the appropriate HP-GL* commands to create plots with the plotter. The programs are recorded on the included magnetic cards under the file names "BEDIT" and "BPLOT" respectively.

The package allows the user to plot single-page, multiple bar charts. (The package should work with either the HP-IL option of the HP 7470A plotter or with other interface options if the appropriate interconnect device is used.) The axes are not movable: the x-axis is located at the bottom and the y-axis is at the extreme left side of the plot. The axes may be labeled, as may the plot as a whole (with a "main title" and "subtitle"). The user may select between six hatch types and two pen colors for use in plotting the bars. Each bar type has a legend by which it may be described.

The programs interface nicely with mass storage and display devices. The programs work especially well with the HP 82163 Video Interface if it is specified as the DISPLAY IS device. Printers are not supported by the programs because of the nature of the plotter interface. The plotter must be addressed as the PRINTER IS device and therefore no other printer device may be accessed while running the programs.

* Hewlett-Packard Graphics Language - see your HP 7470A Interfacing and Programming Manual.


## SAMPLE PROBLEM

The following example assumes that the user has loaded the edit and the plot programs into memory under the file names "BEDIT" and "BPLOT" respectively. The example also assumes that the file "BARDATA" does not exist in memory, that the HP 7470A is on the HP-IL interface, that it has been assigned a device specifier and has been specified as the printer device (via the PRINTER IS command).

| DISPLAY | KEYSTROKES |
| :---: | :---: |
|  | run "bedit" [RTN] |
| Bar Plot File Creation |  |
| The initial prompts are straight forward. We would like to create a new plot file and will use the default data file name "BARDATA". |  |
| New, old file, quit (n/o/q)? n [RTN] <br> New data file name? BARDATA [RTN] |  |
|  |  |
| Since the file is new, it is empty. We must supply values for the plot's titles, and set the y-scale values. The titles used in this example are superfluous. The scale used for the y-axis is the range 0 to 100 in steps of 10. |  |
| Main title: | Main Title [RTN] |
| Subtitle: | Subtitle [RTN] |
| X axis title: | $X$ Axis [RTN] |
| $Y$ axis title: | Y Axis [RTN] |
| Y min,max,inc.: 0,0,0 | 0,100,10 [RTN] |
| Number of bars, levels: 1,1 4,3 [RTN] |  |
| Once the number of bars and bar levels are specified, descriptive legends, hatch types and pen color must be chosen for each bar. The legend titles in the example are superfluous. We will select hatch type 2 and default pen 1 (the left-hand pen of the HP 7470A) for level one. For level two we will select hatch type 3 and pen 2 (the right-hand pen of the HP 7470A). For level three we will select hatch type 4 and pen 1. |  |

KEYSTROKES

```
Upper legend #1:
Lower legend #1:
Hatch type & pen #1: 1,1
Upper legend 非:
Lower legend 非:
Hatch type & pen 非: 2,1
Upper legend 非3:
Lower legend 非3:
Hatch type & pen #3: 3,1
```

Level 1 ［RTN］
［RTN］
2 ［RTN］
Level 2 ［RTN］
（second set）［RTN］
3，2［RTN］
Level 3 ［RTN］
（third set）［RTN］
4 ［RTN］

Each group of bars on the x－axis may be titled．

| X label 1？ | Group 1［RTN］ |
| :--- | :--- |
| X label 2？ | Group 2［RTN］ |
| X label 3？ | Group 3［RTN］ |
| X label 4？ | Group 4 ［RTN］ |

Each bar must have a height that is specified by its y coordinate．Note that all of the heights specified must fall within the range 0 to 100 in accordance with the scale selected above．Values outside this range would be rejected by the program．

Level 1，bar 1： $0 \quad 10$［RTN］
Level 1，bar 2： $0 \quad 20$［RTN］
Level 1，bar 3： $0 \quad 30$［RTN］
Level 1，bar 4： 0
40 ［RTN］
Level 2，bar 1： 0
20 ［RTN］
Level 2，bar 2： 0
Level 2，bar 3： 0
Level 2，bar 4： 0
Level 3，bar 1： 0
Level 3，bar 2： 0
Level 3，bar 3： 0
30 ［RTN］
40 ［RTN］
50 ［RTN］

Level 3，bar 4： 0

Group 1 ［RTN］
Group 2 ［RTN］
Group

30 ［RTN］
40 ［RTN］
50 ［RTN］
60 ［RTN］

Once all of the heights for all of the bars are specified， the program cycles to permit either the creation of a new file or the editing of an old file．In this case，we will go back to modify the file just created．An existing file may reside on a mass storage device，so the program asks for the device specifier．No input for the device specifier indicates that the file exists in HP－75 memory． The file is found and its catalog information is displayed for user verification．（＂tt：tt dd／dd／dd＂in the example represents the time and date display corresponding to the file＇s creation time．）

## SAMPLE PROBLEM

New, old file, quit ( $\mathrm{n} / \mathrm{o} / \mathrm{q}$ ) ? n

- [RTN]

Old data file name? BARDATA
[RTN]
Device specifier?
[RTN]
BARDATA B 370 tt:tt dd/dd/dd
The user is asked whether or not the plot titles and scales are to be edited. We answer "yes". The existing values are redisplayed for editing. The value for the main title is changed by typing the new title over the old. Existing values are retained by pressing [RTN] as they are displayed.

```
Edit titles & scale (y/n/q)? n
Main title: Main Title
Subtitle: Subtitle
X axis title: X Axis [RTN]
Y axis title: Y Axis
Y min,max,inc.: 0,100,10
y [RTN]
Fun and Games [RTN]
[RTN]
    [RTN]
```

    Since we may not want to change the legends, hatch types and
    pens, the program asks us. In this case we do: a value for
    lower legend 1 is added. The other values are retained by
    pressing [RTN].
    Number of bars, levels: 4,3
[RTN]
Edit legends ( $\mathrm{y} / \mathrm{n} / \mathrm{q}$ )? n
y [RTN]
Upper legend \#1: Level 1
[RTN]
Lower legend \#1:
Hatch type \& pen \#1: 2,1
(first set) [RTN]
[RTN]
Upper legend \#2: Level 2
[RTN]
Lower legend 非2: (second set)
[RTN]
Hatch type \& pen \#2: 3,2
[RTN]
Upper legend \#3: Level 3
[RTN]
Lower legend 非3: (third set) [RTN]


We opt to change neither the x-axis labels nor the values for the heights of the bars.

Edit $x$-axis labels ( $\mathrm{y} / \mathrm{n} / \mathrm{q}$ )? n
[RTN]
Edit bar data ( $y / n / q$ ) $n$
[RTN]

The program recycles and we choose to quit.

New, old file, quit (n/o/q)? n
q [RTN]
Having created a data file, we choose to plot the information. The default file name is that of our file (since we chose the default in the edit program) and it still exists in memory. We are asked whether the bars are to be stacked or grouped. First we will choose grouped, later we will repeat the plot with stacked bars for the sake of comparison. We are given a choice of plotting speeds: fast, medium and slow. We choose fast.
run "bplot"
Bar Plot
Data file name? BARDATA [RTN]
Device specifier?
[RTN]
BARDATA B 384 tt:tt dd/dd/dd
Stacked or grouped plot ( $\mathrm{s} / \mathrm{g}$ )? g
[RTN]
Plot speed (f/m/s) ? s
f [RTN]
The program procedes to generate the plot. When through, it recycles and prompts for a new data file. We will rerun the program plotting the bars as stacked.

Data file name? BARDATA
[RTN]
Device specifier?
BARDATA B 384 tt:tt dd/dd/dd
Stacked or grouped plot (s/g)? g [RTN]
Plot speed ( $\mathrm{f} / \mathrm{m} / \mathrm{s}$ ) ? s
[RTN]
f [RTN]

Note after the plot has finished that the bars labeled "Group 3" and "Group 4" meet the top of the plot. The stacking of these bars has caused them to exceed the specified scale. This fact is signified by the label "(Range Error)" in the upper right-hand corner of the plot. The offending bars are marked with a dot between the x-axis and the bar's x-axis title.

At this point, the program has returned to the data file prompt. Inputting no name will cause the program to terminate.

Data file name? BARDATA
[CLR][RTN]
$\operatorname{six} \forall \lambda$
$\operatorname{arang}$ crace

Type number

## CREATING A NEW FILE

STEP (NEW) 1:

```
Bar Plot File Creation
```

This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (NEW) 2:
New, old file, quit (n/o/q)? n n, o or q [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file. The prompt also gives the option of quitting the program without manipulating a data file. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared.

The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "new", "old" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not n , o or q) will generate an error and cause the prompt to be repeated. Select " $n$ " to create a new file (" $n$ " is the default, so just press [RTN]).

STEP (NEW) 3:
New data file name? BARDATA
8 character string [RTN]
This prompt requests the name of the data file to be created. Any string of up to 8 characters, upper or lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be
repeated. An invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "BARDATA" will be displayed any time the program is RUN or the program has cycled and "BARDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

If main memory is specified (by no input) and a file of the same name exists in memory, the catalog information of the existing file will be displayed and the user will be asked if the file is to be purged.
'filename' exists in memory, purge ( $\mathrm{y} / \mathrm{n}$ )? n

An affirmative response will purge the file and continue the program at step (NEW) 4. A negative response will cycle the program to step (NEW) 2 of the User Instructions without affecting the existing file. ('filename' in the above example will be replaced by the actual file name.)

STEP (NEW) 4:
Main Title:
up to 50 characters [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted parallel to the x-axis along the top of the graph. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 5:
Subtitle:
up to 50 characters [RTN]
The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and
quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted parallel to the $x$-axis immediately below the main title (or immediately below the place the main title would be). Pressing [RTN] with no input is acceptable and will cause no subtitle to be plotted.

STEP (NEW) 6:
X axis title:
up to 50 characters [RTN]
The program is asking for the title of the $x$-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately below the x-axis. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 7:
Y axis title: up to 50 characters [RTN]
The program is asking for the title of the y-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately to the left of the y-axis. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 8:
Y min,max,inc.: $0,0,0$
3 numeric values [RTN]
This prompt requests the scaling of the y-axis and requires three numeric inputs separated by commas. The first value to be input is the bottommost $y$ value to be plotted. It may be negative or positive, integer or real. The second input value is the topmost $y$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest y values, respectively. The program will allow the bottommost point on the $y$-axis $(y-m i n)$ to be larger than
the topmost point (y-max). A plot in which the y-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $y-m i n$ and $y-m a x$ is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

The third input value is the $y$ increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of $y-m i n$ and $y$-max. The magnitude of the increment must be less than or equal to the distance between $y-m i n$ and $y$-max. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $y$-max is greater than that of $y-m i n$ (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $y-m i n$ is greater than that of $y-m a x$ (a decrease), the increment must be negative. A valid example is 5,-5,-1. The increment value cannot be zero.

All tics will be labeled with their y-coordinate. Tics should be spaced wide enough that the labels do not overlap.

STEP (NEW) 9:

Number of bars, levels: 1,1
two integers [RTN]
The program is asking for the number of bars and levels to be plotted. Valid input for the number of bars is an integer between 1 and 50. Valid input for the number of levels is an integer between 1 and 14. All other inputs will generate an error and cause the prompt to be repeated. The program can store up to 50 different bar groups, but the physical limitations of the plot will not support this extreme. For example, more than 10 or 12 bar groups will cause crowding of the legends and with 2 pens and 6 hatch types only 12 distinct bars can be drawn.

STEP (NEW) 10:

Upper legend \#1: up to 50 characters [RTN]
The program is asking for the first half of the descriptive label for line 1. This may be any string of text,

## excluding commas，semicolons and quotation marks，of up to

 50 characters．It will be plotted parallel to and immediately below the subtitle．Erroneous inputs （containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated． Pressing［RTN］with no input is acceptable and will cause no upper legend to be plotted．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．STEP（NEW）11：

## Lower legend \＃1：

up to 50 characters［RTN］
The program is asking for the second half of the descriptive label for line 1．This may be any string of text，excluding commas，semicolons and quotation marks，of up to 50 characters．It will be plotted parallel to and immediately below the upper legend．Erroneous inputs （containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated． Pressing［RTN］with no input is acceptable and will cause no lower legend to be plotted．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．

STEP（NEW）12：
Hatch type \＆pen $⿰ ⿰ 三 丨 ⿰ 丨 三 ⿻ ⿻ 一 𠃋 十 一 ~ 1: ~ 1,1 ~$
2 integers［RTN］
The program is asking for the hatch type and pen number． Valid hatch type values are integers between 1 and 6 while valid pen numbers are 1 and 2．All other inputs will generate an error and cause the prompt to be repeated．A list of the hatch types can be found on page 51．Pen \＃1 is the left－hand pen on the HP 7470A plotter while pen \＃2 is the right－hand pen．

Steps（NEW） 10 through 12 will be repeated for each line as specified by step（NEW） 9.

STEP（NEW）13：
X label 1？
up to 50 characters［RTN］
Each group of bars may be labeled．This input may be a string of up to 50 characters excluding commas，semicolons

## USER INSTRUCTIONS

and quotation marks. Invalid inputs will generate an error message and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no label to be plotted. Note that to prevent crowding, many fewer than 50 characters should be used based on the number of labels to be plotted.

This prompt will be repeated for each group of bars as specified in step (NEW) 8.

STEP (NEW) 14:
Level 1, bar 1: 0
a real number [RTN]
Each bar must have a height to be plotted. Note that all of the heights specified must fall within the range specified in step (NEW) 8 or an error will be generated and the prompt repeated. No check is made to see if the accumulated bar heights would excede the scale if the bars were to be stacked. The prompt is repeated for each bar in each level as specified in step (NEW) 8.

Once all of the heights for all of the bars are specified, the program will cycle back to step (NEW) 2 to permit either the creation of a new file or the editing of an old file.

