

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE



Introduction

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE is the latest addition to the Tektronix family of statistical software packages. Its 17 interactive programs cover many aspects of analysis of variance (ANOVA) using both conventional and state-of-the-art methodologies.

The programs are arranged in menu form (see Figure 1) in such a way that program selection follows the natural flow of analysis as it progresses from data-entry to exploratory plotting to actual ANOVA of one-, two-, and three-way designs.

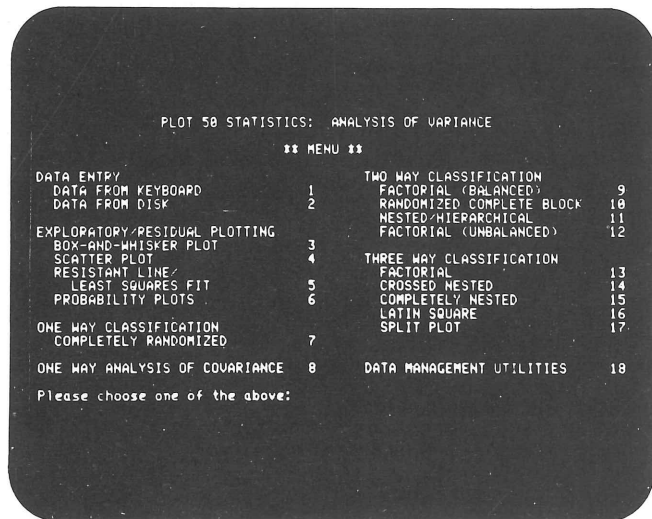


Figure 1. The Program Menu.

The program's English language messages are easy to read and easy to understand. This makes learning easy. You'll find yourself generating highly productive results in less than an hour after you first start using the programs.

Many of the programs have sub-menus and options. These provide different tools for handling various kinds of applications.

Besides the programs, PLOT 50 STATISTICS: ANALYSIS OF VARIANCE also assigns special functions to 18 of the 4050 Series desktop computer's user-definable keys giving you an extra degree of program control. (See Figure 2.)

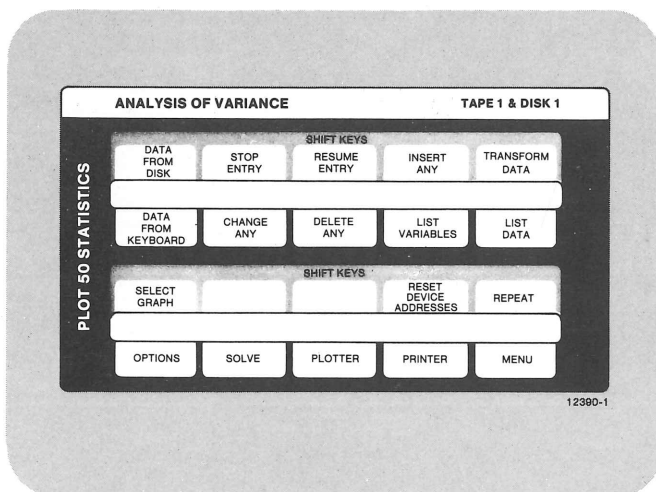


Figure 2. The Functions.

There is also a set of file handling routines available through Program 18 Data Management Utilities (see Figure 3). These are provided to meet all your data manipulation needs.

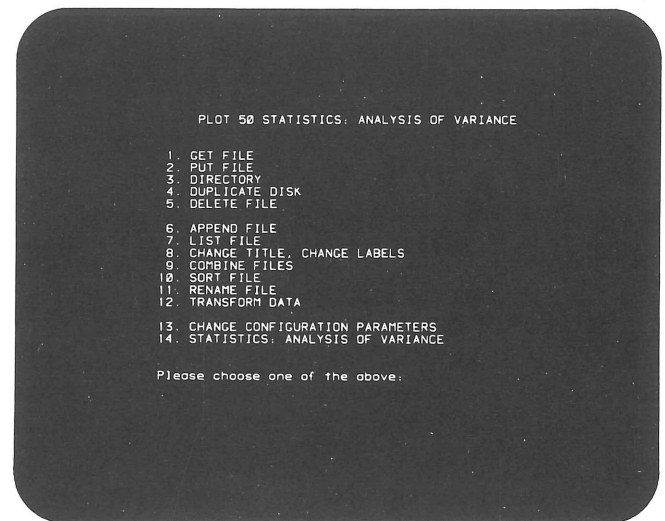


Figure 3. The Data Management Utilities.

