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KRIGING - An interactive program to determine the best Linear Unbiased Estimation

by

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1. Denver, Colorado

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ABSTRACT

KRIGING is a FORTRAN program written to provide Honeywell Multics users with a straightforward method to produce the "minimum-variance unbiased linear estimator of the mean characteristic of a block of any given geometry" (Journel and Huijbregts, 1978, Mining Geostatistics: New York, Academic Press, Inc., 600 p.). It is a combination of programs written by different individuals; each performing a different step in the process known as kriging. The descriptions given here explain the usage of both the driver and individual routines.

INTRODUCTION

KRIGING combines programs that most often have been used by USGS geostatisticians for estimation purposes. These programs are recoded versions of work developed within the U.S. Geological Survey and under contract for the Department of Energy and published by Journel and Huijbregts (1978). Some were written as general purpose routines and contained options that were irrelevant or lacked options that would be useful to kriging. Modifications have been made to "customize" them; then all were incorporated into a single interactive system.

KRIGING requires active participation by the user. It is written to allow easy progression through the multiple steps involved. The ability to automatically sequence through each step and the inclusion of several default answers streamline its use. Answer screening and interactive explanations reduce the chances that a typographical error or confusion about terminology will cause the program to fail. These, however, are not intended to provide a novice with an automatic solution. Users of this system must be thoroughly familiar with the theories, methods and terminology involved in kriging (Knudsen and Kim, 1977), (Journel and Huijbregts, 1978) and (Clark, 1979).

GENERAL USE

KRIGING provides the user with a self-documenting capability. Whenever the user is uncertain about the options available or the type of response required, the word "help" or the character "?" may be entered. A brief explanation is given, then the original question is asked again.

The order in which the options are listed on the menu is the program's default sequence of execution. Lack of a specific reply (a carriage return) indicates the next step is desired. Within any of the main routines, if a carriage return is entered in response to a question, a default answer will be supplied. If a default answer does not exist, the program responds as it would when a "?" is entered.

KRIGING screens user responses for appropriateness. For example, if the question requires a yes or no reply, the entry of a number initiates an error message, an explanation of what is expected, and the opportunity to answer the question again.

KRIGING is designed to safeguard existing datafiles. Several files are created during each execution of the program. To insure that none will accidently be overwritten, the program reviews all the user's existing files. If the name has been previously assigned, the user must acknowledge file destruction by the re-use of the filename, or may enter another name.

The progress of a kriging session may be reviewed at anytime by listing all datafiles written. The file type and name of the kriging step that created each file are identified. The input file currently in use and data columns corresponding to the X, Y, and Z values are also listed. This provides the user with a brief overview of the steps accomplished up to any given point.

A permanent record of the program session may be kept in a separate disk file. This provides a convenient way for the user to keep a permanent record of the order in which steps are executed, the intermediate results, all changes made, and the final conclusions reached. This record is referred to as the log of the session. It contains all information output to the user at the terminal along with all input received from the user. This file is a character file which is created at the beginning of a kriging session and updated throughout the session. It is accessible after the user exits (Step 16) the kriging program.

INPUT DATA REQUIREMENTS

KRIGING requires all input data be in STATPAC form (VanTrump and others, 1983). This format was first developed as a USGS standard for storing geochemical data that required qualifying codes (i.e. greater than, less than, blank data, etc.) be taken into consideration during statistical analyses. The STATPAC system was developed to store these codes and include them as a part of the data during program execution. Much of the USGS data available today is stored in this form and the kriging-based software has been developed to take advantage of the optional presence of qualifying codes.

A major source of coal data, however, is stored in the PACER system (Cargill and others, 1976), a non-STATPAC file. A separate program is available to convert a specially formatted PACER output file to a STATPAC file. The program is called pacer_to_statpac. It requires input of the name of the PACER output file, the name to be assigned to the STATPAC file, and the longitude of the central meridian being used. The dataset id "ALL BEDS" is automatically assigned to the STATPAC file. A listing of the PACER commands used to create the output file and a run of the program pacer_to_statpac are given later in this paper.

PROGRAM EXECUTION

Upon execution of the KRIGING program, the user is asked if a permanent log of the session is to be kept, and then to enter the STATPAC input filename. The file locations of the stored coordinates and variable values must also be initialized. If the user is not sure where the north coordinates, the east coordinates, or the variable values being kriged are stored, a printout of the column ids may be obtained through a yes response to the column id print query. This allows a quick review of the ordering of the data. The user is next asked to specify the column numbers for the coordinates, and the variable value to be kriged (referred to as the assay value). These selections will remain constant until the user indicates a change of file and/or variables.

The initializing phase of the program execution is complete. This is indicated by the appearance of the KRIGING menu. The function of each of the 16 routines on the menu is briefly reviewed below. At the finish of execution of each routine, the user is returned to the menu selection stage.

STATPAC FILE REVIEW

Step 1 (LOOKSTAT) allows the user to selectively view the data stored in the STATPAC input file. The dataset id, number of rows, and number of columns are automatically printed. The user has the option to list the column identifiers and to view all or selected portions of the data. Multiple groupings of rows and/or columns are specified and the selected data are printed with the accompanying qualifiers. The original version of this program (LOOKST) was written by George VanTrump, Jr. (written commun.).

If the user needs to modify any information contained in the STATPAC file, the program EDSTAT can be used. EDSTAT is available through the STATPAC system (VanTrump, Fife, and Miesch, written commun., 1983).

CALCULATE BASIC STATISTICS

Step 2 (BASTAT) calculates univariant statistics, correlations, and optionally, histograms and percentiles on user-selected portions of the input datafile. An output STATPAC file containing the selected subset of data can be created. The process of choosing the selected data is similar to that found in Step 1 (LOOKSTAT) with the additional ability to select qualified data only, unqualified data only, or all data with qualifiers ignored. Logarithmic transformations may also be performed prior to processing. The statistics listed for each variable include the maximum value, the minimum value, the mean value, and number of data points that are unqualified. The correlations are listed in matrix form. If the option to print histograms is selected, the column number of the desired variable must be entered and lower limit and class interval may be chosen. After all desired histograms are printed, the percentiles for all selected data may be printed. Finally, BASTAT provides the user with a recycle capability without returning to the KRIGING menu.

PLOT DATA

Step 3 (MAPPLOT) plots a map on any type of terminal that has a minimum 80 column line. It prompts the user for the directions in which the sample location coordinates increase; east or west, and north or south. The default values are to the east and north. Each sample value is assigned to one of ten equal classes covering the range of the sample variable to be kriged. Symbols (0-9) are used to represent these ten classes. Where more than one sample occurs within a mapping cell, the symbol for the class representing the mean of the sample values is plotted. The X and Y minima and maxima are listed along with the upper and lower values for each of the ten class symbols. An option is also provided to replot the map showing the number of samples per cell. The latter is useful in detecting the presence of duplicate samples where data density is low or cell size is unlikely to contain multiple sample locations.

The original version of this program (MAPPLT) was obtained from A. T. Miesch (written commun.). Additional information about it is available in >uml>statpac>doc>atm.abstracts.

COMPUTE THE SEMI-VARIOGRAM

Step 4 (SEMIVAR) computes the semi-variogram. From this point on the users-guide refers to the semi-variogram as the variogram. This is due primarily to the wide usage of the term in the user community. Several program prompts also refer to the semi-variogram as the variogram for the same reason. Step 4 requires appreciable user-specified control input prior to running. The user has the option to read the control input from a separate file or enter it directly from the terminal. The user is asked where the information is being obtained. If it is read from a file, the user has the further option to make changes before the variogram is calculated. Where a change is desired, the user is queried for the number corresponding to the input item to be changed, and then prompted to enter the new information. If the direct entry from the terminal option is selected, prompts will be given for each input item required. In either case, the final set of control input may be saved in a file for reuse in subsequent trial runs. The following is a list of user-specified items in the control input.

1. Enter 80 character id for variogram run. Up to 80 alphanumeric characters may be used to label the variogram. This label is also used in the variogram plot (Step 5).

2. Logarithmic conversion wanted? A yes or no response indicates whether the input data is transformed prior to the variogram calculation.

3. Will you want a plotfile created? A yes or no response is entered. The PLOTVAR routine (Step 5) requires an input file containing information about the variogram to be plotted. If the variogram being computed in this step is to be plotted, the file is created at this time by a yes response. A file name request will be given at the end of the control input sequence.

4. Is automatic scaling of the graph wanted? A yes or no reply indicating whether the user wants the program to scale the variogram automatically or wants to specify the maximum value. Specification of scale occurs in Item 8 in the event of a no response.

5. Is relative variogram wanted? A yes or no answer is required. If the response is yes, the relative variogram is calculated by dividing the values of the variogram by the square of the mean grade.

6. Enter the number of variogram directions. A number (1-5) is entered. The routine has the capability to calculate up to 5 variograms per run. The user has the option to specify direction in order to identify the presence of anisotropy in the sample values. The default value is 5.

7. Give class interval to group distances. Enter a constant to be used as the distance class in grouping data used in calculating the variogram.

8. Give maximum variogram value for scaling. If automatic scaling (Item 4) was not chosen, the maximum value used in scaling the variogram is entered.

9. Enter angle. For each variogram specified in Item 6, enter the angle in decimal degrees from east along which it is to be calculated. Examples: +45 would be a northeast-southwest direction, -45 would be a northwest-southeast, +90 or -90 would be north-south.

   Enter window. Enter the angle of allowable deviation from the angle of direction chosen. Again, a separate angle, in decimal degrees is entered for each variogram desired. Example: 15 would be a 30 degree wide window, 90 would give a full 360 degree window or all directions.

10. Do you want to select coordinates? A yes or no is entered to indicate whether or not the user wants to specify geographic boundaries within which to accept the assay data. If a yes is entered, prompts for minimum and maximum east and north coordinate values follow immediately.

Following Item 10, the user is asked in sequence 1) whether the control input is to be saved in a file and for a filename, 2) to specify a name for the character output file from SEMIVAR and 3) to specify a name for the plot output file created in Item 3 if the yes response was given. Figure 1 shows a portion of the character output file created by SEMIVAR. In the graphical plot, an & replaces an X where a distance interval class contains less than 30 pairings.

The original version of this program (UGAMM) was written by H. P. Knudsen (Knudsen and Kim, 1977).