## EDITING AN EXISTING FILE

| DISPLAY | KEYSTROKES |
| :--- | :--- |
| STEP (OLD) 1: |  |
| Bar Plot File Creation | run "bedit" [RTN] |

This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (OLD) 2:
New, old file, quit ( $n / o / q$ )? $n \quad n$, o or q [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file. The prompt also gives the option of quitting the program without manipulating a data file. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared.

The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "new", "old" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $n$, o or q) will generate an error and cause the prompt to be repeated. Select "o" to edit an existing file.

STEP (OLD) 3:
Old data file name? BARDATA
8 character string [RTN]
This prompt requests the name of the data file to be manipulated. Any string of up to 8 characters, upper or lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation

## USER INSTRUCTIONS

## DISPLAY

KEYSTROKES
marks will generate an error message and cause the prompt to be repeated. A string that represents an invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "BARDATA" will be displayed any time the program is RUN or if the program has cycled and "BARDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

STEP (OLD) 4:
Device specifier? ":" \& 2 characters [RTN]
Since the old file may exist on some external mass storage device and not in memory, the program asks for the device specifier of the mass storage device. If no device specifier is input, the file is assumed to exist in memory. Device specifiers are of the form ":ab" where "a" is any alphabetical character and "b" is any alphanumeric character. The prompt will accept any input of up to 3 characters.

Any invalid input (string too long, commas, semicolons or quotation marks, first character not ":") will generate an error and cause the prompt to be repeated. An invalid device specifier will not be detected until the program tries to access the device. At such a time, an error will be generated and control will be passed to step (OLD) 2. There is an unavoidable hazard that exists if an invalid device specifier is input or the file doesn't exist on the specified device and does exist in memory. The program will not detect the invalid device specifier or the nonexistent external file until it has detected the duplicate file name in memory. The catalog information of the existing file will be displayed and the user will be asked if the file is to be purged.

# USER INSTRUCTIONS 

'filename' exists in memory, purge ( $\mathrm{y} / \mathrm{n}$ )? n

An affirmative response will purge the memory file before the program has verified the existence or nonexistence of the external file. The user should therefore be relatively certain that the file specifier inputs are accurate. ("filename" in the above example will be replaced by the actual file name.) A response of " $n$ " will cycle the program to step (OLD) 2.

If the program has cycled and a device specifier has previously been input, the last used device specifier will be put into the display - even if it has caused an error. This default may be modified or removed before pressing [RTN] to accept the input.

STEP (OLD) 5:
Edit titles \& scale ( $\mathrm{y} / \mathrm{n} / \mathrm{q}$ )? n
$\mathrm{y}, \mathrm{n}$ or q [RTN]
Since the user may not desire to alter the values of the titles or scales, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or $q$ ) will generate an error and cause the prompt to be repeated.

A response of "y" will cause the program to continue at step (OLD) 6 while that of " $n$ " will continue at step (OLD) 11.

STEP (OLD) 6:
Main Title: old title
up to 50 characters [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or
quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted parallel to the x-axis along the top of the graph. Pressing [RTN] with no input will accept the old title (represented by "old title" in the example above). The main title may be omitted by clearing the input display.

STEP (OLD) 7:
Subtitle: old subtitle
up to 50 characters [RTN]
The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted parallel to the x-axis immediately below the main title (or immediately below the place the main title would be). Pressing [RTN] with no input will accept the old subtitle (represented by "old subtitle" in the example above). The subtitle may be omitted by clearing the input display.

STEP (OLD) 8:
$X$ axis title: old $x$-axis title up to 50 characters [RTN]
The program is asking for the title of the x-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately below the x-axis. Pressing [RTN] with no input will accept the old title (represented by "old $x$-axis title" in the example above). The title may be omitted by clearing the input display.

STEP (OLD) 9:
$Y$ axis title: old y-axis title up to 50 characters [RTN]
The program is asking for the title of the y-axis for the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters.

Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. It will be plotted parallel to and immediately to the left of the y-axis. Pressing [RTN] with no input will accept the old title (represented by "old $y$-axis title" in the example above). The title may be omitted by clearing the input display.

STEP (OLD) 10:

```
Y min,max,inc.: min,max,inc.
3 numeric values [RTN]
```

This prompt requests the scaling of the $y$-axis and requires three numeric inputs separated by commas. The first value to be input is the bottommost $y$ value to be plotted. It may be negative or positive, integer or real. The second input value is the topmost $y$ value to be plotted. It may be negative or positive, integer or real. The values are most commonly, but need not be, the smallest and largest y values, respectively. The program will allow the bottommost point on the $y$-axis ( $y-m i n$ ) to be larger than the topmost point (y-max). A plot in which the y-axis ranges from 100 to -100 is therefore allowed. The only restriction on the values of $y$-min and $y$-max is that they cannot be equal. Invalid inputs will generate an error and cause the prompt to be repeated.

The third input value is the $y$ increment. This value specifies the distance between subdivisions (tic marks) on the axis. The input value is restricted by the values of $y-m i n$ and $y-m a x$. The magnitude of the increment must be less than or equal to the distance between $y-m i n$ and $y$-max. An input of $0,100,101$ is therefore not allowed. The arithmetic sign of the increment must also agree with direction of increment. If the value of $y$-max is greater than that of $y$-min (an increase), the increment must be positive. A valid example is $-5,5,1$. If the value of $y-m i n$ is greater than that of $y-m a x$ (a decrease), the increment must be negative. A valid example is 5,-5,-1. The increment cannot be zero.

All tics will be labeled with their y-coordinate. Tics should be spaced wide enough that the labels do not overlap.

Pressing [RTN] with no input will accept the existing values (represented by "min,max,inc." in the example above).

STEP (OLD) 11:
Number of bars, levels: old \# bars, levels two integers [RTN]
The program is asking for the number of bars and levels per bar to be plotted. Valid inputs are two integers where the number of bars is greater than 0 and the number of levels is between 1 and 14. All other inputs will generate an error and cause the prompt to be repeated.

Pressing [RTN] with no input will accept the existing values (represented by "old" \# of bars, levels in the example above).

The program is capable of generating either stacked or grouped bar charts. When dealing with stacked bars, each complete bar is referred to as a bar and each section of the bar is referred to as a level. When dealing with grouped bars, each group is referred to as a bar and each bar in a group is a level.

STEP (OLD) 12:
Edit legends ( $\mathrm{y} / \mathrm{n} / \mathrm{q}$ ) ? n

$$
y, n, \text { or } q[R T N]
$$

Since the user may not desire to alter the values of the legends, hatch types or pens, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$ or q) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of levels in step (OLD) 11 will skip this option and execution will continue with step (OLD) 13.

KEYSTROKES

A response of＂y＂will cause the program to continue at step（OLD） 13 while that of＂$n$＂will continue at step（OLD） 16.

STEP（OLD）13：
Upper legend \＃1：old legend
up to 50 characters［RTN］
The program is asking for the first half of the descriptive label for level 1．This may be any string of text， excluding commas，semicolons and quotation marks，of up to 50 characters．It will be plotted parallel to and immediately below the subtitle．Erroneous inputs （containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated． Pressing［RTN］with no input will accept the current value （represented by＂old legend＂in the example above）．The legend may be omitted by clearing the input display．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．

STEP（OLD）14：

Lower legend \＃1：old legend
up to 50 characters［RTN］
The program is asking for the second half of the descriptive label for level 1．This may be any string of text，excluding commas，semicolons and quotation marks，of up to 50 characters． It will be plotted parallel to and immediately below the upper legend．Erroneous inputs（containing commas，semicolons or quotation marks）will generate an error and cause the prompt to be repeated．Pressing［RTN］with no input will accept the current value（represented by＂old legend＂in the example above）．The legend may be omitted by clearing the input dis－ play．Note that to prevent crowding，many fewer than 50 characters should be used based on the number of legends to be plotted．

STEP（OLD）15：
Hatch type \＆pen $⿰ ⿰ 三 丨 ⿰ 丨 三 一$ 1：hatch，pen 2 integers［RTN］

The program is asking for the hatch type and pen number． Valid hatch type values are integers between 1 and 6 while

## USER INSTRUCTIONS

valid pen numbers are 1 and 2. All other inputs will generate an error and cause the prompt to be repeated. A
 the left-hand pen on the HP 7470A plotter while pen 非2 is the right-hand pen. Pressing [RTN] with no input will accept the current value (represented by "hatch, pen" in the example above).

Steps (OLD) 13 through 15 will be repeated for each level as specified by step (OLD) 11.

STEP (OLD) 16:

Edit x-axis labels (y/n/q)? $n$
$\mathrm{y}, \mathrm{n}$, or q [RTN]
Since the user may not desire to alter the values of the $x$-axis labels, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or $q$ ) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of bars in step (OLD) 11 will cause this option to be skipped and execution will continue with step (OLD) 17.

A response of "y" will cause the program to continue at step (OLD) 17 while that of "n" will continue at step (OLD) 18 .

STEP (OLD) 17:

X label 1? old label
up to 50 characters [RTN]
Each group of bars may be labeled. This input may be a string of up to 50 characters excluding commas, semicolons and quotation marks. Invalid inputs will generate an error message and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no label
to be plotted. Pressing [RTN] with the default (current) input will cause the current x-axis label to be plotted. Note that to prevent crowding, many fewer than 50 characters should be used based on the number of labels to be plotted.

This prompt will be repeated for each group of bars as specified in step (OLD) 11.

STEP (OLD) 18:
Edit bar data ( $\mathrm{y} / \mathrm{n} / \mathrm{q}$ )? n
$\mathrm{y}, \mathrm{n}$, or q [RTN]
Since the user may not desire to alter the heights of the bars, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response. Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y, n$, or $q$ ) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of bars or levels in step (OLD) 11 will cause this option to be skipped and execution will continue with step (OLD) 19.

A response of "y" will cause the program to continue at step (OLD) 19 while that of " $n$ " will continue at step (OLD) 2.

STEP (OLD) 19:
Edit level $1(y / n / q) ? n \quad y, n$, or $q$ [RTN]
Since the user may not desire to alter the values of the points in level 1, the program gives you the choice of skipping them or of quitting all together. If the latter option is selected, both the HP-75's display and the specified DISPLAY IS device are cleared. The prompt will accept any input string of up to 4 characters. Only the first character is used in the evaluation of the response.

## USER INSTRUCTIONS

Therefore, responses such as "yes", "no" and "quit" are acceptable. The strings may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons, first character not $y$, $n$, or q) will generate an error and cause the prompt to be repeated.

Note that an increase in the number of bars in step (OLD) 11 will skip this option and execution will continue with step (OLD) 20.

A response of "y" will cause the program to continue at step (OLD) 20 while that of " n " will continue at step (OLD) 2.

STEP (OLD) 20:
Level 1, bar 1? old value real number [RTN]
Each bar must have a height to be plotted. Note that all of the heights specified must fall within the range specified in step (OLD) 10 or an error will be generated and the prompt repeated. No check is made to see if the accumulated bar heights would excede the scale if the bars were to be stacked. The prompt is repeated for each bar in each level as specified in step (OLD) 11.

Once all of the heights for all of the bars are specified, the program will cycle back to step (OLD) 2 to permit either the creation of a new file or the editing of an old file.

## PLOTTING

## DISPLAY

STEP (PLOT) 1:
run "bplot" [RTN]
Bar Plot
This output identifies the program and will remain in the display for the duration of the DELAY specified by the user. If the the HP 82163 Video Interface is used, this display will appear at the top of the CRT and will remain there for the duration of the program.

STEP (PLOT) 2:
Data file name? BARDATA 8 character string [RTN]
This prompt requests the name of the data file to be manipulated. Any string of up to 8 characters, upper or lower case, will be accepted. Strings longer than 8 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. A string that represents an invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name "BARDATA" will be displayed any time the program is RUN or if the program has cycled and "BARDATA" was the last file name used. Otherwise, the last file name specified (even if it caused an error) will be displayed. The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input. No input indicates that you want to quit the program. If the input display is empty when you press [RTN], the display(s) are cleared and the program ends.

## USER INSTRUCTIONS

STEP (PLOT) 3:
Device specifier?
":" \& 2 characters [RTN]
Since the file may exist on some external mass storage device and not in memory, the program asks for the device specifier of the mass storage device. If no device specifier is input, the file is assumed to exist in memory. Device specifiers are of the form ":ab" where "a" is any alphabetical character and "b" is any alphanumeric character. The prompt will accept any input of up to 3 characters.

Any invalid input (string too long, commas, semicolons or quotation marks, first character not ":") will generate an error and cause the prompt to be repeated. An invalid device specifier will not be detected until the program tries to access the device. At such a time, an error will be generated and control will be passed to step (PLOT) 2. There is an unavoidable hazard that exists if an invalid device specifier is input or the file does not exist on the specified device and does exist in memory. The program will not detect the invalid device specifier or the nonexistent external file until it has detected the duplicate file name in memory. The catalog information of the existing file will be displayed and the user will be asked if the file is to be purged.
'filename' exists in memory, purge ( $\mathrm{y} / \mathrm{n}$ )? n

An affirmative response will purge the memory file before the program has verified the existence or nonexistence of the external file. The user should therefore be relatively certain that the file specifier inputs are accurate. ("filename" in the above example will be replaced by the actual file name.) A response of " n " will cycle the program to step (OLD) 2.

If the program has cycled and a device specifier has previously been input, the last used device specifier will be put into the display - even if it has caused an error. This default may be modified or removed before pressing [RTN] to accept the input.

STEP (PLOT) 4:
Stacked or grouped plot $(\mathrm{s} / \mathrm{g}) ? \mathrm{~g} \quad \mathrm{~s}$ or g [RTN]
The program is asking whether the plot is to be stacked or grouped. Only "s" or "g" may be input. All other inputs will cause an error and the prompt will be repeated.

