MODEL I / MODEL III

ADVANCED STATISTICAL ANALYSIS

CAT. NO.
26-1705

Radio Shack TRS-80 SOFTWARE™

CUSTOM MANUFACTURED IN USA BY RADIO SHACK, A DIVISION OF TANDY CORP.

Important Information for Cassette Users

Note: Model III BASIC on the TRS-80 Model III is essentially the same as Level II BASIC on the TRS-80 Model I. All of the following references to Level II BASIC also refer to Model III BASIC. The only difference is that a higher baud rate for saving onto tape can be set if you have a Model III with Model III BASIC (high = 1500 and low = 500). Both low and high baud rate use the same volume setting on the Model III.

Using Your Cassette Deck

Many factors affect the performance of a cassette system. The most significant one is volume. Too low a volume may cause some of the information to be missed. Too high a volume may cause distortion and result in the transfer of background noise as valid information.

Four different cassette models have been supplied with the TRS-80 system—the CTR-40, CTR-41, CTR-80, and CTR-80A. Each model has its own loading characteristics. The table below gives the suggested volume ranges for each of the CTR models.

Notice that the volume ranges for Level I and Level II are different. This is because the Level II data transfer rate is faster (500 baud vs. 250 baud). Also, notice that for the TRS-80 Model I, pre-recorded Radio Shack programs need a slightly higher volume setting than that required by your own CSAVEd tapes. This is because the pre-recorded tapes are produced with high-speed audio equipment at a slightly lower volume level than the CSAVE process provides. The Model III records at a lower volume than the pre-recorded tapes are recorded at, so the volume setting for user-generated tapes is higher than for pre-programmed tapes. You will need to take this into account when CLOADing Level II programs into a Model III.

Recorder Model	User-Generated Tapes		Pre-Recorded Radio Shack Tapes	
	LEVEL I	LEVEL II	LEVEL I	LEVEL II
CTR-40	YELLOW LINE	RED LINE	YELLOW LINE	RED LINE
CTR-41	6-8	4-6	6.5-8.5	5-7
CTR-80 & CRT-80A	4.5-6.5	3-5	5.5-7.5	2.5-5

Recommended Volume Settings for Radio Shack Cassette Decks When Used with the TRS-80 Model I

Recorder Model	User-Generated Tapes	Pre-Recorded Radio Shack Tapes
CTR-80, CTR-80A	5-7	4-6

Recommended Volume Settings for Radio Shack Cassette Decks When Used with TRS-80 Model III

(With the CTR-40, CTR-80, and CTR-80A, turn the control to the left to increase volume. With the CTR-41, turn the control to the right.)

When information is being loaded from the cassette tape, two asterisks will appear on the screen. The one on the right will flash on or off as the program is read in. If the asterisks do not appear, or the one on the right does not flash, then the volume setting is probably too low. Increase the volume and try again. If you have a Model III this may be an indication that the tape's baud rate is different than the Computer's baud rate. (All Radio Shack Model I Level II pre-recorded cassettes are recorded at 500 baud rate, so Low baud rate must be selected when they are loaded on the Model III.) Try resetting the baud rate from high to low or vice versa (See your Operation Manual).

Use the reset button to stop the cassette and return control to you if loading problems occur.

Radio Shack programs are recorded at least twice on each tape. Following this practice when you record programs on tape will give you a back-up if one does not load properly or if it becomes damaged.

Important Note: The CTR-41 requires that you keep the supplied "dummy plug" in the **MIC** jack at all times. However, the other models should never be used with the "dummy plug."

Level I

Sometimes you will get an error message during an attempted CLOAD. This means that some information was lost or garbled. Adjust the volume level slightly and try again.

Level II (Also Model III BASIC)

In case of an error message, proceed as above. In Level II, there is also a rare case in which the program is not loaded correctly even though no error message is generated. So, after CLOADing a program, be sure to LIST it. If some data was garbled, then at some point in the listing the display will be filled with meaningless words and characters. Adjust the volume and try again.

Hints and Tips

Computer tapes should be stored in a relatively dust-free area (a cassette case is recommended) and protected from high temperatures. Magnetic and electrical fields may alter recorded information, so avoid placing the tape near them

(i.e. household appliances, power sources such as transformers and television sets, etc.).

The cassette deck supplied with the TRS-80 is very compatible with the system and will perform its duties with great success. To keep the cassette deck in top condition and thus minimize your problems, you should periodically perform some routine maintenance on it. Dirty heads can cause as much as a 50% loss of volume. Also, heads become magnetized with use and may cause distortion. We recommend that you clean the head, capstan, and pinch roller after every four hours of operation. Heads on new recorders should always be cleaned before use.

Note: Cassette cleaning and demagnetizing accessories are available from your local Radio Shack store.

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NOTE: Good data processing procedure dictates that the user test the program, run and test sample sets of data, and run the system in parallel with the system previously in use for a period of time adequate to insure that results of operation of the computer or program are satisfactory.

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Advanced Statistical Analysis

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User Instruction Manual
For
Advanced Statistical Analysis

A system of computer programs designed for the analysis of data in business, education, medicine, government administration, and other fields.

Written by

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for use with Level II BASIC or DISK BASIC on the Radio Shack TRS-80™ Microcomputer System

Table of Contents

Introduction

Advanced Statistical Analysis (ASA) is a user oriented data analysis system designed for use on the Radio Shack TRS-80 Micro Computer. The system is ideally suited for applications in business, education, medicine, and government administration. The programs can be run with little formal knowledge of data analysis techniques and no knowledge of computer programming. Each program in the system was written to interact with the user and to guide him/her in conducting statistical analyses.

Description of the System

The Advanced Statistical Analysis system consists of 13 computer programs stored on cassette tapes and a comprehensive manual which takes the user through each program step-by-step. The system includes ten programs for describing data sets and conducting statistical data analyses; two utility programs for preparing, updating, and listing data files stored on tape or disk; and a program to aid in selecting data samples. Programs supplied with the Advanced Statistical Analysis system are listed below.

Tape Data Files	Analysis of Variance
Disk Data Files	T-Test For Matched Pairs
Random Sample	Correlation & Linear Regression
Descriptive Statistics	Multiple Linear Regression
Histogram	Time Series Analysis (2 Programs)
Frequency Distribution	Chi Square Analysis

Advanced Statistical Analysis was designed to run with Radio Shack Level II BASIC or DISK BASIC. The amount of data which can be analyzed usually depends upon how much memory (RAM) is installed in the TRS-80.

Data and Data Files

All of the ASA data analysis programs (except CHI SQUARE ANALYSIS) allow data to be entered from the TRS-80 keyboard, or from a data file stored on cassette tape or diskette (under DISK BASIC). The data input device is selected by the user at the beginning of each program.

Data files are prepared, updated and listed using two file utility programs (TAPE DATA FILES and DISK DATA FILES). Several different "types" of data are used by ASA programs. CORRELATION & LINEAR REGRESSION, T-TEST FOR MATCHED PAIRS, and the two TIME SERIES ANALYSIS programs require a set of data pairs (variable X, variable Y) as input. Files of this type are referred to as "paired" data files. ANALYSIS OF VARIANCE requires a file containing a set of measurements for each group in the design (ANOVA type). MULTIPLE LINEAR REGRESSION requires a data record for each subject.

Each record in a linear regression type file contains a measurement on the dependent variable, plus measurements on from one to five independent variables. Data files prepared for DESCRIPTIVE STATISTICS, HISTOGRAM or FREQUENCY DISTRIBUTION contain a set of measurements on one variable and are called single type data files. However, these last three programs can accept **any** type ASA data file as input. The ASA data file structure is described in Appendix A.

The different types of data files are handled automatically by the file utility programs. In addition, each ASA data analysis program will accept only the correct type of data file. An error message is displayed and the program stops when a data file of the wrong type is encountered.

All cassette tape data files are read from, and written to, recorder #-1. If you are using the TRS-80 Expansion Interface and dual cassette recorders, be sure to insert your tapes into the correct unit. Disk data files are not allocated to a particular disk drive; therefore, ASA programs can be run with any number of drives connected. However, when you prepare or update a disk data file on a multi-drive system, you will have to read the file directories to find out which diskette contains the new file.

Some Words of Caution

Although many safeguards are built into the Advanced Statistical Analysis system, users are urged to become familiar with the programs, test them using sample sets of data, and follow the displayed instructions carefully. When in doubt, consult this manual.

Simple errors such as entering incorrect data, using the wrong data file, or providing the computer with the wrong code (when it asks for an instruction) can result in output that is erroneous. Computer programmers refer to this phenomena as "Garbage in – Garbage out".

The statistical procedures used in all of the ASA programs (except MULTIPLE LINEAR REGRESSION and TIME SERIES ANALYSIS) require that data values be actual measurements. That is, the data values must **not** be codes referring to categories such as 1 for male, 2 for female, 1Ø for New York, 6 for California, nor rankings such as 1 for first or largest, etc. Examples of valid data include temperature, age, test or attitude scores, elapsed time, cost, length, weight, miles-per-gallon, and numbers of people or objects, etc. (statisticians call these interval scale measures). Data pairs for

TIME SERIES ANALYSIS consist of a code representing a time interval (year, quarter, month, week, or day), followed by an interval scale measurement on the Y variable. MULTIPLE LINEAR REGRESSION allows coded independent variables, but the dependent variable must be an interval scale measurement.

In order to allow for "end of data" and "end of group" signals, all data values are input in string form (i.e., as alphanumeric variables) then converted to numerical equivalents. The following considerations apply to this method of data input.

- The Computer does not distinguish between numbers and other characters. If you accidentally type a character (e.g., $ instead of 4) the computer will convert the character to a number and store it. HINT: Don't press **ENTER** until you verify what you have typed.

- The TAPE DATA FILES program stores all data values in memory as strings. Unlike numerical values, which take a predetermined amount of memory for storage (e.g., 2 bytes for integers), the amount of memory needed to store a string depends on how many **characters** the string contains. The data set size limitations (stated in the TAPE DATA FILES chapter) assumes an average data value length of 10 characters. You will be able to prepare larger data files by representing very large or very small data values in exponential form (e.g., .ØØØØØØØØØØ12 as 1.2E-11, 54432ØØØØØØØØØØ as 5.4432E15).

As with any computer system, very large (positive or negative) values and values containing many decimal places are subject to certain errors. The number of significant figures retained by the ASA programs varies from 7 to 16. Additionally, repetitive arithmetic operations may magnify rounding errors to a significant degree. In most cases, since the data collected for use in statistical analysis procedures usually contain a fair amount of measurement error, the rounding errors above should be negligible.

Users who feel uncomfortable using one or more of the ASA data analysis procedures are urged to consult a textbook on statistics to be sure they are applying the procedure properly and interpreting its results accurately. Elementary statistics textbooks in most fields cover, to some degree,the statistical procedures in the Advanced Statistical Analysis system. We've provided a selected list of books in Appendix C; you will find some of these in most public libraries or college libraries.

Loading the ASA Programs

The Advanced Statistical Analysis computer programs are supplied on cassette tapes ready for loading into your TRS-80. If you are using Level II BASIC, simply turn on your Computer, insert the program tape into the cassette recorder and load the program according to the instructions in your Level II Manual.

If you are using DISK BASIC, the programs must be loaded with the machine in DISK BASIC command mode (not in DOS). Be sure to disable the real-time clock before attempting to load the program. This is done by typing CMD"T". To save time, you may want to store the program on disk (explained in your TRSDOS/DISK BASIC Manual).

NOTE: To aid you in using this Manual with the programs, we've either used special type style to show the Computer or program's responses or a direct print-out for all Video Display examples. Where you must provide some input, we've printed the commands/letters, etc. in a gray area. Your eyes will quickly adjust to look for these key responses.

Printing Program Results

The results of all ASA data analysis programs, and file listings from the file utility programs, can be printed on the TRS-80 Line Printer. For many of the programs, the output is automatically formatted at 8½" x 11" – a line of stars marks the cutting line. After typing a page number on the trimmed printout, copies can be made on a duplicating machine for inclusion in your reports. The printer output is formatted for a carriage width of approximately 60 characters. The print density control, located on the rear apron of the TRS-80 Line Printer, should be set slightly above minimum print density (i.e., almost fully counter-clockwise). Printing at a higher density will distort histograms and data plots (graphs) by producing disproportionate X and Y axes. Appendix B contains sample printouts from ASA programs.

Users of the TRS-80 Quick Printer may also use the print feature in ASA programs. The program will automatically set the print width to 80 characters to accommodate the output format.

Tape Data Files

Description of the Program

Data may be stored on cassette tape for use as input in ASA data analysis programs. TAPE DATA FILES provides all the necessary file handling functions relative to data files stored on cassette tape.

Features

- Handles data files for all ASA data analysis programs (single, paired, ANOVA, and multiple regression type data)
- Preparation of new data files
- Automatically assigns file type code
- Assigns user-supplied file name
- Correction and updating of any type ASA data file
- Copies data files
- Lists data files
- Optional file listing on line printer

Limitations

- 16K maximum data set sizes (approximate)
  800 single or ANOVA data elements
  400 paired data elements (pairs)
  100 multiple regression elements (subjects)

- 32K maximum data set sizes (approximate)
  2000 single or ANOVA data elements
  1000 paired data elements (pairs)
  250 multiple regression elements (subjects)

- A maximum of 150 data elements, of any type, can be removed during any single run of the program

Loading the Tape Data Files Program

Unlike other ASA programs which can be run under LEVEL II BASIC or DISK BASIC, TAPE DATA FILES must be loaded and run only under LEVEL II BASIC on 16K TRS-80 Microcomputers. This should be no handicap, since DISK BASIC features are not used within the program. To load the program into a TRS-80 without an Expansion Interface, simply use the CLOAD command. If an Expansion Interface is connected, turn on the power to the CPU while holding down the **BREAK** key. You are now operating in LEVEL II BASIC with the Expansion Interface connected and can load the program using the CLOAD command.

NOTE: Users of TRS-80 Computers having 32K or more memory may load and run TAPE DATA FILES under either Level II BASIC or DISK BASIC (after disabling the real-time clock).

Preparing a New Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** The Computer will respond with

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE     ? _
```

2. Enter a **P**. The Computer will ask

```
FOR WHICH PROGRAM WILL THE DATA BE PREPARED:
    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM
    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES
    3 = ANALYSIS OF VARIANCE
    4 = MULTIPLE REGRESSION       ? _
```

3. Enter the number corresponding to the program for which you are preparing the data; the DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, and HISTOGRAM programs will accept data files prepared for any of the ASA analysis programs.

- If you enter a 1, the following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA ELEMENTS.
SIGNAL END OF DATA WITH @.

? _
```

Enter your first data value, after the question mark. Another question mark will appear. Continue entering your data. After the last data value has been entered, type and enter an @. The Computer will display the number of data values input as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
```

(Now skip to instruction #4)

- If you enter a 2, the following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA PAIRS (X,Y).
SIGNAL END OF DATA WITH @,@.
?_
```

Enter your first data pair, after the question mark, separating the X and Y values with a comma. Another question mark will appear. Continue entering your data. After the last data pair has been entered, type and enter @,@ (two "at" symbols, separated by a comma). The computer will display the number of data **pairs** input as follows:

```
NEW DATA COUNT - N  DATA ELEMENTS.
```

NOTE: Consult the chapters on TIME SERIES ANALYSIS before preparing data for those programs. Special instructions are contained in the sections titled INSTRUCTIONS FOR INPUTTING DATA.

(Now skip to instruction #4)

- If you enter a 3 the Computer will ask,

```
HOW MANY GROUPS (2 TO 5 ONLY) ?_
```

Enter the number of groups for which analysis of variance data will be prepared. The following message will appear on the screen:

```
BEGIN ENTERING THE DATA FOR GROUP # 1.
SIGNAL END OF DATA WITH @.
?_
```

Enter the first data value for Group 1, after the question mark. Another question mark will appear. Continue entering data for Group 1. After the last data value for that group has been entered, type and enter an @ ("at" symbol). The Computer will then request data for Group 2.

NOTE: Remember which of your groups is Group 1, which is Group 2, etc. This information will be needed when you run the ANALYSIS OF VARIANCE, DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION programs on the data.

After all the data have been entered the Computer will display the **total** number of data elements entered as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
(ALL GROUPS COMBINED)
```

(Now skip to instruction #4)

- If you enter a 4, the Computer will ask

```
HOW MANY INDEPENDENT VARIABLES (1 TO 5 ONLY) ?_
```

NOTE: The number of independent variables must be the same for each subject in the study. If values for one or more independent variables are missing for any subject, that subject must be excluded from the study.

Enter the number of independent variables for which data will be entered. The following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA BY ENTERING @ FOR THE DV VALUE.

SUBJECT 1 :
  DV   ? _
```

Enter the value on the dependent variable for Subject #1, after the question mark. The Computer will then display

```
IV 1 ? _
```

Enter the value on the first independent variable for Subject #1. Data will be requested on each successive independent variable for the first subject, then the Computer will request data values for Subject #2. After the data for all subjects have been entered, type and enter an @ ("at" symbol) instead of a DV data value.

NOTE: Remember which independent variable has been assigned the codes IV1, IV2, etc. This information will be necessary when running MULTIPLE LINEAR REGRESSION, DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM on the data.

The number of **subjects** for which data were entered will then be displayed as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
```

4. The Computer will ask

```
NAME FOR THE NEW DATA FILE ?_
```

Enter an alphanumeric name which describes the data file being prepared. Try to keep the name short (abbreviate if necessary). Do **not** use commas in the file name.

5. The message

```
INSERT A BLANK TAPE - SET TO 'RECORD' - HIT ENTER ?_
```

will be displayed. Insert a tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system) and press **ENTER** Don't forget to "cue" tapes which have plastic leaders! The data file will be recorded on tape while the Computer displays

```
WRITING DATA TO TAPE.
```

Updating an Old Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will reply

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE      ? _
```

2. Enter a **U**. The Computer will ask

```
FOR WHICH PROGRAM WERE THE DATA PREPARED:
    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM
    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES
    3 = ANALYSIS OF VARIANCE
    4 = MULTIPLE REGRESSION        ? _
```

3. Enter the number corresponding to the program for which the old data file was prepared. The Computer will ask

```
HOW MANY DATA ELEMENTS ARE TO BE REMOVED ? _
```

If you will only be adding elements to the old file, or if you are making a copy of the file, enter a **0** and skip to instruction #4.

NOTE: If you are updating a data file prepared for DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM, the file is a single type data file, and each data value is a data element. If the data were prepared for CORRELATION & LINEAR REGRESSION, T-TEST FOR MATCHED PAIRS, or TIME SERIES ANALYSIS, the file is a paired-type data file, and each data **pair** (X, Y) is a data element. Data files prepared for ANALYSIS OF VARIANCE consist of groups of data values and each data group is separated by the symbol @. In these files, called ANOVA files, each value (including the group separating symbol) is considered a data element. In multiple regression data files, each subject is a data element. That is, each data element consists of the DV value, plus the values on each IV for one subject.

Enter the number of data elements that you wish to remove from the old file. The Computer will display

```
LIST THE DATA ELEMENTS TO BE REMOVED.

? _
```

You must know that exact element number of each data element that is to be removed. If you are not sure, terminate the program (press **BREAK**) and list the data file to obtain the data element number(s). Enter one element number after each question mark.

4. The Computer will display the message

```
INSERT DATA TAPE - SET TO 'PLAY' - HIT ENTER ? _
```

Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the old data tape is rewound, set the recorder controls to Play, and press **ENTER**. The Computer will begin reading the data and the name of the data file will be displayed. Check to be sure you have loaded the correct data tape. The Computer will display the number of data elements read from the tape. For ANALYSIS OF VARIANCE FILES the number of actual data values (excluding group separation symbols) will be displayed for each group. Next the number of data elements which were removed will be displayed followed by the new data element count (# elements read – # elements removed).

5. The Computer will ask

```
DO YOU WANT TO ADD ANY NEW DATA ELEMENTS - (Y)ES OR (N)O ?_
```

If you do not want to add new data elements to the file (that is, you are copying a data file or just removing elements) enter an **N** and skip to instruction #6.

If you enter a **Y**, the Computer will decide what type of data file is being updated and will request the new data elements as follows:

- For single type data (files prepared for DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM) the Computer will display

```
BEGIN ENTERING YOUR NEW DATA ELEMENTS.
SIGNAL END OF NEW DATA WITH @.
?_
```

Enter a new data value after the question mark. Another question mark will appear. Continue entering data. After the last new data value has been entered, type and enter an **@** ("at" symbol).

(Skip to instruction #6)

- For paired type data (files prepared for CORRELATION & LINEAR REGRESSION, T-TEST FOR MATCHED PAIRS, or TIME SERIES ANALYSIS) the Computer will display

```
BEGIN ENTERING YOUR NEW DATA PAIRS (X,Y).
SIGNAL END OF NEW DATA WITH @,@.
?_
```

  Enter your first new data pair, after the question mark, separating the X and Y values with a comma. Another question mark will appear. Continue entering your new data. After the last new data pair has been entered, type and enter @,@ (two "at" symbols, separated by a comma).

  (Skip to instruction #6)

- For ANOVA type data (files prepared for ANALYSIS OF VARIANCE), the Computer will ask

```
NUMBER OF NEW DATA ELEMENTS FOR GROUP # 1 ?_
```

  If no new data values will be added to Group I, the Computer will ask for the number of new elements for the second group.

  If data elements will be added to Group 1, the Computer will display

```
BEGIN ENTERING THE NEW DATA FOR GROUP #1
?_
```

  Enter the first new data value for Group 1, after the question mark. Another question mark will appear. Continue entering new data values for the first group. After all the new data elements for Group 1 have been entered, the computer will display the new data count for that group. The entire new data sequence above will be repeated for the number of groups found on the old data file, then the Computer will display

```
HIT ENTER TO CONTINUE ?_
```

  Press **ENTER** . (Now skip to instruction #6.)

- For multiple regression type data (files prepared for MULTIPLE LINEAR REGRESSION) the Computer will display

```
BEGIN ENTERING YOUR NEW DATA.
SIGNAL END OF NEW DATA BY ENTERING @ FOR THE DV VALUE.
SUBJECT 1 :
  DV   ?_
```

The subject number will be the number of subjects encountered on the old data file, minus any that were removed, plus 1 (that is, the new data count +1). Enter the value on the dependent variable for the first new subject. The Computer will display

```
IV 1 ?_
```

Enter the value on the first independent variable for the first new subject. Data will be requested on each successive independent variable for the first subject (the number of IVs will be between 1 and 5 and will agree with the number of IVs per subject found on the old data file), then the Computer will request data for the second new subject. After the data for all new subjects have been entered, type and enter an @ ("at" symbol) instead of a data value.

NOTE: The number of independent variables must be the same for each subject in the study. If values for one or more independent variables are missing for any subject, that subject must be excluded from the study.

6. The Computer will display the new data element count (data elements read from the old file, minus data elements removed, plus data elements added) and ask

```
NAME FOR THE NEW DATA FILE ?_
```

Enter an alphanumeric name which describes the data file being prepared. Try to keep the name short (abbreviate if necessary). Do **not** use commas in the file name.

7. The message

```
INSERT A BLANK TAPE - SET TO 'RECORD' - HIT ENTER ?_
```

will be displayed. Insert a tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system) and press **ENTER** . Don't forget to "cue" tapes which have plastic leaders! The data file will be recorded on tape while the Computer displays

```
WRITING DATA TO TAPE.
```

Listing a Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will reply

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE ?_
```

2. Enter an **L**. The Computer will ask,

```
LIST DATA FILE ON LINE PRINTER - (Y)ES OR (N)O ?_
```

3. If you have a Line Printer and desire a permanent copy of the file listing, enter a **Y**, otherwise enter an **N**.

4. The Computer will display

```
INSERT DATA TAPE - SET TO 'PLAY' - HIT ENTER ?_
```

Insert the data tape into the tape recorder (use recorder #-1 if you are using a dual cassette system). Be sure the data tape is rewound, set the recorder controls to play, and press **ENTER**. The Computer will begin reading the data, and the name of the data file will be displayed. Next, the Computer will display the type of data file being read.

NOTE: Single, paired, ANOVA, and multiple regression file types are described in a note under instruction #3 for UPDATING AN OLD DATA FILE.

The number of data elements read from the data file will be displayed, followed by the message

```
HIT ENTER TO BEGIN LISTING ?_
```

or

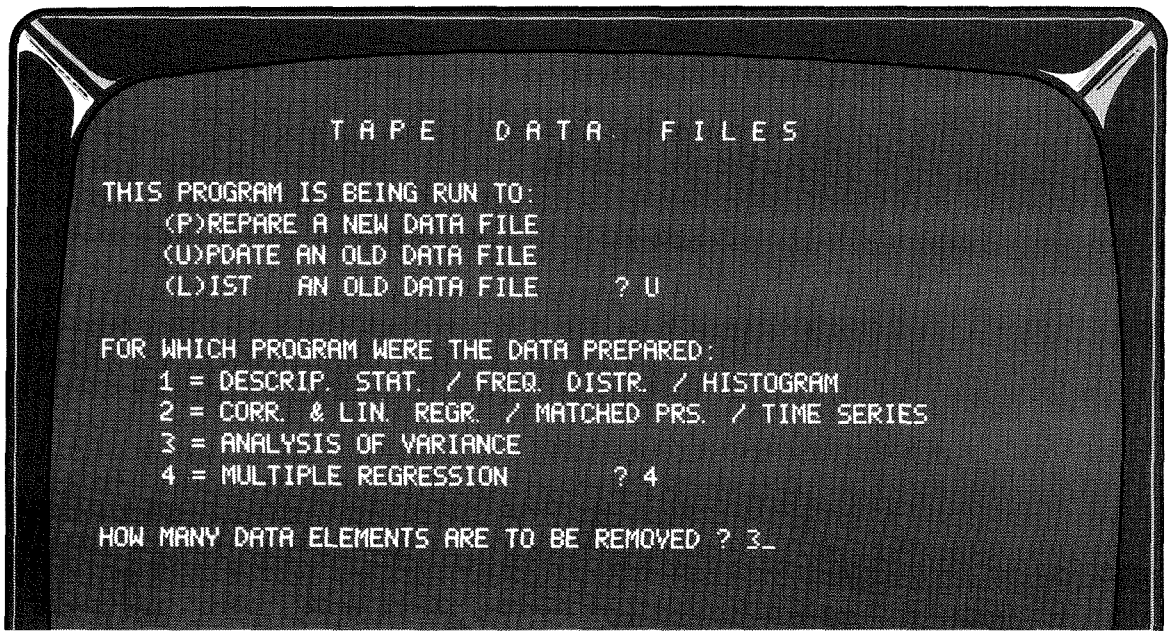
```
TURN ON YOUR PRINTER - HIT ENTER TO BEGIN LISTING ?_
```

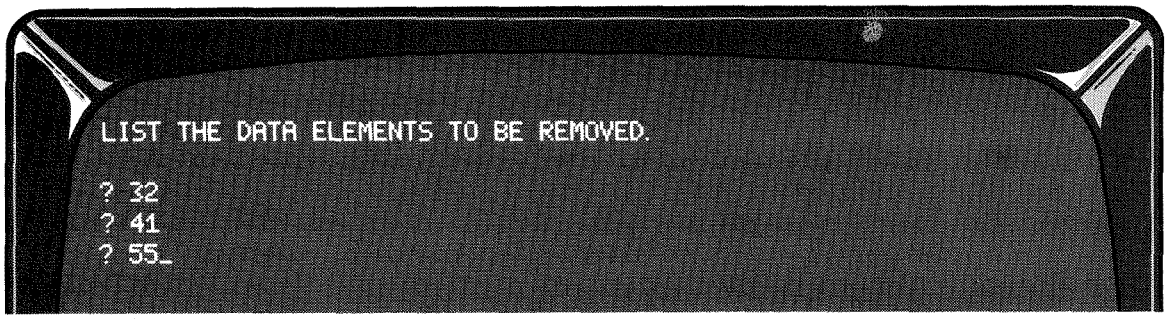
5. Turn on your Printer, if applicable, and press **ENTER**. The data file will begin listing on the Video Screen (and Printer). The listing may be stopped (for viewing) by simply pressing **@**. Pressing **@** again will restart the listing. The listing (and printing) can be halted completely by pressing **BREAK** for a few seconds. After the entire data file has been listed, the program will ask

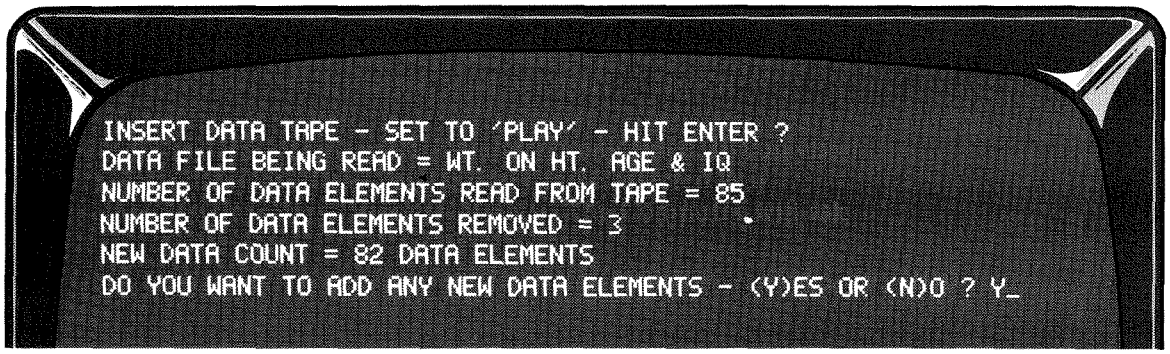
```
(L)IST DATA AGAIN OR (E)ND PROGRAM ?_
```

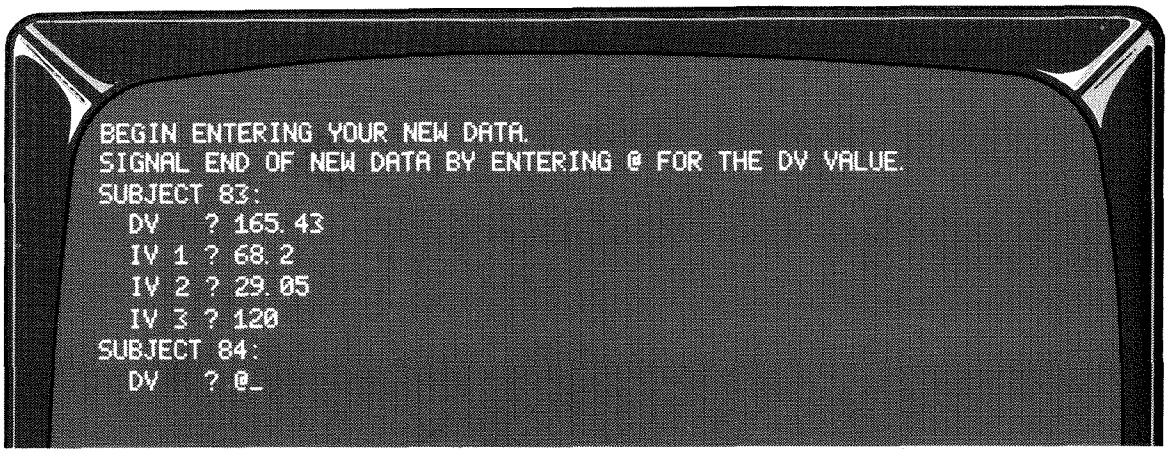
Enter an **L** or an **E** as appropriate.

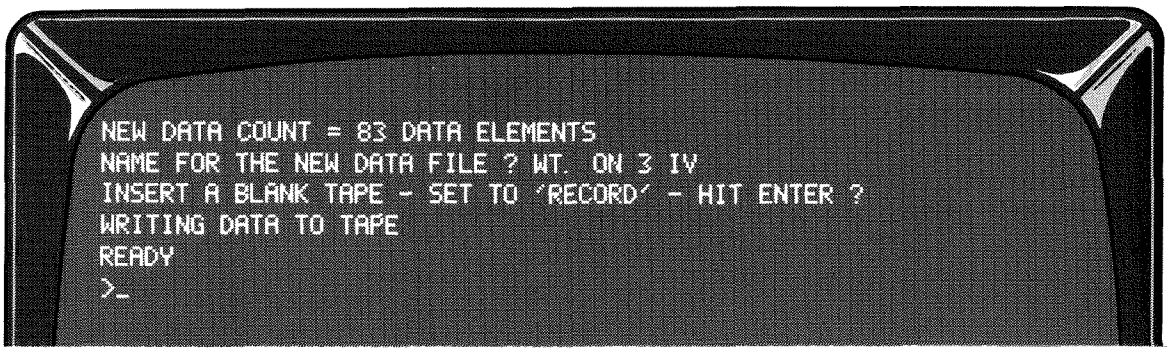
Sample Run (Updating a multiple regression tape file)











Messages and Special Considerations

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a tape file. The tape may contain an ASA data file of the wrong type (in which case the name of the incorrect file will be displayed), a data file not prepared for ASA programs, or a computer program rather than a data file.

If the number of data elements removed from the file by the Computer is less than the number you expected to be removed, you may have (1) entered a data value which did not exist or (2) entered the same data element more than once. You may cancel the update by pressing **BREAK** or allow the program to run to completion, then list the updated file and check it for mistakes.

Disk Data Files

Description of the Program

Data may be stored on Minidisk for use as input in any of the ASA data analysis programs. DISK DATA FILES provides all the necessary file handling functions relative to data files stored on disk.

Features

- Handles data files for all ASA data analysis programs (single, paired, ANOVA, and multiple regression type data)
- Preparation of new data files
- Automatically assigns file type code
- Correction and updating of any type ASA data file
- Copies data files
- Lists data files
- Optional file listing on Line Printer

Limitations

- Maximum data set size is limited only by the space available on TRS-80 Mini Disk drives.
- Disk space required for updating a data file is roughly twice that required for preparation of the original file, because a temporary "scratch" file must be created. This file is automatically removed from disk when the update is complete.
- A maximum of 150 data elements, of any type, can be removed during a single run of the program.

Loading the Disk Data Files Program

Unlike other ASA programs which can be run under LEVEL II BASIC or DISK BASIC, DISK DATA FILES must be loaded and run only under DISK BASIC. To load the program, type `CMD"T"`, then use the CLOAD command.

Preparing a New Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** . The Computer will reply

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE      ? _
```

2. Enter a **P**. The Computer will ask

```
WHAT WILL BE THE NAME OF THE NEW DATA FILE ? _
```

3. Enter a file name which describes the data. The file name must conform to the file naming conventions, described in the TRS-80 TRSDOS/DISK BASIC Manual. The Computer will then ask

```
FOR WHICH PROGRAM WILL THE DATA BE PREPARED:
    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM
    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES
    3 = ANALYSIS OF VARIANCE
    4 = MULTIPLE REGRESSION        ? _
```

4. Enter the number corresponding to the program for which you are preparing the data (the DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, and HISTOGRAM programs will accept data files prepared for any of the ASA analysis programs).

   - If you enter a **1**, the following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA ELEMENTS.
SIGNAL END OF DATA WITH @.

? _
```

     Enter your first data value, after the question mark. Another question mark will appear. Continue entering your data. After the last data value has been entered, type and enter an **@**. The Computer will display the number of data values input as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
```

     (Now skip to instruction #5)

- If you enter a 2, the following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA PAIRS (X,Y).
SIGNAL END OF DATA WITH @,@.

? _
```

Enter your first data pair, after the question mark, separating the X and Y values with a comma. Another question mark will appear. Continue entering your data. After the last data pair has been entered, type and enter @,@ (two "at" symbols, separated by a comma). The computer will display the number of data **pairs** input as follows:

```
NEW DATA COUNT - N DATA ELEMENTS.
```

NOTE: Consult the chapters on TIME SERIES ANALYSIS before preparing data for those programs. Special instructions are contained in the sections titled INSTRUCTIONS FOR INPUTTING DATA.

(Now skip to instruction #5)

- If you enter a 3, the Computer will ask

```
HOW MANY GROUPS (2 TO 5 ONLY) ?_
```

Enter the number of groups for which analysis of variance data will be prepared. The following message will appear on the screen:

```
BEGIN ENTERING THE DATA FOR GROUP # 1
SIGNAL END OF DATA WITH @.
?_
```

Enter the first data value for Group 1, after the question mark. Another question mark will appear. Continue entering data for Group 1. After the last data value for that group has been entered, type and enter an @. The Computer will then request data for Group 2.

NOTE: Remember which of your groups is Group 1; which is Group 2; etc. This information will be needed when you run the ANALYSIS OF VARIANCE, DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION programs on the data.

After all the data have been entered, the Computer will display the **total** number of data elements entered as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
(ALL GROUPS COMBINED)
```

(Now skip to instruction #5)

- If you enter a 4, the Computer will ask

```
HOW MANY INDEPENDENT VARIABLES (1 TO 5 ONLY) ?_
```

NOTE: The number of independent variables must be the same for each subject in the study. If values for one or more independent variables are missing for any subject, that subject must be excluded from the study.

Enter the number of independent variables for which data will be entered. The following message will appear on the screen:

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA BY ENTERING @ FOR THE DV VALUE.
SUBJECT 1 :
DV   ?_
```

Enter the value on the dependent variable for Subject #1, after the question mark. The Computer will then display

```
IV 1 ?_
```

Enter the value on the first independent variable for Subject #1. Data will be requested on each successive independent variable for the first subject; then the computer will request data values for Subject #2. After the data for all subjects have been entered, type and enter an @ instead of a DV data value.

NOTE: Remember which independent variable has been assigned the codes IV1, IV2, etc. This information will be necessary when running MULTIPLE LINEAR REGRESSION, DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM on the data.

The number of **subjects** for which data were entered will then be displayed as follows:

```
NEW DATA COUNT = N DATA ELEMENTS.
```

5. The Computer will finish writing the data file on disk and display the new file name.

   NOTE: If your data file is large, the computer may write data to disk several times during the data entry process (instruction #4). Be sure to wait for a question mark to appear on the screen before entering your next data value.

Updating an Old Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** The Computer will reply

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE     ? _
```

2. Enter a **U**. The Compuer will ask

```
WHAT IS THE NAME OF THE OLD DATA FILE ? _
```

3. Enter the name of the file to be updated. The Computer will reply

```
(S)AVE OLD FILE OR (R)EMOVE OLD FILE FROM DISK ? _
```

4. Enter an **S** if you still need the old data file, otherwise enter an **R** to kill the old file and free extra space on disk. The Computer will ask

```
WHAT WILL BE THE NAME OF THE UPDATED DATA FILE ? _
```

5. Enter a name which describes the updated data. The name cannot be the same as the name of the old file (see file name section in your TRS-80 TRSDOS/DISK BASIC Manual).The Computer will ask

```
FOR WHICH PROGRAM WERE THE DATA PREPARED:
    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM
    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES
    3 = ANALYSIS OF VARIANCE
    4 = MULTIPLE REGRESSION       ? _
```

6. Enter the number corresponding to the program for which the old data file was prepared. The Computer will ask

```
HOW MANY DATA ELEMENTS ARE TO BE REMOVED ? _
```

If you will only be adding elements to the old file, or if you are making a copy of the file, enter a 0 and skip to instruction #7.

NOTE: If you are updating a data file prepared for DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM, the file is a single-type data file, and each data value is a data element. If the data were prepared for CORRELATION & LINEAR REGRESSION, T-TEST FOR MATCHED PAIRS, or TIME SERIES ANALYSIS, the file is a paired-type data file and each data **pair** (X,Y) is a data element. Data files prepared for ANALYSIS OF VARIANCE consist of groups of data values and each data group is separated by the symbol @. In these files, called ANOVA files, each value (including the group separation symbol) is considered a data element. In multiple regression data files each subject is a data element. That is, each data element consists of the DV value, plus the value on each IV for one subject.

Enter the number of data elements you wish to remove from the old file. The Computer will display

```
LIST THE DATA ELEMENTS TO BE REMOVED.
? _
```

You must know the exact element number of each data element that is to be removed. If you are not sure, terminate the program (press **BREAK**) and list the data file to obtain the data element number(s). Enter one element number after each question mark. When all the element numbers have been entered, the Computer will begin reading the data and the name of the data file will be displayed. The Computer will display the number of data elements read from the file. For ANALYSIS OF VARIANCE FILES, the number of actual data values (excluding group separation symbols) will be displayed for each group. Next, the number of data elements which were removed will be displayed, followed by the new data element count (# elements read – # elements removed).

7. If you are updating an ANOVA data file (a file prepared for ANALYSIS OF VARIANCE), skip to instruction #8.

The Computer will ask

```
DO YOU WANT TO ADD ANY NEW DATA ELEMENTS - (Y)ES OR (N)O ? _
```

If you do not want to add new data elements to the file (that is, you are copying a data file or just removing elements), enter an N and skip to instruction #9.

If you enter a Y, the Computer will decide what type of data file is being updated, and will request the new data elements as follows:

- For single type data (files prepared for DESCRIPTIVE STATISTICS, FREQUENCY DISTRIBUTION, or HISTOGRAM) the Computer will display

```
BEGIN ENTERING YOUR NEW DATA ELEMENTS.
SIGNAL END OF NEW DATA WITH @.
? _
```

  Enter a new data value, after the question mark. Another question mark will appear. Continue entering data. After the last new data value has been entered, type and enter an @.

  (Skip to instruction #9)

- For paired type data (files prepared for CORRELATION & LINEAR REGRESSION, T-TEST FOR MATCHED PAIRS, or TIME SERIES ANALYSIS) the Computer will display

```
BEGIN ENTERING YOUR NEW DATA PAIRS (X,Y).
SIGNAL END OF NEW DATA WITH @,@.
? _
```

  Enter your first new data pair, after the question mark, separating the X and Y values with a comma. Another question mark will appear. Continue entering your new data. After the last new data pair has been entered, type and enter @,@ (two "at" symbols, separated by a comma).

  (Skip to instruction #9)

- For multiple regression type data (files prepared for MULTIPLE LINEAR REGRESSION), the Computer will display

```
BEGIN ENTERING YOUR NEW DATA.
SIGNAL END OF NEW DATA BY ENTERING @ FOR THE DV VALUE.
SUBJECT 1 :
  DV   ? _
```

The subject number will be the number of subjects encountered on the old data file, minus any that were removed, plus 1 (that is, the new data count +1). Enter the value on the dependent variable for the first new subject. The Computer will display

```
IV 1 ? _
```

Enter the value on the first independent variable for the first new subject. Data will be requested on each successive independent variable for the first subject (the number of IVs will be between 1 and 5 and will agree with the number of IVs per subject found on the old data file). Then the Computer will request data for the second new subject. After the data for all new subjects have been entered type and enter an @ ("at" symbol) instead of a data value.

NOTE: The number of independent variables must be the same for each subject in the study. If values for one or more independent variables are missing for any subject, that subject must be excluded from the study.

(Now skip to instruction #9)

8. The Computer will ask

```
NEW DATA FOR GROUP 1 - (Y)ES OR (N)O ? _
```

If you are copying a file, or do not wish to add new data elements to Group 1, enter an N. Otherwise enter a Y.

If no new data values will be added to Group 1, the Computer will ask whether or not new data will be added to the second group.

If data elements will be added to Group 1, the Computer will display

```
BEGIN ENTERING THE NEW DATA FOR GROUP #1
SIGNAL END OF DATA WITH @
? _
```

Enter the first new data value for Group 1, after the question mark. Another question mark will appear. Continue entering new data values for the first group. After all the new data elements for Group 1 have been entered, type and enter an @. The Computer will display the new data count for that group. The entire new data

sequence above will be repeated for the number of groups found on the old data file; then the Computer will display

```
HIT ENTER TO CONTINUE ? _
```

Press **ENTER**.

9. The Computer will display the new data element count (data elements read from the old file, minus data elements removed, plus data elements added), update the old data file, and display the name of the new data file.

Listing A Data File

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will reply

```
THIS PROGRAM IS BEING RUN TO:
    (P)REPARE A NEW DATA FILE
    (U)PDATE AN OLD DATA FILE
    (L)IST   AN OLD DATA FILE     ? _
```

2. Enter an **L**. The Computer will ask

```
WHAT IS THE NAME OF THE OLD DATA FILE ? _
```

Enter the exact name of the file to be listed. The computer will ask,

```
LIST DATA FILE ON LINE PRINTER - (Y)ES OR (N)O ? _
```

3. If you have a Line Printer and desire a permanent copy of the file listing, enter a **Y**, otherwise enter an **N**.

The Computer will begin reading the data and the name of the data file will be displayed. Next the Computer will display the type of data file being read.