Figure 1.--Variogram Calculations

DATE: 2-8-84

VARIOGRAM

STATPAC DATA SET : XXXXXXXX VARIABLE ID : pct iron

Clark data - percent iron

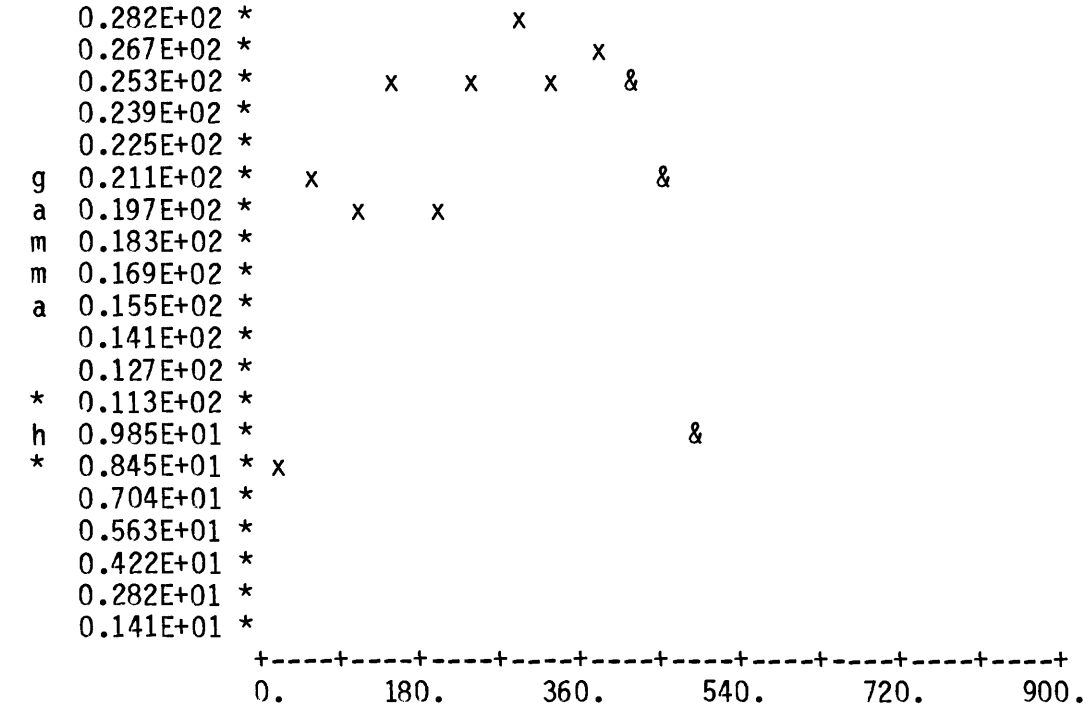
DIRECTION = 90. WINDOW 90.
CLASS SIZE = 45.0
MAX. DISTANCE = 900.
LOGARITHMS -no RELATIVE VARIOGRAM -no

DATA USED IN CALCULATIONS
MEAN = 0.345E+02
VARIANCE = 0.226E+02
STD DEVIATION = 0.475E+01
NO.OF SAMPLES = 50

DISTANCE	PAIRS	DRIFT	GAMMA (H)	MOMENT CENT	AVER DIST
0 - 45	36.	0.156E+01	0.785E+01	0.777E+01	30.48
45 - 90	102.	-0.175E+01	0.199E+02	0.208E+02	67.15
90 - 135	154.	-0.150E+01	0.191E+02	0.189E+02	114.01
135 - 180	187.	-0.133E+01	0.242E+02	0.241E+02	158.16
180 - 225	179.	-0.135E+01	0.195E+02	0.194E+02	202.09
225 - 270	173.	-0.230E+01	0.251E+02	0.253E+02	246.16
270 - 315	134.	-0.171E+01	0.282E+02	0.282E+02	290.72
315 - 360	126.	-0.166E+01	0.240E+02	0.239E+02	337.32
360 - 405	87.	-0.299E+01	0.255E+02	0.255E+02	380.51
405 - 450	27.	-0.781E+00	0.249E+02	0.250E+02	424.73
450 - 495	6.	-0.600E+00	0.208E+02	0.209E+02	464.90
495 - 540	2.	-0.119E-06	0.968E+01	0.968E+01	500.67

STATPAC DATA SET : XXXXXXXX VARIABLE ID : pct iron

Clark data - percent iron



PLOT SEMI-VARIOGRAM

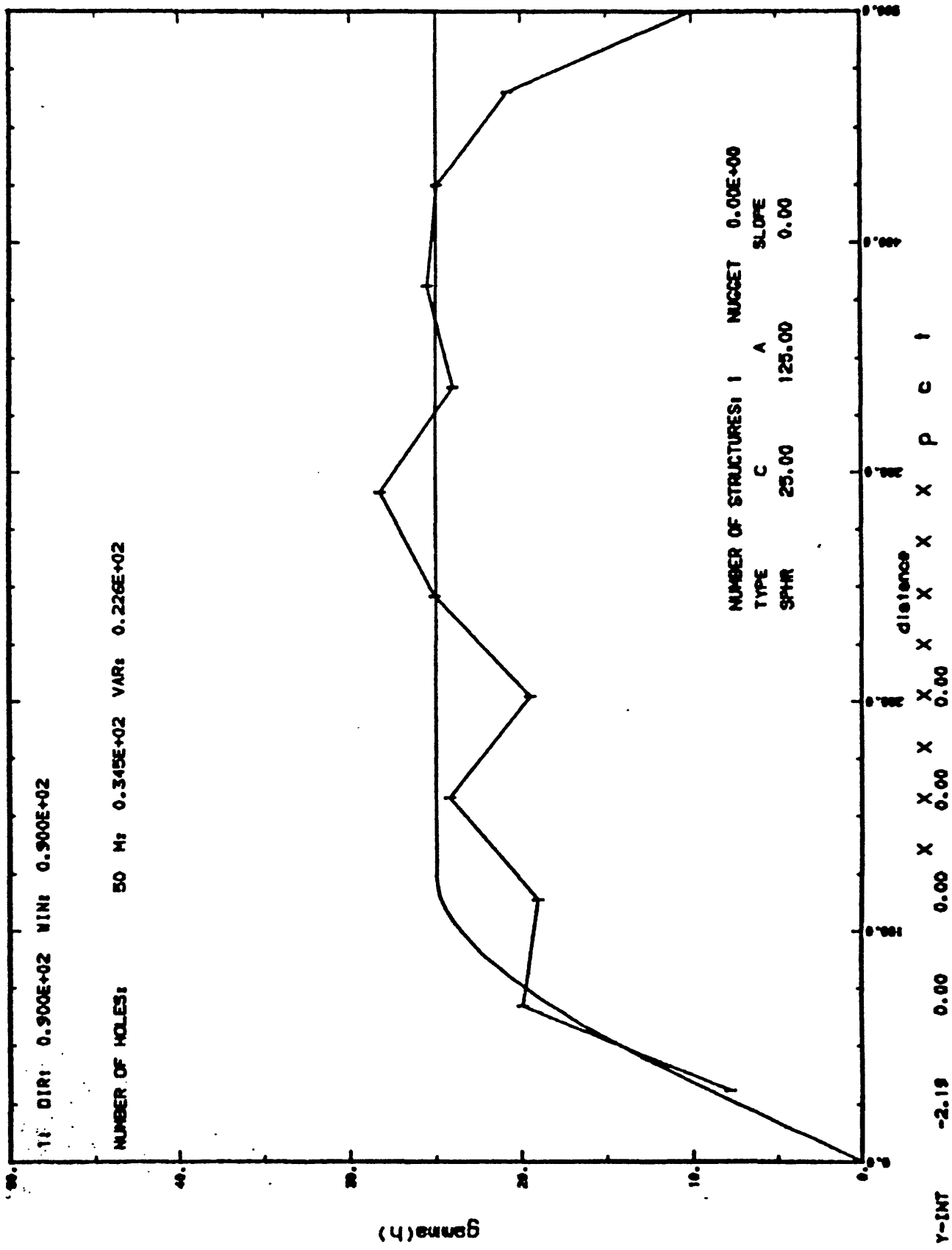
Step 5 (PLOTVAR) plots single or multiple variograms on a Tektronix graphics terminal or a Tektronix plotter. If a plotfile was defined in Step 4 (SEMIVAR), it is automatically used as the input datafile. If the step has not been executed or no plotfile was created, the user is asked to specify an existing plotfile. This allows the user an opportunity to select a plotfile created in a previous run of the program. To do this, the current execution sequence should exclude the creation of a plotfile in Step 4 or should skip Step 4 entirely. The routine has the capacity to plot 5 separate variograms and a theoretical variogram curve simultaneously. The user is prompted for the number of variograms to be plotted. The default value is 5. The variograms are stored in the plotfile in the order in which they were defined in Step 4. Numbers representing the order are entered to indicate which variograms within the file should be plotted.

Regardless of how many variograms are plotted, a single group of graph specifications are used. The maximum X-axis value and the minimum and maximum Y-axis values are required for scaling the graph. Distance between tick marks in either direction may be specified or will default to 1. The number of ticks per annotation may also be entered. These default to 5. If a theoretical curve is desired, it is defined at this time. Provisions exist for constructing a theoretical variogram curve which may be a composite of as many as five nested variograms including spherical, exponential, linear, gaussian and/or cubic components. Finally the user must specify whether or not the output is to go to a plotter.

Once the graph is complete, the user has the option to request a plot using data from another plotfile created by the SEMIVAR routine. Figure 2 is a plot of the all-directional variogram shown in Table 1 with a superimposed theoretical curve.

The routine uses a general plotting package written and maintained by Wahl (written commun., 1977). For use on the Multics system, the search rule >udd>Potfield>RWahl>plot_sys must be invoked prior to program execution.

Figure 2.--Variogram Plot



VALIDATE THE VARIOGRAM

Step 6 (CROSS_VALID) is a two-dimensional routine used to cross-validate variogram models. CROSS_VALID provides the user with three possible methods for testing a theoretical variogram against the sample data. The methods are 1) using hole-by-hole suppression, 2) splitting a randomly permutted data set into two parts and kriging one subset from another, or 3) selecting the beginning row number of the input data set which is to be validated. Sample points from the row number selected to the last row in the data set are processed.

CROSS_VALID has a choice of universal or ordinary kriging. Universal kriging assumes a systematic change in the assay value across the study area. This relationship is called drift. Ordinary kriging is applicable in stationary cases where sample location has no correlation with the value of the assay (variable). If drift is present, the form of the drift must be supplied. The number of terms in the equation is specified first then the X- and Y-exponents for all but the first term are entered. The first term exponents are automatically set to 0. The user is also required to specify the neighborhood size and population by entering the maximum allowable distance a hole location can be from the centroid and the maximum allowable number of holes to be used in the calculation.