Note that the input data can always be used to generate a grouped plot because all bar heights are checked on input to ensure that they are within the range specified for the y-axis. If the user has specified a y-axis range that is large enough to accomodate stacking of the bars, the stacked option may be chosen. If the stacked option is chosen and stacking causes a range error, the plot will continue but "(Range Error)" will be plotted in the upper right-hand corner of the page and the offending bar will be marked with a "." immediately above its x-axis label. In such a case, the user may use the "edit" program to alter the y-axis scale and replot the chart.

## STEP (PLOT) 5:

Plot Speed (f/m/s)

$$
\mathrm{f}, \mathrm{~m} \text { or } \mathrm{s}[\mathrm{RTN}]
$$

The program is asking whether it should plot fast, medium or slow. The selection is mostly user preference, but a slow speed may be required to prevent pen skipping on such things as slides for overhead projectors. Only "f", " $m$ " and "s" are allowed inputs. All other inputs will generate an error and cause the prompt to be repeated.

The program continues from here to generate the plot. When finished, execution will continue at step (PLOT) 2.

## PROGRAM DETAIL

## ERROR MESSAGES

| Number | Message | Description |
| :---: | :---: | :---: |
| 16 | Not enough memory. | Not enough memory exists in order to create or expand the data file. |
| 33 | Data type. | The information read from the data file is not of the correct type. |
| 34 | No data. | The program tried to read from the data file at a location in which no data is stored. |
| 42 | String too long. | The text the user has input is longer than that allowed by the prompt. |
| 43 | Numeric input. | The user entered text in response to a numeric prompt. |
| 44 | Too many inputs. | Either too many numeric inputs were specified or commas or semicolons were entered in a text string. |
| 51 | PRINT \# to runfile. | The plot file specified is actually the current program file. |
| 57 \& 58 | I/O error. | An error occurred when trying to access the HP-IL interface. |
| 62 | File not found. | The specified data file was not found either in memory or on the specified mass storage device. |
| 63 | Invalid filespec. | Reported only by the plot program: the file name or device specifier is not legal. |

## PROGRAM DETAIL

| Number | Message | Description |
| :---: | :---: | :---: |
| 63-68 | File error. | An error occurred when trying to access the data file. |
| 92-97 | Mass storage error. | The mass storage device has malfunctioned. |
| 98 | Not a plot file. | The data file specified is not recognized as being a plot file. |
| 99 | Invalid parameter. | The value input is not in the range required by the prompt. |
| $n \mathrm{n}$ | Unable to run. | This is the default message when an error occurs that is not one of those listed above. The error number is reported so that the associated HP-75 error message can be determined. |

## PROGRAM DETAIL

Minimum byte requirement:

$$
\begin{aligned}
& \text { BEDIT }=5504 \\
& \text { BPLOT }=8426
\end{aligned}
$$

Variables:
the edit program

A\$[4]
$\mathrm{B} \$[50]$ contains the currently accessed title information.
contains the lower legend text.
the device specifier.
the error message.
the file name.
the number of bars.
an integer variable containing the current error number.
the hatch type.
an integer variable used as an index in several instances.
bar counter.
counter used to delete bars from the data file if the current number is smaller than the old number.
an integer variable containing the number of levels to be plotted.

N
an integer variable used as a flag to indicate whether or not the file is new. $1=$ new, $0=$ old.

## PROGRAM DETAIL

0
the plot program number of bars. number of levels. number.
the minimum $y$ scale value.
the maximum y scale value.
the $y$ scale increment.
$A \$[4] \quad$ the user's response to yes/no/quit and new/old/quit questions.
$B \$[50]$

C\$ [50]
$D \$[3]$

E\$[20]
F\$[8]

B
E

E1

F
an integer variable that contains the previous
an integer variable that contains the previous
an integer variable containing the pen
the height of the current bar.
contains the currently accessed title information.
contains the lower legend text.
the device specifier.
the error message.
the file name.
the number of bars.
an integer variable containing the current error number.
the plot error flag - indicates whether stacking has caused a range error.
the step distance in plotter units between hatch marks - used in FNH\$.

## PROGRAM DETAIL

| F1 | ```a real variable that contains the multiplication factor used to convert the y-axis scale to absolute plotter units.``` |
| :---: | :---: |
| G | cross hatching flag - used by FNH\$. |
| I, J, K | integer variables used as indices in several instances. |
| L | an integer variable containing the number of levels to be plotted. |
| L1 | the x-axis location in absolute plotter units of the lower left-hand corner of the bar. |
| L2 | the y-axis location in absolute plotter units of the lower left-hand corner of the bar. |
| P | an integer variable containing the pen number. |
| P1 | an integer variable containing the containing the plotting offset in characters. |
| R1 | the x-axis location in absolute plotter units of the upper right-hand corner of the bar. |
| R2 | the y-axis location in absolute plotter units of the upper right-hand corner of the bar. |
| S | an integer variable containing the plotting speed. |
| T | stacked plot flag. |
| Y | a real variable containing the height of current bar. |
| Y( ) | a real-valued, single dimensioned array containing the stacked height of the bars. |
| YO | a real variable containing the value of $y-m i n$. |
| Y1 | a real variable containing the value of $y$-max. |
| Y2 | a real variable containing the value of the $y$-increment. |

## PROGRAM DETAIL

Functions: (only the plot program contains user defined functions)
FNB\$ (L1,L2,R1,R2)
This function generates the plot of the bar perimeter. The parameters are the lower left xy coordinates and the upper right xy coordinates.

FNH\$ (L1,L2,R1,R2,H)

This function generates the plot of the bar hatching. The parameters are the lower left xy coordinates and the upper right $x y$ coordinates and the hatch type ( $\mathrm{H}=1$ to 6 ).

FNL\$ (H,X,Y,P\$,P,S\$[50],R1,R2)
This function generates all of the labels used in the plot. The parameter $H$ specifies the relative size of the characters. X and Y are the coordinates of the label in absolute plotter units. $\mathrm{P} \$$ is either "C", "L", or "R" indicating whether the label is to be centered, left justified or right justified with respect to the coordinates. $P$ is the offset in character heights of the label from the coordinates. $S \$$ is the text to be plotted. $R 1$ and $R 2$ are the rise and run of the label (i.e., the angle between R1 and R2 is the slope on which the label is plotted).

FNM\$ (X,Y)

This function moves the pen (in the up position) to the absolute plotter coordinates specified by $X$ and $Y$.

All of the above functions return the null string and are used solely for their parameter passing properties.

Data files:
A plot data file is organized as follows:
Line $1=$ contains the character "b" used to identify the file as a bar plot file.

Line 2 = contains the main title text.

Line 3 = contains the subtitle text.

Line 4 = contains the $x$-axis title text.
Line $5=$ contains the $y$-axis title text.
Line 6 = contains the y-axis scale values.
Line $8=$ contains the number of bars and levels to be plotted.

Lines 9 through $8+$ the number of levels = each line contains the legend text, hatch type and pen number for the corresponding bar.

Lines 51 through 50 + the number of bars = each line contains $x$-axis label for the corresponding bar.

Lines 100 through ( 100 * the number of levels) + the number of bars = the bar heights for the bars in each level are stored between lines numbered Level * 100 and (Level + 1) * 100 .

## PROGRAM LISTING

```
10 !
20 ! Ear olot file 氏reation program
OO ! HF-75C Graphic= Solutions Book
40 ! March 198%
G!
O0 DATA "Main title","Suttitie";"X axi
s title":"Y a<is title"
```



```
ion"
8O WTDTH TNF
```



```
],Fक[8]
1OO TNTEGFFE E,E,T, 工,F!, !N, O,O1,F
11O FEAL Y,YO,YL,Ye
12O F#="EAFDATA" # D古=""
10% !
140 ! File query
150!
160 GOSUE 1970 E GOSUF 1710 ! Clexr di
splay % set error trap
17O TNFUT "NEw, old file. quite (n/o/q)
?","п""A家
```



```
0150,190,170,2020
170 !
```



```
E N=O
21O ON EFFOF GOSUE 178O G GOTO 2,O
2\varrhoO TF N THEN DISF "NEW":ELSE DTSF "OI
d"
23 TNFUT " data file mame? "#F"争F事
24O ON EFFOF GOSUE 178O G GOTO DEO
EO TF NOT N THEN TNFUT "DEvice specif
i Er? ",Dक:Dक ELSE SGO
260 TF D事="" THEN उ40
27O IF FOS(D串,":")#1 THEN E=6马 E GOSUE
    1800 G G0TO 250
28O E=O E ON EFFOF E=FFFFN
29O TF N THEN CAT F% ELSE COFY D示 TO F
$
OO IF N AND NOT E THEN GOSUE 16SO ! D
uplicate file
\Xi1O TF N THEN 36O
\Xi2O IF E#G4 AND E THEN GOSUE IBOO E GO
TO 130 ! If not duplicate file error.
उO IF E THEN GOSUE 16SO E GOTO 2BO
340 BOSUE 1710 ! Set error trap.
उ5 CAT F京
OO GOSuF 1710 ! Set error trap.
Z7O ASSIGN # 1 TO FW, EASIC
OBO TF N THEN FFINT # 1 : "b" E GOTO 4
O
S9O FEAD # 1 : AD
```

Data for title input prompts－ see steps 440 to 580
Clear DISPLAY IS device and display program identifier
Eliminate default linefeeds Allocate strings

Allocate integer variables Allocate string variables Default file name and device specifier

Establish＂new file＂flag condition
On error display error message， repeat prompt

Display error，repeat prompt Prompt for device specifier only if file exists
If no input or new file，skip If bad device spec．．display message and repeat prompt
Initialize error flag
Find file
New file and no error on CAT means duplicate file
If＂new＂then skip＂old＂errors
If error not duplicate file，display
message and repeat prompt
Error is duplicate file－ask purge
File must be in main memory now
Open file
Store plot file identifier in first record of new file
Read first record of old file

## PROGRAM LISTING

 GOTO 150
410 ！
420 ！Titles
4 O ！
440 IF N THEN 490
450 ON EFFOF GOSUE 1780 E GOTO 460
460 GOSUE 1970 ！Clear display
470 JNFUT＂Edit tities \％scale（y／n／q） ？＂，＂n＂：A婁
480 ON FOS（＂YNQ＂，UFFCक（A\＆［1．1］））＋1 GOT
（0）460，490，710，2020
490 GOSUE 1970 GESTOFE 60 ！CIEar dj
splay，restore prompt deta．
500 FOF $T=2$ TO 5
S10 GOSUE 1710 ！Set error trap
520 IF NOT $N$ THEN FEAD \＃1：T：E\＆ELSE B 串＝＂＂
EXO READ C安
540 ON EFFOF GOSUB 1780 G GOTO 550

560 GOSUE 1710 ！Set error trep．
570 FRINT \＃1，I E Ew
580 NEXT I．
590 ！
600 ！Sceling
610 ！
62 IF NOT $N$ THEN FEAD \＃ $1.0: Y 0, Y 1, Y$
2 ELSE YO，Y1，Y2＝0
GZO ON ERFOR GOSUE 1780 GOTO 640
640 INFLIT＂Y min，max，inc．＂＂，STR串（YO）\＆
＂，＂\＆STFi（Y1）\＆＂，＂3STRक（Y2）：YO，Y1，Y2
650 IF SGN（Y2）\＃SGN（Y1－YO）THEN E＝99 E
GOSUB 1800 G GOTO 640
660 IF ABS（Y2）$\triangle A B S(Y 1-Y O)$ OF $Y O=Y 1$ OF
NOT Y2 THEN E＝99 E GOSUE 1800 E GOTO 6
40
670 GOSUE 1710 ！Set error trap．
680 PRINT \＃1．6：YO，Y1．Y2
690 ！
700 ！\＃of bars \＆levels
710 ！
720 GOSUB 1970 ！Clear display．
730 IF NDT $N$ THEN FEEAD \＃1， $8: B, L$ ELS
E E，L＝1
$740 \mathrm{O}=\mathrm{B}$ 区 $01=\mathrm{L}$
750 ON ERFOR GOSUB 1780 G GOTO 720
760 INFUT＂Number of bars，levels：＂， 5

770 IF $L<1$ OR $L>14$ OF $B<1$ THEN $E=99$ E
GOSUB 1800 G GOTO 720
780 GOSUE 1710 ！Set error trap
790 FRINT \＃1．8：E！L

First element of existing file must be＂b＂

If＂new＂，skip edit option
On error，repeat prompt

Record 2 through 5 of data file
Read the string if is exists
Read the input prompt
On error，repeat prompt

Store in the data file

Read the scale if it exists

On error，repeat prompt

If increment not in direction
of scale
If increment too large，$y$ max $=$ $y$ min or increment $=0$ ，then error

