)AA Eastern Region Computer Programs
ıd Problems NWS ERCP - No. 32

Scatter Diagram and Histogram Program - SCATR

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Eastern Region Headquarters
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NOAA TECHNICAL MEMORANDUM

National Weather Service, Eastern Region Computer Programs and Problems

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1 An AFOS version of the Flash Flood Checklist. Cynthia M. Scott, March 1981. (PB81 211252).

2 An AFOS Applications Program to Compute Three-Hourly Stream Stages. Alan P. Blackburn, September 1981. (PB82 156886).

3 PUPPY (AFOS Hydrologic Data Reporting Program). Daniel P. Provost, December 1981. (PB82 199720).

4 Special Search Computer Program. Alan P. Blackburn, April 1982. (PB83 175455).

5 Conversion of ALEMBIC$ Workbins. Alan P. Blackburn, October 1982. (PB83 138313).

6 Real-Time Quality Control of SAOs. John A. Billet, January 1983. (PB83 166082).

7 Automated Hourly Weather Collective from HRR Data Input. Lawrence Cedrone, January 1983 (PB83 167122).

8 Decoders for FRH, FTJ and FD Products. Cynthia M. Scott, February 1983. (PB83 176057).

9 Stability Analysis Program. Hugh M. Stone, March 1983. (PB83 197947).

10 Help for AFOS Message Comp. Alan P. Blackburn, May 1983. (PB83 213561).

11 Stability and Other Parameters from the First Transmission RAOB Data. Charles D. Little, May 1983. (PB83 220475).

12 TERR, PERR, and BIGC: Three Programs to Compute Verification Statistics. Matthew R. Peroutka, August 1983. (PB84 127521).

13 Decoder for Manually Digitized Radar Observations. Matthew R. Peroutka, June 1983. (PB84 127539).

14 Slick and Quick Data Entry for AFOS Era Verification (AEV) Program. Alan P. Blackburn, December 1983. (PB84 138726).

15 MDR--Processing Manually Digitized Radar Observations. Matthew R. Peroutka, November 1983. (PB84 161462)

16 RANP: Stability Analysis Program. Hugh M. Stone, February 1984.(PB84 16144

17 ZONES. Gerald G. Rigdon, March 1984. (PB84 174325)

18 Automated Analysis of Upper Air Soundings to Specify Precipitation Type. Joseph R. Bocchieri and Gerald G. Rigdon, March 1984. (PB84 174333)

EASTERN REGION COMPUTER PROGRAMS AND PROBLEMS - No. 32

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I. Introduction

One of the laborious tasks usually required for statistical studies is the plotting of scatter diagrams and frequency histograms. These two types of displays are usually needed to visualize the relationship between two or more variables and they usually provide more useful information than a table of correlation coefficients between the variables. For example, such a diagram may reveal a good relationship between some variables over a limited range of the data, while correlation coefficients computed over the full range may indicate a poor relationship. At the conclusion of the research study, considerable labor must usually be devoted to drafting finished figures of this type for publication.

The preparation of these diagrams has now been automated by the program SCATR, which creates them as an AFOS graphic product. The size and dimensions of the graphic are specified by the user, so that the final product is suitable for publication.

The data must be contained in an RDOS file IDXCR1. This file is the same as the IDXCR1 file used by the correlation coefficient and regression equation program REGRS (Stone, 1985), and may be in any format designed by the user. Format for reading IDXCR1 is specified by the user at runtime. Since this program is for research purposes only and will not be run very often, it is designed to operate from the Dasher.

II. Methodology and Software Structure

A. Methodology

The data file IDXCR1 may be in any format, but the first line must consist of exactly 80 characters, which are inserted by the user for identification purposes only, and which are read in the format (40A2). An example of a small IDXCR1 file is shown in figure 1. In this case, six data records follow the identification line at the top, with eight variables (field width 6) on the first line of each record and a single variable (field width 9) on the second line of each record. The appropriate format for reading would be (5F6.0, F6.2 F6.0, F6.4/F9.0), but since each variable contains a decimal point, the simplified format (8F6.0/F9.0) may be used. Parentheses must be used when specifying the format at runtime. Each record may contain up to 50 variables.

When the program is started a series of questions appear on the Dasher, regarding the number of variables and format of the IDXCR1 file, type of diagram wanted, dimensions of diagram, etc. The answer to each question determines the following question. A complete list of computer queries and a guide to proper responses is given in section V.B. A typical example of Dasher printout is given in Figure 2 and the corresponding full size scatter diagram that was produced is shown in Figure 3. The data file IDXCR1 used to produce Figure 3 was fairly large containing 373 records, indicated by N=373 at the bottom of the diagram. Appearing to the right of N=373 is a reproduction of the first line (identification) of the IDXCR1 file. On the left side, "X=21E Ø" denotes that the X axis is used for variable no. 21 and the numbers along the X axis are to be multiplied by 1Ø to the Ø power. Likewise, "Y=2ØE Ø" denotes that the Y axis is used for variable no. 20 and the numbers along the Y axis are also multiplied by 1Ø to the Ø power. Legend numbers along the X and Y axes are always integers; the decimal point is set by the exponent of 1Ø following the "E" on the title line.

The program examines the range of values for the variables specified for the X and Y axes and maximum and minimum values of each are output on the Dasher printout. This range of values is used to divide the axis into a reasonable number of intervals, usually around 10 to 14 intervals are selected. The method of doing this is given in section II.B. The points are then plotted in accordance with the coordinate system just determined. The intervals that are automatically chosen may not be satisfactory to the user. In this case, an interval of 9 units was chosen for the X axis and 7 units for the Y axis (Figure 3). If the user wanted an interval of 10 units for the X axis and 5 units for the Y axis, response to the question "Finished?" on the Dasher would be "N" (No) and the diagram could be done over using the intervals specified. The lower half of Figure 2 shows the Dasher printout in this circumstance and the resulting scatter diagram is shown in Figure 4.

Figures 3 and 4 are full size scatter diagrams. Smaller size diagrams may be produced by applying reduction factors to the X and Y directions. An example of this is shown in Figure 5, where a reduction factor of .50 was applied to the Y direction and a reduction of .32 in the X direction. If a reduction factor of less than .50 is used, alternate legend numbers are removed from that axis to avoid a cluttered appearance.

Another type of scatter diagram is shown in Figure 5A, which was produced from the data file IDXCR1 of Figure 1. In this case, the X and Y axes are used for variables 6 and 8 respectively, and the value of a third variable Ƶ (variable number 1) is plotted at the appropriate coordinates. Only integers are plotted as the Ƶ variable. If a real variable is specified for Ƶ, the numbers are truncated to integer values, which are then plotted. If Ƶ is well related to the X and Y variables, isopleths of Ƶ may be drawn on the diagram. The resulting analysis may be useful in estimating Ƶ when only X and Y are known. If Ƶ is a binary valued variable, such as variable 7 in Figure 1, which may represent the occurrence or non-occurrence of some event, the type of scatter diagram shown in Figure 5B may be obtained. In this case, an "x" is plotted for values of

Z=1 and an "o" is plotted for values of Z=Ø. These symbols are centered on the data point at the appropriate X, Y coordinates. In some circumstances it may be desirable to obtain separate diagrams for Z=1 and Z=Ø, these are shown respectively in Figures 5C and 5D.

If the relationship between a binary valued variable and a single continuous valued variable is being investigated, the scatter diagram is not very interesting since all the data points lie on two lines at Y=Ø and Y=1. A very simple example is shown in Figure 6, again using the data of the IDXCR1 file of Figure 1. Variable number 1 is used for the X axis and variable 7 for the Y axis. Three data points for Y=Ø lie in the lower left corner of the diagram and three for Y=1 in the upper right portion of the diagram.

This data can be displayed as a histogram of the relative frequency of occurrence of Y=1 for each of the intervals indicated on the X axis. The result is shown in Figure 7A. Two numbers are plotted for each interval; the lower number represents the number of data points that lie within that interval and the upper number is the number of cases where the binary valued variable is equal to one. Dividing the upper by the lower number gives the relative frequency of occurrence of binary value one in that interval, which is shown by the height of the bar.

When using the histogram form of display, the user retains control of the interval used for both the Y axis and more importantly the X axis. Both of the intervals of Figure 7A have been changed to create the histogram shown in Figure 7B. The X interval was changed from 3 units to 2 units and relative frequencies were computed for each of the new intervals. In Figure 7B, the bars of the graph are shaded with horizontal lines for greater visual clarity.

Figure 8A shows a histogram prepared from a fairly large IDXCR1 file containing 501 data points. It represents the relative frequency of occurrence of an event at various intervals of the X variable. Notice that there is only one data point in the X interval (-32, -28) and also only one point in the interval (12, 16). It is desirable for each interval to contain at least several data points, so that one or more anomalous points will not unduly distort the histogram. To assure that each interval contains a specified number of data points, intervals may be grouped together until the count of data points equals or exceeds the minimum number specified. The histogram of Figure 8B was obtained using the same data as Figure 8A but specifying that each interval must contain 7 or more data points. Three of the original intervals on the left of Figure 8A were combined in Figure 8B to create one large interval between -32 and -20, which contains 19 data points. On the right side two of the original intervals are combined to create an expanded interval between 8 and 16 in Figure 8B, which contains 7 data points. This procedure smooths out irregularities in the histogram caused by sparse samples in the extreme ends of the distribution.

B. Software Structure

The main program is called SCATR. It interrogates the user via the Dasher to determine the structure of the IDXCR1 data file, variables in the file to be used, type of diagram desired, dimensions of diagram, etc. It also reads the IDXCR1 file for the first time and determines maximum and minimum values for all the variables in the file.

The intervals for numbers along the X and Y axes may be computed from maximum and minimum values of the appropriate variable by the following formula:

$$INTERVAL = 0.1 \times ROUND(VMAX-VMIN)$$

where, VMAX = maximum value of the variable in IDXCR1
VMIN = minimum value of the variable in IDXCR1
ROUND(VMAX-VMIN) = difference rounded to the first significant figure.

Using this technique 10 to 14 numbers along the axis cover the range of data. The interval may also be specified by user input to the Dasher, if this is desired.

The software structure and load line are shown in Figure 9. The various subroutines are briefly described below:

GPTX

This subroutine reads the IDXCR1 data file a second time and plots the points on the scatter diagram in the manner specified by the Dasher input or produces the relative frequency histogram. The AFOS graphic product "NMCGPHSCT" is produced utilizing the subroutines given by MacDonald (1981).

ROUND

Rounds a real number to the first significant place. For example, 24. is rounded to 20. and .036 is rounded to .04 etc.

ISCR5

Converts a 1 to 5 digit integer to ASCII characters. This is used for plotting numbers on the SCT graphic.

SHADE

This puts shading on the histogram by drawing horizontal lines across each bar.

An additional small program called MBG.SV is run once when the SCATR program

is installed; it creates a blank map background (B99) for the SCT graphic. If B99 is not created, the words "PAGE Ø1" appear on the SCT graphic, an undesirable feature. MBG appears on the last program in the program listings at the end of this report.

III. Cautions and Restrictions

The SCATR program can read up to a maximum of 50 variables per record in the IDXCR1 data file. The size of IDXCR1 is limited only by the available disk space.

Incorrect responses to most of Dasher questions will only result in the wrong type diagram being produced. However, an incorrect answer "Y" to the question "BINARY DATA?" usually results in a fatal runtime error. The program must then be restarted from the beginning.

Reduction factors should not be less than about .30; factors less than this usually result in a cluttered and illegible diagram.

If the interval of the X or Y axis is specified by the user, a value must be chosen so that the axis is divided into no more than 40 intervals. If this number is exceeded the program terminates abnormally with the Dasher message, "NO. OF INTERVALS EXCEEDS PARAMETER L1." This limitation is imposed to keep the numerals printed along the axis legible.

IV. References

MacDonald, A.E., 1981: AFOS Graphics Creation from FORTRAN, NOAA Western Region Computer Programs and Problems NWS WRCP-No. 18, National Weather Service, Salt Lake City, UT.

Stone, H.M., 1985: Correlation and Regression Equation Program - REGRS, NOAA Eastern Region Computer Programs and Problems NWS ERCP - No. 31, National Weather Service, Garden City, NY

V. Program Information and Procedures for Installation and Execution

Scatter Diagram and Histogram Program - SCATR

Part A: Program Information and Installation Procedure

Program Name: SCATR.SV

AAL ID:

Revision No.: 01.00

Function: Plots scatter diagram for any two (or three) variables in IDXCR1 file, or, if one variable is binary, relative frequency histogram is produced instead of scatter diagram.