Data Entry Programs

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE has two data entry programs. The first, DATA FROM KEYBOARD, lets you create a data file by typing it into the 4050 Series desktop computer keyboard. The second, DATA FROM DISK, lets you recall a data file previously stored on disk.

A data file contains file labeling information and data. The file labeling information includes such things as file name, data title, variable labels, and observation labels. The data is put into an O x V matrix where O is the number of observations (rows of the matrix) and V is the number of variables (columns). You can enter up to 100 variables per data file. The number of observations you enter is limited only by how much space is left on the disk.

You may enter the data one observation (row) at a time, or for convenience in ANOVA applications, you can enter it cell by cell, and the program will generate the necessary factor codes for you.

After entering the data, it is automatically stored on disk as a PLOT 50 Standard File. This means it can be used with other PLOT 50 Standard File compatible packages such as PLOT 50 Easy Graphing, PLOT 50 Business Planning and Analysis Volume 2, PLOT 50 Statistics: Tests and Distributions, PLOT 50 Statistics: Multiple Linear Regression, PLOT 50 Statistics: Nonlinear Estimation or PLOT 50 Modeling and Reporting.

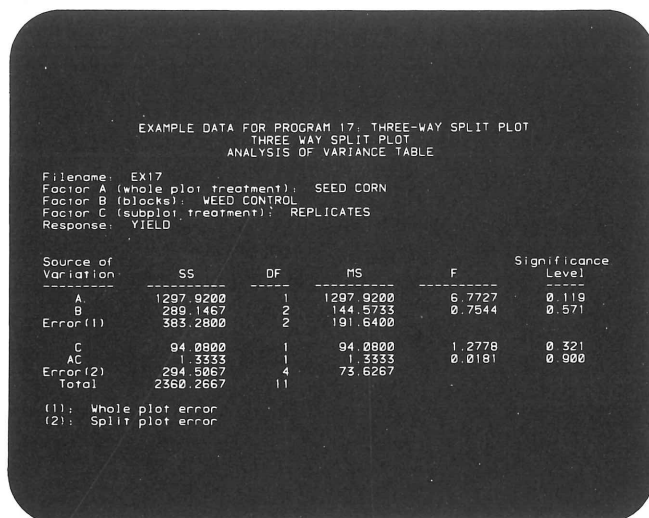


Figure 12. Output from Program 17.

ANOVA Program Options

Many of the ANOVA programs have options which help you do some or all of the following:

1. Print one-way (level) means (see Figure 13).
2. Print two-way means.
3. Print three-way means.
4. Plot one-way means (see Figure 14).
5. Plot two-way means (see Figures 15 and 16).
6. Print contrasts.
7. List fitted values and residuals.
8. Save fitted values and residuals.
9. Print ANOVA table.

These options are available during the analysis by pressing OPTIONS on the user-definable keys. (See Figure 2).

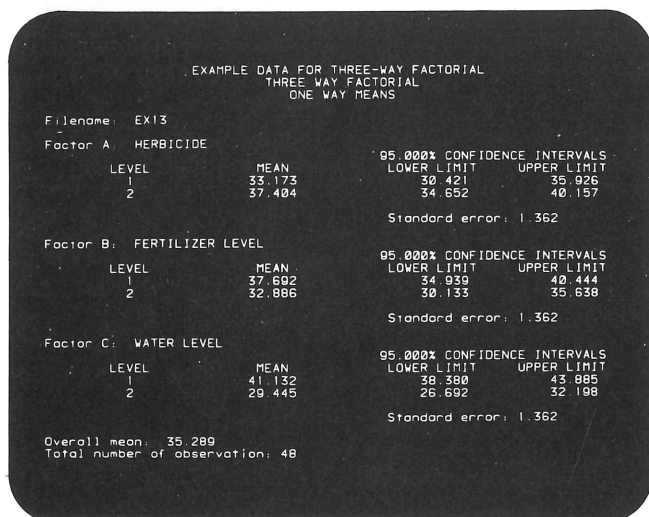


Figure 13. One-Way Means.