The number of data elements read from the data file will be displayed, followed by the message

```
HIT ENTER TO BEGIN LISTING ? _
```

or

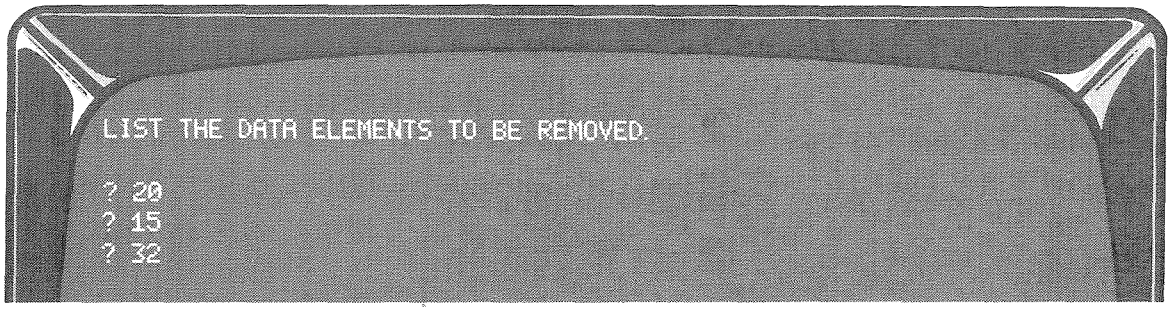
```
TURN ON YOUR PRINTER - HIT ENTER TO BEGIN LISTING ? _
```

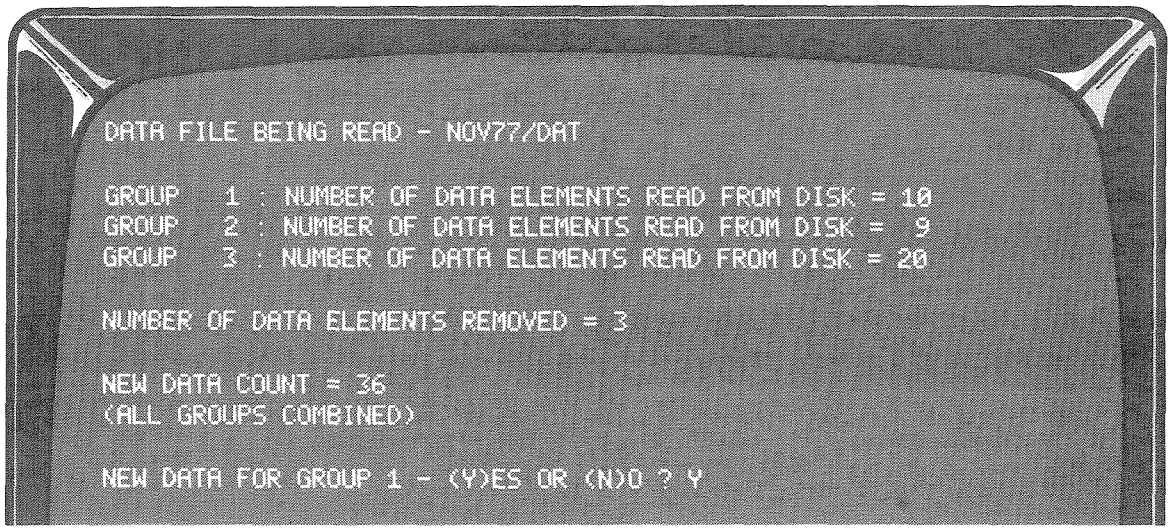
4. Turn on your Printer, if applicable, and press **ENTER**. The data file will begin listing on the video screen (and printer). The listing may be stopped for viewing by simply pressing @. Pressing @ again will restart the listing. The listing (and printing) can be halted completely by pressing **BREAK** for a few seconds. After the entire data file has been listed, the program will ask

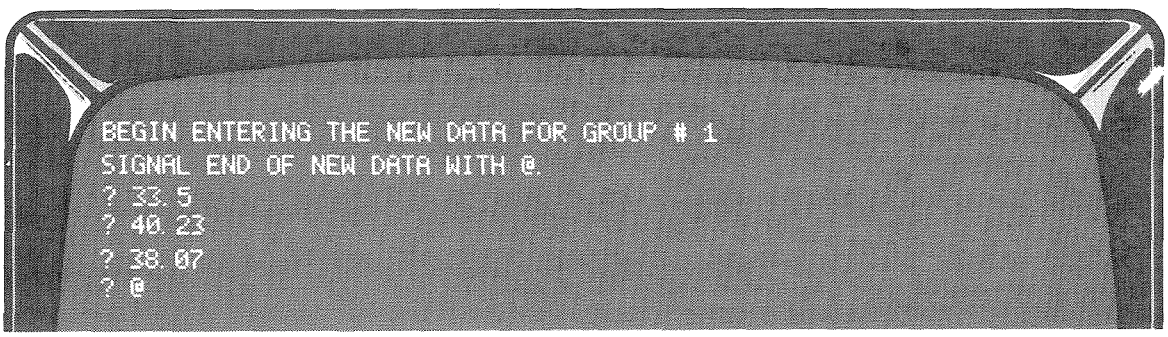
   ```
   (L)IST DATA AGAIN OR (E)ND PROGRAM ? _
   ```

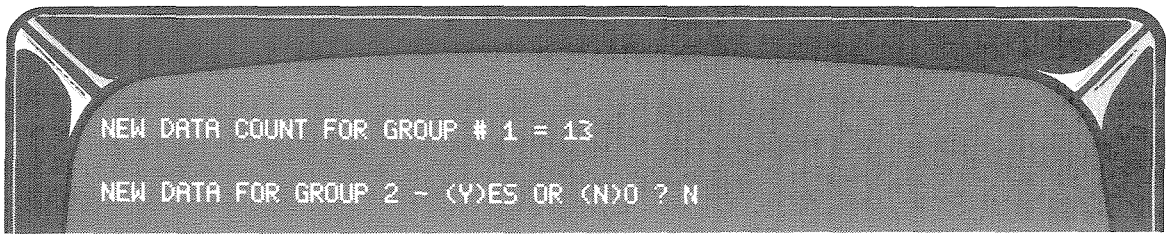
   Enter an L or an E as appropriate.

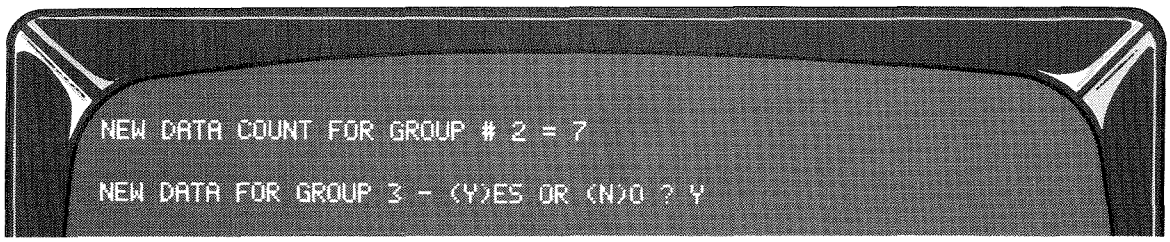
Sample Run (Updating an ANOVA disk file)

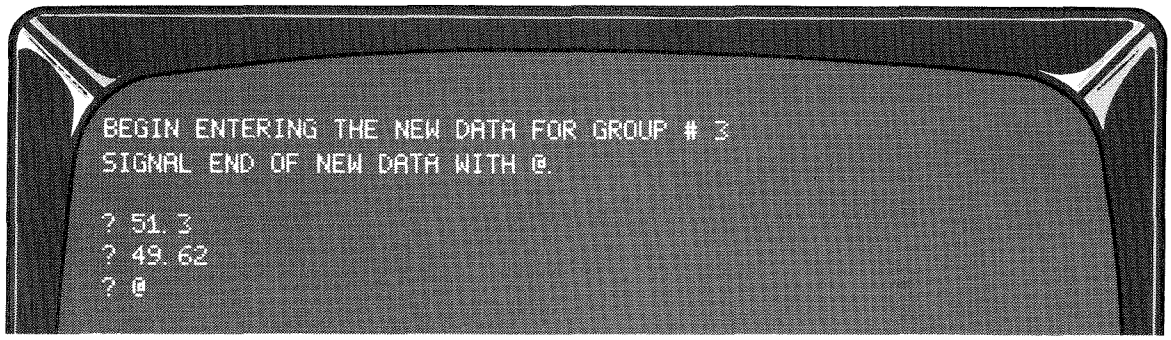

LIST THE DATA ELEMENTS TO BE REMOVED.
? 20
? 15
? 32

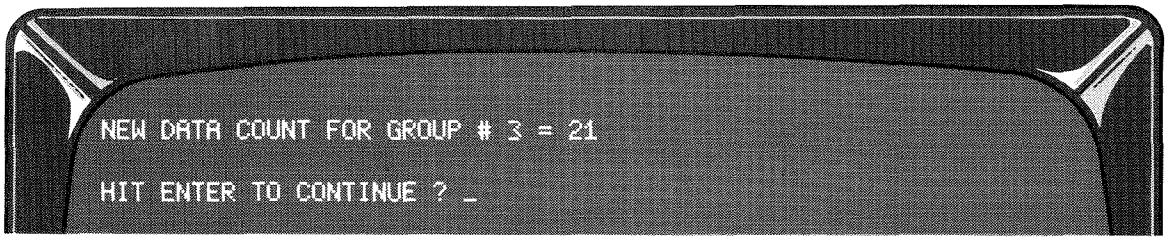

DATA FILE BEING READ - NOV77/DAT
GROUP 1 : NUMBER OF DATA ELEMENTS READ FROM DISK = 10
GROUP 2 : NUMBER OF DATA ELEMENTS READ FROM DISK = 9
GROUP 3 : NUMBER OF DATA ELEMENTS READ FROM DISK = 20
NUMBER OF DATA ELEMENTS REMOVED = 3
NEW DATA COUNT = 36
(ALL GROUPS COMBINED)
NEW DATA FOR GROUP 1 - (Y)ES OR (N)O ? Y

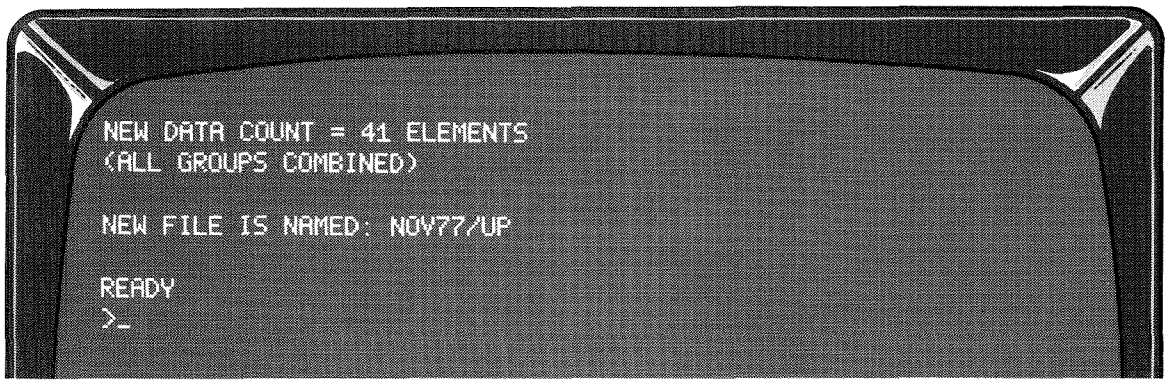

BEGIN ENTERING THE NEW DATA FOR GROUP # 1
SIGNAL END OF NEW DATA WITH @
? 33.5
? 40.23
? 38.07
? @


NEW DATA COUNT FOR GROUP # 1 = 13
NEW DATA FOR GROUP 2 - (Y)ES OR (N)O ? N


NEW DATA COUNT FOR GROUP # 2 = 7
NEW DATA FOR GROUP 3 - (Y)ES OR (N)O ? Y


BEGIN ENTERING THE NEW DATA FOR GROUP # 3
SIGNAL END OF NEW DATA WITH @.
? 51.3
? 49.62
? @


NEW DATA COUNT FOR GROUP # 3 = 21
HIT ENTER TO CONTINUE ? _


NEW DATA COUNT = 41 ELEMENTS
(ALL GROUPS COMBINED)
NEW FILE IS NAMED: NOV77/UP
READY
>_

Messages and Special Considerations

FILE NOT FOUND IN 700 means that the data file to be updated or listed does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

BAD FILE DATA and **WRONG DATA FILE TYPE** both indicate a problem in a data file. The disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

If the number of data elements removed from the file by the Computer is less than the number you expected to be removed, you may have (1) entered a data value which did not exist or (2) entered the same data element more than once. You may cancel the update by pressing **BREAK** or allow the program to run to completion, then list the updated file and check it for mistakes.

If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The Computer will either remove the scratch file or display **FILE NOT FOUND**.

Random Sample

Description of the Program

This program aids the user in selecting a random sample from a larger group of subjects, items or observations. Stratified random sampling can be performed by running the program more than once. After the user specifies the size of the population and the size of the desired sample, the Computer selects the sample and lists the numbers of the chosen data elements on the screen.

Features

- Sampling with or without replacement
- Output can be listed in a Line Printer

Limitations

- Largest population size from which a sample may be drawn is 32767
- Maximum sample size per run is 2200.

How to Run Random Sample

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** . The Computer will ask

```
WHAT IS THE TOTAL POPULATION SIZE ? _
```

2. Enter the number of persons, objects, packages, etc. in the total group. The Computer will display

```
WHAT SIZE SAMPLE DO YOU DESIRE ? _
```

3. Enter the number of persons, objects, etc. that you want as your sample. The Computer will reply

```
SAMPLING PROCEDURES AVAILABLE:
      1=SAMPLING WITH REPLACEMENT
      2=SAMPLING WITHOUT REPLACEMENT   WHICH ? _
```

4. Select a procedure and enter the appropriate value. If you enter a **1**, each member of the total group can be selected as a member of the sample more than once. The Computer will ask

```
LIST SAMPLE DATA ELEMENT NUMBERS ON PRINTER - (Y)ES OR (N)O ? _
```

5. Enter a **Y** if you have a Line Printer and want a permanent list of the selected element numbers. Otherwise, enter an **N**.

6. The Computer will reply

```
COMPUTER AT WORK - PLEASE BE PATIENT.
```

   Depending on the size of the sample you are selecting, it may take quite a while before the selection is completed.

7. The element numbers which make up your sample will be displayed on the screen. If you do not have a printer, copy these numbers down for use in preparing your sample data. If your sample is larger than 48, the Computer will stop listing numbers as it fills the screen, and will display

```
HIT ENTER TO CONTINUE LIST ? _
```

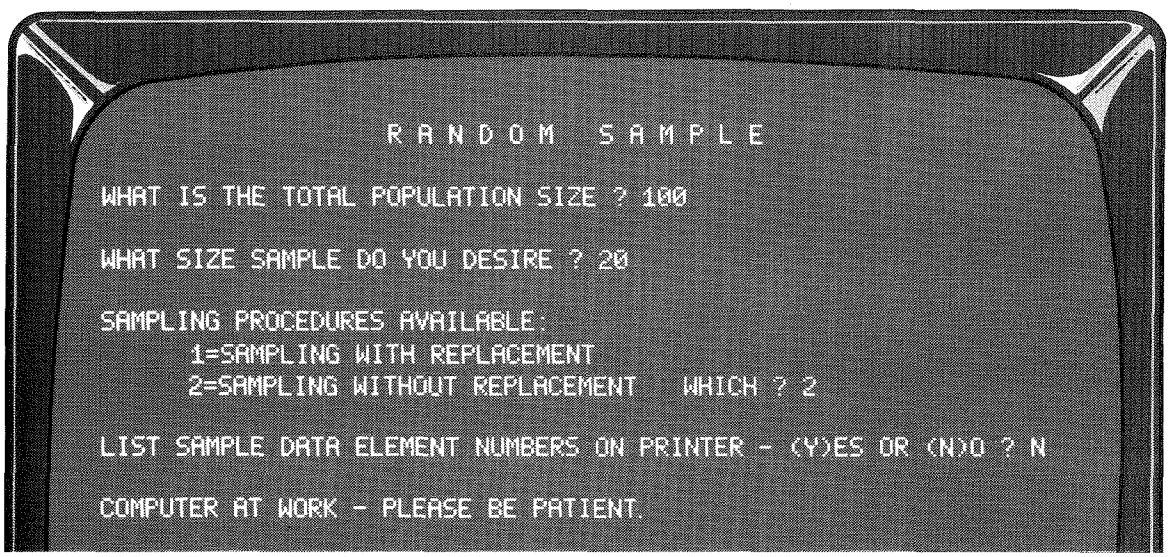
   When you have copied the element numbers from the screen, press **ENTER**.

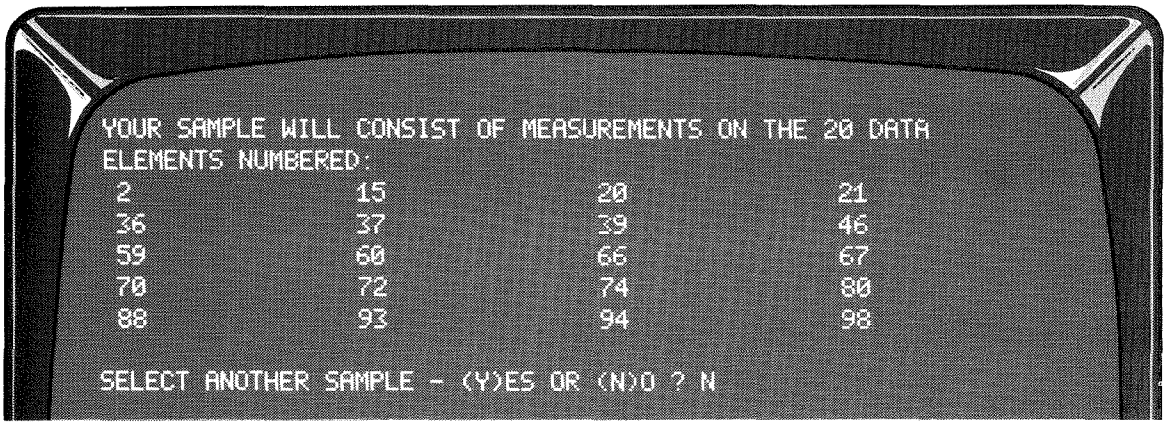
8. When all sample element numbers have been listed, the Computer will print

```
SELECT ANOTHER SAMPLE - (Y)ES OR (N)O ? _
```

   Enter a **Y** or an **N**.

Sample Run





Messages and Special Considerations

If you run this program for practice using the population and sample sizes above and obtain "results" that are different from the sample run, don't panic – that is the way the program is supposed to work! Remember, it is drawing a **random** sample.

Descriptive Statistics

Description of the Program

DESCRIPTIVE STATISTICS provides the user with an overall picture of his/her data. Output from the program includes sample statistics (mean, variance, standard deviation, range, minimum, and maximum); sample size; unbiased estimates of population parameters (variance and standard deviation); and data distribution coefficients (skewness and kurtosis).

Features

- Input from keyboard or data file (tape or disk)
- Input accepted from any type ASA data file (X or Y variable from a paired type file, any single group from an analysis of variance file, dependent variable or any single independent variable from a multiple regression file)
- Output formatted at 8½" x 11" on Line Printer

How to Run Descriptive Statistics

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** The Computer will ask

   ```
   HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
   ```

2. Answer **K**, **T**, or **D** depending on the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

   If you entered a **K**, skip to instruction #4.

   The Computer will ask

   ```
   SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ? _
   ```

3. If your tape or disk data file was prepared as a single type file (prepared for DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION) enter an **N** and skip to instruction #4. If the file was prepared for any other ASA program enter a **Y**.

   If you enter a **Y**, the computer will ask,

```
WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,
            2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ? _
```

   Depending on whether you enter a **1**, **2**, or **3**, the Computer will display,

```
WHICH VARIABLE (1=X, 2=Y) ? _
```

   or

```
WHICH GROUP (1 - 5 ONLY) ? _
```

   or

```
WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ? _
```

   Enter the number corresponding to the variable or group for which descriptive statistics are desired.

   > Note: Do not run DESCRIPTIVE STATISTICS on the time (X) variable in time series data nor on any coded independent variable in multiple regression files.

4. The Computer will ask,

```
WHAT IS THE NAME OF YOUR VARIABLE ? _
```

   Enter any alphanumeric name up to 14 characters in length. The name will be used for labeling the output from the program. To save time you can simply press **ENTER**. The Computer will display,

```
DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
```

5. Enter a **Y** if you have a printer and desire a permanent record of the program output. Otherwise enter an **N**.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will respond,

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA WITH @ (AT SYMBOL) ? _
```

   Type your first data value, after the question mark and hit **ENTER**. Another question mark will appear. Continue to enter the remaining data values, then enter **@**.

   (Skip to instruction #7)

   - If you enter a **T** at instruction #2, the Computer will reply

```
INSERT DATA TAPE - HIT ENTER ? _
```

   Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the tape is rewound and that the recorder controls are set to Play. Then press **ENTER**. The Computer will begin reading your data and the name of the data file will appear on the screen. Check the name of the file to be certain that the correct data are being read.

7. If you requested output on the Line Printer, the Computer will display

```
TURN ON YOUR PRINTER - HIT ENTER ? _
```

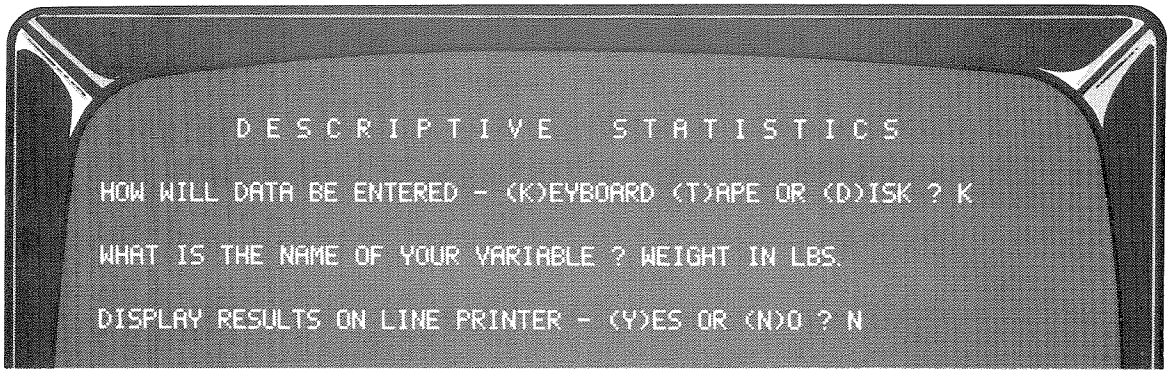
   Make sure your Printer is turned on, then press **ENTER**.

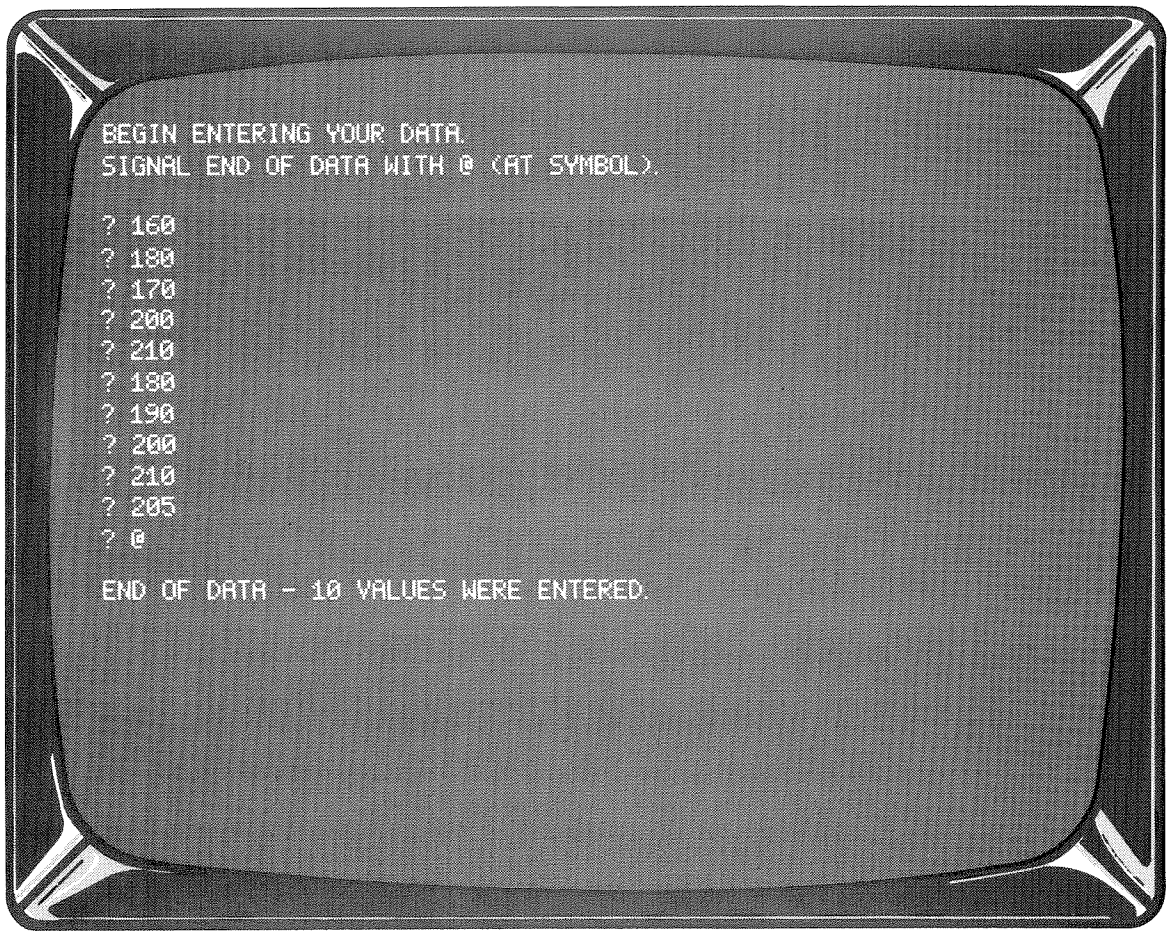
8. After the results of the program have been displayed (and printed, if applicable) the Computer will ask

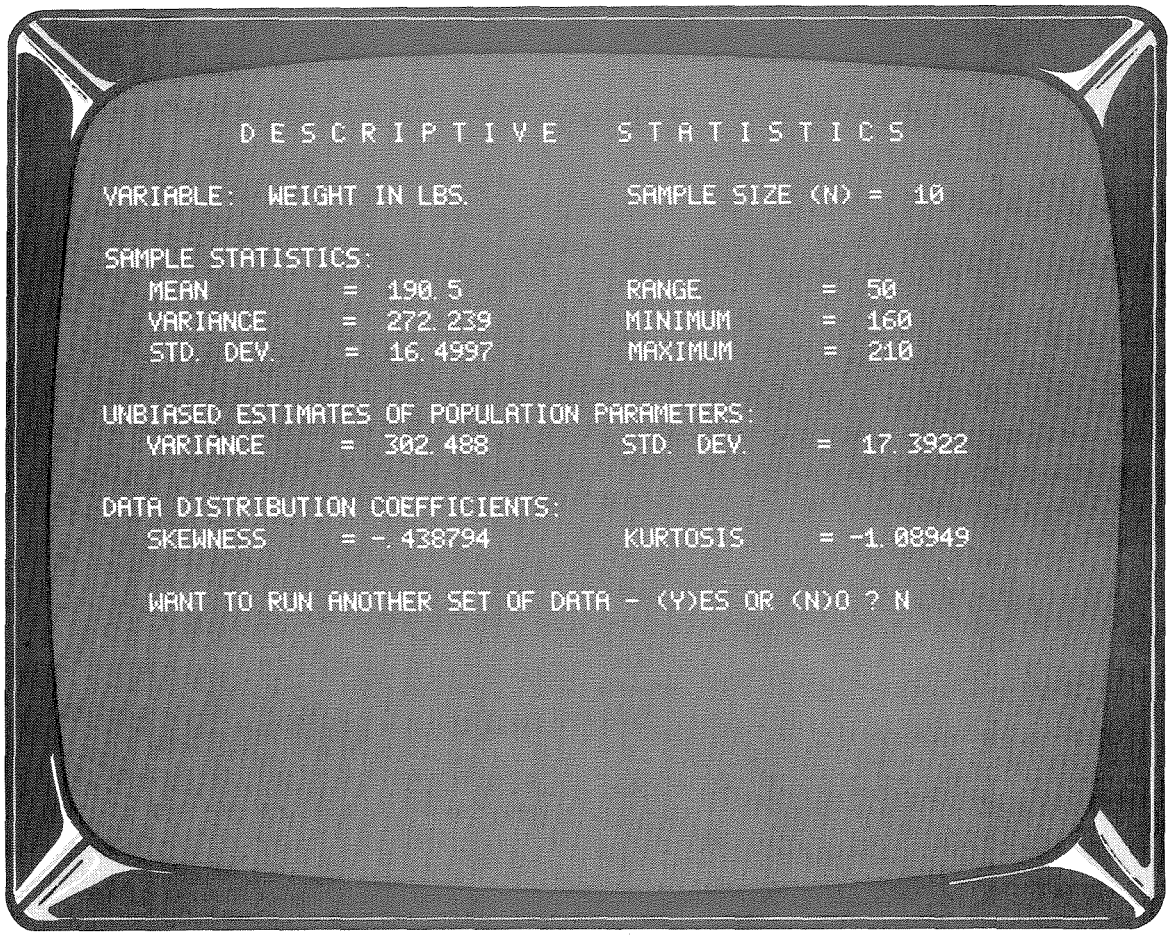
```
WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ? _
```

   Respond by entering a **Y** or an **N**.

Sample Run


D E S C R I P T I V E S T A T I S T I C S
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? K
WHAT IS THE NAME OF YOUR VARIABLE ? WEIGHT IN LBS.
DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? N


BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA WITH @ (AT SYMBOL).
? 160
? 180
? 170
? 200
? 210
? 180
? 190
? 200
? 210
? 205
? @
END OF DATA - 10 VALUES WERE ENTERED.


D E S C R I P T I V E S T A T I S T I C S
VARIABLE: WEIGHT IN LBS.
SAMPLE SIZE (N) = 10
SAMPLE STATISTICS:
MEAN = 190.5
VARIANCE = 272.239
STD. DEV. = 16.4997
RANGE = 50
MINIMUM = 160
MAXIMUM = 210
UNBIASED ESTIMATES OF POPULATION PARAMETERS:
VARIANCE = 302.488
STD. DEV. = 17.3922
DATA DISTRIBUTION COEFFICIENTS:
SKEWNESS = -.438794
KURTOSIS = -1.08949
WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ? N

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced at instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

> NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The computer will either remove the file or display **FILE NOT FOUND.**

THERE ARE ONLY 3 GROUPS! means that you were using a special input data file type (in this case a tape or disk file prepared for ANALYSIS OF VARIANCE) and specified descriptive statistics for a group which did not exist on the file (3 is only an example).

THERE ARE ONLY 2 INDEPENDENT VARIABLES! means that you were using a special input data file type (a tape or disk file prepared for MULTIPLE LINEAR REGRESSION) and specified descriptive statistics for an independent variable that did not exist.

> NOTE: Data distribution coefficients (Skewness and Kurtosis) are not displayed or printed if the standard deviation of the data set is 0.

Histogram

Description of the Program

HISTOGRAM allows the user to obtain a graphic description of his/her data set. The histogram is drawn with from one to eight intervals as selected by the user. Both frequencies and percentages are labeled on the histogram and each interval is plotted with considerable accuracy. The number of intervals on the histogram can be changed at will without the need for re-entering the data.

Features

- Input from keyboard or data file (tape or disk)
- Input accepted from any type ASA data file (X or Y variable from a paired type file, any single group from an analysis of variance file, dependent variable or any single independent variable from a multiple regression file)
- User may set limits of each interval or allow the Computer to calculate limits for equal size intervals
- Histogram may be reconstructed using different limits or a different number of intervals via simple keyboard instructions
- Print option may be selected each time histogram is reconstructed
- Line Printer output formatted at 8½" x 11"

Limitations

- 8 intervals maximum
- Label values limited to 6 characters (see note in Special Considerations section)

How to Run Histogram

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** . The Computer will reply

```
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
```

or

```
HOW WILL DATA BE ENTERED - (K)EYBOARD OR (T)APE ? _
```

2. Answer K, T or D, according to the type of input device you will be using. If you answer K skip to instruction #5.

   If you enter a D the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRS-80 TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

   The Computer will ask

   ```
   SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ? _
   ```

3. If your tape or disk data file was prepared as a single type file (prepared for DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION) enter an N and skip to instruction #5. Otherwise, enter a Y.

   If you enter a Y the Computer will ask

   ```
   WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,
               2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ? _
   ```

   Depending on whether you enter a 1, 2 or 3, the Computer will ask

   ```
   WHICH VARIABLE (1=X, 2=Y) ? _
   ```

   or

   ```
   WHICH GROUP (1 - 5 ONLY) ? _
   ```

   or

   ```
   WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ? _
   ```

4. Enter the number corresponding to the variable or group for which a histogram is desired.

   NOTE: Do not run HISTOGRAM on the time (X) variable in time series data nor on any coded independent variable in multiple regression files.

5. The Computer will ask

   ```
   WHAT IS THE NAME OF YOUR VARIABLE ? _
   ```

   Enter an alphanumeric name (up to 14 characters in length). Do not use commas. The name will be used to label the results of the program on the Line Printer, if used. You may simply press ENTER to save time.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will display

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA WITH @ (AT SYMBOL).

? _
```

     Type your first data value, after the question mark and press **ENTER** . Another question mark will appear. Enter the remaining data values, then enter **@**.

     (Now skip to instruction #7)

   - If you entered a **T** at instruction #2, the Computer will display

```
INSERT DATA TAPE - SET TO PLAY - HIT ENTER ? _
```

     Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the data tape is rewound, set the recorder controls to play, and press **ENTER** . The Computer will begin reading the data and the name of the data file will be displayed. Check the name of the file to be certain that the correct data are being read.

7. The Computer will display the number of data elements, minimum data value, and maximum data value and ask

```
HOW MANY INTERVALS FOR HISTOGRAM (1 THROUGH 8) ? _
```

8. Enter the number of intervals you want the histogram to contain. The Computer will reply

```
LIMITS SET BY - (U)SER OR (C)OMPUTER ? _
```

   - Enter a **C** if you want the Computer to calculate the limits necessary to produce the number of equal size intervals requested above.

     (Now skip to instruction #9)

- Enter a **U** to set the interval limits yourself. The Computer will ask

  ```
  WHAT IS THE LOWER LIMIT FOR INTERVAL # 1 ? _
  ```

  Enter the smallest value to be included in the first interval. The Computer will ask for the lower limit for each succeeding interval. The limit value entered for each interval must be larger than the last limit that was entered. If you enter the same limit twice or enter a small limit value after one which was larger, you will be instructed to start over.

  After the lower limits for all the intervals have been entered, the Computer will ask

  ```
  WHAT IS THE TOP LIMIT FOR THE HISTOGRAM  ? _
  ```

  Enter the largest data value to be included in the histogram. This value must be larger than the lower limit of the last interval and is inclusive (i.e., data values equal to the top limit value will be placed in the last interval – they will not be excluded from the histogram).

9. The Computer will display the histogram on the screen.

   NOTE: Data values are accumulated in the intervals according to their size relative to the various interval limits. Interval 1, for example, will contain all data values greater than (or equal to) the lower limit of that interval but less than the lower limit of interval 2.

   The following message will be displayed below the histogram:

   ```
   (N)EW INTERVALS, (P)RINT HISTOGRAM, OR (E)ND PROGRAM ? _
   ```

10. Enter an **N** to reconstruct the histogram, a **P** to print the displayed histogram on the Line Printer, or an **E** to end the program.

    - If you enter an **N**, go to instruction #7.
    - If you enter a **P**, the Computer will display,

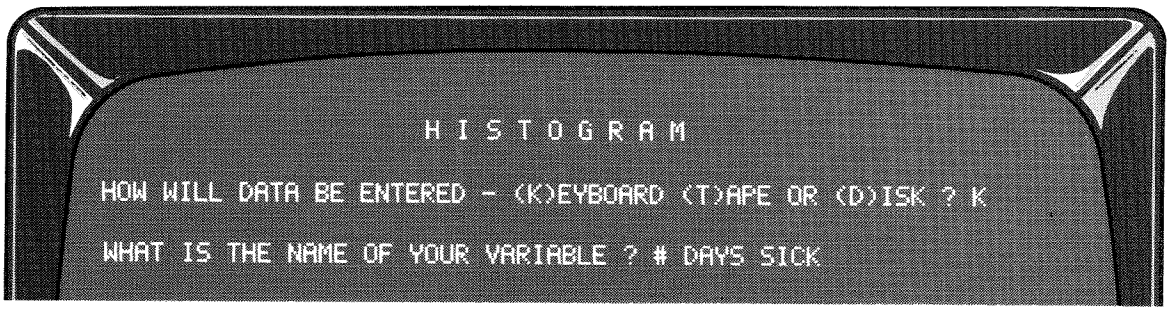
    ```
    TURN ON YOUR PRINTER - HIT ENTER ? _
    ```

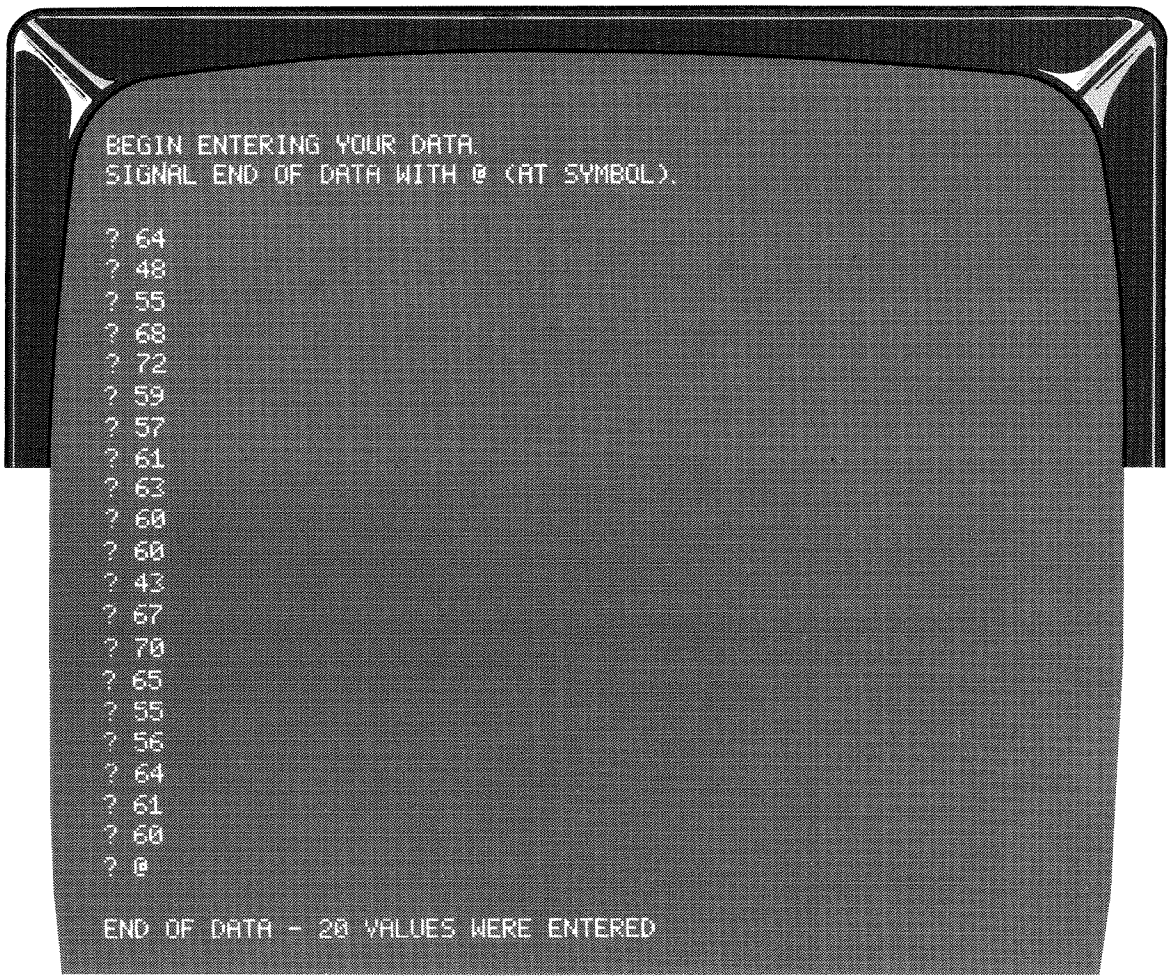
11. Press **ENTER** . The Computer will print the histogram and then display

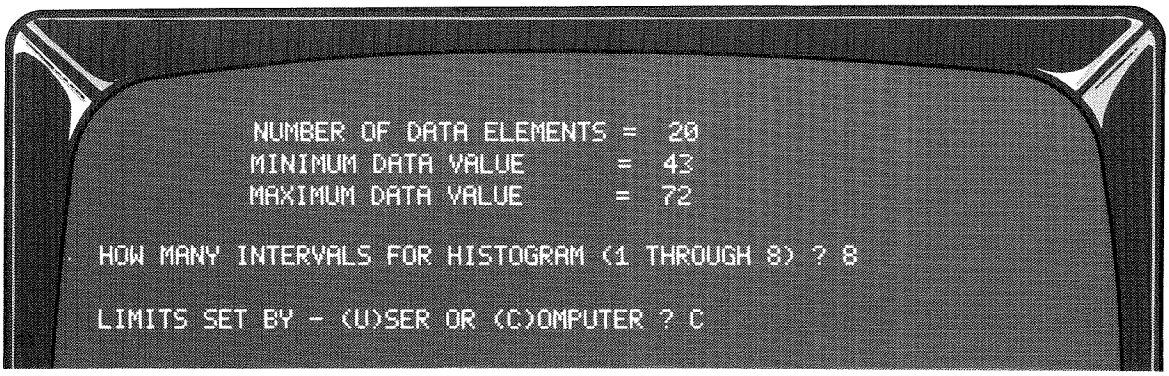
    ```
    (N)EW INTERVALS, (P)RINT HISTOGRAM, OR (E)ND PROGRAM ? _
    ```

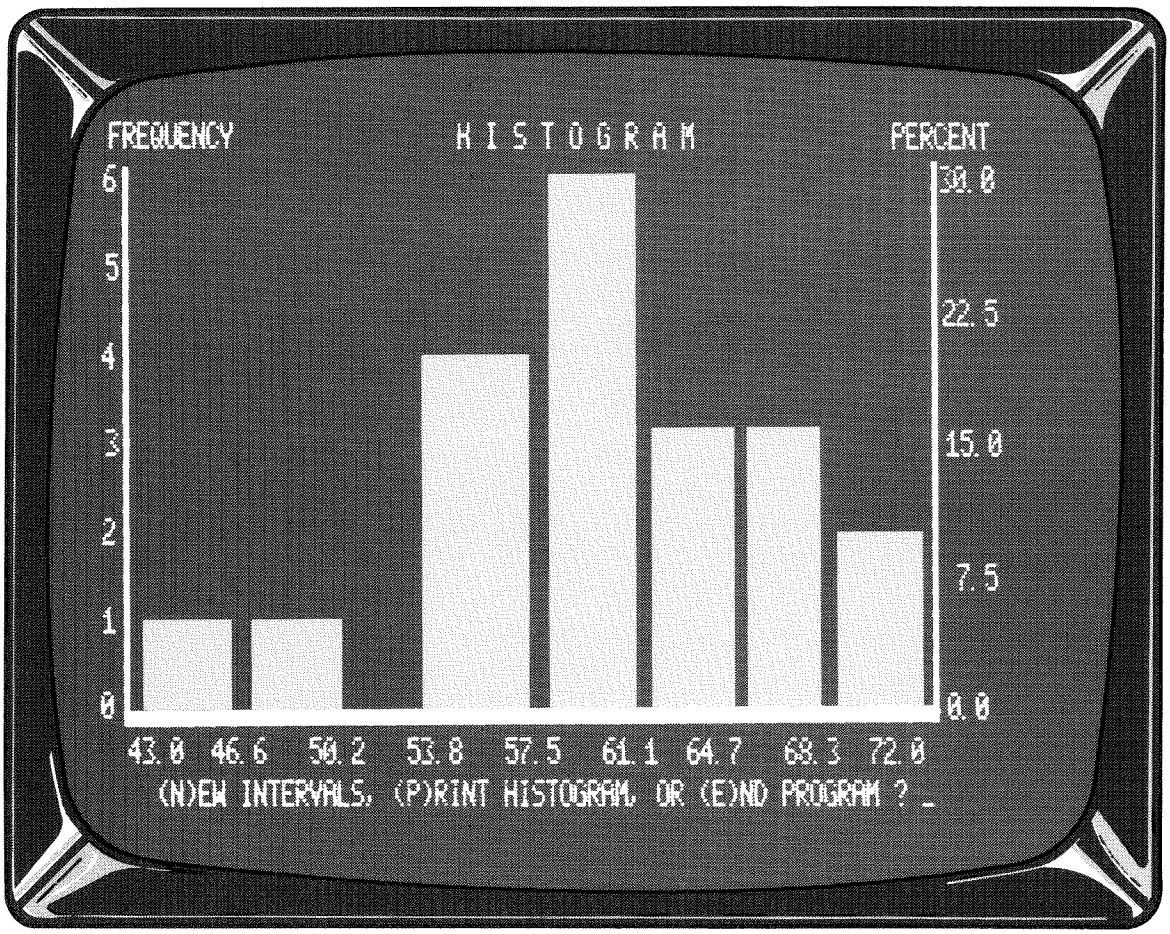
    (Now go to instruction #10)

Sample Run


H I S T O G R A M
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? K
WHAT IS THE NAME OF YOUR VARIABLE ? # DAYS SICK


BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA WITH @ (AT SYMBOL).
? 64
? 48
? 55
? 68
? 72
? 59
? 57
? 61
? 63
? 60
? 60
? 43
? 67
? 70
? 65
? 55
? 56
? 64
? 61
? 60
? @
END OF DATA - 20 VALUES WERE ENTERED


NUMBER OF DATA ELEMENTS = 20
MINIMUM DATA VALUE = 43
MAXIMUM DATA VALUE = 72
HOW MANY INTERVALS FOR HISTOGRAM (1 THROUGH 8) ? 8
LIMITS SET BY - (U)SER OR (C)OMPUTER ? C


FREQUENCY
H I S T O G R A M
PERCENT
6
5
4
3
2
1
0
30.0
22.5
15.0
7.5
0.0
43.0 46.6 50.2 53.8 57.5 61.1 64.7 68.3 72.0
(N)EW INTERVALS, (P)RINT HISTOGRAM, OR (E)ND PROGRAM ? _

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced in instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

THERE ARE ONLY 3 GROUPS! means that you were using a special input data file type (in this case a tape or disk file prepared for ANALYSIS OF VARIANCE) and specified descriptive statistics for a group which did not exist on the file. (The "3" above is only an example.)

THERE ARE ONLY 2 INDEPENDENT VARIABLES! means that you were using a special input data file type (a tape or disk file prepared for MULTIPLE LINEAR REGRESSION) and specified descriptive statistics for an independent variable that did not exist.

LIMITS MUST BE IN ORDER! — START OVER means that while entering lower limits for intervals (or the top limit for the distribution), you entered a value which was smaller than (or equal to) a previous limit value. See instruction #8.

ONE INTERVAL MUST CONTAIN AT LEAST 6 VALUES TRY FEWER INTERVALS (YOU TRIED 5 LAST TIME) is self-explanatory. Any data set containing a total of 6 or more values can be plotted (try asking for 1 interval) but may have to settle for fewer intervals than you wanted.

NOTE: Data values for HISTOGRAM may range from −3276.7 to +3276.7 only. To insure that the program will run properly, and to provide for readable values on the X axis of the histogram figure, it is recommended that all data values be "coded" down to consist of a maximum of three (3) digits **before** the decimal point. Any valid coding scheme, such as division by a constant, subtraction of a constant, etc., may be used. The number of digits following the decimal point has no effect on the operation of the program, but all values are rounded to one decimal place.

For example, a researcher studying **income**, might input each subject's income in "thousands of dollars" (an income of $15,000.00 would be input as 15, an income of $11,450.00 as 11.45, etc.). The resulting histogram would present the data as "thousands of dollars of income." Coding can also be used to make histograms involving extremely **small** values more readable. In this case, the values would be "coded" up, or made larger.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter `KILL "SCRATCH/ASA"`. The Computer will either remove the file, or display **FILE NOT FOUND**.