Specification of parameters for the theoretical variogram begins with definition of the nugget value. Provisions exist for entry of up to 5 additional nested variograms through definition of the type curve and by setting the A- and C-values. The routine can accept specification of anisotropy, if present, which may be either geometric or zonal. Geometric anisotropy occurs where the assay variation in one direction is equal to the anisotropy ratio times the variation in another direction. Zonal anisotropy applies where the variation in assay value is dependent not only on distance but also the number of stratigraphic layers crossed. If anisotropy is present, both the angle and type must be defined.

The user has the option to print the summary statistics and correlations at the terminal. The kriged average error, root mean square error and reduced root mean square error are printed automatically. STATPAC and character output files containing the results are created. The user must assign both names. The STATPAC dataset header information is printed at the terminal. The STATPAC file contains sample id, X-coordinates, Y-coordinates, assay values, kriged values, kriged errors, kriged standard deviations, and standard deviations for each location. The character output file contains a listing of the values used to define the models, the point by point information contained in the STATPAC file, and if desired, the summary statistics and correlations. The correlations contain information critical to evaluating and determining which theoretical variogram gives the best validation. A portion of the character output file is shown in Figure 3.

This routine was adapted from UKRIG (Knudsen and Kim, 1977) and a kriging program by Skrivan and Karlinger (1980).

Figure 3. - Validation Test Results

DATE: 2-8-84

VARIOGRAM PARAMETERS
NUGGET ONLY MODEL

NUGGET = 0.000

SEARCH RADIUS = 200.00
MAXIMUM NUMBER OF HOLES USED = 16

OUTPUT OF MODEL VARIOGRAM TEST RESULTS

HOLE NO.	X-COORD.	Y-COORD.	ASSAY VALUE	KRIGED VALUE	KRIGING ERROR	KRIGING STD.DEV	ERROR/ STD.DEV
	0.000	170.000	34.30	31.95	2.35	2.98	0.79
	10.000	40.000	35.50	32.07	3.43	4.18	0.82
	15.000	135.000	28.60	31.54	-2.94	2.79	-1.06
	55.000	145.000	29.40	29.87	-0.47	3.65	-0.13
	125.000	20.000	41.50	36.24	5.26	3.69	1.43
	175.000	50.000	36.80	35.68	1.12	3.80	0.29
	120.000	180.000	33.40	33.75	-0.35	2.41	-0.15
	160.000	175.000	36.00	38.31	-2.31	2.64	-0.88
	240.000	185.000	30.20	38.37	-8.17	4.25	-1.92
	260.000	115.000	33.20	31.52	1.68	3.15	0.53
	235.000	15.000	33.70	32.91	0.79	3.65	0.22
...							
...							
...							
...							
	270.000	285.000	32.90	37.91	-5.01	4.28	-1.17
	365.000	340.000	40.00	39.96	0.04	1.91	0.02
	330.000	320.000	44.10	39.56	4.54	2.39	1.90
	330.000	290.000	41.40	40.10	1.30	2.99	0.43

KRIGED AVERAGE ERROR = -0.1425
KRIGED ROOT MEAN SQUARE ERROR = 3.5620
KRIGED REDUCED ROOT MEAN SQUARE ERROR = 1.0191

KRIGING A GRID OF POINTS

Step 7 (KRIG_GRID) is a two-dimensional point-kriging routine used to krig a grid of points. User specified input parallels that provided in Step 6 for CROSS_VALID with an additional requirement for specifying the grid spacing parameters and coordinates for the southwest corner.

Output may be to a single STATPAC file or to two GARNET files. The GARNET files are gridded datasets, one containing the kriged values and the other the kriging variances. The STATPAC file contains the X-coordinates, the Y-coordinates, kriged values and kriging variances. A character output file is also created, a sample is shown in Figure 4. The user must assign filenames.

This routine is an adaptation of programs by Kim and Knudsen and Skrivan and Karlinger, modified by including special algorithms described by Journel and Huijbregts (1978).

Figure 4.--Point Kriging Results

DATE: 2- 8-84

VARIOGRAM PARAMETERS

NUGGET = 0.000 SILL = 25.000 NO.STRUCTURES = 1

VARIOGRAM NO.	TYPE	C-VALUE	ANGLE ANISOTROPY	ANISOTROPHY FACTOR	A-VALUE	SLOPE (IF LINEAR)
1	SPHR	25.000	0.000	1.000	125.000	0.000

NUMBER OF POINTS IN NORTH-SOUTH DIRECTION = 17
DISTANCE BETWEEN POINTS IN NORTH-SOUTH DIRECTION = 25.00
NUMBER OF POINTS IN EAST-WEST DIRECTION = 17
DISTANCE BETWEEN POINTS IN EAST-WEST DIRECTION = 25.00
NORTHING OF SOUTHWEST CORNER OF GRID OF POINTS = 0.00
EASTING OF SOUTHWEST CORNER OF GRID OF POINTS = 0.00
SEARCH RADIUS = 200.00
MAXIMUM NUMBER OF HOLES USED = 16

OUTPUT OF KRIGED RESULTS

COLUMN	ROW	X-COORD.	Y-COORD.	VALUE	KRG VAR
1	1	0.000	0.000	34.41	18.9169
1	2	0.000	25.000	35.36	9.7137
1	3	0.000	50.000	35.36	7.3492
1	4	0.000	75.000	34.28	11.8932
1	5	0.000	100.000	33.07	9.7726
1	6	0.000	125.000	31.32	7.9678
1	7	0.000	150.000	31.75	6.5211
1	8	0.000	175.000	34.26	2.4318
1	9	0.000	200.000	33.96	4.0164
1	10	0.000	225.000	33.60	13.6678
1	11	0.000	250.000	33.21	18.3759
1	12	0.000	275.000	32.43	20.7744
1	13	0.000	300.000	31.07	22.7849
1	14	0.000	325.000	29.95	22.5355
1	15	0.000	350.000	28.86	18.3094
1	16	0.000	375.000	28.12	9.7753
1	17	0.000	400.000	28.24	7.9579
2	1	25.000	0.000	33.63	17.5311
2	2	25.000	25.000	33.67	8.6148
2	3	25.000	50.000	33.19	6.6747
2	4	25.000	75.000	32.67	9.7661
2	5	25.000	100.000	32.23	3.8243
2	6	25.000	125.000	29.76	5.0852

KRIGING A BLOCK

Step 8 (KRIG_BLOCK) is a two-dimensional block-kriging routine. It computes the kriged mean value and the kriging variance of a variable over a single block of any specified shape. User input again includes specification of universal or ordinary kriging, neighborhood size and population, a nugget value and variogram model composed of up to five nested variograms. For each variogram, the type, and parameters must be supplied. Anisotropies, if present may be either geometric or zonal, and both the angle and type must be defined.

Coordinates of inflection points along the block boundary must be entered from a stored character file or manually from the terminal. The boundary data must be entered in a clockwise direction, with the northing specified first. The number of grid points in both directions also must be specified. The final entry is a random number keyed in from the terminal.

The kriging results are output to a character file specified by the user and includes a kriging mean and variance for the variable and a listing of sample ids with coordinates, sample value, error measure and kriging weight. A sample of this file is shown in Figure 5.

Figure 5.--Block Kriging Results

```
                DATE:  2-8-84


                          VARIOGRAM PARAMETERS
                          NUGGET ONLY MODEL

               NUGGET =    0.000


 NO. OF Y-GRID POINTS        2
 NO. OF X-GRID POINTS        4
 AREA OF BLOCK =  0.30000000E+05
 SEARCH RADIUS =  0.20000000E+03
 NUMBER OF HOLES READ FROM DATA FILE =     50


 BLOCK VARIANCE =                          5.12242


 NUMBER OF GRID POINTS USED     6
 NUMBER OF HOLES USED   16


                      ***OUTPUT OF KRIGED RESULTS***
                 X-COORD.  Y-COORD.   KRIGING     KRIGING
                                        MEAN      VARIANCE

                 216.667   183.333     33.356       0.123
```

KRIGING MULTIPLE BLOCKS

Step 9 (KRIG_MULT) is also a two-dimensional block-kriging routine. It computes the kriged mean values and kriging variances of a variable in multiple rectangular blocks contained within a single block of any specified shape. The required information is the same as that required in Step 8 with the addition of information about the size, shape and location of the multiple blocks. The coordinates of the southwest corner of the lowermost block must be specified along with the size and total number of blocks in both directions.

Output is to a user-specified character file. For each rectangle whose center is located within the single polygon, the coordinates of the center, a kriged mean value, and kriged variance are given. Figure 6 shows a sample of this file.

Figure 6.--Multiple-Block Kriging Results

DATE: 2-8-84

VARIOGRAM PARAMETERS
NUGGET ONLY MODEL

NUGGET = 0.000
AREA OF POLYGON = 0.30000000E+05

DESCRIPTION OF RECTANGULAR BLOCKS

MINIMUM NORTHING = 0.10000000E+03 MINIMUM EASTING = 0.10000000E+03
EACH BLOCK IS: 100.000 BY 50.000
THERE ARE 2 BLOCKS IN THE N-S DIRECTION AND 4 BLOCKS IN THE E-W DIRECTION.

BLOCK VARIANCE = 13.73812

NO. OF Y-GRID POINTS = 4
NO. OF X-GRID POINTS = 4
THE SEARCH RADIUS = 0.20000000E+03
NUMBER OF HOLES READ FROM DATA FILE 50

OUTPUT OF KRIGED RESULTS

COLUMN	ROW	X-COORD.	Y-COORD.	KRIGING MEAN	KRIGING VARIANCE
1	1	125.000	150.000	32.228	1.619
2	1	175.000	150.000	34.524	2.114
3	1	225.000	150.000	32.104	2.904
3	2	225.000	250.000	33.333	2.477
4	1	275.000	150.000	33.758	1.842
4	2	275.000	250.000	36.015	1.424

AVERAGE KRIGED VALUE = 0.336604E+02

NORMALITY TEST

Step 10 (NORCHI) tests for normality of a variable. Any variable in the STATPAC file may be tested. The user specifies the column number and whether the data are to be logarithmically transformed prior to testing. Basic summary statistics including mean, variance, standard deviation, skewness, kurtosis, minimum value, maximum value and range are listed. Class intervals with corresponding observed and theoretical frequencies are given. Finally, the chi-square value, degrees of freedom and probability level are listed. Because the variables dealt with in kriging are spatially correlated, the degrees of freedom and the probability level are only approximations. (Garratt, 1961).

