COMPARISONS AND NOTES ON STATISTICS
PROGRAM PACKAGES FOR APPLE, TRS-80, AND CP/M
MICROCOMPUTERS

by

Robert D. Stevens and Valerie Auserehl Kelly

Contents

I. Introduction

II. Comparisons of Statistics Program Packages
   A. Objectives of Comparisons
   B. System Requirements
   C. Range of Statistics Routines
   D. Comparison of Selected Routines
      1. Descriptive Statistics
      2. Frequencies
      3. Cross tabs
      4. ANOVA
      5. Regression
   E. Data Management Capabilities
   F. General Summary Comments

III. Outline of Detailed Program Documentation Contained in Staff Paper 82-23
   A. A-STAT
   B. Apple Interactive Data Analysis (AIDA)
   C. Econometric Linear Forecasting (ELF)
   D. MICROSTAT
   E. STAT PAC
   F. STAT-PRO
   G. STATISTICAL PROCESSING SYSTEM (S.P.S.)
IV. List of Microcomputer Statistics Packages.
   A. More Comprehensive Packages
   B. Less Comprehensive Packages
   C. Specialized Application Packages

V. Related Papers

VI. Recommended Reading
I. Introduction

The advent of a large number of microcomputers in the last three years has led to numerous efforts to produce computer programs to capitalize on the potential of these machines. Statistics program packages are of particular interest to professionals in many fields.

This short paper presents an outline of the more detailed information about microcomputer statistics packages for the TRS-80, Apple II, and CP/M operating systems which is contained in Staff Paper 82-23. In Section II, we compare a number of microcomputer packages with respect to system requirements and range of statistical routines. We also compare the microcomputer packages to each other and to SPSS with respect to five selected statistical routines. A comparison of data management capabilities and a summary of special attributes ends the comparisons.

Section III provides a one to two page summary of information contained in Staff Paper 82-23 for each package compared in Section II and for a few additional packages which we consider promising. These latter packages were not included in Section II due to inadequate information. Sample printouts and extracts from manuals are not included here, but may be found in Staff Paper 82-23.

Section IV contains a list of all statistics packages identified to date. The list is presented using three groupings: 1) more comprehensive packages, 2) less comprehensive packages and 3) specialized applications. The list is, in effect, the table of contents to an annotated "diskography" of statistics packages found in Staff Paper 82-23.
Computer journals and personal contacts were used to attempt an up-to-date list of statistics program packages. The focus of the search was on relatively comprehensive packages of integrated statistics programs. No attempt was made to identify the many single purpose limited programs, some of which are in the public domain and may be obtained at no cost through computer clubs.

II. Comparisons of Statistics Program Packages

The comparison of statistics packages which follows is presented with the following objectives in mind:

1) to illustrate how the microcomputer system requirements (hardware configurations) differ from one statistical package to another (Table I),

2) to illustrate the range of statistical routines contained in microcomputer packages and the variability of routines included from one package to another (Table II),

3) to illustrate the variability of statistics packages, both mainframe and microcomputer, vis a vis 5 selected statistical routines (descriptive statistics, frequencies, crosstabs, ANOVA, and regression). (Tables III-VII),

4) to illustrate the variability of data management capabilities among selected microcomputer statistical packages (Table VIII),

5) to offer a format for others to use when attempting to evaluate packages or routines which are not covered in this paper.

Tables I and II are self-explanatory. Tables III - VII describe the contents of the mainframe package SPSS and five microcomputer packages. The table format allows the reader to easily compare the packages and
identify those which provide features most appropriate to particular applications. We have not presented any evaluation of the packages described. During the course of our study, it became evident that, given the current state of the art, a microcomputer package is best selected with a particular application in mind and a careful analysis of whether or not a given package can perform all the desired functions.