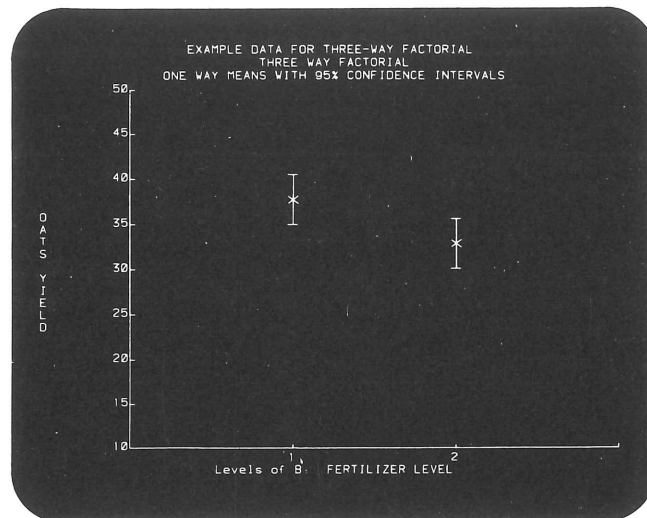


Figure 14. Confidence Intervals for One-Way Means.

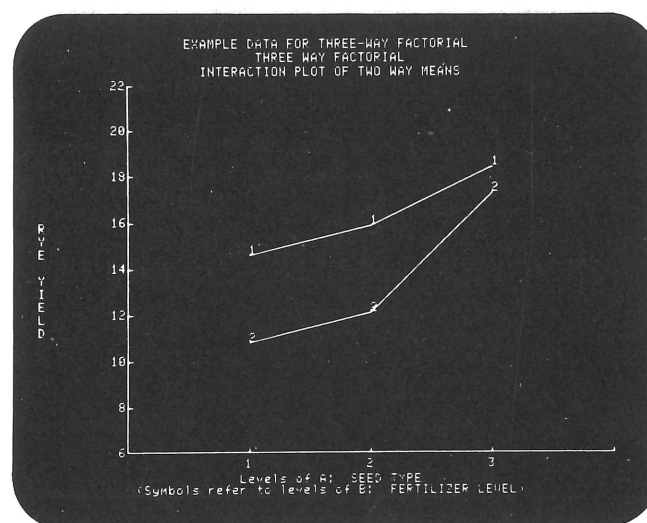


Figure 15. Interaction Plot for Two-Way Means.

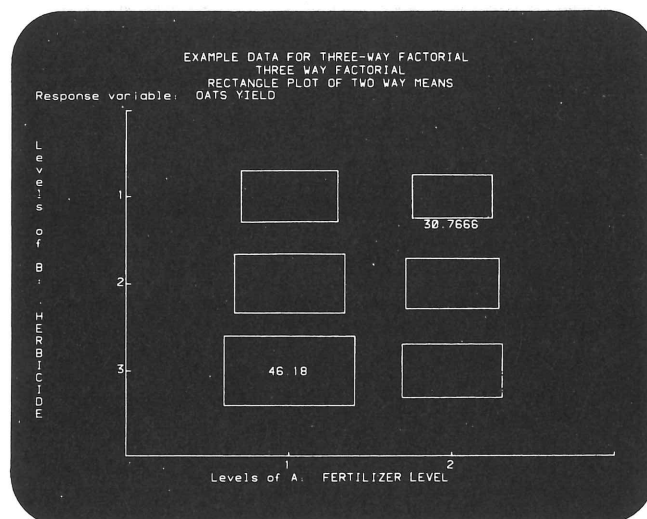


Figure 16. Rectangular Plot of Two-Way Means.