Frequency Distribution

Description of the Program

FREQUENCY DISTRIBUTION provides a tabular description of the distribution of values in a set of data. The table is prepared with from one to ten intervals as selected by the user. The number of intervals in the table can be changed at will without the need for re-entering the data. Entries on the frequency distribution table include interval limits, frequency of occurrence, percentage for each interval, and cumulative percentage by interval.

Features

- Input from keyboard or data file (tape or disk)
- Input accepted from any type ASA data file (X or Y variable from a paired type file, any single group from an analysis of variance file, dependent variable or any single independent variable from a multiple regression file)
- User may set limits of each interval or allow the Computer to calculate limits for equal size intervals
- Table may be reconstructed using different limits or a different number of intervals via simple keyboard instructions
- Print option may be selected each time table is reconstructed
- Line Printer output formatted at 8½" x 11"

Limitations

- 10 intervals maximum

How to Run Frequency Distribution

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**
   The Computer will reply

```
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
```

or

```
HOW WILL DATA BE ENTERED - (K)EYBOARD OR (T)APE ? _
```

2. Answer K, T or D according to the type of input device you will be using. If you answer K skip to instruction #5.

   If you enter a D, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRS-80 TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

   The Computer will ask

```
SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ? _
```

3. If your tape or disk data file was prepared as a single type file (prepared for DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION) enter an N and skip to instruction #5. Otherwise enter a Y .

   If you enter a Y the Computer will ask

```
WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,
            2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ? _
```

   Depending on whether you enter a 1, 2 or 3, the Computer will ask

```
WHICH VARIABLE (1=X, 2=Y) ? _
```

   or

```
WHICH GROUP (1 - 5 ONLY) ? _
```

   or

```
WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ? _
```

4. Enter the number corresponding to the variable or group for which a frequency distribution is desired.

   NOTE: Do not run FREQUENCY DISTRIBUTION on the time (X) variable in time series data, nor on any coded independent variable in multiple regression files.

5. The Computer will ask

```
WHAT IS THE NAME OF YOUR VARIABLE ? _
```

Enter an alphanumeric name (up to 14 characters in length). Do not use commas. The name will be used to label the results of the program on the printer, if used. You may simply press **ENTER** to save time.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will display

     ```
     BEGIN ENTERING YOUR DATA.
     SIGNAL END OF DATA WITH @ (AT SYMBOL).

     ? _
     ```

     Type your first data value, after the question mark and press **ENTER** . Another question mark will appear. Enter the remaining data values then enter **@**.

     (Now skip to instruction #7)

   - If you entered a **T** at instruction #2, the Computer will display

     ```
     INSERT DATA TAPE - SET TO PLAY - HIT ENTER ? _
     ```

     Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the data tape is rewound, set the recorder controls to Play, and press **ENTER** . The Computer will begin reading the data and the name of the data file will be displayed. Check the name of the file to be certain that the correct data are being read.

7. The Computer will display the number of data elements, minimum data value, and maximum data value and ask

   ```
   HOW MANY INTERVALS FOR DISTRIBUTION (1 THROUGH 10) ? _
   ```

8. Enter the number of intervals you want the distribution table to contain. The Computer will reply

   ```
   LIMITS SET BY - (U)SER OR (C)OMPUTER ? _
   ```

   - Enter a **C** if you want the Computer to calculate the limits necessary to produce the number of equal size intervals requested above.

     (Now skip to instruction #9)

- Enter a **U** to set the interval limits yourself. The Computer will ask

```
WHAT IS THE LOWER LIMIT FOR INTERVAL # 1 ? _
```

Enter the smallest value to be included in the first interval. The Computer will ask for the lower limit for each succeeding interval. The limit value entered for each interval must be larger than the last limit that was entered. If you enter the same limit twice or enter a small limit value after one which was larger, you will be instructed to start over.

After the lower limits for all the intervals have been entered, the Computer will ask

```
WHAT IS THE TOP LIMIT FOR THE DISTRIBUTION  ? _
```

Enter the largest data value to be included in the distribution. This value must be larger than the lower limit of the last interval and is inclusive (i.e., data values equal to the top limit value will be placed in the last interval – they will not be excluded from the distribution).

9. The Computer will display the frequency distribution table on the screen.

NOTE: Data values are accumulated in the intervals according to their size relative to the various interval limits. Interval 1, for example, will contain all data values greater than or equal to the lower limit of that interval but less than the lower limit of interval 2. For aesthetic reasons, the upper limit of each interval, except the last, will be listed on the distribution table as the lower limit of the next higher interval minus .001 (e.g., 43.000 TO 46.599, 46.600 TO 50.199, 50.200 TO 53.799).

The following message will be displayed below the distribution table:

```
                                                              ? _

(N)EW INTERVALS, (P)RINT DISTRIBUTION, OR (E)ND PROGRAM
```

10. Enter an **N** to reconstruct the table, a **P** to print the displayed distribution table on the Line Printer, or an **E** to end the program.

- If you enter an **N**, go to instruction #7.
- If you enter a **P**, the Computer will display

```
                                        ? _
TURN ON YOUR PRINTER - HIT ENTER
```

11. Press ENTER. The Computer will print the distribution table and then display

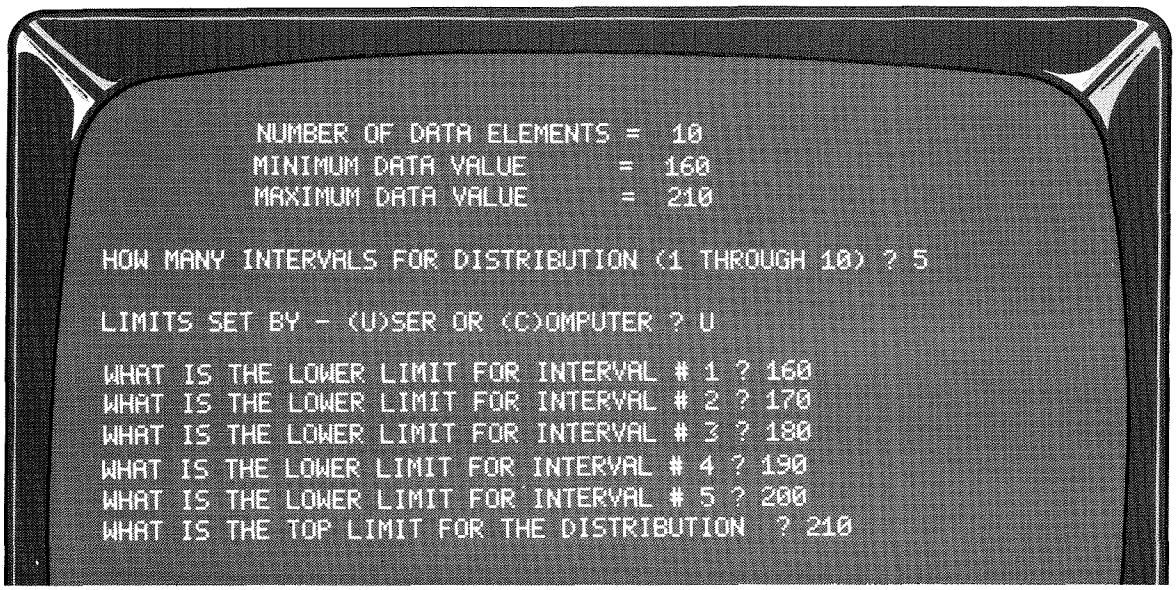
```
                                                              ? _
(N)EW INTERVALS, (P)RINT DISTRIBUTION, OR (E)ND PROGRAM
```

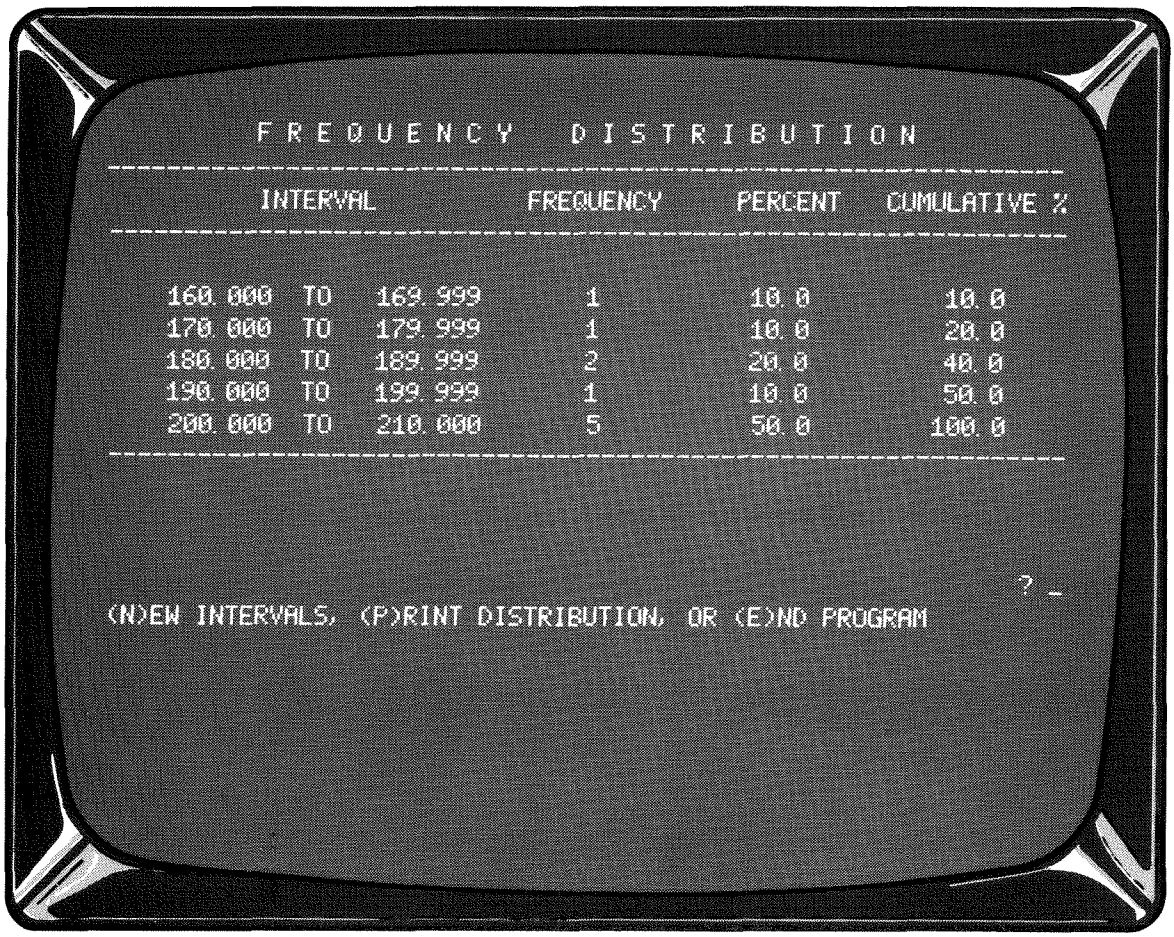
(Now go to instruction #10)

Sample Run

```
        F R E Q U E N C Y    D I S T R I B U T I O N

HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? K

WHAT IS THE NAME OF YOUR VARIABLE ? WEIGHT IN LBS.
```

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA WITH @ (AT SYMBOL).

? 160
? 180
? 170
? 200
? 210
? 180
? 190
? 200
? 210
? 205
? @

END OF DATA - 10 VALUES WERE ENTERED.
```


NUMBER OF DATA ELEMENTS = 10
MINIMUM DATA VALUE = 160
MAXIMUM DATA VALUE = 210
HOW MANY INTERVALS FOR DISTRIBUTION (1 THROUGH 10) ? 5
LIMITS SET BY - (U)SER OR (C)OMPUTER ? U
WHAT IS THE LOWER LIMIT FOR INTERVAL # 1 ? 160
WHAT IS THE LOWER LIMIT FOR INTERVAL # 2 ? 170
WHAT IS THE LOWER LIMIT FOR INTERVAL # 3 ? 180
WHAT IS THE LOWER LIMIT FOR INTERVAL # 4 ? 190
WHAT IS THE LOWER LIMIT FOR INTERVAL # 5 ? 200
WHAT IS THE TOP LIMIT FOR THE DISTRIBUTION ? 210


F R E Q U E N C Y D I S T R I B U T I O N
INTERVAL FREQUENCY PERCENT CUMULATIVE %
160.000 TO 169.999 1 10.0 10.0
170.000 TO 179.999 1 10.0 20.0
180.000 TO 189.999 2 20.0 40.0
190.000 TO 199.999 1 10.0 50.0
200.000 TO 210.000 5 50.0 100.0
? _
(N)EW INTERVALS, (P)RINT DISTRIBUTION, OR (E)ND PROGRAM

Messages and Special Considerations

FILE NOT FOUND IN 7ø ø means that the data file referenced in instruction #2 does not exist on disk. You may have entered the data file name incorrectly, or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and WRONG DATA FILE TYPE all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

THERE ARE ONLY 3 GROUPS! means that you were using a special input data file type (in this case a tape or disk file prepared for ANALYSIS OF VARIANCE), and specified descriptive statistics for a group which did not exist on the file. (The "3" above is only an example.)

THERE ARE ONLY 2 INDEPENDENT VARIABLES! means that you were using a special input data file type (a tape or disk file prepared for MULTIPLE LINEAR REGRESSION), and specified descriptive statistics for an independent variable that did not exist.

LIMITS MUST BE IN ORDER! - START OVER means that while entering lower limits for intervals or the top limit for the distribution, you entered a value which was smaller than (or equal to) a previous limit value. See instruction #8.

NOTE: Data values and interval limit values of any magnitude may be used in FREQUENCY DISTRIBUTION but, on the program output, the interval limits are rounded to three decimal places in order to fit on the screen. If your data set contains exceptionally large or small data values (e.g., 3652377.65, 1.7E22, .00000000062, −1.2E18), it would be best to "code" the data up or down resulting in values that could better be represented on the frequency distribution table. See the note under HISTOGRAM – Messages and Special Considerations for examples.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter KILL "SCRATCH/ASA". The computer will either remove the file or display FILE NOT FOUND.

Analysis of Variance

Description of the Program

This program performs a one-way (single-classification) analysis of variance on two to five groups or samples. Output from the program includes the analysis of variance (ANOVA) summary table, F ratio, estimate of exact chance probability, and summary statistics (N, mean, and standard deviation) for each group in the study.

Features

- Equal or unequal sample sizes
- Estimate of exact chance probability
- Input from keyboard or data file (disk or tape)
- Output formatted at 8½" x 11" on Line Printer

Limitations

- Maximum of five (5) groups

How to Run Analysis of Variance

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**
   The Computer will reply

```
HOW WILL DATA BE ENTERED - (K)EYBOARD, (T)APE, OR (D)ISK ? _
```

   or

```
HOW WILL DATA BE ENTERED - (K)EYBOARD OR (T)APE ? _
```

2. Answer **K**, **T** or **D** according to the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRS-80 TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

   The Computer will ask

```
HOW MANY GROUPS (2 TO 5 ONLY) ? _
```

3. Enter the number of groups or samples in the study. The Computer will display

```
NAME OF GROUP # 1 ? _
```

4. Enter an alphanumeric name (up to 14 characters in length). Do not use commas in the name. The group name will be used to label the results of the program.

   The Computer will request the name of each successive group in the study and then reply

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

5. Enter a **Y** if you have a printer and desire a permanent record of the analysis of variance results. Otherwise, enter an **N**.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will display

     ```
     BEGIN ENTERING THE DATA FOR GROUP # 1
     SIGNAL END OF DATA WITH @ (AT SYMBOL).
     ? _
     ```

     Enter the first data value for Group 1, after the question mark. Another question mark will appear. Continue entering data for Group 1. After the last data value for that group has been entered, type and enter an **@** ("at" symbol). The Computer will then request data for the next group. For each group in the study enter the data values followed by an **@**.

     (Now skip to instruction #7)

   - If you entered a **T** at instruction #2, the Computer will display,

     ```
     INSERT DATA TAPE - SET TO PLAY - HIT ENTER ? _
     ```

     Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the data tape is rewound, set the recorder controls to Play, and press **ENTER** . The Computer will begin reading the data and the name of the data file will be displayed. Check the name of the file to be certain that the correct data are being read.

7. If you requested output on the line printer, the Computer will reply

   ```
   TURN ON PRINTER - HIT ENTER ?
   ```

   Turn on your printer and press **ENTER**.

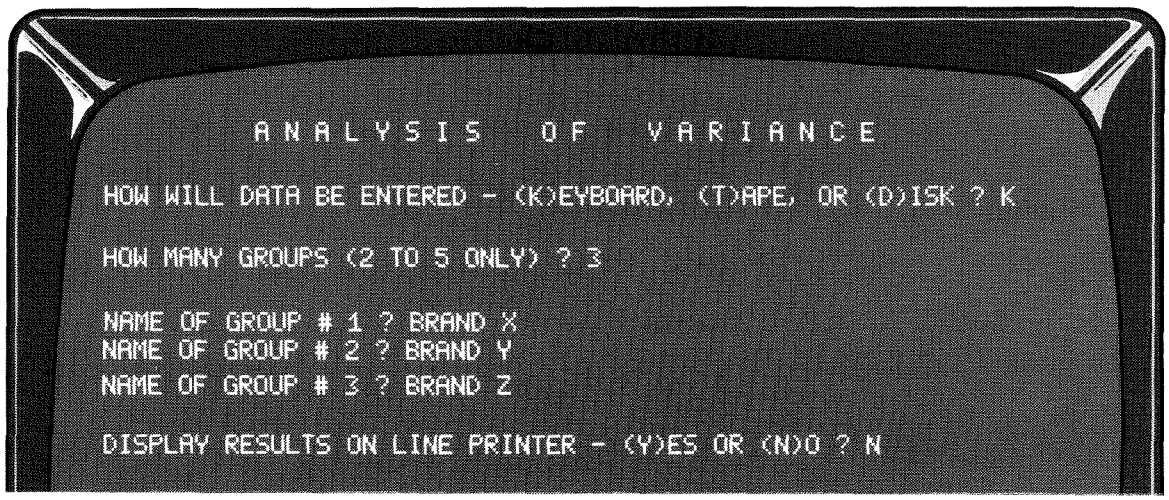
8. The Computer will display the ANOVA summary table on the screen and, if applicable, print both the ANOVA summary table and the group statistics.

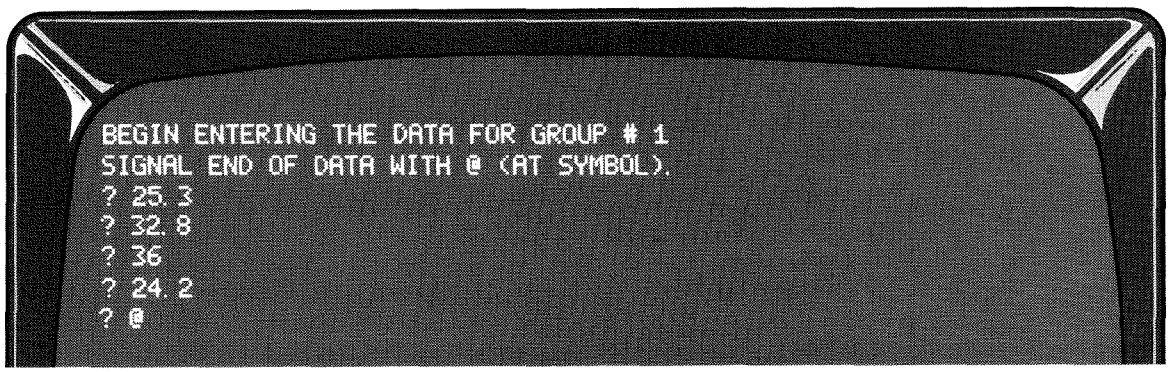
   The Computer will then display

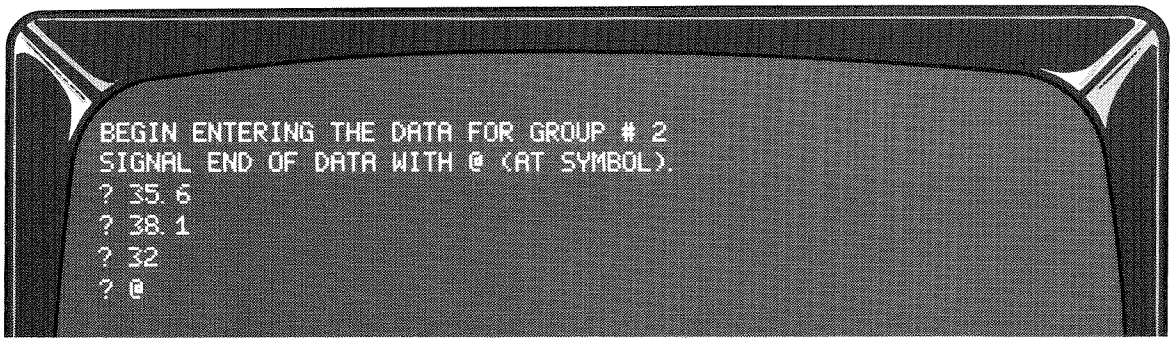
```
                                                    ? _
(G)ROUP STATISTICS, (A)NOVA TABLE, OR (E)ND PROGRAM
```

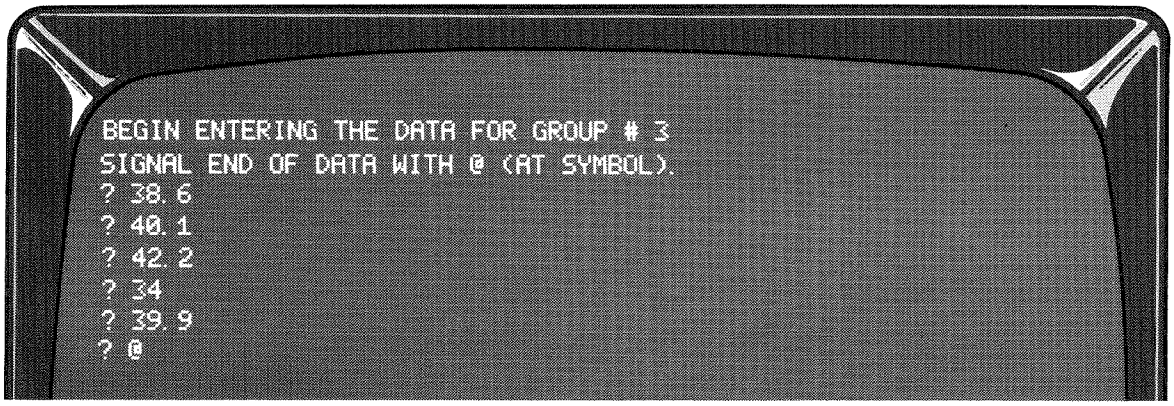
9. Enter a **G** to obtain summary statistics on each group. The statement above will again appear on the screen. You may view the ANOVA summary table and the group statistics as many times as you wish by entering the appropriate codes; the results will be printed on the Line Printer only once. Entering an **E** will end the program.

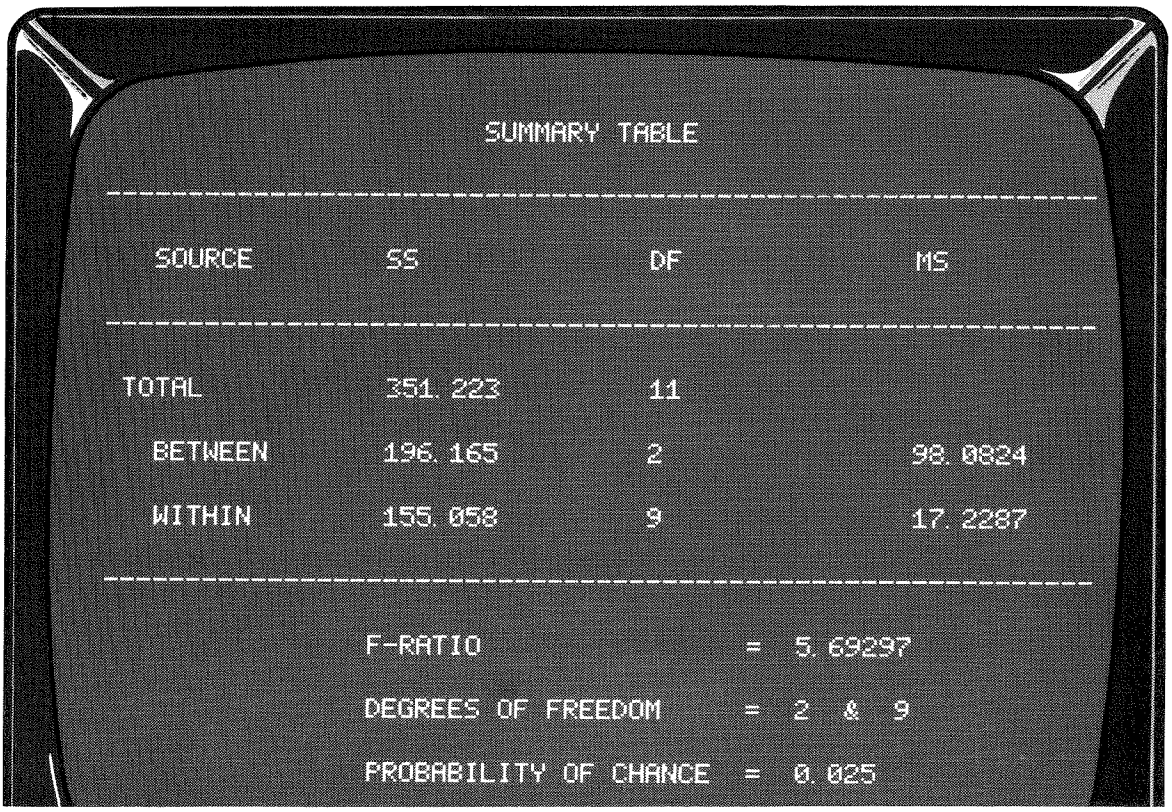
Sample Run

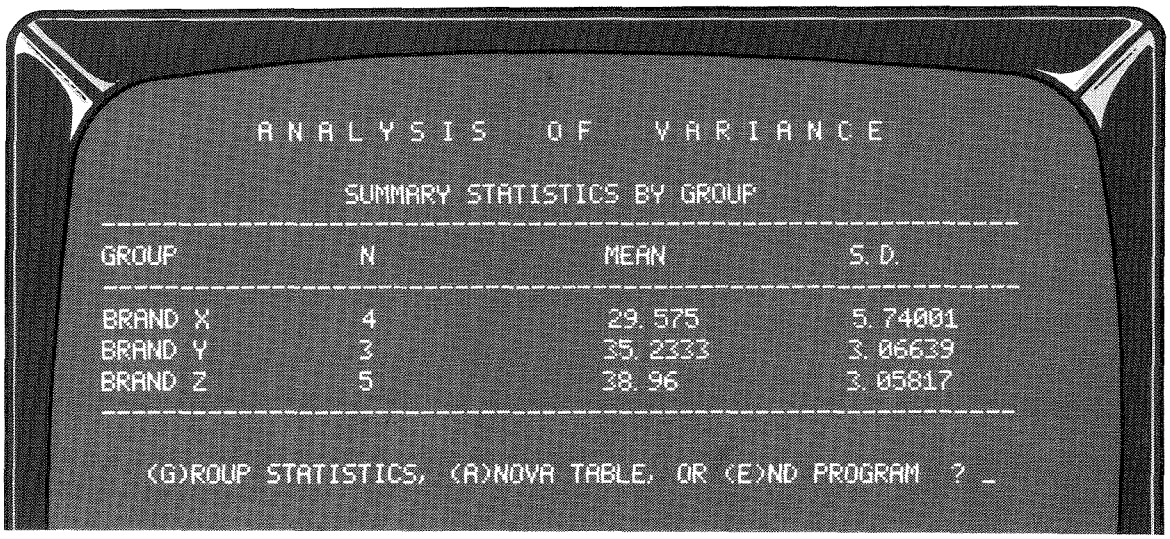





BEGIN ENTERING THE DATA FOR GROUP # 2
SIGNAL END OF DATA WITH @ (AT SYMBOL).
? 35.6
? 38.1
? 32
? @


BEGIN ENTERING THE DATA FOR GROUP # 3
SIGNAL END OF DATA WITH @ (AT SYMBOL).
? 38.6
? 40.1
? 42.2
? 34
? 39.9
? @


SUMMARY TABLE
SOURCE SS DF MS
TOTAL 351.223 11
BETWEEN 196.165 2 98.0824
WITHIN 155.058 9 17.2287
F-RATIO = 5.69297
DEGREES OF FREEDOM = 2 & 9
PROBABILITY OF CHANCE = 0.025



Messages and Special Considerations

FILE NOT FOUND IN 2ØØ means that the data file referenced in instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

THE DATA FILE CONTAINS 4 GROUPS NOT 3 means that the number of groups you specified in instruction #3 did not agree with the number of groups encountered in the tape or disk data file.

> NOTE (DISK BASIC ONLY): If the program ends prematurely a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The Computer will either remove the scratch file or display **FILE NOT FOUND**.

T-Test for Matched Pairs

Description of the Program

T-TEST FOR MATCHED PAIRS allows the user to test for a significant difference between the means of two measures, X and Y, when:

1. the measures were taken on the same individuals, both before and after the introduction of an experimental factor (pre-post design), or

2. individuals were matched on the basis of some variable(s) to ensure that the samples were as similar as possible before the experiment was begun.

This procedure is also referred to as a *t* test for correlated data, related measures, matched samples, etc. Output includes means, standard deviations, and standard errors of the means for the two variables; number of pairs; product-moment correlation between X and Y; difference between means; degrees of freedom; *t* ratio; and a probability estimate.

A *t* test for independent samples can be obtained for non-correlated data by running ANALYSIS OF VARIANCE. Run the program for two groups. The *t* ratio is simply the square root of the obtained F ratio.

Features

- One-tailed or two-tailed tests
- Estimate of exact chance probability
- Input from keyboard or data file (disk or tape)
- Output to Line Printer formatted at 8½" x 11"

How to Run T-Test for Matched Pairs

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**
   The Computer will ask

```
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
```

2. Answer **K**, **T** or **D** depending on the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

   The Computer will reply

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

3. Enter a **Y** if you have a printer and desire a permanent record of the test results. Otherwise, enter an **N**. The Computer will ask

   ```
   WHAT IS THE NAME OF VARIABLE X ? _
   ```

4. Enter any alphanumeric name (up to 14 characters in length). Do not use commas. The name will be used for labeling the *t* test results. Answer accordingly to the question,

   ```
   WHAT IS THE NAME OF VARIABLE Y ? _
   ```

   To save time you can reply to the above questions by simply pressing **ENTER** but the variables will be unlabeled when the results are displayed. The Computer will display

   ```
   TEST OF HYPOTHESIS (1=ONE-TAILED, 2=TWO-TAILED) ? _
   ```

5. If your hypothesis predicts the direction of the difference between the means for X and Y, enter a **1**. If only a difference (in either direction) is predicted, enter a **2**.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will respond

   ```
   BEGIN ENTERING YOUR DATA PAIRS (X,Y).
   SIGNAL END OF DATA WITH @,@.

   ? _
   ```

Type your first data pair, after the question mark (separate the X and Y values with a comma) and hit ENTER. Another question mark will appear. Continue entering the data pairs, then type and enter @,@ after the last pair.

(Now skip to instruction #7)

- If you enter a T at instruction #2, the Computer will respond,

```
INSERT DATA TAPE - HIT ENTER ? _
```

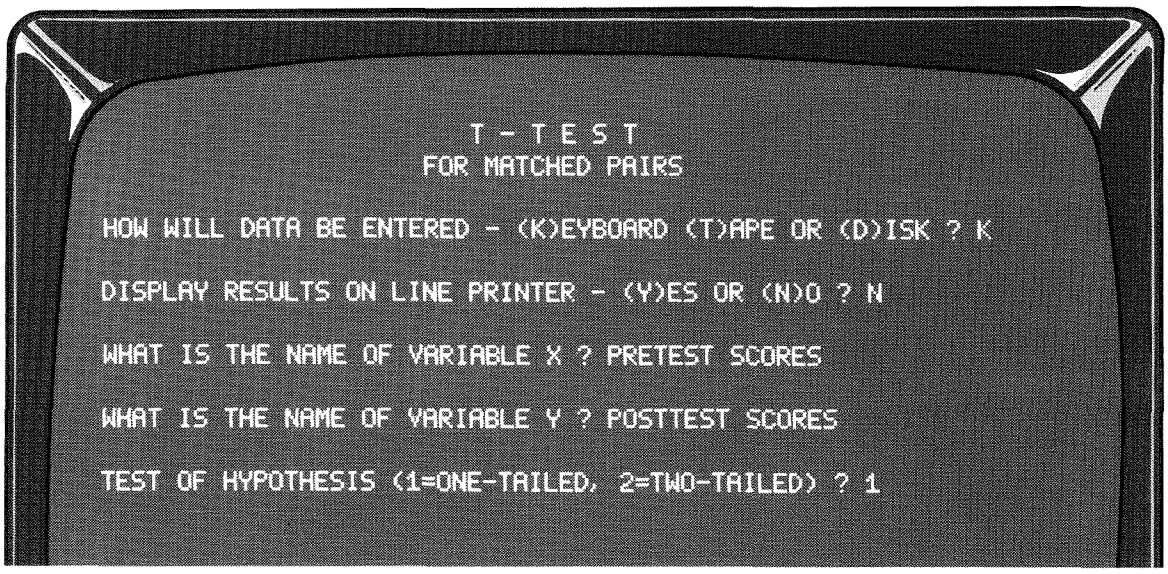
Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the tape is rewound and that the recorder controls are set to Play. Then press ENTER. The Computer will begin reading your data and the name of the data file will appear on the screen. Check the name of the file to be certain that the correct data are being read.

7. The Computer will display the results of the *t* test on the screen and ask

```
WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ? _
```

Enter a Y or an N as appropriate.

Sample Run



```
BEGIN ENTERING YOUR DATA PAIRS (X,Y).
SIGNAL END OF DATA WITH @,@.

? 45,50
? 50,57
? 42,48
? 56,60
? 38,44
? 47,59
? @,@

6 PAIRS WERE ENTERED.
```

```
                T-TEST  RESULTS

 VARIABLE X: PRETEST SCORES      VARIABLE Y: POSTTEST SCORE
 MEAN OF X    =  46.3333         MEAN OF Y    =  53
 S.D. OF X    =  5.73492         S.D. OF Y    =  6.00012
 S.E. OF MEAN =  2.56473         S.E. OF MEAN =  2.68334

          NUMBER OF PAIRS (N)              =  6
          CORRELATION OF X WITH Y (R)  = 0.906

          DIFFERENCE (MEAN X - MEAN Y) = -6.66667
          DEGREES OF FREEDOM (DF)      =  5
          T-RATIO FOR THE DIFFERENCE   = -5.82939
          PROBABILITY ( 1 TAILED TEST) = 0.001

WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ? N
```

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced in instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The Computer will either remove the file or display **FILE NOT FOUND**.

Correlation & Linear Regression

Description of the Program

CORRELATION & LINEAR REGRESSION is a multi-step program which describes the relationship between two variables or sets of measurements, calculates regression coefficients, provides an X by Y plot of the data with or without the regression (prediction) line, and allows the user to obtain the predicted value of Y at any value of X. The output also includes means and standard deviations for X and Y, number of pairs, and degrees of freedom.

Features

- Input from keyboard or data file (tape or disk)
- X by Y plot of the data
- Regression line on the X by Y plot if desired
- Expected values of Y in interactive mode (X values input via keyboard)
- Correlation/regression statistics and X by Y plot on Line Printer (formatted at 8½" x 11")

How to Run Correlation & Linear Regression

1. Load the program into the TRS-80. Type **RUN** and press **ENTER** . The Computer will ask

   ```
   HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
   ```

2. Answer **K**, **T** or **D** according to the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRSDOS/DISK BASIC Manual).

   Instruction #5 contains further information concerning your response to the above question.

   The Computer will ask

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

3. Enter a Y if you have a Line Printer and desire a permanent record of the correlation/regression statistics. If you select the PLOT option while running the program, the X by Y plot will also be printed (with or without the regression line).

   NOTE: During any single run of CORRELATION & LINEAR REGRESSION the correlation/regression statistics and the X by Y plot will be printed only once, regardless of how many times the STATISTICS and PLOT options are selected (see instruction #7).

   The Computer will ask

   ```
   WHAT IS THE NAME OF VARIABLE X ? _
   ```

4. Enter any alphanumeric name (up to 14 characters in length). The name will be used for labeling the results of the program. Answer accordingly to the question,

   ```
   WHAT IS THE NAME OF VARIABLE Y ? _
   ```

   To save time you can reply to the above questions by simply pressing ENTER but the variables will be unlabeled when the results are displayed.

5. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a D at instruction #2, skip to instruction #7.
   - If you entered a K at instruction #2, the Computer will reply

   ```
   BEGIN ENTERING YOUR DATA PAIRS (X,Y).
   SIGNAL END OF DATA WITH @,@.
   ? _
   ```

   Type your first data pair, after the question mark (separate the X and Y values with a comma) and hit ENTER. Another question mark will appear. Continue entering data pairs, then type and enter @,@ after the last pair.

   (Skip to instruction #7)

   - If you entered a T at instruction #2, the Computer will reply

   ```
   INSERT DATA TAPE - HIT ENTER ? _
   ```

Load the data tape into the cassette recorder (into Recorder #-1 if you are using a dual cassette system). Be sure the tape is rewound and that the recorder controls are set to Play. Then press **ENTER** . The Computer will begin reading your data and the name of the data file will appear on the screen. Check the name of the file to be certain that the correct data are being read.

6. If you requested output on the Line Printer the Computer will display

```
TURN ON PRINTER - HIT ENTER ? _
```

Make sure your printer is turned on, then press **ENTER** .

7. The Computer will display (and print, if applicable) the correlation/regression statistics and ask

```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ? _
```

You may select any of the options by entering the appropriate code.

- If you enter a **1** the Computer will ask

```
WANT REGRESSION LINE SHOWN (1=YES, 2=NO) ? _
```

Enter a **1** or a **2**. The Computer will draw and label a scattergram (X values on the horizontal axis, Y values on the vertical axis) and plot the data points. If you wanted the regression line, the line will be drawn on the scattergram at the proper location. The Computer will next print the X by Y plot (with or without the regression line) on the Line Printer, if applicable, and display

```
HIT ENTER TO CONTINUE ?
```

When you have finished viewing the scattergram, press **ENTER** . The Computer will again reply

```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN)   WHICH?
```

- If you enter a 2, the Computer will display

