PREFACE

This pubblication is adressed to P6060 system users interested in Statistical Analysis Applications.

SUMMARY

This manual contains the user's documentation of P6060 Statistical Analysis Series.
Paired Data Analysis.

Related Documents:
P6060 Technical Supplement
Paired Data Analysis

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This product is devoted to assist you in performing statistical analysis: paired data analysis is concerned with determining the relationship between two measurements made on an object.
Simple linear regression applies when there are only two measurements x and y and the relationship is linear, i.e., it can be described by the expression:

$y = a + bx$

where a and b are the regression parameters.
In a plot a y versus x, a is the point where the line crosses the y axis and b is the slope of the line. Regression analysis allows one to predict a "reasonable" value of y from a known value of x. The variable y is referred to as the dependent variable and x is the independent variable.
It is assumed that the dependent variable y is normally distributed for each value of x. The independent variable x may be either stochastic (random) or non-stochastic, that is certain values of x have been selected by the experimenter.

Thus regression analysis can be applied to data gathered in two different ways:

- there is only one y value for each x value
- there are several y measurements for each x selected value.

If the relationship between the two variables has been studied by different investigators or under different conditions, a comparison of the different regression lines may be made to determine whether they are significantly different or not.

Note that the classical regression analysis cannot be applied if one variable is continous and the other is measured in the form of dichotomy: in this case the relationship is said to be biserial.
Finally, if the relationship between the two variables is slightly non-linear, the correlation ratio measures the correlation between two variables determined by using the column means of a correlation table.
In each program, particular attention has been paid to include correction routines of data entry errors.
Using some system utilities (see Appendix A, Installation and Maintenance) it is possible to form permanent data archives in order to avoid re-entering data in a future use.

CONVERSATIONAL MODE

The programs in this package were written in Olivetti P6060 BASIC, a simple to use computer language not requiring extensive professional training in programming.
However, the user of the package need not be concerned with the language used at all.
This is because the P6060 uses "conversational mode" to ask the operator questions through

the visual display and will proceed on the basis of the operator answers entered on the key - board. At all times the P6060 will guide the operator through the required procedure and give him explicit error messages on the display if his answers were not meaningful .
When multiple options are given at any time in the program they can be listed on the printer (entering option 0), so the operator will always be informed of what his choices of action are.

It is advised that the reader continues reading this manual through the INTRODUCTION and the description of the *HELP program before attempting to use a program.

PROGRAMS AVAILABLE IN THIS PACKAGE

The programs in this package were designed to operate on a machine with 16K of User Memory and dual drive floppy disk unit.

This package is composed of 6 programs.
The *HELP program describes for every program the contents, the used method, the available options and some particular procedure the user needs.
The other programs concern solution of correlation between two variables problems.

The following programs are available:

*HELP Description of contents of the package

*SLRS Simple linear regression with single observation for the dependent variable
Options available:

- transformation facilities
- regression parameter calculation
- test for linearity
- test for outliers
- orthogonal regression
- tests for correlation coefficient:
  - significance test for zero correlation
  - significance test for any correlation
  - comparison of two correlation coefficients
  - confidence interval for correlation coefficient

*SLRM Simple linear regression with multiple observations for the dependent variable.
Options available:

- transformation facilities
- regression parameters calculation
- test for linearity

- tests for correlation coefficient:
  - significance test for zero correlation
  - significance test for any correlation
  - comparison of two correlation coefficients
  - confidence interval for correlation coefficient

*COMP Comparison of several simple linear regressions

*BICO Biserial and point biserial correlation coefficients

*CORA Correlation ratio.

HOW THIS MANUAL IS ORGANIZED

This manual presents the description and procedural information for each program in the package by standard subsections as follows:

- Program title and Mnemonic
- Purpose
- Method
- Function key template
- Operating Procedure
- Error messages
- Sample Program Run
- References.

A brief description of what information is contained in each subsection follows.

Within each program there are a number of alternative editing routines selected by F-key.

The descriptive and procedural information for each of these F-key routines is presented by standard subsections as follows:

- Routine Title and F-Key
- Purpose
- Method
- Operating Procedure
- Error Messages
- Sample RoutineRun.

The routine subsections serve the same purpose as the main program subsections and contain similar information specific for that routine choice.

PROGRAM TITLE AND MNEMONIC

Note that the filename which designates the program on the disk appears in the upper right hand corner enclosed in a box. This will help you find the program you are looking for more quickly.
Note also that all Olivetti supplied programs have filenames beginning with an asterisk.

PURPOSE

A short paragraph briefly describing the program's internal purpose and scope is given here.

METHOD

One or two paragraphs briefly describing the algorithm and main options available are given in this subsection. If the user needs to know more about mathematical techniques or methods employed a fuller explanation is given in the Technical Supplement, a companion volume to each package in this series.

FUNCTION KEY TEMPLATE

The P6060 keyboard has a row of eight keys at the upper right which are customer-defined by the program being used. (In fact, they are at the user's disposal to define also).
Each program in the series using these keys has an associated template which should be inserted into the holder just above the keys.
In this manual under this subsection you will find a facsimile of this template and an explanation of the functions titles.

OPERATING PROCEDURE

After a program has been selected by the user and called by the simple command:

RUN filename (E.O.L.)

the operating procedure should be clear from the prompting messages displayed.
Each message ending with a "?" demands a response from the operator before continuing execution.
Usually, this will be entry of a numeric value (followed by the (E.O.L.) or pressing an appropriate F-Key.
However, we have listed for your convenience a step-by-step operating procedure that parallels this question and response sequence. Each displayed prompting message is indicated by the symbol  and each printed list of options or printed text is indicated by the symbol  . There are in general, two phases to each numbered step:

- Question : a prompting message generated by the machine (sometimes with accompanying printing text)

- Response : an action required by the operator in response to the prompting message.

Within each program there are usually a number of alternative computational options selected by a simple numerical code in response to a prompting message.
Once these choices are made, the reader can simply scan the steps of the operating procedure (which are grouped under options) to find the proper step paralleling his choice made at the machine keyboard.

ERROR MESSAGES

If operator's mistake is made, the machine in most cases will give an explicit error message and return the operator to some previous prompting message at which point a correction can be made. A list of the possible error messages generated by the program is given in this subsection.. Note that in every case the action to be taken by the operator is specified.

SAMPLE PROGRAM RUN

The sample program run serves to illustrate the required operating procedure and may answer certain questions without requiring your time in an actual run.

REFERENCES

Given in this subsection are most of the references used in preparation of the program. They should be consulted for a fuller theoretical background in the subject under discussion.

HOW TO BEGIN

Turn on the power and insert a system disk and the user disk supplied with this package. After a momentary warm up period the machine will display READY and you are ready to go.

Choose the program you want to use either by scanning the contents of the manual or by calling the *HELP program, which will give you descriptive text independent of the manual. Call the *HELP program by hitting the [RUN] and spell out *HELP on the keyboard, followed by [END OF LINE] key.
Call any other Olivetti Library program by hitting the [RUN] key and spell out the corre-

sponding filename, followed by the [END OF LINE] key.
It's that simple. Once the program is accessed, the system runs in conversational mode and you are guided by the displayed prompting messages.

HOW TO ENTER DATA FROM THE KEYBOARD

All data are first entered through the keyboard.
Entering sample data, they are stored on an external data file.

SINGLE NUMBERS

A keyboard entry is required whenever a prompting message appears on the display followed by a question mark. If it is a single number the program requests, the operator enters it using the numeric keys in the algebraic section with decimal point used where it appears in the number (*).
If a number is negative, simply enter the [-] key before the number. Hit [END OF LINE] to terminate the entry of the number. At this point it will be received by the system and program execution will continue.
Notice that as the numbers are keyed in they appear on the display, the first entered replacing the prompting message. A pointer moves along with each added character in the display. If at any time before terminating the entry it is desired to see the prompting display, simply hit [CLEAR RECALL] and it will reappear. Hit [CLEAR RECALL] again to retrieve your unfinished data entry in the display.
Before hitting [END OF LINE] you may want to check the entry on the visual display.
If a mistake has been made in a single digit and you have not yet hit the [END OF LINE] key, you may move the pointer backward to the erroneous digit using the [←] key, hit the the [CHAR DELETE] key, replace the digit in error with a correct one. Move the pointer back to the right if more digits or numbers are to be added. If no more are required, however, it is sufficient to leave the pointer where it is.
Hitting [END OF LINE] will enter all characters in the display.
Manipulation of the [SHIFT] [→] and [CHAR DELETE] keys can also facilitate insertion or rtion or deletion of a digit or group of digits. In many cases however simply use the [SHIFT] [CLEAR] key to clear out the display and start from scratch.

LIST OF NUMBERS

If the program requests a list of two or more numbers (always clear from the prompting message) then simply enter the single numbers in the list separated by commas. You can use the comma key in the algebraic section or the one in the alphanumeric section as you prefer.

---

* The numeric keys in the top row of the alphanumeric section and the decimal point in that section can alternatively be used.

HOW ERRORS ARE RECOGNIZED AND HANDLED

DATA ERRORS YOU CATCH

If you catch an entry error before hitting [END OF LINE] you may correct it before it is actually received by the system as explained above. After hitting [END OF LINE] you normally have two choices: 1) correcting it immediately by use of IMMEDIATE ERROR CORRECTION available on the Function Key or 2) correcting it after the input is ended by use of the MODIFY DATA routine also generally available on a Function Key. Note that not every single datum is correctable in this way, but only those that are part of a lengthly vector of input. Single program parameters are best corrected by restarting the program at a point prior to their occurrence.

ERRONEOUS OPTIONS OR DATA ERRORS THE PROGRAM CATCHES

If you have chosen an option you didn't intend to take usually you must start the program over again.
However, if the entered options were not valid or data was unacceptable to the program an error message will generally be given citing the specific reason. This message remains on the display , but hitting [SHIFT] [→] you can retrive the proper prompting message for entering a valid response and continuing the program.

HOW TO TERMINATE A RUN OR PERFORM A RERUN

Regardless of the software package being used, a program currently running may always be terminated by hitting the BREAK button on the P6060 console; but the normal termination of a program will be made by pressing F-Key # 8 (RETURN) when the display requires. To access the same program or any other program simply enter RUN filename followed by [END OF LINE] .

HOW TO FIND OUT IF YOUR DISK IS THE CORRECT ONE

In Appendix A of this User's Manual can be found a catalog of programs which constitute this software package. By entering the system command CAT U, : ,, F (available at any time when the machine is in command mode) you should be able to reproduce the catalog listing shown there. Subsequent software releases of this package, however, may supersede this published listing so be sure to obtain the latest software release from your sales representative.

Note that all Olivetti programs have an asterisk as first character of the filename. Olivetti only supports and maintains these programs.

*HELP

HELP PROGRAM

Purpose

This program is designed to assist you use the programs contained in this package. If you are already familiar with the contents of the package and have previously run the programs you may not need to use this program at all. Simply hit the RUN key, enter the filename of the program you want and hit (END OF LINE)

If you are somewhat familiar with the package but have forgotten the filename mnemonics for the program you want, then you may use *HELP to list the available programs and their filenames.
Then you can access the programs without asking for the descriptive text.

If you have never used the package before, then you may use *HELP to give you a thorough description of each program you want and the procedure for accessing them.

Note

You may run the *HELP program at any time by breaking the current program and entering RUN *HELP.
But this procedure is not recommended here because some errors in selecting options or function keys will arise when the old program will be called for execution:
it is preferable to end the current program with the normal termination by means of F-8 (RETURN) key.

Operating Procedure

1. Ensure that the machine is in COMMAND mode (if you happen to be running a program, press F-8 to stop its execution: the P6060 will then put you into COMMAND mode. If you are already in COMMAND mode you will get an audio beep).

2. Enter RUN *HELP
   The package identifying the message will be displayed:

   PAIRED DATA ANALYSIS

   and the program header will be printed:

*HELP HELP PROGRAM RUNNING

followed by the list of program numbers (explanation code), program titles, their mnemonics and some general information.

3. The following message will now be displayed:

ENTER EXPLANATION CODE (1-5)?

If you are already familiar with these programs, simply press F-8 key to stop the *HELP program.
The P6060 will take you to step 6.

If you are running this package for the first time, or want to refresh your memory on certain details, then enter the code identifying the program you want know.

4. The P6060 will now print out descriptive text for the selected program: short description, method, available options with some explanation.

5. Again the display asks for entering a new explanation code repeating step 3.

If you wish explanation for another program, return to step 3 entering a new request.
If you wish no explanation on other programs, then press F-8 and go to step 6.

6. The message:

PROCEDURE FOR RUNNING A PROGRAM

will now appear and a reminder on running your program will be printed.
The P6060 will automatically exit the *HELP program.
Simply, enter RUN filename for the program you wish to run.

Sample Program

Run

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*HELP   HELP PROGRAM RUNNING


                        AVAILABLE PROGRAMS
                        ******************

1  *SLRS   SIMPLE LINEAR REGRESSION FOR SINGLE OBSERVATION OF Y
2  *SLRM   SIMPLE LINEAR REGRESSION FOR MULTIPLE OBSERVATIONS OF Y
3  *COMP   COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS
4  *BICO   BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENT
5  *CORR   CORRELATION RATIO

    EDITING FACILITIES
    ------------------

THE FOLLOWING FUNCTION KEYS ARE AVAILABLE DURING ALL PROGRAMS
EXECUTION , WITH THE FOLLOWING MEANING :

  F-1  ORIGINAL DATA INPUT
  F-2  IMMEDIATE CORRECTION
  F-3  DATA MODIFICATION
  F-4  DATA DELETION
  F-5  DATA ADDITION
  F-6  INTERMEDIATE STATISTICS INPUT
  F-7  DATA PRINTOUT
  F-8  RETURN

THE FUNCTION KEY F-8 HAS ALWAYS THE MEANING :
END OF OPEN-ENDED ROUTINES AND RETURN TO THE MAIN PROGRAM
SEQUENCE , OR END OF THE RUNNING PROGRAM.

UNLESS F-2 ALL THESE FUNCTION KEYS ARE AVAILABLE AT ANY TIME THE
MESSAGE <SELECT ROUTINE ON F-KEY> APPEARS ON THE DISPLAY
(F-2 IS AVAILABLE ONLY DURING INPUT AND ADDING STAGES.)

TO STOP THE FOLLOWING INFORMATION
(WHEN A NEW EXPLANATION CODE IS REQUIRED) PRESS F-8
```

*SLRS SIMPLE LINEAR REGRESSION FOR SINGLE OBSERVATION OF Y

THIS PROGRAM SOLVES THE SIMPLE LINEAR REGRESSION PROBLEM BETWEEN TWO VARIABLES USING THE LEAST SQUARE METHOD WHEN FOR EACH MEASURE OF THE INDEPENDENT VARIABLE X THERE IS ONLY ONE MEASURE OF THE DEPENDENT VARIABLE Y .

AVAILABLE OPTIONS:

1 TRANSFORMATIONS FACILITIES
2 REGRESSION PARAMETERS CALCULATION
3 TEST FOR LINEARITY
4 TEST FOR OUTLIERS
5 ORTHOGONAL REGRESSION
6 TESTS FOR CORRELATION COEFFICIENT

TRANSFORMATIONS FACILITIES

TO USE THESE FACILITIES , ENTER OPTION 1 AND SELECT TYPE.
WHEN YOUR SELECTION IS COMPLETE , PRESS F-8 TO RUN TRANSFORMATIONS

1 1/X
2 1/Y
3 LOG(X)
4 LOG(Y)

ALL COMBINATIONS OF THESE TYPES ARE AVAILABLE

5 PRINTOUT OF TRANSFORMED DATA
6 NO TRANSFORMATION

AFTER HAVING MADE SOME TRANSFORMATIONS,IF YOU WANT TO USE ORIGINAL DATA AGAIN, SELECT OPTION 1 (TRANSFORMATION FACILITIES) AND ENTER 6 (NO TRANSFORMATIONS).

LINEARITY OF THE REGRESSION LINE IS TESTED MEASURING THE RUNS ABOUT THE REGRESSION LINE.

TEST FOR OUTLIERS : IF PROBABILITY OF ONE OUTLIER IS < 0.05
THIS ONE WILL BE ELIMINATED FROM SCRATCH FILE,
AND CALCULATIONS WILL BE PERFORMED WITH THE REMAINING DATA.
(NOTE THAT THE CRITERION 0.05 IS PARAMETRICALLY DEFINED : IT CAN BE CHANGED BY THE USER).

OPTION # 6 PROVIDES THE FOLLOWING TESTS:

1 SIGNIFICANCE TEST FOR ZERO CORRELATION
2 SIGNIFICANCE TEST FOR ANY CORRELATION
3 COMPARISON OF TWO CORRELATION COEFFICIENTS
4 CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT

*COMP COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS
==========

THIS PROGRAM PROVIDES A WAY OF TESTING SEVERAL SIMPLE LINEAR REGRES-
SIONS (UP TO 20 IN DEFAULT OF ANY DIFFERENT WILLING OF THE USER) TO
DETERMINE WHETER THEY ARE SIGNIFICANTLY DIFFERENT OR NOT.
FOR EACH ENTERED SAMPLE AN ANOVA TABLE IS COMPUTED ; FOR COMPARISON
THE VARINCE IS DIVIDED INTO FIVE PARTS : EACH PART CORRESPNDS TO A
DIFFERENT TYPE OF CONSTRAINT.

TO ENTER SAMPLES SELECT EDITING FEATURES AND PRESS CORRECT
FUNCTION KEY.
WHEN A SAMPLE IS CORRECTLY ENTERED SELECT REGRESSION ANALYSIS FOR
THIS SAMPLE DATA TO HAVE THE RESULTS PRINTOUT AND TO STORE SOME
PARAMETERS NEEDED FOR FURTHER COMPARISON.

EACH SAMPLE DATA IS IDENTIFIED BY AN INDEX-NUMBER(INTEGER POSITIVE):
ENTERING A NEW SAMPLE DATA THE OLD ONE IS LOST,BUT IT REMAINS
AVAILABLE FOR COMPARISON,IF ITS REGRESSION WAS COMPUTED,UP TO ANOTHER
SAMPLE DATA WITH THE SAME INDEX-NUMBER IS ENTERED.

WHEN ALL SAMPLES HAVE BEEN ENTERED AND ANALYZED,COMPARISONS ARE
AVAILABLE IN ANY ORDER AND ANY TIME YOU DESIRE.
THE INDEX-NUMBER IDENTIFYING EACH SAMPLE INCLUDED IN THE COMPARISON
IS REQUIRED BY THE PROGRAM:PRESS F-8 WHEN ALL SAMPLES ARE SELECTED.

AFTER RESULTS PRINTOUT A NEW COMPARISON IS AVAILABLE:
PRESS F-8 TO END COMPARISON ROUTINE.

IMPORTANT :
     A SAMPLE STATE TABLE MAY BE PRINTED OUT FROM SCRATCH FILE DATA22
     IDENTIFYING SAMPLES STORED FOR COMPARISON (1 = STORED SAMPLE,
     2 = NO STORED SAMPLE).

******PROCEDURE FOR RUNNING A PROGRAM******

TO RUN A PROGRAM ENTER RUN filename
PERMITTED FILENAMES ARE : *SLRS *SLRM *COMP *BICO *CORA
INSERT THE APPROPRIATE TEMPLATE IN THE HOLDER

NOTE: 1) WHEN THE DISPLAY PROMPTS YOU TO SELECT AN OPTION ENTER 0 TO
       OBTAIN A PRINTED LIST OF OPTIONS. THEN ENTER THE NUMBER OF
       THE OPTION DESIRED.
      2) WHENEVER ANY PROMPTING MESSAGES IS DISPLAYED, IT IS
       POSSIBLE TO EXIT THE PRESENT LEVEL OF THE PROGRAM BY
       PRESSING FKEY#8 (RETURN).

END OF *HELP

*SLRS

SIMPLE LINEAR REGRESSION WITH SINGLE OBSERVATION FOR THE DEPENDENT VARIABLE

Purpose

This program calculates simple linear regression in the case there is single observation of the dependent variable y (measured for randomly chosen values of x).

Features are provided to test linearity and outliers and to calculate orthogonal regression in the case both variables are subject to error.
Parameters of the regression line are computed with their standard errors, t-statistic, standard error of estimate correlation coefficient and common statistics for each variable.
Features are developed to test the significance of the slope and of any pair (x,y); to find, for any confidence level, the confidence and prediction intervals for the dependent variable; to calculate confidence interval for correlation coefficient, to test zero or any correlation coefficient and to compare two correlation coefficients.
Also it is possible to store on external data file for future use tabulation of x and y calculated values.
Two variable transformations, logarithm and reciprocal, are provided with all their combinations: so it is possible to test 16 different regression lines.

Method

First, it is necessary to store the data (original data or intermediate statistics) on external data file.
Because the dependent variable y is measured for randomly chosen x-values, experimental data are composed of data pairs (x_i, y_i), $i = 1, 2, \ldots, n$.
Least square method is used to solve the regression line problem.
For detailed description of the algorithms, see "Statistical Analysis Series-Paired data Analysis - Technical Supplement"
Limitations depend on the defined external data file size for entering data, but if the observations are not arranged in increasing numerical x-values, not more than 1000 observations can be handled with P6060 with 16-K memory size.
See Appendix B for possible customizations.

Notes

1. To run this program , the following external data files must be defined:

DATA21, DATA22, DATA23

The following rules must be followed to determining their minimum length:

length (DATA21) $\geq 4(12 + 2\ n)$

length (DATA22) $\geq 4(12 + 4\ n)$

where n is the number of observations (x, y) one is entering.
Note that length is defined in bytes.
The first external data file (DATA21) is used to store original data and it is refered in the program as file # 1; the second one (DATA22) is refered as file # 2 and it is used as scratch external data file (to store, for example, the selected transformations).

The third file will contain the calculated y-values for determined x-values. See Appendix A "Installation and Maintenance" for its length and use.

For more details about the handling of these external data files see Appendix A "Installation Maintenance".

2. Using this program, first you are required to select what you are doing: editing or computations.
After this selection, editing and handling of data is made by pressing correct function key, computations by entering correct code by the keyboard (see next pages for documentation).

Function key Template

Looking at the template, you can have a clear idea on editing features this program provides.

INPUT	IMMEDIATE CORRECTION	MODIFY	DELETE	ADD	INTERMED STATISTICS INPUT	PRINT	RETURN

F-1 Input of a new sample data with recording on external data file

F-2 Correction of the last entered observation

F-3 Modify some observations in the stored sample

F-4 Delete observations from the stored sample

F-5 Add new observations to the stored sample

F-6 Input of intermediate statistics, instead of original data

F-7 Printout of the stored observations and intermediate statistics

F-8 Terminate open-ended data entry, modifying, adding and deleting loops or computational loops and return to the main program sequence, or finish program execution.

Unless F-2 these function keys are available at any time during program execution when the prompting message SELECT ROUTINE ON F-KEY is displayed.

The program disables the not defined function keys: if you press them, no action is made.

Operating Procedure

1. Ensure that the disk labelled "Paired Data Analysis" is on drive 1.

2. Enter RUN *SLRS and insert the appropriate template in the holder.

PAIRED DATA ANALYSIS

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*SLRS - SIMPLE LINEAR REGRESSION FOR SINGLE OBSERVATION OF Y RUNNING
```

ENTER JOB #

3. Enter Job #

JOB # entered value

```
ROUTINES AVAILABLE ON F-KEY
---------------------------
 F-1  ORIGINAL DATA INPUT
 F-2  IMMEDIATE CORRECTION
 F-3  DATA MODIFICATION
 F-4  DATA DELETION
 F-5  DATA ADDITION
 F-6  INTERMEDIATE STATISTICS INPUT
 F-7  DATA PRINTOUT
 F-8  RETURN

F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

SELECTING OPTIONS
-----------------
WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
OPTION ENTER 0 TO OBTAIN A PRINTED LIST
OF SUCH CHOICES.
THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

ACTION? 1 (COMPUTATION), 2 (EDIT)?

4. Enter ∅ to have the printout of possible choices;
   enter 1 to select computational features;
   enter 2 to select editing facilities;
   press F-8 (RETURN) to stop program execution.

   Entering ∅ the following message is printed out:

```
AVAILABLE CHOICES
-----------------
 1  COMPUTATION FEATURES
 2  EDITING FEATURES

PRESS F-8 TO STOP PROGRAM EXECUTION
```

   and again the display prompts:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

   Repeat step 4 for appropriate selection.
   Pressing F-8 (RETURN) the message:

END OF *SLRS

   appears and the P6060 prints:

END OF *SLRS

   returning to the COMMAND mode.
   Entering 1 go to step 6.
   Entering 2, the display prompts the message:

SELECT ROUTINE ON F-KEY?

5. Press correct function key to select editing facilities (refer to the next pages for documentation).
   Pressing F-8, the P6060 prompts:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

   Return to step 4 for correct choice.

6. The display prompts the following message:

SELECT OPTION (1-6)?

7. Enter correct code for computations (refer to the next pages for documentation)
   Entering ∅ the following explanation is printed out:

```
AVAILABLE OPTIONS
-----------------
 1  TRANSFORMATION FACILITIES
 2  REGRESSION PARAMETERS CALCULATION
 3  TEST FOR LINEARITY
 4  TEST FOR OUTLIERS
 5  ORTHOGONAL REGRESSION
 6  TESTS FOR CORRELATION COEFFICIENT
```

and again:

SELECT OPTION (1-6)?

Repeat step 7 for correct choice.

Pressing F-8 (RETURN) the display prompts:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

Repeat step 4 for appropriate selection.

TRANSFORMATION FACILITIES — option # 1

1. Enter 1 followed by END OF LINE key

SELECT TRANSFORMATION (1-6)?

2. Enter correct code for transformation.
   Entering ∅ followed by END OF LINE key the following explanation is printed out:

```
TRANSFORMATIONS FACILITIES :
----------------------------
  1  1/X      !
  2  1/Y      ! ALL COMBINATIONS
  3  LOG(X)   ! ARE AVAILABLE
  4  LOG(Y)   !
  5  PRINTOUT OF TRANSFORMED DATA
  6  NO TRANSFORMATIONS

WHEN SELECTION IS COMPLETE PRESS F-8 TO RUN TRANSFORMATIONS
```

In any case again the display asks for transformation selection

SELECT TRANSFORMATION (1-6)?

3. Repeat step 2 to select other possible transformation (16 different combinations are available).

To stop selection and run transformations, press F-8:

TRANSFORMATIONS: selected type of transformation

Transformed values printout if required by entering 5 (printout of transformed data).

SELECT OPTION (1-6)?

4. At this point, transformed values are available for execution.

Important To eliminate the selected transformation (to use again original data) select option # 1 (transformation facilities) and enter transformation # 6 (no transformation): in this way original data are again available on the file DATA22 for calculations.

REGRESSION PARAMETERS CALCULATION	option #2

1. Enter 2 followed by END OF LINE key

COMMON STATISTICS

Regression parameters printout:

- number of observations
- mean of the independent variable x
- standard error of the x variable
- mean of the dependent variable y
- standard deviation of the y variable
- correlation coefficient
- standard error of estimate
- intercept with its standard error
- slope with its standard error
- t statistic

CONFIDENCE INTERVAL OF THE SLOPE

ENTER CONFIDENCE LEVEL?

2. Enter conficence level (positive number less than 100)

Lower and upper limits of the confidence interval of the slope at the selected confidence level printout

ENTER CONFIDENCE LEVEL?

3. Repeat step 2 for new confidence level you desire to test.
Press F-8 to continue execution:

ENTER CONFIDENCE LEVEL?

4. Enter confidence level for the next calculations (confidence and prediction intervals for y, significance test of the slope and significance test for an (x,y) pair).

If no other calculations are desired,press F-8: the P6060 will return you to the SELECT OPTION level.

If correct value is entered to continue execution, the P6060 prints:

CONFIDENCE INTERVAL FOR Y

SELECTED CONFIDENCE LEVEL PRINTOUT and asks:

ENTER X MINIMUM?

5. Enter the starting x-point X_0 for tabulation

ENTER X MAXIMUM?

6. Enter the end x-point X_M for tabulation

ENTER INCREMENT DELTA (x)?

7. Enter step Δx for tabulation

For all $x_i = X_0 + (i - 1)\ \Delta x \leq X_M$ $(i = 1, 2, \ldots, k)$printout of:

- x value and the corresponding y calculated value
- lower and upper limits for confidence interval

RECORDING. ENTER 1 (YES), ∅ (NO)?

8. Enter 1 for recording on external data file DATA23, ∅ if recording is not required.
Entering ∅ go to step 9.

Entering 1, the program records on external data file DATA23 all x values $x_i = X_0 + (i - 1)\,\Delta x \leqslant X_M$ $(i = 1, 2, \ldots, k)$ and their corresponding calculated y values

9. ENTER X MINIMUM?

Repeat step 5 for new tabulation.
Press F-8 to continue program execution:

PREDICTION INTERVAL FOR Y

ENTER X VALUE?

10. Enter x value

Entered x value, corresponding y calculated value and lower and upper limits of prediction interval printout

ENTER X VALUE?

11. Repeat step 10 for a new x value.
Press F-8 to continue program execution:

SIGNIFICANCE TEST OF THE SLOPE

ENTER SLOPE?

12. Enter slope to be tested

Entered value and its significance level printout

ENTER SLOPE?

13. Repeat step 12 to test a new slope.
Press F-8 to continue program execution:

SIGNIFICANCE TEST FOR AN X, Y PAIR

ENTER X VALUE?

14. Enter x value

ENTER Y VALUE?

15. Enter y value

Entered (x,y) pair and its significance level printout

ENTER X VALUE?

16. Return to step 14 for a new (x,y) pair.
Press F-8 to continue program execution:

SELECT OPTION (1-6)?

TEST FOR LINEARITY — option #3

1. Enter 3 followed by END OF LINE key

TEST FOR LINEARITY

TO USE THIS TEST, PAIRS MUST BE ARRANGED IN ORDER OF INCREASING X

ARE PAIRS ARRANGED? 1(YES), ϕ (NO)?

2. Enter 1 if observations are already ordered in increasing numerical x value (execution will be shorter); enter ϕ if not.

Printout of:

- number of pairs
- intercept of the regression line
- slope of the regression line
- theoretical mean of the number of runs
- number of actual runs

- probability that the regression curve is linear

SELECT OPTION (1-6)?

TEST FOR OUTLIERS — option # 4

1. Enter 4 followed by END OF LINE key

TEST FOR OUTLIERS

Printout of:

- number of observations
- regression parameters
- outlier (x,y) and its probability of occurrence $Q(t)$ for all outliers such that $Q(t) < 0.05$ (or any other probability level selected by the user).

SELECT OPTION (1-6)?

ORTHOGONAL REGRESSION — option # 5

1. Enter 5 followed by END OF LINE key

ORTHOGONAL REGRESSION

Printout of:

- number of observations
- mean and standard deviation for both variables
- correlation coefficient
- standard error of estimate

Printout of two regression lines defined by their intercepts (A1 and A2) and their slope (B1 and B2), the first being the line more probable.

SELECT OPTION (1-6)?

TEST FOR CORRELATION COEFFICIENTS	option # 6

1. Enter 6 followed by (END OF LINE) key

   SELECT TEST (1, 2, 3, 4,)?

2. Select test you desire on correlation coefficient.
   Entering ∅ the following list is printed out.

```
AVAILABLE TESTS
---------------
 1  SIGNIFICANCE TEST FOR ZERO CORRELATION
 2  SIGNIFICANCE TEST FOR ANY CORRELATION
 3  COMPARISON OF TWO CORRELATION COEFFICIENTS
 4  CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT
```

   and again the display asks for selection: repeat step 2

   Entering 1 go to step 3

   Entering 2 go to step 4

   Entering 3 go to step 7

   Entering 4 go to step 11.

3. SIGNIFICANCE TEST FOR ZERO CORRELATION

   - Common statistics printout:
     - number of observations
     - mean and standard deviation for both variables
     - standard error of estimate
     - correlation coefficient
   - Significance test for zero correlation coefficient

   SELECT OPTION (1-6)?

4. SIGNIFICANCE TEST FOR ANY CORRELATION

   Common statistics printout (see step 3)

   ENTER CORRELATION COEFFICIENT?

5. Enter correlation coefficient to be tested

Entered correlation coefficient and its significance level printout

ENTER CORRELATION COEFFICIENT?

6. Repeat step 5 for a new calculation.
Press F-8 to stop this option execution:

SELECT OPTION (1-6)?

7. 

COMPARISON OF TWO CORRELATION COEFFICIENTS

Common statistics printout (see step 3)

ENTER SAMPLE SIZE?

8. Enter sample size (number of pairs) of the correlation coefficient to be compared to the actual one.

ENTER CORRELATION COEFFICIENT?

9. Enter correlation coefficient to be compared.

Printout of:

- entered values
- significance level of the difference

ENTER SAMPLE SIZE?

10. Repeat steps 8 and 9 for a new comparison.
Press F-8 to stop comparisons:

SELECT OPTION (1-6)?

11. 

CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT

Common statistics printout (see step 3)

ENTER CONFIDENCE LEVEL?

12. Enter confidence level to be tested (ex: 95 for 95%).

Lower and upper limits printout

ENTER CONFIDENCE LEVEL?

13. Repeat step 12 for a new confidence level

Press F-8 to stop execution:

SELECT OPTION (1-6)?

Error Messages

ERROR-ACTION? 1 (COMPUTATION)? 2 (EDIT)

ERROR-SELECT OPTION (1-6)?

Incorrect code for option or action selection is entered.

Action: enter correct code by keyboard.

ERROR-SELECT ROUTINE ON F-KEY

Function key selection was made incorrectly by entering a number by the keyboard

Action: press correct function key.

F-2 DEFINED ONLY DURING INPUT.

Function key # 2 is pressed at non-input nor add stages.

Action: press correct function key.

ERROR: DATA FOR PROGRAM # i

Stored data are not compatible with this program.

(Call *HELP program for programs numbering).

Action: run compatible program or enter correct data using INPUT routine (F-1).

ERROR-SELECT TRANSFORMATION (1-6)

Incorrect code for transformation is entered.

Action: enter only integer numbers from 1 to 6.

ERROR-SELECT TEST (1, 2, 3, 4)

Incorrect code for tests on correlation coefficient is entered.

Action: enter only integer numbers from 1 to 4.

ERROR-ENTER CONFIDENCE LEVEL

Entered confidence level is incorrect.

Action: enter only positive number less than 100 (ex: 95 for 95% level).

ERROR - $|R| < 1$

The entered correlation coefficient is wrong.

Action: enter only values greater than - 1 and less than + 1.

ERROR-INTEGER POSITIVE ONLY

The entered sample size is incorrect.

Action: enter only integer, positive value.

ERROR-ONLY 1 OR $\emptyset$

Only binary choice is available.

Action: enter 1 for yes, $\emptyset$ for no.

ERROR IN ENTERING PARAMETERS

Entering parameters for tabulation, the minimum x value is greater than or equal to the maximum x value.

Action: enter again x minimum and x maximum (x minimum < x maximum)

ERROR-POSITIVE ONLY

Entering step for tabulation, the entered increment is null or negative.

Action: enter only positive value.

ONLY INTERMEDIATE STATISTICS ARE STORED

Only intermediate statistics were entered: options 1, 3 and 4 cannot be executed.

Action: select compatible options.

Sample Program Run # 1

Data are taken from Ref. # 2, pag. 450

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M24002SS
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*SLRS - SIMPLE LINEAR REGRESSION FOR SINGLE OBSERVATION OF Y RUNNING

JOB # 1

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING OPTIONS
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                    OPTION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH CHOICES.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

F-1 DATA INPUT
****

PAIR	X	Y
1	6	.029
2	7	.052
3	8	.079
4	9	.125
5	10	.181
6	11	.261
7	12	.425
8	13	.738
9	14	1.13
10	15	1.882
11	16	2.812

TEST FOR LINEARITY
****

TO USE THIS TEST , PAIRS MUST BE ARRANGED IN ORDER OF INCREASING X

NUMBER OF DATA PAIRS = 11
A = -1.8845273
B = .23507273
M(R) = 7
R = 3
Q(U) = 3.0849497E-03

TEST FOR OUTLIERS
****

NUMBER OF DATA PAIRS = 11
REGRESSION PARAMETERS :
A = -1.8845273
B = .23507273
OUTLIER 1
X 11 = 16
Y 11 = 2.812
Q(T) = .0804637

TRANSFORMATIONS FACILITIES :

1	1/X	!
2	1/Y	! ALL COMBINATIONS
3	LOG(X)	! ARE AVAILABLE
4	LOG(Y)	!
5	PRINTOUT OF TRANSFORMED DATA	
6	NO TRANSFORMATIONS	

WHEN SELECTION IS COMPLETE PRESS F-8 TO RUN TRANSFORMATIONS

TRANSFORMATIONS : LOG(Y) = A + B*X

X	Y
6	-3.5404594
7	-2.9565116
8	-2.5383074
9	-2.0794415
10	-1.7092582
11	-1.3432349
12	-.85566611
13	-.30381145
14	.12221763
15	.63233504
16	1.0338960

TEST FOR LINEARITY
****

TO USE THIS TEST , PAIRS MUST BE ARRANGED IN ORDER OF INCREASING X

NUMBER OF DATA PAIRS = 11

A	=	-6.1921084
B	=	.45103265
M(R)	=	7
R	=	6
Q(U)	=	.34781347

TEST FOR OUTLIERS

NUMBER OF DATA PAIRS = 11
REGRESSION PARAMETERS :
A = -6.1921084
B = .45103265
OUTLIER 1
X 6 = 11
Y 6 = -1.3432349
Q(T) = .671992

COMMON STATISTICS

NUMBER OF DATA PAIRS	= 11
MEAN OF THE INDEPENDENT VARIABLE (X)	= 11
STANDARD DEVIATION OF THE INDEPENDENT VARIABLE	= 3.3166248
MEAN OF THE DEPENDENT VARIABLE (Y)	=-1.2307493
STANDARD DEVIATION OF THE DEPENDENT VARIABLE	= 1.4971556
CORRELATION COEFFICIENT	= .99916538
STANDARD ERROR OF ESTIMATE	= 6.4463516E-02
INTERCEPT OF THE REGRESSION LINE (A)	=-6.1921084
STANDARD ERROR OF A	= 7.0348250E-02
SLOPE OF THE REGRESSION LINE (B)	= .45103265
STANDARD ERROR OF THE SLOPE	= 6.1463551E-03
T VALUE	= 73.382133

CONFIDENCE INTERVAL OF THE SLOPE

CONFIDENCE LEVEL = 99 %
BL = .43105356
BH = .47101173

CONFIDENCE LEVEL = 98 %
BL = .43368673
BH = .46837857

CONFIDENCE LEVEL = 95 %
BL = .43712484
BH = .46494045

ORTHOGONAL REGRESSION
****

NUMBER OF DATA PAIRS	= 11
MEAN OF X VARIABLE	= 11
STANDARD DEVIATION OF X VARIABLE	= 3.3166248
MEAN OF Y VARIABLE	=-1.2307493
STANDARD DEVIATION OF Y VARIABLE	= 1.4971556
CORRELATION COEFFICIENT	= .99916538
STANDARD ERROR OD ESTIMATE	= 6.4463516E-02

INTERCEPT	(A1)	=-6.1935104
SLOPE	(B1)	= .45116010

INTERCEPT	(A2)	= 23.150839
SLOPE	(B2)	=-2.2165080

END OF *SLRS

Sample Program Run # 2

Data are taken from ref. # 2 pag. 150

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M24002SS
Release 1 - Level 0    September 1976
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```

```
*SLRS - SIMPLE LINEAR REGRESSION FOR SINGLE OBSERVATION OF Y RUNNING

JOB # 2

                ROUTINES AVAILABLE ON F-KEY
                ---------------------------
                 F-1  ORIGINAL DATA INPUT
                 F-2  IMMEDIATE CORRECTION
                 F-3  DATA MODIFICATION
                 F-4  DATA DELETION
                 F-5  DATA ADDITION
                 F-6  INTERMEDIATE STATISTICS INPUT
                 F-7  DATA PRINTOUT
                 F-8  RETURN

                F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                SELECTING OPTIONS
                -----------------
                WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                OPTION ENTER 0 TO OBTAIN A PRINTED LIST
                OF SUCH CHOICES.
                THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

F-1 DATA INPUT

****

PAIR	X.	Y
1	10	70.9
2	8.9	74
3	8.9	58.6
4	9.2	80.6
5	7.8	69.4
6	10.1	76
7	9	66.4
8	8.2	50.9
9	9.5	61.9
10	10.8	65.2
11	11.1	77.2
12	11.2	89.6
13	12.5	74.2
14	12.3	83.1
15	10	66.7
16	10.2	77.2
17	11.2	838
IMMEDIATE CORRECTION		
17	11.2	83.8
18	11.2	67.9
19	10	88.9
20	10.7	69
21	10.3	69.8
22	12.9	86
23	11.8	79.9
24	14.9	88.2

COMMON STATISTICS

****

NUMBER OF DATA PAIRS	= 24
MEAN OF THE INDEPENDENT VARIABLE (X)	= 10.529167
STANDARD DEVIATION OF THE INDEPENDENT VARIABLE	= 1.6106923
MEAN OF THE DEPENDENT VARIABLE (Y)	= 73.975
STANDARD DEVIATION OF THE DEPENDENT VARIABLE	= 10.019600
CORRELATION COEFFICIENT	= .61822888
STANDARD ERROR OF ESTIMATE	= 8.0523842
INTERCEPT OF THE REGRESSION LINE (A)	= 33.481893
STANDARD ERROR OF A	= 11.098338
SLOPE OF THE REGRESSION LINE (B)	= 3.8458036
STANDARD ERROR OF THE SLOPE	= 1.0424326
T VALUE	= 3.6892588

CONFIDENCE INTERVAL OF THE SLOPE

CONFIDENCE LEVEL = 99 %
BL = .90690154
BH = 6.7847057

CONFIDENCE LEVEL = 95 %
BL = 1.6834119
BH = 6.0081954

CONFIDENCE INTERVAL FOR Y

CONFIDENCE LEVEL = 95 %

CONFIDENCE INTERVAL

XL = 7
XH = 15
DELTA (X) = 2

X	Y	YL	YH
7	60.402518	52.044028	68.761008
9	68.094125	63.344446	72.843805
11	75.785733	72.227355	79.344110
13	83.477340	77.139189	89.815490
15	91.168947	80.917617	101.42028

PREDICTION INTERVAL FOR Y

X = 10
Y = 71.939929
LOWER LIMIT = 54.853499
UPPER LIMIT = 89.026359

X = 15
Y = 91.168947
LOWER LIMIT = 71.570451
UPPER LIMIT = 110.76744

SIGNIFICANCE TEST OF THE SLOPE
****

```
SLOPE     =        3
Q(T,N-2)  =        .42580402

SLOPE     =        4
Q(T,N-2)  =        .88374462

SLOPE     =        5
Q(T,N-2)  =        .28011857
```

SIGNIFICANCE TEST OF AN X,Y PAIR
****

```
X         =    12
Y         =    75
Q(T,N-2)  =   0.0513

X         =    12
Y         =    100
Q(T,N-2)  =  -0.0000
```

AVAILABLE TESTS
---

1 SIGNIFICANCE TEST FOR ZERO CORRELATION
2 SIGNIFICANCE TEST FOR ANY CORRELATION
3 COMPARISON OF TWO CORRELATION COEFFICIENTS
4 CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT

CONFIDENCE INTERVAL FOR A CORRELATION COEFFICIENT
****

NUMBER OF DATA PAIRS	= 24
MEAN OF THE INDEPENDENT VARIABLE (X)	= 10.529167
STANDARD DEVIATION OF THE INDEPENDENT VARIABLE	= 1.6106923
MEAN OF THE DEPENDENT VARIABLE (Y)	= 73.975
STANDARD DEVIATION OF THE DEPENDENT VARIABLE	= 10.819600
STANDARD ERROR OF ESTIMATE	= 8.0523752
CORRELATION COEFFICIENT	= .61823

CONFIDENCE LEVEL = 95 %
RL = .28612601
RH = .81773029

CONFIDENCE LEVEL = 99 %
RL = .15860381
RH = .85763054

END OF *SLRS

INPUT

F-1

Purpose

This routine provides the possibility to enter a new sample by the keyboard, storing data on external data file.
Data handled are pairs of variables (x_i, y_i) $i = 1,\ldots, n$

Method

Intermediate statistics are computed:

$$\sum_{i=1}^{n} x_i$$

$$\sum_{i=1}^{n} y_i$$

$$\sum_{i=1}^{n} x_i^2$$

$$\sum_{i=1}^{n} y_i^2$$

$$\sum_{i=1}^{n} x_i y_i$$

where:

n is the number of observations (x_i, y_i)

Entering a new sample data by the keyboard, the last one is lost, but one can form permanent data archives. For more details, see Appendix A "Installation and Maintenance".

Operating Procedure

1. Press F-1

F-1 DATA INPUT

For i = 1, the display asks:

ENTER X(i), Y(i)?

2. Enter the first pair (x,y)

Order i and entered values printout

For i = i + 1 the display asks:

ENTER X(i), Y(i)?

3. Repeat step 2 for all pair (x_i, y_i)
   To stop input routine, press F-8:

Intermediate statistics are stored on external data file

SELECT ROUTINE ON F-KEY?

Error Messages

END OF FILE DATA21, LAST OBSERVATION NOT RECORDED.
The external data file is full: last entered observation is not recorded.
Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance")and continue to enter data using ADD capability (F-key # 5)

Sample Routine Run

F-1 DATA INPUT
****

PAIR	X	Y
1	6	.029
2	7	.059
3	8	.79
IMMEDIATE CORRECTION		
3	8	.079
4	9	.125
5	10	1.181
6	11	1.261
7	12	.425
8	13	.738
9	14	1.13
10	15	1.882
11	16	2.812

IMMEDIATE CORRECTION

F-2

Purpose

This routine, available only at the input and adding stages, provides the correction of the last entered observation.

Operating Procedure

1. If k values are already entered, the display asks for the next observation:

ENTER X(k+1), Y(k+1)?

2. Press F-2 to correct the k-th observation.
The display asks again for the k-th entry:

ENTER X(k), Y(k)?

3. Enter the correct (x,y) values following the procedures described for INPUT routine (F-key # 1) and continue entering or adding data.

Sample Routine Run

See INPUT (F-1) and ADD (F-5) routines.

MODIFY

F-3

Purpose This routine provides the possibility of modifying data stored on external data file.

Method Each observation is identified by a sequential index number.

Operating Procedure

1. Press F-3

   F-3 DATA MODIFICATION

   ENTER ROW OF X, Y TO MODIFY?

2. Enter index-number of observation to be modified.

   Old pair printout

   ENTER NEW PAIR?

3. Enter correct (x,y) values (separated by a comma).

   Correct values printout

   ENTER ROW OF X, Y TO MODIFY?

4. Repeat steps 2 and 3 for new corrections.
   Press F-8 to stop modifications:

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = n
The entered index-number of the observation to be modified is wrong.
Action: enter only integer, positive number less than or equal to the number of stored observations.

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to modify data because only intermediate statistics were entered.

Sample

Routine Run

```
                    F-3  DATA MODIFICATION
                    **********************

OLD PAIR X= 10 Y= 1.181
NEW PAIR X= 10 Y= .181

OLD PAIR X= 11 Y= 1.261
NEW PAIR X= 11 Y= .261
```

DELETE

F-4

Purpose

This routine gives the possibility of deleting some observations from external data file.

Operating Procedure

1. Press F-4

   F-4 DATA DELETION

   ENTER ROW OF X, Y TO DELETE?

2. Enter index-number of observation to be deleted .

   Pair printout

   DELETE? ENTER 1 (YES), ∅ (NO)?

3. Enter 1 if this is the observation to be deleted, ∅ if not.
   If 1 is entered the program prints the message:

   ...DELETED...

   In any case, the display asks for a new observation:

   ENTER ROW OF X, Y TO DELETE?

4. Repeat steps 2 and 3 as many time as necessary.
   Press F-8 to stop this routine:

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR INT POSITIVE<=n
The entered index-number of the observation to be deleted is wrong.
Action: enter only integer, positive number less than or equal to the number of stored observations.

ERROR-ONLY 1 OR ∅
Only binary choice is available.
Action: enter 1 for deletion; ∅ if not

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistic were entered.

Sample

Routine Run

```
                    F-4  DATA DELETION
                    ******************

PAIR TO DELETE : ORDER= 6        X= 11 Y= .261
PAIR TO DELETE : ORDER= 11       X= 16 Y= 2.812
---DELETED---
PAIR TO DELETE : ORDER= 10       X= 15 Y= 1.882
---DELETED---
```

ADD

F-5

Purpose

This routine provides the possibility of adding observations to those already stored, without loose them.

Operating Procedure

1. Press F-5

F-5 DATA ADDITION

2. If there are n stored observations, the display requests the next one:

ENTER X(n+1), Y(n+1)?

3. Enter data following the same operating procedure for INPUT routine (F-1)

Error Messages

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered.

END OF DATA21, LAST OBSERVATION NOT RECORDED
The external data file is full: last entered observation is not recorded. Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A Installation and Maintenance) and continue to enter data using ADD capability (F-Key # 5).

Sample Routine Run

```
                F-5  DATA ADDITION
                ******************

PAIR            X               Y

10              15              1.882
11              16              2.812
```

INTERMEDIATE STATISTICS INPUT

F-6

Purpose

This routine provides the possibility for entering directly intermediate statistics instead of the original data.

See "Method" section for INPUT routine (F-1) for description of intermediate statistics.

Operating Procedure

1. Press F-6

   F-6 INTERMEDIATE STATISTICS INPUT

   ENTER # OF PAIRS?

2. Enter number of observations

   Entered value printout

   ENTER X SUM?

3. Enter $\sum_{i=1}^{n} x_i$

   Entered value printout

   ENTER Y SUM?

4. Enter $\sum_{i} y_i$

   Entered value printout

   ENTER X * X SUM?

5. Enter $\sum_{i} x_i^2$

   Entered value printout

   ENTER Y * Y SUM?

6. Enter $\sum_{i} y_i^2$

   Entered value printout

ENTER X * Y SUM?

7. Enter $\sum_i x_i\ y_i$

Entered value printout

CORRECTION? ENTER 1 (YES), ϕ (NO)

8. Enter 1 if you need corrections :the P6060 return you to step 2.
Enter ϕ if corrections are not required:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-ONLY 1 OR ϕ

Only binary choice is available.

Action: enter 1 for yes, ϕ for no.

ERROR-INTEGER POSITIVE ONLY

Entering number of observations, an error is made .

Action: enter only integer and positive number.

ERROR-POSITIVE ONLY

Entered value Σx_i^2 or Σy_i^2 is incorrect.

Action: enter only positive number.

Sample Routine Run

```
                F-6  INTERMEDIATE STATISTICS INPUT
                **********************************

NUMBER OF PAIRS = 11
X SUM    =          121
Y SUM    =          7.721
X*X SUM  =          1441
Y*Y SUM  =          13.578499
X*Y SUM  =          118.761
```

PRINT

F-7

Purpose This routine provides the possibility of printing original data or transformed data (if some transformations were selected) with their intermediate statistics.

Method External data files DATA21 containing original data or DATA22 containing transformed data if some transformations were made or containing intermediate statistics if no transformations were selected, can be printed out.