STEPFORWARD REGRESSION

Step 11 (REGRES) performs a stepwise multiple regression and computes related regression statistics. The user has the ability to specify a linear, quadratic, or cubic fit. The assay value is the dependent variable. The independent variables are X, Y, XY, X^2, Y^2, XY^2, X^2Y, X^3, and Y^3 depending on the fit chosen. A complete explanation of the procedure originated by Handwerker is in VanTrump (written commun., 1978, Program D0094).

The user must supply several input parameters. REGRES automatically sets the probability level to 1. A title of up to 30 alphanumeric characters is needed. It is used as a header for the printed output. The input dataset id is required. If this is not known, it can be found by reviewing the dataset with LOOKSTAT (Step 1). To maintain as much similarity as possible to the original program D0094, the options are referred to by number and only those available in D0094 are used here.

Option 1 represents how the residuals are handled. It expects a number between 0 and 2. 0 = no residuals computed. 1 = compute and print the residuals. 2 = compute and print the residuals and create a STATPAC file containing the observed dependent, computed dependent, residual and independent variables in the derived regression equation. The recommended and default value for Option 1 is 2. If the information is output to the STATPAC file, the user specifies a filename and dataset id.

Option 2 is provided to force the regression equation through the origin. If this is desired, the option is set to 1. The recommended and default value is 0, i. e. do not force the equation through the origin.

Option 3 is set to 0 if the user wants the correlation matrix printed. This is the default value. To suppress the printing, set the option to 1.

Option 10 allows the user to select the column identifiers used in the output file. If the column identifiers from the input file and standard ids for the newly created columns are to be used, this option is set to 0. 0 is the default value. If new ids are desired, the option is set to 1 and the column identifiers are supplied by the user.

The type of fit is chosen and finally the user is asked if the printer file should be queued, and/or saved. If the file is saved, a name must be

assigned. The printer output includes verification of all input parameters, means and standard deviations of selected columns, correlation matrix (if specified), record of sequence in which variables were added to and deleted from the regression equation, regression constant and coefficients, multiple correlation coefficient, sum of squares of the regression residuals, partial correlation coefficients between dependent variable and variables in the regression equation, regression weights, standard error of regression weights, standard error of regression constant and coefficients, standard error of estimate of the dependent variable, percent of the total sum of squares of the dependent variable, and a listing of the observed, computed, and residual values (if specified).

CHANGE IN INPUT DATA

Step 12 (DATA_CHANGE) changes the information pertaining to the input STATPAC file. The user has the option to use a new datafile or use different columns within the current file. If a new file is chosen, the name and the column numbers must be specified. If the existing file is desired, the user will be queried for the column numbers only. In either case, all three columns, X-coordinate, Y-coordinate, and assay value must be specified.

REVIEW DATAFILES

Step 13 (REVIEW) lists the current input datafile name and the column identifiers corresponding to the chosen north coordinate, east coordinate and assay value. All output files created in the current session are listed by name, file type (i.e. STATPAC or CHARACTER), and source (e.g. SEMIVAR).

RANDOMLY PERMUTE DATAFILE

Step 14 (PERMUTER) randomly rearranges the rows in a Statpac datafile. Step 6 (CROSS_VALID) requires a randomly permutted file as input to the second available validation method. Step 14 provides the user with the ability to convert the data to the required ordering. The input file in current use is automatically chosen. The user is required to specify a name for the output datafile to be created. The program was adapted from the U. S. Atomic Energy Commission (written commun.).

REARRANGE DATAFILE

Step 15 (STATSORT) sorts a Statpac datafile by primary row id, by secondary row id, or by one, two, or three Statpac variables. The user may specify whether sorting is to be in ascending or descending order and whether the sorting is to be done on the absolute value of the variable. As in Step 14, the input file currently in use is automatically chosen and the user is required to specify the output datafile. The program was also adapted from U. S. Atomic Energy Commission (written commun.).

EXIT THE PROGRAM

Step 16 (QUIT) exits the program and returns the user to system command level. All files are closed and detached. The log of the session is terminated at this point. This log is stored in the user's area under the name XXMonth.sts where XX is the current date and Month is the current month. If more than one run of the program is made in the same day and both kept in a log, the second run is concatenated at the end of the first and a single .sts file is created. It is a character file so may be viewed by the user simply by issuing a print or a dprint system command.

WORKED EXAMPLE

Below is an example of the process used to convert a PACER output file to a STATPAC file. The sample includes the creation of the PACER file using the required output format. The program prompts are shown in upper case and the user responses are in lower case. Variable ids are printed as stored in datafile.

```
ENTER COMMAND:  cond

A.   bed eq (name you need)
B.   lith eq coal
C.



ENTER COMMAND:  logi

ENTER LOGIC:  a.and.b

ENTER COMMAND:  sear

ENTER INPUT FILE NAME:

ENTER OUTPUT FILE NAME:  tempout

ENTER COMMAND:  list

ENTER NAME OF FILE:  tempout

ENTER NUMBER OF LINES/PAGE:
AT EACH PAUSE PRESS CR KEY TO CONTINUE.  TO ABORT ENTER A.

3 TYPES OF LISTINGS ARE POSSIBLE:
  C - COLUMN TYPE (DEFAULT FORMAT)
  U - COLUMN TYPE (USER FORMAT)
  R - ROW TYPE

SELECT C, U, OR R:  u
```

```
WOULD YOU LIKE OUTPUT TO BE TO DISK?  (y or n):  y

ENTER DISK FILE NAME:  anderson

ENTER THE LIST OF ITEM NAMES.

1.  fieldid 1 16 (4a4)
2.  latitud 18 11 (i11)
3.  longtud 30 11 (i11)
4.  surfelv 42 6 (f6.0)
5.  from 49 6 (f6.0)
6.  to 56 6 (f6.0)
7.  thk 63 6 (f6.0)
8.  bed 70 20 (5a4)
9.  key 92 8 (i8)
10.

ENTER COMMAND:  quit
```

```
pacer_to_statpac
 WHAT IS THE LONGITUDE OF THE CENTRAL MERIDIAN ?: 105.0
 ENTER NAME OF PACER FILE.
anderson
 ENTER NAME OF OUTPUT FILE.
anderson_st
     THE STATPAC FILE HAS BEEN WRITTEN
     THE FILE ID IS ALL BEDS     N =  198     M =  8

STOP
```

The following is an example of a typical session of the KRIGING program.