```
ENTER @ TO STOP PREDICTING
```

and will set up a table. A question mark will appear and the Computer will wait for you to input a value for X. Enter any numeric value within the range of X values in your data. The predicted Y value will be displayed along with another question mark. When you want to stop predicting, enter @ in place of an X value.

NOTE: Values of Y predicted from X values which lie outside the range of X for your data will probably be inaccurate. When an X value outside this range is entered, the predicted value will be accompanied by the message, (X NOT IN RANGE).

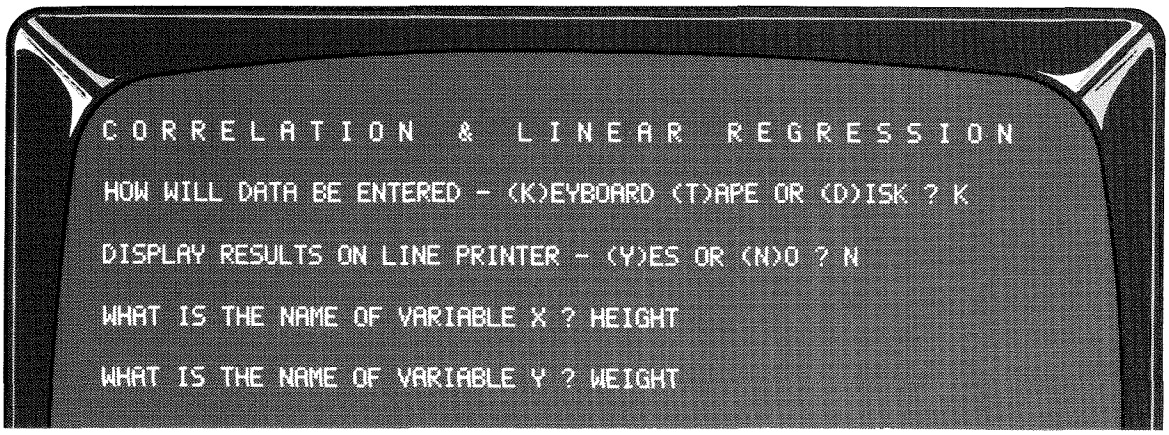
When you have stopped predicting, the Computer will reply

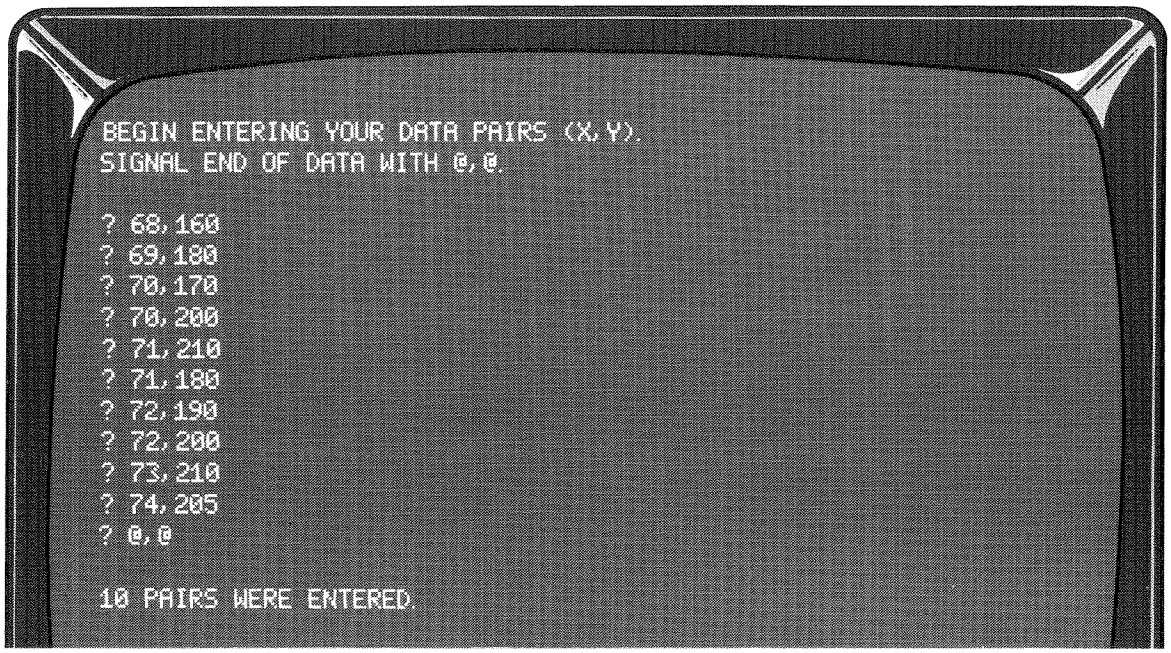
```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ? _
```

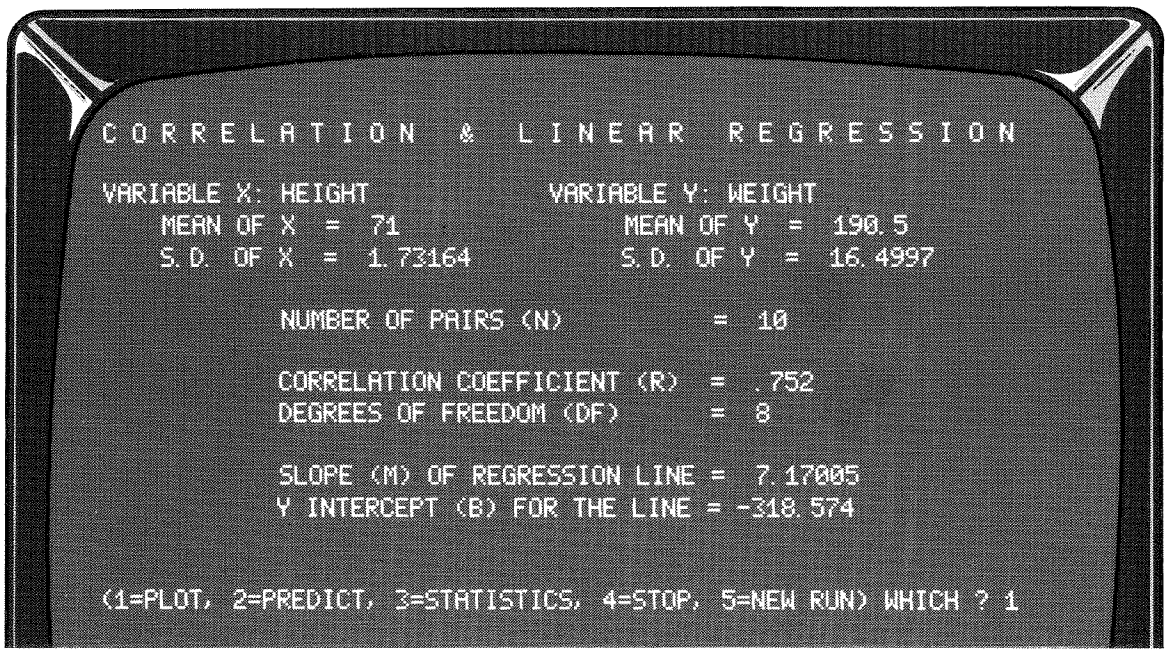
- If you enter a 3, the correlation/regression statistics will be displayed and the message above will reappear.

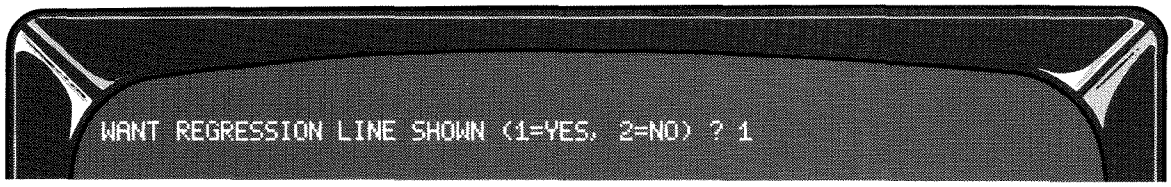
7. Run the program options as many times as you wish, then enter a 4 or 5 as appropriate. Remember, the correlation/regression statistics and the X by Y plot are only printed once.

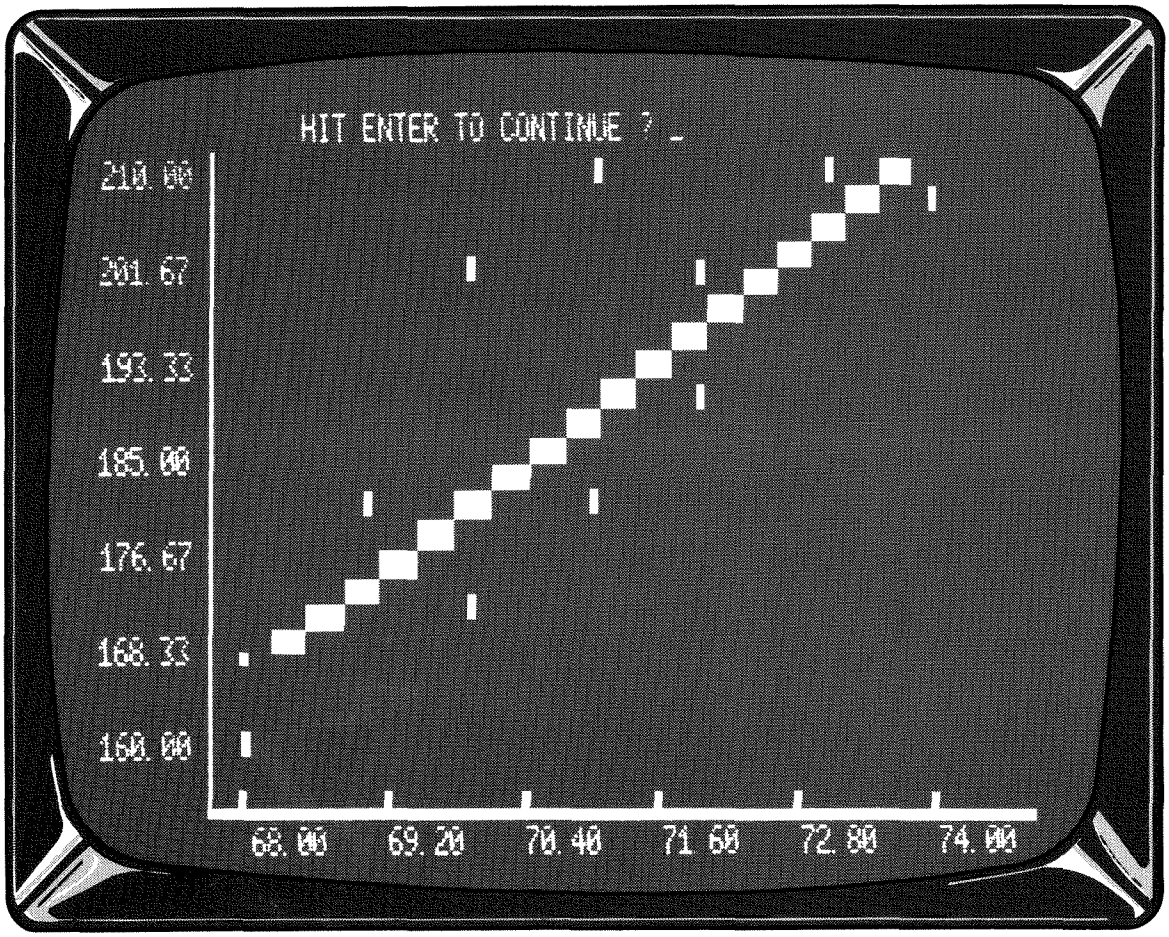
Sample Run

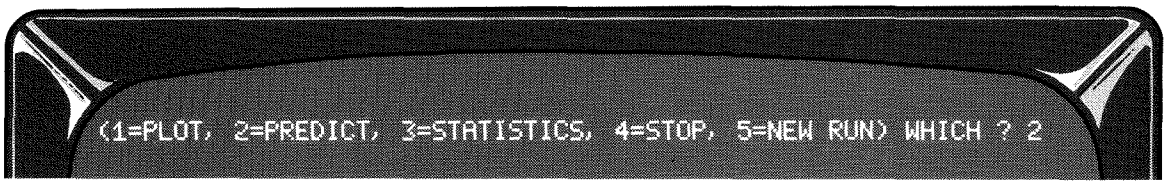


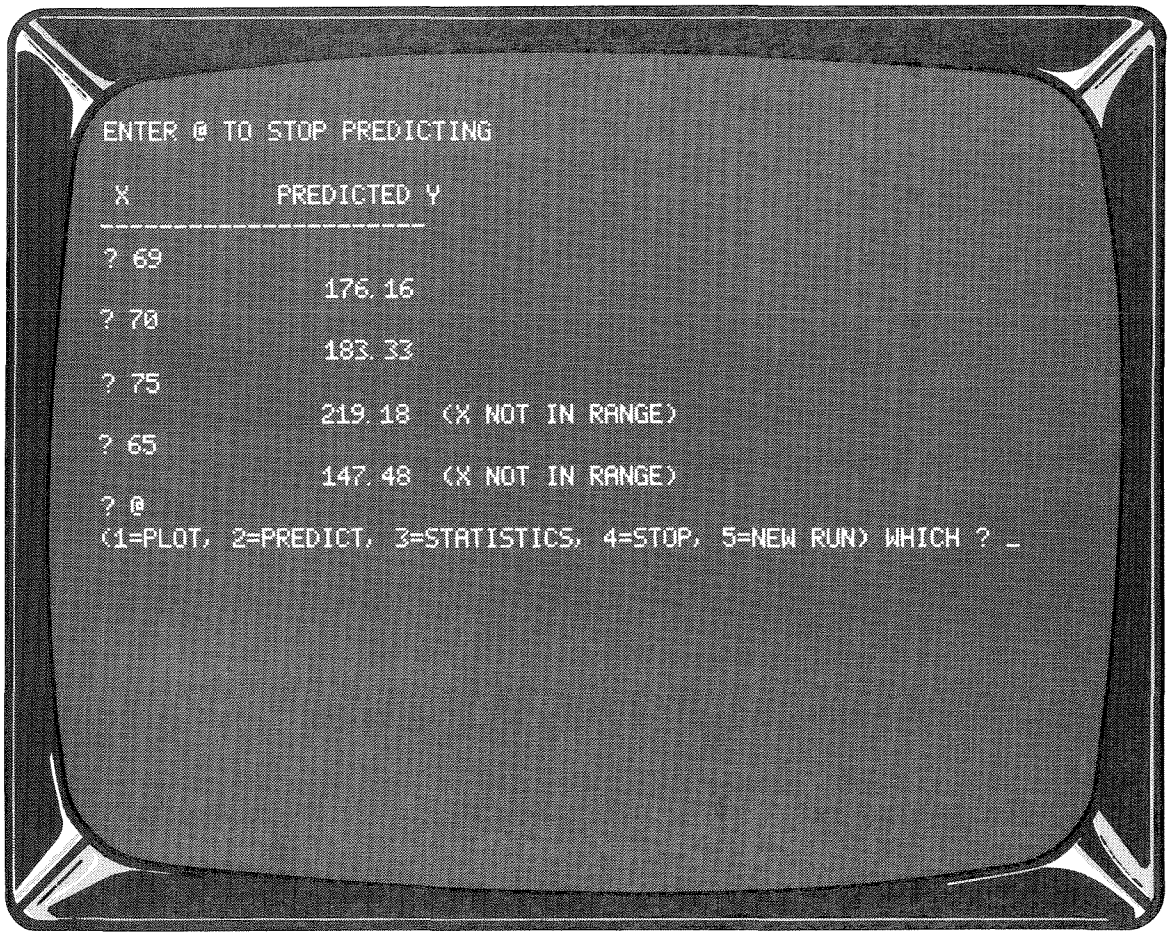

BEGIN ENTERING YOUR DATA PAIRS (X,Y).
SIGNAL END OF DATA WITH @,@.
? 68,160
? 69,180
? 70,170
? 70,200
? 71,210
? 71,180
? 72,190
? 72,200
? 73,210
? 74,205
? @,@
10 PAIRS WERE ENTERED.


C O R R E L A T I O N & L I N E A R R E G R E S S I O N
VARIABLE X: HEIGHT
MEAN OF X = 71
S.D. OF X = 1.73164
VARIABLE Y: WEIGHT
MEAN OF Y = 190.5
S.D. OF Y = 16.4997
NUMBER OF PAIRS (N) = 10
CORRELATION COEFFICIENT (R) = .752
DEGREES OF FREEDOM (DF) = 8
SLOPE (M) OF REGRESSION LINE = 7.17005
Y INTERCEPT (B) FOR THE LINE = -318.574
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ? 1


WANT REGRESSION LINE SHOWN (1=YES, 2=NO) ? 1


HIT ENTER TO CONTINUE ? _
210.00
201.67
193.33
185.00
176.67
168.33
160.00
68.00
69.20
70.40
71.60
72.80
74.00


(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ? 2


ENTER @ TO STOP PREDICTING
X PREDICTED Y
? 69
176.16
? 70
183.33
? 75
219.18 (X NOT IN RANGE)
? 65
147.48 (X NOT IN RANGE)
? @
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ? _

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced at instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and WRONG DATA FILE TYPE all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

(X NOT IN RANGE) means that you entered a value of X which did not fall within the range of X in your original data (see the note at instruction #7).

NOTE: CORRELATION & LINEAR REGRESSION calculates the statistics necessary for predicting values of Y from values of X. That is, the X variable is the **predictor**. It is important, therefore, when entering data or preparing a data file to place the predictor variable in the X, or first, position in the pair. In our example, we predicted people's weight from their height. We could predict height from weight by running the program again, entering the weight as the X variable and height as the Y variable.

Since the X and Y variables are not labeled on the scattergram it is important to remember that the X variable is plotted on the horizontal axis; the Y variable on the vertical axis.

NOTE (DISK BASIC ONLY): If the program ends prematurely a temporary scratch file may have been left on your diskette. Enter KILL "SCRATCH/ASA". The Computer will either remove the file or display FILE NOT FOUND.

CAUTION: If all X values or all Y values are identical, variance will be equal to zero. This condition with either cause a "division by zero" error message or provide results that are inaccurate or misleading.

Multiple Linear Regression

Description of the Program

This program performs a multiple regression analysis on data with up to five independent variables on any number of subjects. Output from the program includes the coefficient of determination; coefficient of multiple correlation; standard error of estimate; regression, residual, and total sums of squares; F ratio; degrees of freedom; probability of chance; and means, standard deviations, and regression (equation) coefficients for each variable.

Features

- Input from keyboard or data file (disk or tape)
- Any or all independent variables on a data file may be included in the analysis. The regression model can be modified without re-creating the data file.
- F ratio for the regression with an estimate of exact chance probability
- Output can be listed on a Line Printer

Limitations

- Maximum of 5 independent variables
- Dependent variable cannot be run as an independent variable – it is fixed in position #1 in the data file.

How to Run Multiple Linear Regression

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will reply

   ```
   HOW WILL DATA BE ENTERED - (K)EYBOARD, (T)APE, OR (D)ISK ? _
   ```

2. Answer **K**, **T** or **D** according to the type of input device you will be using.

   If you enter a **D** the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRS-80 TRSDOS/DISK BASIC Manual).

   Instruction #5 contains more information concerning your response to the above question.

   The Computer will reply

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

3. Enter a **Y** if you have a Printer and want a permanent record of the program results. Otherwise, enter an **N**. The Computer will ask

```
HOW MANY INDEPENDENT VARIABLES FOR THIS RUN (1-5) ? _
```

4. Enter the number of independent variables for the regression model which will be used in **this** run of the program.

5. The Computer's next action depends on your response at instruction #2 (input device)

   - If you entered a **T** or a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will ask for the name of the dependent variable and the name of each independent variable. The names you enter (up to 10 characters in length) will be used to label the program results. Do not use commas in the names. To save time you may simply press **ENTER** instead of entering a name.

   The Computer will display

```
BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA BY ENTERING @ FOR THE DV VALUE.

SUBJECT # 1
DV   ? _
```

6. Enter the value on the dependent variable for Subject #1, after the question mark. The Computer will then display

```
IV 1 ? _
```

   Enter the value on the first independent variable for Subject #1. Data will be requested on each successive independent variable for the first subject, then the Computer will request data values for Subject #2. After the data for all subjects have been entered type and enter **@** instead of a DV data value.

   (Now skip to instruction #12.)

7. At instruction #4 you indicated the number of independent variables which will be used during this run of MULTIPLE LINEAR REGRESSION. Since data files on tape or disk can contain up to 5 independent variables, you will now have to tell the Computer exactly **which** independent variables on your file it is to use (the variable names will also be requested at this time).

EXAMPLE: Your data file on tape contains 5 independent variables for each subject. You want to analyze the regression of the dependent variable on independent variables 1, 3 and 4. At instruction #4 you entered a 3.

The Computer will ask

```
WHICH 3 IV'S FROM THE FILE WILL BE USED
(ENTER ONE IV # AFTER EACH QUESTION MARK)

FIRST ? _
```

8. Enter the **number** of an independent variable that you want to be included in the analysis (e.g., 1). The Computer will ask

```
WHAT IS THE NAME OF THAT IV ? _
```

9. The name you enter (up to 10 characters in length) will be used to label the program results. Do not use commas in the name. To save time you may simply press ENTER.

   The Computer will request numbers and names for the other independent variables in like manner (i.e., SECOND, THIRD).

   NOTE: The order in which the IV numbers are entered is not important. However, the number of IV's must equal the number you entered at instruction #4 and each IV# must be entered once – and only once.

   The Computer will ask

```
WHAT IS THE NAME OF THE DV ? _
```

10. Enter the name of the dependent variable.

    - If you entered a D at instruction #2 (input data on disk) skip to instruction #12.
    - If you entered a T at instruction #2, the Computer will display,

```
LOAD DATA TAPE - HIT ENTER ? _
```

11. Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the data tape is rewound, set the recorder controls to Play, and press ENTER. The Computer will begin reading the data and the name of the data file will be displayed. Check the name of the file to be certain that the correct data are being read.

12. The Computer will take a few seconds to complete the necessary calculations – be patient.

    If you requested output on the Line Printer the Computer will reply

    ```
    TURN ON PINTER - HIT ENTER ? _
    ```

    Be sure your Printer is turned on, then press **ENTER**.

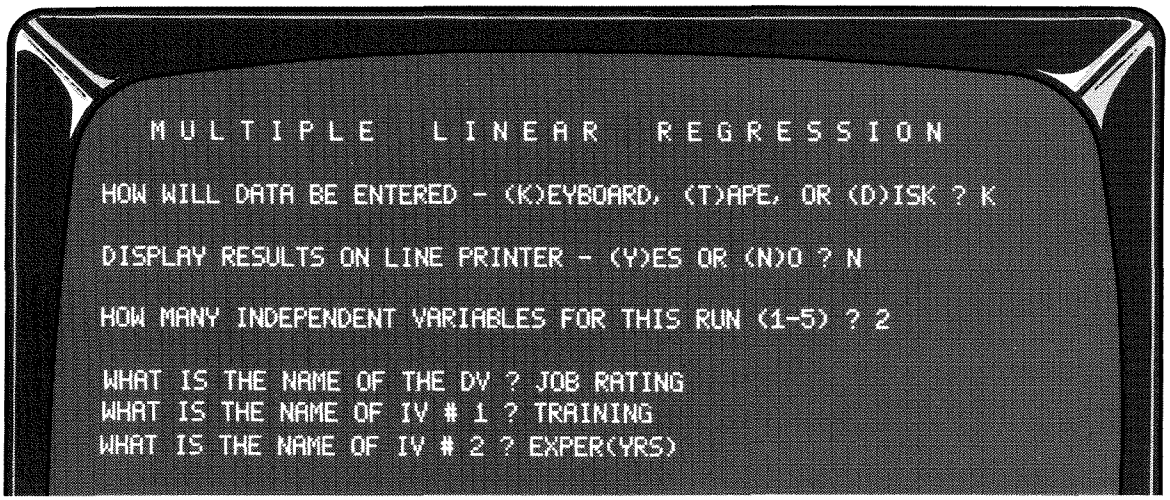
13. The regression statistics will be displayed on the screen (and on the Line Printer, if applicable) and the Computer will reply

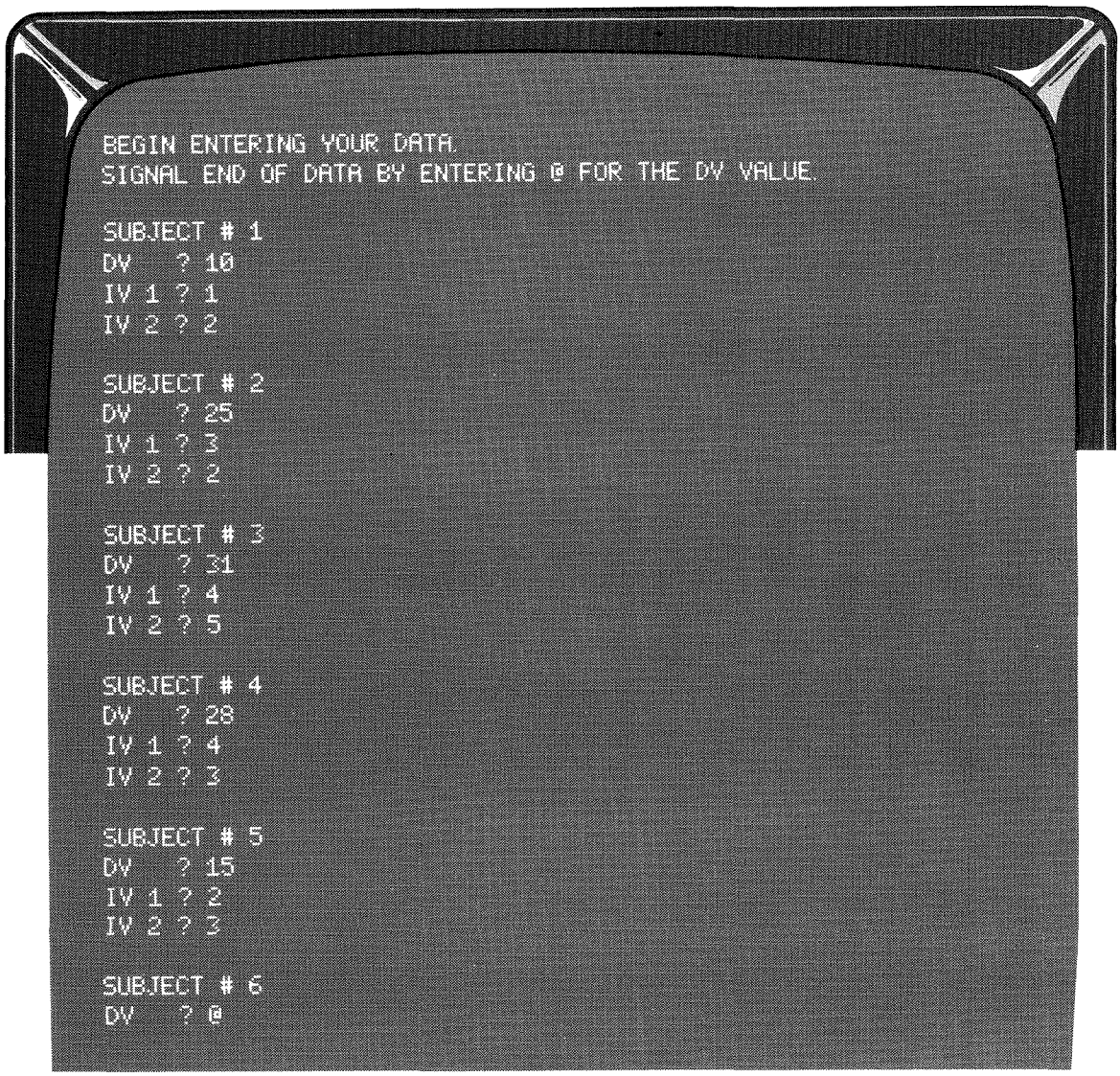
    ```
    (C)OEFFICIENTS OR (R)EGRESSION STATISTICS ? _
    ```

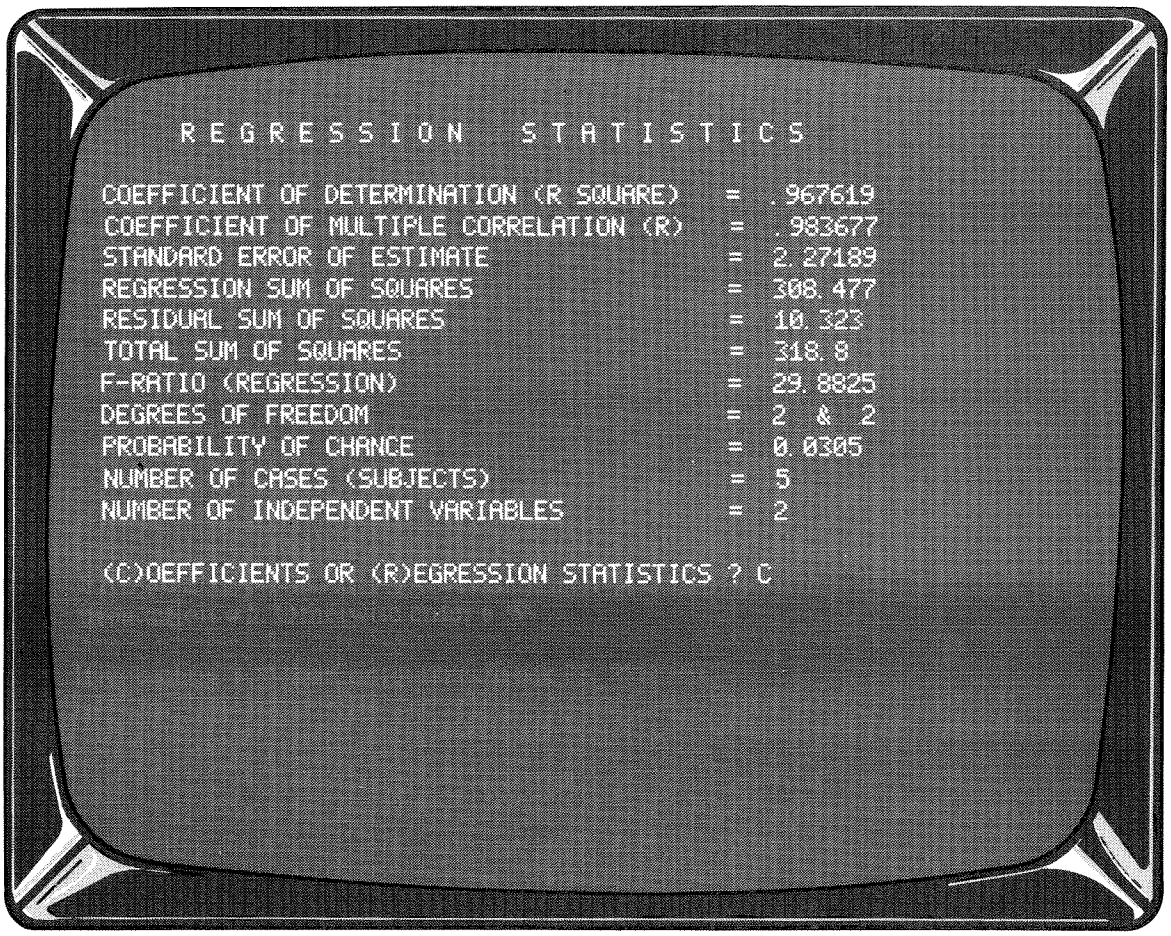
14. Enter a **C** to obtain a summary table listing the variables, regression coefficients, etc.

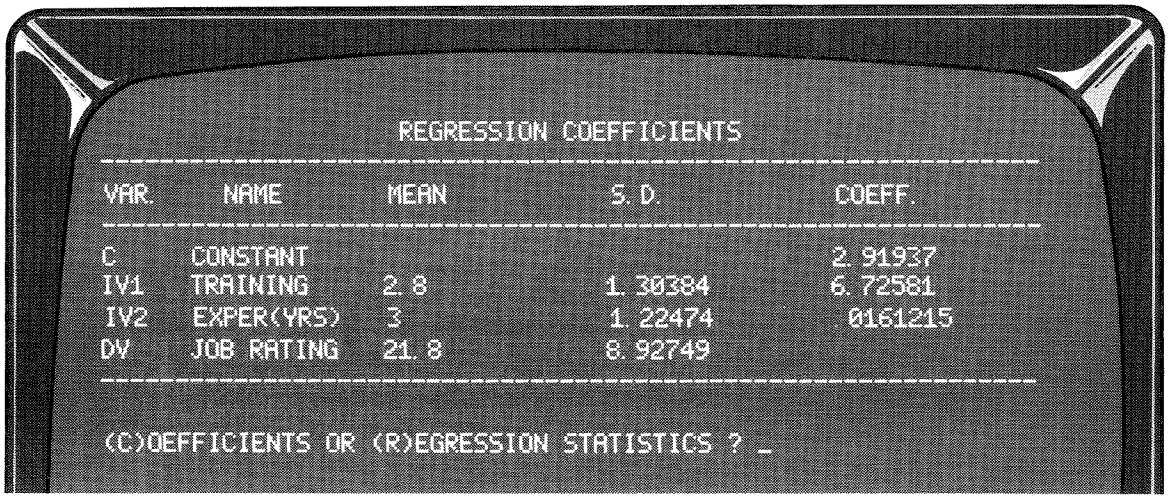
    You may view the regression statistics and the table of coefficients as many times as you wish by entering the appropriate codes; the results will be printed on the Line Printer only once.

Sample Run




BEGIN ENTERING YOUR DATA.
SIGNAL END OF DATA BY ENTERING @ FOR THE DV VALUE.
SUBJECT # 1
DV ? 10
IV 1 ? 1
IV 2 ? 2
SUBJECT # 2
DV ? 25
IV 1 ? 3
IV 2 ? 2
SUBJECT # 3
DV ? 31
IV 1 ? 4
IV 2 ? 5
SUBJECT # 4
DV ? 28
IV 1 ? 4
IV 2 ? 3
SUBJECT # 5
DV ? 15
IV 1 ? 2
IV 2 ? 3
SUBJECT # 6
DV ? @


REGRESSION STATISTICS
COEFFICIENT OF DETERMINATION (R SQUARE) = .967619
COEFFICIENT OF MULTIPLE CORRELATION (R) = .983677
STANDARD ERROR OF ESTIMATE = 2.27189
REGRESSION SUM OF SQUARES = 308.477
RESIDUAL SUM OF SQUARES = 10.323
TOTAL SUM OF SQUARES = 318.8
F-RATIO (REGRESSION) = 29.8825
DEGREES OF FREEDOM = 2 & 2
PROBABILITY OF CHANCE = 0.0305
NUMBER OF CASES (SUBJECTS) = 5
NUMBER OF INDEPENDENT VARIABLES = 2
(C)OEFFICIENTS OR (R)EGRESSION STATISTICS ? C


REGRESSION COEFFICIENTS
VAR. NAME MEAN S.D. COEFF.
C CONSTANT 2.91937
IV1 TRAINING 2.8 1.30384 6.72581
IV2 EXPER(YRS) 3 1.22474 .0161215
DV JOB RATING 21.8 8.92749
(C)OEFFICIENTS OR (R)EGRESSION STATISTICS ? _

Messages and Special Considerations

FILE NOT FOUND IN 45Ø means that the data file referenced in instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and WRONG DATA FILE TYPE all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

ONLY 2 IV'S ON FILE! means that in instruction #4 you requested the Computer to perform the analysis using more independent variables than the number contained on the data file (i.e., the number of IV's placed on the data file when it was prepared).

MATRIX IS SINGULAR. means that the regression analysis was not performed because the covariance matrix had no inverse. This situation arises when two or more of the rows in the matrix are dependent upon one another (correlated).

NOTE: A singular matrix is artificially created if you accidentally enter a duplicate IV# at instruction #9. The Computer will enter that IV into the equation more than once resulting, of course, in a perfect correlation.

NOTE: Although means and standard deviations are automatically printed for each variable, they will be meaningless for coded independent variables. If a multiple regression data file contains coded variables (not true measurements) this should be taken into consideration if you run DESCRIPTIVE STATISTICS, HISTOGRAM, or FREQUENCY DISTRIBUTION on the file.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter KILL "SCRATCH/ASA". The Computer will either remove the scratch file or display FILE NOT FOUND.

Time Series Analysis I

Description of the Program

This program analyzes a set of observations made at different periods of time (time series) for trend and allows the user to obtain predicted values of the variable under study according to the least squares trend line fitted through the data. The test performed to ascertain whether trend is present in the data is the sign (change of direction) test. Output includes the percentage of variance accounted for by the trend, coefficients for the trend line equation, point of origin, and time unit. Additionally, the program plots the time series data with or without the trend line.

Features

- Input from keyboard or data file (tape or disk)
- Yearly data can be consecutive or evenly spaced years
- Y by TIME plot of the data
- Trend line on the plot if desired
- Predicted values of Y in interactive mode (TIME values input via keyboard)
- Trend analysis statistics and plot (with or without trend line) on Line Printer formatted at 8½" x 11"

Limitations

- Quarterly, monthly, and weekly data must be consecutive.
- Missing data must be handled according to the instructions for entering time series data (page 97).

How to Run Time Series Analysis I

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will ask

   ```
   HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
   ```

2. Answer **K**, **T** or **D** according to the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRSDOS/DISK BASIC Manual).

   Instruction #6 contains further information concerning your response to the above question.

The Computer will display

```
TYPE OF DATA - (Y)EARLY (Q)UARTERLY (M)ONTHLY (W)EEKLY ? _
```

3. Enter **Y**, **Q**, **M** or **W** according to the type of data you will be using. Yearly data may be comprised of consecutive years (e.g., 1968, 1969, 1970) or years spaced at equal intervals (e.g., 1950, 1960, 1970). Quarterly, monthly, and weekly data must be consecutive. The Computer will ask

```
DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
```

4. Enter a **Y** if you have a Line Printer and desire a permanent record of the trend statistics. If you select the PLOT option while running the program, the TIME by Y plot will also be printed (with or without the trend line).

   NOTE: During any single run of TIME SERIES ANALYSIS I the statistics and the Y plot will be printed only once, regardless of how many time the STATISTICS and PLOT options are selected (see instruction #8).

   The Computer will ask

```
WHAT IS THE NAME OF VARIABLE Y ? _
```

5. Enter any alphanumeric name (up to 14 characters in length). Do not use commas in the name. The name will be used for labeling the results of the program. To save time you can reply to the above question by simply pressing **ENTER** but the variable will be unlabeled when the results are displayed.

6. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #7.
   - If you entered a **K** at instruction #2, the Computer will reply

```
BEGIN ENTERING YOUR OBSERVATIONS (SEE MANUAL).
SIGNAL END OF DATA WITH @,@.
? _
```

   See the instructions concerning entering time series data in INSTRUCTIONS FOR INPUTTING DATA. Type your first observation, after the question mark (separate the TIME and Y values with a comma) and press **ENTER**. Another question mark will appear. Continue entering observations then type and enter **@,@** after the last observation.

(Now skip to instruction #7)

- If you entered a **T** at instruction #2, the Computer will reply,

```
INSERT DATA TAPE - HIT ENTER ? _
```

Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the tape is rewound and that the recorder controls are set to Play. Then press **ENTER** . The Computer will begin reading your data and the name of the data file will appear on the screen. Check the name of the file to be certain that the correct data are being read.

7. If you requested output on the Line Printer, the Computer will display

```
TURN ON YOUR PRINTER - HIT ENTER ? _
```

Make sure your Printer is turned on then press **ENTER** .

8. The Computer will display (and print, if applicable) the time series analysis statistics and ask

```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP) WHICH ? _
```

You may select any of the options by entering the appropriate code.

- If you enter a **1**, the Computer will ask

```
WANT TREND LINE SHOWN (1=YES, 2=NO) ? _
```

Enter a **1** or a **2**. The Computer will draw and label a graph (TIME values on the horizontal axis, Y values on the vertical axis) and plot the data points. If you wanted the trend line, the line will be drawn on the graph at the proper location. The Computer will next print the TIME by Y plot (with or without the regression line) on the Printer, if applicable, and display (for example)

```
SALES (X1000) BY YEAR . . . HIT ENTER ? _
```

When you have finished viewing the graph, press **ENTER** . The Computer will again reply

```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP) WHICH ? _
```

- If you enter a **2**, the Computer will display

```
ENTER @ TO STOP PREDICTING

YEAR ? _
```

Enter the year for which you want a prediction made. If you are using quarterly, monthly, or weekly data, the Computer will display

```
QUARTER ? _
```

or

```
MONTH ? _
```

or

```
WEEK ? _
```

Enter the **number** corresponding to the desired quarter (Ø1-Ø4), month (Ø1-12), or week (Ø1-52). The predicted Y value will be displayed along with another question mark. When you want to stop predicting, enter **@** instead of a year.

NOTE: Predictions made for dates much later than the last observation will be inaccurate. Continually updating the data file and revising the prediction (trend line) equation will help keep this error to a minimum.

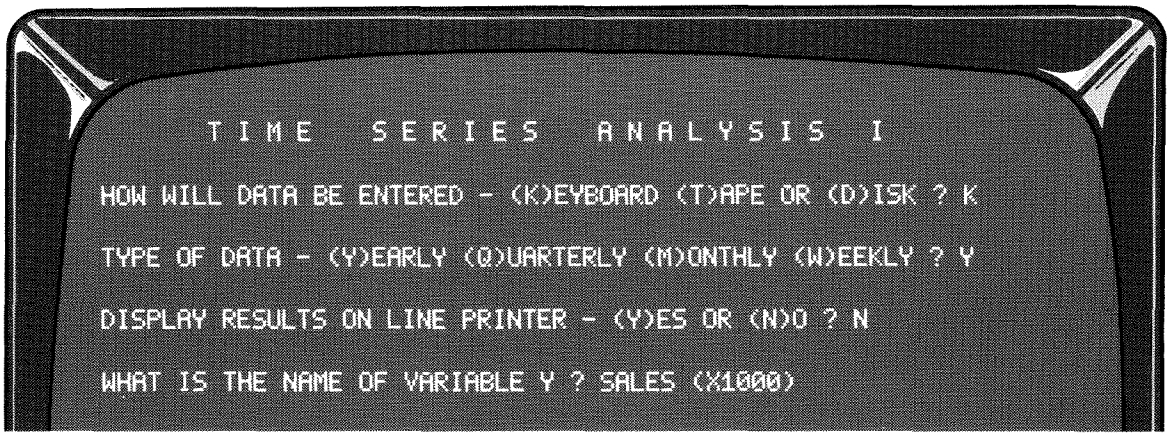
When you have stopped predicting, the Computer will reply

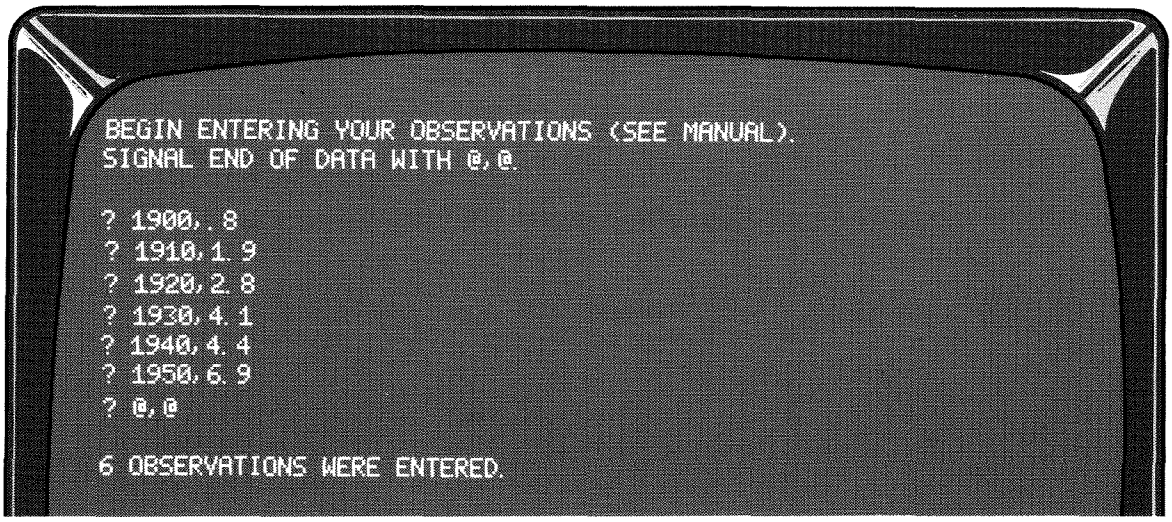
```
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP) WHICH ? _
```

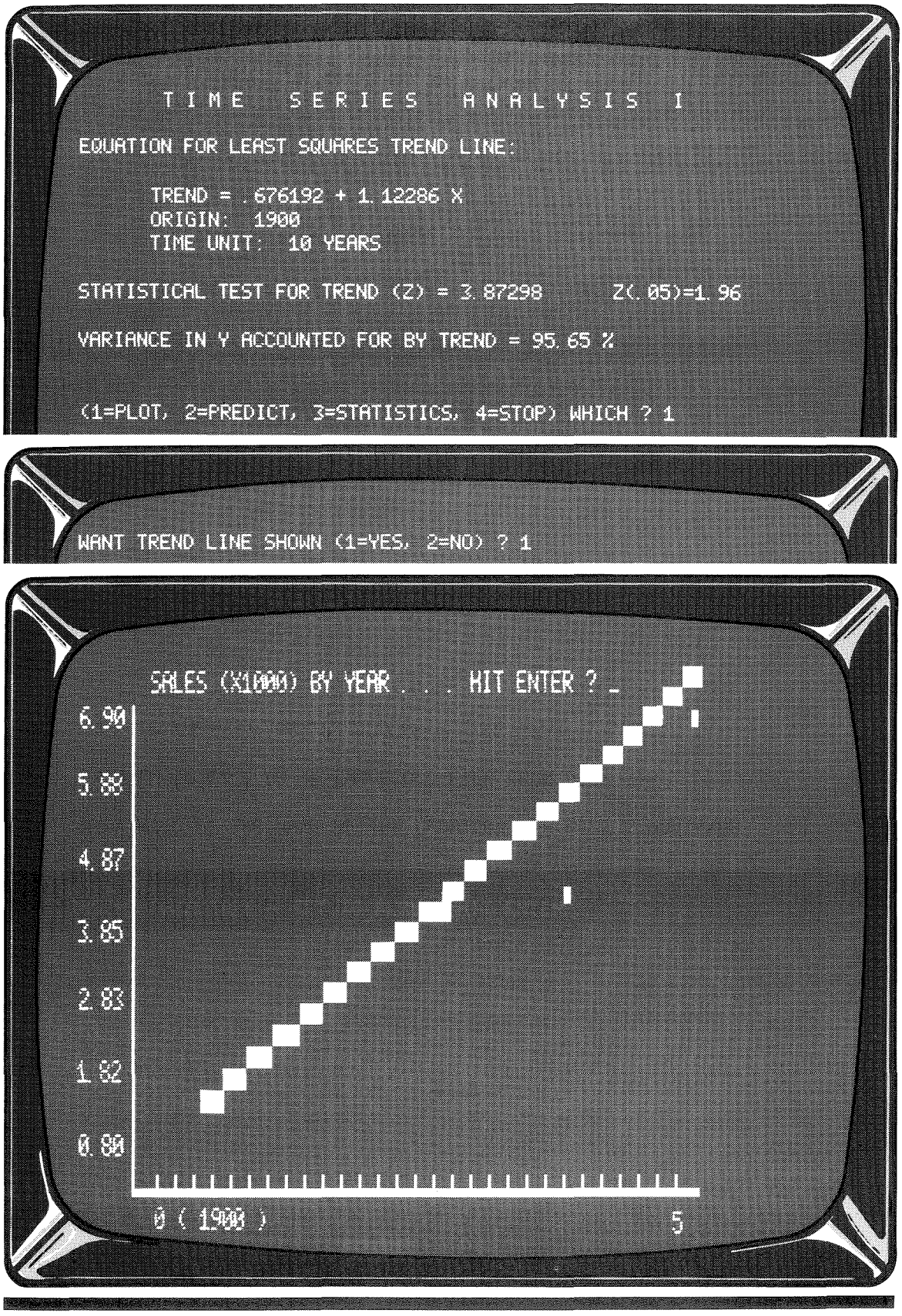
- If you enter a **3**, the time series analysis statistics will be displayed and the message above will reappear.

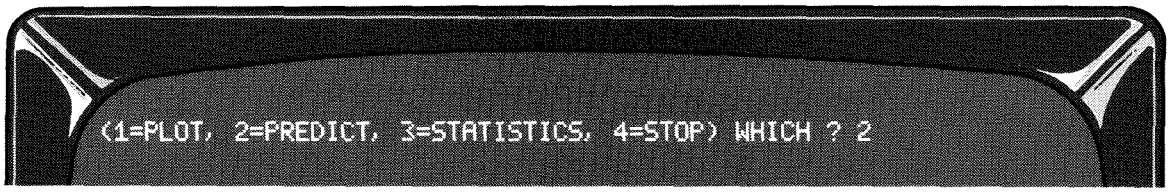
9. Run the program options as many times as you wish, then enter a **4** or **5** as appropriate. Remember, the statistics and the plot are only printed once on the Line Printer.

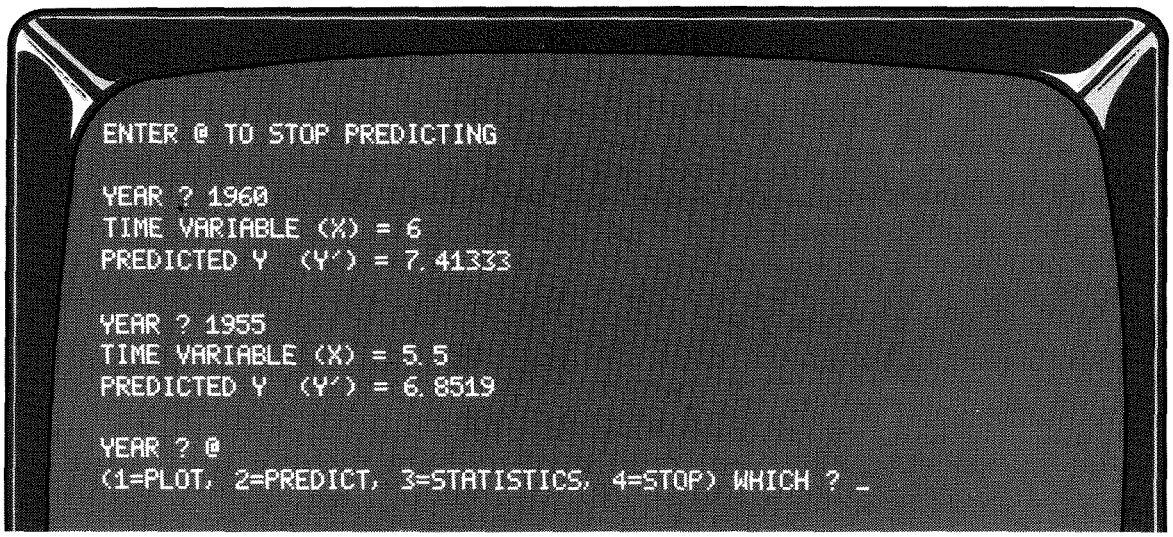
Sample Run


T I M E S E R I E S A N A L Y S I S I
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? K
TYPE OF DATA - (Y)EARLY (Q)UARTERLY (M)ONTHLY (W)EEKLY ? Y
DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? N
WHAT IS THE NAME OF VARIABLE Y ? SALES (X1000)


BEGIN ENTERING YOUR OBSERVATIONS (SEE MANUAL).
SIGNAL END OF DATA WITH @,@.
? 1900,.8
? 1910,1.9
? 1920,2.8
? 1930,4.1
? 1940,4.4
? 1950,6.9
? @,@
6 OBSERVATIONS WERE ENTERED.


T I M E S E R I E S A N A L Y S I S I
EQUATION FOR LEAST SQUARES TREND LINE:
TREND = .676192 + 1.12286 X
ORIGIN: 1900
TIME UNIT: 10 YEARS
STATISTICAL TEST FOR TREND (Z) = 3.87298 Z(.05)=1.96
VARIANCE IN Y ACCOUNTED FOR BY TREND = 95.65 %
(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP) WHICH ? 1
WANT TREND LINE SHOWN (1=YES, 2=NO) ? 1
SALES (X1000) BY YEAR . . . HIT ENTER ? _
6.90
5.88
4.87
3.85
2.83
1.82
0.80
0 (1900)
5





Instructions for Inputting Data

Unlike other ASA data analysis programs, the TIME SERIES ANALYSIS programs use data made up of a measure on one variable (Y) and a coded value from which the Computer calculates the TIME (X) variable for use in the analysis. In order to analyze data files consisting of measurements taken by year, quarter, month, week or day, a special coding scheme is used. For the analysis results to be accurate, your data must conform to the following guidelines. The guidelines apply whether you are entering data into the TIME SERIES ANALYSIS programs via keyboard or preparing a data file with TAPE DATA FILES or DISK DATA FILES (these will ask for "data pairs").

- Yearly data is the simplest to input. Simply type the year, followed by a comma and the measurement on the Y variable. Examples for consecutive and spaced years follow:

Consecutive