Operating Procedure

1. Press F-7

   ENTER FILE DESIGNATOR (1, 2)?

2. Enter 1 to printout DATA21, enter 2 to printout DATA22

   Selected filename and its contents printout

   SELECT ROUTINE ON F-KEY?

Error Messages ERROR-ONLY 1 (DATA21); 2(DATA22)
Incorrect choice for file designator.
Action: enter 1 for external data file DATA21; enter 2 for external file DATA22.

Sample Routine Run

```
                CONTENTS OF FILE DATA21 (ORIGINAL DATA)
                ***************************************

PAIRS NUMBER      11
X SUM             121
Y SUM             7.721
X*X SUM           1441
Y*Y SUM           13.578499
X*Y SUM           110.761

 PAIR             X              Y

 1                5              .029
 2                7              .059
 3                8              .079
 4                9              .125
 5                10             .181
 6                11             .261
 7                12             .425
 8                13             .738
 9                14             1.13
 10               15             1.882
 11               16             2.812
```

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M. Abramovitz and Stegun, N.B.S. (National Bureau of Standard), Applied Mathematic Series, 55, 1968.

*SLRM

SIMPLE LINEAR REGRESSION WITH MULTIPLE OBSERVATIONS FOR THE DEPENDENT VARIABLE

Purpose

This program calculates simple linear regression in the case there are several y values (dependent variable) with each x value (independent variable).

Regression parameters are provided with their standard errors, t - statistic, standard error of estimate and correlation coefficient.
Confidence intervals for y, significant test for the slope, confidence and prediction interval for y, significant test for a pair (x,y), test for linearity, significance test and confidence interval for correlation coefficient are provided with the standard feature for storing tabulation (x and y calculated values) on external data file.
Two variable transformations, logarithm and reciprocal are provided with all their combinations: so it is possible to test 16 different regression lines.

Method

First, it is necessary to store the data (original data or intermediate statistics) on external data file. Because the dependent variable y is measured for certain values of x that have been selected by the experimenter, one can have several y measurements for each x value: experimental data are composed of data sets x_i, y_{i1}, y_{i2},..., y_{in_i} $(i = 1,2,...n)$.

Least square method is used to solve the regression line problem.
For detailed description of the algorithms see "Statistical Analysis series - Paired data Analysis- Technical Supplement "
Limitations depend only on the defined external data file size for entering data.

Notes

1. To run this program, the following external data files must be defined:

   DATA21, DATA22, DATA23.

   The following rules must be followed for determining their minimum length:

   length (DATA21) $\geq 4\ (16 + (m + 2)n\ )$;

   where:
   m = average number of y values for each x value;
   n = number of data groups x_i, y_{i1},...y_{in_i} $(i = 1, 2, ..., n)$, being n_i the number of y values for the i-th x-value;

   length (DATA22) $\geq$ 68 bytes (fixed length)

3973440 B

Note that length is defined in bytes.
The first external data file (DATA21) is used to store original data and it is refered in the program as file # 1; the second one (DATA22) is refered as file # 2 and it is used as scratch external data file.
The third file (DATA23) will contain the calculated y values for predetermined x values. See Appendix A "Installation and Maintenance" for its length and use.

For more details about the handling of these external data files, see Appendix A "Installation and Maintenance".

2. Using this program, first you are required to select what you are doing: editing or computations.
After this selection, editing and handling of data is made by pressing correct function key; computations by entering correct code by the key-board (see next pages for documentation).

3. Data for tests on correlation coefficient (option # 4) can be entered by rows (first entering y_j followed by the corresponding x_{ij} values) or by columns (first entering x_j followed by the corresponding y_{ij} values). Furthermore, since the correlation coefficient is independent of the dimensions of x and y, either one or both the variables may be coded: in this case mean and standard deviation of the coded variable have not any significance.

Function Key Template

Looking at the template, you can have a clear idea on editing features this program provides.

INPUT	IMMEDIATE CORRECTION	MODIFY	DELETE	ADD	INTERMED STATISTICS INPUT	PRINT	RETURN

F-1 Input of a new sample data with recording on external data file

F-2 Correction of the last entered observation

F-3 Modify some observations in the stored sample

F-4 Delete observations from the stored sample

F-5 Add new observations to the stored sample

F-6 Input of intermediate statistics, instead of original data

F-7 Printout of the stored observations and intermediate statistics

F-8 Terminate open-ended data entry, modifying, adding and deleting loops

or computational loops and return to the main program sequence, or finish program execution.

Unless F-2 these function keys are available at any time during program execution when the prompting message SELECT ROUTINE ON F-KEY is displayed.

The program disables the not defined function keys;if you press them, no action is made.

Operating Procedure

1. Ensure that the disk labelled "Paired Data Analysis" is on drive 1.
2. Enter RUN *SLRM and insert the appropriate template in the holder.

PAIRED DATA ANALYSIS

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400ZSS
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*SLRM  SIMPLE LINEAR REGRESSION FOR MULTIPLE OBSERVAT. OF Y RUNNING
```

ENTER JOB #

3. Enter job #

JOB # entered value

```
ROUTINES AVAILABLE ON F-KEY
---------------------------
 F-1  ORIGINAL DATA INPUT
 F-2  IMMEDIATE CORRECTION
 F-3  DATA MODIFICATION
 F-4  DATA DELETION
 F-5  DATA ADDITION
 F-6  INTERMEDIATE STATISTICS INPUT
 F-7  DATA PRINTOUT
 F-8  RETURN

F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

SELECTING OPTIONS
-----------------
WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
OPTION ENTER 0 TO OBTAIN A PRINTED LIST
OF SUCH CHOICES.
THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

ACTION? 1 (COMPUTATION) 2 (EDIT)?

4. Enter ∅ to have the printout of possible choices;
   enter 1 to select computational features;
   enter 2 to select editing facilities;
   press F-8 (RETURN) to stop program execution.

   Entering ∅ the following message is printed out:

```
AVAILABLE CHOICES
-----------------
 1  COMPUTATION FEATURES
 2  EDITING FEATURES

PRESS F-8 TO STOP PROGRAM EXECUTION
```

and again the display prompts:

ACTION? 1(COMPUTATION), 2 (EDIT)?

Repeat step 4 for appropriate selection.

Pressing F-8 (RETURN) the message:

END-OF *SLRM

appears and the P6060 prints:

END OF *SLRM

returning to the COMMAND mode.

Entering 1 go to step 6

Entering 2 the display prompts the message:

SELECT ROUTINE ON F-KEY?

5. Press correct function key to select editing facilities (refer to the next pages for documentation).
   Pressing F-8, the display prompts:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

Return to step 4 for correct choice.

6. The display prompts the following message:

SELECT OPTION (1-4)?

7. Enter correct code for computations (refer to the next pages for documentation).

Entering ∅ the following explanation is printed out:

```
AVAILABLE OPTIONS
-----------------
 1  TRANSFORMATION FACILITIES
 2  REGRESSION PARAMETERS CALCULATION
 3  TEST FOR LINEARITY
 4  TESTS FOR CORRELATION COEFFICIENT
```

and again:

SELECT OPTION (1-4)?

Repeat step 7 for correct choice.

Pressing F-8 (return) the display prompts:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

Repeat step 4 for appropriate selection.

TRANSFORMATION FACILITIES — option # 1

1. Enter 1 followed by END OF LINE key

SELECT TRANSFORMATION (1-6)?

2. Enter correct code for transformation.

Entering ∅ followed by END OF LINE key the following explanation is printed out:

```
TRANSFORMATIONS FACILITIES
--------------------------
 1  1/X      |
 2  1/Y      | ALL COMBINATIONS
 3  LOG(X)   | ARE AVAILABLE
 4  LOG(Y)   |
 5  PRINTOUT OF TRANSFORMED DATA
 6  NO TRANSFORMATIONS
```

WHEN SELECTION IS COMPLETE PRESS F-8 TO RUN TRANSFORMATIONS

In any case again the display asks for transformation selection:

SELECT TRANSFORMATION (1-6)?

3. Repeat step 2 to select other possible transformation (16 different combinations are available).

To stop selection and run transformations, press F-8:

TRANSFORMATIONS: selected type of transformation.
Transformed values printout if required by the user entering 5 (printout of transformed data).

SELECT OPTION (1-4)?

4. At this point, transformed values are available for execution.

Important — To eliminate the selected transformation (to use original data again) select option # 1 (transformation facilities) and enter transformation # 6 (no transformation): in this way original data are again available on the file DATA22 for calculations.

REGRESSION PARAMETERS CALCULATION — option # 2

1. Enter 2 followed by END OF LINE key

COMMON STATISTICS

Regression parameters printout:

- number of data groups (observations)
- number of y entries
- mean of the independent variable x
- mean of the dependent variable y
- standard deviation of y
- correlation coefficient
- standard error of estimate
- intercept of the regression line with standard error
- slope of the regression line with standard error
- t statistic

CONFIDENCE INTERVAL FOR THE SLOPE

ENTER CONFIDENCE LEVEL?

2. Enter confidence level (positive number less than 100)

Lower and upper limits of the confidence interval for the slope at the selected confidence level printout.

ENTER CONFIDENCE LEVEL?

3. Repeat step 2 for new confidence level you desire to test.
To continue execution, press F-8

ENTER CONFIDENCE LEVEL?

4. Enter confidence level for the next calculations (confidence and prediction intervals for y, significance test of the slope and significance test for an (x,y) pair).
If no other calculations are desired, press F-8: the P6060 will return you to the SELECT OPTION level.
If correct value is entered to continue execution, the P6060 prints:

CONFIDENCE INTERVAL FOR Y
Entered confidence level value

and asks:

ENTER X MINIMUM?

5. Enter the starting x-point X_0 for tabulation

ENTER X MAXIMUM?

6. Enter the end x-point X_M for tabulation

ENTER DELTA (x)?

7. Enter step Δx for tabulation

For all $x_i = X_0 + (i-1)\,\Delta x \leq X_M$ $(i = 1, 2, \ldots, k)$ printout of:

- x value and the corresponding y calculated value
- lower and upper limits for confidence interval.

RECORDING? ENTER 1 (YES), ∅ (NO)?

8. Enter 1 for recording on external data file DATA23, ∅ if recording is not required.
Entering ∅ go to step 9.

Entering 1, the program records on external data file DATA23 all x-values $x_i = X_0 + (i - 1)\ \Delta x \leqslant X_M$ $(i = 1, 2, \ldots, k)$ and their corresponding calculated y values

9. ENTER X MINIMUM?

Repeat from step 5 for new tabulation.
Press F-8 to continue program execution:

PREDICTION INTERVAL FOR Y

ENTER X VALUE?

10. Enter x value

Entered x value, corresponding y calculated and lower and upper limits of prediction interval printout

ENTER X VALUE?

11. Repeat step 10 for new x-value.
Press F-8 to continue program execution:

SIGNIFICANCE TEST OF THE SLOPE

ENTER SLOPE?

12. Enter slope to be tested

Entered value and its significance level printout

ENTER SLOPE?

13. Repeat step 12 to test a new slope.
    Press F-8 to continue program execution:

    SIGNIFICANCE TEST FOR AN X,Y PAIR

    ENTER X VALUE?

14. Enter x value

    ENTER Y VALUE?

15. Enter y value

    Entered (x,y) pair and its significance level printout

    ENTER X VALUE?

16. Return to step 14 for a new (x,y) pair.
    Press F-8 to continue program execution:

    SELECT OPTION (1-4)?

TEST FOR LINEARITY	option # 3

1. Enter 3 followed by END OF LINE key

    TEST FOR LINEARITY:

    - number of data groups
    - number of y entries
    - intercept
    - slope
    - degrees of freedom n_1 and n_2 for F-ratio
    - F-ratio
    - significance level.

    SELECT OPTION (1-4)?

TESTS FOR CORRELATION COEFFICIENT — option # 4

1. Enter 4 followed by END OF LINE key.
   If this is the first time you ask for this option

   DATA BY COLUMNS (1) OR ROWS (2)?

2. Enter 1 if data were entered by columns (x_j followed by y_{ij}); enter 2 if they were entered by rows (y_j followed by corresponding x_{ij} values)

   SELECT TEST (1, 2, 3, 4)?

3. Select the test you desire on correlation coefficient.
   Entering ∅ the following list is printed out:

```
AVAILABLE TESTS
---------------
 1  SIGNIFICANCE TEST FOR ZERO CORRELATION
 2  SIGNIFICANCE TEST FOR ANY CORRELATION
 3  COMPARISON OF TWO CORRELATION COEFFICIENTS
 4  CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT
```

   and again the program asks for selection: repeat step 3.

   Entering 1 go to step 4

   Entering 2 go to step 5

   Entering 3 go to step 8

   Entering 4 go to step 12.

4. SIGNIFICANCE TEST FOR ZERO CORRELATION

   - Common statistics printout:
     - number of data pairs
     - mean of the independent variable x
     - standard deviation of x variable
     - mean of the dependent variable y
     - standard deviation of y variable
     - standard error of estimate if data are by rows or residual x-variance not explained if data are by columns
     - correlation coefficient
   - Significance test for zero correlation coefficient

SELECT OPTION (1-4)?

5. SIGNIFICANCE TEST FOR ANY CORRELATION

Common statistics printout (see step 4)

ENTER CORRELATION COEFFICIENT?

6. Enter correlation coefficient to be tested

Entered correlation coefficient and its significance level printout

ENTER CORRELATION COEFFICIENT?

7. Repeat step 6 for a new calculation
Press F-8 to stop this option execution:

SELECT OPTION (1-4)?

8. COMPARISON OF TWO CORRELATION COEFFICIENTS

Common statistics printout (see step 4)

ENTER SAMPLE SIZE?

9. Enter sample size (number of pairs) of the correlation coefficient to be compared to the actual one

ENTER CORRELATION COEFFICIENT?

10. Enter correlation coefficient to be compared

Printout of:

- entered values
- significance level of the difference

ENTER SAMPLE SIZE?

11. Repeat steps 9 and 10 for new comparison.
Press F-8 to stop comparisons:

SELECT OPTION (1-4)?

12. 

CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT

Common statistics printout (see step 4)

ENTER CONFIDENCE LEVEL?

13. Enter confidence level to be tested (ex: 95 for 95%)

Lower and upper limits printout

ENTER CONFIDENCE LEVEL?

14. Repeat step 13 for new confidence level.
Press F-8 to stop execution:

SELECT OPTION (1-4)?

Error Messages

ERROR-ACTION? 1 (COMPUTATION), 2 (EDIT)

ERROR-SELECT OPTION (1-4)
Incorrect code for option or action selection is entered.
Action: enter correct code by the keyboard.

ERROR-SELECT ROUTINE ON F-KEY
Function key selection was made incorrectly by entering a number by the keyboard.
Action: press correct function key

F-2 DEFINED ONLY DURING INPUT
Function key # 2 is pressed at non-input nor add stages.
Action: press correct function key or enter correct code for option selection.

ERROR: DATA FOR PROGRAM # i
Stored data are not compatible with this program.
(Call *HELP program for programs numbering)
Action: run compatible program, or enter correct data using INPUT routine (F-1).

ERROR-SELECT TRANSFORMATION (1-6)
Incorrect code for transformation is entered.
Action: enter only integer numbers from 1 to 6.

ERROR-SELECT TEST (1, 2, 3, 4)

Incorrect code for tests on correlation coefficient is entered.

Action: enter only integer numbers from 1 to 4.

ERROR-ENTER CONFIDENCE LEVEL

Entered confidence level is incorrect .

Action: enter only positive number less than 100 (ex: 95 for 95% level).

ERROR IN ENTERING PARAMETERS

Entering parameters for tabulation, the minimum x value is greater than or equal to the maximum x value .

Action: enter again x minimum and x maximum (x minimum < x maximum).

ERROR POSITIVE ONLY

Entering step for tabulation, the entered increment is null or negative.

Action: enter only positive value .

ERROR-INTEGER POSITIVE ONLY

The entered sample size is incorrect.

Action: enter integer, positive value.

ERROR $|R| < 1$

The entered correlation coefficient is incorrect.

Action: only values greater than -1 and less than + 1 must be entered.

ERROR-ONLY 1 OR $\emptyset$

Only binary choice is available.

Action: enter 1 for yes, $\emptyset$ for no

Sample Program Run

Data are taken from Ref. # 2, pag. 541

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*SLRM  SIMPLE LINEAR REGRESSION FOR MULTIPLE OBSERVAT. OF Y RUNNING
```

```
                ROUTINES AVAILABLE ON F-KEY
                ---------------------------
                 F-1  ORIGINAL DATA INPUT
                 F-2  IMMEDIATE CORRECTION
                 F-3  DATA MODIFICATION
                 F-4  DATA DELETION
                 F-5  DATA ADDITION
                 F-6  INTERMEDIATE STATISTICS INPUT
                 F-7  DATA PRINTOUT
                 F-8  RETURN

                F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                SELECTING OPTIONS
                -----------------
                WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                OPTION ENTER 0 TO OBTAIN A PRINTED LIST
                OF SUCH CHOICES.
                THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

```
                F-1  DATA GROUPS INPUT
                **********************

X( 1 ) =        1                 Y  =            13              13.3
 11.8
X( 2 ) =        2                 Y  =          21.9              24.5
 24.7
X( 3 ) =        3                 Y  =          29.8              28
 24.1             24.2             26.2
X( 4 ) =        7                 Y  =          32.4              30.4
 34.5             33.1             35.7
X( 5 ) =        28                Y  =          41.8              42.6
 40.3             35.7             37.3
```

AVAILABLE OPTIONS
---

1 TRANSFORMATION FACILITIES
2 REGRESSION PARAMETERS CALCULATION
3 TEST FOR LINEARITY
4 TESTS FOR CORRELATION COEFFICIENT

TEST FOR LINEARITY
****

NUMBER OF DATA GROUPS	= 5
NUMBER OF Y ENTRIES	= 21
INTERCEPT OF THE REGRESSION LINE (A)	= 22.587086
SLOPE OF THE REGRESSION LINE (B)	= .65814673
DEGREES OF FREEDOM (N1)	= 3
DEGREES OF FREEDOM (N2)	= 16
F-RATIO VALUE	= 35.545222
PROBABILITY OF OCCURRENCE OF F	= 0.0000

TRANSFORMATIONS FACILITIES
---

1 1/X
2 1/Y
3 LOG(X)
4 LOG(Y)
} ALL COMBINATIONS ARE AVAILABLE

5 PRINTOUT OF TRANSFORMED DATA
6 NO TRANSFORMATIONS

WHEN SELECTION IS COMPLETE PRESS F-8 TO RUN TRANSFORMATIONS

TRANSFORMATIONS : Y =A+B*LOG(X)

TEST FOR LINEARITY
****

NUMBER OF DATA GROUPS	= 5
NUMBER OF Y ENTRIES	= 21
INTERCEPT OF THE REGRESSION LINE (A)	= 16.982520
SLOPE OF THE REGRESSION LINE (B)	= 7.3216889
DEGREES OF FREEDOM (N1)	= 3
DEGREES OF FREEDOM (N2)	= 16
F-RATIO VALUE	= 7.1928497
PROBABILITY OF OCCURRENCE OF F	= 0.0029

TRANSFORMATIONS : LOG(Y) = A + B/X

TEST FOR LINEARITY
****

NUMBER OF DATA GROUPS	= 5
NUMBER OF Y ENTRIES	= 21
INTERCEPT OF THE REGRESSION LINE (A)	= 3.6878185
SLOPE OF THE REGRESSION LINE (B)	=-1.1455284
DEGREES OF FREEDOM (N1)	= 3
DEGREES OF FREEDOM (N2)	= 16
F-RATIO VALUE	= 1.1606567
PROBABILITY OF OCCURRENCE OF F	= 0.3560

COMMON STATISTICS

NUMBER OF DATA GROUPS	= 5
NUMBER OF Y ENTRIES	= 21
AVERAGE OF THE INDEPENDENT VARIABLE (X)	= .33616780
MEAN OF THE DEPENDENT VARIABLE (Y)	= 3.3027287
STANDARD DEVIATION OF THE DEPENDENT VARIABLE	= .36724578
CORRELATION COEFFICIENT	=-.98033629
STANDARD ERROR OF ESTIMATE	= 7.5571024E-02
INTERCEPT OF THE REGRESSION LINE (A)	= 3.6878185
STANDARD ERROR OF THE INTERCEPT	= 2.4252776E-02
SLOPE OF THE REGRESSION LINE (B)	=-1.1455284
STANDARD ERROR OF THE SLOPE	= 5.2900067E-02
T VALUE	=-21.654574

CONFIDENCE INTERVAL OF THE SLOPE

CONFIDENCE LEVEL = 99 %
BL = -1.2969004
BH = -.99415636

CONFIDENCE LEVEL = 95 %
BL = -1.2562765
BH = -1.0347803

CONFIDENCE INTERVAL FOR Y

CONFIDENCE LEVEL = 95 %

CONFIDENCE INTERVAL PLOT

MINIMUM = 0
MAXIMUM = 1
DELTA(X) = .2

X	Y	YL	YH
0	3.6878185	3.6370445	3.7385925
.2	3.4587128	3.4210386	3.4963870
.4	3.2296071	3.1943664	3.2648478
.6	3.0005014	2.9552723	3.0457306
.8	2.7713958	2.7095035	2.8332881
1	2.5422901	2.4610691	2.6235111

PREDICTION INTERVAL FOR Y
****

X	=	.25
Y	=	3.4014364
LOWER LIMIT	=	3.2392219
UPPER LIMIT	=	3.5636509
X	=	.5
Y	=	3.1150543
LOWER LIMIT	=	2.9521074
UPPER LIMIT	=	3.2780012
X	=	.75
Y	=	2.8286722
LOWER LIMIT	=	2.6603779
UPPER LIMIT	=	2.9969665

SIGNIFICANCE TEST OF THE SLOPE
****

SLOPE	=	0
Q(T,N-2)	=	-0.0000
SLOPE	=	-1
Q(T,N-2)	=	0.0127
SLOPE	=	-1.2
Q(T,N-2)	=	0.3161
SLOPE	=	-1.3
Q(T,N-2)	=	0.0088
SLOPE	=	-1.455
Q(T,N-2)	=	0.0000

SIGNIFICANCE TEST OF AN X,Y PAIR
****

X	=	0
Y	=	3.5
Q(T,N-2)	=	0.0000
X	=	0
Y	=	3.6
Q(T,N-2)	=	0.0018
X	=	0
Y	=	3.7
Q(T,N-2)	=	0.6212
X	=	0
Y	=	3.8
Q(T,N-2)	=	0.0002

CONFIDENCE INTERVAL FOR CORRELATION COEFFICIENT
****

NUMBER OF DATA PAIRS	=	21
MEAN OF THE INDEPENDENT VARIABLE (X)	=	.33616780
STANDARD DEVIATION ON X	=	.31943617
MEAN OF THE DEPENDENT VARIABLE (Y)	=	3.3027287
STANDARD DEVIATION ON Y	=	.37326294
STANDARD ERROR OF ESTIMATE	=	7.5571024E-02
CORRELATION COEFFICIENT	=	-.98033629

CONFIDENCE LEVEL = 95 %	
RL	=-.99214945
RH	=-.95118278
CONFIDENCE LEVEL = 99 %	
RL	=-.99412173
RH	=-.93527127

COMPARISON OF TWO CORRELATION COEFFICIENTS
****

```
NUMBER OF DATA PAIRS                          =  21
MEAN OF THE INDEPENDENT VARIABLE (X) =  .33616780
STANDARD DEVIATION ON X                       =  .31943617
MEAN OF THE DEPENDENT VARIABLE (Y)    =  3.3027287
STANDARD DEVIATION ON Y                       =  .37326294
STANDARD ERROR OF ESTIMATE                    =  7.5571024E-02
CORRELATION COEFFICIENT                       = -.98033629

2-ND SAMPLE SIZE          =  25
2-ND SAMPLE CORREL COEFF = -.95
Q(U) =              0.1355722

2-ND SAMPLE SIZE          =  21
2-ND SAMPLE CORREL COEFF = -.98034
Q(U) =              0.9997717
```

END OF *SLRM

F-1

Purpose

This routine provides the possibility to enter a new sample by the keyboard, storing data on external data file.
Data handled are grouped data, i.e. for each x_i value ($i = 1, 2, \ldots, n$) there are n_i corresponding y values, so the data group has the form:

$$x_i, y_{i1}, y_{i2}, \ldots, y_{in_i} \quad (i = 1, 2, \ldots, n)$$

where: n_i is not constant.

Method

Intermediate statistics are calculated:

$$\sum_{i=1}^{n} n_i x_i$$

$$\sum_{i=1}^{n} n_i \bar{y}_i \quad \text{where } \bar{y}_i = \left(\sum_{j=1}^{n_i} y_{ij}\right) / n_i$$

$$\sum_{i=1}^{n} n_i x_i^2$$

$$\sum_{i=1}^{n} n_i \bar{y}_i^2$$

$$\sum_{i=1}^{n} n_i x_i \bar{y}_i$$

$$\sum_{i=1}^{n} \left[n_i \bar{y}_i^2 - \sum_{j=1}^{n_i} y_{ij}^2 \right]$$

Entering a new sample data by the keyboard, the last one is lost, but one can form permanent data archives. For more details, see Appendix A "Installation and Maintenance".

Operating Procedure

1. Press F-1

F-1 DATA GROUPS INPUT

For i = 1, the display asks:

ENTER X (i)?

2. Enter the first x-value
   For j = 1 the display asks:

   ENTER Y (i,j)?

3. Enter the first y value corresponding to the entered x value.
   For j = j + 1 the display asks:

   ENTER Y (i,j)?

4. Repeat step 3 for all y-values corresponding to the i-th x-value.
   To end input for the i-th x-value , press F-8:

   Printout of entered data group

   For i = i + 1 the display asks:

   ENTER X (i)?