Store scale values in file

Read number of bars and levels if they exist

On error，repeat prompt

Values out of range，generate error

```
800
810 ！Clear old legends
820 ！
830 GOSUB 2OOO ！Set error trap．
840 FOR \(I=1+1\) TO O1．
850 FRINT \＃1．I +8 ！Clear old leqends
860 NEXT I
870 IF O．E THEN \(\because=0\) ELSE \(\because=E\)
```



```
FINT \＃1，1OO＊I＋J E NEXT J G NEXT I
890 IF \(01 \%\) THEN \(\because=01\) ELSE \(K=L\)
```



```
INT \＃1，100＊J＋I E NEXT J G NEXT I
910
920！Legends：hatch type：pen
930 ！
940 IF 1.801 OR \(N\) THEN 990
950 ON EFROF GOSUB 1780 E GOTO 960
960 GOSUB 1970 ！Clear display．
970 INFUT＂Edit legends（y／n／q）？＂，＂n＂
：A
980 ON POS（＂YNQ＂，UFRC\＆（A末［1．1］））＋1 GOT \(0960,990,1130,2020\)
990 FOR \(I=1\) TO L．
1000 GOSUB 1970 G GOSUE 1710 ！Clear d
isplay，set error trap．
1010 IF NOT \(N\) AND \(I<=01\) THEN READ \＃ 1.
```



```
\(I-1,6)+1\) \(\mathrm{E}=1\)
1020 ON ERROR GOSUE 1780 G GOTO 1030
1030 DISF＂Upper legend \＃＂\＆STR（I）：E
INFUT＂：＂，Bक ：E \(\$\)
1040 ON ERROF GOSUE 1780 G GOTO 1050
```




```
1060 ON ERROR GOSUB 1780 GOTO 1070
1070 DISF＂Hatch type \(\%\) pen \＃＂\＆STR事（I）
```



```
1080 IF \(H<1\) OR \(H ン 6\) OR F＜ 1 OR F 2 THEN
\(E=99\) G GOSUE 1800 玉 GOTO 1070
1090 FRINT \＃ \(1, I+\varepsilon ; B \notin, C \neq, H, P\)
1100 NEXT I
1110
1120 ！ X －axis labels
1130 ！
1140 IF E＞O OR N THEN 1210
1150 GOSUB 1970 ！Clear dimplay
1160 FOR \(I=E+1\) TO 0 © FRINT \＃ \(1.50+T\) E NEXT I
1170 ON ERFOR GOSUB 1780 E GOTO 1180
1180 GOSUB 1970！Clear Display
1190 INPUT＂Edit \(x-a x i s l a b e l s(y / n / q)\)
？＂，＂n＂A
```

From new number of levels to old Delete record
$K=\operatorname{Max}(0, B)$
Delete excess bars
$L=\operatorname{Max}(01, L)$
Delete excess levels

New or additional level，skip edit On error，repeat prompt

For each level

Read legend titles，match type and pen color if they exist

On error，repeat prompt

On error，repeat prompt

On error，repeat prompt

If inputs out of range，error
Store in data file

If new or additional bars，skip edit

## Delete extra bars

On error，repeat prompt

## PROGRAM LISTING

```
12OO ON FOS("YNO",UFRC& (A⿻⿱口口丨[[1,1]))+1 GO
TO 1180,1210,1210,2020
I210 GOSUE 1970 ! Clear Display
1220 6OSUE 1710
12SO FOF I=1 TO E
1240 IF NOT N AND I< =O THEN FEAD # 1,5
O+I : Eक ELSE E变=""
125O ON EFFOF GOSUE 1780 E GOTO 1260
1260 DISF "X label "&STFक(I):
1270 INFUT "? ",B婁!E串
1280 GOSUE 1710
1200 PRINT # 1,50+I ; E串
1300 NEXT I
1310 
1320 ! Ear data
130%!
134O IF LPO1 OF N OF EDO THEN 139O
135O ON EFFOF GOSUE 1780 G GOTO 1360
1S60 GOSUE 1970 ! Clear Display
1370 INPUT "Edit bar data (y/n/q)? ","
n":A串
1380 ON FOS("YNQ",UFRC& (A&[1,1]))+1 GO
T0 1360,1390,1580,2020
139O GOSUE 1970 E GOSUE 1710 ! Clear d
isplay % set error trap
1400 FEAD # 1.6 : YO,Y1.Y2
1410 FOF I=1. TO L
1420 IF I OO1. OR L=1 OR N OF EDO THEN I
470
14%O ON EFROR GOSUE 1780 E GOTO 144O
1440 GOSUB 1970 ! Clear display
1450 DISF "Edit level "&STR叓(I) &" (y/n
(q) ": ( INPUT "? ","n":A串
1460 ON POS("YNQ",UPRC& (A$[1,1]))+1 GO
TO 1440,1470,1570,2020
1470 GOSUB 1970 G GOSUB 1710 ! Clear d
isplay & set error trap
1480 FOR J=1 TO E
1490 IF I<=O1 AND NOT N AND J<=O THEN
READ # 1,100*I+J : Y ELSE Y=0
1500 ON ERROR GOSUB 1780 G GOTO 1510
1510 DISF "Level "&STR事(I)&", bar "&ST
R*(J); E INFUT "? ",STR要(Y);Y
1520 IF YO\Y1 THEN 1540
15%O IF Y<YO OR Y>Y1 THEN E=99 G GOSUB
    1800 G GOTO 1500 ELSE 1550
1540 IF Y>YO OR Y<Y1 THEN E=99 G GOSUB
    1800 E GOTO 1500
1550 GOSUE 1720 छֻ FRINT # 1,100*I+J ;
Y
1560 NEXT J
1570 NEXT I
```

Set error trap
For each bar
Read label if it exists
On error，repeat prompt

Set fatal error trap
Store label in file

If new facts or bars，skip edit On error，repeat prompt

Get scale values
For each level
If new level，skip edit
On error，repeat prompt

For each prompt
Get bar height，if it exists
On error，repeat prompt

If scale from high to low
Is height out of range？
If scale from low to high－ is height out of range？
Store height
Next bar
Next level
1580 !

159 ASSTEN \＃ 1 TO＊
1600 GOTO 150 ！Eact to the beginning． 1610 ！
$16 \%$ ：Furge duplicete file 1630 ！
1640 IF NOT N THEN CAT Fक
1650 ON EFFOF GOSUE 1770 G GOTO 1660
1660 DTSF＂：＂8F辂＂exists in memory＂＂
ヨ DISF＂purge（y／n）＂：
n＂：A事

$01660,1700,1680$
1680 FUFEF F＊
1690 FETUFN
1700 FOF G GOTO 130 ！Escepe the subro utine．
1710
1720 ！Set error trep
1730 ！
1740 ON EFFOF GOSUE 1780 EOTO 160
1750 FETLIFN
1760 ！
1770！error detection
1780 ！
1790 E＝FFFN
1800 ！
1810 E象＂Unable to run＂
182 O IF $E=16$ THEN E $⿻=1=$ Not Enough memor
$y^{\prime \prime}$

1840 JF E＝54 THEN E $=\mathbf{F}=$＂No data．＂

＂

1870 IF E＝44 THEN Eक＝＂Too many inputE．
＂
1880 TF E＝SI THEN EF＝＂FRINT \＃to runfi 1E＂
1890 TF $E=57$ OR $E=58$ THEN E $==" I / O$ erro
r．＂
1900 IF E＝S2 THEN E $\$=$＂File not found．＂
1910 IF ESG2 AND E 69 THEN E\＆＝＂File er ror．＂
1920 IF E971 AND Eく98 THEN Eq＝＂Mass st or age error．＂
1930 TF E＝98 THEN EF＝＂Not a plot file． ＂

1940 IF $E=99$ THEN EF＝＂Tnvalid paramete r＂＂
1950 EEEF 1000 E DISF＂Error＂ 8 STF（E） \％＂，＂8E中 WATT 2
1960 FETUFN
1970 ！

Close file

On error，repeat prompt

Report error，restart at beginning of program

Save error number
Default error message

## PROGRAM LISTING

```
1980 ! C1ear display
1990!
2000 DISF CHFक (27)&"%"%CHFw(O)&CHFक(2)
8CHF事(27)名"J":
2010 FETUFN
2020!
2080 ! End program
2040 !
250 DTSF CHF争(27)%"E"&CHF㤩(27)%"H";
2O60 ASSIGN # 1 TO *
2070 END
```

Clear display，home cursor Close data file

10
20
उO
40
50
60
70 DISF CHF象（27）8＂EEar FIot＂！Frogram identifier 80
90 OFTION EASE I

110 INTEGEF $B, E, E 1, F, G, H 1, T, J, K, L, L 1, L, F, F 1, F 1, F 2, G, T$
120 REAL F1，Y，YO，Y1，Y2，Y（SO）
1 ZO F串＝＂BAFDATA＂！Default file name
140 D事＝＂＂！Default device specifier
150 ！
160 ！Function to generate labels
170 ！

$190 \mathrm{Fl}=-\mathrm{LEN}(\mathrm{S}=)$ ！Left justified
2OO IF F＇$=$＂R＂THEN Fj＝－Fi ！Fignt justified

 E
2उO FFINT USING＂K＂：＂DI＂：FI：＂，＂F2：＂：＂
240 FFINT FNM $(X, Y)$ ！MOVE
2SO FRINT USTNG＂ド＂＂＂CF＂；Fi！＂，＂F：＂：＂！Move characters relative to $\%$ ： $\gamma$

260 FRINT＂LE＂8S事CHFi（E）8＂FU：＂！Flot label
270 FNL $\$=" "$ ！Dummy value
280 END DEF
290
300
310
工2O DEF FNH\＆（LI，L2，F1，R2，H）
3 OO ON H GOTO $460,340,350,360,370,380$ ！Select hatch type
$340 F=200$ G $G=0$ GOTO 390 ！$H=2:$ wide，single hatch
S50 $F=100$ G $G=0$ GOTO 390 ！$H=3$ n narrow，single hatch

$370 F=100$ G $G=1$ GOTO 390 ！$H=5:$ narrow，cross－hatch
उ80 $F=20$ G $G=0$ ！$H=6:$ fill．
צ90 PRINT USING＂氏゙＂
is bar perimeter
400
410 FOF K＝12－（R1－Li）TO F2 STEF F ！Hatching loop


440 NEXT K
450 ！
460 FRINT＂FU：IW：＂！Lift peng restore plotting window
470 FNH\＆$=$＂＂！Dummy value
480 END DEF
490 ！

## PROGRAM LISTING

```
Go% ! Move function
510!
```



```
5% !
540 ! Function to generate bar
550 !
560 DEF FNE& (LI,LZ,F1,F2)
5 7 0 ~ F F T N T ~ F N M \$ ( L I , L 2 ) ~ ! ~ M o v e ~ t o ~ l o w e r ~ l e f t ~ c o r n e r ~
```



```
",":2:"FU!" ! Dreaw
5 9 0 ~ F N E क = : " " ~ ! ~ D u m m y ~ v a l u e
6OO END DEF
610!
620 ! File query
60 !
G4O FWIDTH INF ! Eliminate default line feeds to plotter
GSO WIDTH INF ! Eliminate default line feeds to display
600 GOSUE 22EO ! Elear display
670 GOSUE 2180 ! Set error trap
680 INFUT "Data file name? ",F央:F"$
690 IF Fक="" THEN 2280 ! Duit: on no input
700 !
710 ON EFFOF GOSUB 2O40 E GOTO 72O
720 INFUT "Devicer specifier? ",Dक: Dक 
73O IF D韦"" AND FOS(D串,":")#1 THEN E=6马 E GOSUE 2O60 G GOTO 720
740
750 E=0 ! Initi alizae error Variable
760 ON ERROF E=ERFN
770 IF D$="" THEN CAT F$ ELSE COFY D& TO Fo ! Try to find the file
```



```
790 IF D吕"" OR NOT E THEN 9OO ! No problems
800 !
810 IF E#64 THEN GOSUE 2O60 G GOTO 64O ! If not duplicate file
820 CAT Fक ! Does file exist?
83O ON ERROR GOSUE 2040 G GOTO 840
840 DISF ":"&F串尔" exists in memory:"
850 INFLIT " purge (y/n)? ","n":A$
860 ON FOS("NY",UFFC古(A$[1,1])) +1 GOTO 840,640.870
870 FURGE F$
880 GOTD 750 ! Fietry EOpy
890 !
900 GOSUB 2180 ! Set error trap
910 ASSIGN # 1 TD F*;BASIC
920 READ # 1 : A$ ! First record in file
930 IF A$#"b" THEN E=98 E GOSUB 2060 0 GOTO 640 ! Not a bar plot file
940 !
950 ! Stacked or grouped plot?
960 !
970 ON ERROR GOSUB 2040 E GOTO 980
980 GOSUB 2230 ! Clear display
990 INPUT "Stacked or grouped plot (s/g)? ":"g":A$
1000 DN POS("SG",UPRC*(A$[1,1]))+1 GOTO 970,1010,1030
1010 T=1 ! Stacked plot
```


## PROGRAM LISTING

```
1020 g0TO 1040
1030 T=0 ! Grouped plot
1040
10% ! Flotter speed
1060 !
107O ON EFFOR GOSUE 2O40 E GOTO 1080
108O GOSUE 22SO ! Clear display
1090 INFUT "F]ot speed (f/m/s)? "%"s"#A婁
```



```
1110 IF UFRCक(A⿻⿱口口丨['1,1])="F" THEN S=子B E GOTO 1140 ! Flot fast
```



```
11O% !
1140 FRINT "TN,FA,VS"乡STF的(%)"SF1:" ! Initialize plotter" absolute unit
S% select speed & pen
1150 !
1160 ! Flot titles, frame graph
1170 !
1180 GOSUE 218O ! Set error trap.
1190 READ # 1 E% ! read main title
1200 FRINT FNL&(4.7.560%,7479,"C",",5,E#,1,O) ! Flot main titue
1210 READ # 1 E名 ! Fead subtitle
```



```
1250 PRINT FNE$(1300,750,9900,6150) ! Frame plot
1240 GOSUE 2180 ! Set error trap
125O READ # 1 B悉 ! Fead x axis title
1260 FFINT FNL& (Z,5600,279,"C",",F,G&, l,O) ! Flot x axis title
1270 FEAD # 1 E E串 ! Fead y axis title
1280 FRINT FNL&(3,250, 5450,"C",", ", B$,0,1) ! Flot y axi= title
1290 READ # 1 ; YO,Y1,Y2,E,L. ! Fiead y min, y max, y inc: # bars, # level
5
1300!
1310 ! Flot X-1abels
1320!
1330 GOSUE 2180 ! Set error trap
1340!
1350 FOR I=1 TO.E ! For each bar
1360 FEAD # 1,50+I : E名 ! FRead bar label
1370 FRINT FNL$(Z,13OO+86OO\(B+1)*I,75O,"C",-1, B&,1,O) ! Flot bar label
1380 NEXT I
1390!
1400 ! Flot Y-tics % tic labels
1410!
1420 GOSUE 2180 ! Set error trap
1430 F1=5400/ABS (Y1-YO) ! Y scale factor
1440 J=0 ! Tic number
1450 !
1460 FOR I=750 TO 6150 STEF AES(Y2*F1) ! Move along y axis
1470 FRINT FNMक (1300,I) ! Move to tic location
1480 FRINT "YT;" ! Flace tic mark
1490 FRINT FNL ( ( 3, 1200,I,"L",--25,STR直(YO+Y2*J),1,0) ! Label tic
1500 J=J+1 ! Next tic:
1510 NEXT I
1520 !
```