```
? 196Ø,1ØØ.5
? 1961,1Ø6.8
? 1962,11Ø.4
? 1963,1Ø9.3
? @,@
```

Spaced

```
? 195Ø,8
? 1955,4
? 196Ø,3
? 1965,2
? 197Ø,2
? @,@
```

- Quarterly, monthly, weekly, and daily data contain additional information which tells the computer which quarter, month, week or day the observation is for. Quarters are represented by the numbers .Ø1 through .Ø4, immediately following the year and before the comma. Months are designated using the values .Ø1 through .12 (for January through December), weeks by the values .Ø1 through .52, days by . Ø1 through .99.

  NOTE: No more than 99 consecutive days may be tracked. Daily data is used only for Time Series Analysis II.

Quarterly Data	Monthly Data	Weekly Data	Daily Data
? 1958.Ø2,1Ø	? 1963.1Ø,1	? 1977.5Ø,-5	? 1968.97,12.2
? 1958.Ø3,12	? 1963.11,2	? 1977.51,-3.6	? 1968.98,14.6
? 1958.Ø4,11.5	? 1963.12,2	? 1977.52,-2.1	? 1968.99,15.1
? 1959.Ø1,16	? 1964.Ø1,3	? 1978.Ø1,-3	? @,@
? 1959.Ø2,18.2	? 1964.Ø2,5	? 1978.Ø2,-5	
? @,@	? @,@	? @,@	

- The origin (first observation) may be any quarter, month, week, or day in a year. However, the observations **must** be consecutive. If you are missing a measurement for one of the periods, you can still run the program by inserting as the Y variable, the average of the measurements for the observations immediately before and after the missing one. For example:

Observations		Input to Program
June 1976	Y=106	? 1976.Ø6,1Ø6
July 1976	data missing	? 1976.Ø7,1Ø7.5
August 1976	Y=109	? 1976.Ø8,1Ø9

If you make a mistake while preparing a data file on tape or disk, either terminate the program (by pressing **BREAK**) or, if you have already entered a large amount of data, enter @,@ to save the portion of the data file which is correct. Then run the utility program over again to **update** the file containing the mistake. Remove the incorrect data element (pair) plus any data elements which follow. Then add the rest of your data to the file. This procedure is necessary because time series data (observations) must always be in **sequence**.

Many users will want to continually update their files by adding new observations daily, weekly, monthly, etc. This is easily done since new data elements are always written at the end of the old data. Additionally, if only a certain amount of data is kept in the updated file (e.g., data for the last 36 months) the earliest element(s) can be removed during each file update.

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced at instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The Computer will either remove the file or display **FILE NOT FOUND**.

NOTE: Do **not** run DESCRIPTIVE STATISTICS, HISTOGRAM or FREQUENCY DISTRIBUTION on the TIME (X) variable in a time series data file. The values are not regular interval scale measurements.

NOTE: The sign test for trend considers only the direction of the movement from one period of time to the next – not the magnitude of change. In some instances (e.g., many large upward movements and an equal number of small downward movements) the presence of trend may not be disclosed by the test. Additionally, if there are several small changes in the data which are cancelled by a few large changes in the opposite direction (i.e., no actual trend) the test may indicate a trend where none exists. Evaluate the test for trend by comparing the Z value with a visual inspection of the TIME by Y plot. The critical value of Z at the 5% level of confidence is 1.96.

NOTE: The X axis on the data plot represents the TIME variable. The TIME variable begins at Ø (origin) and increases by one for each succeeding time interval or observation. In order to most easily find the point on the X axis corresponding to a particular year, quarter, month, or week, run the PREDICT option – the value of the TIME variable is displayed for any time interval input.

Time Series Analysis II

Description of the Program

This program is used to obtain seasonal indexes for quarterly or monthly time series data and n-item moving averages for data collected yearly, quarterly, monthly, weekly, or daily. Quarterly and monthly seasonal indexes are calculated using the ratio to moving averages method with an adjustment for rounding error. The largest and smallest values for each quarter or month are discarded before the index is derived. All even-item moving averages are automatically centered by taking a 2-item moving total before averaging. The resulting centered moving averages are printed next to the **later** time interval values.

Features

- Input from keyboard or data file (tape or disk)
- Number of items comprising the moving average selected by user
- Automatic centering of even-item moving averages
- Output can be listed on a Line Printer

Limitations

- Quarterly, monthly, weekly, and daily data must be consecutive.
- Missing values must be handled according to the instructions for entering time series data (page 106).
- Maximum data set sizes (approximate)
  16K Level II BASIC – 825 observations
  16K DISK BASIC – 140 observations
  32K Level II BASIC – 2150 observations
  32K DISK BASIC – 1450 observations

How to Run Time Series Analysis II

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will ask

```
HOW WILL DATA BE ENTERED - (K)EYBOARD (T)APE OR (D)ISK ? _
```

2. Enter a **K**, **T** or **D** according to the type of input device you will be using.

   If you enter a **D**, the Computer will ask for the name of the data file on disk. You must enter the exact file name including the extension and password, if applicable (explained in your TRSDOS/DISK BASIC Manual).

   Instruction #8 contains further information concerning your response to the above question.

   The Computer will display

   ```
   (S)ASONAL INDEXES OR (M)OVING AVERAGES - WHICH ? _
   ```

3. Enter an **S** if you have quarterly or monthly data and are running the program to obtain seasonal indexes. If you want moving averages, enter an **M**.

   Depending on whether you enter an **S** or an **M** the Computer will respond either

   ```
   (Q)UARTERLY, (M)ONTHLY - WHICH ? _
   ```

   or

   ```
   (Y)EARLY, (Q)UARTERLY, (M)ONTHLY, (W)EEKLY, (D)AILY - WHICH ? _
   ```

4. Enter a **Y** if you have yearly data, a **Q** for quarterly, etc.

   - If you are obtaining seasonal indexes skip to instruction #6.
   - If you are running the program for moving averages the Computer will ask (for example)

   ```
   MOVING AVERAGE FOR HOW MANY MONTHS ? _
   ```

5. Enter the number of years, quarters, months, weeks, or days which will comprise the moving average. For example, for a 12 month moving average enter a **12**.

6. The Computer will reply

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

7. Enter a **Y** if you have a Line Printer and desire a permanent record of the program results. Otherwise enter an **N**.

8. The Computer's next action depends on your response at instruction #2 (input device).

   - If you entered a **D** at instruction #2, skip to instruction #9.
   - If you entered a **K** at instruction #2, the Computer will reply

```
BEGIN ENTERING YOUR OSERVATIONS (SEE MANUAL).
SIGNAL END OF DATA WITH @,@.
? _
```

   See the instructions concerning entering time series data in INSTRUCTIONS FOR INPUTTING DATA. Type your first observation, after the question mark (separate the TIME and Y values with a comma) and press **ENTER**. Another question mark will appear. Continue entering observations; then type and enter **@,@** after the last observation.

   (Now skip to instruction #9)

   - If you entered a **T** at instruction #2, the Computer will reply

```
INSERT DATA TAPE - HIT ENTER ? _
```

   Load the data tape into the cassette recorder (into recorder #-1 if you are using a dual cassette system). Be sure the tape is rewound and that the recorder controls are set to Play. Then press **ENTER**. The Computer will begin reading your data and the name of the data file will appear on the screen. Check the name of the file to be certain that the correct data are being read.

9. If you requested output on the Line Printer, the Computer will display

```
TURN ON YOUR PRINTER - HIT ENTER ? _
```

   Make sure your Printer is turned on, then press **ENTER**.

10. The Computer's next action depends on whether you are obtaining seasonal indexes or moving averages.

    - If you are running the program for seasonal indexes, the Computer may take quite a while to complete its calculations – be patient. The table of indexes, by quarter or month, will be displayed on the screen and, if applicable, printed on the Line Printer. The Computer will reply

```
(N)EW RUN OR (E)ND PROGRAM ? _
```

   Enter an **N** or an **E** as appropriate.

- If you are obtaining moving averages, the Computer will display the number of items comprising each average, the point of origin, and the message

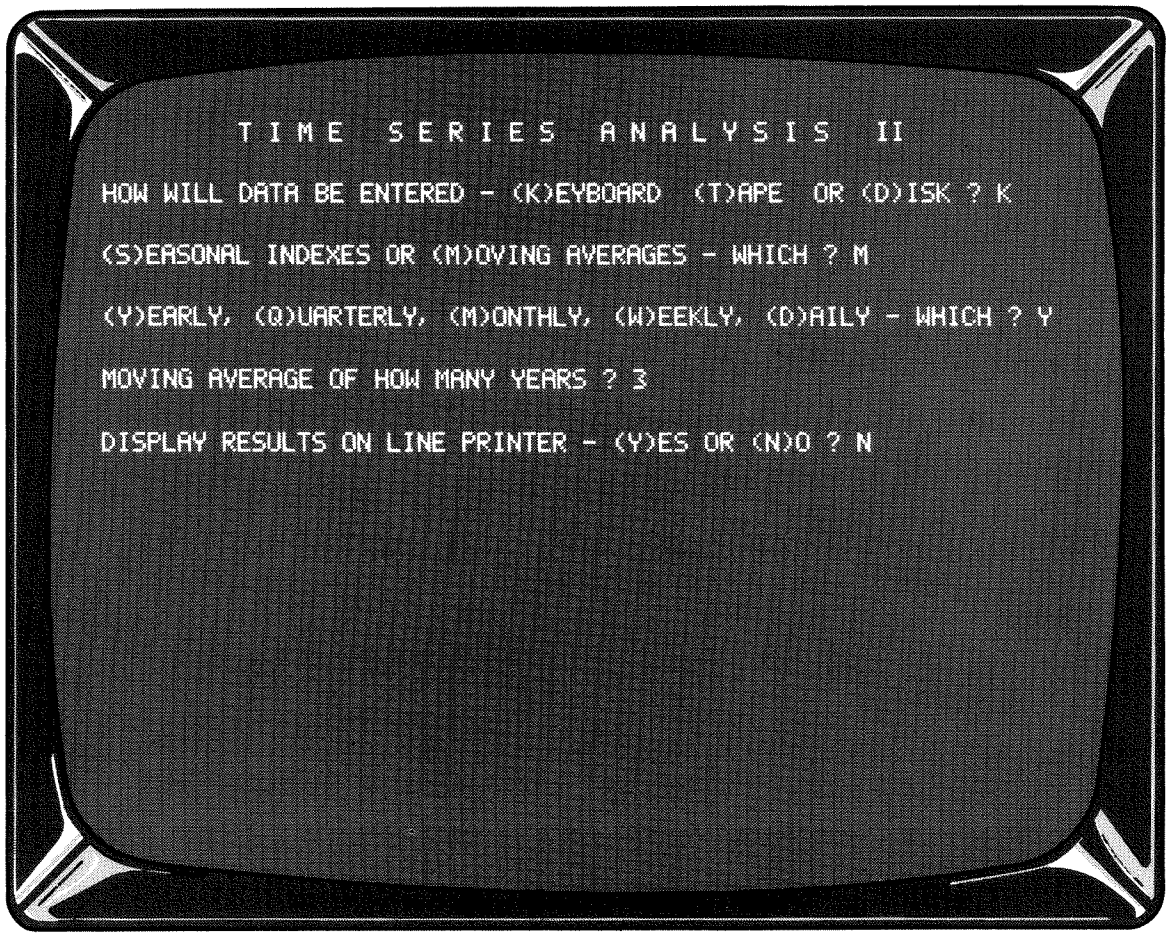
```
HIT @ TO START & STOP
```

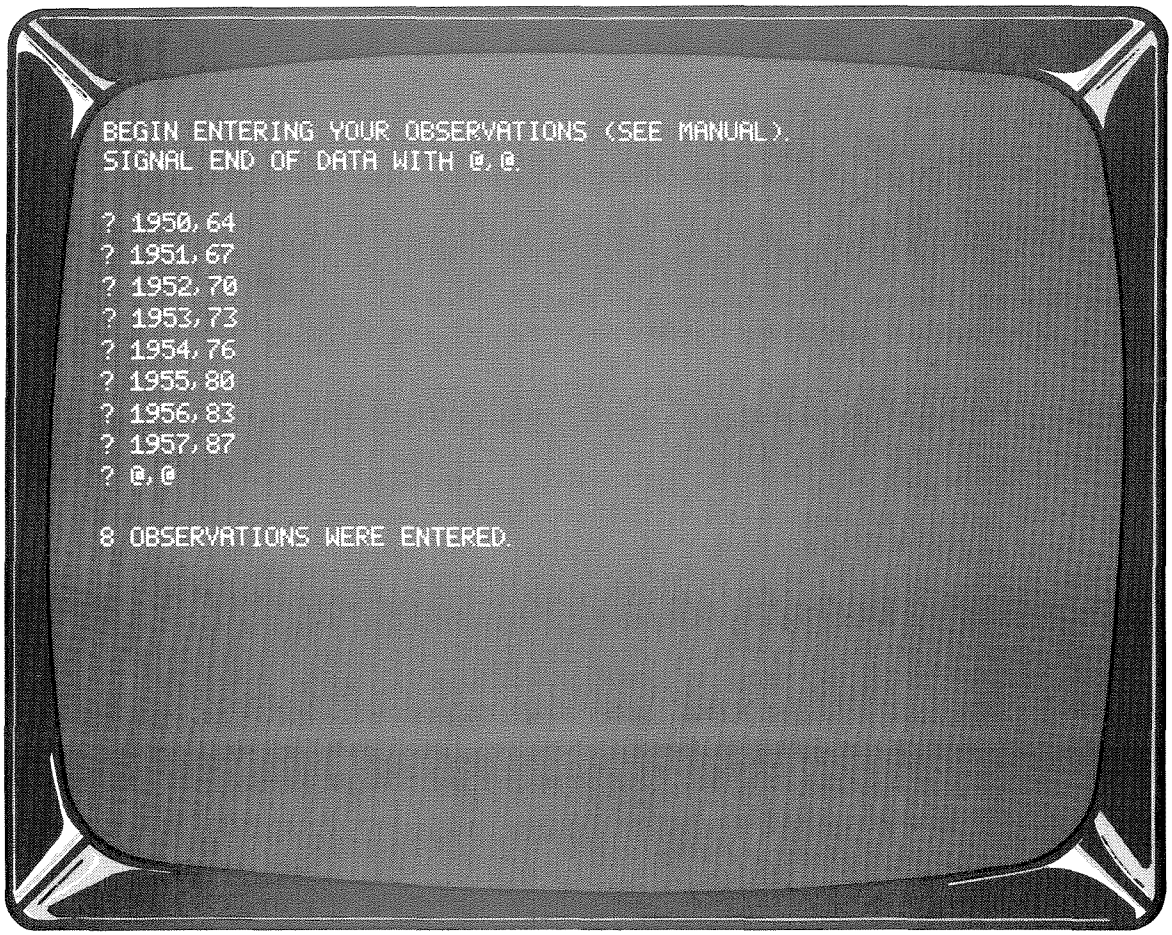
  Press @. The moving averages by year, quarter, month, week, or day will be listed on the screen and, if applicable, on the Line Printer. Press @ to stop the listing at any time; then press @ again to continue. After all the moving averages have been listed, the Computer will display

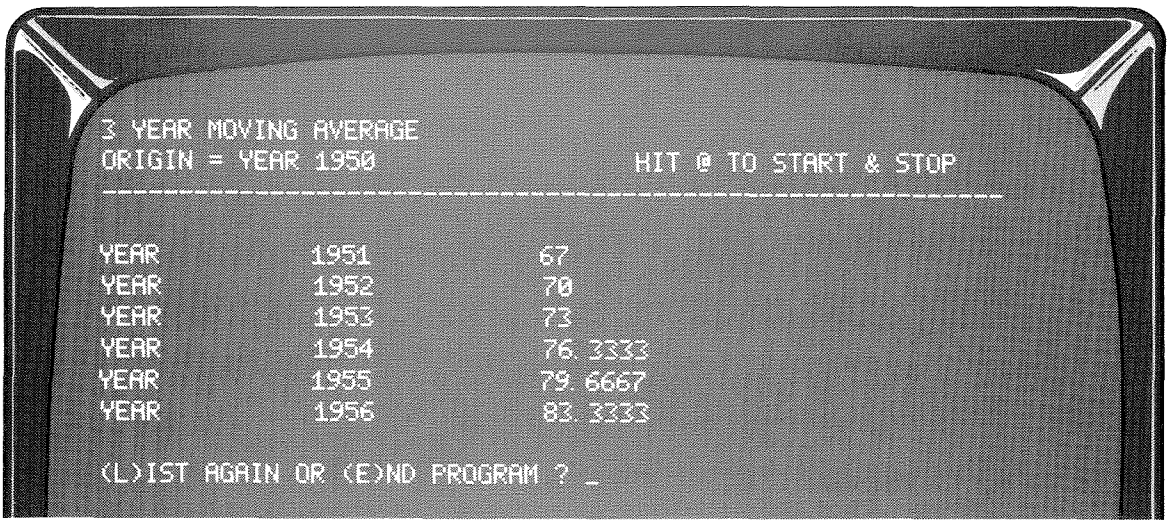
```
(L)IST AGAIN OR (E)ND PROGRAM ? _
```

  If you want to view the moving averages again (from the beginning), enter an L. Otherwise enter an E. You may terminate the program at any point during the listing by pressing BREAK.

Sample Run




BEGIN ENTERING YOUR OBSERVATIONS (SEE MANUAL).
SIGNAL END OF DATA WITH @,@.
? 1950,64
? 1951,67
? 1952,70
? 1953,73
? 1954,76
? 1955,80
? 1956,83
? 1957,87
? @,@
8 OBSERVATIONS WERE ENTERED.


3 YEAR MOVING AVERAGE
ORIGIN = YEAR 1950
HIT @ TO START & STOP
YEAR 1951 67
YEAR 1952 70
YEAR 1953 73
YEAR 1954 76.3333
YEAR 1955 79.6667
YEAR 1956 83.3333
(L)IST AGAIN OR (E)ND PROGRAM ? _

Instructions for Inputting Data

Unlike other ASA data analysis programs, the TIME SERIES ANALYSIS programs use data made up of a measure on one variable (Y) and a coded value from which the Computer calculates the TIME (X) variable for use in the analysis. In order to analyze data files consisting of measurements taken by year, quarter, month, week, or day, a special coding scheme is used. For the analysis results to be accurate your data must conform to the following guidelines. The guidelines apply whether you are entering data into the TIME SERIES ANALYSIS programs via keyboard or preparing a data file with TAPE DATA FILES or DISK DATA FILES (these will ask for "data pairs").

- Yearly data is the simplest to input. Simply type the year followed by a comma and the measurement on the Y variable. Examples for consecutive and spaced years follow:

Consecutive

```
? 196Ø,1ØØ.5
? 1961,1Ø6.8
? 1962,11Ø.4
? 1963,1Ø9.3
? @,@
```

Spaced

```
? 195Ø,8
? 1955,4
? 196Ø,3
? 1965,2
? 197Ø,2
? @,@
```

- Quarterly, monthly, weekly, and daily data contain additional information which tells the Computer which quarter, month, week, or day the observation is for. Quarters are represented by the numbers .Ø1 through .Ø4 immediately following the year and before the comma. Months are designated using the values .Ø1 through .12 (for January through December), weeks by the values .Ø1 through .52, days by .Ø1 through .99.

  NOTE: No more than 99 consecutive days may be tracked. Daily data is used only for Time Series Analysis II.

Quarterly Data

```
? 1958.Ø2,1Ø
? 1958.Ø3,12
? 1958.Ø4,11.5
? 1959.Ø1,16
? 1959.Ø2,18.2
? @,@
```

Monthly Data

```
? 1963.1Ø,1
? 1963.11,2
? 1963.12,2
? 1964.Ø1,3
? 1964.Ø2,5
? @,@
```

Weekly Data

```
? 1977.5Ø,-5
? 1977.51,-3.6
? 1977.52,-2.1
? 1978.Ø1,-3
? 1978.Ø2,-5
? @,@
```

Daily Data

```
? 1968.97,12.2
? 1968.98,14.6
? 1968.99,15.1
? @,@
```

- The origin (first observation) may be any quarter, month, week, or day in a year. However, the observations **must** be consecutive. If you are missing a measurement for one of the periods you can still run the program by inserting as the Y variable, the average of the measurements for the observations immediately before and after the missing one. For example:

Observations		Input to Program
June 1976	Y=106	`? 1976.Ø6,1Ø6`
July 1976	data missing	`? 1976.Ø7,1Ø7.5`
August 1976	Y=109	`? 1976.Ø8,1Ø9`

If you make a mistake while preparing a data file on tape or disk, either terminate the program (by pressing **BREAK**) or, if you have already entered a large amount of data, enter @,@ to save the portion of the data file which is correct. Then run the utility program over again to **update** the file containing the mistake. Remove the incorrect data element (pair) plus any data elements which follow. Then add the rest of your data to the file. This procedure is necessary because time series data (observations) must always be in **sequence.**

Many users will want to continually update their files by adding new observations daily, weekly, monthly, etc. This is easily done since new data elements are always written at the end of the old data. Additionally, if only a certain amount of data is kept in the updated file (e.g., data for the last 36 months) the earliest element(s) can be removed during each file update.

Messages and Special Considerations

FILE NOT FOUND IN 7ØØ means that the data file referenced at instruction #2 does not exist on disk. You may have entered the data file name incorrectly or failed to insert the diskette containing the data file into a disk drive.

FD, BAD FILE DATA and **WRONG DATA FILE TYPE** all indicate a problem in a data file. The tape or disk may contain an ASA data file of the wrong type, a data file not prepared for ASA programs, or a computer program rather than a data file.

TOO LITTLE DATA FOR SEASONALS means that after discarding the highest and lowest monthly or quarterly averages there were no observations left on which to base the indexes. You need at least three years of quarterly or monthly data for seasonal indexes – more are recommended.

NOTE (DISK BASIC ONLY): If the program ends prematurely, a temporary scratch file may have been left on your diskette. Enter **KILL "SCRATCH/ASA"**. The Computer will either remove the file or display **FILE NOT FOUND.**

NOTE: Do **not** run DESCRIPTIVE STATISTICS, HISTOGRAM or FREQUENCY DISTRIBUTION on the TIME (X) variable in a time series data file. The values are not regular interval scale measurements.

Chi Square Analysis

Description of the Program

This program performs a chi square test on data in the form of a contingency table. The table may have any dimensions from 1 X 2 to 8 X 8. Output includes the number of rows and columns in the contingency table, total number of observations, number of expected frequencies less than five, chi square, degrees of freedom, and probability of chance. Additionally, tables of observed and expected frequencies can be displayed.

Features

- Expected frequencies may be input by the user or computed automatically from marginal totals
- Correction for continuity automatically applied to tests involving a single degree of freedom
- Estimate of exact chance probability
- Line Printer output formatted at 8½" x 11"

Limitations

- Maximum of 8 rows and 8 columns
- If user does not enter expected values for contingency tables with one row or one column, equal expected frequencies will be assumed

How to Run Chi Square

1. Load the program into the TRS-80. Type **RUN** and press **ENTER**. The Computer will reply

```
HOW MANY ROWS IN CONTINGENCY TABLE (1-8) ? _
```

2. Enter the number of rows in your chi square design. The Computer will ask

```
HOW MANY COLUMNS IN CONTINGENCY TABLE (1-8) ? _
```

3. Input the number of columns and hit **ENTER**. The Computer will display

```
EXPECTED FREQUENCIES CALCULATED BY - (C)OMPUTER OR (U)SER ? _
```

4. If you want to input expected frequencies based on previous knowledge, research findings, etc. enter a **U**, otherwise enter a **C**.

   Further information concerning your response to this question is contained in instruction #6.

   The Computer will reply

   ```
   DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ? _
   ```

5. Enter a **Y** if you have a Printer and want a permanent record of the chi square results. Otherwise enter an **N**. The Computer will display

   ```
   ENTER THE OBSERVED FREQUENCY FOR CELL:

   ROW 1
      COLUMN 1 ? _
   ```

6. Enter the observed frequency data value for Row 1, Column 1, in the contingency table. The Computer will ask for the observed frequency for Row 1, Column 2. After all the data for Row 1 have been entered, the Computer will request the data for Row 2, etc.

   - If you entered a **C** at instruction #4, skip to instruction #8.
   - If you entered a **U** at instruction #4, the Computer will reply

   ```
   ENTER THE EXPECTED FREQUENCY FOR CELL:

   ROW 1
      COLUMN 1 ? _
   ```

7. Enter the expected frequency data value for Row 1, Column 1, in the contingency table. The Computer will ask for the expected frequency for Row 1, Column 2. After all the data for Row 1 have been entered, the Computer will request the data for Row 2, etc.

8. The Computer will display

   ```
   COMPUTER AT WORK - PLEASE BE PATIENT
   ```

9. If you requested output on the Line Printer, the following message will appear

   ```
   TURN ON YOUR PRINTER - HIT ENTER ? _
   ```

   Turn your Printer on and press **ENTER**.

10. The results of the chi square analysis will be displayed on the screen and, if applicable, the results including the observed and expected frequency contingency tables will be printed on the Line Printer.

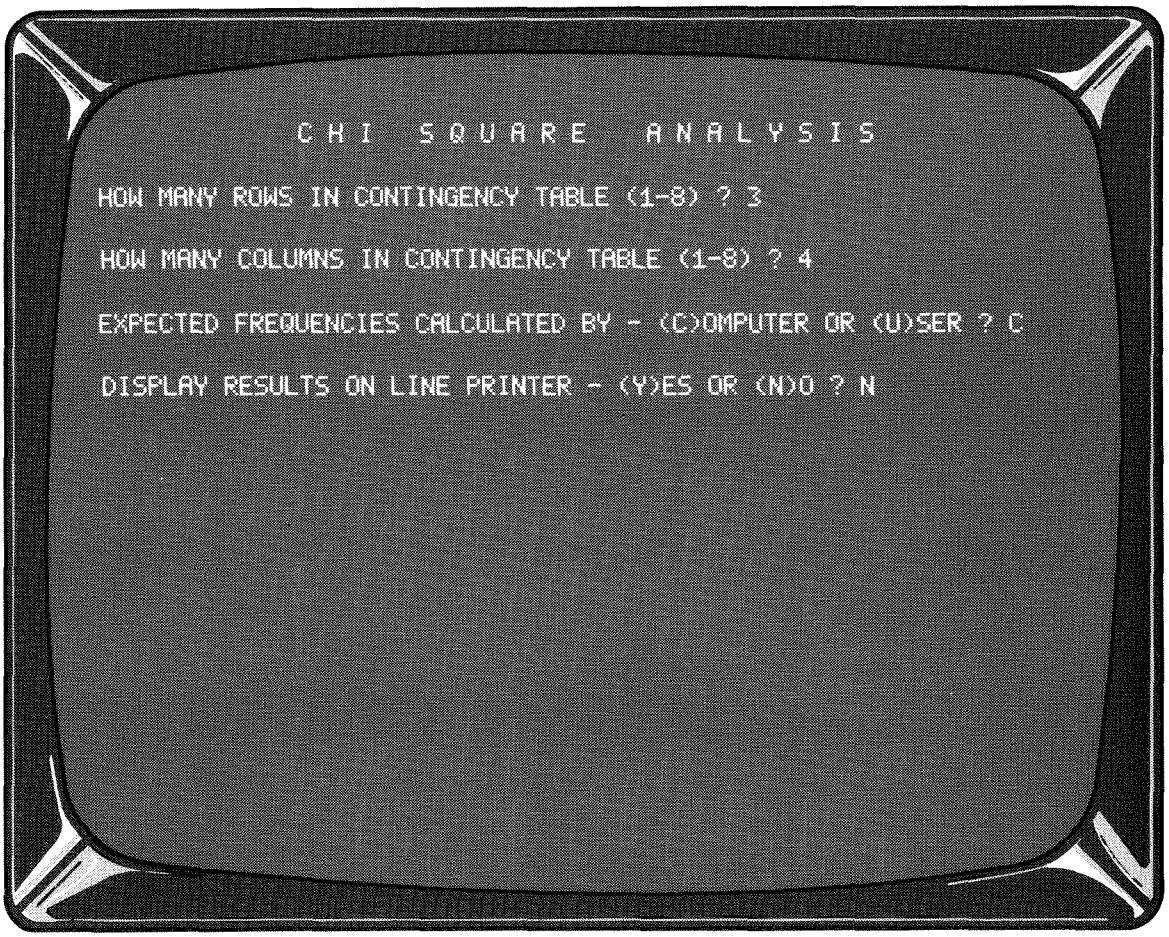
    The Computer will display

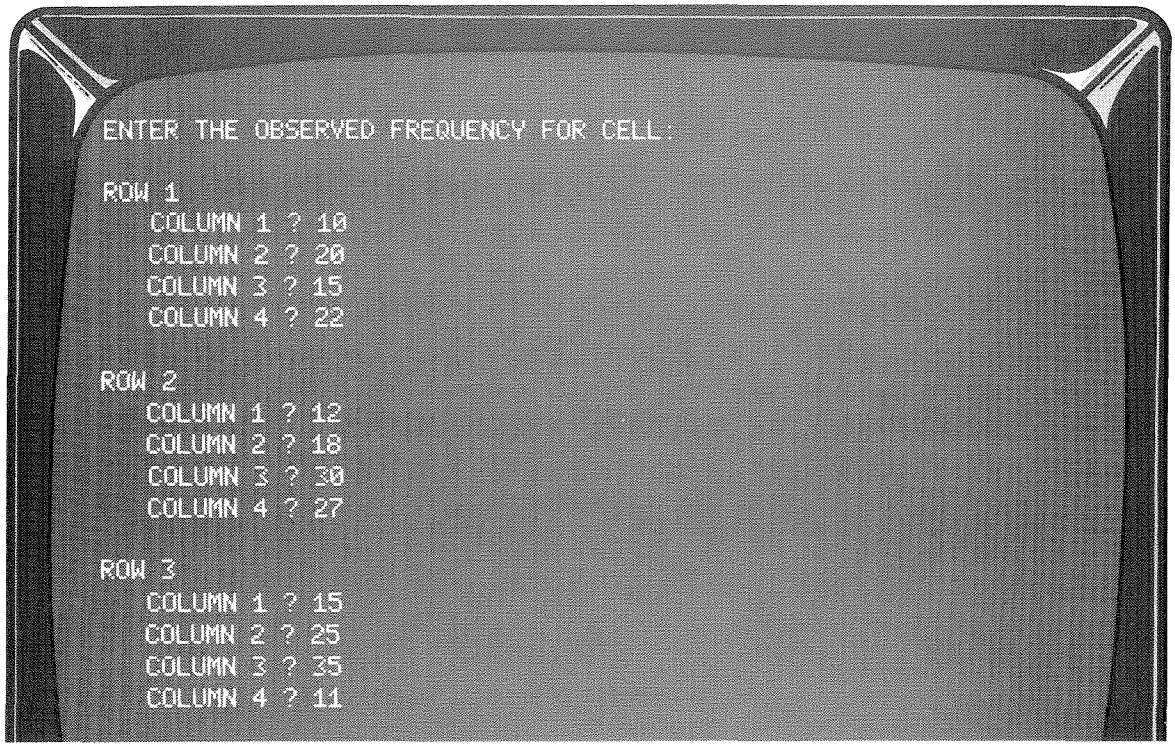
    ```
    (O)BSERVED TABLE, (E)XPECTED TABLE, (C)HI SQUARE RESULTS ? _
    ```

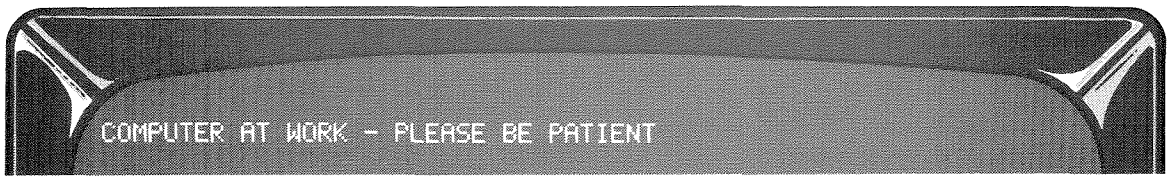
11. Enter an **O** to obtain the contingency table of observed frequencies, an **E** to view the expected frequency table, or a **C** to see the chi square results again. The chi square results and contingency tables are printed on the Line Printer only once, but these items may be displayed on the Video Monitor over and over by entering the appropriate letter code.

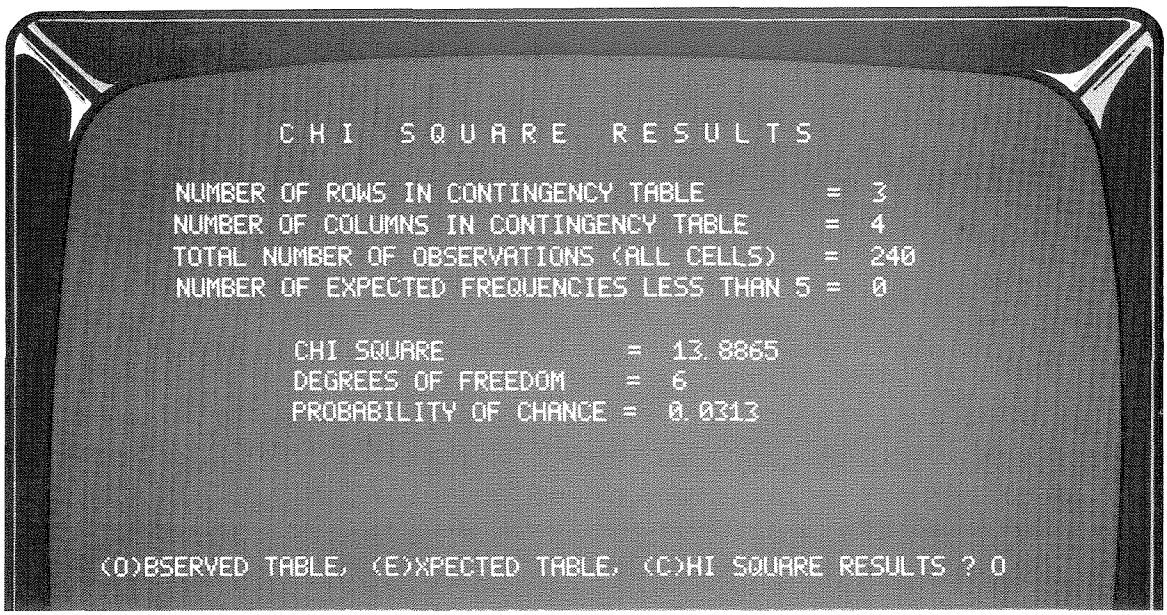
    To end the program press **BREAK**.

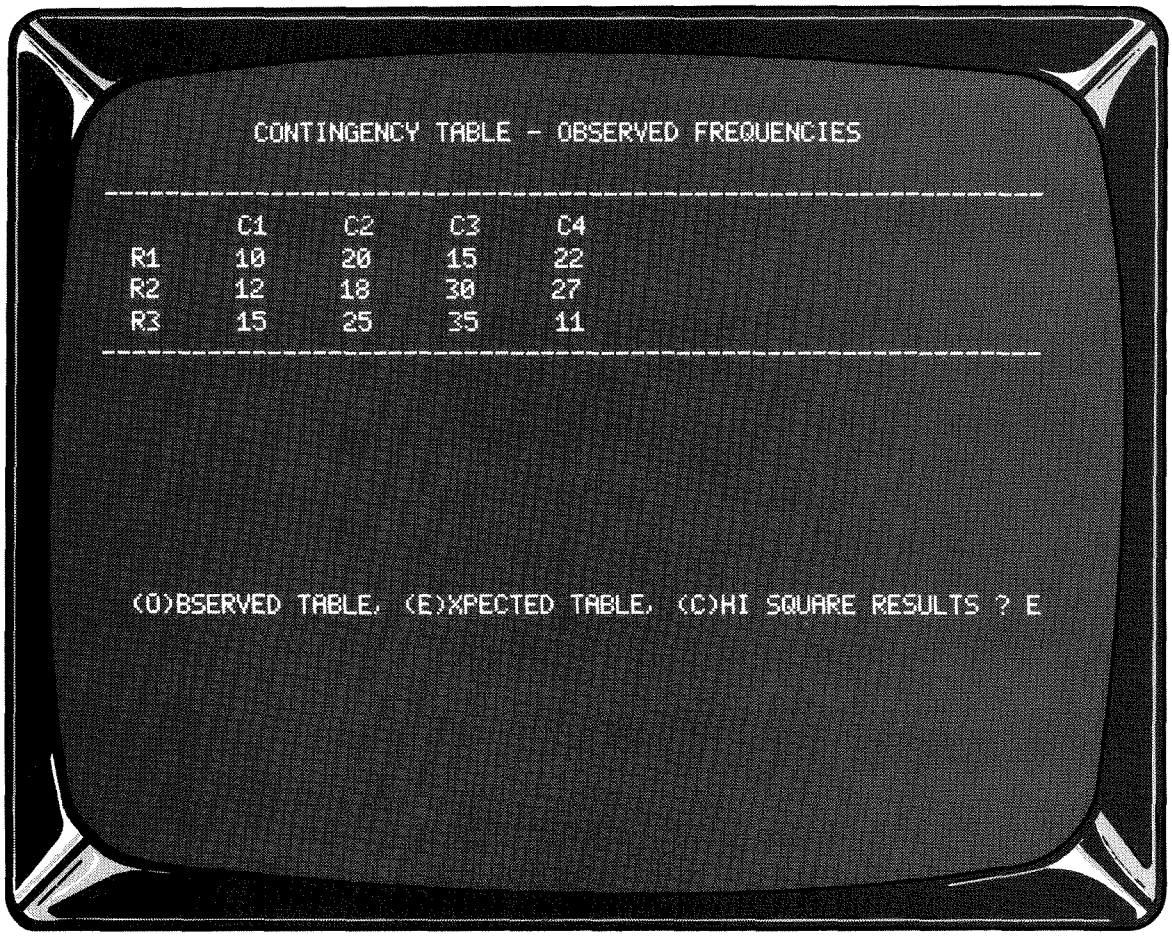
Sample Run

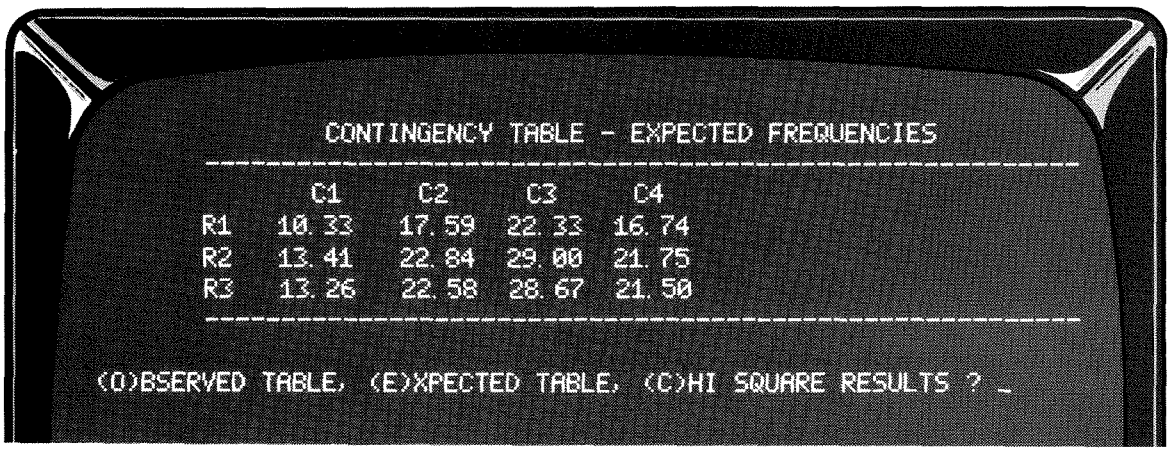



ENTER THE OBSERVED FREQUENCY FOR CELL:
ROW 1
COLUMN 1 ? 10
COLUMN 2 ? 20
COLUMN 3 ? 15
COLUMN 4 ? 22
ROW 2
COLUMN 1 ? 12
COLUMN 2 ? 18
COLUMN 3 ? 30
COLUMN 4 ? 27
ROW 3
COLUMN 1 ? 15
COLUMN 2 ? 25
COLUMN 3 ? 35
COLUMN 4 ? 11


COMPUTER AT WORK - PLEASE BE PATIENT


C H I S Q U A R E R E S U L T S
NUMBER OF ROWS IN CONTINGENCY TABLE = 3
NUMBER OF COLUMNS IN CONTINGENCY TABLE = 4
TOTAL NUMBER OF OBSERVATIONS (ALL CELLS) = 240
NUMBER OF EXPECTED FREQUENCIES LESS THAN 5 = 0
CHI SQUARE = 13.8865
DEGREES OF FREEDOM = 6
PROBABILITY OF CHANCE = 0.0313
(O)BSERVED TABLE, (E)XPECTED TABLE, (C)HI SQUARE RESULTS ? O


CONTINGENCY TABLE - OBSERVED FREQUENCIES
C1 C2 C3 C4
R1 10 20 15 22
R2 12 18 30 27
R3 15 25 35 11
(O)BSERVED TABLE, (E)XPECTED TABLE, (C)HI SQUARE RESULTS ? E


CONTINGENCY TABLE - EXPECTED FREQUENCIES
C1 C2 C3 C4
R1 10.33 17.59 22.33 16.74
R2 13.41 22.84 29.00 21.75
R3 13.26 22.58 28.67 21.50
(O)BSERVED TABLE, (E)XPECTED TABLE, (C)HI SQUARE RESULTS ? _

Messages and Special Considerations

EXPECTED FREQUENCY IN LAST CELL WAS LESS THAN 5. is simply a reminder that there are certain statistical considerations involving expected frequencies less than five. Consult a statistics textbook.

NOTE: YATES' CORRECTION FOR CONTINUITY WAS APPLIED. The data are corrected for continuity whenever there is only one degree of freedom in the chi square analysis.

NOTE; Degrees of freedom for the chi square test is (ROWS-1) X (COLUMNS-1). When there is only one row or one column in the contingency table, the degrees of freedom become zero. In order to avoid possible algorithmic problems, the program will change that single row or column's contribution to the degrees of freedom formula from zero to one (a standard procedure).

Appendix

APPENDIX A
Advanced Statistical Analysis Data File Structure

Cassette Tape

Record 1

The first record in every ASA tape data file consists of a number indicating the type of data contained in the file. The file type codes are as follows:

1 = single type data
2 = paired type data
3 = ANOVA (analysis of variance) type data
4 = multiple regression type data

Record 2

An alphanumeric file name comprises the second record of each data file. The name, which is written and read as a string variable, is supplied by the user when TAPE DATA FILES is run and is displayed on the screen by ASA data analysis programs while the data file is read.

Record 3

This record is found **only** in ANOVA and multiple regression files. It contains a number from 1 to 5 which indicates either

- how many groups of data are stored on an ANOVA data file,

or

- how many independent variables are stored on each subject's record in a multiple regression data file.

Data Records

The number of data records contained in an ASA data file depends on the size of the data set. Each data record contains exactly eight (8) values. Therefore, each data record in a(n)

- single type file contains 8 data elements
- paired type file contains 4 data elements (pairs)
- ANOVA type file contains 8 elements (which may include one or more group separation symbols)

- multiple regression type file contains the data for one subject formatted as follows:

  Position 1 = Dependent variable
  Position 2 = Independent Variable #1
  Position 3 = I.V. #2 (or a * if less than 2 I.V.s)
  Position 4 = I.V. #3 (or a * if less than 3 I.V.s)
  Position 5 = I.V. #4 (or a * if less than 4 I.V.s)
  Position 6 = I.V. #5 (or a * if less than 5 I.V.s)
  Positions 7 and 8 contain stars (*) as fillers

End of File and End of Group Signals

The symbol @ is used in ASA tape data files to signal the Computer that it has (1) finished reading all of the data in the file or (2) finished reading the data for one of the groups in an ANOVA data file. That symbol is written on tape between the sets of data corresponding to each ANOVA group and at the end of each data file on tape. Since the last data value in single, paired, and ANOVA type files can fall at any position in a data record, all unused positions in that final record are filled with the symbol @. If the last data value falls at position 8, filling up the final data record, (or if the file is a multiple regression type) another record is written on tape. All eight positions in this extra record contain the symbol @.

On Disk

Record 1

The first record in every ASA disk data file consists of the number indicating the type of data contained in the file. The file type codes are as follows:

1 = single type data
2 = paired type data
3 = ANOVA type data
4 = multiple regression type data

Record 2

This record is found **only** in ANOVA and multiple regression files. It contains a number from 1 to 5 which indicates either

- how many groups of data are stored on an ANOVA data file

  or

- how many independent variables are stored on each subject's record in a multiple regression data file.

Data Records

Data records on disk each contain one value, are sequential, and follow the schemes below depending on the type of data in the file.

- In single type data files each data record is simply one data element. The file terminates with the regular TRS-80 end-of-file mark.
- In paired type data files the first data record contains the X value for the first pair – the second record the Y value. Each consecutive pair of records contains a pair of data values (X,Y). The file terminates with the TRS-80 end-of-file mark.
- In ANOVA type data files the data for the first group is stored one data value per record followed by a record containing the group separating symbol (@). Data for each succeeding group follows in the same manner. The data for the final group in an ANOVA data file is followed by the regular TRS-80 end-of-file mark instead of the symbol @.
- In multiple regression type data files the first data record contains the dependent variable for the first subject. That subject's independent variables are stored on successive data records (one data record per I.V.). Thus, if the user is building a data file for a study using 3 independent variables, 4 data records will be required to store the data for each subject.

  Multiple regression type data files are terminated by a set of records each containing the symbol @. The number of such records is equal to the number of I.V.s plus one. These signal records are followed by the regular TRS-80 end-of-file mark.

APPENDIX B

Sample Printouts from Advanced Statistical Analysis Programs (TRS-80 Line Printer)

Sample Printout from Tape Data Files

```
LISTING OF DATA FILE:  ANOVA 3 GPS

                                    VALUE OF X
ELEMENT # 1      GROUP # 1          1
ELEMENT # 2      GROUP # 1          2
ELEMENT # 3      GROUP # 1          3
ELEMENT # 4      GROUP # 1          4
ELEMENT # 5      GROUP # 1          5
ELEMENT # 6      GROUP # 1          6
ELEMENT # 7      GROUP # 1          7
ELEMENT # 8      GROUP # 1          8
ELEMENT # 9      GROUP # 1          9
ELEMENT # 10     GROUP # 1          10
ELEMENT # 11     GROUP # 1          @
ELEMENT # 12     GROUP # 2          11
ELEMENT # 13     GROUP # 2          12
ELEMENT # 14     GROUP # 2          13
ELEMENT # 15     GROUP # 2          14
ELEMENT # 16     GROUP # 2          @
ELEMENT # 17     GROUP # 3          15
ELEMENT # 18     GROUP # 3          16
ELEMENT # 19     GROUP # 3          17
ELEMENT # 20     GROUP # 3          18
ELEMENT # 21     GROUP # 3          19
```

```
LISTING OF DATA FILE:  SAMPLE FILE - 3 IVS

                DV       IV#1     IV#2     IV#3     IV#4     IV#5
ELEMENT # 1     10       1        2        3        *        *
ELEMENT # 2     20       2        3        4        *        *
ELEMENT # 3     30       3        4        5        *        *
ELEMENT # 4     40       4        5        6        *        *
ELEMENT # 5     50       5        6        7        *        *
```

```
LISTING OF DATA FILE:  SAMPLE PAIRED DATA

                                    VALUE OF X       VALUE OF Y
ELEMENT # 1                         68               160
ELEMENT # 2                         69               180
ELEMENT # 3                         70               170
ELEMENT # 4                         70               200
ELEMENT # 5                         71               210
ELEMENT # 6                         71               180
ELEMENT # 7                         72               190
ELEMENT # 8                         72               200
ELEMENT # 9                         73               210
ELEMENT # 10                        74               205
```

Sample Printout from Disk Data Files

```
LISTING OF DATA FILE:  PAIRED/DAT

                                VALUE OF X      VALUE OF Y
ELEMENT # 1                     68              160
ELEMENT # 2                     69              180
ELEMENT # 3                     70              170
ELEMENT # 4                     70              200
ELEMENT # 5                     71              210
ELEMENT # 6                     71              180
ELEMENT # 7                     72              190
ELEMENT # 8                     72              200
ELEMENT # 9                     73              210
ELEMENT # 10                    74              205