Data Management Utilities

Program 18 DATA MANAGEMENT UTILITIES offers 14 file handling programs that let you:

1. GET FILES from another disk or tape.
2. PUT FILES on another disk or tape.
3. Display a DIRECTORY of a disk or tape.
4. DUPLICATE the system or data disk.
5. DELETE a file from the disk.
6. APPEND one data file to another.
7. LIST the contents of a data file.
8. CHANGE the TITLE or LABELS of a data file.
9. COMBINE variables from two data files.
10. SORT a file into ascending or descending order.
11. RENAME a data file.
12. TRANSFORM data within a data file using one of 24 mathematical transformations.
13. CHANGE peripheral DEVICE ADDRESSES.
14. LIST the ANOVA program menu.

The TRANSFORM DATA utility offers 24 mathematical operations (see Figure 17). Two of these you can define yourself.

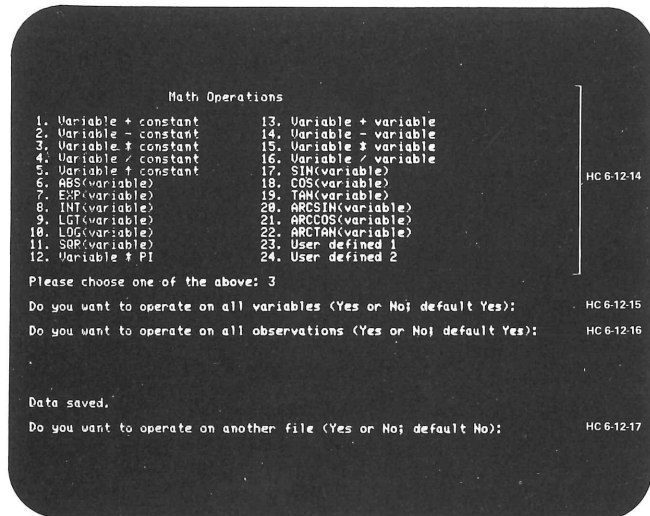


Figure 17. Mathematical Transformation.

General Information

Memory Requirements:

32K bytes

Equipment Requirements:

4050 Series desktop computer
4907 File Manager
4907 File Manager ROM Pack

Optional Equipment:

4631 Hard Copy Unit
4662 and 4662 Option 31 Interactive Digital Plotters
4663 Interactive Digital Plotters
4643 Matrix Printer
4050 Series Option 10 RS-232 Interface ROM Pack

Order Information:

PLOT 50 4050D03 STATISTICS: ANALYSIS OF VARIANCE

Standard Accessories:

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE comes complete with a tape cartridge for initializing the system, a disk for data storage, an overlay for the function keys, and a User's Manual.

Service Policy:

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE is support Category B software, and subject to services stipulated on the Tektronix Software Support Categories Addendum.

For further information, contact:

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Exploratory and Residual Analysis

PLOT 50 STATISTICS: ANALYSIS OF VARIANCE provides four exploratory and residual analysis programs. These are programs 3, 4, 5, and 6. Run Program 3 BOX-AND-WHISKER PLOT to display boxplots of up to 8 variables or 8 factor levels. Boxplots show how the data is distributed. See Figure 4.

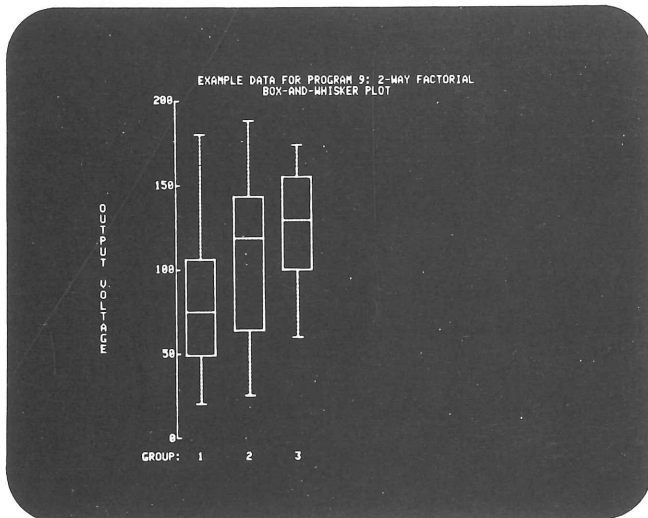


Figure 4. Boxplots.