Program Information:

Development Programmer:
Hugh Stone
Location: ERH Garden City, NY
Phone: FTS 649-5443
Language: DG FORTRAN IV/5.20
Save File Creation Date: 5/8/85

Maintenance Programmer:
Hugh Stone

Running Time: Varies linearly with the size of the IDXCR1 data file. Typical times for scatter diagram:
IDXCR1 (38924 bytes) 35 seconds
IDXCR1 (83246 bytes) 65 seconds
Histogram takes additional 10 seconds.

Disk Space:

SCATR.SV	61 RDOS Blocks
IDXCR1	Variable, 25-200 Blocks usually
Other Data Files	1-3 RDOS Blocks

Program Requirements

Program Files:

Name	Comments
SCATR.SV	

Data Files:

Name	DP Location	Read/Write	Comments
IDXCR1	DPØ	R	Data must begin with 80 ID characters on first line.
HMSGPH.01	DPØ	W/R	Temporary

AFOS Products:

ID	Action	Comments
NMCGPHSCT		Created by SCATR
NMCGPHB99	Blank Map Background	Created by MBG

Load Line:

```
RLDR SCATR GPTX ROUND ISCR5 SHADE OUT AG.LB UTIL.LB
TOP.LB FORT.LB
```

Program Installation:

1. Add map background NMCGPHB99 to database.
2. Add NMCGPHSCT to database and assign map background 99.
3. Put MBG.SV on DPØ.
4. Run MBG from Dasher to create blank map background, B99 (10 seconds running time).
5. Delete MBG.SV from DPØ.
6. SCATR.SV should be on DPØ or DPØF with link to DPØ.
7. Data file IDXCR1 should be on DPØ or DPØF with link to DPØ.

Scatter Diagram and Histogram Program - SCATR

Part B: Program Execution and Error Conditions

Program Name: SCATR.SV

AAL ID:
Revision No.: 01.00

Program Execution

Program is run by typing SCATR at the Dasher and responding to the questions which appear. Twelve different questions may appear which are numbered and listed below with a guide to an appropriate response where clarification is needed. 'Y' denotes a yes response and 'N' for no. When the question 'FINISHED?' appears, the SCT graphic is ready for printing.

1. TYPE NO. OF VARIABLES PER RECORD IN IDXCR1, FORMAT (I2)
   Go to 2.

2. TYPE FORMAT FOR READING DATA IN IDXCR1, USE (***)
   Go to 3.

3. REDUCED FIGURES?...TYPE 'Y' OR 'N'
   'Y' go to 4, 'N' go to 5.

4. TYPE REDUCTION FACTORS FOR Y AND X DIRECTIONS, FORMAT (2F3.2)
   Go to 5.

5. TYPE VARIABLE NO. FOR Y & X AXIS AND Ƶ VARIABLE, FORMAT (3I2).
   VALUE OF Ƶ PLOTTED AT Y & X COORDS...Ƶ=Ø FOR SCATTER ONLY
   Go to 6.

6. AUTOMATIC INTERVAL SELECTION ON Y & X AXIS?...TYPE 'Y' OR 'N'
   'Y' go to 8, 'N' go to 7.

7. TYPE INTERVAL DESIRED FOR 'Y' and 'X' AXES.
   IF ONE AXIS IS NOT TO BE CHANGED, TYPE 'Ø' FOR THAT INTERVAL
   Type intervals in any format. Go to 8.

8. BINARY DATA?...TYPE 'Y' OR 'N'
   If only Y & X variables have been specified in question 5, this question refers to the Y variable; if Y is a binary variable and question is answered 'yes', frequency histogram will be produced. Go to 10. If 'N', scatter diagram is produced. Go to 11.

If Y,X & Z variables have been specified in question 5, this question refers to the Z variable; if answer is 'no', then the value of Z is plotted at the X,Y coordinates such that the lower left corner of the first digit of Z is at the data point. Go to 11. If answer is 'yes', symbol "x" is plotted if Z=1 and "o" is plotted if Z=Ø. Go to 9.

9. PLOT Z=Ø POINTS, Z=1 POINTS, OR ALL POINTS?
Type Ø, 1, or 2 RESPECTIVELY
If "Ø" is typed, only values of Z=Ø(o) are plotted, if "1" only values of Z=1(x) are plotted, if "2" all points are plotted. The plots "x" and "o" are centered on the data point. Go to 11.

10. TYPE MINIMUM # OF POINTS TO BE CONTAINED IN EACH INTERVAL OF BAR GRAPH, AND SHADE INDICATOR : Ø = NO SHADE, 1 = SHADE...FORMAT (I2, I1)
Minimum # of points:
If any number other than ØØ is typed, the intervals of the histogram are combined such that each interval contains at least the specified minimum number of data points. This usually results in unequal intervals in the histogram. If no alteration of intervals is desired, "ØØ" should be typed as a response.

Shade indicator:
If "1" is typed, a series of horizontal lines is drawn across the bars of the histogram to make them more visible, see Figure 7B. If "Ø" is typed, these horizontal lines are omitted, see Figure 7A. Go to 11.

11. FINISHED?...TYPE 'Y' OR 'N'
'Y' : finished. Program terminates.
'N' : do another diagram using the same IDXCR1 data file.
Go to 12.

12. CHANGE REDUCTION FACTORS?...TYPE 'Y' OR 'N'
'Y' : change factors, go to 4.
'N' : use same factors as previous diagram, go to 5.

Any desired number of diagrams may be done at one time and stored as AFOS graphic SCT. The diagrams may be printed as they are created, or may be printed all at once when finished, if there are enough versions of SCT in the database.

Error Conditions

Three abnormal stops are possible in the program, which are accompanied by a message at the Dasher indicating the trouble.

Dasher Message	Meaning
1. TOO MANY VARIABLES, PARAMETER L3=50 MUST BE INCREASED TO EQUAL KKZ	There is a limit of 50 variables per record in IDXCR1.
2. NO VARIATION, DV(X)=Ø.	One of variables 'X' in the IDXCR1 file is constant.
3. NO. OF INTERVALS EXCEEDS PARAMETER L1	The interval specified for one of the axes is too small. No more than 40 numbers can be plotted on an axis.

An incorrect response 'Y' to question 8 (Binary Data?) above, usually results in a fatal runtime error. Program must be restarted.

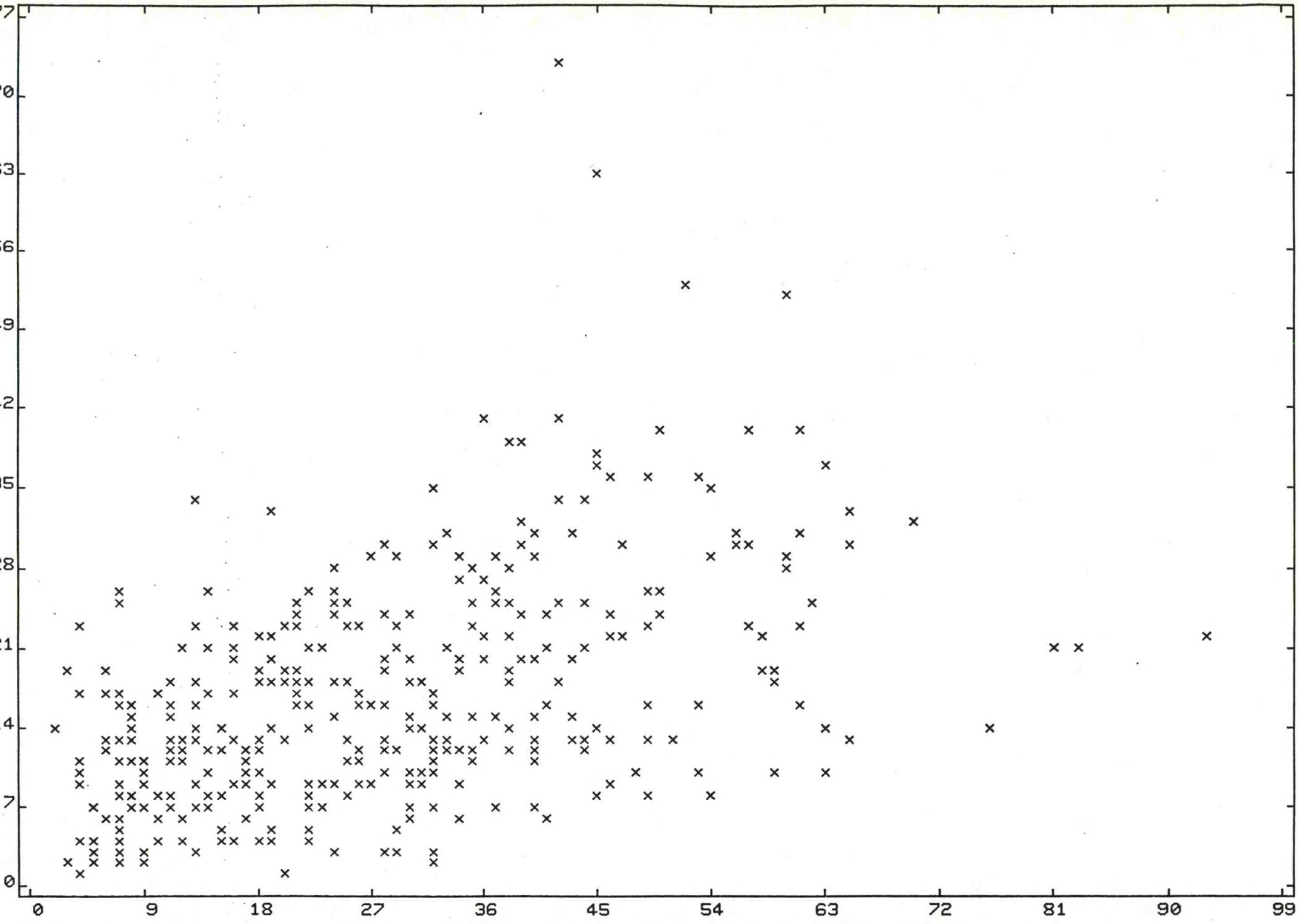
```
HOUR=12  PBS      MDRMIN=6 1111111    0  0 0    0.  0.                    xxxxxxxxxxx
  -13.    1.    9.   11.   11.   .11    0. .0042
34012389.
    3.   12.    1.   23.   23.   .23    1. .0012
   97129.
   14.    2.    3.  109. 1090.  1.09    1. .0083
    2791.
  -10.   14.    5.   97.   97.   .97    0. .0033
  234901.
    7.    8.    3.    9.    9.   .09    1. .0025
   34918.
  -12.    5.    2.  115.  115.  1.15    0. .0060
12922567.
```

Figure 1. Sample of small IDXCR1 data file. First line (for identification purposes) is always exactly 80 characters long and read in the format (40A2). Subsequent six records, in this example, may be read in format (8F6.0/F9.0)

```
SCATR
STRUCTURE OF 'IDXCR' FILE :
TYPE NO. OF VARIABLES PER RECORD IN IDXCR1, FORMAT (I2)
29
KKZ = 29
TYPE FORMAT FOR READING DATA IN IDXCR1, USE (***)
(2F1.0,21F6.0/6F6.0)
REDUCED FIGURES? ... TYPE 'Y' OR (N)
READING IDXCR1 FILE
NTOTAL =      373
TYPE VARIABLE NO. FOR Y & X AXIS AND Z VARIABLE, FORMAT (3I2)
VALUE OF Z PLOTTED AT Y & X COORDS...Z = 0 FOR SCATTER ONLY
2021
IY = 20   IX = 21   IZ =  0
AUTOMATIC INTERVAL SELECTION ON Y & X AXIS? .. TYPE (Y) OR 'N'
BINARY DATA? ... TYPE 'Y' OR (N)
I =  1      VMIN =     0.10000E  1      VMAX =     0.73000E  2
I =  2      VMIN =     0.20000E  1      VMAX =     0.93000E  2
FINISHED ? ... TYPE 'Y' OR (N)


CHANGE REDUCTION FACTORS? ... TYPE 'Y' OR (N)
TYPE VARIABLE NO. FOR Y & X AXIS AND Z VARIABLE, FORMAT (3I2)
VALUE OF Z PLOTTED AT Y & X COORDS...Z = 0 FOR SCATTER ONLY
2021
IY = 20   IX = 21   IZ =  0
AUTOMATIC INTERVAL SELECTION ON Y & X AXIS? .. TYPE 'Y' OR (N)
TYPE INTERVAL DESIRED FOR 'Y' AND 'X' AXES
IF ONE AXIS IS NOT TO BE CHANGED, TYPE '0' FOR THAT INTERVAL
Y =        5.
X =        10.
BINARY DATA? ... TYPE 'Y' OR (N)
I =  1      VMIN =     0.10000E  1      VMAX =     0.73000E  2
I =  2      VMIN =     0.20000E  1      VMAX =     0.93000E  2
FINISHED ? ... TYPE (Y) OR 'N'
R
```

Figure 2. Sample of Dasher printout. Top portion produced Fig. 3 in which the interval for the X and Y axes was selected by the program. The bottom portion produced Fig. 4, in which the X and Y intervals were specified by Dasher input. Manual input above is underlined. 'Y' and 'N' responses do not print on the Dasher so response used is circled. Index I=1 is for Y axis, index I=2 for X axis. VMIN is minimum value of that variable and VMAX is maximum value. NTOTAL is the number of data records in IDXCR1 file.