No attempt was made to show every option but rather to show how the program

is typically used.

```
asr >udd>Potfield>RWahl>plot_sys

kriging
 DO YOU WANT A LOG OF THIS SESSION KEPT?
y
 ENTER NAME OF STATPAC INPUT FILE (1-32 CHARACTERS)
clarkfe.statpac
 DO YOU WANT THE COLUMN IDS PRINTED?
help
```

```
 YOU WILL BE REQUIRED TO SPECIFY WHICH COLUMNS
 CONTAIN THE X-COORDINATES, THE Y-COORDINATES, AND
 ASSAY VALUES.  IF YOU DO NOT KNOW WHERE THEY ARE,
 ANSWER YES AND THE COLUMN IDS WILL BE PRINTED.
 DO YOU WANT THE COLUMN IDS PRINTED?
y
  x-coord.     y-coord.     pct iron

          ENTER STATPAC FILE DESCRIPTORS
 WHAT IS COLUMN NUMBER OF THE NORTH COORDINATE?
2
 WHAT IS COLUMN NUMBER OF THE EAST COORDINATE?
1
 WHAT IS COLUMN NUMBER OF THE ASSAY VALUE?
3


 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
  1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
1


 DATA SET ID = -XXXXXXXX-
 NO OF ROWS    =   50
 NO OF COLUMNS =    3
 DO YOU WANT TO PRINT INPUT COLUMN IDS?
n

 DO YOU WANT TO PRINT THE DATA FOR THIS DATA SET?
y
 DO YOU WANT SELECTED ROWS?
1
 INPUT MUST BE A YES(Y), NO(N), or HELP(?)
 DO YOU WANT SELECTED ROWS?
y
 HOW MANY ROW PAIRS?
2
```

```
 FROM:
1
 TO:
4
 FROM:
47
 TO:
50
 DO YOU WANT SELECTED COLUMNS?
n

 DATA:

 ROW NO =     1  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  0.0000000E+00   1.7000000E+02   3.4300000E+01

 ROW NO =     2  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  1.0000000E+01   4.0000000E+01   3.5500000E+01

 ROW NO =     3  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  1.5000000E+01   1.3500000E+02   2.8600000E+01

 ROW NO =     4  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  5.5000000E+01   1.4500000E+02   2.9400000E+01

 ROW NO =    47  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  2.7000000E+02   2.8500000E+02   3.2900000E+01

 ROW NO =    48  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  3.6500000E+02   3.4000000E+02   4.0000000E+01

 ROW NO =    49  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  3.3000000E+02   3.2000000E+02   4.4100000E+01

 ROW NO =    50  ROW ID                 LOCATION =    0*  0'  0"    0*  0'  0"
  3.3000000E+02   2.9000000E+02   4.1400000E+01


 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
  1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
```

```
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
2
 NO OF ROWS =    50
 NO OF COLUMNS =     3
 DO YOU WANT SELECTED ROWS?
n
 DO YOU WANT SELECTED COLUMNS?
n
 WHAT DO YOU WANT TO INCLUDE IN THE BASIC STATISTICS?
      1 - ONLY UNQUALIFIED DATA
      2 - ONLY QUALIFIED DATA
      3 - ALL DATA (IGNORING QUALIFYING CODES).
 ENTER A 1, 2, OR 3:
1
 LOGARITHMIC TRANSFORMATION WANTED?
n

                    DATE:  2- 8-84
                           UNIVARIATE STATISTICS

 VAR  COLUMN    MINIMUM   MAXIMUM    MEAN     DEVIATION  VALID B   L   N   G OTHER
   1 x-coord. 0.000E+00 4.000E+02 2.119E+02 1.2728E+02  50   0   0   0   0   0
   2 y-coord. 0.000E+00 3.950E+02 1.867E+02 1.1216E+02  50   0   0   0   0   0
   3 pct iron 2.440E+01 4.410E+01 3.450E+01 4.7516E+00  50   0   0   0   0   0
 DO YOU WANT TO SEE THE CORRELATIONS?
y


 CORRELATIONS -- COMPUTED USING ORIGINAL DATA

       1    2    3
   1  1.00 0.11 0.30
   2  0.11 1.00 0.15
   3  0.30 0.15 1.00
 DO YOU WANT HISTOGRAMS FOR ANY SELECTED COLUMNS?
y
 ENTER COLUMN NUMBER FOR WHICH HISTOGRAM IS DESIRED.
3
 DO YOU WANT TO ENTER LOWER LIMIT AND CLASS INTERVAL FOR THIS COLUMN?
 IF NOT THE MINIMUM VALUE FOR THIS COLUMN AND STURGES' RULE WILL BE
 USED TO COMPUTE THE HISTOGRAM.
n
```

```
 HISTOGRAM FOR COL NO.    3(pct iron)

                      OBS CUM  PER  CUM       CLASS
   LIMIT - UPPER      FRQ FRQ  FRQ  FRQ      MIDPOINT  DISTRIBUTION

         n             0   0  0.0   0.0
         ]             0   0  0.0   0.0
 2.440E+01- 2.690E+01  1   1  2.0   2.0     2.565E+01 x
 2.690E+01- 2.940E+01  5   6 10.0  12.0     2.815E+01 xxx
 2.940E+01- 3.190E+01 11  17 22.0  34.0     3.065E+01 xxxxxx
 3.190E+01- 3.440E+01 10  27 20.0  54.0     3.315E+01 xxxxx
 3.440E+01- 3.690E+01  7  34 14.0  68.0     3.565E+01 xxxx
 3.690E+01- 3.940E+01  3  37  6.0  74.0     3.815E+01 xx
 3.940E+01- 4.190E+01 12  49 24.0  98.0     4.065E+01 xxxxxx
 4.190E+01- 4.440E+01  1  50  2.0 100.0     4.315E+01 x
         G             0  50  0.0 100.0
         B             0  50
 DO YOU WANT ANOTHER HISTOGRAM?
n
 DO YOU WANT PERCENTILES FOR SELECTED DATA?
y

 var id      25.0      50.0      75.0      80.0      85.0      90.0      95.0      99.0
 x-coord. 111.1111 226.6667 331.6667 340.0000 350.0000 366.6667 386.6667 413.3333
 y-coord. 100.9444 179.0667 263.3333 302.8333 329.1667 355.5000 381.8333 408.1667
 pct iron  30.4976  34.3438  38.9561  39.5033  40.0506  40.6853  41.3420  44.1000
 DO YOU WANT ANOTHER SET OF COMPUTATIONS?
n


 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
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  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
3
 DOES THIS DATA INCREASE TO THE 1)EAST OR 2)WEST?

 DOES THIS DATA INCREASE TO THE 1)NORTH OR 2)SOUTH?
1
```
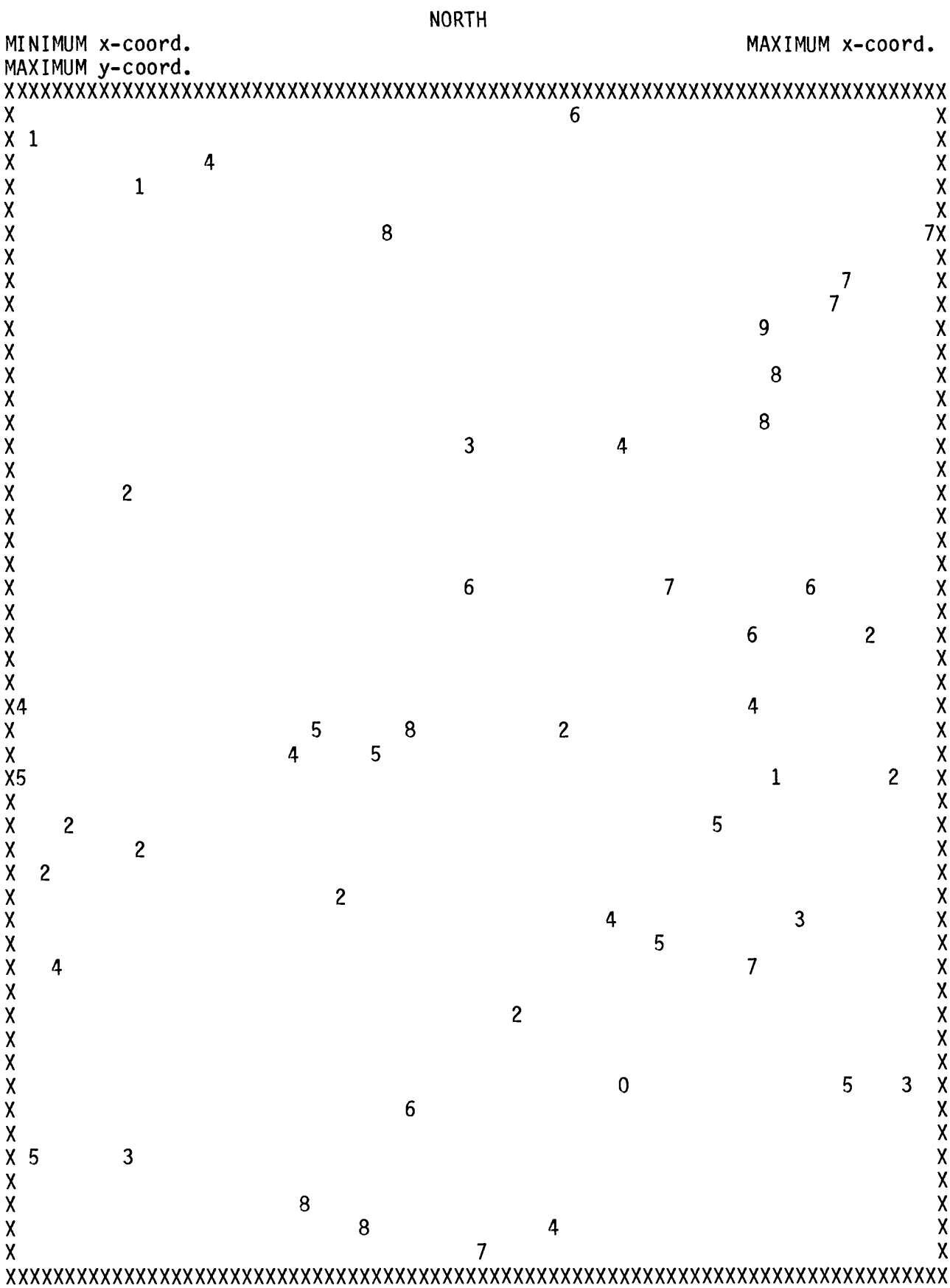
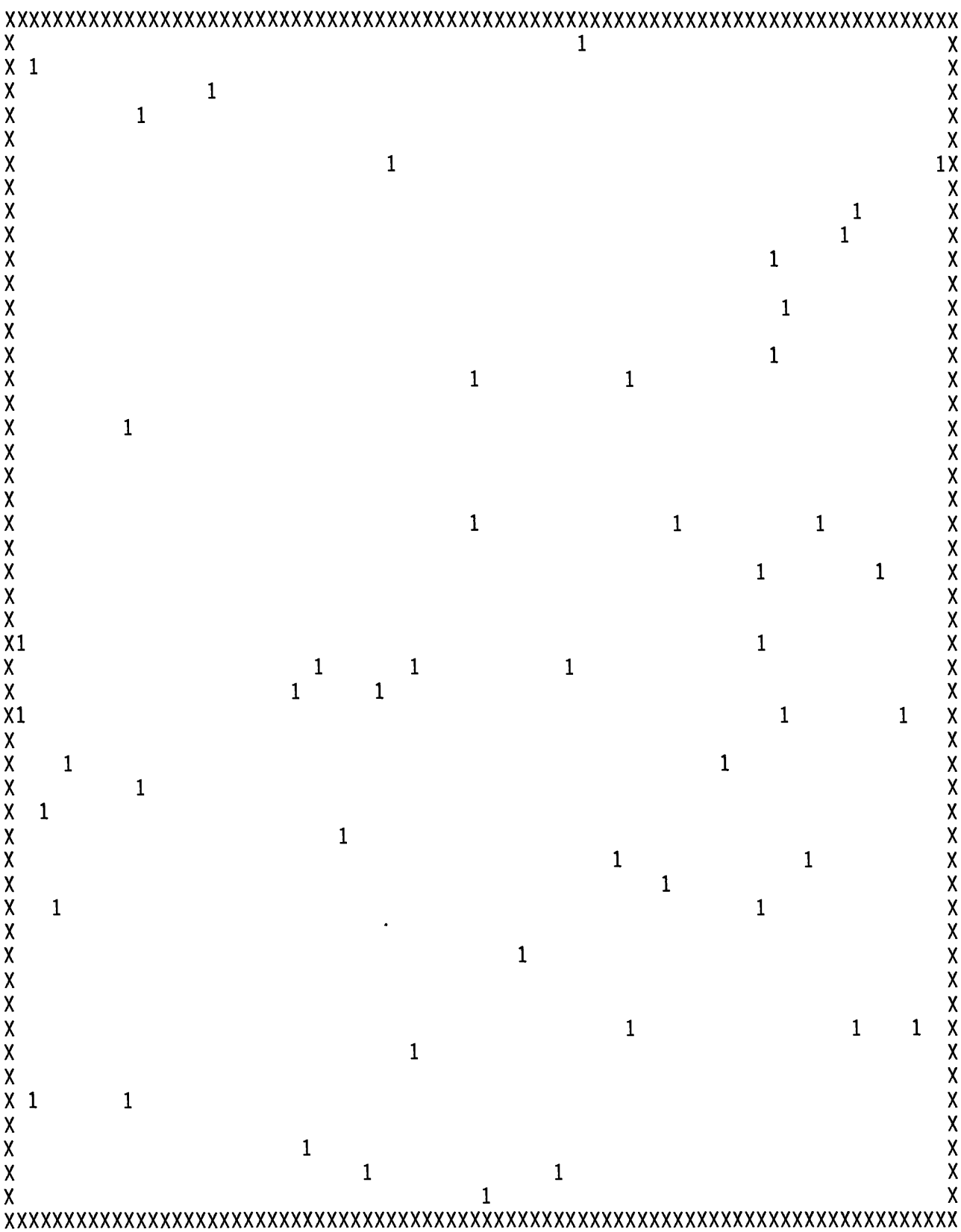

DATE: 2- 8-84



```
 MINIMUM y-coord.

 x-coord.
 MINIMUM =    0.0000
 MAXIMUM =  400.0000

 y-coord.
 MINIMUM =    0.0000
 MAXIMUM =  395.0000

 MAP SYMBOL          RANGE OF  pct iron
      0             24.4000       26.3700
      1             26.3700       28.3400
      2             28.3400       30.3100
      3             30.3100       32.2800
      4             32.2800       34.2500
      5             34.2500       36.2200
      6             36.2200       38.1900
      7             38.1900       40.1600
      8             40.1600       42.1300
      9             42.1300       44.1000
 DO YOU WANT A MAP SHOWING THE NUMBER OF SAMPLES PER CELL?
y
```