The following comparative tables on selected statistics packages are based on our access to the sources of information summarized below:

<table>
<thead>
<tr>
<th>NAME OF PACKAGE</th>
<th>SOURCES OF INFORMATION USED IN COMPARISONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PROGRAM: MANUAL: CURRENT USERS</td>
</tr>
<tr>
<td></td>
<td>VERSION USED: VERSION USED: VERSION USED</td>
</tr>
<tr>
<td>SPSS</td>
<td>MSU MAINFRAME: SECOND EDITION: Stevens/Kelley</td>
</tr>
<tr>
<td></td>
<td>VERSION 79.6, 1981: VERSION 79.6, 1981: Ag. Economics - MSU</td>
</tr>
<tr>
<td>CATING (ELF)</td>
<td>STATISTICAL PROCESSING SYSTEM (SPS): Geoff Remes</td>
</tr>
<tr>
<td>MICRO-STAT</td>
<td>RELEASE 1.0, &amp; PARTS of 2: Leighton Price</td>
</tr>
<tr>
<td></td>
<td>1980: Lifelong Education - MSU</td>
</tr>
<tr>
<td>STAT PAC</td>
<td>NOT AVAILABLE: 1981: Len Malczynski</td>
</tr>
<tr>
<td></td>
<td>Ag. Economics - Purdue</td>
</tr>
</tbody>
</table>
### TABLE I

**SYSTEM REQUIREMENTS**

<table>
<thead>
<tr>
<th>Package Name</th>
<th>SPSS</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO-STAT</th>
<th>SPS</th>
<th>STAT-PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package Price</td>
<td>--</td>
<td>$145</td>
<td>$200</td>
<td>.</td>
<td>.</td>
<td>$285</td>
</tr>
</tbody>
</table>

#### REQUIREMENTS

<table>
<thead>
<tr>
<th>Type of Computer</th>
<th>MAINFRAME</th>
<th>APPLE II+</th>
<th>APPLE II+</th>
<th>VARIABLE</th>
<th>TRS-80 II $^1$</th>
<th>TRS-80 I/III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Operating System</td>
<td>DOS</td>
<td>DOS</td>
<td>CP/M</td>
<td>TRSDOS</td>
<td>I: NEWDOS</td>
<td>III: TRSDOS</td>
</tr>
<tr>
<td>Language Used</td>
<td>APPLESOF</td>
<td>APPLESOF</td>
<td>BASIC-80 $^2$</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Memory (RAM) Required</td>
<td>48K</td>
<td>48K</td>
<td>48K</td>
<td>48K</td>
<td>48K</td>
<td>48K</td>
</tr>
<tr>
<td>DISK DRIVE(S) (5-1/4&quot;)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>RECOMMENDED</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Printer</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Parallel or</td>
<td>RS-232</td>
</tr>
</tbody>
</table>

$^1$ Also available for Model I.

$^2$ Available in 3 versions of CP/M basics

$^3$ One 8" disk drive would also be sufficient in lieu of 2 5-1/4" drives.
It should be noted that selection of packages compared in this section was determined by our access to user manuals. We originally attempted to include other promising packages (STAT-PRO, AIDA, SPM) for which we had obtained fairly detailed program descriptions from software distributors. This plan was abandoned, however, when it became obvious that comparisons based on these non-equivalent information bases risked being more misleading than helpful. Although we believe that the packages compared are representative of the better ones available, the reader is encouraged to refer to section III of this paper and to sections III and IV of Staff-Paper 82-23 for information collected on the numerous packages not included in this comparison. (These packages are listed in Section IV of this paper.)

In making our comparisons, we decided to give a package credit for a particular routine or characteristic only if the manual explicitly told the user how to perform the task. This decision will perhaps mask the potential of some programs in the hands of seasoned statisticians and microcomputer users, however, it will protect the average user from being misled about what he or she will be able to do with a package.
<table>
<thead>
<tr>
<th>PACKAGE NAME</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO-STAT</th>
<th>SPS</th>
<th>STAT-PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF ROUTINE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESCRIPTIVE STATISTICS</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>FREQUENCIES</td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>PROBABILITIES</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>HYPOTHESIS TESTING (T-TEST)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportions</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CROSSTABS/CONTINGENCY TABLES</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CORRELATION ANALYSIS</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>REGRESSION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MULTIPLE REGRESSION(^1)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y(^2)</td>
<td>Y</td>
</tr>
<tr>
<td>STEPWISE</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>PATH ANALYSIS</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N-WAY LEAST SQUARES</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>ANALYSIS OF VARIANCE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONE WAY</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>TWO WAY</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANDOMIZED BLOCK</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>DISCRIMINANT ANALYSIS</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>IMAGE ANALYSIS (GUTTMAN)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>FACTOR ANALYSIS</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>PRINCIPAL COMPONENT ANALYSIS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>COMBINATIONS, PERMUTATIONS, FACTORIALS</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>TIME SERIES</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SCATTERGRAM</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>GENERATION OF MONTE CARLO DATA SETS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>TOTAL 'YES'</td>
<td>7</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL 'NO'</td>
<td>14</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