X=21E 0 Y=20E 0 N=373 HOUR=12 PBS MDRMIN=6 0111111 0 0 0 0. 0.

Figure 3. Sample of full size scatter diagram produced from IDXCR1 file containing 373 data records (N=373). Printing beginning with "HOUR=12..." was obtained from the first line of IDXCR1 file.
"X=21E Ø" denotes X axis used for variable No. 21, interval marks to be multiplied by $1Ø^{Ø}=1$.
"Y=2ØE Ø" denotes Y axis used for variable No. 20, interval marks to be multiplied by $1ØØ=1$.

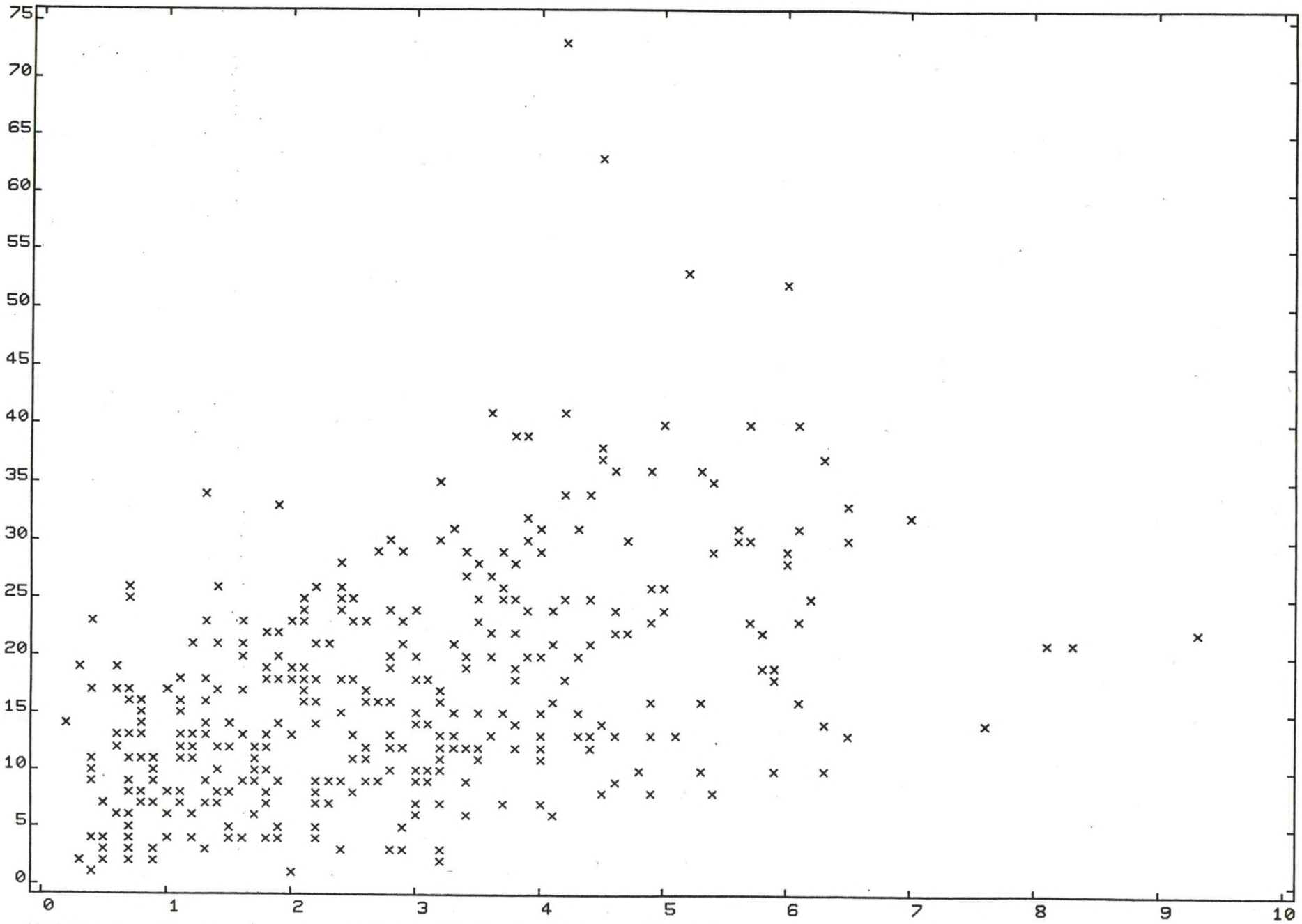
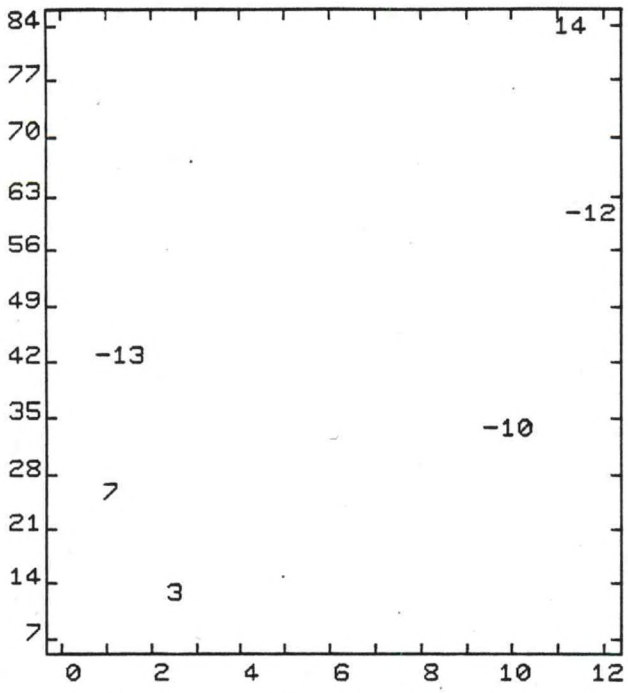
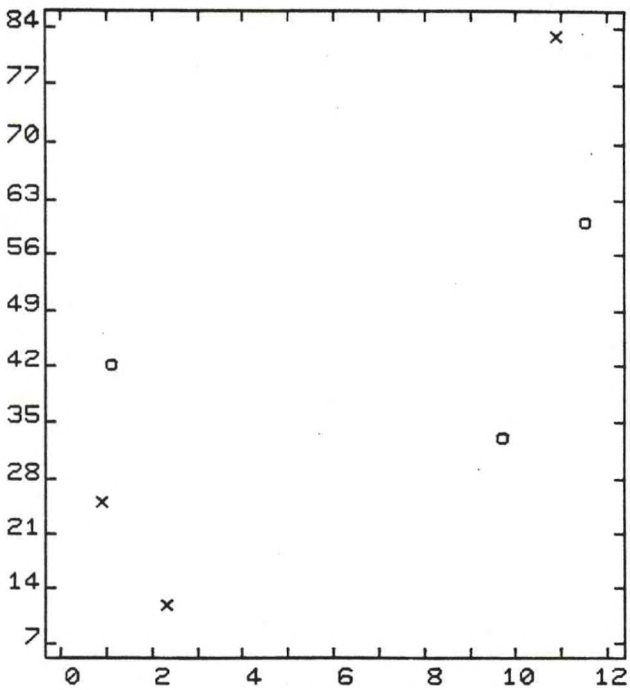


Figure 4. Same as Figure 3, except Y interval was changed from 7 units in Figure 3 to 5 units in this figure and X interval changed from 9 to 10 units. Note that "X=21E +1"now indicates that the X interval marks are to be multiplied by $10^1=10$.



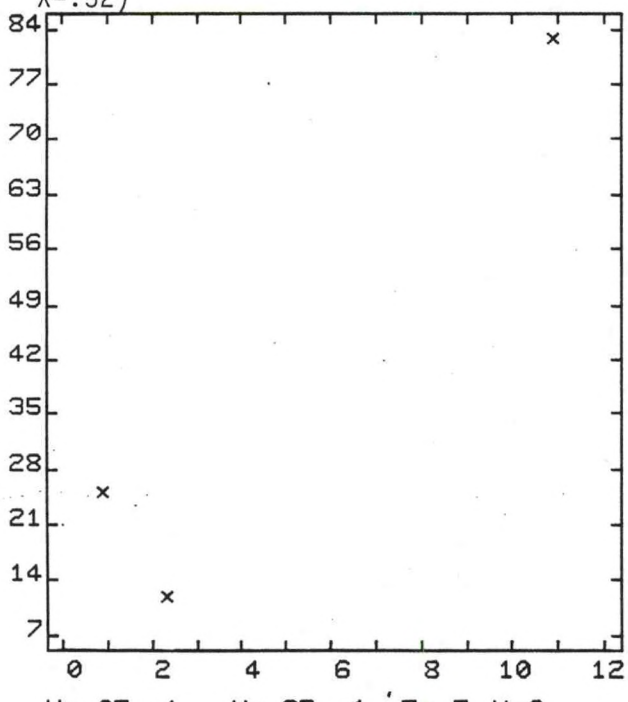
X= 6E -1 Y= 8E -4 Z= 1 N=6

Figure 5A. Small scatter diagram produced from IDXCR1 file in Fig. 1. Values of the variable no. 1 (Z=1) are plotted at the coordinates of variables no. 6 and 8 instead of an "x" plot. Lower left corner of the first digit plotted is the exact location of the data point. (Reduction factors: Y=.50, X=.32)



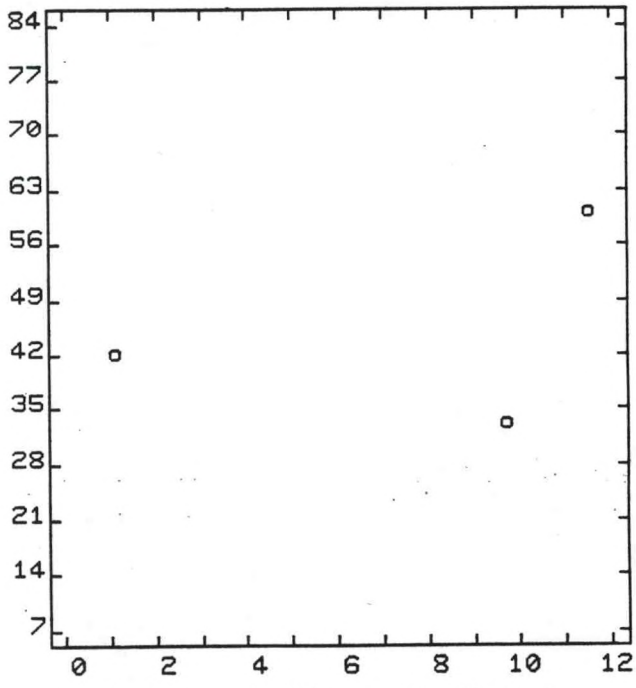
X= 6E -1 Y= 8E -4 Z= 7 N=6

Figure 5B. X and Y axes are same as in 5A, but variable no. 7 (Z=7) is now plotted in place of No. 1. This is a binary valued variable, so "x" is plotted for "1", and "o" is plotted for "Ø", with both symbols centered on exact location of the data point.