LISTING OF DATA FILE:  ANOVA/DAT

                                VALUE OF X
ELEMENT # 1     GROUP # 1       1
ELEMENT # 2     GROUP # 1       2
ELEMENT # 3     GROUP # 1       3
ELEMENT # 4     GROUP # 1       4
ELEMENT # 5     GROUP # 1       5
ELEMENT # 6     GROUP # 1       6
ELEMENT # 7     GROUP # 1       7
ELEMENT # 8     GROUP # 1       8
ELEMENT # 9     GROUP # 1       9
ELEMENT # 10    GROUP # 1       10
ELEMENT # 11    GROUP # 1       @
ELEMENT # 12    GROUP # 2       11
ELEMENT # 13    GROUP # 2       12
ELEMENT # 14    GROUP # 2       13
ELEMENT # 15    GROUP # 2       14
ELEMENT # 16    GROUP # 2       @
ELEMENT # 17    GROUP # 3       15
ELEMENT # 18    GROUP # 3       16
ELEMENT # 19    GROUP # 3       17
ELEMENT # 20    GROUP # 3       18
ELEMENT # 21    GROUP # 3       19


LISTING OF DATA FILE:  MULR/DAT

                DV      IV#1    IV#2    IV#3    IV#4    IV#5
ELEMENT # 1     10      1       2       3
ELEMENT # 2     20      2       3       4
ELEMENT # 3     30      3       4       5
ELEMENT # 4     40      4       5       6
ELEMENT # 5     50      5       6       7
```

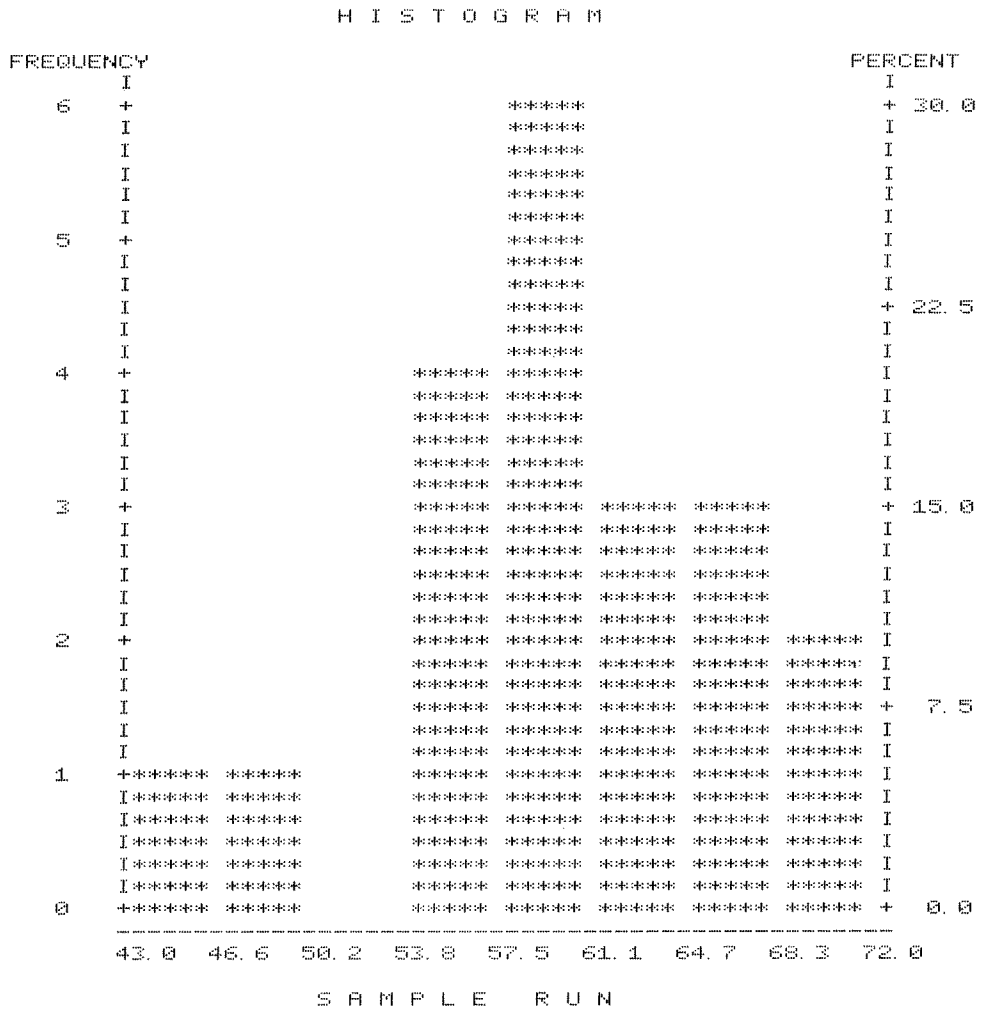
Sample Printout from Random Sample

```
      YOUR SAMPLE WILL CONSIST OF MEASUREMENTS
         ON THE 55 DATA ELEMENTS NUMBERED:

177             311             624             804
998             1214            1931            2283
2844            3398            3862            3979
4050            4449            4796            5029
5721            6220            7377            7982
8707            8753            8854            8920
9011            9067            9155            9442
10035           10082           10345           10604
11115           11349           11789           12214
13121           13516           13624           13809
14356           14600           15175           15199
15270           15454           15708           16778
16841           17870           18636           18645
19243           19846           19948
```

Sample Printout from Descriptive Statistics

```
        D E S C R I P T I V E    S T A T I S T I C S


VARIABLE:  WEIGHT                  SAMPLE SIZE (N) =  10


SAMPLE STATISTICS:

   MEAN       =  190.5            RANGE          =  50

   VARIANCE   =  272.239          MINIMUM        =  160

   STD. DEV.  =  16.4997          MAXIMUM        =  210


UNBIASED ESTIMATES OF POPULATION PARAMETERS:

   VARIANCE   =  302.488          STD. DEV.      =  17.3922


DATA DISTRIBUTION COEFFICIENTS:

   SKEWNESS   = -.438794          KURTOSIS       = -1.08949
```

Sample Printout from Historgram



Sample Printout from Frequency Distribution

F R E Q U E N C Y D I S T R I B U T I O N

DISTRIBUTION OF VARIABLE: SAMPLE RUN

INTERVAL			FREQUENCY	PERCENT	CUMULATIVE %
43.000	TO	45.899	1	5.0	5.0
45.900	TO	48.799	1	5.0	10.0
48.800	TO	51.699	0	0.0	10.0
51.700	TO	54.599	0	0.0	10.0
54.600	TO	57.499	4	20.0	30.0
57.500	TO	60.399	4	20.0	50.0
60.400	TO	63.299	3	15.0	65.0
63.300	TO	66.199	3	15.0	80.0
66.200	TO	69.099	2	10.0	90.0
69.100	TO	72.000	2	10.0	100.0
T O T A L			20	100.0	

Sample Printout from Analysis of Variance

A N A L Y S I S O F V A R I A N C E

SUMMARY TABLE

SOURCE	SS	DF	MS
TOTAL	2351.25	20	
BETWEEN	196.043	3	65.3477
WITHIN	2155.2	17	126.777

F-RATIO = 515455

DEGREES OF FREEDOM = 3 & 17

PROBABILITY OF CHANCE = 0.681

GROUP STATISTICS

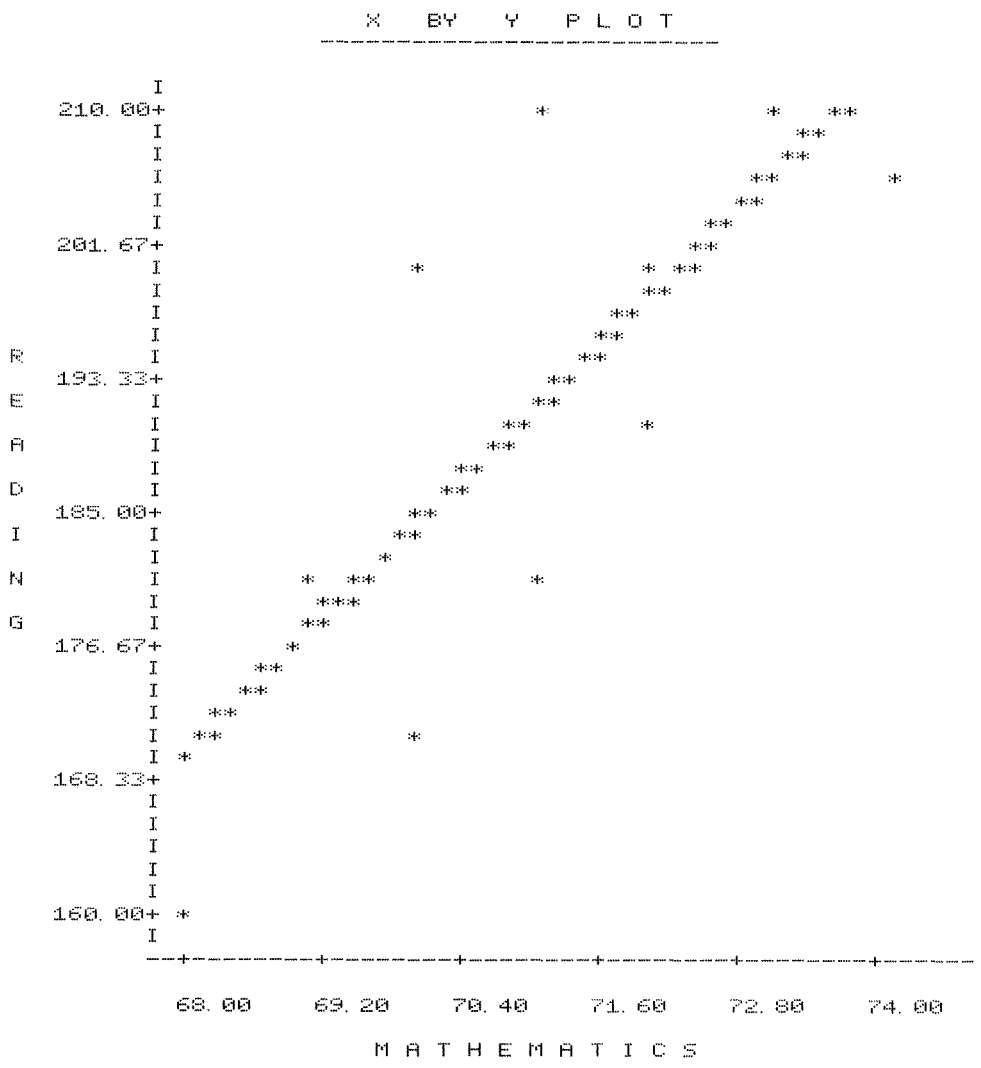
GROUP	N	MEAN	S.D.
TREATMENT A	5	21.6	7.79744
TREATMENT B	6	22	15.1262
TREATMENT C	5	20.8	10.3537
NO TREATMENT	5	14.4	9.2087

Sample Printout from T-Test

```
                T - T E S T   R E S U L T S


VARIABLE X:  HEIGHT            VARIABLE Y:  WEIGHT


MEAN OF X   =   71             MEAN OF Y   =   190.5
S.D.  OF X  =   1.73164        S.D.  OF Y  =   16.4997
S.E.  MEAN  =   .577214        S.E.  MEAN  =   5.49989


          NUMBER OF PAIRS (N)            =   10

          CORRELATION OF X WITH Y (R)    = 0.752


          DIFFERENCE (MEAN X - MEAN Y) = -119.5

          DEGREES OF FREEDOM (DF)        =   9

          T-RATIO FOR THE DIFFERENCE     = -23.5232

          PROBABILITY ( 1 TAILED TEST) = 0.000
```

Sample Printout from Correlation & Linear Regression

```
C O R R E L A T I O N   &   L I N E A R   R E G R E S S I O N


  VARIABLE X:  MATHEMATICS     VARIABLE Y:  READING


  MEAN OF X   =  71            MEAN OF Y   =  190.5

  S.D. OF X   =  1.73164       S.D. OF Y   =  16.4997


          NUMBER OF PAIRS (N)           =  10


          CORRELATION COEFFICIENT (R)   =  .752

          DEGREES OF FREEDOM (DF)       =  8


          SLOPE (M) OF REGRESSION LINE =  7.17005

          Y INTERCEPT (B) FOR THE LINE = -318.574
```


X BY Y PLOT
210.00
201.67
193.33
185.00
176.67
168.33
160.00
READING
68.00
69.20
70.40
71.60
72.80
74.00
MATHEMATICS

Sample Printout from Multiple Linear Regression

R E G R E S S I O N S T A T I S T I C S

COEFFICIENT OF DETERMINATION (R SQ)	=	.952477
COEFFICIENT OF MULTIPLE CORRELATION	=	.975949
STANDARD ERROR OF ESTIMATE	=	.909347
REGRESSION SUM OF SQUARES	=	66.2925
RESIDUAL SUM OF SQUARES	=	3.30765
TOTAL SUM OF SQUARES	=	69.6001
F-RATIO (REGRESSION)	=	16.0137
DEGREES OF FREEDOM	=	5 & 4
PROBABILITY OF CHANCE	=	.0118522
NUMBER OF CASES (SUBJECTS)	=	10
NUMBER OF INDEPENDENT VARIABLES	=	5

REGRESSION COEFFICIENTS

VAR.	NAME	MEAN	S.D.	COEFF.
C	CONSTANT			-2.76248
IV1	APTITUDE	3.7	2.2136	1.3294
IV2	EXPERIENCE	3.3	1.33749	-.479798
IV3	TRAINING	4.3	1.1595	.827602
IV4	AGE	4.3	1.1595	-.183797
IV5	MOTIVATION	4.2	2.04396	.204447
DV	PAY RATE	4.2	2.78089	

Sample Printout from Time Series Analysis I

```
      T I M E    S E R I E S    A N A L Y S I S    I


TEST FOR TREND (Z) = .676481          TREND LINE EQUATION:
                                      Y' = 242.134 + .227646 X
VARIANCE ACCOUNTED FOR                ORIGIN:  1953 - MONTH 1
BY TREND =  0.43 %                    TIME UNIT:  1 MONTH


          I
   445.00+                                                  *
          I
          I
          I           *
          I
N         I
   396.00+
E         I
          I
T         I
          I
A         I                    *
   351.00+          *
L         I                                      *
          I            * *                                  *
          I                      *
          I                                 *
   304.00+              *  *
S         I          *    **                          *
          I
H         I                                                *
          I                   *           *
L         I                  **                             *
   257.00+                  *    *          *  *      **
E         I                                                 *
          I *                        *          *
S         I                             *
          I                                        *     **
          I       *                *       *  * *         *
   210.00+          *                 *           *
          I                             *
          I    *  *                        **          *        *
          I  ***** *                                 * *
          I
          I
   163.00+                               *
          I
          ---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
            0 ( 1953 MONTH 1 )                                      59
```

Sample Printout from Time Series Analysis II

QUARTER	SEASONAL INDEX	# QUARTERS USED
I	82.672	5
II	106.208	5
III	113.581	5
IV	97.5391	5

MONTH	SEASONAL INDEX	# MONTHS USED
JAN.	142.248	2
FEB.	109.634	2
MARCH	92.7467	2
APRIL	103.628	2
MAY	92.3925	2
JUNE	89.9348	2
JULY	102.086	2
AUG.	82.9098	2
SEPT.	78.9706	2
OCT.	83.0246	2
NOV.	98.0496	2
DEC.	124.377	2

12 MONTH MOVING AVERAGE
ORIGIN = JAN. 1953

JULY	1953	224.25
AUG.	1953	238.042
SEPT.	1953	249.5
OCT.	1953	260.417
NOV.	1953	270.583
DEC.	1953	279.458
JAN.	1954	287.667
FEB.	1954	294.5
MARCH	1954	300.458
APRIL	1954	305.542
MAY	1954	306.708
JUNE	1954	304.167
JULY	1954	300.167
AUG.	1954	294.417
SEPT.	1954	287.542
OCT.	1954	280.167
NOV.	1954	272.792
DEC.	1954	265.542
JAN.	1955	258.792
FEB.	1955	252.583
MARCH	1955	245.667
APRIL	1955	238.708
MAY	1955	233.083
JUNE	1955	228.708
JULY	1955	224.792
AUG.	1955	222.458
SEPT.	1955	222.042
OCT.	1955	221.75
NOV.	1955	222.042
DEC.	1955	222.625
JAN.	1956	223.833
FEB.	1956	224.625
MARCH	1956	225.458
APRIL	1956	226.333

MAY	1956	226.5
JUNE	1956	227.875
JULY	1956	230.208
AUG.	1956	231.625
SEPT.	1956	231.708
OCT.	1956	232.417
NOV.	1956	233.167
DEC.	1956	233.875
JAN.	1957	235.417
FEB.	1957	236.708
MARCH	1957	239.417
APRIL	1957	245
MAY	1957	252.375
JUNE	1957	262.833

4 QUARTER MOVING AVERAGE
ORIGIN = QUARTER 1 1954

QUARTER 3	1954	1941.38
QUARTER 4	1954	1935.25
QUARTER 1	1955	1953.75
QUARTER 2	1955	1993.38
QUARTER 3	1955	2027.13
QUARTER 4	1955	2043.25
QUARTER 1	1956	2040.88
QUARTER 2	1956	2003.38
QUARTER 3	1956	1960.25
QUARTER 4	1956	1926.75
QUARTER 1	1957	1893
QUARTER 2	1957	1872
QUARTER 3	1957	1858.25
QUARTER 4	1957	1834.75
QUARTER 1	1958	1799.75
QUARTER 2	1958	1766.63
QUARTER 3	1958	1749.38
QUARTER 4	1958	1755
QUARTER 1	1959	1763.13
QUARTER 2	1959	1756.38
QUARTER 3	1959	1741.13
QUARTER 4	1959	1713.75
QUARTER 1	1960	1702.63
QUARTER 2	1960	1713
QUARTER 3	1960	1723.5
QUARTER 4	1960	1719.13
QUARTER 1	1961	1689.63
QUARTER 2	1961	1655

Sample Printout from Chi Square Analysis

C H I S Q U A R E R E S U L T S

NUMBER OF ROWS IN CONTINGENCY TABLE = 8

NUMBER OF COLUMNS IN CONTINGENCY TABLE = 1

TOTAL NUMBER OF OBSERVATIONS (ALL CELLS) = 36

NUMBER OF EXPECTED FREQUENCIES LESS THAN 5 = 8

CHI SQUARE = 9.33334

DEGREES OF FREEDOM = 7

PROBABILITY OF CHANCE = 0.2301

CONTINGENCY TABLE - OBSERVED FREQUENCIES

	C1
R1	1
R2	2
R3	3
R4	4
R5	5
R6	6
R7	7
R8	8

CONTINGENCY TABLE - EXPECTED FREQUENCIES

	C1
R1	4.50
R2	4.50
R3	4.50
R4	4.50
R5	4.50
R6	4.50
R7	4.50
R8	4.50

APPENDIX C
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APPENDIX D

Program Printouts

Tape Data Files Program Listing

```
50 CLEAR.75*(MEM-800):DEFSTRZ:DIMZD((MEM-800)/3):B$=" ":DEFINTI-N:NT=0:DIMLR(150)
100 CLS:PRINTTAB(15);"T A P E    D A T A    F I L E S":PRINT
110 PRINT"THIS PROGRAM IS BEING RUN TO:":PRINT"    (P)REPARE A NEW DATA FILE"
120 PRINT"    (U)PDATE AN OLD DATA FILE"
125 INPUT"    (L)IST   AN OLD DATA FILE     ";ZR
130 PRINT:IFZR="L"INPUT"LIST DATA FILE ON LINE PRINTER - (Y)ES OR (N)O ";ZI:GOTO1000
140 PRINT"FOR WHICH PROGRAM ";:IFZR="U"PRINT"WERE THE DATA";:GOTO160
150 PRINT"WILL THE DATA BE";
160 PRINT" PREPARED:":PRINT"    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM"
170 PRINT"    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES"
180 PRINT"    3 = ANALYSIS OF VARIANCE":INPUT"    4 = MULTIPLE REGRESSION       ";MT
192 MF=MT:IFMT=3MF=1
195 IFMT=4MF=8
196 IFZR="L"GOTO1035
198 IFZR="P"GOSUB8000:GOTO2000
200 PRINT:INPUT"HOW MANY DATA ELEMENTS ARE TO BE REMOVED ";IR:IFIR=0GOTO1000
210 CLS:PRINT"LIST THE DATA ELEMENTS TO BE REMOVED."
220 PRINT:FORL=1TOIR:INPUTLR(L):NEXTL
1000 CLS:INPUT"INSERT DATA TAPE - SET TO 'PLAY' - HIT ENTER ";A$
1010 GOSUB5000:PRINT:PRINT"DATA FILE BEING READ = ";ZO:PRINT:IFZR="L"MT=IT:GOTO192
1020 IFMT=ITGOTO1040
1030 PRINT"WRONG DATA FILE TYPE":PRINT:END
1035 GOSUB9500
1040 K=1:M=0:MA=1:IFMT=3INPUT#-1,MA
1050 IFMT=4INPUT#-1,IV:IV=IV+1
1060 GOSUB6000:JJ=0:FORJ=1TO8:JJ=JJ+1:IFZ(J)="0"N(K)=M+JJ-1:JL=J:GOSUB7000:JJ=0:K=K+1
1070 IFK>MA:PRINT:GOTO1500
1080 NT=NT+1:ZD(NT)=Z(J):NEXTJ:M=M+8
1090 IFMT=3M=M-JL
1095 GOTO1060
1500 IFZR="L"GOTO10000
1505 IFIR=0GOTO1540
1510 MG=1:MS=N(1)+1:JE=0:FORJ=1TONTSTEPMF:JE=JE+1:IFJE>MSGOTO1525
1515 FORK=1TOIR:IFLR(K)=JEGOTO1530
1520 NEXTK:NEXTJ:GOTO1540
1525 MG=MG+1:MS=MS+N(MG)+1:IFMG=MAMS=MS-1
1528 GOTO1515
1530 IK=IK+1:FORI=J+MFTONT:ZD(I-MF)=ZD(I):NEXTI:NT=NT-MF:J=J-MF:N(MG)=N(MG)-1:NEXTJ
1540 PRINT"NUMBER OF DATA ELEMENTS REMOVED =";IK:PRINT
1545 NP=NT:IFMT=3NP=NT-MA+1
```

Tape Data Files (continued)

```
1550 PRINT"NEW DATA COUNT =";NP/MF;"DATA ELEMENTS."
1555 IFMT=3PRINT"(DATA FOR ALL GROUPS COMBINED)"
1570 PRINT:INPUT"DO YOU WANT TO ADD ANY NEW DATA ELEMENTS - (Y)ES OR (N)O ";A$:IFA$="N"GOTO3000
1580 B$=" NEW "
2000 CLS:ONMTGOTO2010,2110,2300,2210
2010 PRINT"BEGIN ENTERING YOUR";B$;"DATA ELEMENTS."
2020 PRINT"SIGNAL END OF";B$;"DATA WITH @.":PRINT
2030 INPUTZX:IFZX="@"GOTO3000
2040 NT=NT+1:ZD(NT)=ZX:GOTO2030
2110 PRINT"BEGIN ENTERING YOUR";B$;"DATA PAIRS (X,Y)."
2120 PRINT"SIGNAL END OF";B$;"DATA WITH @,@.":PRINT
2130 INPUTZX,ZY:IFZX="@"GOTO3000
2140 ZD(NT+1)=ZX:ZD(NT+2)=ZY:NT=NT+2:GOTO2130
2210 PRINT"BEGIN ENTERING YOUR";B$;"DATA.
2220 PRINT"SIGNAL END OF";B$;"DATA BY ENTERING @ FOR THE DV VALUE.":PRINT
2230 NS=NT/8+1:NT=NT+1:PRINT"SUBJECT";NS;":":INPUT"  DV   ";ZX:IFZX="@"NT=NT-1:GOTO3000
2235 ZD(NT)=ZX
2240 FORL=1TOIV-1:NT=NT+1:PRINT"  IV";L;:INPUTZD(NT):NEXTL:PRINT
2250 FORJ=IV+1TO8:NT=NT+1:ZD(NT)="*":NEXTJ:GOTO2230
2300 IFZR="U"GOTO2500
2310 FORK=1TOMA:CLS:PRINT"BEGIN ENTERING THE DATA FOR GROUP #";K
2320 PRINT"SIGNAL END OF DATA WITH @.":PRINT
2330 INPUTZX:IFZX="@"GOTO2350
2340 NT=NT+1:ZD(NT)=ZX:GOTO2330
2350 NT=NT+1:ZD(NT)="@":NEXTK:GOTO3000
2500 CLS:K=1:NS=0
2510 PRINT"NUMBER OF NEW DATA ELEMENTS FOR GROUP #";K;:INPUTNN
2520 NS=NS+N(K)+1:IFNN=0K=K+1:IFK>MATHEN3000ELSE2510
2530 IFK=MANS=NS-1:GOTO2550
2540 FORI=NTTONSSTEP-1:ZD(I+NN)=ZD(I):NEXTI
2550 PRINT:PRINT"BEGIN ENTERING THE NEW DATA FOR GROUP #";K:PRINT
2560 FORJ=NSTONS+NN-1:INPUTZD(J):NEXTJ:N(K)=N(K)+NN:NT=NT+NN:NS=NS+NN
2570 CLS:PRINT"NEW DATA COUNT FOR GROUP #";K;"=";N(K):PRINT:K=K+1:IFK<=MAGOTO2510
3000 NP=NT:IFMT=3NP=NT-MA:IFZR="U"NP=NP+1:INPUT"HIT ENTER TO CONTINUE ";A$
3003 CLS:PRINT"NEW DATA COUNT =";NP/MF;"DATA ELEMENTS.":IFMT=3PRINT"(ALL GROUPS COMBINED)"
3005 PRINT:INPUT"NAME FOR THE NEW DATA FILE ";ZN:PRINT
3010 INPUT"INSERT A BLANK TAPE - SET TO 'RECORD' - HIT ENTER ";A$
3020 PRINT:PRINT"WRITING DATA TO TAPE.":PRINT#-1,MT:PRINT#-1,ZN
3022 IFMT=3PRINT#-1,MA
3025 IFMT=4IV=IV-1:PRINT#-1,IV
3030 FORI=1TO8:ZD(NT+I)="@":NEXTI:I=INT(NT/8+1)
3040 K=0:FORJ=1TOI:Z1=ZD(K+1):Z2=ZD(K+2):Z3=ZD(K+3):Z4=ZD(K+4)
3050 Z5=ZD(K+5):Z6=ZD(K+6):Z7=ZD(K+7):Z8=ZD(K+8):GOSUB9000:K=K+8:NEXTJ:PRINT:END
5000 INPUT#-1,IT:INPUT#-1,ZD:RETURN
6000 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):RETURN
7000 NP=N(K)/MF:IFMT=3PRINT"GROUP";K;":  ";
7010 PRINT"NUMBER OF DATA ELEMENTS READ FROM TAPE =";NP:M=0:RETURN
8000 PRINT:IFMT=3INPUT"HOW MANY GROUPS (2 TO 5 ONLY) ";MA:IFMA<=5THEN8020ELSE8000
8010 IFMT=4INPUT"HOW MANY INDEPENDENT VARIABLES (1 TO 5 ONLY) ";IV:IV=IV+1:IFIV<=6THEN8020ELSE8000
8020 RETURN
9000 PRINT#-1,Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8:RETURN
```

Tape Data Files (continued)

```
9500 C$="SINGLE":IFMT=2C$="PAIRED":GOTO9800
9600 IFMT=3C$="ANOVA":GOTO9800
9700 IFMT=4C$="MULT. REGR."
9800 PRINT"DATA FILE TYPE = ";C$:PRINT:RETURN
9900 FORJ=1TO100:C$=INKEY$:IFC$="@"GOTO9920
9910 NEXTJ:RETURN
9920 C$=INKEY$:IFC$="@"THEN9930ELSE9920
9930 RETURN
10000 IFZI="Y"PRINT"TURN ON YOUR PRINTER - ";
10005 INPUT"HIT ENTER TO BEGIN LISTING ";C$
10007 IFZI="Y"FORI=1TO8:LPRINT" ":NEXTI:LPRINTCHR$(29);"LISTING OF DATA FILE:  ";ZD:LPRINT" "
10010 CLS:ONMTGOTO10068,10078,10088,10108
10068 PRINT,,"VALUE OF X":IFZI="Y"LPRINT,,"VALUE OF X"
10070 FORK=1TONT:IFZI="Y"LPRINT"ELEMENT #";K,,ZD(K)
10075 PRINT"ELEMENT #";K,,ZD(K):GOSUB9900:NEXTK:GOTO10500
10078 PRINT,,"VALUE OF X","VALUE OF Y":IFZI="Y"LPRINT,,"VALUE OF X","VALUE OF Y"
10080 FORK=1TONTSTEP2:IFZI="Y"LPRINT"ELEMENT #";(K+1)/2,,ZD(K),ZD(K+1)
10085 PRINT"ELEMENT #";(K+1)/2,,ZD(K),ZD(K+1):GOSUB9900:NEXTK:GOTO10500
10088 PRINT,,"VALUE OF X":IFZI="Y"LPRINT,,"VALUE OF X"
10090 KL=1:FORK=1TONT:IFZI="Y"LPRINT"ELEMENT #";K,"GROUP #";KL,ZD(K)
10095 PRINT"ELEMENT #";K,"GROUP #";KL,ZD(K):GOSUB9900:IFZD(K)="@"KL=KL+1
10100 NEXTK:GOTO10500
10108 PRINTTAB(14);"DV      IV#1    IV#2    IV#3    IV#4    IV#5"
10109 IFZI="Y"LPRINTTAB(14);"DV      IV#1    IV#2    IV#3    IV#4    IV#5"
10110 FORK=1TONTSTEP8
10115 IFZI="Y"LPRINT"ELEMENT #";(K+7)/8;:FORM=0TO5:LPRINTTAB(14+M*8);ZD(K+M);:NEXTM:LPRINT" "
10120 PRINT"ELEMENT #";(K+7)/8;:FORM=0TO5:PRINTTAB(14+M*8);ZD(K+M);:NEXTM:PRINT" ":GOSUB9900:NEXTK
10500 PRINT:INPUT"(L)IST DATA AGAIN OR (E)ND PROGRAM ";C$:IFC$="L"THEN10010ELSEEND
50000 INPUT#-1,A$,B$,C$:PRINTA$:PRINTB$:PRINTC$
```

Disk Data Files Program Listing

```
50 DEFSTRZ:B$=" ":DEFINTI-N:DIMLR(150):D$="OLD"
100 CLS:PRINTTAB(15);"D I S K    D A T A    F I L E S":PRINT
110 PRINT"THIS PROGRAM IS BEING RUN TO:":PRINT"    (P)REPARE A NEW DATA FILE"
120 PRINT"    (U)PDATE AN OLD DATA FILE"
125 INPUT"    (L)IST   AN OLD DATA FILE     ";ZR:IFZR="P"GOTO128
126 PRINT:INPUT"WHAT IS THE NAME OF THE OLD DATA FILE ";ZN:IFZR="L"GOTO130
127 PRINT:INPUT"(S)AVE OLD FILE OR (R)EMOVE OLD FILE FROM DISK ";ZK
128 D$="NEW":IFZR="U"D$="UPDATED"
129 PRINT:PRINT"WHAT WILL BE THE NAME OF THE ";D$;:INPUT" DATA FILE ";ZM
130 PRINT:IFZR="L"INPUT"LIST DATA FILE ON LINE PRINTER - (Y)ES OR (N)O ";ZI:GOTO1000
140 CLS:PRINT"FOR WHICH PROGRAM ";:IFZR="U"PRINT"WERE THE DATA";:GOTO160
150 PRINT"WILL THE DATA BE";
160 PRINT" PREPARED:":PRINT"    1 = DESCRIP. STAT. / FREQ. DISTR. / HISTOGRAM"
170 PRINT"    2 = CORR. & LIN. REGR. / MATCHED PRS. / TIME SERIES"
180 PRINT"    3 = ANALYSIS OF VARIANCE":INPUT"    4 = MULTIPLE REGRESSION       ";MT
190 IFZR="P"GOSUB8000:GOTO2006
200 PRINT:INPUT"HOW MANY DATA ELEMENTS ARE TO BE REMOVED ";IR:IFIR=0GOTO1000
210 CLS:PRINT"LIST THE DATA ELEMENTS TO BE REMOVED."
220 PRINT:FORL=1TOIR:INPUTLR(L):NEXTL
1000 CLS:OPEN"I",1,ZN
1010 INPUT#1,IT:PRINT"DATA FILE BEING READ = ";ZN:PRINT:IFZR="L"MT=IT:GOTO1035
1020 IFMT=ITGOTO1040
1030 PRINT"WRONG DATA FILE TYPE":PRINT:END
1035 GOSUB9500
1040 MA=1:IFMT=3INPUT#1,MA:IT=MA
1045 MF=MT:IFMT=3MF=1
1050 IFMT=4INPUT#1,IV:IT=IV:MF=IV+1
1500 K=1:IFZR="L"GOTO1510
1505 OPEN"O",2,"SCRATCH/ASA":GOSUB8030:JE=0:K=1
1510 JE=JE+1:JR=0:FORKK=1TOIR:IFLR(KK)<>JEGOTO1514
1512 JR=1:KR=KR+1
1514 NEXTKK:FORLL=1TOMF:INPUT#1,ZX:IFZX<>"@"GOTO1522
1516 IFMT=4GOSUB7000:JE=JE-1:GOTO1540
1518 GOSUB7000:K=K+1:N(K)=-1
1522 N(K)=N(K)+1:IF(JR=0)AND(ZR="U")PRINT#2,ZX
1523 IFEOF(1)GOSUB7000:GOTO1540
1524 NEXTLL:GOTO1510
1540 IFZR="L"THEN10000ELSEPRINT:PRINT"NUMBER OF DATA ELEMENTS REMOVED =";KS:PRINT
1545 ND=JE-KS:IFMT=3ND=ND-MA+1
1550 PRINT"NEW DATA COUNT =";ND;"DATA ELEMENTS."
1555 IFMT=3PRINT"(DATA FOR ALL GROUPS COMBINED)":PRINT:GOTO2000
1570 PRINT:INPUT"DO YOU WANT TO ADD ANY NEW DATA ELEMENTS - (Y)ES OR (N)O ";A$:IFA$="Y"B$=" NEW "
2000 JE=ND:CLOSE:IFZK="R"KILLZN
2002 OPEN"I",1,"SCRATCH/ASA":OPEN"O",2,ZM:IFMT=3GOTO2300
2004 INPUT#1,ZX:PRINT#2,ZX:IFEOF(1)THEN2005ELSE2004
2005 IFA$="N"GOTO3000
2006 CLS:ONMTGOTO2010,2110,2300,2210
2010 PRINT"BEGIN ENTERING YOUR";B$;"DATA ELEMENTS."
2020 PRINT"SIGNAL END OF";B$;"DATA WITH @.":PRINT
2030 INPUTZX:IFZX="@"GOTO3000
2040 JE=JE+1:PRINT#2,ZX:GOTO2030
```

Disk Data Files (continued)

```
2110 PRINT"BEGIN ENTERING YOUR";B$;"DATA PAIRS (X,Y)."
2120 PRINT"SIGNAL END OF";B$;"DATA WITH @,@.":PRINT
2130 INPUTZX,ZY:IFZX="@"GOTO3000
2140 PRINT#2,ZX:PRINT#2,ZY:JE=JE+1:GOTO2130
2210 PRINT"BEGIN ENTERING YOUR";B$;"DATA.
2220 PRINT"SIGNAL END OF";B$;"DATA BY ENTERING @ FOR THE DV VALUE.":PRINT
2230 JE=JE+1:PRINT"SUBJECT";JE;":";INPUT"  DV   ";ZX:IFZX="@"JE=JE-1:GOTO3000
2235 PRINT#2,ZX
2240 FORL=1TOIV:NT=NT+1:PRINT"  IV";L;:INPUTZX:PRINT#2,ZX:NEXTL:PRINT:GOTO2230
2300 IFZR="U"GOTO2500
2310 FORK=1TOMA:CLS:PRINT"BEGIN ENTERING THE DATA FOR GROUP #";K
2320 PRINT"SIGNAL END OF DATA WITH @.":PRINT
2330 INPUTZX:IFZX="@"GOTO2350
2340 JE=JE+1:PRINT#2,ZX:GOTO2330
2350 IFK=MATHEN3000ELSEPRINT#2,"@":NEXTK
2500 K=1:INPUT#1,ZX:PRINT#2,ZX:INPUT#1,ZX:PRINT#2,ZX
2530 FORJ=1TON(K):INPUT#1,ZX:PRINT#2,ZX:NEXTJ
2540 PRINT"NEW DATA FOR GROUP";K;"- (Y)ES OR (N)O ";:INPUTZX:IFZX="Y"CLS:GOTO2550
2545 IFK=MATHEN2570ELSEINPUT#1,ZX:PRINT#2,ZX:GOTO2570
2550 CLS:PRINT"BEGIN ENTERING THE NEW DATA FOR GROUP #";K
2555 PRINT"SIGNAL END OF NEW DATA WITH @.":PRINT
2560 INPUTZX:IFZX<>"@"PRINT#2,ZX:N(K)=N(K)+1:JE=JE+1:GOTO2560
2565 IFK=MATHEN2570ELSEINPUT#1,ZX:PRINT#2,ZX
2570 CLS:PRINT"NEW DATA COUNT FOR GROUP #";K;"=";N(K):PRINT:K=K+1:IFK<=MAGOTO2530
2600 INPUT"HIT ENTER TO CONTINUE ";C$
3000 CLS:PRINT"NEW DATA COUNT =";JE;"DATA ELEMENTS.":IFMT=3PRINT"(ALL GROUPS COMBINED)"
3025 IFMT=4FORJ=1TOMF:PRINT#2,"@":NEXTJ
3050 CLOSE:IFZR="U"KILL"SCRATCH/ASA"
3060 PRINT:PRINT"NEW FILE IS NAMED:  ";ZM:PRINT:END
7000 NP=N(K)/MF:N(K)=N(K)-KR:KS=KS+KR:IFMT=3PRINT"GROUP";K;":  ";:KR=0
7010 PRINT"NUMBER OF DATA ELEMENTS READ FROM DISK =";NP:RETURN
8000 PRINT:IFMT=3INPUT"HOW MANY GROUPS (2 TO 5 ONLY) ";MA:IT=MA:IFMA<=5THEN8020ELSE8000
8010 IFMT=4INPUT"HOW MANY INDEPENDENT VARIABLES (1 TO 5 ONLY) ";IV:IT=IV:IFIV<=5THEN8020ELSE8000
8020 OPEN"O",2,ZM
8030 PRINT#2,MT:IFMT>2PRINT#2,IT
8050 RETURN
9500 C$="SINGLE":IFMT=2C$="PAIRED":GOTO9800
9600 IFMT=3C$="ANOVA":GOTO9800
9700 IFMT=4C$="MULT. REGR."
9800 PRINT"DATA FILE TYPE = ";C$:PRINT:RETURN
9900 FORJ=1TO100:C$=INKEY$:IFC$="@"GOTO9920
9910 NEXTJ:RETURN
9920 C$=INKEY$:IFC$="@"THEN9930ELSE9920
9930 RETURN
10000 CLOSE:PRINT:IFZI="Y"PRINT"TURN ON YOUR PRINTER - ";
10005 INPUT"HIT ENTER TO BEGIN LISTING ";C$:GOTO10700
10007 IFZI="Y"FORI=1TO8:LPRINT" ":NEXTI:LPRINTCHR$(29);"LISTING OF DATA FILE:  ";ZN:LPRINT" "
10010 CLS:K=1:ONMTGOTO10068,10078,10088,10108
10068 PRINT,,"VALUE OF X":IFZI="Y"LPRINT,,"VALUE OF X"
10070 INPUT#1,ZX:IFZI="Y"LPRINT"ELEMENT #";K,,ZX
10075 PRINT"ELEMENT #";K,,ZX:GOSUB9900:K=K+1:IFEOF(1)THEN10500ELSE10070
```

Disk Data Files (continued)

```
10078 PRINT,,"VALUE OF X","VALUE OF Y":IFZI="Y"LPRINT,,"VALUE OF X","VALUE OF Y"
10080 INPUT#1,ZX:INPUT#1,ZY:IFZI="Y"LPRINT"ELEMENT #";K,,ZX,ZY
10085 PRINT"ELEMENT #";K,,ZX,ZY:GOSUB9900:K=K+1:IFEOF(1)THEN10500ELSE10080
10088 KL=1:PRINT,,"VALUE OF X":IFZI="Y"LPRINT,,"VALUE OF X"
10090 INPUT#1,ZX:IFZI="Y"LPRINT"ELEMENT #";K,"GROUP #";KL,ZX
10095 PRINT"ELEMENT #";K,"GROUP #";KL,ZX:GOSUB9900:IFZX="@"KL=KL+1
10100 K=K+1:IFEOF(1)THEN10500ELSE10090
10108 PRINTTAB(14);"DV      IV#1    IV#2    IV#3    IV#4    IV#5"
10109 IFZI="Y"LPRINTTAB(14);"DV      IV#1    IV#2    IV#3    IV#4    IV#5"
10110 FORJ=0TOMF-1:INPUT#1,ZX:IFZX="@"GOTO10500
10115 IFJ=0PRINT"ELEMENT #";K;:IFZI="Y"LPRINT"ELEMENT #";K;
10120 PRINTTAB(14+J*8);ZX;:IFZI="Y"LPRINTTAB(14+J*8);ZX;
10125 NEXTJ:K=K+1:PRINT:IFZI="Y"LPRINT" "
10150 GOTO10110
10500 PRINT:INPUT"(L)IST DATA AGAIN OR (E)ND PROGRAM ";C$
10600 CLOSE:IFC$="E"END
10700 OPEN"I",1,ZN:INPUT#1,ZX:IFMT>2INPUT#1,ZX
10800 GOTO10007
```

Random Sample Program Listing

```
100 CLS:PRINT:PRINTTAB(19);"R A N D O M   S A M P L E"
105 RANDOM:DEFINTA-Z:DIMA(2205)
110 PRINT:INPUT"WHAT IS THE TOTAL POPULATION SIZE ";N
120 PRINT:INPUT"WHAT SIZE SAMPLE DO YOU DESIRE ";M
130 PRINT:PRINT"SAMPLING PROCEDURES AVAILABLE:"
140 PRINTTAB(6);"1=SAMPLING WITH REPLACEMENT"
150 PRINTTAB(6);"2=SAMPLING WITHOUT REPLACEMENT   WHICH ";:INPUTA
155 PRINT:INPUT"LIST SAMPLE DATA ELEMENT NUMBERS ON PRINTER - (Y)ES OR (N)O ";I$
160 K=0:PRINT:PRINT"COMPUTER AT WORK - PLEASE BE PATIENT."
165 A(1)=RND(N):K=K+1
170 IFK=MTHEN245
180 F=RND(N)
185 FORJ=1TOK:IFF<>A(J)THEN210
190 ONAGOTO210,180
210 IFF<A(J)THEN230
220 NEXTJ:A(K+1)=F:GOTO240
230 Z=J:FORL=KTOJSTEP-1:A(L+1)=A(L):NEXTL:A(Z)=F
240 K=K+1:GOTO170
245 IFI$="Y"CLS:INPUT"TURN ON YOUR PRINTER - HIT ENTER ";A$:FORL=1TO8:LPRINT" ":NEXTL
250 CLS:PRINT:PRINT"YOUR SAMPLE WILL CONSIST OF MEASURE";
260 PRINT"MENTS ON THE";M;"DATA"
270 PRINT"ELEMENTS NUMBERED:":K=1
275 IFI$="Y"LPRINTCHR$(29);TAB(7)"YOUR SAMPLE WILL CONSIST OF MEASUREMENTS"
276 IFI$="Y"LPRINTTAB(10)"ON THE";M;"DATA ELEMENTS NUMBERED:":LPRINT" ":L=1
280 FORI=KTOM:K=I:IFK>MTHEN300
285 PRINTA(I),
287 IFI$="Y"LPRINTA(I),:L=L+1:IFL=5LPRINT" ":L=1
290 IFI/48=INT(I/48)THEN310
300 NEXTI
301 IFI$="Y"LPRINT" ":LPRINT" "
302 PRINT:PRINT"SELECT ANOTHER SAMPLE - (Y)ES OR (N)O ";
305 INPUTA$:IFA$="Y"RUN
307 GOTO999
310 INPUT"HIT ENTER TO CONTINUE THE LIST ";A$:K=K+1:GOTO280
999 NEXTP
```

Descriptive Statistics Program Listing

```
5 CLEAR150
10 CLS:DEFDBLA-H,O-Y:DEFINTI-N:DEFSTRZ:N=0:J=0:MT=1
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIMX(MEM/8-100):RESUME20
20 PRINTTAB(9);"D E S C R I P T I V E    S T A T I S T I C S":PRINT
25 ONERRORGOTO0
30 PRINT"HOW WILL DATA BE ENTERED - ";
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO47
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN
47 IFZI="K"GOTO63
48 PRINT:MF=1:MG=1:MA=1:INPUT"SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ";ZT:IFZT="N"GOTO63
49 PRINT:PRINT"WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,"
50 INPUT"            2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ";MF:MT=MF+1
51 PRINT:ONMFGOTO52,53,54
52 INPUT"WHICH VARIABLE (1=X, 2=Y) ";MG:MF=2:GOTO63
53 K=1:INPUT"WHICH GROUP (1 - 5 ONLY) ";MA:MF=1:GOTO63
54 INPUT"WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ";MG:MG=MG+1:MF=8
63 PRINT:INPUT"WHAT IS THE NAME OF YOUR VARIABLE ";ZV
64 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
65 IO=1:IFZO="Y"IO=2
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:PRINT:ONIIGOTO77,150,500
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR DATA."
80 PRINT"SIGNAL END OF DATA WITH @ (AT SYMBOL)."":PRINT
90 INPUTZ:IFZ="@"GOTO120
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):N=N+1:GOTO90
110 X=VAL(Z):PRINT#1,X:N=N+1:GOTO90
120 IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINT"END OF DATA - ";N;"VALUES WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=MTGOTO185
180 PRINT:PRINT"WRONG DATA FILE TYPE.":PRINT:GOTO5000
185 IF(MT=3)OR(MT=4)INPUT#-1,IT
186 IF(MT=3)AND(MA>IT)PRINT:PRINT"THERE ARE ONLY";IT;"GROUPS!":GOTO5000
187 IF(MT=4)AND(MG>IT+1)PRINT:PRINT"THERE ARE ONLY";IT;"INDEPENDENT VARIABLES!":GOTO5000
188 IFII=3GOTO702
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):IFMA>1GOTO205
193 FORJ=MGTO8STEPMF:IFZ(J)="@"GOTO230
196 N=N+1:ONIMGOTO199,202
199 X(N)=VAL(Z(J)):NEXTJ:GOTO190
202 X=VAL(Z(J)):PRINT#1,X:NEXTJ:GOTO190
205 FORJ=1TO8:IFZ(J)="@"K=K+1
208 IFK=MAGOTO214
211 NEXTJ:GOTO190
214 MA=1:IFJ=8GOTO190
```

Descriptive Statistics (continued)