\(^1\)All packages with multiple regression also do simple regressions.

\(^2\)SPS has 3 regression modules including a General Linear Models module which provides much more extensive output vis a vis test and checks than other packages.
### TABLE III

DESCRIPTIVE STATISTICS

<table>
<thead>
<tr>
<th>PACKAGE NAME</th>
<th>SPSS</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO-STAT</th>
<th>SPS</th>
<th>STAT - PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONDESCRIPTIVE</td>
<td>DATA/DES.</td>
<td>STAT</td>
<td>DES. STAT</td>
<td>DES. STAT</td>
<td>DES. STAT</td>
</tr>
<tr>
<td><strong>CAPABILITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SELECT CERTAIN VARIABLES ONLY</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>OUTPUT TO PERMANENT FILE</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Z SCORE TRANSFORMATIONS TO PERM. FILE</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NUMBER VALID CASES READ</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NUMBER MISSING VALUES</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>NUMBER RECORDS READ</td>
<td>N</td>
<td>N</td>
<td>Y³</td>
<td>Y</td>
<td>Y³</td>
<td>Y</td>
</tr>
<tr>
<td>RESPONSE PERCENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STATISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN/MAX</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>RANGE</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>SUM</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MEAN (ARITHMETIC)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>MEDIAN</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>MODE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SUM OF SQUARES</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>VALUES</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>DEVIATIONS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>VARIANCE</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>STANDARD DEVIATION</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>STANDARD ERROR</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>SKEWNESS</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>KURTOSIS</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CONFIDENCE INTERVALS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>TOTAL 'YES'</strong></td>
<td>14</td>
<td>6</td>
<td>11</td>
<td>10</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td><strong>TOTAL 'NO'</strong></td>
<td>6</td>
<td>14</td>
<td>9</td>
<td>10</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL 'UNCERTAIN'</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

---

1. BLANKS REPRESENT UNCERTAINTY DUE TO LACK OF INFORMATION ON THIS AND FOLLOWING TABLES.

2. LACK OF THIS OPTION MEANS YOU GET ALL STATISTICS FOR ALL VARIABLES INCLUDING SUCH VARIABLES AS ID NUMBER TIME CONSUMING AND REQUIRES EDITING OF PRINT-OUT.

3. THE MANUAL FOR ELF SAYS "NUMBER OF OBSERVATIONS IN THE FILE:" FOR SPS MANUAL SAYS N= ; WHILE NOT ENTIRELY CLEAR, WE ARE ASSUMING THAT THE PROGRAMS HAVE NOT MADE CORRECTIONS FOR MISSING DATA VALUES.
### TABLE IV