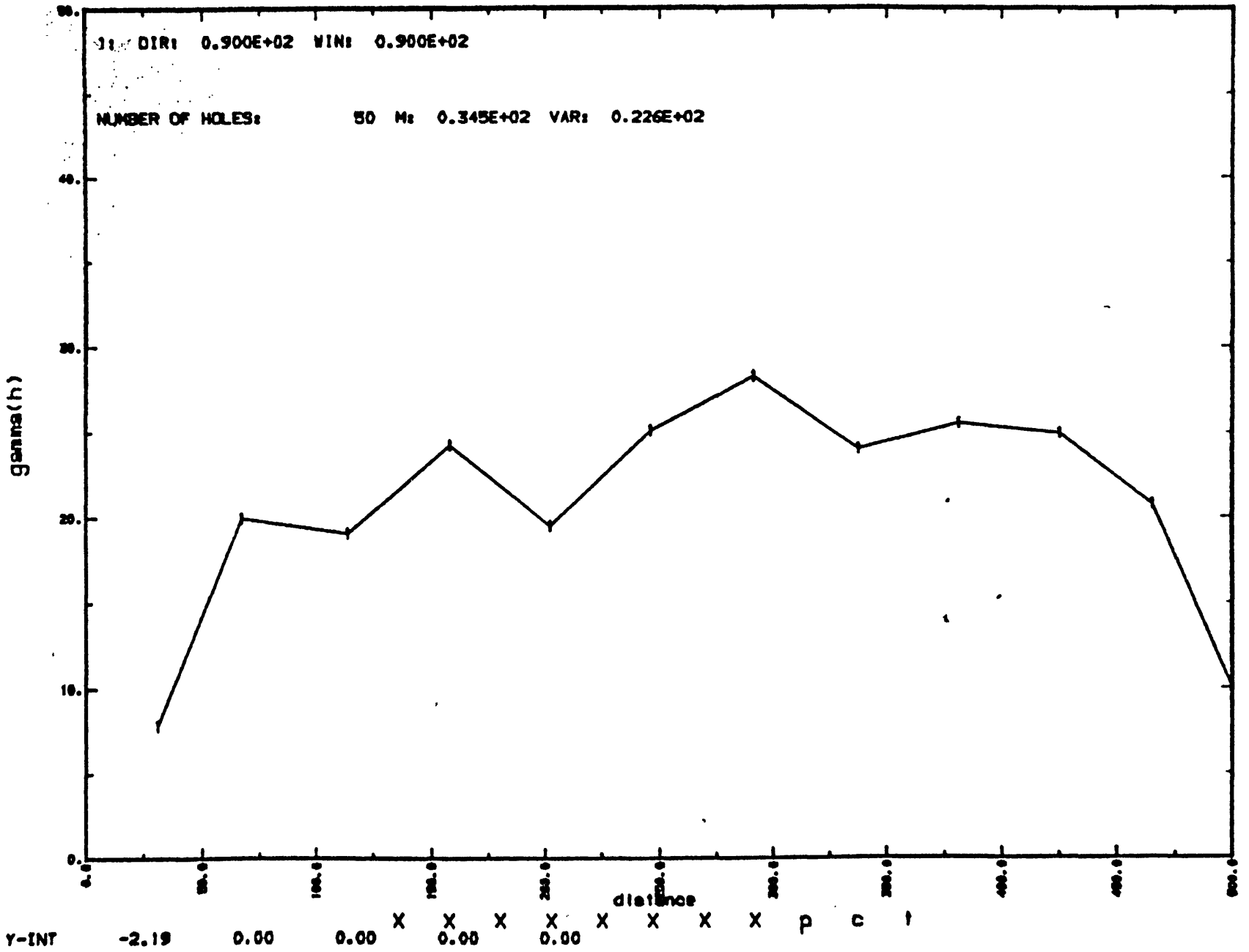
NUMBERS OF SAMPLES
* MEANS MORE THAN 9



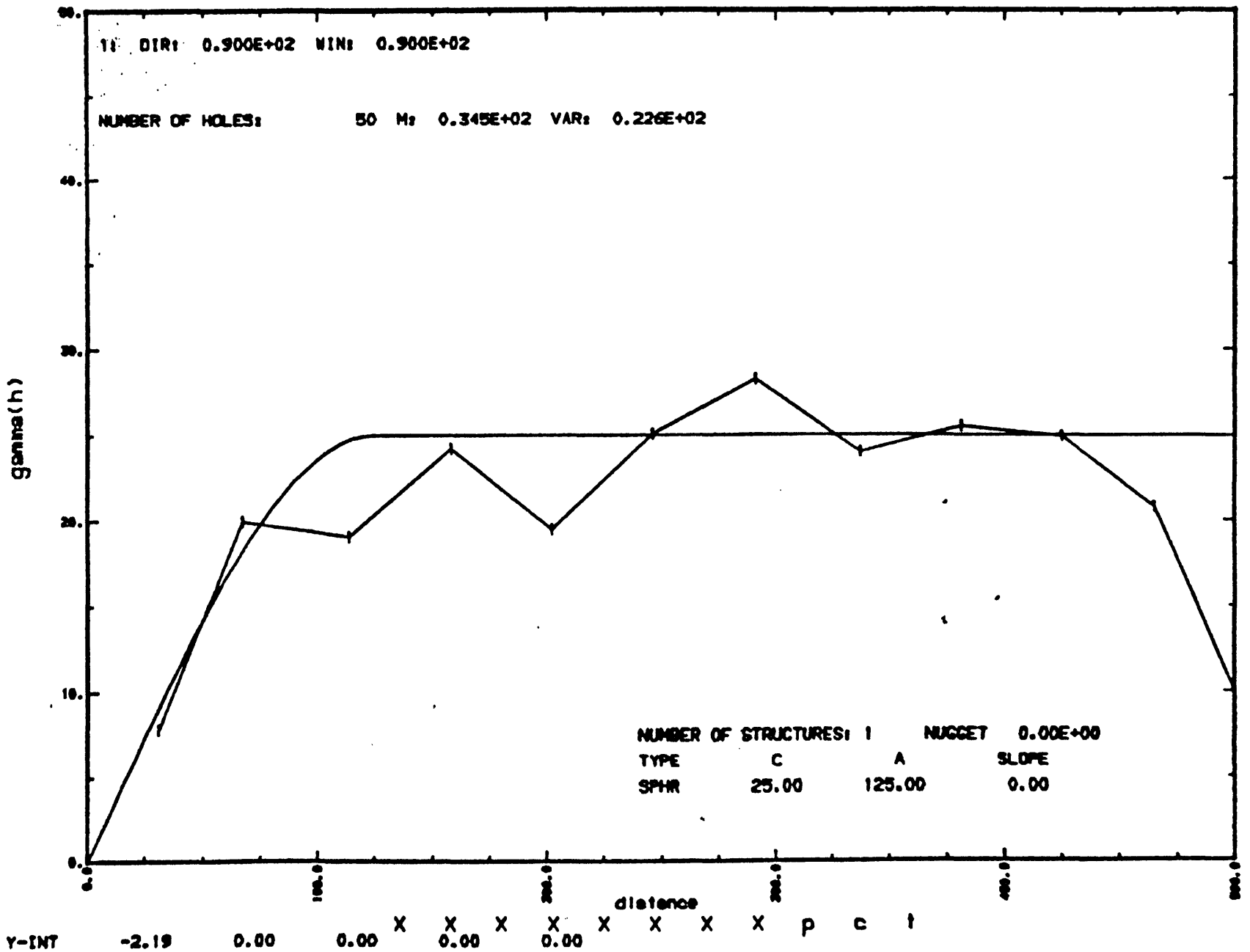
```
*************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
  1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
4
 DO YOU WANT TO READ THE OPTIONS FROM A FILE?
n
 1: ENTER 80 CHARACTER ID FOR VARIOGRAM RUN
Clark data - percent iron
  2: LOGARITHMIC CONVERSION WANTED?
n
  3: WILL YOU WANT A PLOT FILE CREATED?
y
  4: IS AUTOMATIC SCALING OF THE GRAPH WANTED?
y
  5: IS RELATIVE VARIOGRAM WANTED?
n
  6: ENTER NUMBER OF VARIOGRAM DIRECTIONS. (MAX=5)
5
  7: GIVE CLASS INTERVAL TO GROUP DISTANCES.
45
 9: FOR VARIOGRAM 1
 ENTER ANGLE.
90
 ENTER WINDOW.
90
 9: FOR VARIOGRAM 2
 ENTER ANGLE.
-45
 ENTER WINDOW.
15
 9: FOR VARIOGRAM 3
 ENTER ANGLE.
0
 ENTER WINDOW.
15
 9: FOR VARIOGRAM 4
 ENTER ANGLE.
45
```

```
 ENTER WINDOW.
15
 9: FOR VARIOGRAM 5
 ENTER ANGLE.
90
 ENTER WINDOW.
15
 10: DO YOU WANT TO SELECT COORDINATES?
n
 DO YOU WANT TO SAVE THESE OPTIONS IN A FILE?
y
 ENTER NAME OF OPTIONS FILE.
optout
 ENTER NAME OF CHARACTER OUTPUT FILE (1-32 CHARACTERS)
semi.char
 ENTER NAME OF PLOT FILE. (1-32 CHARACTERS)
plotout
 DO YOU WANT TO CHANGE ANY CONTROL VARIABLES AND RERUN?
n

*************************************************************************
KRIGING STEPS CURRENTLY AVAILABLE:
 1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
 2)       BASTAT:  CALCULATE BASIC STATISTICS
 3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
 4)      SEMIVAR:  COMPUTE VARIOGRAM.
 5)      PLOTVAR:  PLOT VARIOGRAM.
 6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
 7)    KRIG_GRID:  KRIG A GRID OF POINTS.
 8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
 9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
10)       NORCHI:  TEST FOR NARMALITY OF A VARIABLE.
11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
16)         QUIT:  EXIT THE KRIGING PROGRAM.
ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
5



 ENTER NAME OF CHARACTER INPUT FILE. (1-32 CHARACTERS)
plotout
 HOW MANY VARIOGRAMS DO YOU WANT PLOTTED? (MAX=5)
1
 ENTER NUMBER CORRESPONDING TO SELECTED VARIOGRAM.
1
 ENTER MAX-X TO BE PLOTTED.
500
 ENTER MIN-Y TO BE PLOTTED.
0
```

```
 ENTER MAX-Y TO BE PLOTTED
50
 FOR X-AXIS:
 ENTER DISTANCE BETWEEN TICKS. (DEFAULT=1)
25
 ENTER NUMBER OF TICKS PER ANNOTATION. (DEFAULT=5)
2
 FOR Y-AXIS
 ENTER DISTANCE BETWEEN TICKS. (DEFAULT=1)
5
 ENTER NUMBER OF TICKS PER ANNOTATION.  (DEFAULT=5)
2
 DO YOU WANT THE THEORETICAL CURVE PLOTTED?
no
```