5. Repeat steps 2, 3 and 4 for all data groups to be entered.
   To stop input routine, when a new x-value is required, press F-8:

   Intermediate statistics are recorded on external data file

   SELECT ROUTINE ON F-KEY?

Error Messages

END OF DATA21, LAST DATA GROUP NOT RECORDED
The external data file is full: data group that you are entering is not recorded; the program stops execution.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance")and continue to enter data using ADD capability (F-key ≠ 5).

Sample

Routine Run

```
                    F-1  DATA GROUPS INPUT
                    **********************

X( 1 ) =       1                    Y  =              13              13.3
 11.8
X( 2 ) =       3                    Y  =            21.9              24.5
 247
IMMEDIATE CORRECTION

ACTION = 1(ADDITION) 2(MODIFICATION) 3(DELETION).
X( 2 ) =       2                    Y  =            21.9              24.5
 24.7
X( 3 ) =       3                    Y  =            29.8              28.8
 24.1              24.2               26.2
X( 4 ) =       7                    Y  =            32.4              30.4
 34.5              33.1               35.7
X( 5 ) =      28                    Y  =            41.8              42.6
 40.3              35.7               37.3            37.3
```

IMMEDIATE CORRECTION

F-2

Purpose

This routine, available only at the input and adding stages, provides the correction of the:

- last entered data group (observation)
- last entered y-value in the present observation
- just entered x-value in the present observation.

Operating Procedure

1. If a new x-value is required by the program and you need corrections for the last entered data group, press F-2 and go to step 5.
   If the just entered x-value is incorrect when the P6060 requires the first corresponding y-value press F-2 and go to step 3.
   If the last entered j-th y-value for the present i-th group is incorrect, when the P6060 asks:

   ENTER Y(i, j+1)?

   press F-2.
   The P6060 will ask again for the j-th y-value

   ENTER Y(i,j)?

2. Enter correct y_{ij} value and continue to enter data using F-1 (INPUT) or F-5 (ADD) operating procedure.

3. Again the display asks for the i-th x-value:

   ENTER X(i)?

4. Enter correct value and continue to enter data using F-1 (INPUT) or F-5 (ADD) operating procedure.

5. IMMEDIATE CORRECTION
   ACTION = 1 (ADDITION) 2(MODIFICATION) 3(DELETION)

   ENTER ACTION (1, 2, 3)?

6. Enter 1 to add y-values to the last entered observation
   Enter 2 to modify the x-value or some y-values
   Enter 3 to delete some y-values.

   Entering 1 go to step 7.

Entering 2 go to step 9.

Entering 3 go to step 12.

7.  ENTER VALUE?

8. Enter y-value to be added

 ENTER ACTION (1, 2, 3)?

go to step 14.

9.  ENTER ROW-VALUE?

Enter index-row of value to be corrected (note: x_i is the first row-value, y_{i1} is the second, etc...)

 ENTER VALUE?

11. Enter correct value

 ENTER ACTION (1, 2, 3)?

go to step 14

12.  ENTER ROW-VALUE?

13. Enter index-row of value to be deleted (note: entering 1 the x value is deleted and y_{i1} will become the x_i value)

 ENTER ACTION (1, 2, 3)?

14. Repeat step 6 for new corrections.
Press F-8 to stop correction routine :

 correct data group printout

15. The display asks for the next x-value to be entered for the next data group: continue to enter data using F-1 (input) or F-5 (ADD) operating procedure.

Error Messages	ERROR-ONLY 1, 2, 3. The entered action is illegal: only 1 (addition), 2 (modification), or 3 (deletion) are available. Action: enter only 1, 2 or 3.
	ERROR-INT POSITIVE <= k Non positive or non integer number or greater than k (number of values for the present observation) is entered to identify the value to be corrected or deleted. Action: enter integer, positive number less than or equal to the observation size.
Sample Routine Run	See INPUT (F-1) and ADD (F-5) routines

MODIFY

F-3

Purpose

This routine provides the possibility of modifying data stored on external data file.

Method

Each data group is identified by a sequential index number; as well as each value in each observation.

Note:

only modification of some values is possible: if you need to add new y-values to some observations or to delete some y-values, use DELETE (F-4) capability and ADD (F-5) capability.

Operating Procedure

1. Press F-3

   F-3 DATA GROUPS MODIFICATION
   IF LENGTH OF NEW GROUP IS DIFFERENT THAN OLD'S ONE:
   USE DELETION (F-4) + ADDITION (F-5)

   ENTER # OF GROUP TO MODIFY?

2. Enter index-number of group to be modified

   Group to be modified printout

   ENTER ROW?

3. Enter row-number of value to be modified

   ENTER CORRECT VALUE?

4. Enter correct value

   ENTER ROW?

5. Repeat step 3 for new correction.
   Press F-8 to stop correction for this group:

   Corrected observation printout

   ENTER # OF GROUP TO MODIFY?

6. Repeat from step 2 to correct a new data group.

Press F-8 to end corrections:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE <=n

The entered number of observation to be modified is incorrect.

Action: enter integer positive number less than or equal to the number of stored data groups.

ERROR-INT POSITIVE <= k

The index number of value to be corrected is incorrect.

Action: enter integer positive number less than or equal to the number of values defining the observation you are modifying.

ERROR:ONLY INTERMEDIATE STATISTICS STORED

It is impossible to modify data because only intermediate statistics were entered.

Sample Routine Run

```
                F-3  DATA GROUPS MODIFICATION
                *****************************

IF LENGTH OF NEW GROUP IS DIFFERENT THAN OLD'S ONE :
USE DELETION(F-4)+ADDITION(F-5).

GROUP TO MODIFY :X( 3 )= 3          Y =              29.8            28.8
 24.1             24.2              26.2

NEW GROUP :X( 3 )= 3                Y =              29.8            28
 24.1             24.2              26.2
```

DELETE

F-4

Purpose

This routine gives the possibility of deleting data groups from external data file.

Operating Procedure

1. Press F-4

F-4 DATA GROUPS DELETION

ENTER # OF GROUP TO DELETE?

2. Enter index-number of group to be deleted

Group to be deleted printout

DELETE? ENTER 1 (YES), Ø (NO)?

3. Enter 1 if you want to delete this observation, Ø if not.
If 1 is entered, the program prints the message:

...DELETED...

In any case the display asks for a new data group.

ENTER # OF GROUP TO DELETE?

4. Repeat steps 2 and 3 as many times as necessary.
Press F-8 to stop this routine:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = n
The number of data group to be deleted is incorrect.
Action: enter integer positive number less than or equal to the number of stored data groups.

ERROR-ONLY 1 OR Ø
Only binary choice is available.
Action: enter 1 to delete the printed data group, Ø if not.

ERROR-ONLY INTERMEDIATE STATISTICS STORED
It is impossible to delete data from external data file because only intermediate statistics were entered.

Sample

Routine Run

```
                    F-4  DATA GROUPS DELETION
                    *************************

GROUP TO DELETE : X( 5 )= 28      Y =              41.8              42.6
 40.3              35.7             37.3              37.3
---DELETED---
```

ADD

F-5

Purpose

This routine provides the possibility of adding observations to those already stored, without loose them.

Operating Procedure

1. Press F-5

F-5 DATA GROUPS ADDITION
USE SAME RULES AS FOR INPUT ROUTINE (F-1)

2. If there are n stored observations,the display requests the next one.

ENTER X(n+1)?

3. Enter data following the same operating procedure for INPUT routine (F-1)

Error Messages

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered

Sample Routine Run

```
                F-5  DATA GROUPS ADDITION
                **************************

USE SAME RULES AS FOR INPUT ROUTINE (F-1)
X( 5 ) =      28                 Y  =              41.8              42.6
 40.3            35.7              37.3
```

INTERMEDIATE STATISTICS INPUT

F-6

Purpose

This routine provides the possibility for entering directly intermediate statistics instead of the original data.

Method

Being n the number of observations (data groups) and k the total number of y-values:

$$k = \sum_{i=1}^{n} n_i \quad ,$$

the intermediate statistics are described in the "Method" section for INPUT routine (F-1)

Operating Procedure

1. Press F-6

   F-6 INTERMEDIATE STATISTICS INPUT

   ENTER # OF DATA GROUPS?

2. Enter number of observations

   Entered value printout

   ENTER TOTAL # OF Y VALUES?

3. Enter the total number of y entries

   Entered value printout

   ENTER SUM (Ni * Xi)?

4. Enter $\sum_{i=1}^{n} n_i x_i$

   Entered value printout

   ENTER SUM (Ni * Yi MEAN)?

5. Enter $\sum_{i=1}^{n} n_i \bar{y}_i$

   Entered value printout

   ENTER SUM (Ni * Xi * Xi)?

6. Enter $\sum_{i=1}^{n} n_i x_i^2$

Entered value printout

ENTER SUM (Ni * (Yi MEAN) ↑ 2)?

7. Enter $\sum_{i=1}^{n} n_i \bar{y}_i^2$

Entered value printout

ENTER SUM (Ni * Xi * Yi MEAN)?

8. Enter $\sum_{i=1}^{n} n_i x_i \bar{y}_i$

Entered value printout

ENTER SUM (Ni * (Yi MEAN) ↑ 2 - SUM (Yij* Yij))?

9. Enter $\sum_{i=1}^{n} \left[n_i \bar{y}_i^2 - \sum_{j=1}^{n_i} y_{ij}^2 \right]$

Entered value printout

CORRECTIONS? ENTER 1 (YES), ∅ (NO)?

10. Enter 1 if you need corrections: the P6060 returns you to step 2.
Enter ∅ if corrections are not required:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-ONLY 1 OR ∅
Only binary choice is available.
Action: enter 1 for yes, ∅ for no.

ERROR-INTEGER POSITIVE ONLY
Entering number of observations or total number of y values an error is made.
Action: enter only integer and positive number.

Sample

Routine Run

```
                F-6  INTERMEDIATE STATISTICS INPUT
                **********************************

# OF DATA GROUPS     =  5
TOTAL # OF Y VALUES =  21
SUM(Ni*Xi)                                =  199
SUM(Ni*YiMEAN)                            =  605.3
SUM(Ni*Xi*Xi)                             =  4225
SUM(Ni*(YiMEAN)↑2)                        =  19004.498
SUM(Ni*Xi*YiMEAN)                         =  7275.5
SUM(Ni*(YiMEAN)↑2-SUM(Yij*Yij))           = -81.652
```

PRINT

F-7

Purpose This routine provides the possibility of printing original data with their intermediate statistics.

Method External data files DATA21 containing original data or DATA22, containing only intermediate statistics may be printed out.

Operating Procedure

1. Press F-7

ENTER FILE DESIGNATOR (1, 2)?

2. Enter 1 to printout DATA21, enter 2 to printout DATA 22

Selected filename and its contents printout

SELECT ROUTINE ON F-KEY?

Error Messages ERROR-ONLY 1 (DATA21), 2 (DATA22)

Incorrect choice for file designator

Action: enter 1 for external file DATA21, enter 2 for external file DATA22.

Sample Routine Run

```
                CONTENTS OF FILE DATA21 (ORIGINAL DATA)
                ***************************************

NUMBER OF DATA GROUPS = 5          NUMBER OF Y VALUES = 21
SUM(Ni*Xi)                         =  199
SUM(Ni*YiMEAN)                     =  605.3
SUM(Ni*Xi*Xi)                      =  4225
SUM(Ni*(YiMEAN)↑2)                 =  19004.498
SUM(Ni*Xi*YiMEAN)                  =  7275.5
SUM(Ni*(YiMEAN)↑2-SUM(Yij*Yij))    = -81.652

GROUP = 1      X =              1             Y =             13
 13.3            11.8

GROUP = 2      X =              2             Y =             21.9
 24.5            24.7

GROUP = 3      X =              3             Y =             29.8
 28              24.1           24.2           26.2

GROUP = 4      X =              7             Y =             32.4
 30.4            34.5           33.1           35.7

GROUP = 5      X =              28            Y =             41.8
 42.6            40.3           35.7           37.3
```

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*COMP

COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS

Purpose

This program provides a way of testing several simple linear regressions to determine whether they are significantly different or not.
Such a comparison is useful when the relationship between two variables has been studied under different conditions or by different investigators.
For each sample entered, the program computes the regression coefficients and their standard errors, correlation coefficient, t-statistic, standard error of estimate, ANOVA table with its associated F-ratio statistic and significance level, and the error matrix, storing on a scratch file the parameters required for comparison.
The user can then select those samples that he wishes to compare. The program computes the variance, F-ratio of this variance computed to the residual variance, and significance level of the F-ratio for four different types of constraint. These comparisons can be made in any order and repeated as often as desired.

Method

Given k samples, this program analyzes the variances for each type of constraint added by the linear fit, and computes the relevant F-statistic and its associated significance level.
In each simple regression, a least squares fit is performed to each sample with the model equation:

$$y = a + b\,x$$

and an analysis of this individual fit is performed.
For comparison the variance is divided into five parts: each part corresponds to a different type of constraint.

To run this program, two external data files must already be defined:

DATA21 and DATA22

The following rules must be followed for determining their minimum length:

$$\text{length (DATA 21)} \geqslant 4 * (15 + N * 2)$$

$$\text{length (DATA22)} \geqslant 4 * (22 + 26 * (k/10))$$

where:

N = number of pairs to be stored on DATA21

k = number of samples to be compared (for k = 20, length (DATA22) $\geqslant$ 2168).

In default of any different willing of the user this program handles up to 20 samples.
See Appendix B "Customization" for details concerning possible customizations.

Important

1. Each entered sample is stored on external data file DATA21: entering a new sample by the keyboard the last one is lost.

2. Each sample is identified by an index-number and it is available for comparison only after its regression line is computed, up to another sample with the same index-number is entered by the keyboard, because parameters needed for comparisons are stored on scratch file DATA22 when its regression line is computed.
   The procedure to be used is : enter each sample you have, correct, if you need, and compute its regression line. In this way the scratch file will be correctly written.
   When all samples are entered, select comparisons routine.

3. The scratch file DATA22 contains a "samples state table": any time you need, you can know how many samples were already entered and stored for comparison.

Function Key Template

Looking at the template, you can have a clear idea on editing features this program provides.

INPUT	IMMEDIATE CORRECTION	MODIFY	DELETE	ADD	INTERMED STATISTICS INPUT	PRINT	RETURN

F-1 Input of a new sample data with recording on external data file

F-2 Correction of the last entered observation

F-3 Modify some observations in the stored sample

F-4 Delete observations from the stored sample

F-5 Add new observations to the stored sample

F-6 Input of intermediate statistics, instead of original data

F-7 Printout of the stored observations and intermediate statistics

F-8 Terminate open-ended data entry, modifying, adding and deleting loops or computational loops and return to the main program sequence, or finish program execution.

Unless F-2 these function keys are available at any time during program

execution when the prompting message SELECT ROUTINE ON F-KEY is displayed.

The program disables the not defined function keys: if you press them, no action is made.

Operating Procedure

1. Ensure that the disk labelled:"Paired Data Analysis" is on drive 1.
2. Enter RUN *COMP and insert the appropriate template in the holder

PAIRED DATA ANALYSIS

```
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```

```
*COMP  COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS RUNNING
```

ENTER JOB #

3. Enter Job number

JOB # entered value

```
ROUTINES AVAILABLE ON F-KEY
---------------------------
 F-1  ORIGINAL DATA INPUT
 F-2  IMMEDIATE CORRECTION
 F-3  DATA MODIFICATION
 F-4  DATA DELETION
 F-5  DATA ADDITION
 F-6  INTERMEDIATE STATISTICS INPUT
 F-7  DATA PRINTOUT
 F-8  RETURN

F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

SELECTING CHOICES
-----------------
WHEN THE DISPLAY PROMPTS YOU TO SELECT AN OPTION
OR COMPUTATION ENTER 0 TO OBTAIN A PRINTED LIST
OF SUCH CHOICES.
THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

ACTION? 1 (COMPUTATION), 2 (EDIT)?

4. Enter correct code: Ø to have the printout of possible choices; 1 for

computations (regression analysis or comparison); 2 for editing features.
Press F-8 (RETURN) to stop program execution.
Entering ∅ the following message is printed out:

```
AVAILABLE CHOICES
-----------------
 1  REGRESSION ANALYSIS OR COMPARISON
 2  EDITING FACILITIES

PRESS F-8 TO STOP PROGRAM EXECUTION
```

and again the display asks:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

Repeat step 4 for choice you desire.
Pressing F-8 (RETURN), the message

END OF *COMP

appears and the P6060 prints:

END OF *COMP

returning to the COMMAND mode.
Selecting editing features, to enter or correct a sample, go to step 12.

If computations are selected:

ENTER 1(REGRES.), 2(COMPARISON)?

5. Enter 1 to make regression analysis of the last correctly entered sample; enter 2 to select comparison routine (Remember that a sample is available for comparison only after regression analysis is made).
Entering ∅ the following message is printed out:

```
AVAILABLE CHOICES
-----------------
 1  REGRESSION ANALYSIS OF THE LAST ENTERED SAMPLE
 2  COMPARISON OF ENTERED SAMPLES
```

and again the display asks:

ENTER 1 (REGRES.), 2 (COMPARISON)?

Repeat step 5 for correct choice.

Entering 2 (comparison routine) go to step 7.
Entering 1 (regression analysis):

SAMPLE NUMBER = i

Results printout for the sample # i

ACTION? 1 (COMPUTATION), 2 (EDIT)?

6. Repeat step 4 for choice you desire

7. 

COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS

ENTER SAMPLE-NUMBER TO COMPARE?

8. Enter index-number of the sample you want include in the comparison.

ENTER SAMPLE-NUMBER TO COMPARE?

9. Repeat step 8 for all samples you want include in the comparison.
When all index-number you want enter are included, press F-8:

List of sample numbers under comparison.
Results printout for each type of variance.

ENTER SAMPLE NUMBER TO COMPARE?

10. Repeat steps 8 and 9 for all comparisons you desire.
To stop comparisons, press F-8 (RETURN):

ACTION? 1 (COMPUTATION), 2 (EDIT)?

11. Repeat step 4 for choice you desire.

12. 

SELECT ROUTINE ON F-KEY?

13. Press correct function key to choose an editing routine (refer to the next pages for documentation).

Pressing F-8 (RETURN), the display asks again:

ACTION? 1 (COMPUTATION), 2 (EDIT)?

14. Repeat step 4 for correct choice.

Error Messages

ERROR-ACTION? 1 (COMPUTATION), 2 (EDIT)?
The entered code for selection is incorrect.
Action: enter 1 for computation, 2 for editing and ∅ to have the list of possible choices; or press F-8 to stop program execution.

ERROR-ENTER 1 (REGRES.), 2 (COMPARISON)?
The entered code for selection is incorrect.
Action: enter 1 for regression analysis of the last entered sample, 2 for comparison routine and ∅ to have the list of possible choices.

ERROR-SELECT ROUTINE ON F-KEY?
Incorrect code by the keyboard is entered instead of pressing correct function key.
Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT
F-Key # 2 was pressed at non-input nor add stages.
Action: press correct function key.

ERROR: DATA FOR PROGRAM # i
Stored data are not compatible with this program.
Action: enter correct data or run program # i (call *HELP program for programs numbering).

END OF FILE DATA22, LAST SAMPLE NOT RECORDED FOR COMPARISON
The external data file is full: last entered sample is not stored for future comparisons. Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and repeat regression analysis computation for the just correctly entered sample to have its recording for future comparisons.

NO STORED SAMPLES FOR COMPARISONS
No samples stored for comparisons.
Action: enter samples by the keyboard and select regression analysis computation.

ERROR-INT POSITIVE < = k

The entered index-number of a sample for comparison is not correct.

Action: enter integer positive number, less than or equal to k, the maximum number of samples it is possible to compare.

SAMPLE # i DOES NOT EXIST

The entered index-number of a sample for comparison corresponds to a non-existent sample in the DATA22 file.

Action: enter correct and existent sample-number.

SAMPLE # i ALREADY SELECTED

The entered index-number of a sample for comparison was already selected for the present comparison.

Action: enter samples not selected up to now.

Sample

Program Run

```
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JOB # 5

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING CHOICES
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN OPTION
                    OR COMPUTATION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH CHOICES.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.



                  F-1  INPUT OF A SAMPLE
                  **********************

                    SAMPLE #          1

                     X                Y
 1                   46.7             32.6
 2                   48.3             31.3
 3                   45               30.8
 4                   46.6             32.4
 5                   47.3             32.1
 6                   488              32.7
IMMEDIATE CORRECTION
 6                   48.8             32.7
 7                   46.4             31
 8                   48.1             30.7
 9                   49               32.6
```

```
**********      SAMPLE NUMBER = 1   *****
                ---------------

                ANOVA TABLE
                ***********

TOTAL VARIANCE
              SUM OF SQUARES      = 5.64
              DEGREES OF FREEDOM  = 8
              MEAN SQUARE         = .705
VARIANCE EXPLAINED BY REGRESSION
              SS                  = .86865472
              DF                  = 1
              MS                  = .86865472
RESIDUAL VARIANCE
              SS                  = 4.7713453
              DF                  = 7
              MS                  = .68162075

MULTIPLE CORRELATION COEFFICIENT= .15401679

FISHER'S STATISTICS               = 1.2743959

DEGREES OF FREEDOM :
                    N1            = 1
                    N2            = 7

SIGNIFICANCE LEVEL Q(U)           = .296488

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A)                      = 19.876630
STANDARD ERROR ON A                = 10.565601
SLOPE (B)                          = .25178398
STANDARD ERROR ON B                = .22303648
T VALUE                            = 1.1288315
CORRELATION COEFFICIENT            = .39244974
STANDARD ERROR OF ESTIMATE         = .82560327

ERROR MATRIX
            S(1,1)                 = 111.63192
            S(1,2)                 =-2.3557149
            S(2,2)                 = 4.9745271E-02

END OF FILE DATA22 , LAST SAMPLE NOT RECORDED FOR COMPARISON

                  END OF *COMP
```

```
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*COMP  COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS RUNNING

JOB # 5

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING CHOICES
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN OPTION
                    OR COMPUTATION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH CHOICES.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

********** SAMPLE NUMBER = 1 *****

ANOVA TABLE
****

TOTAL VARIANCE
SUM OF SQUARES = 5.64
DEGREES OF FREEDOM = 8
MEAN SQUARE = .705

VARIANCE EXPLAINED BY REGRESSION
SS = .86865472
DF = 1
MS = .86865472

RESIDUAL VARIANCE
SS = 4.7713453
DF = 7
MS = .68162075

MULTIPLE CORRELATION COEFFICIENT= .15401679

FISHER'S STATISTICS = 1.2743959

DEGREES OF FREEDOM :
N1 = 1
N2 = 7

SIGNIFICANCE LEVEL Q(U) = .296488

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A) = 19.876630
STANDARD ERROR ON A = 10.565601
SLOPE (B) = .25178398
STANDARD ERROR ON B = .22303648
T VALUE = 1.1288915
CORRELATION COEFFICIENT = .39244974
STANDARD ERROR OF ESTIMATE = .82560327

ERROR MATRIX
S(1,1) = 111.63192
S(1,2) =-2.3557149
S(2,2) = 4.9745271E-02

```
                F-1  INPUT OF A SAMPLE
                **********************

                  SAMPLE #          2

                    X               Y
1                   50.3            36.7
2                   50.9            35
3                   52.2            37
4                   51.7            35.6
5                   51.1            38.3
6                   51.5            35.8
7                   49.1            36
8                   51.3            34
9                   514             36.8
```

```
                F-3  DATA MODIFICATION
                **********************
INDEX= 9          X =  51.4        Y =  36.8
```

```
**********      SAMPLE NUMBER = 2    *****
                -------------

                ANOVA TABLE
                ***********

TOTAL VARIANCE
                SUM OF SQUARES      = 12.46
                DEGREES OF FREEDOM  = 8
                MEAN SQUARE         = 1.5575
VARIANCE EXPLAINED BY REGRESSION
                SS                  = 1.5052812E-02
                DF                  = 1
                MS                  = 1.5052812E-02
RESIDUAL VARIANCE
                SS                  = 12.444947
                DF                  = 7
                MS                  = 1.7778496

MULTIPLE CORRELATION COEFFICIENT= 1.2080908E-03

FISHER'S STATISTICS                 = 8.4668644E-03

DEGREES OF FREEDOM :
                N1                  = 1
                N2                  = 7

SIGNIFICANCE LEVEL Q(U)             = .551791
```

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A)	= 33.680579
STANDARD ERROR ON A	= 26.659566
SLOPE (B)	= 4.8040887E-02
STANDARD ERROR ON B	= .52209521
T VALUE	= 9.2015566E-02
CORRELATION COEFFICIENT	= 3.4757601E-02
STANDARD ERROR OF ESTIMATE	= 1.3333603

ERROR MATRIX

S(1,1)	= 710.73248
S(1,2)	=-13.916898
S(2,2)	= .27258341

F-1 INPUT OF A SAMPLE

****

SAMPLE # 4

	X	Y
1	48.3	36
IMMEDIATE CORRECTION		
1	48.3	35.5
2	47.5	33.4
3	45.6	31.5
4	46.5	32.5
5	46.7	34.7
6	48.2	33.1
7	48.4	33.8
8	47.1	33.7
9	45.8	32.9

********** SAMPLE NUMBER = 4 *****

ANOVA TABLE

****

TOTAL VARIANCE

SUM OF SQUARES	= 11.082222
DEGREES OF FREEDOM	= 8
MEAN SQUARE	= 1.3852778

VARIANCE EXPLAINED BY REGRESSION

SS	= 4.3185014
DF	= 1
MS	= 4.3185014

RESIDUAL VARIANCE

SS	= 6.7637209
DF	= 7
MS	= .96624584