X= 6E -1 Y= 8E -4 Z= 7 N=6

Figure 5C. Same as Fig. 5B, except only values of "1" are plotted for variable no. 7.



X= 6E -1 Y= 8E -4 Z= 7 N=6

Figure 5D. Same as Fig. 5B, except only values of "Ø" are plotted for variable no. 7.

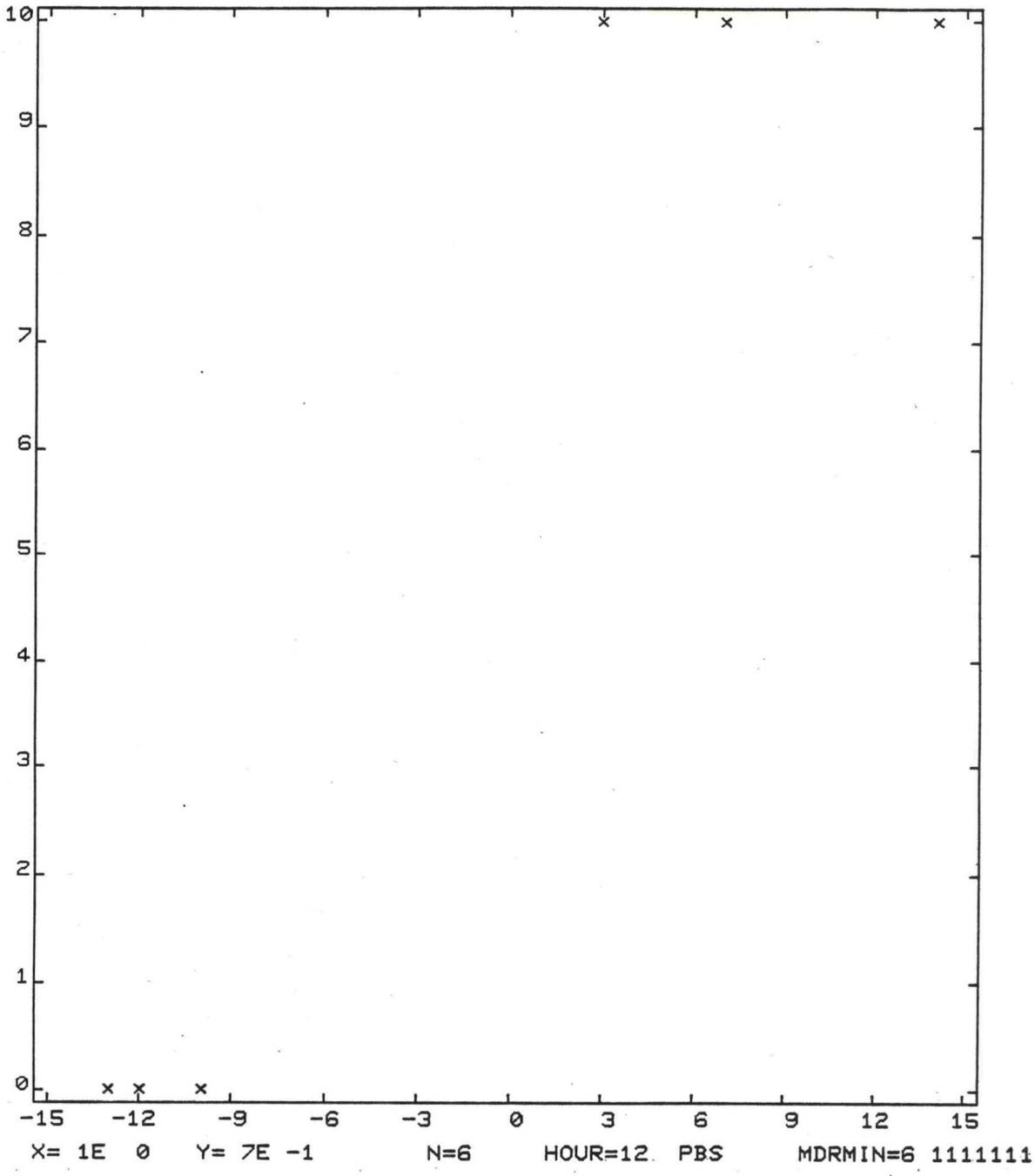


Figure 6. Scatter diagram produced when a binary valued variable is used for the Y axis. In this case, variable 7 of the IDXCR1 file in Fig. 1 was used for Y axis and variable number 1 for the X axis. Reduction factors for this diagram: Y=1.0 and X=.60.

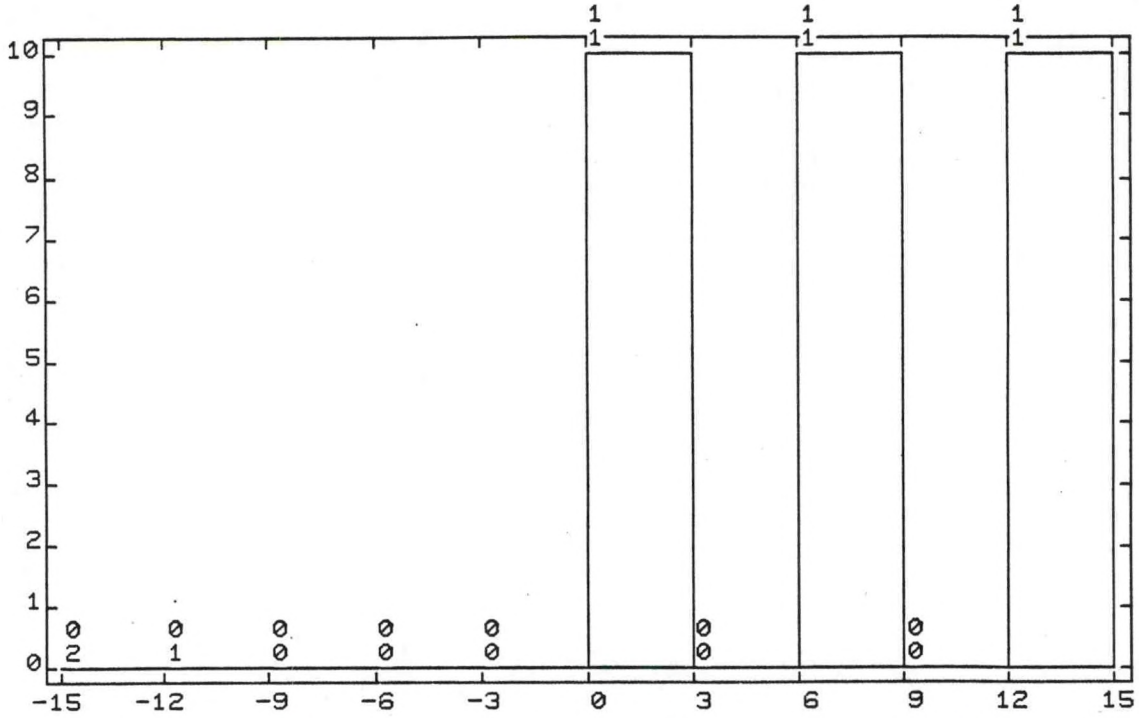


Figure 7A. Relative frequency histogram produced from data file IDXCR1 of Fig. 1. No shading is used for the bars. Range of Variable X=1 is divided into 10 intervals automatically. The relative frequency of occurrence of value "1" for Y=7 is graphed for each interval. Values of X that occur exactly on an interval division point are counted in the interval on the left.

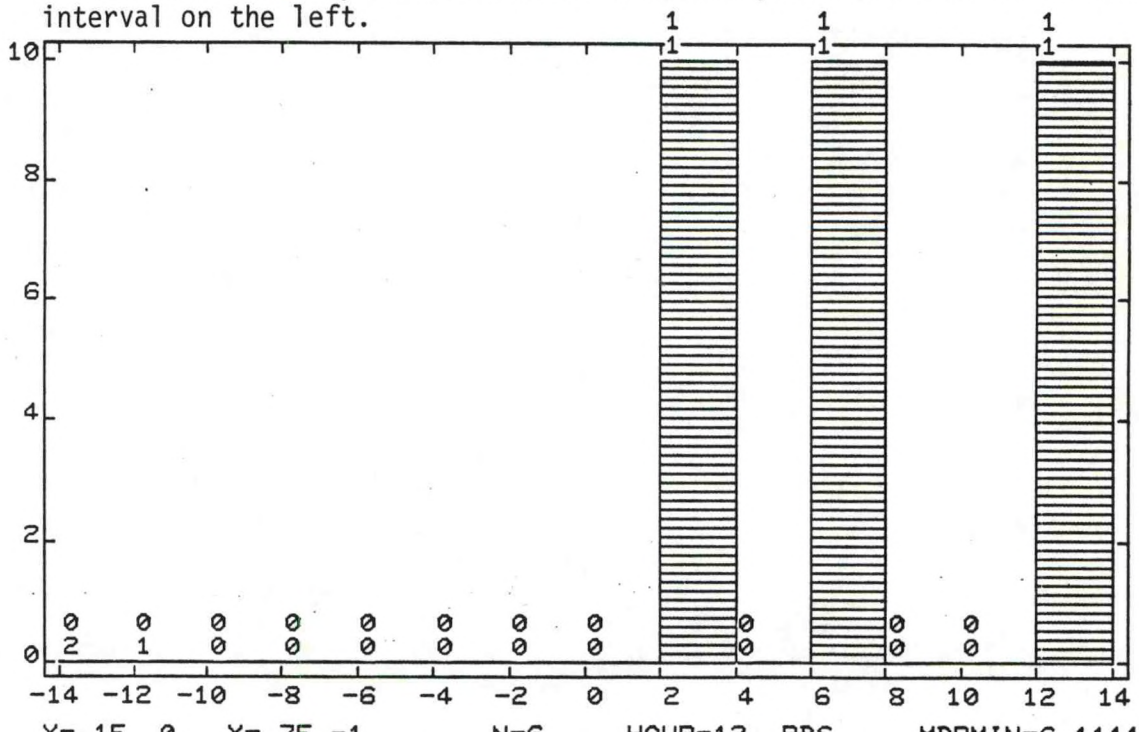


Figure 7B. Same as Fig 7A, except intervals of both X and Y axes have been manually specified, and bars have been shaded for improved clarity. The top number above each interval is the number of times variable no. 7 assumes value "1" in the interval. Bottom number is the total number of data points in the interval. Reduction factors used for this size diagram: Y=.50 and X=.60.

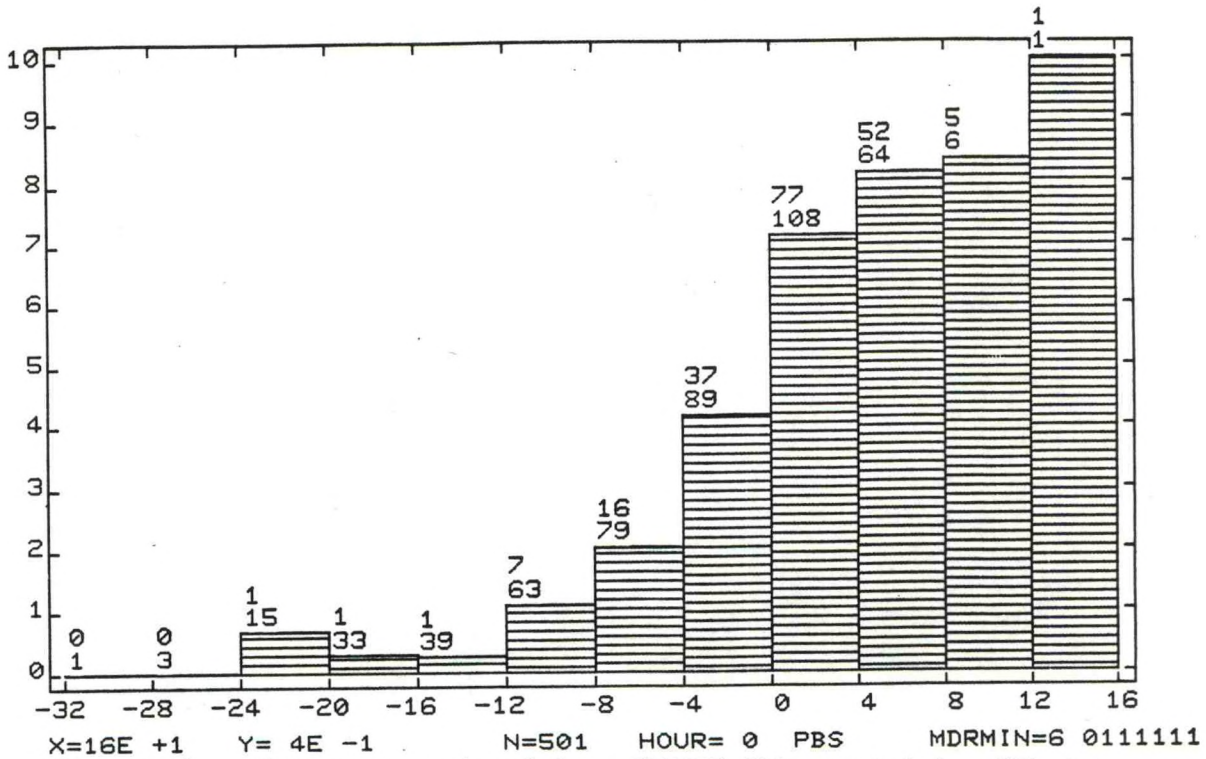


Figure 8A. Histogram produced from IDXCR1 file containing 501 data points. Automatic interval selection was used on both axes, and the minimum number of data points for each interval was specified as Ø. Note that the first and last interval in the histogram contain only 1 data point each (bottom number above the bar).