## PROGRAM LISTING

```
15% ! Flot legends % bar=
1540!
1550 E1=0 ! Initialize bar height error flag
1560 IF NOT T THEN 1620 ! Grouped plot
1570!
1580 FOF J=1 TO B ! [lear acwumulator for each bar
1500 Ү(J)=0
16OO NEXT J
1610 1
1620 FOF T=1 TO L. ! For Each level
1630 GOSUE 2180 ! Set error trap
1640 FEAD # 1. T+8 # E事,%,H1,F ! Upper legend, lower legend, hatch typen
    pen #
1650 FI=1300+T*(8600\(1+1)) ! X locetjon of legend
1660 FFINT "SFInLT:" ! Select pen ly solid line
1670 FFINT FNL#(2.6,F1,6800,"C",Oy##, 1,O) ! Flot upper legend label
```



```
1690 FFTNT USING "K゙" " "GF"#F:":" ! Select pen
1700 FFINT FNEक (FI- 300, 6200,F1+300, 6550) ! Flot legend bar
1710 FFTNT FNH婁(FIMOO, 62OO,FI+SOO, 6S5O,H1) ! Hatch legend bar
1720 !
17SO FOF J=1 TO E
1740 FEAD # 1, 1OO*I+J : Y ! Fiead bar hejght
1750 IF T THEN 1810 ! Stacted plot
1760 LI=INT(((L+1)*(2*J-1)+2*I-1)*8600/(2*(L+1)*(E+1))+1SOO) ! Lower lef
t < coordinate
1770 L2=750 ! Lower left y coordjnate
1780 F1=INT(((1+1)*(2*J-1)+2*I+1)*8600/(2*(L+1)*(E+1))+1300) ! Upper rig
ht * coordinate
1790 R2=INT(750+Y*5400/ABS(Y1-YO)) ! Upper right y roordinate
1800 GOTO 1920
1810 LI=INT((4*J-1)*2150/(B+1)+13OO) ! Lower left x coordinate
1820 FiI=INT ((4*J+1)*2150/(E+1) +1300) ! Upper right x coordimate
18ЗO L2=INT(75O+Y(J)*S4OO/ABS(Y1-YO)) ! Lower left y coordinate
1840 Y(J)=Y(J)+Y ! Accumulate stacked bar height
1850 R2=INT(75O+Y(J)*54OO/AES(Y1-YO)) ! Upper right y coordinate
1860 IF R2&=6150 THEN 1920 ! If stacked height is not out of range
1870 IF L2`6150 THEN L?=6150 ! If the base of the bar }>\mathrm{ max heigt
1880 R2=6150 ! New bar height.
```



```
out of range bar
1900 IF NOT E1 THEN FRINT FNL.$(2,10250,7479,"L",-1,"(Fange Error)",1,0)
! Flot error message
1910 E1=1. ! Flag error so message is not replotted
1920 FFINT FNE$(L1,L2,R1,R2) ! Plot bar
1930 FRINT FNH& (L.,1,L2,R1,F2,H1) ! Hatch bar
1940 NEXT J ! Next bar
1950 !
1960 NEXT I ! Next level.
1970)!
1980 ! Fut pen away & recycle program
1990 !
20OO FFTNT "FUO,O:SF:" ! Move to O,O & replace pen
```


## PROGRAM LISTING

```
2010 GOTO 610
2020 !
W0%O ! Error detectiom
2040 !
2O5O E=EFRN
2060
2070 Eq="Unable to runn"
2080 TF E=3Z THEN Eक="Data type."
2090 IF E=S4 THEN E&="NO datan"
2100 IF E=42 THEN E婁="String too long."
2IIO IF E=44 THEN E&="Too many inputssn"
2I2O TF E=62 THEN Eक="File not found."
213O IF E=63 THEN Eक="Invalid filespec."
2140 EEEF 10OO
2\O DISF "Error "%STR串(E)%", "%E&
2160 WAIT 2
2170 FETUFN
180 !
2190 ! Set error trep
200 !
2210 ON EFFOF GOSUE 2O4O G GOTO 640
22"0 FETUIFN
220 !
2240 ! Clear display
2250 !
```



```
2970 FETUFN
280 !
2990 ! End program
2300 !
2土10 DIGF CHFiक(27)&"E"%CHF婁(27)%"H":
22O ASSIGN # I TO *
2区O END
```


## PIE CHART

What the Programs are Designed To Do:
The PIE CHART plotting package consists (as does each package in this Solutions Book) of two programs: a file creation/editing program and a plotting program. The editing program prompts the user for inputs by which data files that contain the information necessary to create plots using the HP 7470A plotter are created. The plot program translates these data files into the appropriate HP-GL* commands to create plots with the plotter. The programs are recorded on the included magnetic cards under the file names "PEDIT" and "PPLOT" respectively.

The package allows the user to plot single-page, single pie charts. (The package should work with either the HP-IL option of the HP 7470A plotter or with other interface options if the appropriate interconnect device is used.) The plot may be labeled with a main title and subtitie. The user may select between six hatch types for use in plotting the sections.

The programs interface with mass storage and display devices. Printers are not supported by the programs because of the nature of the plotter interface. The plotter must be addressed as the PRINTER IS device and therefore no other printer device may be accessed while running the programs. If a mass storage device is used, it is assumed to have the device specifier ": CA".

* Hewlett-Packard Graphics Language - see your HP 7470A Interfacing and Programming Manual.

The following example assumes that the user has loaded the edit and the plot programs into memory under the file names "PEDIT" and "PPLOT" respectively. The example also assumes that the file "PDATA" does not exist in memory, that the HP 7470A is on the HP-IL interface, that it has been assigned a device specifier and has been specified as the printer device (via the PRINTER IS command).


## SAMPLE PROBLEM

| DISPLAY | KEYSTROKES |
| :---: | :---: |
| Slice 2 Label: | Slice \#2 - [RTN] |
| Slice 2 Value: \% | 17 [RTN] |
| Slice 2 Hatchtype: | 2 [RTN] |
| Explode slice $2 \underline{Y}$ / P ? | y [RTN] |
| Slice 3 Label: | Slice \#3 - [RTN] |
| Slice 3 Value: \% | 17 [RTN] |
| Slice 3 Hatchtype: | 3 [RTN] |
| Explode slice 3 Y/N? | n [RTN] |
| Slice 4 Label: | Slice \#4 - [RTN] |
| Slice 4 Value: \% | 16 [RTN] |
| Slice 4 Hatchtype: | 4 [RTN] |
| Explode slice 4 Y/N? | y [RTN] |
| Slice 5 Label: | Slice 非 - [RTN] |
| Slice 5 Value: \% | 16 [RTN] |
| Slice 5 Hatchtype: | 1 [RTN] |
| Explode slice 5 Y/N? | n [RTN] |
| Slice 6 Label: | Slice \#6 - [RTN] |
| Slice 6 Value: \% | 17 [RTN] |
| Slice 6 Hatchtype: | 6 [RTN] |
| Explode slice $6 \underline{Y}$ N? | y [RTN] |
| We have made an error in slic | wish to correct it. |
| Edit File $\mathrm{Y} / \mathrm{N}$ ? | y [RTN] |
| Edit Title $\bar{s} \bar{Y} / \mathrm{N}$ ? | $n$ [RTN] |
| Edit Slices $\underline{Y} / \overline{\text { N/ }}$ ? | $y[R T N]$ |
| Slice units: \% | [RTN] |
| Add, Move, Change, Delete, eXit: | c [RTN] |
| Slice \# tō change: | 5 [RTN] |
| Slice 5 Label: Slice \#7 - | Slice \#5 - [RTN] |
| Slice 5 Value: 16 \% | [RTN] |
| Slice 5 Hatchtype: 1 | 5 [RTN] |
| Explode slice 5 Y/N? | n [RTN] |
| Add, Move, Change, Delete, exit : | x [RTN] |
| $\begin{array}{lllll}\text { Plot } \\ \text { PPLOT } / \mathrm{N} \text { ? } & & \\ \text { B } 5770 & 11: 22 & 05 / 12 / 83\end{array}$ | y [RTN] |

## SAMPLE PROBLEM

Having created a data file, we choose to plot the information. The default file name is that of our file (since we chose the default in the edit program) and it still exists in memory. We are given a choice of plotting speeds: fast, medium and slow. We choose fast.

Data Filename: PDATA [RTN]
PDATA B 217 tt:tt dd/dd/dd
Plot Rate (F,M,S):
f [RTN]

The program procedes to generate the plot.
Main Title
Subtitle


## CREATING A NEW FILE

DISPLAY

STEP (NEW) 1:
run "pedit" [RTN]
STEP (NEW) 2:
Create a NEW Plot File $\underline{Y} / \underline{N}$ ?
y [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file.

The response character may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons) will generate an error and cause the prompt to be repeated. Select "y" to create a new file ("y" is the default, so just press [RTN]).

STEP (NEW) 3:
Data File Name: PDATA
13 character string [RTN]
This prompt requests the name of the data file to be created. Any string of up to 13 characters, upper or lower case, will be accepted. Strings longer than 13 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. An invalid file file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed.

The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

STEP (NEW) 4:

Main title:
50 character string [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs
(containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted along the top of the graph. Pressing [RTN] with no input is acceptable and will cause no title to be plotted.

STEP (NEW) 5:
Subtitle:
50 character string [RTN]

The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted immediately below the main title (or immediately below the place the main title would be). Pressing [RTN] with no input is acceptable and will cause no subtitle to be plotted.

STEP (NEW) 6:
Slice units: \%
3 character string [RTN]
The program is asking for the value units that each slice represents. This symbol will be plotted, along with the slice's value, after its label. The default is percent (\%). Any three-character string may be used excluding those containing commas, semicolons and quotation marks. Invalid strings will cause an error and the prompt will be repeated. The slice unit string may be omitted.

If the chosen string units are percentage, the program will test the accumulated total for all of the slices and generate an error if it is greater than 100.

STEP (NEW) 7:
Number of Slices:
integer [RTN]
The program is asking for the number of slices to be plotted. Valid input for the number of slices is an integer between 1 10. All other inputs will generate an error and cause the prompt to be repeated.

The program is asking for the descriptive label for slice 1. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 17 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no descriptive label to be plotted.

STEP (NEW) 9:
Slice 1 Value: \%
integer [RTN]
The program is asking for the size of the slice in the appropriate units (the example assumes "\%"). Input must be an integer between 1 and 99 (if units are percentage) or between 1 and 9999. Real numbers may be input but are rounded to integers for use. All other inputs will cause the prompt to be repeated.

STEP (NEW) 10:
Slice 1 Hatchtype:
integer [RTN]
The program is asking for the hatch type of the slice. Valid hatch type values are integers between 1 and 6 . All other inputs will generate an error and cause the prompt to be repeated. A list of the hatch types can be found on page 93.

STEP (NEW) 11:
Explode slice $1 \underline{Y} / \underline{N}$ ?
y or n [RTN]
The program is asking whether the slice is to be "pulled" away from the other slices in the plot. The program requires a single character response. Inputs of more than one character will cause an error and the prompt will be repeated. Any single-character input, other than " $n$ " or " $N$ " will be interpreted as "yes".

STEPS (NEW) 8 through 11 will be repeated for each slice as specified in STEP (NEW) 7.

STEP (NEW) 12:

Edit File Y/N?
y or n [RTN]
The newly created file may now be edited. The program requires a single character response. Inputs of more than one character will cause an error and the prompt will be repeated. Any single-character input, other than "n" or "N" will be interpreted as "yes".

See User Instructions for "Editing an Existing File" beginning with step (OLD) 4 to edit the file.

A negative response will cause the program to continue at step (NEW) 13.

STEP (NEW) 13:

Plot $\underline{Y}$ /N? $\quad$ y or n [RTN]
The program is asking whether the file should be plotted or not. The program requires a single character response. Inputs of more than one character will cause an error and the prompt will be repeated. Any single-character input, other than "n" or "N" will be interpreted as "yes". The use of this option requires either that the plot program be in file "PPLOT" in main memory or that it be in file "PPLOT" on device ":CA".

See User Instructions for "Plotting" beginning at step (PLOT) 2 to plot the file.

A negative response will cause the program terminate.

## USER INSTRUCTIONS

## EDITING AN EXISTING FILE

STEP (OLD) 1:
run "pedit" [RTN]
STEP (OLD) 2:
Create a NEW Plot File $\underline{Y} / \underline{N}$ ?
n [RTN]
This prompt requests the type of file to be manipulated by the program. The program is capable of creating a new plot file or of modifying an existing plot file.

The response character may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons) will generate an error and cause the prompt to be repeated. Select " n " to edit an existing file.

STEP (OLD) 3:
Name of File to Edit: PDATA
13 character string [RTN]
This prompt requests the name of the data file to be edited. Any string of up to 13 characters, upper or lower case, will be accepted. Strings longer than 13 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. An invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed. If the specified file is not found in memory, device ":CA" is searched. If the file is not found on device ":CA", an error occurs and the prompt is repeated.

The default file name may be used by pressing [RTN] with no input. The file name may be modified or replaced by pressing the appropriate keys (the [CLR], [SHIFT][DEL], [DEL], [I/R] and [BACK] keys are active at this time) before pressing [RTN] to accept the input.

