More statistical programs for Commodore computers

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In a previous article, Pittenger and Hodge (1986) presented a comprehensive package of statistical software for Commodore computers. In the present paper, several revisions and additions are described that enhance the overall utility of the package.

Overview

The programs are written in BASIC to operate on the Commodore family of computers, including the PET/CBM 4032 and 8032, the C-64, and the C-128. The programs are stored on a disk that is read/write compatible with Commodore 4040, 2031, 1541, and 1571 disk drives. Most of the programs also require a printer.

The Appendix summarizes the major features and analytical options of the package. A description of the revisions and additions is given below. An important component is Data Manager, a utility program that creates, edits, and stores on disk the data files used with the majority of the computational programs. Although the amount of memory in these Commodore machines is less than in other popular computers, it is sufficient for the analysis of typical data sets.

We have attempted to maximize computational accuracy by the use of updating routines (Lachenbruch, 1983) and other algorithms that minimize rounding errors.

Revisions and New Procedures

Correlation/Regression. Two revisions have been made in this program, described in Pittenger and Hodge (1986). First, we divided the routines into separate parts to obtain more efficient use of computer memory. The Correlation program calculates all possible Pearson correlation coefficients (r) and reports with each coefficient the t ratio and degrees of freedom. The program will also print the mean, standard deviation, sum of scores, and sum of squared scores for each variable. The correlation matrix is saved on disk for use with the Regression program. The Regression program calculates bivariate and multiple linear regression equations. The user must identify the dependent variable and any number of independent variables. The printout includes an estimate of the intercept, the beta weights of each independent variable, R^2 , and an analysis of variance of the regression model.

Second, we increased computational accuracy by using z scores to calculate the correlation coefficients. Testing the programs with Longley's (1967) data, we found that all correlation and regression coefficients were error free relative to Longley's computations.

Significance Tester. This program now evaluates the significance of a difference between two independent Pearson correlation coefficients, an observed and population proportion, and two observed proportions.

Multiple Comparisons. This program now includes the Fisher LSD procedure. As with the orthogonal comparisons test, the user may specify the probability level (.05 to .005) at which the compared means are to be tested.

One- and Two-Sample Comparisons. This is a new program that contains five separate routines: t test of an observed mean against a population mean, t test of two independent means, t test of two related groups, Mann-Whitney U test, and Wilcoxon sign test. The program calculates and prints the mean for parametric tests and the median for nonparametric tests, the standard deviation of each group, the value of the test statistic, and the degrees of freedom. The Behrens-Fisher t is also reported when t test for independent groups is selected. The correlation between groups is included with the t test of related means. Both the Mann-Whitney and the Wilcoxon tests are corrected for ties within the data, and when sample sizes are sufficiently large, a z score approximation is given.

Contingency Table Analysis. This new option has two analytical routines. One evaluates 2×2 (fourfold) tables, and the other analyzes contingency tables with R rows and C columns. Both programs have their own data entry and editing routines. The four-fold program prints the Fisher exact test and chi-square, coefficient kappa (Cohen, 1960), coefficient phi, and effective percent agreement and disagreement (Hartman, 1977). The $R \times C$ table analysis reports the three lambda coefficients (Goodman & Kruskal, 1954; Hartwig, 1973), chi-square and the corrected contingency coefficient (Sachs, 1984), and the coefficient kappa.

Matrix Algebra. The matrix algebra program is another stand-alone program that performs common matrix algebra operations, including matrix and scalar addition, subtraction, and multiplication; matrix transposition and inversion; and calculation of the determinant.

Documentation and Availability

In a comprehensive manual for the package, a separate section describes the purpose, capabilities and limitations, and step-by-step use of each program. A copy of the disk and manual may be obtained by sending a check or money order for \$15 (\$20 U.S. money order for foreign requests) to either author (payable to Psi Chi, UGA Chapter).

Requests for reprints and copies of the program disk and user manual may be sent to either author, Department of Psychology, University of Georgia, Athens, GA 30602.

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APPENDIX

Primary Features of the Commodore Statistics Package*

General Features

Hardware	
Commodore 4032, 8032, 64, 128	
RAM	32-64K
Printer	Yes
Cost	\$15
Menus	Yes
Copy Protected	No
List Protected	No
Language	BASIC
	Compiled BASIC
Manual	Yes
Overall Error Trapping	Yes

Statistics

Descriptive Statistics	
Number of Observations	See Text
Arithmetic Mean	Yes
Harmonic Mean	Yes
Geometric Mean	Yes
Median	Yes
Mode	Yes
Variance	Yes
Standard Deviation	Yes
Standard Error of Mean	Yes

Range	Yes
Quartiles and Quartile Range	Yes
Coefficient of Variation	Yes
Skewness and Kurtosis	Yes
Frequency Distribution	Yes
Correlation	
Pearson <i>r</i>	Yes
Spearman rho	No
Accuracy	See Text
Multiple Linear Regression	Yes
Simple Comparisons	
<i>t</i> Test	Yes
Independent Groups	Yes
Behrens-Fisher Test	Yes
Dependent Groups	Yes
Mann-Whitney <i>U</i>	Yes
Wilcoxon	Yes
Analysis of Variance	
Independent Variables	9
Repeated Measures	Yes
Epsilon Correction	Yes
Multiple Comparisons	
Orthogonal Comparisons	Yes
Fisher LSD	Yes
Tukey HSD	Yes
Contingency Table Analysis	
Chi-Squared	Yes
Fisher Exact Test	Yes
Coefficient Kappa	Yes
Lambda Coefficients	Yes
Coefficient Phi	Yes
Matrix Algebra	
Common Operations	Extensive

Other Features

Graphics	
Scattergram	No
Histogram	No
Data Input	
Disk Files	Yes
Specific to Package	Yes
Compatible Across Routines	Yes
Error Trapping	Yes
Data Editing	
Onscreen	Yes
Groups Numbered	Yes
Transforming Variables	Extensive

*Characteristics based on Butler and Jones (1987).

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