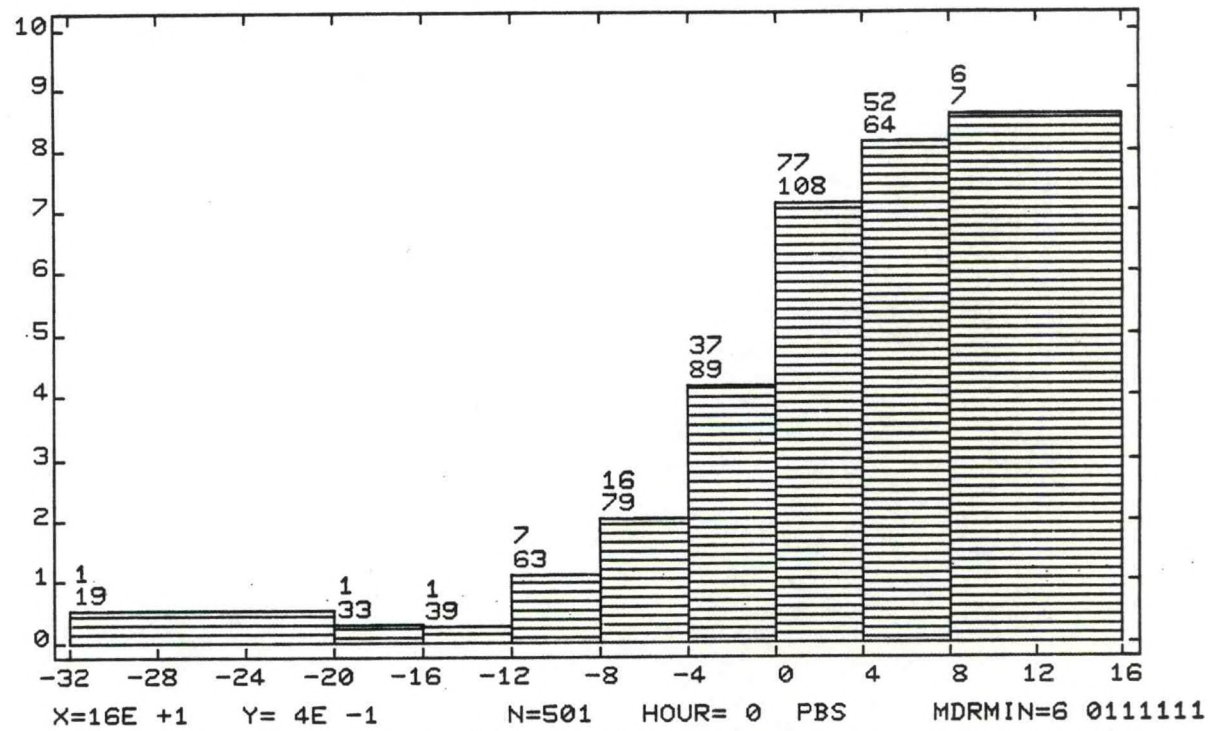


Figure 8B. Same as Fig. 8A, except a minimum number of 7 data points was specified for each interval. Intervals containing less than 7 data points are combined with adjacent intervals until the total reaches at least 7. In this case, the first three and the last 2 intervals of Fig. 8A were combined.