```
MULTIPLE CORRELATION COEFFICIENT= .38967829

FISHER'S STATISTICS                = 4.4693609

DEGREES OF FREEDOM :
                      N1           = 1
                      N2           = 7

SIGNIFICANCE LEVEL Q(U)            = .0705232

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A)                      = .73308929
STANDARD ERROR ON A                = 15.481770
SLOPE (B)                          = .69441687
STANDARD ERROR ON B                = .32847139
T VALUE                            = 2.1140863
CORRELATION COEFFICIENT            = .62424217
STANDARD ERROR OF ESTIMATE         = .98297804

ERROR MATRIX
             S(1,1)                = 239.68519
             S(1,2)                =-5.0841794
             S(2,2)                = .10789346
```

F-1 INPUT OF A SAMPLE
****

SAMPLE # 3

	X	Y
1	47.1	36.9
2	47.2	37.2
3	51.8	37.4
4	49.4	34.7
5	46.7	35
6	46.4	35.7
7	49.3	32.2

********** SAMPLE NUMBER = 3 *****

ANOVA TABLE
****

TOTAL VARIANCE
SUM OF SQUARES = 20.228571
DEGREES OF FREEDOM = 6
MEAN SQUARE = 3.3714286
VARIANCE EXPLAINED BY REGRESSION
SS = 1.7756304E-02
DF = 1
MS = 1.7756304E-02
RESIDUAL VARIANCE
SS = 20.210815
DF = 5
MS = 4.0421630

MULTIPLE CORRELATION COEFFICIENT= 8.7778341E-04

FISHER'S STATISTICS = 4.3927730E-03

DEGREES OF FREEDOM :
N1 = 1
N2 =. 5

SIGNIFICANCE LEVEL Q(U) = .50447

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A) = 36.919015
STANDARD ERROR ON A = 20.131147
SLOPE (B) =-2.7620918E-02
STANDARD ERROR ON B = .41674340
T VALUE =-6.6277996E-02
CORRELATION COEFFICIENT =-2.9627409E-02
STANDARD ERROR OF ESTIMATE = 2.0105131

ERROR MATRIX
S(1,1) = 405.26307
S(1,2) =-8.3835434
S(2,2) = .17367506

F-1 INPUT OF A SAMPLE
****

SAMPLE # 6

	X	Y
1	53.4	34
2	53	35
3	51.7	34.7
4	51.7	32.6
5	51.6	30.8
6	50	33.6
7	49.5	32.4

********** SAMPLE NUMBER = 6 *****

ANOVA TABLE
****

TOTAL VARIANCE
SUM OF SQUARES = 12.98
DEGREES OF FREEDOM = 6
MEAN SQUARE = 2.1633333
VARIANCE EXPLAINED BY REGRESSION
SS = 2.1527546
DF = 1
MS = 2.1527546
RESIDUAL VARIANCE
SS = 10.827245
DF = 5
MS = 2.1654491

MULTIPLE CORRELATION COEFFICIENT= .16585166

FISHER'S STATISTICS = .99413770

DEGREES OF FREEDOM :
N1 = 1
N2 = 5

SIGNIFICANCE LEVEL Q(U) = .366521

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A) = 11.622290
STANDARD ERROR ON A = 21.748644
SLOPE (B) = .42045988
STANDARD ERROR ON B = .42169775
T VALUE = .99706454
CORRELATION COEFFICIENT = .40724890
STANDARD ERROR OF ESTIMATE = 1.4715465

ERROR MATRIX
S(1,1) = 473.00353
S(1,2) =-9.1683549
S(2,2) = .17782900

F-7 CONTENTS OF FILE DATA22 (SCRATCH FILE)
****

SAMPLES STATE TABLE : 1 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0

SAMPLE NUMBER 1
****

NUMBER OF PAIRS	9		
X SUM	426.2	X MEAN	47.355556
Y SUM	286.2	Y MEAN	31.8
X↑2 SUM	20196.64	-1/N	-.11111111
Y↑2 SUM	9106.8	(X↑2 SUM)-(X SUM↑2)/N	13.702222
X*Y SUM	13556.61	(X*Y SUM)-(X SUM * Y SUM)/N	3.45
SS TOTAL	5.64	SS RESIDUAL	4.7713453

SAMPLE NUMBER 2
****

NUMBER OF PAIRS	9		
X SUM	459.5	X MEAN	51.055556
Y SUM	325.2	Y MEAN	36.133333
X↑2 SUM	23466.55	-1/N	-.11111111
Y↑2 SUM	11763.02	(X↑2 SUM)-(X SUM↑2)/N	6.5222222
X*Y SUM	16603.58	(X*Y SUM)-(X SUM * Y SUM)/N	.313333
SS TOTAL	12.46	SS RESIDUAL	12.444947

SAMPLE NUMBER 3
****

NUMBER OF PAIRS	7		
X SUM	337.9	X MEAN	48.271429
Y SUM	249.1	Y MEAN	35.585714
X↑2 SUM	16334.19	-1/N	-.14285714
Y↑2 SUM	8884.63	(X↑2 SUM)-(X SUM↑2)/N	23.274286
X*Y SUM	12023.77	(X*Y SUM)-(X SUM * Y SUM)/N	-.642857
SS TOTAL	20.228571	SS RESIDUAL	20.210815

SAMPLE NUMBER 4
****

NUMBER OF PAIRS	9		
X SUM	424.1	X MEAN	47.122222
Y SUM	301.1	Y MEAN	33.455556
X↑2 SUM	19993.49	-1/N	-.11111111
Y↑2 SUM	10084.55	(X↑2 SUM)-(X SUM↑2)/N	8.9555556
X*Y SUM	14194.72	(X*Y SUM)-(X SUM * Y SUM)/N	6.21888
SS TOTAL	11.082222	SS RESIDUAL	6.7637209

SAMPLE NUMBER 6
****

NUMBER OF PAIRS	7		
X SUM	360.9	X MEAN	51.557143
Y SUM	233.1	Y MEAN	33.3
X↑2 SUM	18619.15	-1/N	-.14285714
Y↑2 SUM	7775.21	(X↑2 SUM)-(X SUM↑2)/N	12.177143
X*Y SUM	12023.09	(X*Y SUM)-(X SUM * Y SUM)/N	5.12
SS TOTAL	12.98	SS RESIDUAL	10.827245

F-1 INPUT OF A SAMPLE
****

SAMPLE # 5

	X	Y
1	51.6	39.1
2	50.6	37.4
3	50.6	37.2
4	50.2	37.3
5	51.3	38.5
6	50.8	38
7	50.9	36.1
8	50.2	37
9	52.1	37.7

********** SAMPLE NUMBER = 5 *****

ANOVA TABLE
****

TOTAL VARIANCE
SUM OF SQUARES = 6.1288889
DEGREES OF FREEDOM = 8
MEAN SQUARE = .76611111
VARIANCE EXPLAINED BY REGRESSION
SS = 1.6280561
DF = 1
MS = 1.6280561
RESIDUAL VARIANCE
SS = 4.5008328
DF = 7
MS = .64297611

MULTIPLE CORRELATION COEFFICIENT= .26563642

FISHER'S STATISTICS = 2.5320632

DEGREES OF FREEDOM :
N1 = 1
N2 = 7

SIGNIFICANCE LEVEL Q(U) = .153621

REGRESSION PARAMETERS AND STANDARD ERRORS

INTERCEPT (A)	= 1.5783615
STANDARD ERROR ON A	= 22.631977
SLOPE (B)	= .70716724
STANDARD ERROR ON B	= .44441106
T VALUE	= 1.5912458
CORRELATION COEFFICIENT	= .51539929
STANDARD ERROR OF ESTIMATE	= .80185791

ERROR MATRIX

S(1,1)	= 512.20640
S(1,2)	=-10.057200
S(2,2)	= .19750119

COMPARISON OF SEVERAL SIMPLE LINEAR REGRESSIONS

COMPARED SAMPLES : 1 2 3 4 5 6

	SS	DF	MS	F	Q(U)
TYPE A	68.875329	1	68.875329	43.973632	5.4236089E-06
TYPE B	4.8622738	5	.97245475	.62086625	.66120611
TYPE C	7.9687139	1	7.9687139	5.0876460	2.8201186E-02
TYPE D	129.65478	4	32.413694	20.694607	1.1236619E-06
TYPE E	59.518907	38	1.5662870		
TOTAL	270.88	49			

COMPARED SAMPLES : 1 2

TYPE A

SS	DF	MS	F	Q(U)
70.424946	1	70.424946	57.268383	2.5011258E-05

TYPE B

.18343241	1	.18343241	.14916416	.67112630

TYPE C

14.775330	1	14.775330	12.015051	3.9800678E-03

TYPE D

-8.1011000E-07	0	0	0	1

VANISHES BECAUSE OF ONLY TWO SAMPLES

TYPE E

17.216292	14	1.2297352

TOTAL

102.6	17

END OF *COMP

INPUT

F-1

Purpose

This routine provides the possibility to enter a new sample data by the keyboard, storing data on external data file DATA21.

Method

Let $(x_i, y_i)_k$, i = 1,..., N the sample data # k entered by the keyboard. The following intermediate statistics are computed:

$$\Sigma x_i \ , \quad \Sigma y_i \ , \quad \Sigma x_i^2 \ , \quad \Sigma y_i^2 \ , \quad \Sigma x_i \, y_i \ , \quad i = 1,\ldots, N$$

When a new sample data is entered by the keyboard, the last one is lost: only some parameters needed for comparison will be stored on scratch file DATA22 and they are available for future comparison up to a new sample with the same index-number is entered by the keyboard.

Operating Procedure

1. Press F-1

   F-1 INPUT OF A SAMPLE

   ENTER SAMPLE NUMBER?

2. Enter index-number identifying the sample you are entering

   SAMPLE # entered value

   For i = 1, the display asks:

   ENTER X(i)?

3. Enter the required x value

   ENTER Y(i)?

4. Enter the correspondent y value

   Entered values printout

   For i = i +1, the display asks:

   ENTER X(i)?

5. Repeat steps 3 and 4 for all pairs (x,y) of the sample.
   To stop input routine, press F-8:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = k

The entered index-number identifying the sample is incorrect.

Action: enter integer positive number, less than or equal to the maximum number of samples the program can compare.

ERROR-ENTER Y (i)?

F-key # 8 is pressed at incorrect stage: i.e. when the display requires the y value.

Action: enter correct y-value.

ERROR-ENTER X (1)?

F-key # 2 is pressed when the program requires the first x-value (for the first x, y pair).

Action: enter correct x-value.

END OF FILE DATA21, LAST DATA PAIR NOT RECORDED

The external data file is full: last entered pair is not recorded.

Program execution stops.

Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-key # 5).

Sample Routine Run

```
                F-1  INPUT OF A SAMPLE
                **********************

                  SAMPLE #          5

                    X               Y
 1                  51.6            39.1
 2                  50.6            37.4
 3                  50.6            372
IMMEDIATE CORRECTION
 3                  50.6            37.2
 4                  50.2            37.3
 5                  513             38.5
 6                  50.8            38.2
 7                  50.9            36.1
 8                  50.2            37
 9                  52.1            37.7
```

IMMEDIATE CORRECTION

F-2

Purpose

This routine, available only at the input (F-1) and adding (F-5) stages, provides the correction of the:

- last entered pair (x,y)
- last entered x-value.

Operating Procedure

1. If the (i + 1)-th x-value is required by the display and you need correction for the just entered i-th (x,y) pair, press F-2 and go to step 3.

   If the just entered i-th x-value is incorrect, when the display asks for the correspondent y-value:

   

   ENTER Y(i)?

   Press F-2
   The P6060 will ask again for the i-th x-value:

   

   ENTER X(i)?

2. Enter correct i-th x-value and continue to enter data using F-1 (INPUT) operating procedure.

3. 

   IMMEDIATE CORRECTION

   The display asks again for the i-th x-value:

   

   ENTER X(i)?

4. Enter correct x-value

   

   ENTER Y(i)?

5. Enter the correct correspondent y-value

   

   Corrected values printout

6. Continue to enter data using F-1 (INPUT) operating procedure.

Sample Routine Run

See INPUT (F-1) and ADD (F-5) routines.

MODIFY

F-3

Purpose

This routine provides the possibility of modifying data already stored on external data file.

Operating Procedure

1. Press F-3

   F-3 DATA MODIFICATION

   ENTER INDEX OF PAIR TO MODIFY?

2. Enter index-number of pair to be modified

   OLD = old x and y values NEW VALUES?

3. Enter correct x and y values (separated by a comma).

   Index and entered values printout

   ENTER INDEX OF PAIR TO MODIFY?

4. Repeat steps 2 and 3 for all corrections you need.
   Press F-8 to stop corrections:

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INTEGER POSITIVE < = N
The entered index-number of the pair to be modified is incorrect.
Action: enter integer positive number less than or equal to the total number of stored pairs (N).

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered.
Action: enter original data or select computations.

Sample Routine Run

```
                F-3  DATA MODIFICATION
                **********************
INDEX= 5          X =  51.3        Y =  38.5
INDEX= 6          X =  50.8        Y =  38
```

DELETE

F-4

Purpose

This routine provides the possibility of deleting data pairs from external data file DATA21.

Operating Procedure

1. Press F-4

   F-4 DATA DELETION

   ENTER INDEX OF PAIR TO DELETE?

2. Enter index-number of pair to be deleted

   (x,y) values to be deleted printout

   DELETE? ENTER 1 (YES), ∅ (NO)?

3. Enter 1 if you want to delete this pair; ∅ if not.
   If 1 is entered, the program prints the message:

   ...DELETED...

   In any case the display asks for a new pair:

   ENTER INDEX OF PAIR TO DELETE?

4. Repeat steps 2 and 3 as many time as necessary.
   Press F-8 to stop data deletion:

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = N
The entered index-number of the pair to be deleted is incorrect.
Action: enter integer positive number less than or equal to the total number of stored pairs (N).

ERROR-ONLY 1 OR ∅
Only binary choice is available.
Action: enter 1 for yes, ∅ for no.

ERROR: ONLY INTERMEDIATE STATISTICS STORED

It is impossible to update data, because only intermediate statistics were entered.

Action: enter original data or select computations.

Sample

Routine Run

```
                F-4  DATA DELETION
                ******************

PAIR TO DELETE= 50.2  37          INDEX = 3
---DELETED---
PAIR TO DELETE= 50.2  37.3        INDEX = 4
PAIR TO DELETE= 52.1  37.7        INDEX = 8
---DELETED---
```

ADD

F-5

Purpose

This routine provides the possibility of adding observations to those already stored, without loose them.

Operating Procedure

1. Press F-5

F-5 DATA ADDITION

2. If there are k stored pairs, the display requests the next x-value:

ENTER X(k + 1)?

3. Enter data following the same operating procedure for INPUT routine (F-1).

Error Messages

ERROR: ONLY INTERMEDIATE STATISTICS STORED

It is impossible to update data, because only intermediate statistics were entered.

Action: enter original data or select computations.

Sample Routine Run

```
                F-5  DATA ADDITION
                ******************
8                  50.2              37
9                  52.1              37.7
```

INTERMEDIATE STATISTICS INPUT

F-6

Purpose

This routine provides the possibility for entering directly intermediate statistics instead of the original data.

Method

For description of the intermediate statistics, see the "Method" section for INPUT (F-1) routine.

Operating Procedure

1. Press F-6

   F-6 INTERMEDIATE STATISTICS INPUT

   ENTER SAMPLE NUMBER?

2. Enter index-number identifying the sample you are entering

   SAMPLE # entered value

   ENTER # OF PAIRS?

3. Enter total number of observations (pairs)

   Entered value printout

   ENTER X SUM?

4. Enter $\sum_i x_i$

   Entered value printout

   ENTER Y SUM?

5. Enter $\sum_i y_i$

   Entered value printout

   ENTER X↑2 SUM?

6. Enter $\sum_i x_i^2$

   Entered value printout

   ENTER Y↑2 SUM?

7. Enter $\sum_i y_i^2$

Entered value printout

ENTER X*Y SUM?

8. Enter $\sum_i x_i\ y_i$

Entered value printout

CORRECTION? ENTER 1 (YES), ∅ (NO)?

9. Enter 1 if you need corrections: the P6060 returns you to step 2.
Enter ∅ if corrections are not required:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = k

The entered index-number identifying the sample is incorrect.

Action: enter integer positive number, less than or equal to the maximum number of samples the program can compare.

ERROR-INTEGER POSITIVE ONLY

The entered number of observations is incorrect.

Action: enter integer positive number only.

ERROR-POSITIVE ONLY

Entered value $\sum_i x_i^2$ or $\sum_i y_i^2$ is incorrect.

Action: enter only positive numbers .

ERROR-ONLY 1 OR ∅

Only binary choice is available.

Action: enter 1 if you need corrections, ∅ if not.

Sample Routine Run

```
                F-6  INTERMEDIATE STATISTICS INPUT
                **********************************
SAMPLE #    5
NUMBER OF PAIRS  = 9
X SUM        458.3
Y SUM        338.3
X↑2 SUM      23340.91
Y↑2 SUM      12722.45
X*Y SUM      17229.29
```

PRINT

F-7

Purpose

This routine provides the possibility of printing original data (file DATA21) with their intermediate statistics or parameters needed for comparisons (file DATA22).

Method

A samples state table is defined in the scratch file DATA22: it contains 1 if the related sample was already stored for comparison, ∅ if not.
In this way, at any time the user needs, he can know how many and what samples are ready for comparison.

ex.: the table
1 1 1 0 1 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0

is meaning that samples # 1, 2, 3, 5, 6, 11 are stored and ready for comparison.

Operating Procedure

1. Press F-7

   ENTER FILE DESIGNATOR (1/2)?

2. Enter 1 to have the printout of DATA21 contents, enter 2 for DATA22.

   Depending of the selected external data file, the P6060 prints:

   F-7 CONTENTS OF FILE DATA21 (ORIGINAL DATA)

   or:

   F-7 CONTENTS OF FILE DATA22 (SCRATCH FILE)

   Contents of selected file printout (with samples state table for DATA22)

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-ONLY 1 (DATA21), 2 (DATA22)
The entered file designator is incorrect.
Action: enter only 1 for DATA21, and 2 for DATA22.

Sample

Routine Run

```
                F-7  CONTENTS OF FILE DATA21 (ORIGINAL DATA)
                **********************************************

NUMBER OF PAIRS= 9                SAMPLE # = 5
X SUM    =        458.3
Y SUM    =        338.3
X↑2 SUM  =        23340.91
Y↑2 SUM  =        12722.45
X*Y SUM  =        17229.29

 X                Y

 51.6             39.1
 50.6             37.4
 50.6             37.2
 50.2             37.3
 51.3             38.5
 50.8             38
 50.9             36.1
 50.2             37
 52.1             37.7
```

References

1. Statistical Theory with Engineering Applications
A. Hald, J. Wiley & Sons, N.Y. 1962, p.579-584.

2. Handbook of Mathematical Functions
M. Abramovitz and I. Stegun, N.B.S., Applied Mathematic Series, 55, 1968, p. 932-947.

3. Statistical Methods
Snedecor and Cochran, Iowa State University Press, 1967, p.419-438.

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P.G. Moore and D.E. Edwards, Sir Isaac Pitman & Sons, London - 1965, p. 60-64.

***BICO**

BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENTS

Purpose

This program computes the correlation of data pairs in which one variable is continous and the other is measured in the form of a dichotomy, i.e. pass/fail, yes/no, male/female, etc...
Such a relationship is said to be biserial and there are two possible measures of the correlation, called biserial and point biserial coefficients. These two coefficients differ essentially by the type of assumption made concerning the nature of the dichotomized variable.
Both, numeric and qualitative values for y can be handled.

Method

The data are of the form:

	State 1	State 2
y_1	n_{11}	n_{21}
y_2	n_{12}	n_{22}
.	.	.
.	.	.
.	.	.
y_i	n_{1i}	n_{2i}
.	.	.
.	.	.
.	.	.
y_m	n_{1m}	n_{2m}

Table # 1

For any value of y_i, there are n_{1i} observations in the state 1 and n_{2i} observations in the state 2. The variable y must be continous and normally distributed.
For biserial coefficient r_b calculation it is assumed that the dichotomized variable is in reality continous and normally distributed: many apparently

dichotomous variables are really continous, e.g., yes and no responses vary from emphatic to mitigated; in the pass/fail dichotomy, e passing grade can vary from barely passing to passing with great ease and a failing grade can vary from dismal failure to almost passing, etc.

Furthermore, two calculations of r_b are possible depending on whether the continous variable ,y, is numerical (see sample program run # 1) or qualitative (see sample program run # 2).

The problem reduces to finding the estimate of the correlation coefficient of a bivariate normal distribution whose sample data points are in the form shown above.

If the dichotomous variable cannot be represented by a normal distribution but one can take on two values only (male/female, on/off, etc.), the correlation coefficient is called a point biserial correlation coefficient r_{pb}.

To run this program only one external data file must be defined, it has the fixed name DATA21.

Its minimum length depends on the type of data:

- if numerical y-values are handled,

  length (DATA21) $\geqslant 4 * (14 + 3m)$;

- if qualitative y-values are handled,

  length (DATA22) $\geqslant 4 * (10 + 2m)$;

where:

m = number of rows described in table # 1 .

Only limitation to the program is the defined file size.

Notes:

1. The point biserial correlation coefficient is defined only for numerical values of y. It cannot be used with a qualitative y variate.
2. For numerical values of y variate, the program computes both, r_b and r_{pb} : the user will select what he is interested.
3. From the sample run # 1 it is seen that $|r_{pb}| < |r_b|$ and this always holds true.

Function Key Template

Looking at the template you can have a clear idea on editing features this program provides.

INPUT	IMMEDIATE CORRECTION	MODIFY	DELETE	ADD	INTERMED STATISTICS INPUT	PRINT	RETURN

F-1 Input of a new sample data with recording on external data file

F-2 Correction of the last entered observation

F-3 Modify some observations in the stored sample

F-4 Delete observations from the stored sample

F-5 Add new observations to the stored sample

F-6 Input of intermediate statistics, instead of original data

F-7 Printout of the stored observations and intermediate statistics

F-8 Terminate open-ended data entry modifying, adding and deleting loops or computational loops and return to the main program sequence or finish program execution.

Unless F-2 these function keys are available at any time during program execution when the prompting message SELECT ROUTINE ON F-KEY is displayed.

The program disables the not defined function keys; if you press them, no action is made.

Operating Procedure

1. Ensure that the disk labelled "Paired Data Analysis" is on drive 1.

2. Enter RUN *BICO and insert the appropriate template in the holder.

PAIRED DATA ANALYSIS

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti
```

```
*BICO - BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENT RUNNING

ENTER JOB # ?
```

3. Enter job #

JOB # entered value

```
ROUTINES AVAILABLE ON F-KEY
---------------------------
 F-1  ORIGINAL DATA INPUT
 F-2  IMMEDIATE CORRECTION
 F-3  DATA MODIFICATION
 F-4  DATA DELETION
 F-5  DATA ADDITION
 F-6  INTERMEDIATE STATISTICS INPUT
 F-7  DATA PRINTOUT
 F-8  RETURN

F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

SELECTING ACTIONS
-----------------
WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
ACTION ENTER 0 TO OBTAIN A PRINTED LIST
OF SUCH ACTIONS.
THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

```
ACTION? 1(COMPUTATION), 2 (EDIT)?
```

4. Enter correct code: ∅ to have the printout of possible choices; 1 for biserial and point biserial correlation coefficient; 2 for editing features.

   Press F-8 (RETURN) to stop program execution.

   Entering ∅ the following message is printed out:

```
AVAILABLE ACTIONS
-----------------
 1  COMPUTATION OF BISERIAL AND
    POINT-BISERIAL CORRELATION COEFFICIENT
 2  EDITING FACILITIES

PRESS F-8 TO STOP PROGRAM EXECUTION
```

and again the display asks:

```
ACTION? 1 (COMPUTATION), 2 (EDIT)?
```

Repeat step 4 for choice you desire.

Pressing F-8 (RETURN), the message

```
END OF *BICO
```

appears and the P6060 prints:

```
END OF *BICO
```

returning to the COMMAND mode.

Selecting editing features, go to step 5.

If computations are selected:

Results printout:

- N1 and N2 (Σn_{1i}, Σn_{2i});
- $\bar{y}_1$ and $\bar{y}_2$ with standard deviation on y (only for numerical y-values);
- biserial coefficient r_b
- standard error on r_b (numerical y-values only)
- point biserial coefficient r_{pb} (numerical y-values only)

The program continues with the next step for a new sample.

5.  SELECT ROUTINE ON F-KEY?

6. Press correct function key to choose an editing routine (refer to the next pages for documentation).
   Pressing F-8 the display asks again:

 ACTION? 1 (COMPUTATION), 2 (EDIT)?

7. Repeat step 4 for correct choice.

Error Messages

ERROR-ACTION? 1(COMPUTATION), 2 (EDIT)?
The entered code for selection is incorrect.
Action: enter 1 for computation, 2 for editing and ∅ to have the list of possible choices, or press F-8 to stop program execution.

ERROR-SELECT ROUTINE ON F-KEY?
Incorrect code by the keyboard is entered instead of pressing correct function key.
Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT
F-key # 2 was pressed at non-input nor add stages.
Action: press correct function key.

ERROR: DATA FOR PROGRAM # i
Stored data are not compatible with this program.
Action: enter correct data or run program # i (call *HELP program for programs numbering)

Sample Program Run # 1

Data are taken from Ref. # 3, pag. 192: Binet IQ versus pass or fail on "abstract words" (state 1 = pass; state 2 = fail).