## USER INSTRUCTIONS

## KEYSTROKES

STEP (OLD) 4:
Edit Titles $\mathbf{Y} / \underline{N}$ ?
y or n [RTN]
Since the user may not desire to alter the values of the titles, the program gives you the choice of skipping them. The response string may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons) will generate an error and cause the prompt to be repeated. Single character responses other than " n " or " N " will be interpreted as yes.

A response of "y" will cause the program to continue at step (OLD) 5 while that of " n " will continue at step (OLD) 7 .

STEP (OLD) 5:
Main title: old title
50 character string [RTN]
The program is asking for the main title of the plot. This title may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The title will be plotted along the top of the chart. Pressing [RTN] with no input will accept the old title (represented by "old title" in the example above). The main title may be omitted by clearing the input display.

STEP (OLD) 6:

## Subtitle: old subtitle <br> 50 character string [RTN]

The program is asking for the subtitle of the plot. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 50 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. The subtitle will be plotted immediately below the main title (or immediately below the place the main title would be). Pressing [RTN] with no input will accept the old title (represented by "old subtitle" in the example above). The main title may be omitted by clearing the input display.

## USER INSTRUCTIONS

STEP (OLD) 7:
Edit Slices $\mathrm{Y} / \mathrm{N}$ ?
y or n [RTN]
Since the user may not desire to alter the values of the slices, the program gives you the choice of skipping them. The response string may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons) will generate an error and cause the prompt to be repeated. Single character responses other than "n" or "N" will be interpreted as yes.

A response of "y" will cause the program to continue at step (OLD) 8 while that of "n" will continue at step (OLD) 19.

STEP (OLD) 8:

Slice units: \%
3 character string [RTN]

The program is asking for the value units that each slice represents. Default is percent. Any three-character string may be used excluding those containing commas, semicolons and quotation marks. Invalid strings will cause an error and the prompt will be repeated. The slice unit string may be omitted.

If the chosen string units are percentage, the program will test the accumulated total for all of the slices and generate an error if it is greater than 100.

STEP (OLD) 9:
Add, Move, Change, Delete, exit: a, m, c, d or x [RTN]
This is the branch point for selecting the following options:

Add: add a slice to the pie at any location. Go to step (OLD) 10.

Move: move a slice in the pie from one location to another in the pie. Go to step (OLD) 11.

Change: alter the characteristics of a slice in the pie. Go to step (OLD) 13.

## USER INSTRUCTIONS

Delete: remove a slice from the pie. Go to step (OLD) 14.
eXit: leave the slice-editing section of the program. Go to step (OLD) 19.

The response string may be entered in either upper or lower case. Any invalid input (string too long, commas or semicolons) will generate an error and cause the prompt to be repeated.

STEP (OLD) 10:

Add after slice 非: integer [RTN]
The response to this prompt should be the slice after which the new slice is to be inserted. Only integers in the range 0 to the total number of slices will be accepted. Inputting 0 will cause the slice to be inserted before the first slice. Execution will continue at step (OLD) 15.

STEP (OLD) 11:
Slice \# to be moved:
integer [RTN]
The response to this prompt is the slice to be moved. Only integers in the range 1 to the total number of slices will be accepted.

STEP (OLD) 12:

Put after slice 非:
integer [RTN]
The response to this prompt is the location to which the slice is to be moved. Only integers in the range 0 to the total number of slices will be accepted. Inputting 0 will cause the slice to be inserted before the first slice. Execution will continue at step (OLD) 9.

STEP (OLD) 13:
Slice \# to change: integer [RTN]
The response to this prompt should be the number of the slice to be changed. Only integers in the range 1 to the total number of slices will be accepted. Execution will continue at step (OLD) 15.

STEP (OLD) 14:
Slice \# to delete: integer [RTN]
The response to this prompt is the slice to be deleted. Only integers in the range 1 to the total number of slices will be accepted. Execution will continue at step (OLD) 9.

STEP (OLD) 15:
Slice $n$ Label:
17 character string [RTN]
The program is asking for the descriptive label for slice $n$, the slice to be altered or added. This may be any string of text, excluding commas, semicolons and quotation marks, of up to 17 characters. Erroneous inputs (containing commas, semicolons or quotation marks) will generate an error and cause the prompt to be repeated. Pressing [RTN] with no input is acceptable and will cause no descriptive label to be plotted.

STEP (OLD) 16:
Slice $n$ Value: \% integer [RTN]
The program is asking for the size of the slice in the appropriate units (the example assumes "\%"). Input must be an integer between 1 and 99 (if units are percentage) or between 1 and 9999. Real numbers may be input but are rounded to integers for use. All other inputs will cause the prompt to be repeated.

STEP (OLD) 17:

Slice n Hatchtype: integer [RTN]
The program is asking for the hatch type of the slice. Valid hatch type values are integers between 1 and 6. All other inputs will generate an error and cause the prompt to be repeated. A list of the hatch types can be found on page 93.

STEP (OLD) 18:
Explode slice $\mathrm{n} \underline{Y}$ N?
y or n [RTN]
The program is asking whether the slice is to be "pulled" away from the other slices in the plot. The program requires a single character response. Inputs of more than one character

## USER INSTRUCTIONS

will be repeated. Any single-character input, other than "n" or "N" will be interpreted as "yes". Execution continues with step (OLD) 9.

STEP (OLD) 19:
Plot Y/N?
y or n [RTN]
The program is asking whether the file should be plotted or not. The program requires a single character response. Inputs of more than one character will cause an error and the prompt will be repeated. Any single-character input, other than " n " or " N " will be interpreted as "yes".

See User Instructions for "Plotting" beginning at step (PLOT) 2 to plot the file.

A negative response will cause the program to terminate.

PLOTTING

| DISPLAY | KEYSTROKES |
| :---: | :---: |

STEP (PLOT) 1:
run "pplot" [RTN]

STEP (PLOT) 2:

Data Filename? PDATA 13 character string [RTN]
This prompt requests the name of the data file to be manipulated. Any string of up to 13 characters, upper or lower case, will be accepted. Strings longer than 13 characters or containing commas, semicolons or quotation marks will generate an error message and cause the prompt to be repeated. A string that represents an invalid file specifier will not be detected until the program tries to access the file. At that time an error will be generated and the prompt will be redisplayed. Press [RTN] to accept the default file name.

The catalog information for the selected file will be displayed for the current DELAY setting before it is accessed.

STEP (PLOT) 3:
Plot Rate ( $F, M, S$ ):
$\mathrm{f}, \mathrm{m}$ or s [RTN]
The program is asking whether it should plot fast, medium or slow. The selection is mostly user preference, but a slow speed may be required to prevent pen skipping on such things as slides for overhead projectors. Only "f", "m" and "s" are allowed inputs. All other inputs will generate an error and cause the prompt to be repeated.

The program continues from here to generate the plot.

## PROGRAM DI

| Number | Message | Description |
| :---: | :---: | :---: |
| 16 | Not enough memory | Not enough memory exists in order to create or expand the data file. |
| 42 | Line too long | The text the user has input is longer than that allowed by the prompt. |
| 43 | Number only | The user entered text in response to a numeric prompt. |
| 44 | No commas | Either too many numeric inputs were specified or commas or semicolons were entered in a text string. |
| 56 | Error in HP-IL loop | The HP-IL loop is broken or some other physical error has occurred. The loop should be checked. |
| 62 | No file: name | The specified data file was not found either in memory or on the specified mass storage device. |
| 63 | Invalid name | The file name or device specifier is illegal. |
| 68 | Wrong file type | An error occurred when trying to access the data file. |
| 34 or 42 | Not a plot file | The data file specified is not reconized as being a plot file. |
| nn | Unable to run | This is the default message when an error occurs that is not one of those listed above. The error number is reported so that the associated HP-75 error message can be determined. |

## PROGRAM DETAIL

Variables:
the edit program
$\mathrm{A} \$[1]$

B

B0

B1

B2

C\$[3]

D

D1
D2
D\$
D9\$
$E \$[20]$

## F\$

G\$[3]

I

J
K
L\$[50]
$y / n$ response; response to option prompt. not used.

1 - file has been copied from cassette to memory.
2 - file has not been copied.
1 - file not on memory. 0 - file in memory.
matches $D$ until out of the file creation routines, then $\mathrm{B} 2=0$. It is used by the error message routine.

STR $\$$ (T1)
1 - edit existing file. 0 - create new file.
slice hatch type; slice type in \%.
temporary storage of hatch type.
dummy storage from file; STR\$(D1).
slice size input.
error message.
file name.
units label.
slice index.
slice after which to add; slice to move.
slice after which to move.
file name + device specifier; title.

## PROGRAM DETAIL

| L2\$ | temporary storage of slice title. |
| :---: | :---: |
| N | pointer to file; number of slices. |
| P\$ | ESC\&"<Y/N" |
| R | index to records in the data file. |
| S\$ | "Main Title: "; "Subtitle: "; slice title. |
| T1 | ```slice size; total percent represented by slices; hatch type.``` |
| T2 | temporary storage of slice size. |
| Y\$ | first character(s) read from data file. |
|  | the plot program |
| A | angle index for pie perimeter; midangle of slice. |
| A1 | lower bound of current slice. |
| A2 | upper bound of current slice. |
| A3 | tempory storage of slice midangle. |
| A2(10) | slice sizes. |
| A3(10) | slice hatch types. |
| A4 $(10,3)$ | minimum, maximum and midangle for each slice. |
| A5 ( 4,6 ) | not used. |
| A6 (4) | not used. |
| A\$ | plot rate response; dummy input. |
| B | temporary storage of slice lower bound. |
| B0 | 1 - file has been copied from cassette to memory. <br> 2 - file has not been copied. |

## PROGRAM DETAIL

C

D
D1
D2
E

L
index for hatch direction.
index for hatch lines through slice. x coordinate of hatch intersection with low bound. $x$ coordinate of hatch intersection with high bound. 1
error message.
character height; label length.
character width; number of spaces to shift label number of lines to shift label.
temporary storage of label postiion variable.
250 - minimum x coordinate.
279 - minimum y coordinate.
10250 - maximum x coordinate.
7479 - maximum y coordinate.
label position.
hatch type.
character height parameter.
character width parameter.
plot speed; slice index.
label offset from slice; temp. storage.
1250 - minimum $x$ coordinate of pie plot area.
8850 - maximum x coordinate of pie plot area.
350 - minimum y coordinate of pie plot area.

## PROGRAM DETAIL

L4
L\$[50]
N
0
P
P1
P2
P3
P4
P9
Q
Q3
Q4
Q5
Q6
Q8
Q9

R

R1

R2

R3

S

S\$ [5]

7400 - maximum y coordinate of pie plot area.
file name + device specifier; title; subtitle.
file index; number of slices.
temporary storagae of label offset.
pen number.
narrow hatch flag.
cross hatch/fill flag.
temporary storage.
hatch line angle.
SQR(2)
coordinate adjustment for hatch line endpoints.
x coordinate adjustment for scaling function.
y coordinate adjustment for scaling function.
$x$ scale factor for scaling function'.
y scale factor for scaling function.
not used.
1/plotter scale factor (ratio of plotter height to width).
file pointer; unscaled radius of the pie.
angle between low bound of slice and hatch line in counter clockwise direction.
angle between low bound and high bound of slice in counter clockwise direction.
angle between low bound and high bound of slice in counter clockwise direction.
distance between hatch lines.
units characters.

## PROGRAM DETAIL

T

T1

T2

X

X1
X2
X3
X9

X\$

Y

```
total of pie slices in percent.
scale factor for intersection of hatch line and
low bound of slice.
scale factor for intersection of hatch line and
high bound of slice.
x coordinate to plot (absolute plotter units).
preliminary scaling of x coordinate.
scaling of x coordinate of intersection.
temporary storage.
x coordinate of pie tip.
file name; first character from data file.
y coordinate to plot (absolute plotter units).
preliminary scaling of y coordinate.
scaling of y coordinate of intersection.
temporary storage.
y coordinate of pie tip.
index to slice terminals.
```

```
10 !
OO Fie Flot File Creetion
```



```
40 ! May 190%
50 !
```



```
42क[17],64[177,Fक[5],Fक反1%]
7O TNTEGEF T,J,&,N,T1,TE,E,BO,E1,E2,D,
D|,De
```



```
06)
70 D,B,B2=0 盾 F*="FDATA"
100 !
1| ! detea file awsimmment
1%0
13O ON EFFOF EOSUB 219O 6 GOTO 14O
140 ¢TSF "Wreete a NE| Flot File **Fक"
    * TNFUT Aक
|O TF UFFC*(A%)="N"THEN 又一O
16O ON EFFOF GOCUE 2190 G GOTO 17O
170 INFuT *Dete File Namen * "FonF%
```



```
190 ON EFFOF EOSU# 2190 % םOTO 400
OO FUFGE Fक
210 GOTO 400
2Q O=1 ! file existscold file
Q区 EO,EI=O
240 ON EFFOF GO&UE 2190 IN GOTG व5O
EO TNFUT *NamE of File to Edita * *F%:
F方
260 E2=1
27O 1. %=F%
2gO ON FFFOF GOSUE 2190 G GOTO उIO
20O CAT FW
उO 0TEF
310 ON EFFOF GOSUE 2190 G GOTO उO
उO IF BI THEN EI=O EOTO EEO ELSE 4O
0
SO TF BO THEN FUFEE F家
उप ज0TO 220
```



```
З0 [АT 人家
*TO OTSF "LOADTNE FTLE"
उBO COFY L. WTOF$
900 EO=1
4OO ASSTGN # 1 TO F㝖,BAST世
40 IF D=O THEN FFINT # 1 : "口" E EOTO
    490 ! if new file
```



```
43O TF Y覀:"p" THEN 470
```