MAIN PROGRAM

SCATR

SUBROUTINES

LOAD LINE

```
RLDR SCATR GPTX ROUND ISCR5 SHADE OUT
AG.LB UTIL.LB TOP.LB FORT.LB
```

Figure 9. Software Structure and Load Line for Program SCATR.

```
C     PROGRAM SCATR                                          REV 01.00
C     MAY 1985                  STONE, H. M.                 ERH SSD/FTS 649-5443
C     FORTRAN IV/ REV 5.20  DG ECLIPSE (S230)                RDOS/REV 7.20
C     LOAD LINE:  RLDR SCATR GPTX ROUND ISCR5 SHADE
C                 OUT AG.LB UTIL.LB TOP.LB FORT.LB
C     PURPOSE
C         PLOTS SCATTER DIAGRAM FOR ANY TWO (OR THREE) VARIABLES IN
C         IDXCR1 FILE, OR, IF ONE VARIABLE IS BINARY, RELATIVE FREQUENCY
C         HISTOGRAM IS PRODUCED INSTEAD OF SCATTER DIAGRAM
C     CHANNELS/FILES
C         20 ... IDXCR1
C     EXITS
C         STOP 78  ''TOO MANY VARIABLES, ...''
C               LIMIT 50 VARIABLES PER RECORD IN IDXCR1
C
C         STOP 14  ''NO VARIATION, ...''
C               NO VARIATION IN ONE OF VARIABLES NEEDED.
C
C         STOP 15  ''NO. OF INTERVALS EXCEEDS PARAMETER L1''
C               L1=40 IS MAXIMUM NO. INTERVALS X,Y AXIS.
C
C
C    PARAMETERS L1 & L3 MUST AGREE WITH SAME IN GPTX SUBROUTINE
          PARAMETER L1=40    ;    MAXIMUM NO. OF INTERVALS ON X & Y AXES
          PARAMETER L3=50    ;    NO. OF POSSIBLE VARIABLES IN IDXCR1
          DIMENSION ITITLE(41),FT(80),VMAX(L3),VMIN(L3),V(L3),DDV(2),DV(2),
         1  RE(2),IE(2),VMX(3),VMN(3),VMN1(2),JE(2),VL(2,L1),IV(2),JDV(2),
         2  JVMN(2),JVL(2,L1),RF(2),ADV(2)
          KFIN=0
          NTOTAL=0
          RF(1)=1.    ;    REDUCTION FACTOR, Y DIRECTION
          RF(2)=1.    ;    REDUCTION FACTOR, X DIRECTION
          CALL OPEN (20,"IDXCR1",1,IER)
          IF (IER.NE.1) TYPE "OPEN 20, IER = ",IER
          CALL CFILW ("HMSGPH.01",2,IER)
          IF (IER.NE.1) TYPE "CFILW, HMSGPH.01, IER = ",IER
          TYPE "STRUCTURE OF 'IDXCR' FILE : "
          TYPE "TYPE NO. OF VARIABLES PER RECORD IN IDXCR1, FORMAT (I2)"
          READ (11,1) KKZ
1         FORMAT (I2)
          WRITE (10,69) KKZ
69        FORMAT (" KKZ = ",I2)
          IF (KKZ.LE.L3) GO TO 77
          K3=L3
          WRITE (10,78) K3
78        FORMAT (" TOO MANY VARIABLES, PARAMETER L3 =",I3,"  MUST BE INCREASE
         1D TO EQUAL KKZ")
          STOP 78
77        TYPE "TYPE FORMAT FOR READING DATA IN IDXCR1, USE (***)"
          READ (11,32) FT(1)
32        FORMAT (S80)
          TYPE "REDUCED FIGURES? ... TYPE 'Y' OR 'N'"    ;    Y=89  N=78
          CALL GCHAR(IREDUC,IER)
          IF (IREDUC.EQ.78) GO TO 70    ;    NO REDUCTION
76        TYPE "TYPE REDUCTION FACTORS FOR Y AND X DIRECTIONS, FORMAT (2F3.2)"
          READ (11,71) (RF(I),I=1,2)
71        FORMAT (2F3.2)
          WRITE (10,72) (RF(I),I=1,2)
72        FORMAT (1X,"RF(Y) = ",F4.2,"   RF(X) = ",F4.2)
          IF (KFIN.EQ.1) GO TO 5    ;    IDXCR1 HAS ALREADY BEEN READ
```

```
70      DO 4 I=1,KKZ
        VMIN(I)=1.E+50
4       VMAX(I)=1.E-50
        TYPE "READING IDXCR1 FILE"
        READ (20,62) (ITITLE(IT),IT=1,40)
62      FORMAT (40A2)
3       READ (20,FT,END=13) (V(I),I=1,KKZ)
        NTOTAL=NTOTAL+1    ;    COUNT NO. OF DATA POINTS
        DO 2 I=1,KKZ
        IF (V(I).LT.VMIN(I)) VMIN(I)=V(I)    ;    FIND MINIMUM
2       IF (V(I).GT.VMAX(I)) VMAX(I)=V(I)    ;    FIND MAXIMUM
        GO TO 3
13      REWIND 20
        TYPE "NTOTAL = ",NTOTAL
        GO TO 5
6       TYPE "FINISHED ? ... TYPE 'Y' OR 'N'"    ;    Y=89  N=78
        CALL GCHAR (IFINISH,IER)
        IF (IFINISH.EQ.89) GO TO 7
        KFIN=1    ;    INDICATES ONE GRAPHIC HAS ALREADY BEEN MADE
        TYPE "CHANGE REDUCTION FACTORS? ... TYPE 'Y' OR 'N'" ;  Y=89 N=78
        CALL GCHAR (IREDUC,IER)
        IF (IREDUC.EQ.89) GO TO 76
5       TYPE "TYPE VARIABLE NO. FOR Y & X AXIS AND Z VARIABLE, FORMAT (3I2)"
        TYPE "VALUE OF Z PLOTTED AT Y & X COORDS...Z = 0 FOR SCATTER ONLY"
        READ (11,8) IY,IX,IZ
8       FORMAT (3I2)
        WRITE (10,9) IY,IX,IZ
9       FORMAT (1X,"IY = ",I2,3X,"IX = ",I2,3X,"IZ = ",I2)
        ADV(1)=0.    ;    INDICATES AUTOMATIC SELECTION OF 'Y' INTERVAL
        ADV(2)=0.    ;    INDICATES AUTOMATIC SELECTION OF 'X' INTERVAL
        TYPE "AUTOMATIC INTERVAL SELECTION ON Y & X AXIS? .. TYPE 'Y' OR 'N'"
        CALL GCHAR (INTER,IER)
        IF (INTER.EQ.89) GO TO 79  ;  AUTOMATIC INTERVAL SELECTION
        TYPE "TYPE INTERVAL DESIRED FOR 'Y' AND 'X' AXES"
        TYPE "IF ONE AXIS IS NOT TO BE CHANGED, TYPE '0' FOR THAT INTERVAL"
        ACCEPT "Y =         ",ADV(1),"X =         ",ADV(2)
79      TYPE "BINARY DATA? ... TYPE 'Y' OR 'N'"
        CALL GCHAR (IPBS,IER)
        IF (IZ.EQ.0) GO TO 73
        IF (IPBS.EQ.78) GO TO 11    ;    N = 78    Y = 89
        TYPE "PLOT Z=0 POINTS, Z=1 POINTS, OR ALL POINTS?"
        TYPE "TYPE 0, 1, OR 2 RESPECTIVELY"
        CALL GCHAR(IW,IER)
        IW=IW-48
        WRITE (10,25) IW
25      FORMAT (1X,"IW = ",I1)
        GO TO 11
73      IF (IPBS.EQ.78) GO TO 11    ;    REGULAR SCATTER DIAGRAM
        TYPE "TYPE MINIMUM # OF POINTS TO BE CONTAINED IN EACH INTERVAL OF B
     1AR GRAPH, AND"
        TYPE "SHADE INDICATOR: 0 = NO SHADE, 1 = SHADE ... FORMAT (I2,I1)"
        READ (11,74) I1,ISHAD
74      FORMAT (I2,I1)
        WRITE (10,75) I1,ISHAD
75      FORMAT (" I1 = ",I2,"    ISHAD = ",I1)
        IF (ISHAD.NE.0) ISHAD=40    ;    40 INTERVALS BETWEEN LINES
11      DV(1)=VMAX(IY)-VMIN(IY)
        DV(2)=VMAX(IX)-VMIN(IX)
        VMX(1)=VMAX(IY)
        VMX(2)=VMAX(IX)
```

```
      VMN(1)=VMIN(IY)
      VMN(2)=VMIN(IX)
      IF (IZ.EQ.0) GO TO 26
      VMX(3)=VMAX(IZ)
      VMN(3)=VMIN(IZ)
26    JS=2
      IF (IZ.NE.0) JS=3
      DO 21 I=1,JS
21    WRITE (10,23) I,VMN(I),VMX(I)
23    FORMAT (1X,"I = ",I2,6X,"VMIN = ",E15.5,6X,"VMAX = ",E15.5)
      DO 10 I=1,2
      IF (DV(I).NE.0.) GO TO 12
      WRITE (10,14) I,DV(I)
14    FORMAT (1H ,"NO VARIATION,",4X,"DV(",I2,") = ",E20.8)
      STOP 14
12    IF (ADV(I).NE.0.) DV(I)=ADV(I)*10.  ;  MANUAL DETERMINATION OF INTERVAL
      CALL ROUND (DV(I),IE(I),RE(I))
      DV(I)=DV(I)*.1    ;    INTERVAL FOR AXIS LEGEND
      HM=10.**(1-IE(I))
      JDV(I)=DV(I)*HM   ;    INTERVAL FOR LEGEND OF X & Y AXES
      JVMN(I)=VMN(I)*HM   ;   MINIMUM NO. ON LEGEND
C   ENSURE THAT "0" APPEARS ON Y & X AXES
      JM=MOD(JVMN(I),JDV(I))
      IF (JM) 27,28,29
27    JVMN(I)=JVMN(I)-JDV(I)-JM
      GO TO 28
29    JVMN(I)=JVMN(I)-JM
C
28    VMN1(I)=JVMN(I)/HM  ;    CORRESPONDING ACTUAL MINIMUM
      JE(I)=IE(I)-1       ;    EXPONENT FOR LEGEND
C   DETERMINE REFERENCE POINTS ON Y = 1 & X = 2 AXES
      IF (VMN(I).GE.VMN1(I)) GO TO 16
      VMN1(I)=VMN1(I)-DV(I)
      JVMN(I)=JVMN(I)-JDV(I)
16    VL(I,1)=VMN1(I)
      JVL(I,1)=JVMN(I)
      IV(I)=1
17    JX=IV(I)+1
      IF (JX.LE.L1) GO TO 15
      TYPE "NUMBER OF INTERVALS EXCEEDS PARAMETER L1"
      STOP 15
15    VL(I,JX)=VL(I,IV(I))+DV(I)
      JVL(I,JX)=JVL(I,IV(I))+JDV(I)
      IV(I)=JX
      IF (VL(I,JX).LT.VMX(I)) GO TO 17
10    CONTINUE
      CALL GPTX (IV,VL,JVL,JE,ITITLE,IX,IY,IZ,FT,KKZ,IPBS,NTOTAL,
     1  IW,RF,I1,ISHAD)
      CALL UTF ("NMCGPHSCT","HMSGPH.01")
      DO 19 I=1,1500
19    TIMEWASTE=1./2.
      DO 18 I=1,1000
      CALL DFILW ("HMSGPH.01",IER)
      IF (IER.EQ.1) GO TO 6
18    CONTINUE
      TYPE "DFILW, HMSGPH.01, IER = ",IER
      GO TO 6
7     CALL CLOSE (20,IER)
      IF (IER.NE.1) TYPE "CLOSE 20, IER = ",IER
      STOP
```

```
      END
                                    *
                                    *
      PARAMETER L1=40    ;   MAXIMUM NO. OF INTERVALS ON X & Y AXES
      PARAMETER L3=50    ;   NO. OF POSSIBLE VARIABLES IN IDXCR1 FILE
      SUBROUTINE GPTX (IV,V,JVL,JE,ITITLE,IX,IY,IZ,FT,KKZ,IPBS,NTOTAL,
     1  IW,RF,I1,ISHAD)
C                             REV 01.00
C     MAY 1985                STONE, H. M.          ERH SSD/FTS 649-5443
C     FORTRAN IV/ REV 5.20    DG ECLIPSE (S230)     RDOS/REV 7.20
C     PURPOSE
C         CREATES GRAPHIC, AFOS PRODUCT 'SCT', SCATTER DIAGRAM OR
C         RELATIVE FREQUENCE HISTOGRAM
C     ARGUMENT LIST
C         IV                  - NO. OF INTERVALS ON Y & X AXES
C         V                   - VALUES OF THE INTERVAL MARKS FOR Y,X AXIS
C                               LEGEND
C         JVL                 - ACTUAL NOS. PLOTTED AS INTERVAL MARKS FOR Y,X
C                               AXIS LEGEND
C         JE                  - EXPONENT LEGEND OF Y,X AXIS ... V=JVL*(10**JE)
C         ITITLE              - 80 CHARACTERS (IDENTIFICATION) OF FIRST LINE
C                               OF IDXCR1 FILE
C         IX                  - NO. OF VARIABLE IN IDXCR1, PLOTTED ON X AXIS
C         IY                  - NO. OF VARIABLE IN IDXCR1, PLOTTED ON Y AXIS
C         IZ                  - NO. OF VARIABLE IN IDXCR1 (IF ANY), USED AS
C                               Z VARIABLE IN SCATTER PLOT
C         FT                  - FORMAT FOR READING IDXCR1 FILE
C         KKZ                 - NO. OF VARIABLES PER RECORD IN IDXCR1
C         IPBS                - 89 FOR BINARY DATA (Y OR Z), 78 NON-BINARY
C         NTOTAL              - NO. OF DATA RECORDS IN IDXCR1
C         IW                  - REFERS TO BINARY Z VALUES: 0 PLOT Z=0 PTS,
C                               1 PLOT Z=1 PTS, 2 PLOT ALL PTS
C         RF                  - REDUCTION FACTORS FOR Y & X DIRECTIONS
C         I1                  - MINIMUM NUMBER OF DATA IN EACH INTERVAL
C                               OF THE HISTOGRAM
C         ISHAD               - 0...NO SHADING OF BARS ON HISTOGRAM
C                               40..SPACING OF HORIZONTAL LINES FOR SHADE
C     CHANNELS/FILES
C         20 ... IDXCR1
C
      DIMENSION IV(2),V(2,L1),JE(2),ITITLE(41),ISC(7),LX(5),LY(5),
     1  MARL(2),MARR(2),KL(2),KR(2),JJ(2),JVL(2,L1),FACTOR(2),
     2  FT(80),VV(L3),KS(2),IC(2,L1),JL(L1),RF(2),IK1(L1),IK2(L1),IKE(L1),
     3  VKE(L1),LYY(L1)
      COMMON/TITLE1/JT(20),JV(7),LD(2)
      DATA JT/"X=    E          Y=    E          Z=       "/
C                  1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
      DATA JV/"N=              "/
      DATA LD/3071,4095/
      KS(1)=111     ;   o   SYMBOLS FOR PLOT
      KS(2)=120     ;   x
      ITC=0
      DO 25 I=1,2
      DO 25 J=1,L1
25    IC(I,J)=0
C   PLOT OUTLINE OF DIAGRAM
      MARL(1)=140   ;   LEFT MARGIN, Y DIRECTION
      MARL(2)=220   ;   LEFT MARGIN, X DIRECTION
```

```
      MARR(1)=120    ;   RIGHT MARGIN, Y DIRECTION
      MARR(2)=85     ;   RIGHT MARGIN, X DIRECTION
      DO 35 I=1,2    ;   CHANGE RIGHT MARGINS TO MATCH REDUCTION FACTOR RF
      MR=LD(I)-MARL(I)
      MRR=MR-MARR(I)
35    MARR(I)=MR-RF(I)*MRR
      KD=35          ;   INDENTATION FOR 1ST AND LAST REFERENCE POINT
      KL(1)=MARL(1)+KD
      KL(2)=MARL(2)+KD
      KR(1)=3071-MARR(1)-KD
      KR(2)=4095-MARR(2)-KD
      JJ(1)=MARL(2)-220
      JJ(2)=MARL(1)-55
      LX(1)=MARL(2)
      LX(2)=LX(1)
      LX(3)=4095-MARR(2)
      LX(4)=LX(3)
      LX(5)=LX(1)
      LY(1)=3071-MARR(1)
      LY(2)=MARL(1)
      LY(3)=LY(2)
      LY(4)=LY(1)
      LY(5)=LY(1)
      CALL LINES (LX,LY,5,1,0)
      JD=20   ;   LENGTH OF REFERENCE MARKER
      DO 1 I=1,2
      FACTOR(I)=(KR(I)-KL(I))/(V(I,IV(I))-V(I,1))
      K=IV(I)
      IF (I.EQ.2) GO TO 3
C   PLOT NUMBERS ON Y AXIS
      LX(1)=MARL(2)
      LX(2)=LX(1)+JD
      LX(4)=4095-MARR(2)
      LX(3)=JD-LX(4)
      DO 2 J=1,K
      JL(J)=KL(I)+(V(I,J)-V(I,1))*FACTOR(I)
      DO 4 N=1,4
4     LY(N)=JL(J)
      CALL LINES (LX,LY,4,1,0)
      IVL=JVL(I,J)
      IF (RF(1).GE..5) GO TO 37   ;   FOR SMALL REDUCTION PLOT ALL
      MM=MOD(J,2)
      IF (MM.EQ.0) GO TO 2  ;  IF RF < .5, SKIP EVERY OTHER * ON Y AXIS
37    CALL ISCR5 (ISC,IVL,+1)
      CALL TEXT (ISC,JJ(I),JL(J),0,1,0,0)
2     CONTINUE
      GO TO 1
C   PLOT NUMBERS ON X AXIS
3     LY(1)=MARL(1)
      LY(2)=LY(1)+JD
      LY(4)=3071-MARR(1)
      LY(3)=LY(4)-JD
      DO 5 J=1,K
      JL(J)=KL(I)+(V(I,J)-V(I,1))*FACTOR(I)