```
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PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
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*BICO - BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENT RUNNING
JOB # 6

                ROUTINES AVAILABLE ON F-KEY
                ---------------------------
                 F-1  ORIGINAL DATA INPUT
                 F-2  IMMEDIATE CORRECTION
                 F-3  DATA MODIFICATION
                 F-4  DATA DELETION
                 F-5  DATA ADDITION
                 F-6  INTERMEDIATE STATISTICS INPUT
                 F-7  DATA PRINTOUT
                 F-8  RETURN

                F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                SELECTING ACTIONS
                -----------------
                WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                ACTION ENTER 0 TO OBTAIN A PRINTED LIST
                OF SUCH ACTIONS.
                THEN ENTER THE NUMBER OF THE CHOICE DESIRED.


          F-1  DATA INPUT FOR NUMERICAL VALUES OF Y
          ****************************************

 GROUP          Y              N1             N2

  1             147.5          1              0
  2             137.5          1              0
  3             1325           3              0
IMMEDIATE CORRECTION
  3             132.5          3              0
  4             127.5          4              0
  5             122.5          6              0
  6             117.5          10             0
  7             112.5          7              0
  8             107.5          8              1
  9             102.5          5              1
  10            97.5           9              4
  11            92.5           6              7
  12            87.5           2              9
  13            825            1              3
IMMEDIATE CORRECTION
  13            82.5           1              3
  14            77.5           0              4
  15            72.5           0              5
  16            62.5           0              3
```

```
        BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENT
        **************************************************
                    FOR NUMERICAL VALUES OF Y
                    *************************

N1                                          = 63
Y MEAN 1                                    = 110.35714
N2                                          = 37
Y MEAN 2                                    = 84.932432
STANDARD DEVIATION ON Y                     = 17.687496

BISERIAL COEFFICIENT                        = .88730383
STANDARD ERROR ON BISERIAL COEFFICIENT      = 7.0087357E-02
POINT BISERIAL COEFFICIENT                  = .69400214


                        END OF *BICO
```

Sample Program Run # 2

Data are taken from Ref. 2, pag. 307: Criminals classified according to alcoholism and type of crime (state 1 = alcoholic, state 2 = non-alcoholic).

```
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*BICO - BISERIAL AND POINT BISERIAL CORRELATION COEFFICIENT RUNNING

JOB # 7

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING ACTIONS
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                    ACTION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH ACTIONS.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

F-1 DATA INPUT FOR QUALITATIVE VALUES OF Y

GROUP	N1	N2
1	50	43
2	88	62
3	155	110
4	379	300
5	18	14
6	63	144

BISERIAL CORRELATION COEFFICIENT FOR QUALITATIVE Y VALUES

N1 = 753
N2 = 673

BISERIAL COEFFICIENT = .23337554

F-3 DATA MODIFICATION FOR QUALITATIVE VALUES OF Y

ORDER = 4 N1 = 379 N2 = 30
ORDER = 6 N1 = 63 N2 = 244

BISERIAL CORRELATION COEFFICIENT FOR QUALITATIVE Y VALUES

N1 = 753
N2 = 503

BISERIAL COEFFICIENT = .65639592

END OF *BICO

INPUT

F-1

Purpose

This routine provides the possibility to enter a new sample data by the keyboard, storing data on external data file.
Both, numeric and qualitative y-values can be handled.

Method

Referring to the table # i in the general "Method" section, let:

$$N1 = \sum_{i=1}^{m} n_{1i}, \text{ and } \quad N2 = \sum_{i=1}^{m} n_{2i}.$$

For numeric y-values the following intermediate statistics are computed:

N1 and N2 defined before,

N1 + N2, ,

$\sum_i n_{1i}\, y_i$,

$\sum_i n_{2i}\, y_i$,

$\sum_i (n_{1i}+n_{2i})\, y_i^2$;

For qualitative y-value only the following intermediate statistics are computed:

N1, N2, N1 + N2,

$$\sum_{i=1}^{m} (n_{1i} + n_{2i})\, k_i^2$$

where:
k_i is determined from the expression:

$$p_i = 1 - P(k_i)$$

using the inverse function of the standard normal distribution and

$$p_i = \left| \frac{n_{1i}}{n_{1i}+n_{2i}} \right| .$$

Entering a new sample data by the keyboard, the last one is lost; but one can form permanent data archives. For more details, see Appendix A "Installation and Maintenance".

Operating Procedure

1. Press F-1

   DATA TYPE? 1(NUMER), 2(QUALITAT)?

2. Enter correct code for type of data:
   1 for numerical (quantitative) y-values;
   2 for qualitative y-values.

   If qualitative values are handled, the P6060 prints:

F-1 DATA INPUT FOR QUALITATIVE VALUES OF Y
GROUP N1 N2

For i = 1, the display asks:

ENTER N (1,i)?

Go to step 4.
If numerical values are handled, the P6060 prints:

F-1 DATA INPUT FOR NUMERICAL VALUES OF Y
GROUP Y N1 N2

For i = 1, the display asks:

ENTER Y(i)?

3. Enter the first y-value

ENTER N(1,i)?

4. Enter the required n_{1i} value (number of items in the state 1 for the i-th category)

ENTER N(2,i)?

5. Enter the required n_{2i} value (number of items in the state 2 for the i-th category)

Entered values and index printout

For i = i + 1 the display asks:

ENTER Y (i)?

if numerical values are handled;

ENTER N(1,i)?

if qualitative values are handled.

Repeat steps 3, 4 and 5 for numerical values;
steps 4 and 5 for qualitative values.
To stop input routine, press F-8:

SELECT ROUTINE ON F-KEY?

6. Press correct function key to choose an editing facility.
   Press F-8 to have the results printout.

Error Messages

ERROR-DATA TYPE? 1 (NUMER), 2 (QUALITAT)?
The entered data type is incorrect.
Action: enter 1 for numerical values of y; enter 2 for qualitative values of y.

ERROR-ENTER N(2,i)?
ERROR-ENTER N(1,i)?
F-key # 8 was pressed at incorrect stage : i.e., when the display requires n_{1i} or n_{2i} value.
Action: enter correct value n_{1i} or n_{2i}.

ERROR-INTEGER NON NEGATIVE ONLY
The entered n_{1i} or n_{2i} values are incorrect.
Action: enter only integer and non negative number.

ERROR-BOTH VALUES ARE ZERO.
Both entered values n_{1i} and n_{2i} for qualitative values of y are zero: it is impossible to calculate p_i.
Action: re-enter both values (one of them, at least, must be integer positive).

END OF FILE DATA21, LAST DATA GROUP NOT RECORDED
The external data file is full: last entered data group is not recorded.
Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance")and continue to enter data using ADD capability (F-key # 5).

Sample Routine

Run # 1

F-1 DATA INPUT FOR NUMERICAL VALUES OF Y

GROUP	Y	N1	N2
1	147.5	1	0
2	137.5	1	0
3	1325	3	0
IMMEDIATE CORRECTION			
3	132.5	3	0
4	127.5	4	0
5	122.5	6	0
6	117.5	0	1
IMMEDIATE CORRECTION			
6	117.5	10	0
7	1125	7	0
8	107.5	8	1
9	102.5	5	1
10	975	9	4
11	92.5	6	7
12	87.5	2	9
13	82.5	1	3
14	77.5	0	4
15	72.5	0	5
16	62.5	0	3

Sample Routine

Run # 2

F-1 DATA INPUT FOR QUALITATIVE VALUES OF Y

GROUP	N1	N2
1	50	43
2	88	620
IMMEDIATE CORRECTION		
2	88	62
3	155	110
4	379	300
5	18	14
6	63	144

IMMEDIATE CORRECTION

F-2

Purpose

This routine, available only at the input (F-1) and adding (F-5) stages, provides the correction of the:

- last entered data group y_i, n_{1i}, n_{2i} for numerical y-values and n_{1i}, n_{2i} for qualitative y-values
- last entered y_i value
- last entered n_{1i} value.

Operating Procedure

1. If the (i + 1)-th y value is required by the display and you need corrections for the last entered (and printed) i-th group, press F-2 and go to step 5.

   If the just entered y_i value is incorrect, when the display requires the corresponding n_{1i} value, press F-2 and go to step 3.

   If the just entered n_{1i} value is incorrect, when the display asks:

   ENTER N (2,i)?

   press F-2

   The P6060 will ask again for the n_{1i} value:

   ENTER N(1,i)?

2. Enter correct n_{1i} value and continue to enter data using F-1 (INPUT) operating procedure.

3. Again the display asks for the just entered y_i value:

   ENTER Y(i)?

4. Enter correct y_i value and continue to enter data using F-1 (INPUT) operating procedure.

5. IMMEDIATE CORRECTION

   If qualitative values are handled, the display asks:

   ENTER N (1,i)?

   Go to step 7.

   If numerical values are handled, the display asks:

ENTER Y(i)?

6. Enter correct y_i value

ENTER N(1,i)?

7. Enter correct n_{1i} value

ENTER N(2,i)?

8. Enter correct n_{2i} value

Corrected values printout

9. Continue to enter data using F-1 (INPUT) operating procedure

Sample Routine Run

See INPUT (F-1) and ADD (F-5) routines

MODIFY

F-3

Purpose

This routine provides the possibility of modifying data already stored on external data file.

Method

Each data group is identified by a sequential index number.
Note:
This feature is particularly useful for qualitative values because the correlation between the two variables can depend on the order of y-variable: see program sample run # 2 in which data were deliberately altered to decrease the proportion of alcoholics for one crime (stealing) and to increase the proportion for another crime (fraud).

Operating Procedure

1. Press F-3
   If numerical values of y are handled;

   F-3 DATA MODIFICATION FOR NUMERICAL VALUES OF Y

   If qualitative values of y are handled:

   F-3 DATA MODIFICATION FOR QUALITATIVE VALUES OF Y

   ENTER ROW OF GROUP TO MODIFY?

2. Enter index-number of data group to be modified

   OLD = old values NEW VALUES?

3. Handling numerical values, enter y_i, n_{1i}, n_{2i}; for qualitative values enter n_{1i} and n_{2i}.
   Data must be separated by a comma.

   Entered values and index-number printout

   ENTER ROW OF GROUP TO MODIFY?

4. Repeat steps 2 and 3 for a new correction.
   Press F-8 to stop corrections:

   SELECT ROUTINE ON F-KEY?

5. Press correct function key to choose an editing facility.

Press F-8 to have the results printout.

Error Messages

ERROR-INTEGER POSITIVE < = m.
The entered number of data group to be modified is incorrect.
Action: enter integer positive number less than or equal to the total number of stored data groups.

ERROR-INTEGER NON NEGATIVE ONLY
The entered n_{1i} or n_{2i} values are incorrect.
Action: enter only integer and non negative numbers.

ERROR-BOTH VALUES ARE ZERO
Both entered values n_{1i} and n_{2i} for qualitative values of y are zero: it is impossible to calculate p_i.
Action: re-enter both values (one of them, at least, must be integer positive).

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered.
Action: enter original data or select computation.

Sample Routine Run

```
                F-3  DATA MODIFICATION FOR NUMERICAL VALUES OF Y
                **********************************************

ORDER= 7        Y =  112.5      N1 =  7         N2 =  8
ORDER= 10       Y =  97.5       N1 =  9         N2 =  4
```

DELETE

F-4

Purpose

This routine provides the possibility of deleting data groups from external data file.

Operating Procedure

1. Press F-4

   If numerical values of y are handled :

   F-4 DATA DELETION FOR NUMERICAL VALUES OF Y

   If qualitative values of y are handled:

   F-4 DATA DELETION FOR QUALITATIVE VALUES OF Y

   ENTER ROW OF GROUP TO DELETE?

2. Enter index-number (row) of group to be deleted

   Group to be deleted printout:

   y_i, n_{1i} , n_{2i} for numerical values

   n_{1i} , n_{2i} for qualitative values.

   DELETE? ENTER 1 (YES), $\emptyset$ (NO)?

3. Enter 1 if you want to delete this data group; $\emptyset$ if not.

   If 1 is entered, the program prints the message:

   ...DELETED...

   In any case the display asks for a new data group:

   ENTER ROW OF GROUP TO DELETE?

4. Repeat steps 2 and 3 as many time as necessary.

   Press F-8 to stop data deletion:

   SELECT ROUTINE ON F-KEY?

5. Press correct function key to choose an editing facility.

   Press F-8 to have results printout.

Error Messages

ERROR-INT POSITIVE < = m

The entered index-number of data group to be deleted is incorrect.

Action: enter integer positive number less than or equal to the total number of stored data groups.

ERROR-ONLY 1 OR ∅

Only binary choice is available.

Action: enter 1 to delete the printed data group, ∅ if not.

ERROR:ONLY INTERMEDIATE STATISTICS STORED

It is impossible to update data, because only intermediate statistics were entered.

Action: enter original data or select computation.

Sample Routine Run

```
                F-4  DATA DELETION FOR NUMERICAL VALUES OF Y
                ********************************************

GROUP TO DELETE= 62.5  0  3
---DELETED---

GROUP TO DELETE= 77.5  0  4
GROUP TO DELETE= 72.5  0  5
---DELETED---

GROUP TO DELETE= 77.5  0  4
---DELETED---
```

ADD

F-5

Purpose

This routine provides the possibility of adding observations to those already stored, without loose them.

Operating Procedure

1. Press F-5

   If numerical values are handled:

   F-5 DATA ADDITION FOR NUMERICAL VALUES OF Y

   If qualitative values are handled:

   F-5 DATA ADDITION FOR QUALITATIVE VALUES OF Y

2. If there are k stored data groups, the display requests the next one:

   ENTER Y (k + 1)?

   for numerical values of y; or

   ENTER N(1, k + 1)?

   for qualitative values of y.

3. Enter data following the same operating procedure for INPUT routine (F-1).

Error Messages

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data, because only intermediate statistics were entered.
Action: enter original data or select computation.

Sample Routine Run

```
                F-5  DATA ADDITION FOR NUMERICAL VALUES OF Y
                **********************************************

 GROUP          Y              N1             N2

 14             77.5           0              4
 15             72.5           0              5
 16             62.5           0              3
```

INTERMEDIATE STATISTICS INPUT

F-6

Purpose This routine provides the possibility for entering directly intermediate statistics instead of the original data.

Method For description of intermediate statistics, see the "Method" section for INPUT (F-1) routine.

Operating Procedure

1. Press F-6

   DATA TYPE? 1 (NUMER), 2 (QUALITAT)?

2. Enter correct code for type of data:
   1 for numerical (quantitative) y-values; 2 for qualitative y-values

   If qualitative values are handled, the P6060 prints:

   F-6 INTERMEDIATE STATISTICS FOR QUALITATIVE VALUES OF Y

   If numerical values are handled, the P6060 prints:

   F-6 INTERMEDIATE STATISTICS FOR NUMERICAL VALUES OF Y

   ENTER # OF DATA GROUPS?

3. Enter total number of observations

   Entered value printout

   ENTER N(1,i) SUM?

4. Enter $N1 = \sum_i n_{1i}$

   N1 printout

   ENTER N(2,i) SUM?

5. Enter $N2 = \sum_i n_{2i}$

   N2 and N1 + N2 printout

   If numerical values of y are handled, go to step 7.

ENTER $\left(N\ (1,i) + N\ (2,i)\right) * k\ (i) \uparrow 2$ SUM?

6. Enter $\sum_i (n_{1i} + n_{2i})\ k_i^2$

Entered value printout

CORRECTION? ENTER 1 (YES), ∅ (NO)?
Go to step 11

7. ENTER N(1,i)* Y(i) SUM?

8. Enter $\sum_i n_{1i}\ y_i$

Entered value printout

ENTER N(2,i)*Y(i) SUM?

9. Enter $\sum_i n_{2i}\ y_i$

Entered value printout

ENTER (N (1,i) + N (2,i))* Y(i) ↑ 2 SUM?

10. Enter $\sum_i (n_{1i} + n_{2i})\ y_i^2$

Entered value printout

CORRECTION? ENTER 1 (YES), ∅ (NO)?

11. Enter 1 if you need correction: the P6060 returns you to step .
Enter ∅ is corrections are not required:

SELECT ROUTINE ON F-KEY?

12. Press correct function key to choose an editing facility.
Press F-8 to have the results printout.

Error Messages

ERROR-DATA TYPE? 1(NUMER), 2(QUALITAT)?
The entered data type is incorrect.
Action: enter 1 for numerical values of y ; enter 2 for qualitative values of y.

ERROR-INTEGER POSITIVE ONLY

The entered number of data groups is incorrect

Action: enter only integer and positive number.

ERROR-ONLY 1 OR ∅

Only binary choice is available.

Action: enter 1 for yes, ∅ for no.

Sample

Routine Run

```
                F-6  INTERMEDIATE STATISTICS FOR NUMERICAL VALUES OF Y
                **********************************************************

NUMBER OF DATA GROUPS          = 16
N(1,i) SUM                     = 63
N(2,i) SUM                     = 37
(N(1,i)+N(2,i)) SUM            = 100
N(1,i)*Y(i) SUM                = 6952.5
N(2,i)*Y(i) SUM                = 3142.5
(N(1,i)+N(2,i))*Y(i)↑2 SUM     = 1050375
```

PRINT

F-7

Purpose

This routine provides the possibility of printing original data (file DATA21) with their intermediate statistics.

Operating Procedure

1. Press F-7

   If numerical values were entered:

   ⬜ CONTENTS OF FILE DATA21 FOR NUMERICAL VALUES OF Y

   If qualitative values were entered:

   ⬜ CONTENTS OF FILE DATA21 FOR QUALITATIVE VALUES OF Y

   In any case:

   ⬜ number of groups, intermediate statistics and entered values printout

   ⬜ SELECT ROUTINE ON F-KEY?

2. Press correct function key to choose an editing facility.
   Press F-8 to have the results printout.

Sample Routine Run

```
                CONTENTS OF FILE DATA21 FOR NUMERICAL VALUES OF Y
                ************************************************

NUMBER OF GROUPS =  16
N1 SUM     =       63              N2 SUM          = 37
N1+N2 SUM  =       100             N1*Y SUM        = 6952.5
N2*Y  SUM  =       3142.5          (N1+N2)*Y↑2 SUM = 1050375

 GROUP             Y               N1              N2
 1                 147.5           1               0
 2                 137.5           1               0
 3                 132.5           3               0
 4                 127.5           4               0
 5                 122.5           6               0
 6                 117.5           10              0
 7                 112.5           7               0
 8                 107.5           8               1
 9                 102.5           5               1
 10                97.5            9               4
 11                92.5            6               7
 12                87.5            2               9
 13                82.5            1               3
 14                77.5            0               4
 15                72.5            0               5
 16                62.5            0               3
```

References

1. K. Pearson, Biometrika, vol. 9 - 1909

2. The Advanced theory of statistics, vol. II
Kendall and Stuart, Hafner Publishing, 1963, p. 307-310

3. Psycological Statistics
Mc. Nemar, p. 192.

CORRELATION RATIO

Purpose

This program calculates the correlation ratio which measures the correlation between two variables determined by using the column means of a correlation table. It is useful when the relationship between the two variables is slightly non-linear, to compare the correlation obtained by column means and, for instance, by using quadratic regression.

Method

Having data (x,y) grouped into k columns with running index i (x-variable) and r rows with running index j (y-variable) selecting the x and y values as class midvalues, one has the following type of table:

Class Midvalues	x_1	x_2	x_3	x_k
y_1	f_{11}	f_{21}		f_{k1}
y_2				
y_3	f_{13}			f_{k3}
⋮			f_{ij}	
y_r	f_{1r}			f_{kr}

table = 2

where:

f_{ij} is the number of items in the ij-th cells; k columns with running index i(x-variable); r rows with running index j (y-variable)

$n_i = \sum_j f_{ij}$ = columns total

$N = \sum_i n_i$ = grand total.

Since the correlation ratio is based on column means, each column should contain at least one non-zero cell, i.e., every x grouping should have some items in it: only the cells with $f_{ij} \neq 0$ will be entered for this program.

The actual value of y does not affect the value of the correlation ratio; therefore the y variable can be coded for simpler data entry: rather than

enter the class midvalues as described in the previous table, one can simply number the rows from 1 to r and enter these numbers in place of the class midvalues: of course, if y-values are coded computed mean and standard deviation will have no meaning.
To run this program, only one external data file must be defined, it has the fixed name DATA21.

Its minimum length is defined as:

$$\text{length} \geqslant 4*(10 + (2A + 1) *R);$$

where:
A = mean number of f_{ij} values $\neq \emptyset$ for each y-value;
R = number of rows (y-values).

Only limitation to the program is the defined file size.

Function Key Template

Looking at the template, you can have a clear idea on editing features this program provides.

INPUT	IMMEDIATE CORRECTION	MODIFY	DELETE	ADD	INTERMED STATISTICS INPUT	PRINT	RETURN

F-1 Input of a new sample data with recording on external data file

F-2 Correction of the last entered observation

F-3 Modify some observations in the stored sample

F-4 Delete observations from the stored sample

F-5 Add new observations to the stored sample

F-6 Input of intermediate statistics instead of original data

F-7 Printout of the stored observations and intermediate statistics

F-8 Terminate open-ended data entry, modifying,adding and deleting loops or computational loops and return to the main program sequence, or finish program execution.

Unless F-2 these function keys are available at any time during program execution when the prompting message SELECT ROUTINE ON F-KEY is displayed.

The program disables the not defined function keys ; if you press them, no action is made.

Operating Procedure

1. Ensure that the disk labelled: "Paired Data Analysis" is on drive 1.
2. Enter RUN *CORA and insert the appropriate template in the holder.

PAIRED DATA ANALYSIS

```
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PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
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```

```
*CORA      CORRELATION RATIO RUNNING
```

ENTER JOB #

3. Enter job #

JOB # entered value

```
ROUTINES AVAILABLE ON F-KEY
---------------------------
 F-1  ORIGINAL DATA INPUT
 F-2  IMMEDIATE CORRECTION
 F-3  DATA MODIFICATION
 F-4  DATA DELETION
 F-5  DATA ADDITION
 F-6  INTERMEDIATE STATISTICS INPUT
 F-7  DATA PRINTOUT
 F-8  RETURN

F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

SELECTING ACTIONS
-----------------
WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
ACTION ENTER 0 TO OBTAIN A PRINTED LIST
OF SUCH ACTIONS.
THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

ACTION? 1(COMPUTATION), 2(EDIT)?

4. Enter correct code: Ø to have the printout of possible choices;
   1 for computations;
   2 for editing features.

Press F-8 (RETURN) to stop program execution.

Entering ∅ the following message is printed out

```
AVAILABLE ACTIONS
-----------------
 1  COMPUTATION OF CORRELATION RATIO
 2  EDITING FACILITIES

PRESS F-8 TO STOP PROGRAM EXECUTION
```

and again the display asks:

ACTION? 1(COMPUTATION), 2(EDIT)?

Repeat step 4 for choice you desire.

Pressing F-8 (RETURN) , the message

END OF *CORA

appears and the P6060 prints:

END OF *CORA

returning to the COMMAND mode.

Selecting editing features, go to step 5.

If computations are selected:

CORRELATION RATIO

Results printout:

- number of (y,f) pairs
- mean on y
- standard deviation on y
- correlation ratio and its square.

The program continues with the next step for a new sample.

5. 

SELECT ROUTINE ON F-KEY?

6. Press correct function key to choose an editing routine (refer to the next pages for documentation).

Pressing F-8, the display asks:

ACTION? 1(COMPUTATION), 2 (EDIT)?

7. Repeat step 4 for correct choice.

Error Messages

ERROR-ACTION? 1(COMPUTATION), 2 (EDIT)?
The entered code for selection is incorrect.
Action: enter only 1 for computation, 2 for editing and ∅ to have the list of possible choices, or press F-8 to stop program execution.

ERROR-SELECT ROUTINE ON F-KEY?
Incorrect code by the keyboard is entered instead of pressing correct function key.
Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT
F-key ≠ 2 was pressed at non-input nor add stages.
Action: press correct function key.

ERROR: DATA FOR PROGRAM ≠ i
Stored data are not compatible with this program.
Action: enter correct data or run program ≠ i (call *HELP program for programs numbering).