```
215 FORK=J+1TO8:IFZ(K)="@"GOTO230
216 N=N+1:ONIMGOTO217,220
217 X(N)=VAL(Z(K)):NEXTK:GOTO190
220 X=VAL(Z(K)):PRINT#1,X:NEXTK:GOTO190
230 IFIM=2 CLOSE
235 PRINT:PRINTN;"DATA VALUES WERE READ.":GOTO500
325 GOTO500
350 SM=SM+X(J):SS=SS+X(J)[2:RETURN
360 SM=SM+X:SS=SS+X[2:RETURN
370 N=N+1:SM=SM+X:SS=SS+X[2:RETURN
450 IFSG<>0THENS3=S3+(X(J)-AV)[3:S4=S4+(X(J)-AV)[4
452 IFX(J)<VLTHENVL=X(J)
454 IFX(J)>VHTHENVH=X(J)
456 RETURN
460 IFSG<>0THENS3=S3+(X-AV)[3:S4=S4+(X-AV)[4
462 IFX<VLTHENVL=X
464 IFX>VHTHENVH=X
465 RETURN
500 SM=0:SS=0:IP=1:VH=-1E38:VL=1E38:S3=0:S4=0
505 ONIMGOTO510,600
510 FORJ=1TON:ONIPGOSUB350,450
550 NEXTJ:GOTO750
600 ONIIGOTO610,610,700
610 OPEN"I",1,"SCRATCH/ASA":FORJ=1TON:INPUT#1,X
620 ONIPGOSUB360,460
650 NEXTJ:GOTO750
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>MTGOTO180
701 IF(MT=3)OR(MT=4)INPUT#1,IT:GOTO186
702 IFMA=1GOTO706
703 FORK=1TOMA-1
704 INPUT#1,Z:IFZ<>"@"GOTO704
705 NEXTK:GOTO710
706 FORJ=1TOMG:INPUT#1,X:NEXTJ:ONIPGOSUB370,460
707 IFMT=4MF=IT+1
710 FORJ=1TOMF:INPUT#1,Z:IFZ="@"GOTO750
711 IF(MT=2)AND(MG=1)MT=MT:IFEOF(1)THEN750
712 NEXTJ:X=VAL(Z):ONIPGOSUB370,460
715 IF EOF(1) THEN 750
720 GOTO710
750 ONIPGOTO800,860
800 AV=SM/N:V=(SS-SM[2/N)/(N-1):IFV<=0THEN815
810 SD=SQR(V):GOTO820
815 SD=0:V=0
820 VV=(SS-SM[2/N)/N:IFVV<=0THEN840
830 SG=SQR(VV):GOTO850
840 SG=0:VV=0
850 IFIM=2THEN CLOSE
855 IP=2:GOTO505
860 IFSG<>0SK=(S3/N)/SG[3:ST=((S4/N)/VV[2)-3
875 IFIO=2CLS:PRINT:INPUT"TURN ON YOUR PRINTER - HIT ENTER ";P$
900 CLS:PRINTTAB(9);"D E S C R I P T I V E   S T A T I S T I C S"
```

Descriptive Statistics (continued)

```
910 PRINT:PRINT"VARIABLE:  ";ZV;TAB(35);"SAMPLE SIZE (N) = ";N
915 PRINT:PRINT"SAMPLE STATISTICS:"
920 PRINT"   MEAN","= ";CSNG(AV),"   RANGE","= ";CSNG(VH-VL)
930 PRINT"   VARIANCE","= ";CSNG(VV),"   MINIMUM","= ";CSNG(VL)
940 PRINT"   STD. DEV.","= ";CSNG(SG),"   MAXIMUM","= ";CSNG(VH)
950 PRINT:PRINT"UNBIASED ESTIMATES OF POPULATION PARAMETERS:"
960 PRINT"   VARIANCE","= ";CSNG(V),"   STD. DEV.","= ";CSNG(SD)
965 IFSG=0GOTO978
970 PRINT:PRINT"DATA DISTRIBUTION COEFFICIENTS:"
972 PRINT"   SKEWNESS","= ";CSNG(SK),"   KURTOSIS","= ";CSNG(ST)
978 IFIO=2THEN1020
980 PRINT@960,"   WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ";
985 INPUTZA:IFZA="Y"RUN
999 CLS:GOTO5000
1020 GOSUB2200:LPRINTCHR$(29);" ":LPRINT" ":GOSUB2100:GOSUB2100
1030 LPRINTTAB(11)"D E S C R I P T I V E   S T A T I S T I C S"
1035 GOSUB2100
1040 LPRINT" ":LPRINT"   VARIABLE:  ";ZV;TAB(35);"SAMPLE SIZE (N) = ";N
1050 GOSUB2100:LPRINT" ":LPRINT"   SAMPLE STATISTICS:":GOSUB2100
1060 LPRINT"      MEAN","= ";CSNG(AV),"   RANGE","= ";CSNG(VH-VL):GOSUB2100
1070 LPRINT"      VARIANCE","= ";CSNG(VV),"   MINIMUM","= ";CSNG(VL)
1075 GOSUB2100
1080 LPRINT"      STD. DEV.","= ";CSNG(SG),"   MAXIMUM","= ";CSNG(VH)
1085 GOSUB2100
1090 LPRINT" ":LPRINT"   UNBIASED ESTIMATES OF POPULATION PARAMETERS:"
1095 GOSUB2100
1100 LPRINT"      VARIANCE","= ";CSNG(V),"   STD. DEV.","= ";CSNG(SD)
1105 GOSUB2100
1107 IFSG=0LPRINT" ":LPRINT" ":GOSUB2100:GOTO1130
1110 LPRINT" ":LPRINT"   DATA DISTRIBUTION COEFFICIENTS:":GOSUB2100
1120 LPRINT"      SKEWNESS","= ";CSNG(SK),"   KURTOSIS","= ";CSNG(ST)
1130 FORL=1TO6:GOSUB2100:NEXTL
1140 GOSUB2200:LPRINT" "
2000 GOTO980
2100 LPRINT" ":LPRINT" ":LPRINT" ":RETURN
2200 FORL=1TO13:LPRINT"*****";:NEXTL:RETURN
5000 IFIM=2CLOSE:IFII<>3KILL"SCRATCH/ASA"
5010 END
```

Histogram Program Listing

```
5 CLEAR150:D$="####.#"
10 CLS:DEFDBL A-H,O-Y:DEFINT I-N:DEFSTR Z:N=0:J=0:MT=1:A$="###.#"
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIM X(MEM/8-100):RESUME20
20 PRINTTAB(21);"H I S T O G R A M":PRINT
25 ONERRORGOTO0
30 PRINT"HOW WILL DATA BE ENTERED - ";:ONIMGOTO46,40
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO47
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN:GOTO47
46 INPUT"(K)EYBOARD OR (T)APE ";ZI
47 IFZI="K"GOTO63
48 PRINT:MF=1:MG=1:MA=1:INPUT"SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ";ZT:IFZT="N"GOTO63
49 PRINT:PRINT"WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,"
50 INPUT"            2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ";MF:MT=MF+1
51 PRINT:ONMFGOTO52,53,54
52 INPUT"WHICH VARIABLE (1=X, 2=Y) ";MG:MF=2:GOTO63
53 K=1:INPUT"WHICH GROUP (1 - 5 ONLY) ";MA:MF=1:GOTO63
54 INPUT"WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ";MG:MG=MG+1:MF=8
63 PRINT:INPUT"WHAT IS THE NAME OF YOUR VARIABLE ";ZV
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:PRINT:ONIIGOTO77,150,500
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR DATA."
80 PRINT"SIGNAL END OF DATA WITH @ (AT SYMBOL).":PRINT
90 INPUTZ:IFZ="@"GOTO120
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):N=N+1:GOTO90
110 X=VAL(Z):PRINT#1,X:N=N+1:GOTO90
120 IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINT"END OF DATA - ";N;"VALUES WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - SET TO PLAY - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=MTGOTO185
180 PRINT:PRINT"WRONG DATA FILE TYPE.":PRINT:GOTO5000
185 IF(MT=3)OR(MT=4)INPUT#-1,IT
186 IF(MT=3)AND(MA>IT)PRINT:PRINT"THERE ARE ONLY";IT;"GROUPS!":GOTO5000
187 IF(MT=4)AND(MG>IT+1)PRINT:PRINT"THERE ARE ONLY";IT;"INDEPENDENT VARIABLES!":GOTO5000
188 IFII=3GOTO702
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):IFMA>1GOTO205
193 FORJ=MGTO8STEPMF:IFZ(J)="@"GOTO230
196 N=N+1:ONIMGOTO199,202
199 X(N)=VAL(Z(J)):NEXTJ:GOTO190
202 X=VAL(Z(J)):PRINT#1,X:NEXTJ:GOTO190
205 FORJ=1TO8:IFZ(J)="@"K=K+1
208 IFK=MAGOTO214
211 NEXTJ:GOTO190
214 MA=1:IFJ=8GOTO190
215 FORK=J+1TO8:IFZ(K)="@"GOTO230
```

Histogram (continued)

```
216 N=N+1:ONIMGOTO217,220
217 X(N)=VAL(Z(K)):NEXTK:GOTO190
220 X=VAL(Z(K)):PRINT#1,X:NEXTK:GOTO190
230 IFIM=2 CLOSE
235 PRINT:PRINTN;"DATA VALUES WERE READ.":GOTO500
325 GOTO500
350 IFX(J)<VLTHENVL=X(J)
355 IFX(J)>VHTHENVH=X(J)
360 RETURN
365 N=N+1
370 IFX<VLTHENVL=X
375 IFX>VHTHENVH=X
380 RETURN
450 IFX(J)>A(JB+1)RETURN
452 FORI=JBTO1STEP-1:IFX(J)>=A(I)THENLA(I)=LA(I)+1:RETURN
455 NEXTI:RETURN
460 IFX>A(JB+1)RETURN
462 FORI=JBTO1STEP-1:IFX>=A(I)THENLA(I)=LA(I)+1:RETURN
465 NEXTI:RETURN
500 IP=1:VH=-1E38:VL=1E38
505 ONIMGOTO510,600
510 FORJ=1TON:ONIPGOSUB350,450
550 NEXTJ:GOTO750
600 ONIIGOTO610,610,700
610 OPEN"I",1,"SCRATCH/ASA":FORJ=1TON:INPUT#1,X
620 ONIPGOSUB370,460
650 NEXTJ:GOTO750
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>MTGOTO180
701 IF(MT=3)OR(MT=4)INPUT#1,IT:GOTO186
702 IFMA=1GOTO706
703 FORK=1TOMA-1
704 INPUT#1,Z:IFZ<>"@"GOTO704
705 NEXTK:GOTO710
706 FORJ=1TOMG:INPUT#1,X:NEXTJ:ONIPGOSUB365,460
707 IFMT=4MF=IT+1
710 FORJ=1TOMF:INPUT#1,Z:IFZ="@"GOTO750
711 IF(MT=2)AND(MG=1)MT=MT:IFEOF(1)THEN750
712 NEXTJ:X=VAL(Z):ONIPGOSUB365,460
715 IF EOF(1) THEN 750
720 GOTO710
750 ONIPGOTO780,1400
780 CLS
800 PRINTTAB(10);"NUMBER OF DATA ELEMENTS = ";N
1250 PRINTTAB(10);"MINIMUM DATA VALUE      = ";VL
1260 PRINTTAB(10);"MAXIMUM DATA VALUE      = ";VH
1270 PRINT:INPUT"HOW MANY INTERVALS FOR HISTOGRAM (1 THROUGH 8) ";JB
1275 IF(JB<1)OR(JB>8)THEN800ELSE2000
1280 CLS:FORI=3TO41:SET(12,I):NEXTI:FORI=13TO110:SET(I,41):NEXTI
1290 FORI=41TO3STEP-1:SET(110,I):NEXTI:R=VH-VL:IFC$="U"GOTO1310
1300 FORJ=1TOJB:A(J)=R/JB*(J-1)+VL:NEXTJ:A(JB+1)=VH
1310 FORI=1TOJB:JT=INT(A(I)*10):A(I)=JT/10:NEXTI
```

Histogram (continued)

```
1320 L=894:FORJ=1TOJB+1:L=L+6:PRINT@L,"";:PRINTUSINGD$;A(J);:NEXTJ
1330 IFIM=2THENCLOSE
1350 IP=2:FORI=1TOJB:LA(I)=0:NEXTI:GOTO505
1400 KK=0:FORJ=1TOJB:IFLA(J)>KKTHENKK=LA(J)
1405 NEXTJ:IFKK>=6GOTO1430
1410 CLS:PRINT:PRINT"ONE INTERVAL MUST CONTAIN AT LEAST 6 VALUES."
1420 PRINT"TRY FEWER INTERVALS - YOU TRIED";JB;"LAST TIME.":PRINT:GOTO800
1430 LX=1:IFKK/3=INT(KK/3)THENLX=0
1470 I=1:FI=0:H=0:FORJ=832TO64STEP-128:PRINT@J,H;
1480 FI=INT((FI+KK/6)*10)/10:I=I+1:L2(I)=INT(FI)+LX:H=L2(I):NEXTJ
1485 L2(1)=0:F2(1)=0:I=1:T=KK/N:H=0:FORJ=888TO120STEP-192:PRINT@J,"";:PRINTUSINGA$;H;
1488 H=INT(I*(T/4)*1000+.5)/10:I=I+1:F2(I)=H:NEXTJ
1490 PRINT@0,"FREQUENCY";TAB(22);"H I S T O G R A M";TAB(57);"PERCENT";
1520 L=14:FORI=1TOJB:FORJ=LTOL+10:IFLA(I)=0THEN1580
1530 FORLY=40TO40-LA(I)/KK*36STEP-1:SET(J,LY):NEXTLY:NEXTJ
1580 L=L+12:NEXTI
1590 PRINT@962,"  (N)EW INTERVALS, (P)RINT HISTOGRAM, OR (E)ND PROGRAM ";
1595 PRINT@956,"";:INPUTB$:IFB$="N"THEN780
1598 IFB$="P"THEN2051ELSE5000
1610 GOTO1590
2000 PRINT:INPUT"LIMITS SET BY - (U)SER OR (C)OMPUTER ";C$:IFC$="C"THEN1280ELSEPRINT@384,"";
2010 A(0)=-1E38:FORI=1TOJB:PRINT"WHAT IS THE LOWER LIMIT FOR INTERVAL #";I;:INPUTA(I)
2020 IFA(I)<=A(I-1)THEN2030ELSENEXTI:GOTO2050
2030 PRINT:PRINT"LIMITS MUST BE IN ORDER! - START OVER:":GOTO2010
2050 INPUT"WHAT IS THE TOP LIMIT FOR THE HISTOGRAM  ";A(JB+1):SM=A(1):GOTO1280
2051 PRINT@975,"TURN ON YOUR PRINTER - HIT ENTER";:PRINT@956,"";:INPUTB$:GOSUB7000
2052 FORJ=1TO3:GOSUB6000:NEXTJ:LZ=4:MZ=7:LC=7:LR=0:LPRINTCHR$(29);TAB(21);"H I S T O G R A M"
2054 LPRINT" ":LPRINT"FREQUENCY";TAB(54);"PERCENT"
2060 MC=5:LJ=0:FORJ=3TO40:LI=7:LJ=LJ+1:LZ=LZ+1:MZ=MZ+1
2080 IFLZ=6LPRINTTAB(2);L2(LC);:LPRINTTAB(7);"+";:LC=LC-1:LZ=0:GOTO2100
2090 LPRINTTAB(7);"I";
2100 KT=0:FORL=14TO108STEP2:LI=LI+1
2110 IFPOINT(L,J)=-1THENKT=KT+1:IFKT<6LPRINTTAB(LI);"*";
2115 IFKT=6THENKT=0
2120 NEXTL:IFMZ=9LPRINTTAB(56);"+";:LPRINTUSINGA$;F2(MC):MC=MC-1:MZ=0:GOTO2140
2130 LPRINTTAB(56);"I"
2140 NEXTJ
2500 LPRINTTAB(7)"";:FORK=1TO10:LPRINT"-----";:NEXTK:LPRINT" "
2600 LPRINTTAB(5);"";:FORJ=1TOJB+1:LPRINTUSINGD$;A(J);:NEXTJ
2700 LPRINT" ":LL=LEN(ZV):LPRINT" ":LPRINTTAB(6+(46-2*LL)/2);" ";
2800 FORJ=1TOLL:LPRINTMID$(ZV,J,1);:LPRINT" ";:NEXTJ
2900 FORJ=1TO4:GOSUB6000:NEXTJ:GOSUB7000:GOTO1590
5000 IFIM=2CLOSE:IFII<>3KILL"SCRATCH/ASA"
5010 END
6000 FORJF=1TO3:LPRINT" ":NEXTJF:RETURN
7000 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
```

Frequency Distribution Program Listing

```
5 CLEAR150:B$="######":G$="###.#"
10 CLS:DEFDBLA-H,O-Y:DEFINTI-N:DEFSTRZ:N=0:J=0:MT=1:A$="######.###":DIMA(11)
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIMX(MEM/8-100):RESUME20
20 PRINTTAB(8);"F R E Q U E N C Y    D I S T R I B U T I O N":PRINT
25 ONERRORGOTO0
30 PRINT"HOW WILL DATA BE ENTERED - ";:ONIMGOTO46,40
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO47
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN:GOTO47
46 INPUT"(K)EYBOARD OR (T)APE ";ZI
47 IFZI="K"GOTO63
48 PRINT:MF=1:MG=1:MA=1:INPUT"SPECIAL INPUT FILE TYPE - (Y)ES OR (N)O ";ZT:IFZT="N"GOTO63
49 PRINT:PRINT"WHICH TYPE (1=CORRELATION / MATCHED PAIRS T / TIME SERIES,"
50 INPUT"             2=ANALYSIS OF VARIANCE, 3=MULTIPLE REGRESSION) ";MF:MT=MF+1
51 PRINT:ONMFGOTO52,53,54
52 INPUT"WHICH VARIABLE (1=X, 2=Y) ";MG:MF=2:GOTO63
53 K=1:INPUT"WHICH GROUP (1 - 5 ONLY) ";MA:MF=1:GOTO63
54 INPUT"WHICH VARIABLE (0=DV, 1=IV#1, 2=IV#2 . . . 5=IV#5) ";MG:MG=MG+1:MF=8
63 PRINT:INPUT"WHAT IS THE NAME OF YOUR VARIABLE ";ZV
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:PRINT:ONIIGOTO77,150,500
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR DATA."
80 PRINT"SIGNAL END OF DATA WITH @ (AT SYMBOL).":PRINT
90 INPUTZ:IFZ="@"GOTO120
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):N=N+1:GOTO90
110 X=VAL(Z):PRINT#1,X:N=N+1:GOTO90
120 IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINT"END OF DATA - ";N;"VALUES WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - SET TO PLAY - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=MTGOTO185
180 PRINT:PRINT"WRONG DATA FILE TYPE.":PRINT:GOTO5000
185 IF(MT=3)OR(MT=4)INPUT#-1,IT
186 IF(MT=3)AND(MA>IT)PRINT:PRINT"THERE ARE ONLY";IT;"GROUPS!":GOTO5000
187 IF(MT=4)AND(MG>IT+1)PRINT:PRINT"THERE ARE ONLY";IT;"INDEPENDENT VARIABLES!":GOTO5000
188 IFII=3GOTO702
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):IFMA>1GOTO205
193 FORJ=MGTO8STEPMF:IFZ(J)="@"GOTO230
196 N=N+1:ONIMGOTO199,202
199 X(N)=VAL(Z(J)):NEXTJ:GOTO190
202 X=VAL(Z(J)):PRINT#1,X:NEXTJ:GOTO190
205 FORJ=1TO8:IFZ(J)="@"K=K+1
208 IFK=MAGOTO214
211 NEXTJ:GOTO190
214 MA=1:IFJ=8GOTO190
215 FORK=J+1TO8:IFZ(K)="@"GOTO230
```

Frequency Distribution (continued)

```
216 N=N+1:ONIMGOTO217,220
217 X(N)=VAL(Z(K)):NEXTK:GOTO190
220 X=VAL(Z(K)):PRINT#1,X:NEXTK:GOTO190
230 IFIM=2 CLOSE
235 PRINT:PRINTN;"DATA VALUES WERE READ.":GOTO500
325 GOTO500
350 IFX(J)<VLTHENVL=X(J)
355 IFX(J)>VHTHENVH=X(J)
360 RETURN
365 N=N+1
370 IFX<VLTHENVL=X
375 IFX>VHTHENVH=X
380 RETURN
450 IFX(J)>A(JB+1)RETURN
452 FORI=JBTO1STEP-1:IFX(J)>=A(I)THENLA(I)=LA(I)+1:RETURN
455 NEXTI:RETURN
460 IFX>A(JB+1)RETURN
462 FORI=JBTO1STEP-1:IFX>=A(I)THENLA(I)=LA(I)+1:RETURN
465 NEXTI:RETURN
500 IP=1:VH=-1E38:VL=1E38
505 ONIMGOTO510,600
510 FORJ=1TON:ONIPGOSUB350,450
550 NEXTJ:GOTO750
600 ONIIGOTO610,610,700
610 OPEN"I",1,"SCRATCH/ASA":FORJ=1TON:INPUT#1,X
620 ONIPGOSUB370,460
650 NEXTJ:GOTO750
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>MTGOTO180
701 IF(MT=3)OR(MT=4)INPUT#1,IT:GOTO186
702 IFMA=1GOTO706
703 FORK=1TOMA-1
704 INPUT#1,Z:IFZ<>"@"GOTO704
705 NEXTK:GOTO710
706 FORJ=1TOMG:INPUT#1,X:NEXTJ:ONIPGOSUB365,460
707 IFMT=4MF=IT+1
710 FORJ=1TOMF:INPUT#1,Z:IFZ="@"GOTO750
711 IF(MT=2)AND(MG=1)MT=MT:IFEOF(1)THEN750
712 NEXTJ:X=VAL(Z):ONIPGOSUB365,460
715 IF EOF(1) THEN 750
720 GOTO710
750 ONIPGOTO780,1400
780 CLS
800 PRINTTAB(10);"NUMBER OF DATA ELEMENTS = ";N
1250 PRINTTAB(10);"MINIMUM DATA VALUE      = ";VL
1260 PRINTTAB(10);"MAXIMUM DATA VALUE      = ";VH
1270 PRINT:INPUT"HOW MANY INTERVALS FOR DISTRIBUTION (1 THROUGH 10) ";JB
1275 IF(JB<1)OR(JB>10)THEN800ELSE2000
1290 R=VH-VL:IFC$="U"GOTO1310
1300 FORJ=1TOJB:A(J)=R/JB*(J-1)+VL:NEXTJ:A(JB+1)=VH
1310 IFC$="C"FORI=1TOJB:JT=INT(A(I)*10):A(I)=JT/10:NEXTI
1320 CLS:PRINTTAB(9);"F R E Q U E N C Y    D I S T R I B U T I O N":GOSUB8000
```

Frequency Distribution (continued)

```
1324 PRINTTAB(9);"INTERVAL";TAB(28);"FREQUENCY";TAB(41);"PERCENT";
1326 PRINTTAB(51);"CUMULATIVE %":GOSUB8000
1330 IFIM=2THENCLOSE
1350 IP=2:FORI=1TOJB:LA(I)=0:NEXTI:GOTO505
1400 F3=0:NT=0:FORJ=1TOJB:NT=NT+LA(J):NEXTJ:FORJ=1TOJB
1420 PRINTUSINGA$;A(J);:PRINT"  TO";:A2=A(J+1)-.001:IFJ=JBTHENA2=A(JB+1)
1440 PRINTUSINGA$;A2;:PRINTTAB(30);"";:PRINTUSINGB$;LA(J);
1450 IFNT<>0THENF2=LA(J)/NT*100
1460 PRINTTAB(43);"";:PRINTUSINGG$;F2;:F3=F3+F2
1480 PRINTTAB(55);"";:PRINTUSINGG$;F3:NEXTJ
1490 GOTO1580
1520 PRINTTAB(13);"TOTAL";TAB(30);"";:PRINTUSINGB$;NT;:PRINTTAB(45);"--";TAB(57);"--"
1580 GOSUB8000
1590 PRINT@962,"(N)EW INTERVALS, (P)RINT DISTRIBUTION, OR (E)ND PROGRAM ";
1595 PRINT@956,"";:INPUTJ$:IFJ$="N"THEN780
1598 IFJ$="P"THEN2051ELSE5000
1610 GOTO1590
2000 PRINT:INPUT"LIMITS SET BY - (U)SER OR (C)OMPUTER ";C$:IFC$="C"THEN1290ELSEPRINT@384,"";
2010 A(0)=-1E38:FORI=1TOJB:PRINT"WHAT IS THE LOWER LIMIT FOR INTERVAL #";I;:INPUTA(I)
2020 IFA(I)<=A(I-1)THEN2030ELSENEXTI:GOTO2050
2030 PRINT:PRINT"LIMITS MUST BE IN ORDER! - START OVER:":GOTO2010
2050 INPUT"WHAT IS THE TOP LIMIT FOR THE DISTRIBUTION  ";A(JB+1):SM=A(1):GOTO1290
2051 PRINT@975,"TURN ON YOUR PRINTER - HIT ENTER";:PRINT@956,"";:INPUTB$:GOSUB7000
2052 FORJ=1TO3:GOSUB6000:NEXTJ:LPRINTCHR$(29);TAB(10);"F R E Q U E N C Y   D I S T R I B U T I O N
2500 GOSUB6000:J=LEN(ZV):IFJ>14ZV=LEFT$(ZV,14):J=14
2600 I=(63-26-J)/2:LPRINTTAB(I);"DISTRIBUTION OF VARIABLE: ";ZV:LPRINT" "
2800 GOSUB9000:LPRINT" "
3000 LPRINTTAB(9);"INTERVAL";TAB(28);"FREQUENCY";TAB(41);"PERCENT";
3010 LPRINTTAB(51);"CUMULATIVE %":LPRINT" ":GOSUB9000:GOSUB6000
3050 F3=0:FORJ=1TOJB:LPRINTUSINGA$;A(J);:LPRINT"  TO";
3060 A2=A(J+1)-.001:IFJ=JBTHENA2=A(JB+1)
3070 LPRINTUSINGA$;A2;:LPRINTTAB(30);"";:LPRINTUSINGB$;LA(J);
3080 IFNT<>0THENF2=LA(J)/NT*100
3090 LPRINTTAB(43);"";:LPRINTUSINGG$;F2;:F3=F3+F2
3100 LPRINTTAB(55);"";:LPRINTUSINGG$;F3:LPRINT" ":NEXTJ
3150 LPRINT" ":LPRINT" ":GOSUB9000:LPRINT" "
3200 LPRINT" ";TAB(9)"T O T A L";TAB(30);"";:LPRINTUSINGB$;NT;
3300 LPRINTTAB(43)"";:LPRINTUSINGG$;F3:LPRINT" ":GOSUB9000
3700 FORJ=1TO5:GOSUB6000:NEXTJ
3800 IFJB<>10FORI=1TO10-JB:LPRINT" ":LPRINT" ":NEXTI
3900 GOSUB7000:GOTO1590
5000 IFIM=2CLOSE:IFII<>3KILL"SCRATCH/ASA"
5010 END
6000 FORJF=1TO3:LPRINT" ":NEXTJF:RETURN
7000 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
8000 FORI=1TO12:PRINT"-----";:NEXTI:PRINT"---":RETURN
9000 FORI=1TO12:LPRINT"-----";:NEXTI:LPRINT"---":RETURN
```

Analysis of Variance Program Listing

```
10 CLEAR250:CLS:PRINT:DEFINTI-N:DEFSTRZ:DEFDBLA-E,G,H,O-Y:A$="#.###"
12 DEFSNGF:ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:RESUME20
20 ONERRORGOTO0
30 GOSUB4000:PRINT"HOW WILL DATA BE ENTERED - ";:ONIMGOTO50,40
40 INPUT"(K)EYBOARD, (T)APE, OR (D)ISK ";ZI:IFZI<>"D"GOTO60
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN:GOTO60
50 INPUT"(K)EYBOARD OR (T)APE ";ZI
60 PRINT:INPUT"HOW MANY GROUPS (2 TO 5 ONLY) ";M:PRINT
62 IF(M<2)OR(M>5)GOTO60
64 FORI=1TOM:PRINT"NAME OF GROUP #";I;:INPUTZG(I)
65 IFLEN(ZG(I))>14ZG(I)=LEFT$(ZG(I),14)
68 NEXTI:PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
70 IO=1:IFZO="Y"IO=2
72 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:K=1:ONIIIGOTO79,100,200
79 CLS:PRINT"BEGIN ENTERING THE DATA FOR GROUP #";K
80 PRINT"SIGNAL END OF DATA WITH @ (AT SYMBOL)."
90 INPUTZX:IFZX="@"THEN95ELSEGOSUB250:GOTO90
95 K=K+1:IFK>MTHEN300ELSE79
100 INPUT"INSERT DATA TAPE - SET TO PLAY - HIT ENTER ";ZI
110 INPUT#-1,IT:INPUT#-1,ZO:INPUT#-1,MA:PRINT
120 PRINT"DATA FILE BEING READ = ";ZO:IFIT=3GOTO140
130 PRINT:PRINT"WRONG DATA FILE TYPE.":PRINT:GOTO3000
140 IFM<>MAPRINT:PRINT"THE DATA FILE CONTAINS";MA;"GROUPS, NOT";M:PRINT:GOTO3000
150 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8)
160 FORL=1TO8:ZX=Z(L):IFZX="@"THEN170ELSEGOSUB250:NEXTL:GOTO150
170 K=K+1:IFK>MATHEN300ELSENEXTL:GOTO150
200 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>3GOTO130
210 INPUT#1,MA:IFMA<>MTHEN140
220 INPUT#1,ZX:IFZX="@"THEN230ELSEGOSUB250:GOTO225
225 IFEOF(1)THEN300ELSE220
230 K=K+1:GOTO220
250 SX(K)=SX(K)+VAL(ZX):SS(K)=SS(K)+VAL(ZX)[2:N(K)=N(K)+1:NT=NT+1:RETURN
300 FORK=1TOM:ST=ST+SX(K):SQ=SQ+SS(K):V1=V1+SX(K)[2/N(K):NEXTK
310 V2=ST[2/NT:BG=V1-V2:WG=SQ-V1:F=(BG/(M-1))/(WG/(NT-M))
500 QT=F:IFQT=0QX=1:GOTO800
520 IFQT<1GOTO570
530 QS=M-1:QR=NT-M:QZ=QT:GOTO600
570 QS=NT-M:QR=M-1:QZ=1/QT
600 QJ=2/9/QS:QK=2/9/QR
620 QL=ABS((1-QK)*QZ[(1/3)-1+QJ)/SQR(QK*QZ[(2/3)+QJ)
630 IFQR<4GOTO670
640 QX=.5/(1+QL*(.196854+QL*(.115194+QL*(.000344+QL*.019527))))[4
650 GOTO690
670 QL=QL*(1+.08*QL[4/QR[3):GOTO640
690 IFQT<1QX=1-QX
800 FORK=1TOM:AV(K)=SX(K)/N(K):SD(K)=SQR((SS(K)-SX(K)[2/N(K))/(N(K)-1)):NEXTK
1000 IFIO=2CLS:INPUT"TURN ON PRINTER - HIT ENTER ";ZI
1010 CLS:GOSUB4000:PRINTTAB(23)"SUMMARY TABLE":GOSUB5000
```

Analysis of Variance (continued)

```
1010 CLS:GOSUB4000:PRINTTAB(23)"SUMMARY TABLE":GOSUB5000
1030 PRINT"   SOURCE"," SS"," DF"," MS":GOSUB5000:V2=BG+WG
1050 PRINT" TOTAL",CSNG(V2),NT-1
1060 PRINT"   BETWEEN",CSNG(BG),M-1,CSNG(BG/(M-1))
1070 PRINT"   WITHIN",CSNG(WG),NT-M,CSNG(WG/(NT-M))
1090 GOSUB5000:PRINT:PRINTTAB(16)"F-RATIO                = ";CSNG(F)
1110 PRINTTAB(16);"DEGREES OF FREEDOM    = ";M-1;" & ";NT-M
1120 PRINTTAB(16);"PROBABILITY OF CHANCE =  ";:PRINTUSINGA$;QX
1125 IFIO=2GOSUB10000
1130 PRINT:INPUT"   (G)ROUP STATISTICS, (A)NOVA TABLE, OR (E)ND PROGRAM  ";ZI
1140 IFZI="E"GOTO3000
1150 IFZI="A"GOTO1000
2000 CLS:GOSUB4000
2010 PRINTTAB(16);"SUMMARY STATISTICS BY GROUP"
2030 GOSUB5000:PRINT"GROUP"," N"," MEAN"," S.D.":GOSUB5000
2050 FORK=1TOM:PRINTZG(K),N(K),CSNG(AV(K)),CSNG(SD(K)):NEXTK:GOSUB5000:GOTO1130
3000 IFIM=2CLOSE
3100 END
4000 PRINTTAB(10);"A N A L Y S I S    O F    V A R I A N C E":PRINT:RETURN
5000 FORL=1TO12:PRINT"-----";:NEXTL:PRINT:RETURN
6000 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
7500 FORL=1TO3:LPRINT" ":NEXTL:RETURN
8000 FORL=1TO12:LPRINT"-----";:NEXTL:LPRINT" ":RETURN
10000 GOSUB6000:GOSUB7500:LPRINTCHR$(29);" ":LPRINTTAB(10);"A N A L Y S I S    O
      F   V A R I A N C E"
10100 GOSUB7500:GOSUB7500:LPRINT" ":LPRINTTAB(23);"SUMMARY TABLE":LPRINT" ":GOSU
     B8000
10200 LPRINT" ":LPRINT"   SOURCE"," SS"," DF"," MS":LPRINT" ":GOSUB8000
10300 LPRINT" ":LPRINT" TOTAL",CSNG(V2),NT-1
10400 LPRINT" ":LPRINT"   BETWEEN",CSNG(BG),M-1,CSNG(BG/(M-1))
10500 LPRINT" ":LPRINT"   WITHIN",CSNG(WG),NT-M,CSNG(WG/(NT-M))
10600 LPRINT" ":GOSUB8000:LPRINT" "
10700 LPRINTTAB(16);"F-RATIO                = ";CSNG(F)
10800 LPRINT" ":LPRINTTAB(16);"DEGREES OF FREEDOM     = ";M-1;" & ";NT-M
10900 LPRINT" ":LPRINTTAB(16);"PROBABILITY OF CHANCE  =  ";:LPRINTUSINGA$;QX
11000 LPRINT" ":GOSUB7500:GOSUB7500:LPRINTTAB(21);"GROUP STATISTICS":LPRINT" "
11100 GOSUB8000:LPRINT" ":LPRINT"GROUP"," N"," MEAN"," S.D.":LPRINT" "
11150 GOSUB8000:LPRINT" "
11200 FORK=1TOM:LPRINTZG(K),N(K),CSNG(AV(K)),CSNG(SD(K)):LPRINT" ":NEXTK
11300 GOSUB8000:GOSUB7500:IFM<>5FORK=1TO5-M:LPRINT" ":LPRINT" ":NEXTK
11400 GOSUB7500:GOSUB6000:IO=1:RETURN
```

T-Test for Matched Pairs Program Listing

```
5 CLEAR150
10 CLS:PRINT:N=0:J=0:DEFSNGA-H,O-W:DEFINTI-N:DEFDBLX,Y:DEFSTRZ
11 A$="#.###":DIMA(13):IS=0:IC=0
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIMX(MEM/8-100):RESUME20
20 PRINTTAB(24);"T - T E S T":PRINTTAB(21);"FOR MATCHED PAIRS":PRINT
25 ONERRORGOTO0
30 PRINT"HOW WILL DATA BE ENTERED - ";
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO60
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN:GOTO60
60 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
64 PRINT:INPUT"WHAT IS THE NAME OF VARIABLE X ";ZV:PRINT
65 INPUT"WHAT IS THE NAME OF VARIABLE Y ";ZU:IO=1:IFZO="Y"IO=2
66 IFLEN(ZU)>14ZU=LEFT$(ZU,14)
67 IFLEN(ZV)>14ZV=LEFT$(ZV,14)
68 PRINT:INPUT"TEST OF HYPOTHESIS (1=ONE-TAILED, 2=TWO-TAILED) ";EV:ET=3-EV
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:ONIIGOTO77,150,700
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR DATA PAIRS (X,Y).
80 PRINT"SIGNAL END OF DATA WITH @,@.":PRINT
90 INPUTZ,ZB:IFZ="@"GOTO120
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):X(N+2)=VAL(ZB):N=N+2:GOTO90
110 X=VAL(Z):Y=VAL(ZB):PRINT#1,X,Y:N=N+2:GOTO90
120 N=N/2:IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINTN;"PAIRS WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=2GOTO190
180 PRINT:PRINT"WRONG DATA FILE TYPE":PRINT:GOTO1200
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):ONIMGOTO200,210
200 FORK=1TO8:IFZ(K)="@"THEN230
205 X(N+K)=VAL(Z(K)):NEXTK:N=N+8:GOTO190
210 FORK=1TO8:IFZ(K)="@"THEN230
220 PRINT#1,Z(K):NEXTK:N=N+8:GOTO190
230 IFIM=2 CLOSE
235 PRINT:N=(N+K-1)/2:PRINTN;"PAIRS WERE READ.":GOTO500
350 X1=X1+X(J):Y1=Y1+X(J+1):X2=X2+X(J)[2:Y2=Y2+X(J+1)[2:XY=XY+X(J)*X(J+1)
368 RETURN
370 X1=X1+X:Y1=Y1+Y:X2=X2+X[2:Y2=Y2+Y[2:N=N+1:XY=XY+X*Y
388 RETURN
500 X1=0:X2=0:Y1=0:Y2=0:XY=0:TZ=0
503 IFIM=2N=0
505 ONIMGOTO510,600
510 FORJ=1TO2*NSTEP2:GOSUB350
550 NEXTJ:GOTO810
600 ONIIGOTO610,610,700
```

T-Test for Matched Pairs (continued)

```
610 OPEN"I",1,"SCRATCH/ASA":GOTO710
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>2GOTO180
710 INPUT#1,X,Y:GOSUB370
715 IF EOF(1) THEN 810
720 GOTO710
810 TA=XY-X1*Y1/N:TB=X2-X1*X1/N:TC=Y2-Y1[2/N:TC=Y2-Y1[2/N:TS=SQR(TB/N):TE=X1/N
820 TH=Y1/N:TT=SQR(TC/N):CLS
840 TB=SQR(TB):TC=SQR(TC):R=INT(1000*TA/(TB*TC)+.5)/1000:M=N-1
843 EX=TS/SQR(N-1):EY=TT/SQR(N-1):Q=(TE-TH)/SQR(EX[2+EY[2-2*R*EX*EY)
850 GOSUB1500:IP=2:IFIO=2PRINT"TURN ON PRINTER - HIT ENTER ";:INPUTZI:CLS
900 PRINTTAB(17);"T - T E S T   R E S U L T S"
910 PRINT:PRINTTAB(4);"VARIABLE X: ";ZV;TAB(33);"  VARIABLE Y: ";ZU
920 PRINTTAB(4);"MEAN OF X    = ";TE,"   MEAN OF Y    = ";TH
930 PRINTTAB(4);"S.D.  OF X    = ";TS,"   S.D.  OF Y    = ";TT
940 PRINTTAB(4);"S.E.  OF MEAN = ";EX,"   S.E.  OF MEAN = ";EY:PRINT
945 PRINTTAB(12);"NUMBER OF PAIRS (N)          = ";N
950 PRINTTAB(12);"CORRELATION OF X WITH Y (R)  = ";:PRINTUSINGA$;R:PRINT
960 PRINTTAB(12);"DIFFERENCE (MEAN X - MEAN Y) = ";TE-TH
970 PRINTTAB(12);"DEGREES OF FREEDOM (DF)      = ";M
980 PRINTTAB(12);"T-RATIO FOR THE DIFFERENCE   = ";Q
990 PRINTTAB(12);"PROBABILITY (";EV;"TAILED TEST) = ";:PRINTUSINGA$;QX:PRINT
995 IFIO=2GOSUB3000
1000 INPUT"   WANT TO RUN ANOTHER SET OF DATA - (Y)ES OR (N)O ";ZO
1100 IFZO="Y"RUN
1150 CLS
1200 IFIM=1GOTO1400
1300 CLOSE:IFII<>3KILL"SCRATCH/ASA"
1400 END
1500 QX=1:QY=1:QT=Q[2:IFQT=0QX=1:GOTO1700
1520 IFQT<1GOTO1570
1530 QS=QY:QR=M:QZ=QT:GOTO1600
1570 QS=M:QR=QY:QZ=1/QT
1600 QJ=2/9/QS:QK=2/9/QR
1620 QL=ABS((1-QK)*QZ[(1/3)-1+QJ)/SQR(QK*QZ[(2/3)+QJ)
1630 IFQR<4GOTO1670
1640 QX=.5/(1+QL*(.196854+QL*(.115194+QL*(.000344+QL*.019527))))[4
1650 GOTO1690
1670 QL=QL*(1+.08*QL[4/QR[3):GOTO1640
1690 IFQT<1QX=1-QX
1700 QX=QX/ET:RETURN
3000 GOSUB7000:FORJ=1TO2:GOSUB6000:NEXTJ:LPRINTCHR$(29);" "
3050 LPRINTTAB(17);"T - T E S T   R E S U L T S"
3100 GOSUB6000:GOSUB6000:LPRINT"    VARIABLE X:  ";ZV;TAB(32);"VARIABLE Y:  ";ZU
3200 GOSUB6000:GOSUB6000:LPRINTTAB(4);"MEAN OF X  = ";TE,"MEAN OF Y  = ";TH
3300 LPRINT" ":LPRINTTAB(4);"S.D.  OF X  = ";TS,"S.D.  OF Y  = ";TT
3350 LPRINT" ":LPRINTTAB(4);"S.E.  MEAN  = ";EX,"S.E.  MEAN  = ";EY
3400 GOSUB6000:GOSUB6000:LPRINTTAB(12);"NUMBER OF PAIRS (N)          = ";N
3500 GOSUB6000:LPRINTTAB(12);"CORRELATION OF X WITH Y (R)  = ";:LPRINTUSINGA$;R
3550 GOSUB6000:GOSUB6000:LPRINTTAB(12);"DIFFERENCE (MEAN X - MEAN Y) = ";TE-TH
3600 GOSUB6000:LPRINTTAB(12);"DEGREES OF FREEDOM (DF)      = ";N-1
3700 GOSUB6000:LPRINTTAB(12);"T-RATIO FOR THE DIFFERENCE   = ";Q
```

T-Test for Matched Pairs (continued)

```
3800 GOSUB6000:LPRINTTAB(12);"PROBABILITY (";EV;"TAILED TEST) = ";:LPRINTUSINGA$;QX
3900 FORJ=1TO3:GOSUB6000:NEXTJ:GOSUB7000:RETURN
6000 FORJF=1TO3:LPRINT" ":NEXTJF:RETURN
7000 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
9999 END
```

Correlation & Linear Regression Program Listing

```
5 CLEAR150
10 CLS:PRINT:N=0:J=0:DEFSNGA-H,O-W:DEFINTI-N:DEFDBLX,Y:DEFSTRZ
11 A$="#####.##":B$="######.##":DIMA(13):IS=0:IC=0
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIMX(MEM/8-100):RESUME20
20 PRINT"C O R R E L A T I O N  &  L I N E A R  R E G R E S S I O N":PRINT
25 ONERRORGOTO0
30 PRINT"HOW WILL DATA BE ENTERED - ";
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO60
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN
60 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
64 PRINT:INPUT"WHAT IS THE NAME OF VARIABLE X ";ZV:PRINT
65 INPUT"WHAT IS THE NAME OF VARIABLE Y ";ZU:IO=1:IFZO="Y"IO=2
66 IFLEN(ZU)>14ZU=LEFT$(ZU,14)
67 IFLEN(ZV)>14ZV=LEFT$(ZV,14)
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:ONIIGOTO77,150,500
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR DATA PAIRS (X,Y).
80 PRINT"SIGNAL END OF DATA WITH @,@.":PRINT
90 INPUTZ,ZB:IFZ="@"GOTO120
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):X(N+2)=VAL(ZB):N=N+2:GOTO90
110 X=VAL(Z):Y=VAL(ZB):PRINT#1,X,Y:N=N+2:GOTO90
120 N=N/2:IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINTN;"PAIRS WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=2GOTO190
180 PRINT:PRINT"WRONG DATA FILE TYPE":PRINT:M6=4:GOTO1343
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8):ONIMGOTO200,210
200 FORK=1TO8:IFZ(K)="@"THEN230
205 X(N+K)=VAL(Z(K)):NEXTK:N=N+8:GOTO190
210 FORK=1TO8:IFZ(K)="@"THEN230
220 PRINT#1,Z(K):NEXTK:N=N+8:GOTO190
230 IFIM=2 CLOSE
235 PRINT:N=(N+K-1)/2:PRINTN;"PAIRS WERE READ.":GOTO500
350 X1=X1+X(J):Y1=Y1+X(J+1):X2=X2+X(J)[2:Y2=Y2+X(J+1)[2:XY=XY+X(J)*X(J+1)
360 IFX(J)>XHTHENXH=X(J)
362 IFX(J)<XLTHENXL=X(J)
364 IFX(J+1)>YHTHENYH=X(J+1)
366 IFX(J+1)<YLTHENYL=X(J+1)
368 RETURN
370 X1=X1+X:Y1=Y1+Y:X2=X2+X[2:Y2=Y2+Y[2:N=N+1:XY=XY+X*Y
380 IFX>XH THENXH=X
382 IFX<XL THENXL=X
384 IFY>YH THENYH=Y
```

Correlation & Linear Regression (continued)