DIR: 0.900E+02 WIN: 0.900E+02
NUMBER OF HOLES: 50 M: 0.345E+02 VAR: 0.226E+02
gamma(h)
distance
Y-INT -2.19 0.00 0.00 0.00 0.00
X X X X X X X X p c f

```
 ENTER NAME OF CHARACTER INPUT FILE. (1-32 CHARACTERS)
plotout
 HOW MANY VARIOGRAMS DO YOU WANT PLOTTED? (MAX=5)
1
 ENTER NUMBER CORRESPONDING TO SELECTED VARIOGRAM.
1
 ENTER MAX-X TO BE PLOTTED.
500
 ENTER MIN-Y TO BE PLOTTED.
0
 ENTER MAX-Y TO BE PLOTTED
50
 FOR X-AXIS:
 ENTER DISTANCE BETWEEN TICKS. (DEFAULT=1)
25
 ENTER NUMBER OF TICKS PER ANNOTATION. (DEFAULT=5)
4
 FOR Y-AXIS:
 ENTER DISTANCE BETWEEN TICKS. (DEFAULT=1)
5
 ENTER NUMBER OF TICKS PER ANNOTATION. (DEFAULT=5)
2
 DO YOU WANT THE THEORETICAL CURVE PLOTTED?
yes

 ENTER VARIOGRAM PARAMETERS.
 ENTER NUGGET VALUE.
0
 HOW MANY OTHER VARIOGRAMS ARE IN THE MODEL? (MAX=5, DEFAULT=1)
1

                      VARIOGRAM NUMBER 1
                    -------------------------
 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
1
 ENTER THE C-VALUE FOR THIS VARIOGRAM.
25
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
125
 DO YOU WANT YOUR OUTPUT ON THE TEKTRONIX PLOTTER?
no
```


11 DIR: 0.900E+02 WIN: 0.900E+02
NUMBER OF HOLES: 50 M: 0.345E+02 VAR: 0.226E+02
gamma(h)
40.
30.
20.
10.
0.
0.0
100.0
200.0
300.0
400.0
500.0
distance
NUMBER OF STRUCTURES: 1 NUGGET 0.00E+00
TYPE C A SLOPE
SPHR 25.00 125.00 0.00
X X X X X X X X p c t
Y-INT -2.19 0.00 0.00 0.00 0.00

```
 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
  1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
6
 ENTER NAME OF STATPAC OUTPUT FILE. (1-32 CHARACTERS)
cross.stat
 ENTER NAME OF CHARACTER OUTPUT FILE (1-32 CHARACTERS)
cross.char
 TYPES OF VALIDATION:
    1) HOLE-BY-HOLE SUPPRESSION
    2) EVERY-OTHER-SAMPLE
    3) SELECTED-ROW VALIDATION
 ENTER NUMBER CORRESPONDING TO TYPE DESIRED.
n
 BAD CHARACTER n
 INPUT MUST BE A NUMBER, A BLANK, OR HELP(?)
 ENTER NUMBER CORRESPONDING TO TYPE DESIRED.
1
 DO YOU WANT 1)ORDINARY OR 2)UNIVERSAL KRIGING?
1

 ENTER VARIOGRAM PARAMETERS.
 ENTER NUGGET VALUE.
0.
 HOW MANY OTHER VARIOGRAMS ARE IN THE MODEL? (MAX=5, DEFAULT=1)


                   VARIOGRAM NUMBER 1:
                   -------------------
 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
help
 ENTER THE NUMBER (1-5) CORRESPONDING TO DESIRED TYPE.

                   VARIOGRAM NUMBER 1:
                   -------------------
 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
1
 ENTER THE C-VALUE FOR THIS VARIOGRAM.
25
```

```
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
125
 1) ISOTROPIC OR 2)ANISOTROPIC?
1
 ENTER THE MAXIMUM DISTANCE FROM CENTROID FOR A HOLE TO BE INCLUDED.
200
 ENTER THE MAXIMUM NUMBER OF HOLES TO BE USED WITHIN THE NEIGHBORHOOD.
16
 DO YOU WANT THE SUMMARY STATISTICS AND CORRELATIONS CALCULATED?
n


 KRIGED AVERAGE ERROR =    -0.1425
 KRIGED ROOT MEAN SQUARE ERROR =     3.5620
 KRIGED REDUCED ROOT MEAN SQUARE ERROR =     1.0191


 THE STATPAC FILE HAS BEEN WRITTEN.
 THE DATA SET ID IS KRIGTEST
 N=   50   M=   7

 ********************************************************************************
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  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
7
 DO YOU WANT THE OUTPUT TO BE IN THE GARNET FORMAT?
n
 ENTER NAME OF STATPAC OUTPUT FILE. (1-32 CHARACTERS)
kgrid.stat
 ENTER NAME OF CHARACTER OUTPUT FILE (1-32 CHARACTERS)
kgrid.char
 DO YOU WANT 1)ORDINARY OR 2)UNIVERSAL KRIGING?
1

 ENTER VARIOGRAM PARAMETERS.
 ENTER NUGGET VALUE.
0
 HOW MANY OTHER VARIOGRAMS ARE IN THE MODEL? (MAX=5, DEFAULT=1)
```

```
                    VARIOGRAM NUMBER 1:
                    -------------------
 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
1
 ENTER THE C-VALUE FOR THIS VARIOGRAM.
25
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
?
FOR A SPHERICAL OR CUBIC MODEL, THE A-VALUE IS EQUAL TO THE RANGE OF INFLUENCE.
FOR AN EXPONENTIAL MODEL, IT IS EQUAL TO .333 OF THE PRACTICAL RANGE (.95 OF
FULL) AND .577 OF THE PRACTICAL RANGE FOR A GAUSSIAN MODEL.  IT MUST BE > 0.
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
125.
 1) ISOTROPIC OR 2)ANISOTROPIC?
3

 ENTER A NUMBER 1 OR 2.
 1) ISOTROPIC OR 2)ANISOTROPIC?
1
 ENTER THE MAXIMUM DISTANCE FROM CENTROID FOR A HOLE TO BE INCLUDED.
200.
 ENTER THE MAXIMUM NUMBER OF HOLES TO BE USED WITHIN THE NEIGHBORHOOD.
16

 ENTER DESCRIPTORS OF GRID OF POINTS TO BE KRIGED.
 ENTER NUMBER OF POINTS IN NORTH-SOUTH DIRECTION.
17
 ENTER DISTANCE BETWEEN POINTS IN NORTH-SOUTH DIRECTION.
25
 ENTER NUMBER OF POINTS IN EAST-WEST DIRECTION.
17
 ENTER DISTANCE BETWEEN POINTS IN EAST-WEST DIRECTION.
25
 ENTER NORTHING OF SOUTHWEST CORNER OF GRID OF POINTS.
0.
 ENTER EASTING OF SOUTHWEST CORNER OF GRID OF POINTS.
0.

 THE STATPAC FILE HAS BEEN WRITTEN.
 THE DATA SET ID IS KRIGPNTS
 N=  289   M=   4


 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
  1)     LOOKSTAT:  REVIEW CONTENTS OF STATPAC FILE.
  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
```

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  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
 10)       NORCHI:  TEST FOR NORMALITY OF A VARIABLE.
 11)       REGRES:  MULTIPLE STEPWISE REGRESSION.
 12)  DATA_CHANGE:  CHANGE STATPAC FILE AND/OR DATA COLUMNS.
 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
8
 ENTER NAME OF CHARACTER OUTPUT FILE (1-32 CHARACTERS)
kblock.char
 DO YOU WANT 1)ORDINARY OR 2)UNIVERSAL KRIGING?
1

 ENTER VARIOGRAM PARAMETERS.
 ENTER NUGGET VALUE.
0.
 HOW MANY OTHER VARIOGRAMS ARE IN THE MODEL? (MAX=5, DEFAULT=1)


                  VARIOGRAM NUMBER 1:
                  -------------------

 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
1
 ENTER THE C-VALUE FOR THIS VARIOGRAM.
25
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
-10.
FOR A SPHERICAL OR CUBIC MODEL, THE A-VALUE IS EQUAL TO THE RANGE OF INFLUENCE.
FOR AN EXPONENTIAL MODEL, IT IS EQUAL TO .333 OF THE PRACTICAL RANGE (.95 OF
FULL) AND .577 OF THE PRACTICAL RANGE FOR A GAUSSIAN MODEL.  IT MUST BE > 0.
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
125.
 1) ISOTROPIC OR 2)ANISOTROPIC?
1
 ENTER THE MAXIMUM DISTANCE FROM CENTROID FOR A HOLE TO BE INCLUDED.
200.
 ENTER THE MAXIMUM NUMBER OF HOLES TO BE USED WITHIN THE NEIGHBORHOOD.
16.
 ENTER DESCRIPTORS OF BLOCK TO BE KRIGED.
 IS BLOCK RECTANGULAR AND SIDES PARALLEL TO COORDINATE AXES?
no
 ARE THE COORDINATES OF THE NODES TO BE ENTERED FROM THE TERMINAL?
y
 ENTER THE NUMBER OF VERTICES OF THE POLYGON.
7
     ENTER THE  1 NORTH COORDINATE
100
     ENTER THE  1 EAST COORDINATE.
100
     ENTER THE  2 NORTH COORDINATE
200
```

```
     ENTER THE  2 EAST COORDINATE.
100
     ENTER THE  3 NORTH COORDINATE
200
     ENTER THE  3 EAST COORDINATE.
200
     ENTER THE  4 NORTH COORDINATE
300
     ENTER THE  4 EAST COORDINATE.