Run Program 4 SCATTER PLOT to plot any two variables against each other. You can label points on the graph, giving you a means of flagging special data points such as maxima, minima, or outliers. For example, plot residuals against sales. See Figure 5.

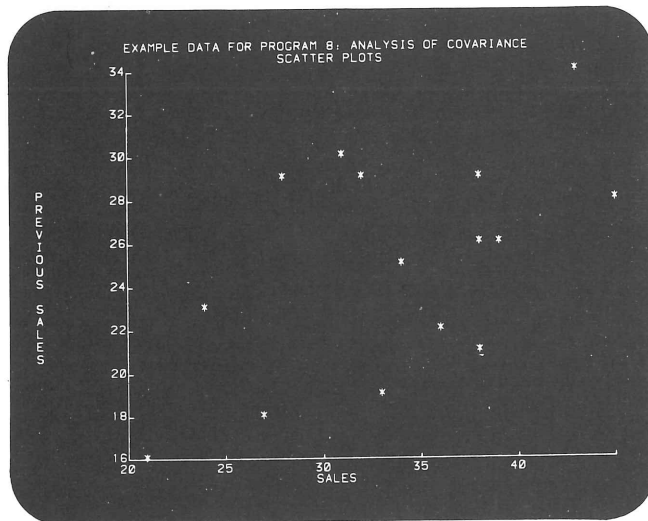


Figure 5. Scatter Plot.

Run Program 5 RESISTANT LINE/LEAST SQUARES FIT to fit a line through a scatter plot of two variables. The line can be fitted using a least-squares or resistant line. See Figure 6.

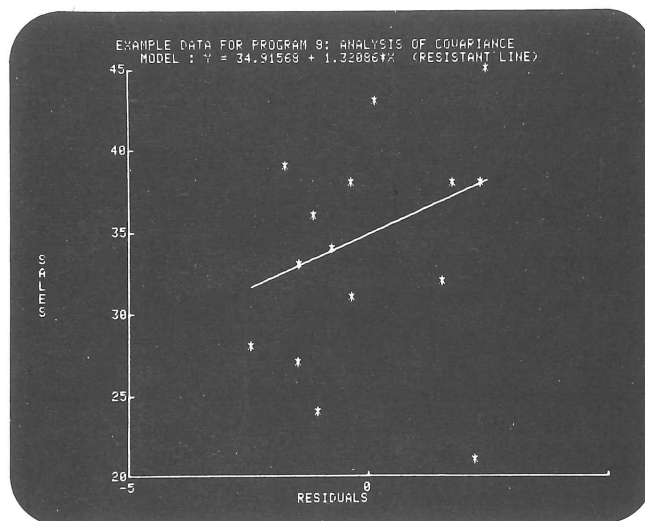


Figure 6. Resistant Line Fit.

Run Program 6 PROBABILITY PLOTS to display the probability plot of a variable, especially residuals. You choose either a normal or log-normal 'paper.' See Figure 7.

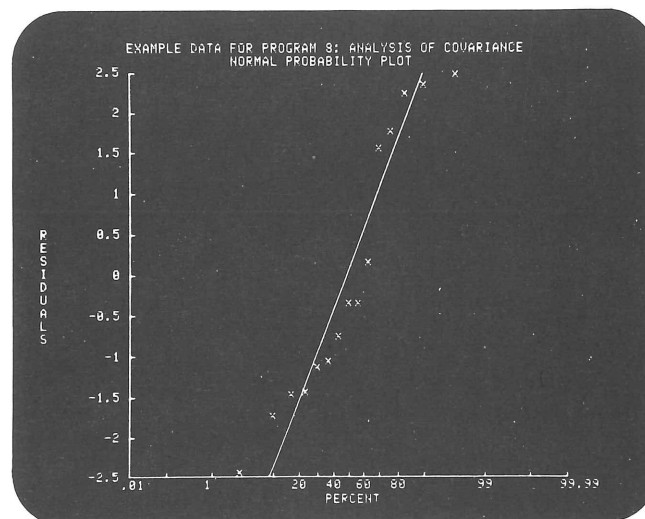


Figure 7. Normal Probability Plot.