Used with $y / n$ questions

Default is yes，branch on no
New file prompt

Make room for file
Branch to create
File is to be edited

Old file name prompt

Edit mode and file creation flag

Does file exist？

If file is in memory．．．
If file was copied from cassette．．．
Try new file
Drive must be assigned＂：CA＂
Does file exist on tape？
Copy from cassette to memory
File was copied
If new file，initialize

Test existing file

## PROGRAM LISTING

```
44O DISF "NOT A FLOT FTLE:
4FO WATT 2
460 60TO 2GO
470
480 !
490 E2=0
5OO ON EFFOF GOSUE 219O E EOTO 5lO
5IO JF D THEN DISF "Edit TitIEE '%Fw:
G TNFUT A系! if file exists, prompt fo
r edit option
520 IF UFFCक(AD)="N" THEN 6BO
50
540 ! titues
55%!
60 N=10
#70 S串"Main Titue: "
580 IF D THEN FEAD # 1.N % L% ELEE L..#=
* ! read tithe if file exists
GOO DN EFFOF GOSUE 219O EOTO 6OO
```



```
6IO FFTNT # 1.N L. L
62O TF N#NO THEN 65O
6O S婁='Subtitte:
65 N=11
640 GOTO 58O
650
60% ! 51icEs
670 !
68O IF D=0 THEN G&="%" E EOTO 71O ! if
    new filen provide default
690 DISF "Edit Slices "%F'w: E TNFUT A名
7OO IF UFFC婁(AD)="N" THEN 17OO EISE FE
AD # 1,2O:G白,N
710 ON EFFOF GOSUE 2190 G GOTO 7%O
7% INFUT "G1 ice units: ",G*:G$
7O IF D THEN FFTNT # 1,2O:G&,N EO
TO ब4O ! store units in new file
740 ON EFFOF GOSUE 219O G GOTO 75O
75O TNFUT "Number" of S1jces: "#N
76O TF NEI OF NSIO THEN GOSUE 215O G
OTO 750
770 FRTNT # 1.2O:G里N
780 FOGF I=1 TO N
790 5古,D䒜,C乎=:"
800 GOSUF 188O
81O NEXT I
8OO GOTO 158O
8%O !
840 ! edit slice
850!
B6O FEAD # 1.2O : D$,N
870 ON EFFROR EOSUE 2190 G GOTO 88O
```



No longer in file creation

Default is yes，branch on no

Index to file
Prompt string

Prompt for title input
Store in file
If through prompting
New prompt string
Next record
Loop

Branch on no，default is yes

Store units in old file

For each slice

Get slice values

Go to wrap－up

Read number of slices
Input prompt

## PROGRAM LISTING


 8＂it：＂：
900 TNFUT＊：A 章
910 TF UFFCक（A ${ }^{\circ}$ ）$={ }^{*} A^{\circ}$ THEN 970
92 O TF UFFCक（A事）$=$＂M＂THEN 1150
9 O IF UFFC


0
960 ！
$970!$ add 51 ice
980 ！
990 ON EFFOF GOSUE 2190 G GOTO 1000
1000 INFuT＂Act after wice \＃＂＂u
1010 TF JO OF J×N THEN GOSUE $21 F O$ E OTO 1000
1020 IF $J=N$ THEN 1070
1030 FOF $F=N+2 O$ TO $J+21$ STEF -1
1040 FEAD \＃1，F $\quad$ Sक，D15T1
1050 FFTNT \＃1．F＋1：S事，D1．TI
1060 NEXT F

$1080 \quad I=J+1$
1090605 UE 1880
$1100 \quad N=N+1$
1110 FEAD \＃1．20 $\quad \mathrm{D} \$$
1120 FRTNT \＃1．20：Dक，N
1130 GOTO 870
1140 ！
1150 ！move slice
1160 ！
1170 ON EFFOR GOSUE 2190 GOTO 1180
1180 INFUT＂SI ice \＃to be moved：＂I
1190 TF J 1 OF JN THEN GOSUE 2IEO E G
0701180
1200 TNFUT＂Fut after sice \＃：＂F

150 GOTO 1200
1220 FEAD \＃1．J＋2O ：G＊，D1．T1

E GOSUB 2090 G GOTO 1280
1240 FOF $\mathrm{F}=\mathrm{J}+19 \mathrm{TO}$ 氏゙＋20 STEF -1
1250 FEAD \＃1，Fi 12. D． D ，T2
1260 FRTNT \＃ $1 . F+1$ ： $124, \mathrm{DO}, \mathrm{T}$
1270 NEXT Fi
1280 FFINT \＃1！ト＋20 ：S象，Dı！TI
1290 GOTO 870
1300 ！
1310 ！change slice
1820 ！
13 OO ONFOF GOSUE 2190 GOTO 1340
1340 TNFUT＂Sjuce \＃to change：＂！

Branch to appropriate routine

If slice out of range
If last slice
Make room for insertion

Get slice information

Back to options

Slice in range？

Slice in range？
Get slice to be moved
Move slices up or down depending
on $J$ and $K$
Move slices up to J

Insert slice
Branch back to options


1 GO TF T1． T THN TI＝T1－10

1990 क＝STFक（T）
$140 \mathrm{QO} \mathrm{\Phi uF} 1$ बल
1410 कणTO $\%$
1420 ！
$14 \%$ ：delete
1440
$14 \sigma$ ON FFFOF GOSUE 2J9O GOTO 1460


07 O .460

$1490 \quad N=1$


1FO FFINT \＃1，

1540
1550 जry up
1660



490 ！巨xistima／old file

1610 T1＝0


1640 TI＝T1＋01
16 OW NET F
1660 IF TI＝ 100 THEN 1700
1670 DTEF＂TOTAL．．\％TOO 1 AFGE：
16 क् WATT
1690 कणTO 870
170 ON EFFOF बOकUE 2190 छ बOTO 1710

172O TF UFFC＊（Aक）＝＂N＂THEN ENO
17 O E1＝0


1760 区AT Fi
1770 OTSF
$17 \Phi 0$ ON FFFOF GMSUE 2190 END
1790 TF NOT EI THEN 1840

1810 GAT
18天O DTSF＂LOADTNG FTLE：
18 O COFY 1 事 TO F
1840 FUN F＊
1850 ！

```
Is slice in range?
Get slice to change
Get slice data
Branch back to option
Is slice in range?
Shift slices over deletion
Decrement slice count
Store new count
Delete slice
Branch to option
No test if not %
Total %
For each slice
Get %
Add to total
Next slice
Total > 100%?
Cycle to options
Plot option
If no, end
Assume file not loaded
Test for file
If file in memory...
Cassette specifier
Test for file
Copy file to memory
Run "PPLOT"
```

```
186% ! get =|ič=
1870
1800 ON EFFOF GOSUE 2190 % GOTO 1690
```



```
    * 5% 5%
1900 ON FFFOF GOSUE 2I90 G GOTO 1910
1910 JF E THEN E=O E GOTO 197%
```



```
19马O IF Dक=* THEN FUT * *
```




```
HN 19%O EISF DI=VAL (D9%)
1960 TF (DI&1 OF DI>9%) AND G%=:%" OF
(0141 OF D1夕9999) THFN GOSU# 2|FO % GO
TO 1920
1970 ON EFFOF GOSUE 2190 ज GOTO 1980
1980 TF E THEN E=O G OOTO 2OIO
```



```
NFUT *: Cw:%T
OOO TF T1<1 OF T1%6 THEN GOSUE 2I5O E
    GOTO 1990
OOO ON EFROF GOSUF 2190 G GOTO 2O2O
20% DTSF "Explode EIAEE":T#Fw! E TNFU
TA婁
2OBO TF UFFC% (A音) #"N" THEN TI=TI+IO
204O FFTNT # 1!T+2O % S*,D|yT1
OFO FETUFN
2060 
%%% ! move forwerd
2080 !
2OQO FOF F=J+21 TO F+2O
21OO FEAD # I,F ; 1%क,D2,T%
2|O FFINT # 1, FF--1 % Leq,D2,TE
2120 NEXT F
21OO FETUFN
2140 !
2150 DTSF *OUTSTDF LTMTTS*
2160 WAIT 2
2170 FETUFN
2180 !
2190 ! Error reporting
200!
210!
2"O E=$="UNAELE TG FUN"
2つ3O IF EFFN=42 AND E2=O THEN E名="LINE
    TOO LONG' G GOTO 2ESO
```



```
GOTO 2SEO ELSE 226O
2क5O IF D THEN E=1
2OO TF EFFN=16 THEN E&=?NOT ENOUGH ME
MDFY:
2270 IF EFFN=44 THEN Eक="NO COMNAS" G
GOTO 2350
```

Put CHR\＄（136），the I／R key Input slice value If legal numeric，get value Test for range

If out of range．．．

If no，then value $=$ value +10
Store slice values

Move indexed slices down one

Range error
$\rightleftharpoons$ PROGRAM LISTING $\square$


```
1 0
%0 Fie Flot Frogram
O! HF-m5 Graphics Solutiome Boof
40 ! Mav 198%
5 0 !
GO OFTTON EASE I
7O OFTION ANGLE DEGFEES
BO DIM AC(10),AX(10),A4(10,#),AE(4,6),
```



```
7O STANDEY ON
100 E1=0
110 ON FFFOF GOSUE 15go a GOTO 12O
1%O EO=0
130 X另="FOATA"
140 DTSF "Data Fi|memame: "%
1FO TNFUT **,X㐘X%
160 1..事齐串
170 ON FFFOF GOSUE 15BO G GOTO 2OO
180 CAT X $
190 0T5F
2O ON EFFOF GOSUE 1580 IG GOTO 2Q0
210 TF E1 THEN EI=O E GOTO 24O FISE 29
O
2QO IF BO THFN FUFGE Xक
2% GOTO 120
```



```
25 CAT L等
2O DTSF'LDADTNE FTLE"
270 COFY \s TO X定
280 BO=1
29O ASSIGN # 1 TO X*"BASTC
OO READ # 1 : xक
310 IF X&*`" THEN OTSF *NOT A FLOT F
ILE" E WATT 2 G GOTO 12O
ZO ON EFROF GOTO उOO
```




```
15
S5O IF UFFCक(Aक)="S" THEN I= =%
SGO FFINT USING *&" # "IN:VS*,I
30 !
30! Titles
90 !
4OO ON EFFOF GOSUE 158O G END
410 65=250
420 66=279
4%0 67=1025%
440 G8=7479
450 09=(67--55) / (G8-G6)
460 08=(G8-G6)/100
470 F=1
480 GOSUE 1740
```

File in memory

File not copied

Is file in memory？

If file not in memory．．．

If file in memory from COPY
Try new file name
Default mass storage specifier
Is file there？

Copy from mass storage
Copy successful
Read first text from file

On error repeat prompt
Select plot speed

Initialize；set plotter speed to I
x minimum
$y$ minimum
$\mathbf{x}$ maximum

## PROGRAM LISTING

490 HI＝4．7

$510 \quad 89=6$
5 玉 $x=506$
$5 \mathrm{~F} \quad \mathrm{Y}=\mathrm{EB}$
$540 \quad N=10$
5FO READ \＃1！N ！！
G60 GOSUF 1780
576 G0玉いE 1750
580 605u\＃ 1830

○ छ БOTO 5EO
60
610 ！Fie
6 人 ！
$63 \quad \mathrm{~T} 日=0$
$640 \mathrm{~F}=20$

6 OO FOF I＝1 TO N
○7O FEAD \＃1，T＋F：

690 AZ（T）＝AB（T）－
700 NEXT T

$72 \mathrm{FOF} \mathrm{I}=1 \mathrm{TO}$
$730 \mathrm{~A} 4(\mathrm{~T}, \mathrm{I})=\mathrm{E}$

$75 \mathrm{~A} 4(\mathrm{I}, 2)=\mathrm{A} 4(\mathrm{~T}, \mathrm{I})+(\mathrm{A} 4(\mathrm{~T}, \mathrm{O}) \mathrm{A} \boldsymbol{\mathrm { A }}(\mathrm{T}, \mathrm{I}))$ ）
2
$760 \mathrm{~B}=\mathrm{A4}(\mathrm{~T}, \mathrm{Z})$
770 NEXT I

0 O
790 D5＝（12－11）／24
$80006=(14-4) / 22$
810 0x＝11＋12＊05
$82004=13+10 * 06$
83 DEF FNX7（ $\times 7$ ）$=05 * \times 7+0 \mathrm{~B}$
84O DEF FNY7（Y7）＝$=06 Y 7+04$
$850 \mathrm{~F}=2$
86O GOSUE 1740
$870 E=1$
$880 \mathrm{~F}=6.5$
890 FOF $I=1$ TO N
$900 \times 9=0$
$910 \quad \gamma 9=0$
920 A $=A 4$（I，2）
930 H＝AS（I）
940 IF Hく10 THEN 980
$950 \times 9=\mathrm{ENOS}(A \mathrm{O})$
960 Y $9=E \operatorname{EIN}(A Z)$
970 ！
980！Gertion

Letter size parameters

Center text
Center of chart
Top of chart

Title or subtitle
Set relative character size
Move（X，Y）
Label（G9，L\＄）
Smaller characters and new y
coordinate for subtitle

Units character（s）and \＃of slices
For each slice
Slice label，size，hatch type
Accumulate total \％
Decrement hatch type
Calculate fractional \％
For each slice
Lower bound of slice I
Upper bound of slice I
Mid－angle of slice I

Next lower bound
Next slice
Bounds of pie area
Constants for use with FNX7 \＆FNY7

Scale x coordinate
Scale y coordinate
Pen 2
Pen up；select pen $P$
Functionless constant
Modified radius of pie
For each slice