**FREQUENCIES**

<table>
<thead>
<tr>
<th>PACKAGE NAME</th>
<th>SPSS</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO-</th>
<th>SPSS</th>
<th>STAT-PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODULE NAME</td>
<td>FREQ.</td>
<td>FREQ.</td>
<td>TABLES</td>
<td>FREQ.</td>
<td>HISTOGRAM &amp; FREQ.</td>
</tr>
<tr>
<td>CAPABILITIES</td>
<td>SELECT CERTAIN VARIABLES ONLY</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>OUTPUT TO PERMANENT FILE</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>NUMBER OF VALID CASES READ</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>NUMBER OF MISSING VALUES</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>NUMBER OF RECORDS READ</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>RESPONSE PERCENT</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>STATISTICS</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>NOMINAL DISTRIBUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ABSOLUTE FREQUENCY</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>RELATIVE FREQUENCY</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>ADJUSTED REL. FREQ. (FOR MISSING VALUES)</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>CUMULATIVE PERCENT</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>CUMULATIVE ABSOLUTE FREQUENCY</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>HISTOGRAM</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>RELATIVE (PERCENT)</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>ABSOLUTE (COUNT)</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>DATA RESTRICTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NO LIMIT ON NUMBER OF VALUE CODES</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>COMPUTES FRACTIONAL VALUE CODES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IGNORS MISSING VALUES</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>IF SPECIFIED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GROUPED DISTRIBUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ABSOLUTE FREQUENCY</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>RELATIVE FREQUENCY</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>ADJUSTED RELATIVE FREQ.</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>CUMULATIVE PERCENT</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>CUMULATIVE ABSOLUTE FREQUENCY</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>HISTOGRAM</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>RELATIVE (PERCENT)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>ABSOLUTE (COUNT)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>INTERVAL RESTRICTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HANDLES UNEQUAL INTERVALS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>NO LIMIT ON NUMBER OF INTERVALS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>LISTS NO. VALUES OUTSIDE INTERVALS</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>TOTAL 'YES'</td>
<td>15</td>
<td>8</td>
<td>22</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>TOTAL 'NO'</td>
<td>16</td>
<td>22</td>
<td>19</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>TOTAL 'UNCERTAIN'</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>-1</td>
</tr>
</tbody>
</table>

1. EACH VARIABLE MUST BE RUN AS A SEPARATE TABLE: SLOW AND AWKWARD.
2. SELECT CERTAIN CASES IS ALSO AN OPTION.
3. SPSS FREQUENCIES MODULE PROVIDES ALL STATISTICS AVAILABLE IN DESCRIPTIVE MODULE PLUS MEDIAN & MODE. OTHER PACKAGES DO NOT PROVIDE STATISTICS WITH THEIR FREQUENCIES MODULES: DESCRIPTIVE STATISTICS MODULES MUST BE USED. (S.P.S. DOES, HOWEVER, PROVIDE MIN. AND MAX. WITH FREQUENCIES.)
4. RELATIVE & ABSOLUTE BOTH AVAILABLE BUT MUST BE RUN AS SEPARATE DISTRIBUTIONS; OTHER PROGRAMS COMBINE BOTH IN SINGLE OUTPUT.
5. DEFAULT SET FOR CODE ≤ 20 BUT CAN BE CHANGED TO MUCH LARGER VALUE IF COMBINED NUMBER OF OBSERVATIONS AND NUMBER OF VALUES DOES NOT EXCEED AVAILABLE MEMORY.
6. LIMIT = 50
7. LIMIT = 36
8. GROUPED DISTRIBUTIONS REQUIRE REDEFINITION OF VARIABLES & VALUE LABELS; OTHER PACKAGES PERFORM ENTIRE OPERATION WITHIN FREQUENCIES MODULE.
9. CAN BE ACCOMPLISHED BY CREATING A NEW SUBFILE OF DATA USING EXTENSIVE DATA MANAGEMENT RECODING CAPABILITIES, BUT NOT WITHIN FREQUENCIES ROUTINE.
<table>
<thead>
<tr>
<th>PROGRAM NAME</th>
<th>SPSS</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO -STAT</th>
<th>SPS</th>
<th>STAT -PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODULE NAME</td>
<td>CROSS TABLES</td>
<td>TABLES</td>
<td>TABLES</td>
<td>CROSS TABLES</td>
<td>CROSS TABLES</td>
<td>CROSS TABLES</td>
</tr>
</tbody>
</table>