ANOVA Programs

Run Program 7 ONE WAY COMPLETELY RANDOMIZED to perform ANOVA on a completely randomized design having one factor. See Figure 8.

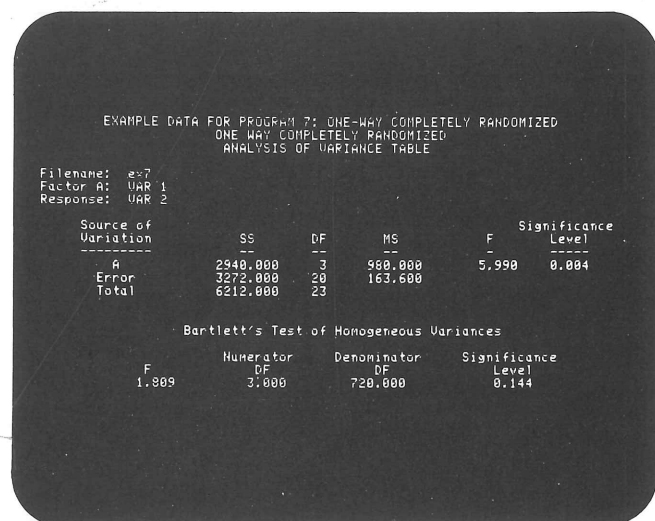


Figure 8. Output from Program 7.

Run Program 8 ONE WAY ANALYSIS OF COVARIANCE to perform analysis of covariance on a design having one factor with one covariate. See Figures 9 and 10.

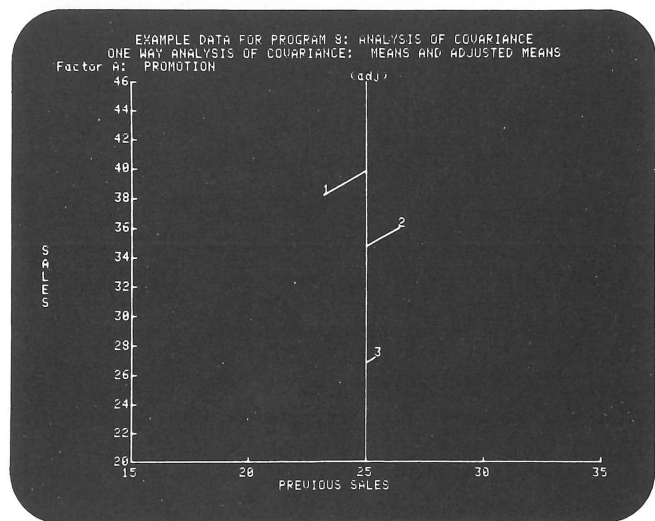


Figure 9. Output from Program 8.

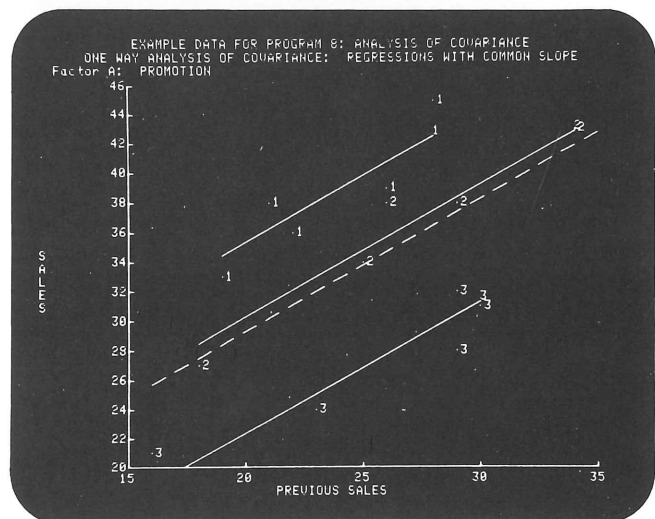


Figure 10. Optional Output from Program 8.