      LX(1)=JL(J)
      LX(2)=JL(J)
      LX(3)=-JL(J)
      LX(4)=JL(J)
      CALL LINES (LX,LY,4,1,0)
      IVL=JVL(I,J)
```

```
      IF (RF(2).GE..5) GO TO 38   ;   FOR SMALL REDUCTION PLOT ALL
      MM=MOD(J,2)
      IF (MM.EQ.0) GO TO 5  ;  IF RF < .5, SKIP EVERY OTHER # ON X AXIS
38    CALL ISCR5 (ISC,IVL,+1)
      JK=JL(J)-170   ;   DISPLACEMENT FOR NUMBERS ON X AXIS
      CALL TEXT (ISC,JK,JJ(I),0,1,0,0)
5     CONTINUE
1     CONTINUE
C   CONVERT TITLE NUMBERS TO ASCII
      CALL ISCR5 (ISC,IX,+1)
      JT(2)=ISC(5)
      JT(3)=ISC(6)
      CALL ISCR5 (ISC,JE(2),-1)
      IF (ISC(1).EQ.32.AND.ISC(2).NE.48) ISC(1)=43  ;  RESTORE + SIGN
      JT(5)=ISC(1)
      JT(6)=ISC(2)
      IF (ISC(3).EQ.0) ISC(3)=32   ;   ELIMINATE ZERO TERMINATOR
      JT(7)=ISC(3)
      CALL ISCR5 (ISC,IY,+1)
      JT(10)=ISC(5)
      JT(11)=ISC(6)
      CALL ISCR5 (ISC,JE(1),-1)
      IF (ISC(1).EQ.32.AND.ISC(2).NE.48) ISC(1)=43  ;  RESTORE + SIGN
      JT(13)=ISC(1)
      JT(14)=ISC(2)
      IF (ISC(3).EQ.0) ISC(3)=32   ;   ELIMINATE ZERO TERMINATOR
      JT(15)=ISC(3)
      IF (IZ.EQ.0) GO TO 12
      CALL ISCR5 (ISC,IZ,+1)
      JT(16)=32   ;   SPACE
      JT(18)=ISC(5)
      JT(19)=ISC(6)
      JT(20)=0    ;    TERMINATOR
      GO TO 13
12    JT(16)=0    ;    TERMINATOR
13    CALL TEXT (JT,MARL(2),0,0,1,0,0)  ;  BOTTOM LEFT TITLE
      CALL ISCR5(ISC,NTOTAL,-1)   ;   NO. OF DATA POINTS
      DO 20 I=2,7
20    JV(I)=ISC(I)
      CALL TEXT (JV,1170,0,0,1,0,0)   ;   BOTTOM CENTER TITLE
      ITITLE(37)=0   ;   TERMINATOR
      CALL TEXT (ITITLE,1450,0,0,1,0,0)   ;   BOTTOM RIGHT TITLE
C   PLOT SYMBOLS FOR DATA POINTS
      ISC(1)=KS(2)
      ISC(2)=0   ;   TERMINATOR
      READ (20,6) (ITITLE(I),I=1,40)
6     FORMAT (40A2)
C
      IF (IZ.NE.0) GO TO 18   ;   PLOT Z VALUES
      IF (IPBS.EQ.89) GO TO 22  ;  BINARY DATA --> FREQ HISTOGRAM
C
C   REGULAR SCATTER DIAGRAM
8     READ (20,FT,END=7) (VV(I),I=1,KKZ)
      KX=KL(2)+(VV(IX)-V(2,1))*FACTOR(2)-10   ;   X COORDINATE
      KY=KL(1)+(VV(IY)-V(1,1))*FACTOR(1)-10   ;   Y COORDINATE
      CALL TEXT (ISC,KX,KY,0,1,0,0)   ;   PLOT SYMBOL
      GO TO 8
7     REWIND 20
      RETURN
C
```

```
C   BAR GRAPH OF RELATIVE FREQUENCY DISTRIBUTION
22      READ (20,FT,END=23) (VV(I),I=1,KKZ)
C   COUNT NO. OF POINTS IN EACH SUBDIVISION
        K=IV(2)    ;   ORIGINAL NUMBER OF INTERVALS FOR X VARIABLE
        DO 24 I=2,K
        IF (VV(IX).GT.V(2,I)) GO TO 24  ;  V(2,I) ARE INTERVAL MARKS, X AXIS
        KV=VV(IY)+.001    ;    TO INSURE '0' OR '1'
        IF (KV.EQ.0) KV=2
        IC(KV,I)=IC(KV,I)+1    ;    COUNT
        ITC=ITC+1              ;    TOTAL COUNT
        GO TO 22
24      CONTINUE
        TYPE "ERROR 24 GPTX"
23      REWIND 20
        IF (ITC.NE.NTOTAL) TYPE "ERROR, ITC = ",ITC,"   NTOTAL = ",NTOTAL,
     1  "   GPTX"
C
C   ALTER SIZE OF X INTERVALS, SO AT LEAST 'I1' NO. OF CASES IN EACH
C   THIS IS DONE BY COMBINING INTERVALS OF SAME SIZE, IF NECESSARY
C
C   CHECK INTERVALS FROM LEFT SIDE OF X AXIS FIRST
        DO 28 I=2,K
28      IC(2,I)=IC(1,I)+IC(2,I)   ;    TOTAL EVENTS FOR EACH X INTERVAL
        IL=0    ;   COUNTER
        IKE(1)=JL(1)
        ITE1=0
        ITE2=0
        DO 29 I=2,K    ;    K= NO. OF INTEVALS + 1 ON X AXIS
        ITE1=ITE1+IC(1,I)
        ITE2=ITE2+IC(2,I)    ;    ADD NO. OF CASES IN EACH INTERVAL
        IF (ITE2.GE.I1) GO TO 30
        IF (I.EQ.K) GO TO 30
        IL=IL+1    ;    COUNT NO. OF INTERVALS WITH LESS THAN I1 EVENTS
        GO TO 29
30      IIL=I-IL
        IKE(IIL)=JL(I)
        IK1(IIL)=ITE1
        IK2(IIL)=ITE2
        ITE1=0
        ITE2=0
29      CONTINUE
C   CHECK INTERVALS NOW IN REVERSE ORDER, RIGHT TO LEFT ON X AXIS
C   ONLY EXTREME RIGHT INTERVALS MAY CONTAIN LESS THAN I1 EVENTS
        ITE1=0
        ITE2=0
        DO 31 I=2,IIL    ;    IIL IS NEW NUMBER OF INTERVALS
        ML=IIL+2-I
        ITE1=ITE1+IK1(ML)
        ITE2=ITE2+IK2(ML)
        IF (ITE2.GE.I1) GO TO 32
31      CONTINUE
        TYPE "COUNT ERROR, LOOP 31, GPTX"
        STOP 31
32      IKE(ML)=IKE(IIL)
        IK1(ML)=ITE1
        IK2(ML)=ITE2
C   COMPUTE RELATIVE FREQUENCY OF OCCURENCE (%) IN EACH NEW INTERVAL
        DO 33 I=2,ML
        VK1=IK1(I)          ;    CONVERT TO REAL
        VK2=IK2(I)          ;    CONVERT TO REAL
```

```
33      VKE(I)=VK1/VK2    ;   RELATIVE FREQUENCY
C   DRAW BAR GRAPH
        IF (ISHAD.NE.0.AND.RF(1).LT.1.) ISHAD=ISHAD*RF(1) ; REDUCE INTERVAL
        DO 34 I=2,ML
        LX(1)=IKE(I-1)
        LX(2)=LX(1)
        LX(3)=IKE(I)
        LX(4)=LX(3)
        LX(5)=LX(1)
        LY(1)=KL(1)
        LYY(I)=KL(1)+(VKE(I)-V(1,1))*FACTOR(1)
        LY(2)=LYY(I)
        LY(3)=LY(2)
        LY(4)=LY(1)
        LY(5)=LY(1)
        CALL LINES (LX,LY,5,1,0)    ;   DRAW BAR GRAPH
        IF (ISHAD.NE.0) CALL SHADE (LX(1),LX(3),LY(1),LY(2),ISHAD,I)
34      CONTINUE
C
C   PLOT FREQUENCY NUMBERS AT TOP OF BARS
        DO 36 J=2,ML
        JY=LYY(J)+20
        JX=IKE(J-1)+10
        CALL ISCR5 (ISC,IK2(J),-1)
        DO 39 I=1,6
39      ISC(I)=ISC(I+1)    ;   SHIFT ISC TO ELIMINATE SIGN, ALWAYS +
        CALL TEXT (ISC,JX,JY,1,1,0,0)    ;   PLOT TOTAL SUBDIVISION COUNT
        JY=JY+50
        CALL ISCR5 (ISC,IK1(J),-1)
        DO 40 I=1,6
40      ISC(I)=ISC(I+1)    ;   SHIFT ISC TO ELIMINATE SIGN, ALWAYS +
        CALL TEXT (ISC,JX,JY,1,1,0,0)    ;   PLOT SUBDIVISION COUNT
36      CONTINUE
        RETURN
C
18      IF (IPBS.EQ.89) GO TO 19    ;   POINT-BISERIAL PLOT
C   PLOT Z VALUES
9       READ (20,FT,END=11) (VV(I),I=1,KKZ)
        IPLOT=VV(IZ)
        CALL ISCR5(ISC,IPLOT,-1)
        KX=KL(2)+(VV(IX)-V(2,1))*FACTOR(2)    ;   X COORDINATE
        KX=KX-30    ;   DISPLACE LEFT, SO BOTTOM LEFT OF 1ST NUMERAL AT POINT
        KY=KL(1)+(VV(IY)-V(1,1))*FACTOR(1)    ;   Y COORDINATE
        CALL TEXT (ISC,KX,KY,0,1,0,0)    ;   PLOT Z VALUE
        GO TO 9
11      REWIND 20
        RETURN
C   PLOT SYMBOLS IN PLACE OF Z VALUES (POINT-BISERIAL PLOT)
19      ISC(2)=0    ;    TERMINATOR
14      READ (20,FT,END=15) (VV(I),I=1,KKZ)
        IF (VV(IZ).GT.0) GO TO 16
        ISC(1)=KS(1)    ;   SYMBOL 'o'
        IF (IW.EQ.1) GO TO 27    ;   DO NOT PLOT 'o'
        GO TO 17
16      ISC(1)=KS(2)    ;   SYMBOL 'x'
        IF (IW.EQ.0) GO TO 27    ;   DO NOT PLOT 'x'
17      KX=KL(2)+(VV(IX)-V(2,1))*FACTOR(2)-10    ;   X COORDINATE
        KY=KL(1)+(VV(IY)-V(1,1))*FACTOR(1)-10    ;   Y COORDINATE
        CALL TEXT (ISC,KX,KY,0,1,0,0)    ;   PLOT SYMBOL
27      CONTINUE
```

```
      GO TO 14
15    REWIND 20
      RETURN
      END
                              *


                              *
      SUBROUTINE ROUND (RA,J,R)
C                             REV 01.00
C     APR 1985                STONE, H. M.          ERH SSD/FTS 649-5443
C     FORTRAN IV/ REV 5.20    DG ECLIPSE (S230)     RDOS/REF 7.20
C     PURPOSE
C         ROUNDS A REAL NUMBER TO THE FIRST SIGNIFICANT PLACE, E.G.
C         1520. BECOMES 2000., .001520 BECOMES .002, ETC.
C     ARGUMENT LIST
C         RA                  - REAL NUMBER TO BE ROUNDED
C         J                   - NO. OF DECIMAL PLACES TO BE SHIFTED IN
C                               ORDER TO MAKE  1.   RA    10.
C                               POSITIVE SHIFT LEFT...NEGATIVE SHIFT RIGHT
C         R                   - 10.**J
C
      A=ABS(RA)
      J=0
      R=1.
      IF (RA.EQ.0.) RETURN
1     IF (A.GE.10.) GO TO 3
2     IF (A.LT.1.) GO TO 4
      GO TO 5    ;   A IS SINGLE DIGIT POSITIVE NUMBER
3     A=A*.1     ;   REDUCE A
      J=J+1
      GO TO 1
4     A=A*10.    ;   INCREASE A
      J=J-1
      GO TO 2
5     AA=AINT(A)     ;   TRUNCATE A
      D=A-AA         ;   DECIMAL PORTION
      IF (D.GE..5) AA=AA+1.
      IF (RA.LT.0.) AA=-AA    ;   RESTORE SIGN
      RA=AA
      R=10.**J
      RA=RA*R
      RETURN
      END
                              *


                              *
      SUBROUTINE ISCR5 (ISC,JDAT,KSHIFT)
C                             REV 01.00
C     MAR 1985                STONE, H. M.          ERH   FTS 649-5443
C     FORTRAN IV/ REV 5.20    DG ECLIPSE (S230)     RDOS/REV 7.20
C     PURPOSE
C         CONVERTS 1 TO 5 DIGIT INTEGER (+ OR -) TO ASCII
C         CHARACTERS, SHIFTED TO LEFT OR RIGHT IN ARRAY 'ISC'
C         INTEGER IN ISC ENDS WITH ZERO (FOR USE WITH TEXT SUBROUTINE).
C     ARGUMENT LIST
C         ISC                 - OUTPUT ARRAY CONTAINING ASCII CHARACTERS
C         JDAT                - INPUT, UP TO 5 DIGIT INTEGER
C         KSHIFT              - -1 FOR SHIFT LEFT, +1 FOR SHIFT RIGHT
```

```
C
      DIMENSION ISC(7)
      ISC(1)=32       ;   SPACE, SUPPRESS + SIGN
      IF (JDAT.LT.0) ISC(1)=45    ;   NEGATIVE SIGN
      JDAT=IABS(JDAT)    ;   USE ABSOLUTE VALUE OF JDAT
      IS=JDAT
      IK=0
      JK=0
      IDIV=10000
      DO 1 I=2,5
      ISC(I)=IS/IDIV    ;   SEPERATING INDIVIDUAL DIGITS
      IS=IS-ISC(I)*IDIV    ;   REMAINING NUMBER
      IF (ISC(I).NE.0) JK=1    ;   JK=1 1ST TIME NON-ZERO ENCOUNTERED
      IF (JK.EQ.1) GO TO 6
      IF (ISC(I).EQ.0) IK=IK+1 ; COUNTING NUMBER OF LEADING ZERO DIGITS
6     ISC(I)=ISC(I)+48    ;   CONVERT TO ASCII
      IDIV=IDIV/10
1     CONTINUE
      ISC(6)=IS+48    ;   UNITS DIGIT, CONVERT TO ASCII
      ISC(7)=0    ;   SET TO ZERO FOR TEXT SUBROUTINE
      IF (IK.EQ.0) RETURN    ;   5 DIGIT NUMBER, NO SHIFT NECESSARY
      IF (KSHIFT.EQ.1) GO TO 2    ;   SHIFT RIGHT
C   SHIFT LEFT
      IK7=7-IK
      DO 4 I=2,IK7
4     ISC(I)=ISC(I+IK)
      IK8=IK7+1
      DO 5 I=IK8,7
5     ISC(I)=32    ;   SET END OF ARRAY TO SPACES
      RETURN
C   SHIFT RIGHT
2     ISC(IK+1)=ISC(1)    ;   SHIFT SIGN TO RIGHT
      DO 3 I=1,IK
3     ISC(I)=32    ;   SET LEADING DIGITS TO SPACE
      RETURN
      END
                              *


                              *
      SUBROUTINE SHADE (IX1,IX2,IY1,IY2,ISHAD,I)
C                         REV 01.00
C     APR 1985            STONE, H. M.          ERH SSD/FTS 649-5443
C     FORTRAN IV/ REV 5.20  DG ECLIPSE (S230)   RDOS/REV 7.20
C     PURPOSE
C         PUTS SHADING ON BAR GRAPH (HISTOGRAM) BY DRAWING HORIZONTAL
C         LINES ACROSS EACH BAR
C     ARGUMENT LIST
C         IX1               - X COORDINATE OF BEGINNING OF LINE
C         IX2               - X COORDINATE OF END OF LINE
C         IY1               - Y COORDINATE OF BASE OF THE BAR
C         IY2               - Y COORDINATE OF TOP OF THE BAR
C         ISHAD             - SPACING BETWEEN HORIZONTAL LINES,
C                             IF FULL SIZE FIGURE, ISHAD=40
C         I                 - INDEX NO. FOR EACH BAR
C
      DIMENSION LX(2),LY(2)
      LX(1)=IX1
      LX(2)=IX2
C   DETERMINE Y COORDINATES AND DRAW LINES
```

```
      IM=MOD(I,2)
      LY(1)=IY1
      IF (IM.EQ.1) LY(1)=IY1-ISHAD/2 ; DISPLACE EVERY OTHER 1ST LINE DOWN
6     LY(1)=LY(1)+ISHAD
      IF (LY(1).GE.IY2) GO TO 3   ;   FINISHED
      LY(2)=LY(1)
      CALL LINES (LX,LY,2,1,0)    ;   DRAW LINE
      GO TO 6
3     CONTINUE
      RETURN
      END
                                *


                                *
C     PROGRAM MBG                                    REV 01.00
C     APR 1985              STONE, H. M.             ERH SSD/FTS 649-5443
C     FORTRAN IV/ REV 5.20  DG ECLIPSE (S230)        RDOS/REV 7.20
C     LOAD LINE:  RLDR MBG OUT AG.LB UTIL.LB TOP.LB FORT.LB
C     PURPOSE
C         CREATES BLANK MAP BACKGROUND B99 TO ELIMINATE "PAGE 01" FROM
C         SCT PRODUCT.  DECIMAL POINT IS PLOTTED IN LOWER LEFT CORNER
C         OF MAP BACKGROUND B99
C
      DIMENSION IP(2)
      CALL CFILW ("HMSGPH.99",2,IER)
      IF (IER.NE.1) TYPE "CFILW, HMSGPH.99, IER = ",IER
      IP(1)=46    ;    .
      IP(2)=0     ;    TERMINATOR
      CALL TEXT (IP,0,0,0,4,0,0)    ;   PLOT . IN LOWER LEFT CORNER
      CALL UTF ("NMCGPHB99","HMSGPH.99")
      DO 1 I=1,1500
1     TIMEWASTE=1./2.
      CALL DFILW ("HMSGPH.99",IER)
      IF (IER.NE.1) TYPE "DFILW, HMSGPH.99, IER = ",IER
      STOP
      END
```