Sample Program Run # 1

Data are taken from Ref. 1. Midvalues for y-classes are entered.

```
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*CORA     CORRELATION RATIO RUNNING

JOB # 8

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING ACTIONS
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                    ACTION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH ACTIONS.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

F-1 ORIGINAL DATA INPUT
****

	Y	F(Y)
COLUMN = 1		
	262.5	1
COLUMN = 2		
	262.5	1
	187.5	11

IMMEDIATE CORRECTION : ENTER THE WHOLE COLUMN AGAIN

COLUMN = 2		
	262.5	1
	187.5	1
COLUMN = 3		
	162.5	1
COLUMN = 4		
	187.5	1
	137.5	3
COLUMN = 5		
	187.5	1
	162.5	1
	137.5	4
	112.5	1
COLUMN = 6		
	137.5	3
	112.5	7
	87.5	2
COLUMN = 7		
	162.5	1
	137.5	2
	112.5	7
	87.5	4
COLUMN = 8		
	137.5	4
	112.5	8
	87.5	10
COLUMN = 9		
	137.5	1
	112.5	5
	87.5	14
	62.5	3
	37.5	1
COLUMN = 10		
	112.5	1
	87.5	3
	62.5	3
COLUMN = 11		
	112.5	2
	87.5	1
	62.5	4
COLUMN = 12		
	112.5	1
	37.5	1

F-7 CONTENTS OF FILE DATA21
****

NUMBER OF COLUMNS = 12 GRAND TOTAL 103
F(i,j)*Y(i,j) TOTAL SUM = 11187.5
((F(i,j)*Y(i,j))↑2/N(i)) SUM = 1307719.2
F(i,j)*Y(i,j)*Y(i,j) SUM = 1351093.8

	Y	F(Y)
COLUMN = 1		
	262.5	1
COLUMN = 2		
	262.5	1
	187.5	1
COLUMN = 3		
	162.5	1
COLUMN = 4		
	187.5	1
	137.5	3
COLUMN = 5		
	187.5	1
	162.5	1
	137.5	4
	112.5	1
COLUMN = 6		
	137.5	3
	112.5	7
	87.5	2
COLUMN = 7		
	162.5	1
	137.5	2
	112.5	7
	87.5	4
COLUMN = 8		
	137.5	4
	112.5	8
	87.5	10
COLUMN = 9		
	137.5	1
	112.5	5
	87.5	14
	62.5	3
	37.5	1
COLUMN = 10		
	112.5	1
	87.5	3
	62.5	3
COLUMN = 11		
	112.5	2
	87.5	1
	62.5	4
COLUMN = 12		
	112.5	1
	37.5	1

```
          CORRELATION RATIO
          *****************

NUMBER OF PAIRS          = 103
MEAN ON Y                = 108.61650
STANDARD DEVIATION ON Y = 36.507668
CORRELATION RATIO ↑2     = .68094389
CORRELATION RATIO        = .82519324
```

```
                    END OF *CORA
```

Sample Program Run # 2

The same data as before were used here but the y-values are coded: mean and standard deviation have not meaning

```
Olivetti P6060 STATISTICAL ANALYSIS SERIES
PAIRED DATA ANALYSIS - Code M2400255
Release 1 - Level 0    September 1976
Copyright 1976, by Olivetti


 *CORA      CORRELATION RATIO RUNNING


JOB # 9

                    ROUTINES AVAILABLE ON F-KEY
                    ---------------------------
                     F-1  ORIGINAL DATA INPUT
                     F-2  IMMEDIATE CORRECTION
                     F-3  DATA MODIFICATION
                     F-4  DATA DELETION
                     F-5  DATA ADDITION
                     F-6  INTERMEDIATE STATISTICS INPUT
                     F-7  DATA PRINTOUT
                     F-8  RETURN

                    F-2 DEFINED ONLY DURING INPUT AND ADDING STAGES.

                    SELECTING ACTIONS
                    -----------------
                    WHEN THE DISPLAY PROMPTS YOU TO SELECT AN
                    ACTION ENTER 0 TO OBTAIN A PRINTED LIST
                    OF SUCH ACTIONS.
                    THEN ENTER THE NUMBER OF THE CHOICE DESIRED.
```

F-1 ORIGINAL DATA INPUT
****

	Y	F(Y)
COLUMN = 1		
	10	1
COLUMN = 2		
	10	1
	7	1
COLUMN = 3		
	6	1
COLUMN = 4		
	7	1
	5	3
COLUMN = 5		
	7	1
	6	1
	5	4
	4	1
COLUMN = 6		
	5	3
	4	7
	3	2
COLUMN = 7		
	6	1
	5	2
	4	7
	3	4
COLUMN = 8		
	5	4
	4	8
	3	10
COLUMN = 9		
	5	1
	4	5
	3	14
	2	3
	1	1
COLUMN = 10		
	4	1
	3	3
	2	3
COLUMN = 11		
	4	2
	3	1
	2	4
COLUMN = 12		
	4	1
	1	1

```
          CORRELATION RATIO
          *****************

NUMBER OF PAIRS          = 103
MEAN ON Y                = 3.8446602
STANDARD DEVIATION ON Y = 1.4603067
CORRELATION RATIO ↑2     = .68094389
CORRELATION RATIO        = .82519324
```

Intermediate statistics (data from sample run # 1) are now entered directly

```
                F-6  INTERMEDIATE STATISTICS INPUT
                ***********************************

NUMBER OF COLUMNS                =  12
GRAND TOTAL                      =  103
F(i,j)*Y(i,j) TOTAL SUM          =  11187.5
((F(i,j)*Y(i,j))↑2/N(i)) SUM     =  1307719.2
F(i,j)*Y(i,j)*Y(i,j) SUM         =  1351093.8
```

```
          CORRELATION RATIO
          *****************

NUMBER OF PAIRS          = 103
MEAN ON Y                = 108.61650
STANDARD DEVIATION ON Y = 36.507675
CORRELATION RATIO ↑2     = .68094396
CORRELATION RATIO        = .82519329
```

```
                END OF *CORR
```

INPUT

F-1

Purpose

This routines provides the possibility to enter a new sample by the keyboard, storing data on external data file.
The y variable may be grouped in r rows and the x variable must be grouped into k columns ($k>1$): see description in the "Method" section.
Data are entered by column: for each row with a non-zero cell ($f_{ij} > 0$) enter the y-class midvalue (or its coded value) and the corresponding f_{ij}.

Method

The data are grouped into

k columns with running index i and

r rows with running index j.

Let:

f_{ij} = number of items in the ij-th cell

$n_i = \sum_i f_{ij}$ i-th column total

$N = \sum_{i=1}^{k} n_i$ grand total.

The following intermediate statistics are computed:

$$\sum_i \sum_j f_{ij}\, y_j \;;$$

$$\sum_i \left[\left(\sum_j f_{ij}\, y_j \right)^2 / n_i \right]$$

$$\sum_i \left(\sum_j f_{ij}\, y_j^2 \right).$$

Entering a new sample data by the keyboard, the last one is lost, but one can form permanent data archives. For more details, see Appendix A "Installation and Maintenance".

Note:

The display requires for entering Y(i,j) because in this way also the column you are entering is emphasized.

Operating Procedure

1. Press F-1

F-1 ORIGINAL DATA INPUT

For i = 1, j = 1 the display asks:

ENTER Y (i,j)?

2. Enter the first item (y-value) for the i-th column with $f_{ij} > 0$

ENTER F(i,j)?

3. Enter the correspondent frequency
   For j = j + 1 (next item in the present column), the display asks:

ENTER Y (i,j)?

4. Repeat step 2 for the next item in the i-th column
   To stop input for the present i-th column, press F-8:

Entered column values and index printout

For i = i + 1, j = 1 (first item in the next column) the display asks:

ENTER Y (i,j)?

5. Repeat steps 2, 3 and 4 for all columns to be entered.
   To stop input routine, press F-8.

Intermediate statistics are stored or external data file

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-ENTER F(i,j)?
F-key # 8 was pressed at non-correct stage , i.e. when the display asks for the frequency-value.
Action: enter frequency value.

ERROR-INTEGER NON NEGATIVE
The entered frequency value is non integer or negative value.
Action: enter only integer, non negative value.

END OF FILE DATA21, LAST DATA COLUMN NOT RECORDED
The external data file is full: last entered column is not recorded. Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-key # 5).

NO STORED DATA.

No data were entered after F-1 (input) selection.

Action: Select editing routine pressing correct function key.

ERROR-ENTER Y (i,1)?

The F-key # 2 (immediate correction) has been used incorrectly.

Action: continue to enter data in the i-th column and correct the old column, if necessary, using MODIFY (F-3) capability.

Sample

Routine Run

```
                    F-1  ORIGINAL DATA INPUT
                    **********************

                       Y                F(Y)

COLUMN = 1
                     262.5               1
COLUMN = 2
                     262.5               1
                     187.5               1
COLUMN = 3
                     162.5               1
COLUMN =.4
                     187.5               10
                     137.5               3

IMMEDIATE CORRECTION : ENTER THE WHOLE COLUMN AGAIN

COLUMN = 4
                     187.5               1
                     137.5               3
COLUMN = 5
                     187.5               1
                     162.5               1
                     137.5               4
                     112.5               1
COLUMN = 6
                     105                 3
                     112.5               7
                     875                 2
COLUMN = 7
                     162.5               1
                     137.5               2
                     112.5               7
                     87.5                4
COLUMN = 8
                     137.5               4
                     112.5               8
                     87.5                10
                     137.5               1
COLUMN = 9
                     137.5               1
                     112.5               5
                     87.5                14
                     62.5                3
                     37.5                1
COLUMN = 10
                     112.5               1
                     87.5                3
                     62.5                3
```

IMMEDIATE CORRECTION

F-2

Purpose

This routine, available only at the input and adding stages, provides the correction of the :

- last entered column
- last entered y-value
- last entered pair (y,f) in the present column.

Operating Procedure

1. If the first y-value of the(i+1)-th column is required by the program and you need corrections for the last entered (and printed) i-th column, press F-2 and go to step 5.

   If the just entered y-value is incorrect, when the display requires the corresponding frequency, press F-2 and go to step 3.

   If the j-th just entered pair (y,f) in the i-th column is incorrect, when the display asks :

   ENTER Y (i,j + 1)?

   press F-2.

   The P6060 will ask again for the j-th y-value

   ENTER Y (i,j)?

2. Enter correct y_{ij} value and continue to enter data using F-1 (INPUT) operating procedure.

3. Again the display asks for the just entered y-value:

   ENTER Y (i,j)?

4. Enter correct value y_{ij} and continue to enter data using F-1 (INPUT) operating procedure.

5. IMMEDIATE CORRECTION : ENTER THE WHOLE COLUMN AGAIN

   The display asks the first y-value in the previous i-th column.

6. Enter the complete i-th column again and continue to enter data using F-1 (INPUT) operating procedure.

Sample Routine Run

See INPUT (F-1) and ADD (F-5) routines.

MODIFY

F-3

Purpose

This routine provides the possibility of modifying data already stored on external data file.

Method

Each data column is identified by a sequential index number.

Note:
only modifieation of some values is possible: if you need to add new data to some columns or to delete some data, use DELETE (F-4) and ADD (F-5) capabilities.

Operating Procedure

1. Press F-3

   F-3 DATA MODIFICATION
   IF LENGTH OF NEW COLUMN IS DIFFERENT THAN LENGTH OF OLD ONE :
   DELETE OLD COLUMN (F-4) AND ADD NEW ONE (F-5)

   ENTER # OF COLUMN TO MODIFY?

2. Enter index-number of column to be modified

   Column to be modified printout

   ENTER Y (1) AND F(1)?

3. Enter the first correct pair (y,f)

   Entered values printout

   ENTER Y(2) and F(2)?

4. Repeat step 3 for all pairs contained in this column.
   At the end:

   ENTER # OF COLUMN TO MODIFY?

5. Repeat step 2 for a new correction.
   To stop corrections, press F-8.

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE < = k.
The entered number of column to be modified is incorrect.

Action: enter integer positive number less than or equal to the total number of stored data columns.

ERROR: ONLY INTERMEDIATE STATISTICS ARE STORED
It is impossible to update data because only intermediate statistics were entered.
Action: enter original data or select computation.

Sample

Routine Run

```
                F-3  DATA MODIFICATION
                **********************

IF LENGTH OF NEW COLUMN IS DIFFERENT THAN LENGTH OF OLD ONE:
DELETE OLD COLUMN (F-4) AND ADD NEW ONE (F-5).

*** GROUP TO MODIFY ***

105             3
112.5           7
875             2

137.5           3
112.5           7
87.5            2
```

DELETE

F-4

Purpose

This routine provides the possibility of deleting data columns from external data file.

Operating Procedure

1. Press F-4

   F-4 DATA DELETION

   ENTER # OF COLUMN TO DELETE?

2. Enter index-number of column to be deleted

   Values and index of the column to be deleted printout

   DELETE? ENTER 1(YES), ∅ (NO)?

3. Enter 1 if you want to delete this data column, ∅ if not.
   If 1 is entered, the program prints the message:

   ...DELETED...

   In any case the display asks for a new data column.

   ENTER # OF COLUMN TO DELETE?

4. Repeat steps 2 and 3 as many time as necessary.
   Press F-8 to stop this routine.

   SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-INT POSITIVE $< = k$
The entered number of column to be deleted is incorrect.
Action: enter integer positive number less than or equal to the total number of stored data columns (k).

ERROR-ONLY 1 OR ∅
Only binary choice is available.
Action: enter 1 to delete the printed data column, ∅ if not.

ERROR:ONLY INTERMEDIATE STATISTICS ARE STORED
It is impossible to update data, because only intermediate statistics were entered.

Action: enter original data or select computation.

Sample

Routine Run

```
                    F-4  DATA DELETION
                    ******************

COLUMN TO DELETE = 3
 137.5              4
 112.5              8
 87.5               10
 137.5              1
---DELETED---
```

ADD

F-5

Purpose This routine provides the possibility of adding observations to those already stored, without loose them.

Operating Procedure

1. Press F-5

F-5 DATA ADDITION

2. If there are k stored data columns, the display requests the next one:

ENTER Y(k+1,1)?

3. Enter data following the same operating procedure for INPUT routine (F-1)

Error Messages

ERROR:ONLY INTERMEDIATE STATISTICS ARE STORED
It is impossible to update data because only intermediate statistics were entered.
Action: enter original data or select computation.

Sample Routine Run

```
                F-5  DATA ADDITION
                ******************

COLUMN = 10
                    137.5           4
                    112.5           8
                    87.5            10
COLUMN = 11
                    112.5           2
                    87.5            1
                    62.5            4
COLUMN = 12
                    112.5           1
                    37.5            1
```

INTERMEDIATE STATISTICS INPUT

F-6

Purpose

This routine provides the possibility for entering directly intermediate statistics instead of the original data.

Method

For description of intermediate statistics, see the "Method" section for ORIGINAL DATA INPUT (F-1).

Operating Procedure

1. Press F-6

F-6 INTERMEDIATE STATISTICS INPUT

ENTER # OF COLUMNS?

2. Enter number of columns

Entered value printout

ENTER GRAND TOTAL?

3. Enter $N = \sum_i n_i$, grand total

Entered value printout

ENTER F(i,j)*Y(i,j)TOTAL SUM?

4. Enter $\sum_i \left(\sum_j f_{ij}\, y_{ij} \right)$

Entered value printout

ENTER (F(i,j)*Y(i,j) ↑ 2/N(i) SUM?

5. Enter $\sum_i \left(\sum_j f_{ij}\, y_{ij}^2 / n_i \right)$

Entered value printout

ENTER F(i,j)*Y(i,j)*Y(i,j) SUM?

6. Enter $\sum_i \sum_j f_{ij}\, y_{ij}^2$

Entered value printout

CORRECTION? ENTER 1(YES), ∅ (NO)?

7. Enter 1 if you need corrections: the P6060 returns you to step 2.
   Enter ∅ if corrections are not required:

SELECT ROUTINE ON F-KEY?

Error Messages

ERROR-ONLY 1 OR ∅

Only binary choice is available.

Action: enter 1 for yes, ∅ for no.

ERROR-INTEGER POSITIVE ONLY

The entered number of columns or the grand total is incorrect.

Action: enter only integer and positive number.

Sample Routine Run

```
                F-6  INTERMEDIATE STATISTICS INPUT
                **********************************

NUMBER OF COLUMNS                 =  12
GRAND TOTAL                       =  103
F(i,j)*Y(i,j) TOTAL SUM           =  11187.5
(F(i,j)*Y(i,j))↑2/N(i)) SUM       =  1307719.2
F(i,j)*Y(i,j)*Y(i,j) SUM          =  1351093.8
```

PRINT

F-7

Purpose

This routine provides the possibility of printing original data (file DATA21) with their intermediate statistics.

Operating Procedure

1. Press F-7

F-7 CONTENTS OF FILE DATA21

Number of columns, grand total, intermediate statistics, and entered data printout

ACTION? 1(COMPUTATION), 2 (EDIT)?

2. Refer to the main procedure for selection:

ø to have the list of possible choices,

1 to select correlation ratio computation,

2 to select editing possibilities,

F-8 to stop program execution.

Sample Routine Run

```
                    F-7  CONTENTS OF FILE DATA21
                    ***************************

NUMBER OF COLUMNS                    12              GRAND TOTAL      103
F(i,j)*Y(i,j) TOTAL SUM          =   11187.5
((F(i,j)*Y(i,j))12/N(i)) SUM     =   1307719.2
F(i,j)*Y(i,j)*Y(i,j) SUM         =   1351093.8

                      Y                F(Y)

COLUMN = 1
                    262.5              1
COLUMN = 2
                    262.5              1
                    187.5              1
COLUMN = 3                             .
                    162.5              1
COLUMN = 4
                    187.5              1
                    137.5              3
COLUMN = 5
                    187.5              1
                    162.5              1
                    137.5              4
                    112.5              1
COLUMN = 6
                    137.5              3
                    112.5              7
                    87.5               2
COLUMN = 7
                    162.5              1
                    137.5              2
                    112.5              7
                    87.5               4
```

COLUMN = 8		
	137.5	1
	112.5	5
	87.5	14
	62.5	3
	37.5	1
COLUMN = 9		
	112.5	1
	87.5	2
	62.5	3
COLUMN = 10		
	137.5	4
	112.5	8
	87.5	10
COLUMN = 11		
	112.5	2
	87.5	1
	62.5	4
COLUMN = 12		
	112.5	1
	37.5	1

References

1. Applied General Statistics, 3rd Edition
F. Croxton, D. Cowden and S. Klein
Prentice-Hall, Englewood Cliffs, N.Y, 1967, p. 451.

INSTALLATION AND MAINTENANCE

A.1. INSTALLATION

Your package will ordinarily be supplied to you in the form of user disk which can be found in a plastic holder inserted into the User's Manual for your package. In order to use the package be sure that the operating system is present on drive 2 of the floppy disk unit (lower).

Then insert the user disk into drive 1 and follow the procedure described under How to begin (p. 1.5 of this manual).

This package does not require the presence of the options (MAT, STR).
Minimum system requirements: 16 K user memory size, dual drive floppy disk unit.

Obtaining a File Catalog for your Package

1) Any time the system is in Command mode, you can obtain the File Catalog for your Package entering CAT u,:,,F (END OF LINE)

2. The result should the listing shown here:

```
CAT U,:,,F
  * R E L E A S E  1.1  *

  *** PACKAGE  LIBRARY  ***
FILE    TYPE  CREAT   LAST MOD  MAX SIZE  USED SIZE  CODE NUMBER

*OLX999  S   010976   010976    256        40         M2400201
*HELP    P   010976   010976    10880      10880      M2400201
*COMP3   P   010976   010976    9984       9984       M2400201
*COMP    P   010976   010976    2048       2048       M2400201
*COMP2   P   010976   010976    5888       5888       M2400201
*COMP1   P   010976   010976    6400       6400       M2400201
*CORA    P   010976   010976    10368      10368      M2400201
*BICO2   P   010976   010976    7168       7168       M2400201
*BICO1   P   010976   010976    7424       7424       M2400201
*BICO    P   010976   010976    5376       5376       M2400201
*SLRM3   P   010976   010976    7552       7552       M2400201
*SLRM2   P   010976   010976    7424       7424       M2400201
*SLRM1   P   010976   010976    8576       8576       M2400201
*SLRM    P   010976   010976    12672      12672      M2400201
*SLRS3   P   010976   010976    10112      10112      M2400201
*SORT    P   010976   010976    1280       1280       M2400201
*SLRS2   P   010976   010976    8960       8960       M2400201
*SLRS1   P   010976   010976    8704       8704       M2400201
*WORK    R   010976   010976    128        128        M2400201
*SLRS    P   010976   010976    10496      10496      M2400201

  ***  COMMON  LIBRARY  ***
FILE    TYPE  CREAT   LAST MOD  MAX SIZE  USED SIZE  CODE NUMBER


  ***  USER'S  LIBRARY  ***
FILE    TYPE  CREAT   LAST MOD  MAX SIZE  USED SIZE  CODE NUMBER

DATA23  R   010976   010976    10112      10112
DATA21  R   010976   010976    4096       4096
DATA22  R   010976   010976    8192       8192
```

Note that data files and program files not normally accessible to the operator are shown as well as those for operator use. Use this catalog listing simply to verify that your copy of the package is correct.
To access programs in the package follow the procedures outlined in the Introduction of this manual.
Attention must be paid to the fact that the random external data files with fixed names DATA21, DATA22, DATA23 are already existent.
If not, they must be created using the following system command:

CREATE U, XXXX, R, length

where:

XXXX is the external data filename;

length is the length (see each program description to define the minimum length).

This procedure must be repeated if data files already defined are lost for some incorrect action. The first action, now, should be on input routine (F-1 key).

A.2. MAINTENANCE

- If the external data file one defined at the begin is not large enough to enter a new and greater sample data, it is possible to increase the file size using the command:

  MODIFY, XXXX, n

  where XXXX is the filename (DATA21, DATA22 or DATA 23) and n will be the new length of the external data file (see General Reference Manual for possible errors in this operation).

- When a new sample data is entered by the keyboard, the old data are lost: one can save them to form permanent data archives using the utility FLCOPY.

  The command has the form:

  EXEC FLCOPY, IN = USLIB, XXXX, OUT = USLIB, filedata
  where "filedata" is the new name defined by the user.

  The P6060 requires loading of another user disk taking the place of the system disk. This user disk will contain the permanent file.

- The following, procedure will permit a new utilization of data stored in the archive:

  1. Insert user disk containing the package and enter the system command:

     PUR XXXX

     (XXXX = DATA21 or DATA22)

2. Enter the command:

   DCH U

3. Remove the user disk and insert the disk containing the archive data

4. Press CONTINUE

5. Enter the command:

   EXEC FLCOPY, IN = USLIB, filedata, OUT = XXXX

6. When the system prompts you to insert the disk, take off the system disk and insert the user disk containing the package and press CONTINUE

7. When the copy is made a message will appear: take off the archive and insert the system disk and press CONTINUE.

Data and programs are now available for execution.

- Use and length of file DATA23

The random external data file DATA23 is used by *SLRS and *SLRM programs to store (x,y) pairs determined by the fitted curve parameters: they are at the user's disposal.

The file length is defined as:

length $\geq 4(99 + 4 * N) + 28$

where:

N is the number of (x,y) pairs to be stored.

The structure is described below:

words 1 ÷ 99 are at the user's disposal

word 100 contains the number of (x,y) pairs stored (single precision)

words 101-102 starting point X_0 (double precision)

words 103-104 end point X_M (double precision)

words 105-106 step Δx (double precision)

words 107-108 first x value (double precision)

words 109-110 first y calculated value (double precision)

All (x,y) pairs follow.

CUSTOMIZATION

Possible customizations for each program are listed below: generally they are intended to increase the program capacity.

The general procedure to change some statements is:

1. press the OLD key and enter the filename

2. press the FETCH key and enter the interested line number

3. enter modifications you desire, as described in the next pages.

If you are interested to save these modifications for future use, enter the command

PRE[PARE]

When on the display will appear "PROGRAM filename READY TO RUN" press the BREAK key and enter the command

REP[LACE]

The program now is ready to run with the new specified parameters.

Important — If the changement must be introduced in programs not normally accessible to the user with the command RUN, the procedure with PREPARE and REPLACE must be used.

*SLRS — If (x,y) pairs are not ordered in increasing numerical x-value, the statement:

```
90 DIM A (2000)
```

in the *SORT module can be modified following the general rule:

```
90 DIM A (2 * N)
```

where N is the total number of stored pairs (x,y)
ex: having 1500 pairs it must be changed:

```
90 DIM A (3000).
```

The criterion for presence of outliers is parametrically defined as 0.05 (95% level).
The corresponding statement is contained in the *SLRS2 module:

```
70 LET W1 = 0.05
```

Desiring the criterion 0.01 (99% level) it must be changed:

```
70 LET W1 = 0.01
```

*SLRM Only possible customizations concern statements image.

*SLRM1

The statement

```
90:Q(T,N-2) =                                    # #.  # # # #
```

is used for the printout of significance test of the slope and of an (x,y) pair.

*SLRM2

The statement

```
90:PROBABILITY OF OCCURRENCE OF F  =     # # . # # # #
```

is used in the test for linearity.

*SLRM3

The statement

```
90:Q(T,N-2)  =                                   # #  . # # # #
```

is used for zero correlation;

The statement

```
100:Q(u)  =                                      # # . # # # # # #
```

is used for significance test for any correlation and for comparison of two correlation coefficients.

*COMP In default of any different willing of the user, this program handles up to 20 samples for comparisons.
This maximum number may be increased doing different assignements and dimensions (and equal in each module) to the following statements:

in the *COMP1 module:

```
 90 DIM T (20)
100 LET T1=20
```

in the *COMP2 module:

```
 90 DIM T (20), D(20)
100 LET T1=20
```

in the *COMP3 module:

```
 90 DIM T (20)
100 LET T1=20
```

ex: having 30 samples data to compare, the parameter T1 will become T1 = 30 in each module and dimensions will be defined as :
DIM (T) = DIM (D) = T1 = 30

PROGRAM ERROR MESSAGES

*SLRS

ERROR-ACTION? 1(COMPUTATION), 2 (EDIT)
ERROR-SELECT OPTION (1-6)?
Incorrect code for option or action selection is entered.
Action: enter correct code by keyboard.

ERROR-SELECT ROUTINE ON F-KEY
Function key selection was made incorrectly by entering a number by the keyboard.
Action: press correct function key.

F-2 DEFINED ONLY DURING INPUT
Funtion key # 2 is pressed at non-input nor add stages.
Action: press correct function key.

ERROR: DATA FOR PROGRAM = i
Stored data are not compatible with this program.
(Call *HELP program for programs numbering).
Action: run compatible program or enter correct data using INPUT routine (F-1).

ERROR-SELECT TRANSFORMATION (1-6)
Incorrect code for transformation is entered
Action:enter only integer numbers from 1 to 6.

ERROR-SELECT TEST (1, 2, 3, 4)
Incorrect code for tests on correlation coefficient is entered.
Action: enter only integer numbers from 1 to 4.

ERROR-ENTER CONFIDENCE LEVEL
Entered confidence level is incorrect.
Action: enter only positive number less than 100 (ex: 95 for 95% level).

ERROR - $|R|<1$
The entered correlation coefficient is wrong.
Action: enter only values greater than -1 and less than +1 .

ERROR-INTEGER POSITIVE ONLY
The entered sample size is incorrect
Action: enter only integer, positive value.

ERROR- ONLY 1 OR ∅
Only binary choice is available.
Action: Enter 1 for yes, ∅ for no

ERROR IN ENTERING PARAMETERS
Entering parameters for tabulation, the minimum x value is greater than or equal to the maximum x value.
Action: enter again x minumum and x maximum (x minimum < x maximum).

ERROR-POSITIVE ONLY
Entering step for tabulation, the entered increment is null or negative .
Action: enter only positive value.

ONLY INTERMEDIATE STATISTICS ARE STORED
Only intermediate statistics were entered: options 1, 3 and 4 cannot be executed.
Action: select compatible options..

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered.

END OF FILE DATA21, LAST OBSERVATION NOT RECORDED
The external data file is full: last entered observation is not recorded. Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-key # 5)

ERROR-INT POSITIVE < = n
The entered index-number of the observation to be modified or deleted is wrong.
Action: enter only integer, positive number less than or equal to the number of stored observations.

ERROR-INTEGER POSITIVE ONLY
Entering number of observations, an error is made.
Action: enter only integer and positive number.

ERROR-POSITIVE ONLY
The entered value Σx_i^2 or Σy_i^2 is incorrect.
Action: enter only positive number.

ERROR-ONLY 1(DATA2i), 2(DATA22).
Incorrect choice for file designator.
Action: enter 1 for external data file DATA21; enter 2 for external file DATA22.

*SLRM

ERROR-ACTION? 1(COMPUTATION), 2 (EDIT)
ERROR-SELECT OPTION (1-4)
Incorrect code for option or action selection is entered.
Action: enter correct code by the keyboard.

ERROR-SELECT ROUTINE ON F-KEY
Function key selection was made incorrectly by entering a number by the keyboard.
Action: press correct function key.

F-2 DEFINED ONLY DURING INPUT
Function key = 2 is pressed at non-input nor add stages .
Action: press correct function key or enter correct code for option selection.

ERROR: DATA FOR PROGRAM # i
Stored data are not compatible with this program
(call *HELP program for programs numbering)
Action: run compatible program, or enter correct data using INPUT routine (F-1).

ERROR-SELECT TRANSFORMATION (1-6)
Incorrect code for transformation is entered.
Action: enter only integer numbers from 1 to 6.

ERROR-SELECT TEST (1, 2, 3, 4)
Incorrect code for tests on correlation coefficient is entered.
Action: enter only integer numbers from 1 to 4.

ERROR-ENTER CONFIDENCE LEVEL
Entered confidence level is incorrect.
Action: enter only positive number less than 100 (ex. 95 for 95% level).

ERROR IN ENTERING PARAMETERS

Entering parameters for tabulation, the minimum x value is greater than or equal to the maximum x value.

Action: enter again x minimum and x maximum (x minimum < x maximum).

ERROR-POSITIVE ONLY

Entering step for tabulation, the entered increment is null or negative.

Action: enter only positive value.

ERROR-INTEGER POSITIVE ONLY

The entered sample size is incorrect.

Action: enter integer, positive value.

ERROR- $|R|<1$

The entered correlation coefficient is incorrect.

Action: only values greater than -1 and less than +1 must be entered.

ERROR-ONLY 1 OR $\emptyset$

Only binary choice is available.

Action: enter 1 for yes, $\emptyset$ for no.

END OF DATA21, LAST DATA GROUP NOT RECORDED

The external data file is full : data group that you are entering is not recorded, the program stops execution. .

Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-Key # 5).

ERROR-ONLY 1, 2, 3.

The entered action is illegal.

Only 1 (addition), 2 (modification), or 3 (deletion) are available.

Action: enter only 1, 2, or 3.

ERROR-INT POSITIVE <= k

Non positive or non integer number or greater than k (number of values for the present observation) is entered to identify the value to be corrected or deleted.

Action: enter integer, positive number less than or equal to the observation size.

ERROR-INT POSITIVE <= n

The number of data group to be deleted or modified is incorrect.

Action: enter integer positive number less than or equal to the number of stored data groups.

ERROR: ONLY INTERMEDIATE STATISTICS STORED
It is impossible to update data because only intermediate statistics were entered.

ERROR-INTEGER POSITIVE ONLY
Entering number of observations or total number of y values an error is made.
Action: enter only integer and positive number.

ERROR-ONLY 1(DATA21), 2(DATA 22)
Incorrect choice for file designator.
Action: enter 1 for external file DATA21, enter 2 for external file DATA22.

*COMP

ERROR-ACTION?1(COMPUTATION), 2 (EDIT)
The entered code for selection is incorrect.
Action: enter 1 for computation, 2 for editing and ∅ to have the list of possible choices; or press F-8 to stop program execution.

ERROR-ENTER 1(REGRES.), 2(COMPARISON)?
The entered code for selection is incorrect.
Action: enter 1 for regression analysis of the last entered sample, 2 for comparison routine and ∅ to have the list of possible choices.

ERROR-SELECT ROUTINE ON F-KEY?
Incorrect code by the keyboard is entered instead of pressing correct function key.
Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT
F-key # 2 was pressed at non-input nor add stages.
Action: press correct function key.

ERROR: DATA FOR PROGRAM # i
Stored data are not compatible with this program.
Action: enter correct data or run program # i (call *HELP program for programs numbering). Program execution stops.

END OF FILE DATA22, LAST SAMPLE NOT RECORDED FOR COMPARISON.
The external data file is full; last entered sample is not stored for future comparison.

Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and repeat regression analysis computation for the just correctly entered sample to have its recording for future comparisons.

NO STORED SAMPLES FOR COMPARISONS
No samples stored for comparisons.
Action: enter samples by the keyboard and select regression analysis computation.

ERROR-INT POSITIVE <= k
The entered index-number identifying the sample is not correct.
Action: enter integer positive number less than or equal to k, the maximum number of samples it is possible to compare.

SAMPLE # i DOES NOT EXIST
The entered index-number of a sample for comparison corresponds to a non-existent sample in the DATA22 file.
Action: enter correct and existent sample-number.

SAMPLE # i ALREADY SELECTED
The entered index-number of a sample for comparison was already selected for the present comparison.
Action: enter samples not selected up to now.

ERROR-ENTER Y(i)?
F-key # 8 is pressed at incorrect stage: i.e. when the display requires the y-value.
Action: enter correct y-value.

ERROR-ENTER X(1)?
F-key # 2 is pressed when the program requires the first x-values(for the first x, y pair).
Action: enter correct x-value.

END OF FILE DATA21, LAST DATA PAIR NOT RECORDED
The external data file is full: last entered pair is not recorded. Program execution stops.
Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-key # 5).

ERROR-INTEGER POSITIVE < = N

The entered index-number of the pair to be modified or deleted is incorrect.

Action: enter integer positive number less than or equal to the total number of stored pairs (N).

ERROR: ONLY INTERMEDIATE STATISTICS STORED

It is impossible to update data because only intermediate statistics were entered.

Action: enter original data or select computations

ERROR-ONLY 1 OR Ø

Only binary choice is available.

Action: enter 1 for yes, Ø for no.

ERROR-INTEGER POSITIVE ONLY

The entered number of observations is incorrect.

Action: enter integer positive number only.

ERROR-POSITIVE ONLY

Entered value $\sum_i x_i^2$ or $\sum_i y_i^2$ is incorrect

Action: enter only positive numbers.

ERROR-ONLY 1(DATA21), 2(DATA22)

The entered file designator is incorrect.

Action: enter only 1 for DATA21, and 2 for DATA22.

*BICO

ERROR-ACTION? 1(COMPUTATION), 2 (EDIT)?

This entered code for selection is incorrect.

Action: enter 1 for computation, 2 for editing and Ø to have the list of possible choices, or press F-8 to stop program execution.

ERROR-SELECT ROUTINE ON F-KEY?

Incorrect code by the keyboard is entered instead of pressing correct function key.

Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT

F-key # 2 was pressed at non-input nor add stages.

Action: press correct function key.

ERROR: DATA FOR PROGRAM # i

Stored data are not compatible with this program.

Action: enter correct data or run program # i

(call *HELP program for programs numbering).

ERROR:ONLY INTERMEDIATE STATISTICS STORED

It is impossible to update data because only intermediate statistics were entered.

Action: enter original data or select computation.

ERROR-DATA TYPE? 1(NUMER), 2(QUALITAT)?

The entered data type is incorrect.

Action: enter 1 for numerical values of y; enter 2 for qualitative values of y.

ERROR-ENTER N(2,i)?

ERROR-ENTER N(1,i)?

F-key # 8 was pressed at incorrect stage: i.e., when the display requires n_{1i} or n_{2i} values are incorrect.

Action: enter correct value n_{1i} or n_{2i}.

ERROR-INTEGER NON NEGATIVE ONLY

The entered n_{1i} or n_{2i} values are incorrect.

Action: enter only integer and non negative number.

ERROR-BOTH VALUES ARE ZERO

Both entered values n_{1i} and n_{2i} for qualitative values of y are zero : it is impossible to calculate p_i.

Action: re-enter both values (one of them, at least, must be integer positive).

END OF FILE DATA21, LAST DATA GROUP NOT RECORDED

The external data file is full: last entered data group is not recorded. Program execution stops.

Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-key # 5).

ERROR-INTEGER POSITIVE <= m

The entered number of data group to be modified or deleted is incorrect.

Action: enter integer positive number less than or equal to the total number of stored data groups.

ERROR-INTEGER NON NEGATIVE ONLY

The entered n_{1i} or n_{2i} values are incorrect.

Action: enter only integer and non negative numbers.

ERROR-ONLY 1 OR ∅

Only binary choice is available.

Action: enter 1 to delete the printed data group, ∅ if not.

ERROR-INTEGER POSITIVE ONLY

The entered number of data groups is incorrect.

Action: enter only integer and positive number.

*CORA

ERROR-ACTION? 1(COMPUTATION) 2(EDIT)

The entered code for selection is incorrect.

Action: enter only 1 for computation, 2 for editing and ∅ to have the list of possible choices; or press F-8 to stop program execution.

ERROR-SELECT ROUTINE ON F-KEY?

Incorrect code by the keyboard is entered instead of pressing correct function key.

Action: press correct function key to choose an editing routine.

F-2 DEFINED ONLY DURING INPUT

F-key # 2 was pressed at non-input nor add stages.

Action: press correct function key.

ERROR-DATA FOR PROGRAM # i

Stored data are not compatible with this program.

Action: enter correct data or run program # i (call *HELP program for programs numbering).

END OF FILE DATA21, LAST DATA COLUMN NOT RECORDED

The external data file is full: last entered column is not recorded. Program execution stops.

Action: increase external data file size using the command MODIFY (see Appendix A "Installation and Maintenance") and continue to enter data using ADD capability (F-Key # 5).

NO STORED DATA

No data were entered after, F-1 (input) selection.

Action: select editing routine pressing correct function key.

ERROR ENTER F(i,j)?

F-key # 8 was pressed at non-correct stage , i.e. when the display asks for the frequency value.

Action: enter frequency value.

ERROR-INTEGER NON NEGATIVE

The entered frequency value is non integer or negative value.

Action: enter only integer, non negative value.

ERROR-ENTER Y(i,1)?

The F-key # 2 (immediate correction) has been used incorrectly.

Action: continue to enter data in the i-th column and correct the old column if necessary, using MODIFY (F-3) capability.

ERROR: ONLY INTERMEDIATE STATISTICS ARE STORED

It is impossible to update data because only intermediate statistics were entered.

Action: enter original data or select computation.

ERROR-INT POSITIVE <= k

The entered number of column to be modified or deleted is incorrect.

Action: enter integer positive number less than or equal to the total number of stored data columns.

ERROR-ONLY 1 OR $\emptyset$

Only binary choice is available.

Action: enter 1 to delete the printed data column, $\emptyset$ if not.

ERROR-INTEGER POSITIVE ONLY

The entered number of columns or the grand total is incorrect.

Action: enter only integer and positive number.

SYSTEM ERROR MESSAGES

To assist you in using the P6060 and to help you identify programming errors quickly, the system issues three types of message

1. advisory messages
2. informational messages
3. error messages: BASIC statement, system command, utility program

A brief discussion of each type of message is provided below. You will find that advisory and informational messages are self-explanatory, but a complete listing of all error messages, with explanations, follows this discussion.

Advisory Messages

Advisory messages are those that explicitly advise you that information has been specified incorrectly. As an example, if you enter too much data in response to an INPUT statement, the system notifies you by issuing the following message:

TOO MUCH INPUT - EXCESS IGNORED

Similarly, if an INPUT statement asks for numeric data and you enter string data, the system displays:

INCORRECT FORMAT - RETYPE LINE

and waits for the corrected data.

Informational Messages

Informational messages provide you with such information as the status of the system, as illustrated by the message:

READY

which indicates that the system is ready to accept a command or, as shown by the message:

PROGRAM program-name READY TO RUN

that your program has been successfully pre-executed, by the PREPARE command.

Informational messages require no response.

Error Messages

These messages identify errors resulting from the use of P6060 commands, utility programs, or BASIC statements. The types of error they identify fall into three categories: syntax, pre-execution, and execution.

1. Syntax Errors: errors in command or BASIC statement structure (e.g., erroneous punctuation)

2. Pre-execution Errors: errors that prevent the start of execution (e.g., invalid nesting, missing END statement, etc.)

3. Execution Errors: errors detected during the execution of a program (e.g., division by zero, discrepancy between argument and operand, improper subscript values, etc.)

The system detects syntax errors as you enter each statement or command and allows you, after you press (RECALL), to take immediate corrective action. The system detects pre-execution errors after you issue a PREPARE or RUN command. After notifying you of all such errors, the system switches to command mode, permitting you to make all necessary corrections. The system detects execution errors after you issue a RUN or START command or, if pre-execution has been successful, a PREPARE command. Execution errors are either recoverable or nonrecoverable.

Recoverable errors are those that can be corrected during the execution phase. When a recoverable error is detected, the system interrupts program execution, issues a warning message, and switches to debug mode. Most recoverable errors relate to invalid variable values. In these cases, the system makes an assumption for the value. To give two examples, if an attempt was made to assign the square root of a negative number to a variable, the system assumes the square root of its absolute value; if a numeric variable has not been initialized, the system assumes a value of

zero. At the time the interruption takes place, the variable is given that value. Because you are in debug mode, you have the option of changing the value assumed by the system or of accepting it. In both these cases, you can then restart execution by pressing either the STEP or CONTINUE button. You may also choose to terminate execution, by pressing the BREAK button. After BREAK is pressed, the system switches to command mode. You can then edit your program as desired.

Nonrecoverable errors are those that cannot be corrected during the execution phase. When a nonrecoverable error is detected, the STEP button lights, the system suspends program execution, issues a diagnostic message, and allows you to check the current values of the variables in your program and use calculator-mode facilities -- as you would in debug mode. However, in the case of a nonrecoverable error, you cannot use the other features of debug mode: the START command, the STEP button, or the CONTINUE button. After a nonrecoverable error occurs, you must press the BREAK button to terminate the execution of your program. (BREAK can be pressed either before or after checking the contents of the variables in your program -- but it must be pressed.) After BREAK is pressed, the system enters command mode so that the necessary corrections may be made.

A numeric code identifies each error message. In the case of pre-execution and execution errors, the code is followed by an identification of the line in which the error was made (for example, ERROR 6 IN LINE 155). The section that follows lists each code and explains the condition or conditions that caused the error. Codes 1 - 13 refer to recoverable errors detected during execution; 40 - 55 to errors that may occur during the pre-execution phase; 65 - 97 to nonrecoverable execution errors. Codes 100 - 128 refer to errors detected during the entry of a BASIC program or the compilation of a text file. Codes 151 - 156 relate to errors that may occur during an access operation to a floppy disk. Errors that may occur during the entry or execution of a system command are identified by codes 181 - 216. Codes 232 - 235 refer to utility programs and commands. The final section, abnormal termination errors, lists errors that can occur from operational malfunctions.

Error Code	Explanation
1	Either a numeric or string variable has not been initialized. The system assumes zero for a numeric variable; "null string" for a string variable.
2	The value of an argument in a built-in string function is not valid. The value returned by the function will vary according to the function specified. (See the section on built-in functions in chapter 4 for additional information.)
3	Numeric overflow. The system assumes the maximum value permitted by internal representation, with the appropriate sign.
4	Numeric underflow. The system assumes zero.
6	An attempt was made to calculate the square root of a negative number. The system assumes the square root of its absolute value.
7	A chaining operation generates a string longer than 1023 characters. The string is truncated after the first 1023 characters.
8	String overflow during the assignment of a string value to a string variable. The string is truncated at the allocation length of the variable to which it is assigned.
9	An attempt was made to calculate the logarithm of a negative number. The system assumes the logarithm of its absolute value.
10	An attempt was made to calculate the logarithm of zero. The system assumes -9.999999999999E+99.
11	An attempt was made to raise a negative number to the power of a non-integer value. The absolute value of the number is assumed and is raised to the specified power.

Recoverable errors that can occur during the execution of a BASIC program (part 1 of 2)

Error Code	Explanation
12	An attempt was made to raise zero to the power of a negative number. The system assumes +9.999999999999E+99.
13	An attempt was made to calculate the inverse of a matrix whose determinant is zero. The result of the operation is unpredictable.

Recoverable errors that can occur during the execution of a BASIC program (part 2 of 2)

Error Code	Explanation
40	A branch specified in one of the following statements is invalid: GOSUB GOTO IF...THEN MAT...READ: MAT...WRITE: ON...GOSUB ON...GOTO READ: WRITE: For complete specification information, see the explanation of the statement in error (Chapter 5).
41	NEXT not preceded by FOR or invalid nesting of two FOR/NEXT loops.
42	A multi-line function definition contains a multi-line function definition.
43	There is a reference to a function that has not been defined.
44	The maximum number of FOR/NEXT nesting levels permitted in a FOR/NEXT loop (15) has been exceeded.

Errors that can occur during the pre-execution of a BASIC program (part 1 of 2)

Error Code	Explanation
45	Use of FN* or FN*$ or FNEND outside a multi-line function definition or use of FN* within a string multi-line function definition or use of FN*$ within a numeric multi-line function definition.
46	Two nested FOR/NEXT loops use the same control variable.
47	FOR statement used with no matching NEXT.
48	A multi-line function definition lacks an FNEND statement.
49	A one- and two-dimensional array have the same name.
50	An END statement appearing in a program is not the last statement.
51	Missing END statement.
52	An attempt has been made to pre-execute a program that contains errors detected during execution of a COMPILE command, but not corrected.
53	A multi-line function definition lacks an FN* or FN*$ statement.
54	Lack of an Image statement that corresponds to a PRINT USING, DISP USING, MAT PRINT USING, or BUILD USING statement.
55	A STOP statement has been used in a multi-line function definition.

Errors that can occur during the pre-execution of a BASIC program (part 2 of 2)

Error Code	Explanation
65	No space is available in user memory to continue execution. After this error is encountered, the system switches to command mode.
66	The subscript of an array variable is invalid.
67	The operation requested would produce invalid new allocation dimensions for the specified matrix.
68	A RUN line-num or START line-num command has been used to begin execution in the middle of a FOR/NEXT loop.
69	The argument specified in a reference to a user defined function does not correspond to the type of parameter of the function.
70	RETURN statement used without GOSUB or an invalid reference has been made to a statement within a multi-line function definition.
71	An attempt has been made to assign more than 238 characters to the function keys.
72	The number of arguments specified in a reference to a user defined function does not match the number of parameters of the function.
73	The actual dimensions of a matrix do not permit the operation requested.
74	The maximum number of references to other single- or multi-line function definitions within a single- or multi-line function definition (256) has been exceeded.
75	Either matrix or string processing is requested, but the required OPTIONS command has not been entered at system initialization time.

Nonrecoverable errors that can occur during the execution of a BASIC program (part 1 of 3)

Error Code	Explanation
76	An attempt has been made to open a file which, during a preceding execution of the program, has not been closed. (To close the file, use the VALIDATE command.)
77	The file designator is either less than one or greater than the maximum number of the files that can be opened by the program at one time.
78	The operation requested for the specified file is invalid.
80	The value specified as the word number in a SETW: statement is greater than the number of words that the file can contain.
82	The requested operation is not compatible with the size of the file.
84	The EOF option has not been specified and, after the end of the file has been reached, a read operation requests additional data or a write operation attempts to continue writing.
85	The numeric expression specified as the argument of a TAB function has been evaluated as less than 1.
86	An attempt has been made to assign a string value to a numeric variable.
87	In a BBUILD statement, the allocation length of the specified string variable is not sufficient to allow the assignement of all the data resulting from the evaluation of its expressions.
88	Either a READ statement has requested additional data and the program's internal file contains no more data or, for an ASSIGN statement, the number of data items resulting from the evaluation of the string expression is less than the number of variables to which they must be assigned.

Nonrecoverable errors that can occur during the execution of a BASIC program (part 2 of 3)

Error Code	Explanation
89	The image field is invalid for data specified in a BUILD USING, DISP USING, MAT PRINT USING, or PRINT USING statement.
90	An attempt has been made to convert a value greater than 255 or less than 0 into an ISO character.
91	In a CONVERT statement, the numeric expression assigned as the value of the LENGTH operand has been evaluated as negative.
92	Invalid file name specified in a CHAIN statement.
93	In a BASSIGN, MAT READ:, or READ: statement, an attempt has been made to assign a string value to a numeric variable or vice versa.
96	The value specified as the word number in a SETW: statement is less than or equal to zero.
97	A SCRATCH: or APPEND: statement refers to a random file.

Nonrecoverable errors that can occur during the execution of a BASIC program (part 3 of 3)

Error Code	Explanation
100	Only a line number has been specified.
101	Invalid line number.
102	Invalid keyword.
103	Invalid operand.
104	Invalid expression.
105	Type discrepancy between operand and operator.
106	The arguments specified in a reference to a function are wrong either in number or type.
107	Invalid file name.
109	Non-interpretable syntax error.
110	The function being defined has already been defined in another DEF statement.
111	An attempt has been made to cross-reference more than 255 lines.
112	The number of numeric or string variables previously referred to in the program is the maximum permitted.
113	Invalid character. (This error may occur in the case of unbalanced parentheses.)
114	Recursive definition in a single-line user-defined function.
115	Invalid reference to a variable or function.
117	No space is available in user memory to accept the keyboard entry.
118	The program already contains a FILES statement.

Errors that can occur when entering a program or compiling a text file or in calculator mode (part 1 of 2)

Error Code	Explanation
119	The number of functions that can be defined or re-defined in a program is currently at its maximum.
120	The line number referred to does not exist in the program.
128	Too many operations have been attempted in a single statement.

Errors that can occur when entering a program or compiling a text file or in calculator mode (part 2 of 2)

Error Code	Explanation
151	Operational problem on floppy disk drive 1 (upper drive).
152	Operational problem on floppy disk drive 2 (lower drive).
156	There is no system floppy disk in the unit.

Errors that can occur in access to a floppy disk

Error Code	Explanation
181	Insufficient memory to execute the requested operation.
182	The line number option (#) specified in a TRANSCODE statement is invalid for the requested operation.
183	No space has been allocated for the specified library.
184	The user floppy disk has not been initialized or reference has been made to a user floppy disk when none is in the drive.
185	The system floppy disk has not been initialized to contain an application library.

Errors that can occur during the entry or execution of a system command (part 1 of 3)

Error Code	Explanation
186	The specified file name duplicates the name of an existing file.
187	A specified file cannot be found.
188	Insufficient space available on the floppy disk or in the specified library for the requested operation.
189	Invalid attempt to decrease the size of a file.
190	The command is not recognized.
191	No file name specified.
192	Invalid character specified.
193	A required operand has not been specified.
194	Specified line number cannot be found.
195	An attempt has been made to use the START command for a program that was previously stored without pre-execution.
196	Invalid operand.
197	The line number specified in a START command is part of a multi-line function definition.
198	The space requested exceeds the space available.
199	The requested operation is not accepted for a protected program.
200	The requested operation is not accepted for a protected library.
201	The requested operation requires a double floppy disk unit.

Errors that can occur during the entry or execution of a system command (part 2 of 3)

Error Code	Explanation
202	The requested operation is valid only for systems having a printer.
203	The first line number specified is greater than the second line number.
205	The requested operation is invalid for a protected line.
206	The file present in main memory is not a program.
207	The requested operation is invalid for the file type.
208	The option specified is not available with the system.
209	A line number greater than 9999 has been generated.
210	The X option is invalid for a program.
211	There is no program or file in main memory.
212	The line or lines to be printed do not exist.
213	The length of the line prevents its listing, display, or the compilation.
214	Attempt to link a multi-line function definition that has no DEF statement.
216	A program for which the compilation has been specified contains a branch to a line number that does not exist.

Errors that can occur during the entry or execution of a system command (part 3 of 3)

Error Code	Explanation
232	The sum of $n_1 + n_2 + n_3$ is greater than 14.
234	The name of the utility program has been omitted.
235	Invalid utility program name.

Errors that can occur during the calling or execution of a utility program

Error Code	Explanation
4A *	Main memory is damaged; its contents has been deleted.
12A * 16A *	The system floppy disk is damaged; the contents of the disk are invalid. The contents of main memory are deleted.
ABN FD *	The upper drive of the floppy disk unit is not working properly. (Check if the flap is closed.)
ABN FD**	The lower drive of the floppy disk unit is not working properly. (Check if the flap is closed.)
ABN PRT	The integrated printer is not working properly. (Check the position of the release lever.)

Abnormal termination errors

Note: Other error codes similar in form to those listed above may be issued when the system encounters an abnormal operational condition. In the case of such errors, and of the ones above, pressing the [redacted] button can sometimes correct the error condition. If you press [redacted] and the READY message appears, retry the operation that resulted in the error. If READY fails to appear, try switching off the power, waiting a few seconds, and switching the power back on. If READY does not appear, contact your nearest Olivetti technical representative.