Run Program 9 TWO-WAY FACTORIAL (BALANCED) to perform ANOVA on a full two-way classification having the same number of observations in each cell.

Run Program 10 TWO-WAY RANDOMIZED COMPLETE BLOCK to perform ANOVA on a randomized complete block.

Run Program 11 TWO-WAY NESTED/HIERARCHICAL to perform ANOVA on a design having one factor nested in another.

Run Program 12 TWO-WAY FACTORIAL (UNBALANCED) to perform ANOVA for a full two-way classification having a different number of observations in each cell.

Run Program 13 THREE-WAY FACTORIAL to perform ANOVA for a full three-way classification having an equal number of observations in each cell. See Figure 11.

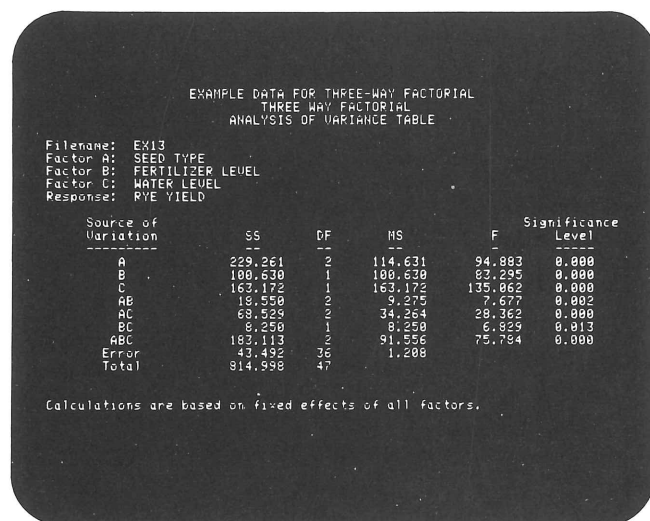


Figure 11. Output from Program 13.

Run Program 14 THREE-WAY CROSSED NESTED to perform ANOVA for a partially hierarchical design having one factor nested under another and the third factor crossed.

Run Program 15 THREE-WAY COMPLETELY NESTED to perform ANOVA for a design having one factor nested in another which is nested in still another.

Run Program 16 LATIN SQUARE to perform ANOVA for a Latin Square design where the effects of two factors are removable.

Run Program 17 THREE-WAY SPLIT PLOT to perform ANOVA for a split plot having a randomized complete block design for the whole plot. See Figure 12.

EXAMPLE DATA FOR PROGRAM 17: THREE-WAY SPLIT PLOT
THREE WAY SPLIT PLOT
ANALYSIS OF VARIANCE TABLE

Filename: EX17
Factor A (whole plot treatment): SEED CORN
Factor B (blocks): WEED CONTROL
Factor C (subplot treatment): REPLICATES
Response: YIELD

Source of Variation	SS	DF	MS	F	Significance Level
A	1297.9200	1	1297.9200	6.7727	0.0119
B	289.1467	2	144.5733	0.7544	0.571
Error (1)	383.2800	2	191.6400		
C	94.0800	1	94.0800	1.2778	0.321
AC	1.3333	1	1.3333	0.0181	0.900
Error (2)	294.5867	4	73.6267		
Total	2360.2667	11			

(1): Whole plot error
(2): Split plot error

Figure 12. Output from Program 17.

ANOVA Program Options

Many of the ANOVA programs have options which help you do some or all of the following:

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2. Print two-way means.
3. Print three-way means.
4. Plot one-way means (see Figure 14).
5. Plot two-way means (see Figures 15 and 16).
6. Print contrasts.
7. List fitted values and residuals.
8. Save fitted values and residuals.
9. Print ANOVA table.

These options are available during the analysis by pressing OPTIONS on the user-definable keys. (See Figure 2).