```
388 RETURN
500 X1=0:X2=0:Y1=0:Y2=0:XY=0:TZ=0:YH=-1E38:YL=1E38:XH=-1E38:XL=1E38
503 IFIM=2N=0
505 ONIMGOTO510,600
510 FORJ=1TO2*NSTEP2:GOSUB350
550 NEXTJ:GOTO800
600 ONIIGOTO610,610,700
610 OPEN"I",1,"SCRATCH/RSA":GOTO705
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>2GOTO180
705 IFIP=2GOTO1510
710 INPUT#1,X,Y:GOSUB370
715 IF EOF(1) THEN 800
720 GOTO710
800 TM=(XY*N-Y1*X1)/(X2*N-X1*X1):TD=(Y1*X2-XY*X1)/(X2*N-X1*X1)
810 TA=XY-X1*Y1/N:TB=X2-X1*X1/N:TC=Y2-Y1[2/N:TC=Y2-Y1[2/N:TS=SQR(TB/N):TE=X1/N
820 TH=Y1/N:TT=SQR(TC/N):CLS
840 TB=SQR(TB):TC=SQR(TC):R=INT(1000*TA/(TB*TC)+.5)/1000
850 IP=2:IFIO=2PRINT"TURN ON PRINTER - HIT ENTER ";:INPUTZI:CLS
900 PRINT"C O R R E L A T I O N   &   L I N E A R   R E G R E S S I O N"
910 PRINT:PRINT"VARIABLE X: ";ZV;TAB(30);"VARIABLE Y: ";ZU
920 PRINTTAB(4);"MEAN OF X  = ";TE,"   MEAN OF Y  = ";TH
930 PRINTTAB(4);"S.D.  OF X  = ";TS,"   S.D.  OF Y  = ";TT:PRINT
945 PRINTTAB(12);"NUMBER OF PAIRS (N)          = ";N:PRINT
950 PRINTTAB(12);"CORRELATION COEFFICIENT (R)  = ";R
960 PRINTTAB(12);"DEGREES OF FREEDOM (DF)      = ";N-2:PRINT
970 PRINTTAB(12);"SLOPE (M) OF REGRESSION LINE = ";TM
972 PRINTTAB(12);"Y INTERCEPT (B) FOR THE LINE = ";TD
980 PRINT:PRINT:IFIS=1GOTO1330
990 IFIO=2GOSUB3000
1000 FORI=0TO6:A(I+1)=YL+I*(YH-YL)/6:NEXTI:IS=1
1100 FORI=0TO5:A(I+8)=XL+I*(XH-XL)/5:NEXTI
1330 INPUT"(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP, 5=NEW RUN) WHICH ";M6
1340 CLS:IFM6=5RUN
1343 IFIM=2CLOSE
1345 ONM6GOTO1350,1610,900,9999,9999
1350 PRINT:INPUT"WANT REGRESSION LINE SHOWN (1=YES, 2=NO) ";A6:CLS
1352 FORI=7TO1STEP-1:PRINT:PRINTUSINGA$;A(I):NEXTI
1353 PRINT@967," ";:FORI=8TO13:PRINTUSINGB$;A(I);:NEXTI
1355 FORI=4TO43:SET(18,I):NEXTI:FORI=19TO125:SET(I,43):NEXTI
1360 FORJ=23TO113STEP18:SET(J,42):NEXTJ
1505 IFIM=2GOTO600
1510 FORJ=1TO2*N-1STEP2:ONIMGOTO1512,1516
1512 X=X(J):Y=X(J+1):GOTO1518
1516 INPUT#1,X,Y
1518 JO=23+(X-XL)/(XH-XL)*91
1520 JP=40-(Y-YL)/(YH-YL)*36:SET(JO,JP):NEXTJ
1530 TJ=XL:TQ=(XH-XL)/100:ONA6GOTO1540,1588
1540 JO=23+(TJ-XL)/(XH-XL)*93:JP=40-(TM*TJ+TD-YL)/(YH-YL)*37
1550 IF(JP>40)OR(JP<4)GOTO1570
1560 SET(JO,JP)
1570 TJ=TJ+TQ:IFTJ>XHGOTO1588
```

Correlation & Linear Regression (continued)

```
1550 IF(JP>40)OR(JP<4)GOTO1570
1560 SET(JO,JP)
1570 TJ=TJ+TQ:IFTJ>XHGOTO1588
1580 GOTO1540
1588 IF(IO=2)AND(IC=0)GOSUB2000:IC=1
1590 PRINT@15,"HIT ENTER TO CONTINUE ";
1600 INPUTZI:CLS:PRINT:GOTO1330
1610 PRINT:PRINT"ENTER @ TO STOP PREDICTING"
1620 PRINT:PRINT" X          PREDICTED Y":PRINT"----------------------"
1630 INPUTZO:X=VAL(ZO):IFZO="@"THEN1330
1640 AY=TM*X+TD:IF(X<XL)OR(X>XH)GOTO1660
1650 PRINTTAB(14);AY:GOTO1630
1660 PRINTTAB(14);AY;" (X NOT IN RANGE)":GOTO1630
2000 FORJ=1TO3:GOSUB6000:NEXTJ:LZ=4:LC=7:LR=0
2020 LPRINTTAB(5);"                    X   BY   Y   P L O T"
2025 LPRINTTAB(5);"                 -------------------------":LPRINT" "
2050 LP=(39-LEN(ZU)*2)/2
2060 LJ=0:K=-1:FORJ=3TO41:LI=9:LJ=LJ+1:LZ=LZ+1:K=-K
2070 IF(LJ>=LP)AND(LR<LEN(ZU))AND(SGN(K)=1):LR=LR+1:LPRINTMID$(ZU,LR,1);:GOTO208
     0
2075 LPRINT" ";
2080 IFLZ=6LPRINTUSINGA$;A(LC);:LPRINTTAB(9);"+";:LC=LC-1:LZ=0:GOTO2100
2090 LPRINTTAB(9);"I";
2100 FORL=20TO124STEP2:LI=LI+1
2110 IF(POINT(L,J)=-1)OR(POINT(L+1,J)=-1)LPRINTTAB(LI);"*";
2120 NEXTL:LPRINT" ":NEXTJ
2500 LPRINTTAB(9)"--+--------+--------+--------+--------+--------+------"
2550 LPRINT" "
2600 LPRINTTAB(6);" ";:FORJ=8TO13:LPRINTUSINGB$;A(J);:NEXTJ
2700 LPRINT" ":LL=LEN(ZV):LPRINT" ":LPRINTTAB(11+(46-2*LL)/2);" ";
2800 FORJ=1TOLL:LPRINTMID$(ZV,J,1);:LPRINT" ";:NEXTJ
2900 FORJ=1TO3:GOSUB6000:NEXTJ:LPRINT" ":LPRINT" ":GOSUB7000:RETURN
3000 GOSUB7000:FORJ=1TO3:GOSUB6000:NEXTJ
3050 LPRINT"  C O R R E L A T I O N   &   L I N E A R   R E G R E S S I O N"
3100 GOSUB6000:GOSUB6000:LPRINT"    VARIABLE X:  ";ZV;TAB(32);"VARIABLE Y:  ";ZU
3200 GOSUB6000:GOSUB6000:LPRINTTAB(4);"MEAN OF X  = ";TE,"MEAN OF Y  = ";TH
3300 GOSUB6000:LPRINTTAB(4);"S.D.  OF X  = ";TS,"S.D.  OF Y  = ";TT
3400 GOSUB6000:GOSUB6000:LPRINTTAB(12);"NUMBER OF PAIRS (N)          = ";N
3500 GOSUB6000:GOSUB6000:LPRINTTAB(12);"CORRELATION COEFFICIENT (R)  = ";R
3600 GOSUB6000:LPRINTTAB(12);"DEGREES OF FREEDOM (DF)      = ";N-2
3700 GOSUB6000:GOSUB6000:LPRINTTAB(12);"SLOPE (M) OF REGRESSION LINE = ";TM
3800 GOSUB6000:LPRINTTAB(12);"Y INTERCEPT (B) FOR THE LINE = ";TD
3900 FORJ=1TO3:GOSUB6000:NEXTJ:GOSUB7000:RETURN
6000 FORJF=1TO3:LPRINT" ":NEXTJF:RETURN
7000 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
9999 IF(IM=2)AND(II<>3)KILL"SCRATCH/ASA"
10000 END
10100 PRINT"CORRELATION NOT COMPUTABLE (VARIANCE = 0)":GOTO9999
```

Multiple Linear Regression Program Listing

```
100 CLEAR200:B$="#.####":C$="#":CLS:PRINT:DEFINTI-N:DEFSNGP
105 DEFSTRZ:DIMZ(7),C(6,7),S(7),X(7),SS(6),PM(6),PS(6),M(6),V$(6)
110 PRINT"   M U L T I P L E    L I N E A R    R E G R E S S I O N"
112 ONERRORGOTO115:IM=2:CMD"T":GOTO120
115 IM=1:RESUME120
120 ONERRORGOTO0
130 PRINT:PRINT"HOW WILL DATA BE ENTERED - ";
135 INPUT"(K)EYBOARD, (T)APE, OR (D)ISK ";ZI:IFZI<>"D"GOTO150
140 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN
150 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
160 PRINT:INPUT"HOW MANY INDEPENDENT VARIABLES FOR THIS RUN (1-5) ";IV
170 N=0:X(1)=1:IFZI<>"K"GOTO300
173 PRINT:INPUT"WHAT IS THE NAME OF THE DV ";DV$
175 FORJ=2TOIV+1:M(J)=J-1:PRINT"WHAT IS THE NAME OF IV #";J-1;:INPUTV$(J):NEXTJ
180 CLS:PRINT"BEGIN ENTERING YOUR DATA."
185 PRINT"SIGNAL END OF DATA BY ENTERING @ FOR THE DV VALUE."
190 N=N+1:PRINT:PRINT"SUBJECT #";N:INPUT"DV   ";Z:IFZ="@"N=N-1:GOTO700
195 X(IV+2)=VAL(Z)
200 FORI=2TOIV+1:PRINT"IV";I-1;:INPUTZ:X(I)=VAL(Z):NEXTI:GOSUB650:GOTO190
300 CLS:PRINT"WHICH";IV;"IV'S FROM THE FILE WILL BE USED"
305 PRINT"(ENTER ONE IV # AFTER EACH QUESTION MARK)":PRINT
307 DATA FIRST,SECOND,THIRD,FOURTH,FIFTH
310 FORJ=2TOIV+1:READA$:PRINTA$;" ";:INPUTM(J):INPUT"WHAT IS THE NAME OF THAT IV ";V$(J)
320 PRINT:NEXTJ:INPUT"WHAT IS THE NAME OF THE DV ";DV$
330 IFZI="D"THEN450ELSECLS:INPUT"LOAD DATA TAPE - HIT ENTER ";A$:PRINT
340 INPUT#-1,I:INPUT#-1,A$:PRINT"DATA FILE BEING READ = ";A$:IFI=4GOTO355
350 PRINT"WRONG DATA FILE TYPE.":GOTO9000
355 INPUT#-1,JV:IFIV>JVTHEN8900
360 INPUT#-1,Z(0),Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7):IFZ(0)="@"GOTO700
370 N=N+1:X(IV+2)=VAL(Z(0)):FORJ=2TOIV+1:X(J)=VAL(Z(M(J))):NEXTJ
380 GOSUB650:GOTO360
450 OPEN"I",1,ZN:INPUT#1,I:IFI<>4GOTO350
460 INPUT#1,JV:IFIV>JVGOTO8900
465 INPUT#1,Z(0):IFZ(0)="@"GOTO700
470 FORK=1TOJV:INPUT#1,Z(K):NEXTK
480 N=N+1:X(IV+2)=VAL(Z(0)):FORJ=2TOIV+1:X(J)=VAL(Z(M(J))):NEXTJ
490 GOSUB650:GOTO465
650 FORI=1TOIV+1:FORJ=1TOIV+2:C(I,J)=C(I,J)+X(I)*X(J)
660 S(I)=C(I,IV+2):NEXTJ:NEXTI
670 S(IV+2)=S(IV+2)+X(IV+2)[2:RETURN
700 FORK=2TOIV+1:T(K)=C(1,K):NEXTK
705 FORJ=2TOIV+1:SS(J)=C(J,J):NEXTJ
710 FORJ=1TOIV+1:FORK=JTOIV+1:IFC(K,J)<>0GOTO730
720 NEXTK:PRINT"MATRIX IS SINGULAR.":GOTO9000
730 FORL=1TOIV+2:W=C(J,L):C(J,L)=C(K,L):C(K,L)=W:NEXTL
740 Q=1/C(J,J):FORL=1TOIV+2:C(J,L)=Q*C(J,L):NEXTL
750 FORK=1TOIV+1:IFK=JGOTO770
760 Q=-C(K,J):FORL=1TOIV+2:C(K,L)=C(K,L)+Q*C(J,L):NEXTL
770 NEXTK:NEXTJ
775 FORJ=2TOIV+1:PM(J)=T(J)/N:PS(J)=SQR((SS(J)-T(J)[2/N)/(N-1)):NEXTJ
780 FORJ=2TOIV+1:SR=SR+C(J,IV+2)*(S(J)-T(J)*S(1)/N):NEXTJ
```

Multiple Linear Regression (continued)

```
785 ST=S(IV+2)-S(1)[2/N:P2=SR/ST:P1=SQR(P2):PS(1)=SQR(ST/(N-1)):PM(1)=S(1)/N
790 D2=N-IV-1:PF=SR/ST/IV/((1-SR/ST)/D2):PE=SQR(ABS((ST-SR)/D2))
800 QT=PF:IFQT=0QX=1:GOTO995
820 IFQT<1GOTO870
830 QS=IV:QR=D2:QZ=QT:GOTO900
870 QS=D2:QR=IV:QZ=1/QT
900 QJ=2/9/QS:QK=2/9/QR
920 QL=ABS((1-QK)*QZ[(1/3)-1+QJ)/SQR(QK*QZ[(2/3)+QJ)
930 IFQR<4GOTO970
940 QX=.5/(1+QL*(.196854+QL*(.115194+QL*(.000344+QL*.019527))))[4
950 GOTO990
970 QL=QL*(1+.08*QL[4/QR[3):GOTO940
990 IFQT<1QX=1-QX
995 IFZO<>"Y"THEN1100ELSECLS:INPUT"TURN ON PRINTER - HIT ENTER ";A$:GOTO1100GOTO1100
1000 CLS:PRINT:PRINTTAB(20);"REGRESSION COEFFICIENTS"
1010 PRINTSTRING$(63,"-"):PRINT"VAR.     NAME        MEAN            S.D.            COEFF."
1020 PRINTSTRING$(63,"-"):PRINT"C      CONSTANT";TAB(48);CSNG(C(1,IV+2))
1030 FORJ=2TOIV+1:PRINT"IV";:PRINTUSINGC$;M(J);:PRINT"    ";V$(J);
1040 PRINTTAB(18);PM(J);TAB(33);PS(J);TAB(48);CSNG(C(J,IV+2))
1050 NEXTJ:PRINT"DV     ";DV$;TAB(18);PM(1);TAB(33);PS(1)
1060 PRINTSTRING$(63,"-")
1070 PRINT:INPUT"(C)OEFFICIENTS OR (R)EGRESSION STATISTICS ";A$
1080 IFA$="C"THEN1000
1090 IFA$="R"THEN1100
1095 IFA$="P"THEN2000ELSE1070
1100 CLS:PRINT"     R E G R E S S I O N    S T A T I S T I C S":PRINT
1110 PRINT"COEFFICIENT OF DETERMINATION (R SQUARE)   = ";P2
1120 PRINT"COEFFICIENT OF MULTIPLE CORRELATION (R)   = ";P1
1130 PRINT"STANDARD ERROR OF ESTIMATE";TAB(42);"= ";PE
1140 PRINT"REGRESSION SUM OF SQUARES";TAB(42);"= ";CSNG(SR)
1150 PRINT"RESIDUAL SUM OF SQUARES";TAB(42);"= ";CSNG(ST-SR)
1160 PRINT"TOTAL SUM OF SQUARES";TAB(42);"= ";CSNG(ST)
1162 PRINT"F-RATIO (REGRESSION)                    = ";PF
1170 PRINT"DEGREES OF FREEDOM";TAB(42);"= ";IV;" & ";D2
1180 PRINT"PROBABILITY OF CHANCE";TAB(42);"=  ";:PRINTUSINGB$;QX
1185 PRINT"NUMBER OF CASES (SUBJECTS)";TAB(42);"= ";N
1190 PRINT"NUMBER OF INDEPENDENT VARIABLES";TAB(42);"= ";IV
1195 IF(LL=0)AND(ZO="Y")THEN2100ELSE1070
2100 LPRINTCHR$(29);"     R E G R E S S I O N    S T A T I S T I C S":LPRINT" "
2110 LPRINT"COEFFICIENT OF DETERMINATION (R SQ) = ";P2
2120 LPRINT"COEFFICIENT OF MULTIPLE CORRELATION = ";P1
2130 LPRINT"STANDARD ERROR OF ESTIMATE          = ";PE
2140 LPRINT"REGRESSION SUM OF SQUARES           = ";SR
2150 LPRINT"RESIDUAL SUM OF SQUARES             = ";ST-SR
2160 LPRINT"TOTAL SUM OF SQUARES                = ";ST
2162 LPRINT"F-RATIO (REGRESSION)                = ";PF
2170 LPRINT"DEGREES OF FREEDOM";TAB(36);"= ";IV;" & ";D2
2180 LPRINT"PROBABILITY OF CHANCE               = ";QX
2185 LPRINT"NUMBER OF CASES (SUBJECTS)          = ";N
2190 LPRINT"NUMBER OF INDEPENDENT VARIABLES     = ";IV
2200 FORJ=1TO6:LPRINT" ":NEXTJ:LPRINTTAB(20);"REGRESSION COEFFICIENTS"
```

Multiple Linear Regression (continued)

```
3000 LPRINT" ":LPRINTSTRING$(60,"-"):LPRINT"VAR.     NAME        MEAN            S. D.              COEFF. "
3010 LPRINTSTRING$(60,"-"):LPRINT"C      CONSTANT";TAB(48);CSNG(C(1,IV+2))
3030 FORJ=2TOIV+1:LPRINT"IV";:LPRINTUSINGC$;M(J);:LPRINT"    ";V$(J);
3040 LPRINTTAB(18);PM(J);TAB(33);PS(J);TAB(48);CSNG(C(J,IV+2))
3050 NEXTJ:LPRINT"DV     ";DV$;TAB(18);PM(1);TAB(33);PS(1)
3060 LPRINTSTRING$(60,"-"):LL=1:GOTO1070
8900 PRINT"ONLY";JV;"IV'S ON FILE!"
9000 IFIM=2CLOSE
9100 END
```

Time Series Analysis I Program Listing

```
5 CLEAR150
10 CLS:PRINT:N=0:J=0:DEFSNGA-H,O-W:DEFINTI-N:DEFDBLX,Y:DEFSTRZ
11 A$="#####.##":B$="######.##":C$="###.##":DIMA(13):IS=0:IC=0
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:DIMX(MEM/8-100):RESUME20
20 PRINTTAB(7);"T I M E   S E R I E S   A N A L Y S I S   I":PRINT
25 ONERRORGOT00
30 PRINT"HOW WILL DATA BE ENTERED - ";
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO50
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN
50 PRINT:INPUT"TYPE OF DATA - (Y)EARLY (Q)UARTERLY (M)ONTHLY (W)EEKLY ";D$:GOSUB30000
60 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
65 PRINT:INPUT"WHAT IS THE NAME OF VARIABLE Y ";ZU:IO=1:IFZO="Y"IO=2
66 IFLEN(ZU)>14ZU=LEFT$(ZU,14)
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 CLS:ONIIGOTO77,150,500
77 IFIM=2THENOPEN"O",1,"SCRATCH/ASA"
79 PRINT"BEGIN ENTERING YOUR OBSERVATIONS (SEE MANUAL)."
80 PRINT"SIGNAL END OF DATA WITH @,@.":PRINT
90 INPUTZ,ZB:IFZ="@"GOTO120
92 IFN=0K1=INT(VAL(Z)):K4=INT(100*(VAL(Z)-K1))
93 IFN=2K2=1:IFJW=1K2=INT(VAL(Z))-K1:C6=1/K2
95 ONIMGOTO100,110
100 X(N+1)=VAL(Z):X(N+2)=VAL(ZB):N=N+2:GOTO90
110 X=VAL(Z):Y=VAL(ZB):PRINT#1,X,Y:N=N+2:GOTO90
120 N=N/2:IFIM=1GOTO130
125 CLOSE
130 PRINT:PRINTN;"OBSERVATIONS WERE ENTERED.":GOTO500
150 INPUT"INSERT DATA TAPE - HIT ENTER ";ZI
155 IFIM=2THEN OPEN"O",1,"SCRATCH/ASA"
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=2GOTO190
180 PRINT:PRINT"WRONG DATA FILE TYPE":PRINT:M6=4:GOTO1343
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8)
195 IFN=0K1=INT(VAL(Z(1))):K4=INT(100*(VAL(Z(1))-K1))
197 IFN=0K2=1:IFJW=1K2=INT(VAL(Z(3))-K1):C6=1/K2
200 FORK=1TO8:IFZ(K)="@"THEN230
205 IFIM=1X(N+K)=VAL(Z(K)):NEXTK:N=N+8:GOTO190
220 PRINT#1,Z(K):NEXTK:N=N+8:GOTO190
230 IFIM=2 CLOSE
235 PRINT:N=(N+K-1)/2:PRINTN;"OBSERVATIONS WERE READ.":GOTO500
350 K=K+1:X1=X1+K:Y1=Y1+X(J+1):X2=X2+K[2:Y2=Y2+X(J+1)[2:XY=XY+K*X(J+1)
364 IFX(J+1)>YHTHENYH=X(J+1)
366 IFX(J+1)<YLTHENYL=X(J+1)
368 RETURN
370 K=K+1:X1=X1+K:Y1=Y1+Y:X2=X2+K[2:Y2=Y2+Y[2:N=N+1:XY=XY+K*Y
375 IFN=1K1=INT(X):K4=INT(100*(X-K1))
380 IFN=2K2=1:IFJW=1K2=INT(X-K1):C6=1/K2
384 IFY>YH THENYH=Y
386 IFY<YL THENYL=Y
```

Time Series Analysis I (continued)

```
388 RETURN
500 X1=0:X2=0:Y1=0:Y2=0:XY=0:TZ=0:YH=-1E38:YL=1E38
503 K=-1:IFIM=2N=0
505 ONIMGOTO510,600
510 FORJ=1TO2*NSTEP2:GOSUB350
550 NEXTJ:GOTO800
600 ONIIGOTO610,610,700
610 OPEN"I",1,"SCRATCH/ASA":GOTO705
700 OPEN"I",1,ZN:INPUT#1,IT:IFIT<>2GOTO180
705 ONIP+1GOTO710,876,1510
710 INPUT#1,X,Y:GOSUB370
715 IF EOF(1) THEN 800
720 GOTO710
800 TM=(XY*N-Y1*X1)/(X2*N-X1*X1):TD=(Y1*X2-XY*X1)/(X2*N-X1*X1)
875 IFIM=2CLOSE:IP=1:GOTO600
876 L=-1:FORJ=1TO2*N-1STEP2:GOSUB20000:NEXTJ
877 EZ=(A(10)+A(9)/2-(N-1)/2)/SQR((N-1)/12):AY=Y1[2/N:VA=(Y3-AY)/(Y2-AY)*100
900 CLS:IP=2:IFIO=2PRINT"TURN ON YOUR PRINTER - HIT ENTER ";:INPUTZI:CLS
950 PRINTTAB(7);"T I M E    S E R I E S    A N A L Y S I S   I"
970 PRINT:PRINT"EQUATION FOR LEAST SQUARES TREND LINE:":PRINT
971 S$="+":IFTM<0S$="-"
972 PRINTTAB(6);"TREND =";TD;S$;ABS(TM);"X"
973 PRINTTAB(6);"ORIGIN: ";K1;:IFJW<>1PRINT"- ";D$;K4;
974 PRINT:PRINTTAB(6);"TIME UNIT: ";K2;D$;:IFK2>1PRINT"S";
977 PRINT:PRINT:PRINT"STATISTICAL TEST FOR TREND (Z) =";EZ;"     Z(.05)=1.96"
978 PRINT:PRINT"VARIANCE IN Y ACCOUNTED FOR BY TREND =";:PRINTUSINGC$;VA;:PRINT" %"
980 PRINT:PRINT:IFIS=1GOTO1330
990 IFIO=2GOSUB3000
1000 FORI=0TO6:A(I+1)=YL+I*(YH-YL)/6:NEXTI:IS=1
1330 INPUT"(1=PLOT, 2=PREDICT, 3=STATISTICS, 4=STOP) WHICH ";M6
1343 CLS:IFIM=2CLOSE
1345 ONM6GOTO1350,1610,950,9999,9999
1350 PRINT:INPUT"WANT TREND LINE SHOWN (1=YES, 2=NO) ";A6:CLS
1352 FORI=7TO1STEP-1:PRINT:PRINTUSINGA$;A(I):NEXTI
1353 PRINT@971,"0 (";K1;:IFJW<>1PRINTD$;K4;
1354 PRINT")";TAB(55);N-1;
1355 FORI=4TO43:SET(18,I):NEXTI:FORI=19TO125:SET(I,43):NEXTI
1360 FORJ=23TO113STEP3:SET(J,42):NEXTJ
1505 IFIM=2GOTO600
1510 K=-1:FORJ=1TO2*N-1STEP2:K=K+1:ONIMGOTO1512,1516
1512 X=K:Y=X(J+1):GOTO1518
1516 INPUT#1,X,Y
1518 X=K:JO=23+X/(N-1)*91
1520 JP=40-(Y-YL)/(YH-YL)*36:SET(JO,JP):NEXTJ
1530 TJ=0:TQ=(N-1)/100:ONR6GOTO1540,1588
1540 JO=23+TJ/(N-1)*93:JP=40-(TM*TJ+TD-YL)/(YH-YL)*37
1550 IF(JP>40)OR(JP<4)GOTO1570
1560 SET(JO,JP)
1570 TJ=TJ+TQ:IFTJ>N-1GOTO1588
1580 GOTO1540
1588 IF(IO=2)AND(IC=0)GOSUB2000:IC=1
```

Time Series Analysis I (continued)

```
1590 PRINT@10,ZU;" BY ";D$;" . . . HIT ENTER ";
1600 INPUTZI:CLS:PRINT:GOTO1330
1610 PRINT"ENTER @ TO STOP PREDICTING"
1620 PRINT:INPUT"YEAR ";Z0:IFZ0="@"THEN1330
1630 K3=VAL(Z0):JJ=0:IFJW<>1PRINTD$;:INPUTJJ
1640 X=(K3-K1)*C6-K4+JJ:AY=TM*X+TD
1650 PRINT"TIME VARIABLE (X) =";X:PRINT"PREDICTED Y  (Y') =";AY:GOTO1620
2000 GOSUB6000:LZ=4:LC=7:LR=0
2050 LP=(39-LEN(ZU)*2)/2
2060 LJ=0:K=-1:FORJ=3TO41:LI=9:LJ=LJ+1:LZ=LZ+1:K=-K
2070 IF(LJ>=LP)AND(LR<LEN(ZU))AND(SGN(K)=1):LR=LR+1:LPRINTMID$(ZU,LR,1);:GOTO2080
2075 LPRINT" ";
2080 IFLZ=6LPRINTUSINGA$;A(LC);:LPRINTTAB(9);"+";:LC=LC-1:LZ=0:GOTO2100
2090 LPRINTTAB(9);"I";
2100 FORL=20TO124STEP2:LI=LI+1
2110 IF(POINT(L,J)=-1)OR(POINT(L+1,J)=-1)LPRINTTAB(LI);"*";
2120 NEXTL:LPRINT" ":NEXTJ
2500 LPRINTTAB(9);:FORJ=1TO17:LPRINT"--+";:NEXTJ:LPRINT" "
2600 LPRINTTAB(11);"0 (";K1;:IFJW<>1LPRINTD$;K4;
2700 LPRINT")";TAB(55);N-1;
2900 FORJ=1TO2:GOSUB6000:NEXTJ:LPRINT" ":GOSUB7000:RETURN
3000 GOSUB7000:FORJ=1TO2:GOSUB6000:NEXTJ
3500 LPRINTCHR$(29);TAB(7);"T I M E   S E R I E S   A N A L Y S I S   I":GOSUB6000
3600 LPRINT"TEST FOR TREND (Z) =";EZ;TAB(35);"TREND LINE EQUATION:"
3650 LPRINTTAB(35);"Y' =";TD;S$;ABS(TM);"X"
3700 LPRINT"VARIANCE ACCOUNTED FOR";TAB(35);"ORIGIN: ";K1;:IFJW<>1LPRINT"- ";D$;K4;
3800 LPRINT" ":LPRINT"BY TREND =";:LPRINTUSINGC$;VA;
3900 LPRINT" %";TAB(35);"TIME UNIT: ";K2;D$;:IFK2>1LPRINT"S"
3950 LPRINT" ":RETURN
6000 FORJF=1TO3:LPRINT" ":NEXTJF:RETURN
7000 LPRINTSTRING$(65,"*"):RETURN
9999 IF(IM=2)AND(II<>3)KILL"SCRATCH/ASA"
10000 END
20000 IFIM=2THEN20010ELSEY=X(J+1):GOTO20030
20010 INPUT#1,X,Y
20030 IFJ=1HL=Y:GOTO20050
20040 K=9+SGN(Y-HL):A(K)=A(K)+1:HL=Y
20050 L=L+1:Y3=Y3+(TD+TM*L)^2:RETURN
30000 IFD$="Y"JW=1:D$="YEAR"
30010 IFD$="Q"C6=4:JW=2:D$="QUARTER"
30020 IFD$="M"C6=12:JW=3:D$="MONTH"
30030 IFD$="W"C6=52:JW=4:D$="WEEK"
30040 RETURN
```

Time Series Analysis II Program Listing

```
5 CLEAR150
10 CLS:DEFINTI-N:DEFSTRZ:N=1
12 ONERRORGOTO15:IM=2:CMD"T":CLOSE:GOTO20
15 IM=1:RESUME20
20 PRINTTAB(5);"T I M E   S E R I E S   A N A L Y S I S   I I":PRINT
25 ONERRORGOTO0
27 J=(MEM-800)/12:DIMX(J),Y(J),A(J),QM(12),NN(12)
30 PRINT"HOW WILL DATA BE ENTERED - ";
40 INPUT"(K)EYBOARD (T)APE OR (D)ISK ";ZI:IFZI<>"D"GOTO46
45 PRINT:INPUT"WHAT IS THE NAME OF YOUR DATA FILE ";ZN
46 PRINT:INPUT"(S)EASONAL INDEXES OR (M)OVING AVERAGES - WHICH ";ZR
47 PRINT:IFZR="M"PRINT"(Y)EARLY, ";
48 PRINT"(Q)UARTERLY, (M)ONTHLY";:IFZR="M"PRINT", (W)EEKLY, (D)AILY";
50 INPUT" - WHICH ";D$:GOSUB30000
55 IFZR="M"PRINT:PRINT"MOVING AVERAGE OF HOW MANY ";D$;"S ";:INPUTM
60 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";ZO
65 IO=1:IFZO="Y"IO=2
70 II=1:IFZI="T"II=2
75 IFZI="D"II=3
76 ONIIGOTO79,150,300
79 CLS:PRINT"BEGIN ENTERING YOUR OBSERVATIONS (SEE MANUAL)."
80 PRINT"SIGNAL END OF DATA WITH @,@.":PRINT
90 INPUTZ,ZB:IFZ="@"N=N-1:GOTO130
100 X(N)=VAL(Z):Y(N)=VAL(ZB):N=N+1:GOTO90
130 PRINT:PRINTN;"OBSERVATIONS WERE ENTERED.":GOTO500
150 CLS:INPUT"INSERT DATA TAPE - HIT ENTER ";ZI:N=0
160 INPUT#-1,IT:INPUT#-1,ZO:PRINT
170 PRINT"DATA FILE BEING READ = ";ZO:IFIT=2GOTO190
180 PRINT:PRINT"WRONG DATA FILE TYPE":PRINT:M6=4:GOTO1343
190 INPUT#-1,Z(1),Z(2),Z(3),Z(4),Z(5),Z(6),Z(7),Z(8)
200 FORK=1TO7STEP2:IFZ(K)="@"THEN235
205 N=N+1:X(N)=VAL(Z(K)):Y(N)=VAL(Z(K+1)):NEXTK:GOTO190
235 PRINT:PRINTN;"OBSERVATIONS WERE READ.":GOTO500
300 N=1:OPEN"I",1,ZN:INPUT#1,IT:IFIT<>2GOTO180
310 INPUT#1,X(N),Y(N)
315 IFEOF(1)THEN500ELSEN=N+1:GOTO310
500 IFZR="M"THEN530
510 IFD$="QUARTER"THENM=4ELSEM=12
530 KN=N-M+1:KO=INT(M/2+.5):IFM/2=INT(M/2)KO=KO+1
550 FORJ=1TOKN:FORI=JTOJ+M-1:A(J)=A(J)+Y(I):NEXTI:NEXTJ
554 I=1:IFM/2<>INT(M/2)THEN560ELSEI=2:KN=KN-1
556 FORJ=1TOKN:A(J)=A(J)+A(J+1):NEXTJ
560 FORJ=1TOKN:A(J)=A(J)/M/I:NEXTJ:IFZR="S"THEN700
570 CLS:IFIO=2GOSUB20000
580 L=100*(X(1)-INT(X(1))):J$=D$+STR$(L):IFD$="MONTH"GOSUB25000
585 IFD$="YEAR"J$=D$
590 PRINTM;D$;" MOVING AVERAGE":PRINT" ORIGIN = ";J$;INT(X(1));
595 IFIO=2LPRINTCHR$(29);M;D$;" MOVING AVERAGE":LPRINT" ORIGIN = ";J$;INT(X(1))
596 IFIO=2LPRINT" ":LPRINTSTRING$(60,"-"):LPRINT" "
598 PRINTTAB(38);"HIT @ TO START & STOP"
600 PRINTSTRING$(63,"-"):PRINT:GOSUB40020
```

Time Series Analysis II (continued)

```
610 FORLL=1TOKN:I=LL+KO-1:L=.5+100*(X(I)-INT(X(I))):J$=D$+STR$(L):IFD$="YEAR"J$=D$
612 IFD$="MONTH"GOSUB25000
615 PRINTJ$,INT(X(I)),A(LL):IFIO=2LPRINTJ$,INT(X(I)),A(LL)
620 GOSUB40000:NEXTLL:PRINT:INPUT"(L)IST AGAIN OR (E)ND PROGRAM ";ZI
625 IFZI="E"THEN10000ELSECLS:GOTO580
700 FORLL=1TOKN:I=LL+KO-1:A(LL)=Y(I)/A(LL)*100:NEXTLL
710 FORLL=1TOKN:I=LL+KO-1:L=.5+100*(X(I)-INT(X(I)))
720 QM(L)=QM(L)+A(LL):NN(L)=NN(L)+1:NEXTLL
730 FORJ=1TOM:X=1E35:Y=-1E35:FORI=1TOKN
740 K=I+KO-1:L=.5+100*(X(K)-INT(X(K))):IFL<>J GOTO770
750 IFA(I)>YTHENY=A(I)
760 IFA(I)<XTHENX=A(I)
770 NEXTI:QM(J)=QM(J)-X-Y:NN(J)=NN(J)-2:NEXTJ
780 FORJ=1TOM:IFNN(J)<1THEN9999ELSENEXTJ
790 FORJ=1TOM:QM(J)=QM(J)/NN(J):SM=SM+QM(J):NEXTJ:X=M*100/SM
800 FORJ=1TOM:QM(J)=QM(J)*X:NEXTJ
805 CLS:IFIO=2GOSUB20000
810 PRINTD$;TAB(12);"SEASONAL INDEX","# ";D$;"S USED":PRINTSTRING$(50,"-")
820 IFM=12THEN850ELSEZ(1)="I":Z(2)="II":Z(3)="III":Z(4)="IV"
830 FORL=1TO4:PRINTTAB(3);Z(L),QM(L),NN(L):NEXTL:GOTO900
850 FORL=1TO12:GOSUB25000:PRINTJ$,QM(L),NN(L):NEXTL
900 PRINTSTRING$(50,"-"):IFIO<>2GOTO1000
910 LPRINTD$;TAB(12);"SEASONAL INDEX","# ";D$;"S USED":LPRINTSTRING$(50,"-")
920 IFM=12GOTO950
930 FORL=1TO4:LPRINTTAB(3);Z(L),QM(L),NN(L):NEXTL:GOTO990
950 FORL=1TO12:GOSUB25000:LPRINTJ$,QM(L),NN(L):NEXTL
990 LPRINTSTRING$(50,"-")
1000 INPUT"(N)EW RUN OR (E)ND PROGRAM ";ZI:IFZI="N"THENRUNELSE10000
9999 PRINT"TOO LITTLE DATA FOR SEASONALS."
10000 END
20000 INPUT"TURN ON YOUR PRINTER - HIT ENTER ";ZI:CLS:RETURN
25000 RESTORE:FORK=1TOL:READJ$:NEXTK:RETURN
25100 DATAJAN.  ,FEB.  ,MARCH,APRIL,MAY  ,JUNE ,JULY ,AUG. ,SEPT.,OCT.  ,NOV.  ,DEC.
30000 IFD$="Y"D$="YEAR"
30010 IFD$="Q"D$="QUARTER"
30020 IFD$="M"D$="MONTH"
30030 IFD$="W"D$="WEEK"
30035 IFD$="D"D$="DAY"
30040 RETURN
40000 FORJ=1TO100:C$=INKEY$:IFC$="@"GOTO40020
40010 NEXTJ:RETURN
40020 C$=INKEY$:IFC$="@"THEN40030ELSE40020
40030 RETURN
```

Chi Square Analysis Program Listing

```
100 CLS:PRINT:PRINTTAB(13);"C H I   S Q U A R E    A N A L Y S I S":G$="#.####"
110 A$="#":PRINT:INPUT"HOW MANY ROWS IN CONTINGENCY TABLE (1-8) ";NR
120 B$="#####":PRINT:INPUT"HOW MANY COLUMNS IN CONTINGENCY TABLE (1-8) ";NC
125 C$="####.##":N1=NC:IFNC=1THENN1=2
126 N2=NR:IFNR=1THENN2=2
127 DF=(N1-1)*(N2-1):IFDF=1THENCC=.5
130 PRINT:INPUT"EXPECTED FREQUENCIES CALCULATED BY - (C)OMPUTER OR (U)SER ";E$
140 PRINT:INPUT"DISPLAY RESULTS ON LINE PRINTER - (Y)ES OR (N)O ";P$
150 CLS:PRINT"ENTER THE OBSERVED FREQUENCY FOR CELL:"
160 FORI=1TONR:PRINT:PRINT"ROW";I
170 FORJ=1TONC:PRINT"   COLUMN";J;:INPUTO(I,J)
190 NEXTJ:NEXTI:CLS:IFE$="C"GOTO248
200 PRINT"ENTER THE EXPECTED FREQUENCY FOR CELL:"
210 FORI=1TONR:PRINT:PRINT"ROW";I
220 FORJ=1TONC:PRINT"   COLUMN";J;:INPUTE(I,J)
230 IFE(I,J)<5PRINT"EXPECTED FREQUENCY IN LAST CELL WAS LESS THAN 5."
240 NEXTJ:NEXTI
248 CLS:PRINT"COMPUTER AT WORK - PLEASE BE PATIENT"
250 FORI=1TONR:FORJ=1TONC:RT(I)=RT(I)+O(I,J):NEXTJ:T=T+RT(I):NEXTI
260 FORI=1TONC:FORJ=1TONR:CT(I)=CT(I)+O(J,I):NEXTJ:NEXTI:IFE$="U"GOTO280
262 IFNR>1GOTO266
263 FORI=1TONC:E(1,I)=T/NC:IFE(1,I)<5THENL5=L5+1
264 NEXTI:GOTO280
266 IFNC>1GOTO270
267 FORI=1TONR:E(I,1)=T/NR:IFE(I,1)<5THENL5=L5+1
268 NEXTI:GOTO280
270 FORI=1TONR:FORJ=1TONC:E(I,J)=RT(I)*CT(J)/T
275 IFE(I,J)<5THENL5=L5+1
278 NEXTJ:NEXTI
280 FORI=1TONR:FORJ=1TONC:CS=CS+(O(I,J)-E(I,J)-CC)[2/E(I,J)
290 NEXTJ:NEXTI
300 QT=CS/DF:IFQT=0QX=1:GOTO398
305 IFQT<1GOTO315
310 QS=DF:QR=1000:QZ=QT:GOTO320
315 QS=1000:QR=DF:QZ=1/QT
320 QJ=2/9/QS:QK=2/9/QR
325 QL=ABS((1-QK)*QZ[(1/3)-1+QJ)/SQR(QK*QZ[(2/3)+QJ)
330 IFQR<4GOTO345
335 QX=.5/(1+QL*(.196854+QL*(.115194+QL*(.000344+QL*.019527))))[4
340 GOTO350
345 QL=QL*(1+.08*QL[4/QR[3):GOTO335
350 P=QX:IFQT<1P=1-QX
398 CLS:IFP$="Y"INPUT"TURN ON YOUR PRINTER - HIT ENTER ";Q$:CLS
400 CLS:PRINT:PRINTTAB(14);"C H I   S Q U A R E   R E S U L T S":PRINT
410 PRINT"       NUMBER OF ROWS IN CONTINGENCY TABLE        = ";NR
420 PRINT"       NUMBER OF COLUMNS IN CONTINGENCY TABLE     = ";NC
430 PRINT"       TOTAL NUMBER OF OBSERVATIONS (ALL CELLS)   = ";T
440 PRINT"       NUMBER OF EXPECTED FREQUENCIES LESS THAN 5 = ";L5:PRINT
450 PRINTTAB(15);"CHI SQUARE              = ";CS
460 PRINTTAB(15);"DEGREES OF FREEDOM      = ";DF
470 PRINTTAB(15);"PROBABILITY OF CHANCE =  ";:PRINTUSINGG$;P
```

Chi Square Analysis (continued)

```
480 IFCC=.5PRINT:PRINT"       NOTE: YATES' CORRECTION FOR CONTINUITY WAS APPLIED."
490 IF(PR=0)AND(P$="Y")GOSUB1000
500 PRINT@960,"  (O)BSERVED TABLE, (E)XPECTED TABLE, (C)HI SQUARE RESULTS ";:INPUTD$
510 CLS:IFD$="C"GOTO400
520 IFD$="O"THENJ$="OBSERVED":GOTO620
530 IFD$="E"THENJ$="EXPECTED":GOTO800
540 GOTO500
600 PRINTTAB(10);"CONTINGENCY TABLE - ";J$;" FREQUENCIES":PRINT
605 PRINT"-------------------------------------------------------------------"
610 FORI=1TONC:J=194+7*I:PRINT@J,"C";:PRINTUSINGA$;I;:NEXTI:RETURN
620 GOSUB600:PRINT:FORJ=1TONR:PRINT"  R";:PRINTUSINGA$;J;:PRINT"  ";
630 FORK=1TONC:PRINTUSINGB$;O(J,K);:PRINT"  ";:NEXTK:PRINT:NEXTJ
640 PRINT"-------------------------------------------------------------------":GOTO500
800 GOSUB600:PRINT:FORJ=1TONR:PRINT"  R";:PRINTUSINGA$;J;:PRINT"  ";
830 FORK=1TONC:PRINTUSINGC$;E(J,K);:NEXTK:PRINT:NEXTJ
840 PRINT"-------------------------------------------------------------------":GOTO500
1000 GOSUB2200:GOSUB2100:GOSUB2100
1010 LPRINTCHR$(29);TAB(15);"C H I   S Q U A R E   R E S U L T S":GOSUB2100
1020 LPRINT" ":LPRINT"       NUMBER OF ROWS IN CONTINGENCY TABLE        = ";NR
1030 LPRINT" ":LPRINT"       NUMBER OF COLUMNS IN CONTINGENCY TABLE     = ";NC
1040 LPRINT" ":LPRINT"       TOTAL NUMBER OF OBSERVATIONS (ALL CELLS)   = ";T
1050 LPRINT" ":LPRINT"       NUMBER OF EXPECTED FREQUENCIES LESS THAN 5 = ";L5
1060 GOSUB2100:LPRINTTAB(15);"CHI SQUARE            = ";CS
1070 LPRINT" ":LPRINTTAB(15);"DEGREES OF FREEDOM    = ";DF
1080 LPRINT" ":LPRINTTAB(15);"PROBABILITY OF CHANCE =  ";:LPRINTUSINGG$;P
1090 LPRINT" ":LPRINT" ":IFCC=.5LPRINT"       NOTE: YATES' CORRECTION FOR CONTINUITY WAS APPLIED."
1100 IFCC<>.5LPRINT" "
1110 J$="OBSERVED":LPRINT" "
1120 GOSUB2100:LPRINTTAB(10);"CONTINGENCY TABLE - ";J$;" FREQUENCIES"
1130 LPRINT"-------------------------------------------------------------------"
1140 FORI=1TONC:LPRINTTAB(2+7*I);"C";:LPRINTUSINGA$;I;:NEXTI:IFPR=999GOTO1200
1150 PR=999:LPRINT" ":FORJ=1TONR:LPRINT"  R";:LPRINTUSINGA$;J;:LPRINT"  ";
1160 FORK=1TONC:LPRINTUSINGB$;O(J,K);:LPRINT"  ";:NEXTK:LPRINT" ":NEXTJ
1170 LPRINT"-------------------------------------------------------------------"
1180 LPRINT" ":J$="EXPECTED":GOTO1120
1200 LPRINT" ":FORJ=1TONR:LPRINT"  R";:LPRINTUSINGA$;J;:LPRINT"  ";
1210 FORK=1TONC:LPRINTUSINGC$;E(J,K);:NEXTK:LPRINT" ":NEXTJ
1220 LPRINT"-------------------------------------------------------------------"
1225 K=(8-NR)*2:IFK>0FORI=1TOK:LPRINT" ":NEXTI
1230 GOSUB2100:LPRINT" ":GOSUB2200:GOTO500
2100 FORL=1TO3:LPRINT" ":NEXTL:RETURN
2200 FORL=1TO13:LPRINT"*****";:NEXTL:LPRINT" ":RETURN
```

Addendum

The Analysis of Variance program contains an error which causes a "1" to be printed in place of the total degrees of freedom in the summary table. All other displayed items, including the between group and within group degrees of freedom, are correct.

To correct the error, lines 1Ø5Ø and 1Ø3ØØ in the Analysis of Variance program must be changed as follows (see program listing on page 154):

(Wrong) `1050 K=1:PRINT" TOTAL",CSNG(V2),K`

(Right) `1050 PRINT" TOTAL",CSNG(V2),NT-1`

(Wrong) `10300 LPRINT" ":K=1:LPRINT" TOTAL",CSNG(V2),K`

(Right) `10300 LPRINT" ":LPRINT" TOTAL",CSNG(V2),NT-1`

The total degrees of freedom illustrated in the Sample Run (page 66) should have been 11 while the total degrees of freedom on the Sample Program Printout (page 126) should have been 2Ø.

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