ERCP #32
May 1985

Scatter Diagram and Histogram Program - SCATR

Part A: Program Information and Installation Procedure

Program Name: SCATR.SV

AAL ID:

Revision No.: 01.00

Function: Plots scatter diagram for any two (or three) variables in IDXCR1 file, or, if one variable is binary, relative frequency histogram is produced instead of scatter diagram.

Program Information:

Development Programmer:
Hugh Stone
Location: ERH Garden City, NY
Phone: FTS 649-5443

Maintenance Programmer:
Hugh Stone

Language: DG FORTRAN IV/5.20
Save File Creation Date: 5/8/85
Running Time: Varies linearly with the size of the IDXCR1 data file. Typical times for scatter diagram:
IDXCR1 (38924 bytes) 35 seconds
IDXCR1 (83246 bytes) 65 seconds
Histogram takes additional 10 seconds.

Disk Space:

SCATR.SV	61 RDOS Blocks
IDXCR1	Variable, 25-200 Blocks usually
Other Data Files	1-3 RDOS Blocks

Program Requirements

Program Files:

Name	Comments
SCATR.SV	

Data Files:

Name	DP Location	Read/Write	Comments
IDXCR1	DPØ	R	Data must begin with 80 ID characters on first line.
HMSGPH.01	DPØ	W/R	Temporary

AFOS Products:

ID	Action	Comments
NMCGPHSCT		Created by SCATR
NMCGPHB99	Blank Map Background	Created by MBG

Load Line:

```
RLDR SCATR GPTX ROUND ISCR5 SHADE OUT AG.LB UTIL.LB
TOP.LB FORT.LB
```

Program Installation:

1. Add map background NMCGPHB99 to database.
2. Add NMCGPHSCT to database and assign map background 99.
3. Put MBG.SV on DPØ.
4. Run MBG from Dasher to create blank map background, B99 (10 seconds running time).
5. Delete MBG.SV from DPØ.
6. SCATR.SV should be on DPØ or DPØF with link to DPØ.
7. Data file IDXCR1 should be on DPØ or DPØF with link to DPØ.

Scatter Diagram and Histogram Program - SCATR

Part B: Program Execution and Error Conditions

Program Name: SCATR.SV

AAL ID:
Revision No.: 01.00

Program Execution

Program is run by typing SCATR at the Dasher and responding to the questions which appear. Twelve different questions may appear which are numbered and listed below with a guide to an appropriate response where clarification is needed. 'Y' denotes a yes response and 'N' for no. When the question 'FINISHED?' appears, the SCT graphic is ready for printing.

1. TYPE NO. OF VARIABLES PER RECORD IN IDXCR1, FORMAT (I2)
   Go to 2.

2. TYPE FORMAT FOR READING DATA IN IDXCR1, USE (***)
   Go to 3.

3. REDUCED FIGURES?...TYPE 'Y' OR 'N'
   'Y' go to 4, 'N' go to 5.

4. TYPE REDUCTION FACTORS FOR Y AND X DIRECTIONS, FORMAT (2F3.2)
   Go to 5.

5. TYPE VARIABLE NO. FOR Y & X AXIS AND Z VARIABLE, FORMAT (3I2).
   VALUE OF Z PLOTTED AT Y & X COORDS...Z=Ø FOR SCATTER ONLY
   Go to 6.

6. AUTOMATIC INTERVAL SELECTION ON Y & X AXIS?...TYPE 'Y' OR 'N'
   'Y' go to 8, 'N' go to 7.

7. TYPE INTERVAL DESIRED FOR 'Y' and 'X' AXES.
   IF ONE AXIS IS NOT TO BE CHANGED, TYPE 'Ø' FOR THAT INTERVAL
   Type intervals in any format. Go to 8.

8. BINARY DATA?...TYPE 'Y' OR 'N'
   If only Y & X variables have been specified in question 5, this question refers to the Y variable; if Y is a binary variable and question is answered 'yes', frequency histogram will be produced. Go to 10. If 'N', scatter diagram is produced. Go to 11.

If Y,X & Z variables have been specified in question 5, this question refers to the Z variable; if answer is 'no', then the value of Z is plotted at the X,Y coordinates such that the lower left corner of the first digit of Z is at the data point. Go to 11. If answer is 'yes', symbol "x" is plotted if Z=1 and "o" is plotted if Z=Ø. Go to 9.

9. PLOT Z=Ø POINTS, Z=1 POINTS, OR ALL POINTS?
Type Ø, 1, or 2 RESPECTIVELY
If "Ø" is typed, only values of Z=Ø(o) are plotted, if "1" only values of Z=1(x) are plotted, if "2" all points are plotted. The plots "x" and "o" are centered on the data point. Go to 11.

10. TYPE MINIMUM # OF POINTS TO BE CONTAINED IN EACH INTERVAL OF BAR GRAPH, AND SHADE INDICATOR : Ø = NO SHADE, 1 = SHADE...FORMAT (I2, I1)
Minimum # of points:
If any number other than ØØ is typed, the intervals of the histogram are combined such that each interval contains at least the specified minimum number of data points. This usually results in unequal intervals in the histogram. If no alteration of intervals is desired, "ØØ" should be typed as a response.

Shade indicator:
If "1" is typed, a series of horizontal lines is drawn across the bars of the histogram to make them more visible, see Figure 7B. If "Ø" is typed, these horizontal lines are omitted, see Figure 7A. Go to 11.

11. FINISHED?...TYPE 'Y' OR 'N'
'Y' : finished. Program terminates.
'N' : do another diagram using the same IDXCR1 data file.
Go to 12.

12. CHANGE REDUCTION FACTORS?...TYPE 'Y' OR 'N'
'Y' : change factors, go to 4.
'N' : use same factors as previous diagram, go to 5.

Any desired number of diagrams may be done at one time and stored as AFOS graphic SCT. The diagrams may be printed as they are created, or may be printed all at once when finished, if there are enough versions of SCT in the database.

Error Conditions

Three abnormal stops are possible in the program, which are accompanied by a message at the Dasher indicating the trouble.

Dasher Message	Meaning
1. TOO MANY VARIABLES, PARAMETER L3=50 MUST BE INCREASED TO EQUAL KKZ	There is a limit of 50 variables per record in IDXCR1.
2. NO VARIATION, DV(X)=Ø.	One of variables 'X' in the IDXCR1 file is constant.
3. NO. OF INTERVALS EXCEEDS PARAMETER L1	The interval specified for one of the axes is too small. No more than 40 numbers can be plotted on an axis.

An incorrect response 'Y' to question 8 (Binary Data?) above, usually results in a fatal runtime error. Program must be restarted.

Eastern Region Computer Programs and Problems (Continued)

19 Verification of Asynchronous Transmissions. Lawrence Cedrone, March 1984. (PB84 189885)

20 AFOS Hurricane Plotter. Charles Little, May 1984. (PB84 199629)

21 WARN - A Warning Formatter. Gerald G. Rigdon, June 1984. (PB84 204551)

22 Plotting TDL Coastal Wind Forecasts, Paula Severe, June 1984 (Revised) (PB84-220789)

23 Severe Weather Statistics STADTS Decoder (SWX) and Plotter (SWY), Hugh M. Stone, June 1984. (PB84-213693)

24 WXR, Harold Opitz, August 1984. (PB84-23722)

25 FTASUM: Aviation Forecast Summaries, Matthew Peroutka, August 1984. (PB85-112977)

26 SAOSUM: A Short Summary of Observations. Matthew Peroutka, October 1984. (PB85-120384)

27 TRAJ - Single Station Trajectory Plot, Tom Niziol, December 1984. (PB85-135002)

28 VIDTEX, Gerald G. Rigdon, February 1985 (PB85-175669/AS)

29 ISENTROPIC PLOTTER, Charles D. Little, February 1985 (PB85-175651/AS)

30 CERR: An Aviation Verification Program, M. Peroutka, April 1985. (PB85-204824/AS)

31 Correlation and Regression Equation Program - REGRS, H. Stone, May 1985.

NOAA SCIENTIFIC AND TECHNICAL PUBLICATIONS

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