EXAMPLE DATA FOR THREE-WAY FACTORIAL
THREE WAY FACTORIAL
ONE WAY MEANS

Filename: EX13

Factor A: HERBICIDE

LEVEL	MEAN	95.000% CONFIDENCE INTERVALS
1	33.173	LOWER LIMIT: 30.421, UPPER LIMIT: 35.926
2	37.404	LOWER LIMIT: 34.652, UPPER LIMIT: 40.157

Standard error: 1.362

Factor B: FERTILIZER LEVEL

LEVEL	MEAN	95.000% CONFIDENCE INTERVALS
1	37.692	LOWER LIMIT: 34.939, UPPER LIMIT: 40.444
2	32.886	LOWER LIMIT: 30.133, UPPER LIMIT: 35.638

Standard error: 1.362

Factor C: WATER LEVEL

LEVEL	MEAN	95.000% CONFIDENCE INTERVALS
1	41.132	LOWER LIMIT: 38.380, UPPER LIMIT: 43.885
2	29.445	LOWER LIMIT: 26.692, UPPER LIMIT: 32.198

Standard error: 1.362

Overall mean: 35.289
Total number of observation: 48

Figure 13. One-Way Means.

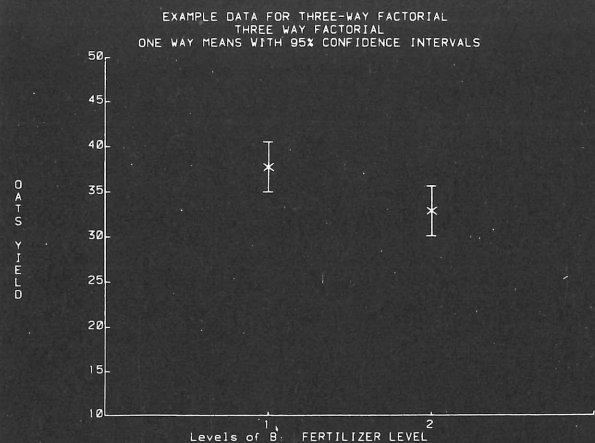


Figure 14. Confidence Intervals for One-Way Means.

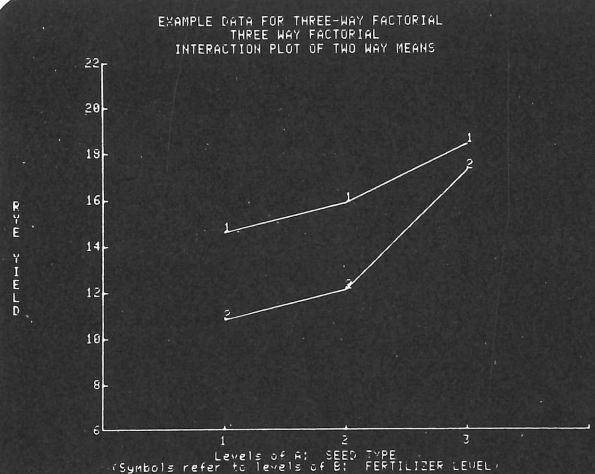


Figure 15. Interaction Plot for Two-Way Means.

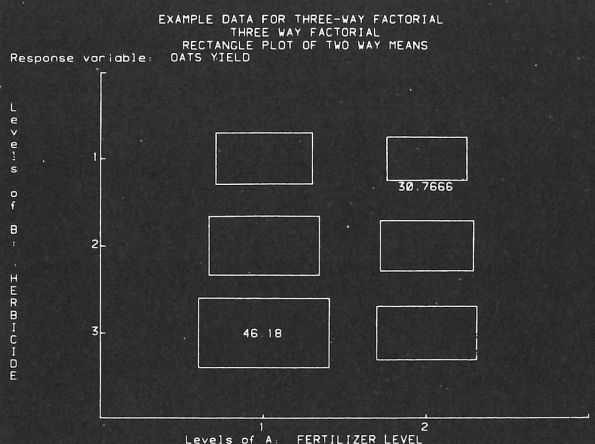


Figure 16. Rectangular Plot of Two-Way Means.