 ENTER X-COORDINATE NOW.
     ENTER THE  4 EAST COORDINATE.
200
     ENTER THE  5 NORTH COORDINATE
300
     ENTER THE  5 EAST COORDINATE.
300
     ENTER THE  6 NORTH COORDINATE
100
     ENTER THE  6 EAST COORDINATE.
300
     ENTER THE  7 NORTH COORDINATE
100
     ENTER THE  7 EAST COORDINATE.
100
 ENTER DESCRIPTORS OF THE KRIGING GRID.
 ENTER NUMBER OF GRID POINTS IN NORTH DIRECTION.
2
 ENTER NUMBER OF GRID POINTS IN EAST DIRECTION.
4
 IS A DRILL HOLE LIST WANTED?
n
 DO YOU WANT THE BLOCK NODES LISTED?
no
 ENTER STARTING SEED FOR RANDOM NUMBER GENERATOR.
124.33


 ********************************************************************************
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  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
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 13)       REVIEW:  REVIEW STATUS OF ALL I/O FILES.
 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
```

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 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT: EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
9
 ENTER NAME OF CHARACTER OUTPUT FILE (1-32 CHARACTERS)
kmultblk.char
 ENTER MINIMUM NORTHING FOR CALCULATION OF MULTIPLE BLOCKS.
100
 ENTER MINIMUM EASTING FOR CALCULATION OF MULTIPLE BLOCKS.
100
 ENTER SIZE (IN Y-COORD. UNITS) OF RECTANGLE IN NORTH DIRECTION.
100
 ENTER SIZE (IN X-COORD. UNITS) OF RECTANGLE IN EAST DIRECTION.
50
 ENTER TOTAL NUMBER OF BLOCKS (NORTH DIRECTION) TO BE KRIGED.
2
 ENTER TOTAL NUMBER OF BLOCKS (EAST DIRECTION) TO BE KRIGED.
4
 DO YOU WANT 1)ORDINARY OR 2)UNIVERSAL KRIGING?
1

 ENTER VARIOGRAM PARAMETERS.
 ENTER NUGGET VALUE.
0.
 HOW MANY OTHER VARIOGRAMS ARE IN THE MODEL? (MAX=5, DEFAULT=1)


                  VARIOGRAM NUMBER 1:
                  -------------------
 IS IT 1)SPHERICAL, 2)EXPONENTIAL, 3)LINEAR, 4)GAUSSIAN, OR 5)CUBIC?
1
 ENTER THE C-VALUE FOR THIS VARIOGRAM.
25.
 ENTER THE A-VALUE FOR THIS VARIOGRAM.
125.
 1) ISOTROPIC OR 2)ANISOTROPIC?
1
 ENTER THE MAXIMUM DISTANCE FROM CENTROID FOR A HOLE TO BE INCLUDED.
200
 ENTER THE MAXIMUM NUMBER OF HOLES TO BE USED WITHIN THE NEIGHBORHOOD.
16
 ENTER DESCRIPTORS OF BLOCK TO BE KRIGED.
 IS BLOCK RECTANGULAR AND SIDES PARALLEL TO COORDINATE AXES?
n
 ARE THE COORDINATES OF THE NODES TO BE ENTERED FROM THE TERMINAL?
y
 ENTER THE NUMBER OF VERTICES OF THE POLYGON.
7
     ENTER THE  1 NORTH COORDINATE
100
     ENTER THE  1 EAST COORDINATE.
100
     ENTER THE  2 NORTH COORDINATE
200
```

```
     ENTER THE  2 EAST COORDINATE.
100
     ENTER THE  3 NORTH COORDINATE
200
     ENTER THE  3 EAST COORDINATE.
200
     ENTER THE  4 NORTH COORDINATE
300
     ENTER THE  4 EAST COORDINATE.
200
     ENTER THE  5 NORTH COORDINATE
300
     ENTER THE  5 EAST COORDINATE.
300
     ENTER THE  6 NORTH COORDINATE
100
     ENTER THE  6 EAST COORDINATE.
300
     ENTER THE  7 NORTH COORDINATE
100
     ENTER THE  7 EAST COORDINATE.
100


 ********************************************************************************
 KRIGING STEPS CURRENTLY AVAILABLE:
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  2)       BASTAT:  CALCULATE BASIC STATISTICS
  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
  4)      SEMIVAR:  COMPUTE VARIOGRAM.
  5)      PLOTVAR:  PLOT VARIOGRAM.
  6)  CROSS_VALID:  CROSS-VALIDATE VARIOGRAM.
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
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 14)     PERMUTER:  CREATE NEW STATPAC FILE BY RANDOMLY REARRANGING ROWS.
 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
10
 CHI-SQUARE TEST FOR NORMALITY OF STATPAC VARIABLE.
 WHAT IS COLUMN NUMBER OF THE VARIABLE?
3
 LOGARITHMIC TRANSFORMATION WANTED?
n
```

DATE: 2- 8-84

XXXXXXXX ** pct iron

SERV-UR-SELF CHI-SQUARE PROGRAM
NORMALITY TEST

SUMMARY STATISTICS

NO. POINTS	50
MEAN	0.34504000E+02
VARIANCE	0.22577513E+02
STD.DEV.	0.47515801E+01
SKEWNESS	0.29544958E-01
KURTOSIS	0.20387125E+01
MAX VALUE	0.44100000E+02
MIN VALUE	0.24400000E+02
RANGE	0.19700000E+02

CLASS INTERVAL		OBSERVED FREQUENCY	THEORETICAL FREQUENCY
LESS THAN	0.19061364E+02	0	0.00000000E+00
0.19061364E+02	0.21437154E+02	0	0.00000000E+00
0.21437154E+02	0.23812944E+02	0	0.00000000E+00
0.23812944E+02	0.26188735E+02	0	0.00000000E+00
0.26188735E+02	0.28564525E+02	5	0.52825000E+01
0.28564525E+02	0.30940315E+02	10	0.60490000E+01
0.30940315E+02	0.33316105E+02	5	0.87329999E+01
0.33316105E+02	0.35691895E+02	11	0.98709999E+01
0.35691895E+02	0.38067685E+02	6	0.87329999E+01
0.38067685E+02	0.40443475E+02	7	0.60490000E+01
0.40443475E+02	0.42819265E+02	6	0.52825000E+01
0.42819265E+02	0.45195055E+02	0	0.00000000E+00
0.45195055E+02	0.00000000E+00	0	0.00000000E+00
0.00000000E+00	0.00000000E+00	0	0.00000000E+00
GREATER THAN	0.00000000E+00	0	0.00000000E+00

COMPUTED CHI-SQUARE	0.54228625E+01
DEGREES OF FREEDOM	4
PROBABILITY LEVEL	0.24551344E+00

DEGREES OF FREEDOM AND PROBABILITY LEVEL APPLY ONLY TO UNCORRELATED DATA.
FOR KRIGING RESULTS, THESE VALUE ARE ONLY APPROXIMATIONS.

****

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4) SEMIVAR: COMPUTE VARIOGRAM.
5) PLOTVAR: PLOT VARIOGRAM.
6) CROSS_VALID: CROSS-VALIDATE VARIOGRAM.

```
  7)    KRIG_GRID:  KRIG A GRID OF POINTS.
  8)   KRIG_BLOCK:  KRIG A SINGLE, IRREGULAR BLOCK.
  9) KRIG_MULTBLK:  KRIG MULTIPLE, REGULAR BLOCKS.
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 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
12
 DO YOU WANT TO USE A NEW STATPAC FILE?
y
 ENTER NAME OF STATPAC INPUT FILE (1-32 CHARACTERS)
kgrid.stat
 DO YOU WANT THE COLUMN IDS PRINTED?
y
  X-COORD.     Y-COORD.     KRIG VAL     KRIG VAR
          ENTER STATPAC FILE DESCRIPTORS
 WHAT IS COLUMN NUMBER OF THE NORTH COORDINATE?
2
 WHAT IS COLUMN NUMBER OF THE EAST COORDINATE?
1
 WHAT IS COLUMN NUMBER OF THE ASSAY VALUE?
4



 ********************************************************************************
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  3)      MAPPLOT:  PLOT A SYMBOL MAP AT THE TERMINAL.
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 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
1


 DATA SET ID = -KRIGPNTS-
 NO OF ROWS    =  289
 NO OF COLUMNS =    4
```

```
 DO YOU WANT TO PRINT INPUT COLUMN IDS?
n
 DO YOU WANT TO PRINT THE DATA FOR THIS DATA SET?
y
 DO YOU WANT SELECTED ROWS?
y
 HOW MANY ROW PAIRS?
1
 FROM:
1
 TO:
3
 DO YOU WANT SELECTED COLUMNS?
n
 DATA:

 ROW NO =     1  ROW ID                  LOCATION =    0*  0'  0"    0*  0'  0"
  0.0000000E+00   0.0000000E+00   3.4412950E+01   1.8916936E+01

 ROW NO =     2  ROW ID                  LOCATION =    0*  0'  0"    0*  0'  0"
  0.0000000E+00   2.5000000E+01   3.5362298E+01   9.7137125E+00

 ROW NO =     3  ROW ID                  LOCATION =    0*  0'  0"    0*  0'  0"
  0.0000000E+00   5.0000000E+01   3.5361379E+01   7.3491764E+00


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 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
13


 INPUT FILENAME: kgrid.stat
 NORTH COORDINATE   COLUMN NO:   2   ID: Y-COORD.
  EAST COORDINATE   COLUMN NO:   1   ID: X-COORD.
     ASSAY VALUE    COLUMN NO:   4   ID: KRIG VAR
```

```
                    OUTPUT FILES CREATED
 FILENAME:                          FILE TYPE:  CREATED BY:

 optout                             CHARACTER   SEMIVAR
 semi.char                          CHARACTER   SEMIVAR
 plotout                            CHARACTER   SEMIVAR
 cross.stat                         STATPAC     UKVTEST
 cross.char                         CHARACTER   UKVTEST
 kgrid.stat                         STATPAC     UKPNEW
 kgrid.char                         CHARACTER   UKPNEW
 kblock.char                        CHARACTER   KRIGBLK
 kmultblk.char                      CHARACTER   MULTBLK

 ********************************************************************************

 KRIGING STEPS CURRENTLY AVAILABLE:
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 15)     STATSORT:  CREATE NEW STATPAC FILE BY SORTING DATA.
 16)         QUIT:  EXIT THE KRIGING PROGRAM.
 ENTER A NUMBER 1-16 OR A CARRIAGE RETURN.
16


STOP
```

SUMMARY

KRIGING provides the user with an easy to use, complete method of kriging a datafile. It requires that the user be knowledgeable in the geostatistical procedure and familiar with the data. No advanced knowledge concerning use of the program itself, however, is necessary. All steps and requirements are explained during execution and safeguards are provided to insure the execution of individual routines.

SELECTED REFERENCES

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