Hatch type
Not＂exploded＂
Coordinates of slice midpoint

## PROGRAM LISTING

```
990 !
1000 X=FNX7(X9)
1010 Y=FNY7(Yg)
1020 60SUE 1750
10%O GOSUE 1760
1040 A1=A4(T, 1)
1050 A2=A4 (T, %)
10めO FOF A=A1 TO AE STEF F
1070 X=FNX7(X9+F*WOS(A))
1080 Y=FNV7(Y9+FASSN(A))
1090 605UE 1760
11OO NEXT A
1110 X=FNX7(X9+F*COS(A2))
112O Y=FNY7(Yq+F**SN(A2))
1130 GOSUE 1760
1140 X=FFNX7(X9)
1150 Y=FNY7(Yव)
1160 GO5UE 1760
117O TF HYO AND H#NO THEN GOSUE 199O
1.80 NEXT I
1190
1200 ! legends
1210!
12"0 F=1
1230 GחSUE 1740
1240 H1=2.75
1250 H2=.45
126O GOSUE 1780
1270 1=F+.5
12BO FOF I=1 TO N
1290 x9=0
1300 Y9=0
1O1OA=A4(I,2)
132O IF AS (I)<1O THEN 1S6O
13OO X9=E*COS(A)
1Z4O Y9=E*STN(A)
1%50 !
1360! Stip Explode
1370!
13O TF AD=SOO OF AXO THEN D=2
1390 IF AO=SO AND A<9O THEN O=1
14OO IF AD=90 AND AC15O THEN D=7
1410 IF AV=150 AND AQ2IO THEN O=8
1420 IF AO=2IO AND A<27O THEN D=9
143O IF AD=27O AND A<SOO THEN O=S
144% GOSUE 177%
145O X=FNX7(X9+1*COS (A))
1460 Y=FNY7(Y9+L*SIN(A))
1470 GOSUE 175O
1480 FEAD # 1.2O+I : L$
```



```
15% GO5U# 1830
1510 NEXT I
```

Convert to plottable units
Draw (X,Y)
Draw (X,Y)
Midpoint coordinates
Hatch slice
Pen 1
Pen up; select pen $P$
Midpoint coordinates
Set character size
Offset from slice perimeter
Midangle of slice I
If not exploded
Coordinates of middlemost
slice point
Parameters for placing label based
on slice orientation
G9 $=0$
Coordinates of label origin
Move (X,Y)
Get slice label
Slice label + size + units
Label (G9,L\$)

## PROGRAM LISTING

```
1520 x ` % =%
15%0 605UE 1750
1540F=0
155% 60SUE 174%
156O ENO
157%!
1580 ! Error
1590!
16OO E名:UNABIEE TO FUN*
1610 TF EFFN=16 THEN ES=?NOT ENOUQH ME
MOF:Y
16еO IF EFFN=34 OF EFFN=42 THFN E%="NO
T A FLOT FTLE, E GOTO 169O
1GOO IF EFFN=5G THFN E$=?FFFOF IN HF
1. LOOF"
164O TF EFFN=6Z THNN E%=? TNVAL ID NAME'
16EO TF EFFNCO62 THEN 1670
```



```
G GOTO 169O ELGE EI=1 E FETUFN
1670 IF EFFN=68 THEN E名=`WFONG FTIE TY
FE: G GOTO 1690
```



```
1690 DTSF E$% E INFUT ", HTT FTN "#A⿻⿱口口丨心
1700 FETUFN
1710!
17%O ! HF-WL
1730 !
174O FFTNT USTNE "K" % "FU:SF",F G FET
UFN
17EO FRTNT USTNG "K゙" " "FU#FA",X!"!",Y
    # FETUFN
```



```
    G FETUFN
1770 69=0 E FETUFN
1780G1=H1*.E
1790 62=H1*H2*(1/09)*.67
18OO FFINT USING "&゙" " "SF",G2%","#%
1810 FETUFN
1820
18%O ! LAEFL
1840!
1850 GI==1FN(!$)
1860 E2,G%=0
1870 64=1MOD(69,10)
1880 IF G4%=4 AND G4&=6 THEN G2=-6E|
3)/2
1890 TF E4%6 THEN G2=-(61%.\Xi区)
1900 IF MOD (04, 3)=2 THEN ES=-_25
1910 TF MOD(G4, 3)=0 THEN GS=--5
1920 TF G9%=11 AND GQ&=13 THEN G2=G2+.
6 6
19%O TF G9%=17 THEN G2=52-.66
1940 TF G9=11 OF G9=14 OF G9=17 THEN G
```

Move（ 0,0 ）
Pen up；select pen $P$

Pen up；select pen $P$
Move（X，Y）
Draw（X，Y）

Select relative character size

Left justify
Move down quarter line
Move down half line 1920－1950：never used

## PROGRAM LISTING

```
F=5z+, 5
1950 TF O9=1% OF G9=16 OF O9=19 THFN E
F=G%-w
```



```
"LE",L%%GHF串(天) E FETUFN
19%O FFTNT USTNG "&゙" "FU!" G FETUFN ( Pen up
1980 !
1990! Hetch
000 !
2010 F|=0
200 F%=0
2OO H=MOD (H, O O)
OO4O TF H=1 OF H=工 THEN F1=1
OEO IF HES OF H=4 THEN F2=1
206O TF H=5 THEN FI=11
2O7O F%=10*(1+1*F1)
208 5=F/F"/2
990 z=0
2100 FOF C=O TO F2
2110 F4=125-90*(T=1)
212O F1=MOD(360+(A1-F4), 360)
213O R2=NOD (36O+(A2-F4), उ%O)
214O FX=MOD(36O+(F2-F1), 26O)
2150 F9=50F(2)
216O DI=F*COS(FI)
\%O D2=F*COS (F2)
21BO TF ABS(D1)<,OI THEN DI=O
2190 TF ABS(D2)<"OD THEN D2=0
2OO TF FI=9O OF FI=27O THEN FI=FI-.0O
O
2Q1O IF F2=9O OF F2=27O THFN F2=F2-"OO
O1
22OTI=-TAN(F1)/F9*(I-..2*C)
22土O T2=-TAN(F2)/FG* (1-2*G)
224O FOF D=F-- S TO O STEF --S
25O TF FSOJBO OF DNDI OF DNDP THEN 2S
0
2260 GO5U& 2680
2270 605UE 2870
2280 605|E 2820
2290 EOTO 24SO
SOO TF SGOMF1DFE OF DQDI OF DCDE THEN
    250
250 60SUF 2680
220 GOSUE 2720
2x% GOSUF 2770
2340 GOTO 24उO
S5O TF DPD1 THEN 2S90
2O6O GOSUE 2680
270 GOSUE 2720
2380 GOSUB 2820
29O IF DSO2 THEN 243O
2400 GOSUB 2680
```

H>10 if slice exploded
Narrow hatch
Cross hatch
Fill
Calculate hatch width
For each hatch direction
Hatch angle
Angle between low bound \& hatch line
Angle between high bound/hatch line
Angle between low and high bound
$x$ coord. of intersection low bound
$x$ coord. of intersection high bound
Round coordinates

Scale factors for line intercepts

## Scale

Line intercept move
Line intercept draw

## Scale

Perimeter intercept move
Perimeter intercept draw

## Scale

Perimeter intercept move
Line intercept draw
Scale

| 2410 | 60SUE 2870 | Line intercept move |
| :---: | :---: | :---: |
| 2420 | GOSUE 2770 | Perimeter intercept draw |
| 2430 | NEXT D |  |
| 2440 | FOF D＝D TO F－ $\mathrm{F}+\mathrm{STEF}$ |  |
| 2450 | IF FC180 THEN $L=180$ |  |
| 2460 | IF F19 $=180$ THEN $L=540$ |  |
| 2470 | IF L FASFE DF DDDI DF DDD THEN 2 |  |
| 50 |  |  |
| 2480 | 60SUE 2680 | Scale |
| 2490 | GOSUE 2720 | Perimeter intercept move |
| 2500 | GOSUE 2770 | Perimeter intercept draw |
| 2510 | 6070 2650 |  |
| 2520 | IF FES＝18O OF DCDI DF DCDE THEN |  |
| 570 |  |  |
| 2590 | GOSUE 2680 | Scale |
| 2540 | GOSUE 2820 | Line intercept move |
| 2550 | GOSUE 2870 | Line intercept draw |
| 2560 G0T0 2650 |  |  |
| 2570 TF DCDJ THFN 2610 |  |  |
| 2580 | GOSUE 2680 | Scale |
| 2590 | GOSUE 2820 | Line intercept move |
| 2600 | GOSUE 2770 | Perimeter intercept draw |
| 2610 TF DCDE THEN 26SO |  |  |
| 2620 | GOSUE 2680 | Scale |
| 26.3 | GOSUE 2720 | Perimeter intercept move |
| 2640 | GOSUE 2870 | Line intercept draw |
| 2650 NEXT D ${ }^{26}$ Dine intercept draw |  |  |
| 2660 NEXT C |  |  |
| 2670 RETUFN |  |  |
| 2680 | $Y 1=D / F Q$ | Preliminary scaling of points |
| $2690 \times 1=\times 9 \cdots 1 *(1-\cdots * C)$ |  |  |
| $2700 \times 1=Y 9+Y 1$ |  |  |
| 271.0 RETUFN |  |  |
| 2720 | $0=50 R(R \times 2-D 2) / F 9$ | Scale factor for perimeter |
| $2730 \times 2=\times 1-\mathrm{O}$ |  |  |
| 2740 Y2＝Y1－0＊（1－－2＊C） |  |  |
| 2750 GOSUE 2920 |  |  |
| 2760 RETUFN |  |  |
|  |  |  |
| $2780 \times 2=\times 1+0$ |  |  |
| $2790 \quad Y 2=Y 1+0 *(1-2 * C)$ |  |  |
| 2800 | GOSUE 2920 | Plot coordinate |
| 2810 FETUFN |  |  |
| 2820 | $0=\mathrm{D} * \mathrm{~W}^{1}$ | Scale factor for line intercept |
| $2830 \times 2=\times 1+0 *(1-2 * C)$ |  |  |
| $2840 \quad Y 2=Y 1+0$ |  |  |
| 2850 | GOSUE 2920 | Plot coordinate |
| 2860 | RETUFN |  |
| 2870 | $\mathrm{O}=\mathrm{D} * \mathrm{~T}^{2}$ | Scale factor for line intercept |
| 2880 | $\times 2=\times 1+\square *(1-2 * C)$ |  |
| 2890 | $Y^{\prime} 2=Y 1+0$ |  |
| 2900 | GOSUE 2920 | Plot coordinate |

2420 GOSUE 2770
24 OO NEXT D
$2440 \mathrm{FOF} \mathrm{D}=\mathrm{D}$ TO $-\cdots+\mathrm{F}$ STEF -S
2450 TF FC 180 THEN $L=180$
2460 IF Fi，$=180$ THEN $L=540$
2470 IF L．FIJF OF DDDI DF DDDE THEN 2
52
2480605482680
2490 GOSUE 2720
$\cdots$ ．

570
2580 6ロ5UE 2680
2540 G0SUE 2820
2550605042870
2560 日0T0 2650
2570 TF DCDI THEN 2610
2580 GOSUB 2680
2590 GOSUE 2820
2600 GOSUF 2770
2610 TF D区D2 THEN 26SO
2620 G0SUE 2680
26.30 GOSUE 2720

640 60SUR 2870
26SO NEXT D
2670 RETUFN
$2680 \quad Y 1=\mathrm{D} / \mathrm{Fq}$
$2690 \times 1=X 9 \cdots 1 *(1-2 * C)$
$2700 \mathrm{Y} 1=Y 9+Y 1$
2710 RETUFN
2720 O＝SOF（R $2-D=2) / F Q$
$2730 \times 2=\times 1-0$
2740 Y2＝Y1－D＊（1－2木呙）
2750 GOSUE 2920
760 RETURN
$2770 \mathrm{SOR}(\mathrm{R} \cdot 2-\mathrm{D} \boldsymbol{\mathrm { D }} \mathrm{C}) / \mathrm{F}$
$2790 \quad Y 2=Y 1+0 *(1-2 * C)$
2800 GOSUE 2920
2810 RETUFN
$2820 \mathrm{O}=\mathrm{D} \boldsymbol{0} 1$
$2830 \times 2=\times 1+0 *(1-2 * C)$
$2840 \quad Y^{\prime 2}=Y 1+0$
2850 GOSUE 2920
2860 RETURN
2870 日＝D＊T 2
$880 \times 2=\times 1+0 *(1-2 * C)$

2900 GOSUE 2920
2910 RETURN

## Line intercept move

Perimeter intercept draw

Scale
Line intercept move
Line intercept draw

Scale
Line intercept move
Perimeter intercept draw

Scale
Perimeter intercept move
Line intercept draw

Preliminary scaling of points

Scale factor for perimeter

Plot coordinate
Scale factor for line intercept

Plot coordinate

Scale factor for line intercept

Plot coordinate

## PROGRAM LISTING

```
29% TF 又#O THEN 2970
<9% X=FNX7(X2)
294% Y=FNY7(Y2)
29世0 क0¢UE 1750
260 60T0 %120
2970 1F z肚 THEN O2O
2980 X=FNX7 (X2)
2990 Y=FNY7(Y2)
OOO GO&UE 1760
3010 G0TO %120
O2O TF Z&% THEN EO&O
OWO XX=X2
O4O Y%=Y%
%% G0TO ए% Increment Z and return
O60 X=FNX7(X2)
30%O Y=FNY7 (Y2)
छब0 क05UE 1750
3O9O X=FNX7(XE) ia Y=FNY7(Y又) a GOSUE i
760
|100 Y=FNY7(YZ)
\triangle110 GOSUE 1760
x1eO %=MOD (z+1,4)
3BO FETUFN
#140 END
```

NOTES

## NOTES

NOTES

## GRAPHICS

LINE PLOT
BAR PLOT
LINE PLOT
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