**CAPABILITIES**

<table>
<thead>
<tr>
<th>VARIABLE LIMIT PER CROSS TAB</th>
<th>8-10</th>
<th>3</th>
<th>3</th>
<th>2</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELECT CASES OPTION AVAILABLE</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TREATMENT OF MISSING VALUES**

| TOTAL NUMBER MISSING VALUES LISTED | Y | N | Y | Y | N | N |
| SHOWN IN TABLE BUT NOT CALCULATED | Y | Y | | | | |

**TABLE CONTENTS**

<table>
<thead>
<tr>
<th>PER CELL</th>
<th>COUNT (FREQUENCY)</th>
<th>% OF ROW</th>
<th>% OF COLUMN</th>
<th>% OF TOTAL</th>
<th>EXPECTED VALUE</th>
<th>EXPECTED PERCENT</th>
<th>PER COLUMN/ROW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

**STATISTICS**

<table>
<thead>
<tr>
<th>DEGREES OF FREEDOM</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHI-SQUARE (OVERALL AND/OR CELL)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>FISHER'S EXACT TEST</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>YATES CORRECTED CHI-SQUARE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>PHI (2 x 2 ONLY)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CONTINGENCY COEFFICIENT</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>LAMBDa</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>UNCERTAINTY COEFFICIENT</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>TAU (B AND/OR C)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>GAMMA (ZERO ORDER AND/OR PARTIAL)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SOMER'S D</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>ETA</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>KENDALL'S S</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>G STATISTIC</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SIGNIFICANCE OF TEST</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CRANER'S V</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>KOLMOGOROV-SMIRNOV GOODNESS OF FIT</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**MAXIMUM TABLE SIZE**

| 15x15 | 20Rx5 | 10x10 |

1. **TOTAL 'YES'** | 23 | 18 | 11 | 11 | 11 | 9 |
2. **TOTAL 'NO'** | 5 | 5 | 14 | 14 | 16 | 18 |
3. **TOTAL 'UNCERTAIN'** | 0 | 5 | 3 | 3 | 1 | 1 |

1. **REQUIRES USE OF A "FILTERED MARGINALS" PROCEDURE AND MULTIPLE RUNS OF THE TABLES MODULE FOR MORE THAN 2 VARIABLES.**
2. **USE OF SPSS QUALITATIVE ANALYSIS SERIES OF MODULES ALLOWS FOR ANALYSIS OF 3 VARIABLES CODED ON A SCALE OF 0-9.**
3. **GREATER THAN TWO WAY COULD BE DONE BY CREATING SUBFILES AND DOING MULTIPLE ANALYSES.**
4. **THESE OPTIONS ARE OBTAINED BY RUNNING A SEPARATE TABLE COMMAND FOR EACH--ALL OUTPUTS CANNOT BE PLACED ON THE SAME TABLE.**
5. **PROGRAM ALLOWS YOU TO SPECIFY VALUES TO BE COUNTED FOR SPECIFIC ROWS AND COLUMNS THEREBY ADJUSTING CONTINUOUS VARIABLES TO FIT TABLE SIZE AS DESIRED.**
6. **ALSO GIVES PROBABILITY OF CHANGE.**
7. **AVAILABLE WITH QUALITATIVE ANALYSIS MODULES MENTIONED IN FOOTNOTE 2. OTHERS AVAILABLE BUT NOT LISTED ON TABLE V: PEARSON'S C, TSCHUPROW'S T, GOODMAN KRUSKAL TAU Y.**
8. **MUST PUT TABLES CHI-SQUARE AND DEGREES OF FREEDOM OUTPUT INTO PROBABILITIES MODULE.**
### TABLE VI
**Regression**

<table>
<thead>
<tr>
<th>Package Name</th>
<th>SPSS</th>
<th>A Stat</th>
<th>ELF</th>
<th>Micro-Stat</th>
<th>SPS</th>
<th>Stat-Pac</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAPABILITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applications described in manuals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bivariate Regression</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y 3</td>
<td>Y</td>
</tr>
<tr>
<td>Multivariate Regression</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y 3</td>
<td>Y</td>
</tr>
<tr>
<td>Stepwise</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y 3</td>
<td>Y</td>
</tr>
<tr>
<td>Path analysis</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N 5</td>
<td>Y N N</td>
</tr>
<tr>
<td>Hierarchical</td>
<td>Y</td>
<td>N</td>
<td>N 5</td>
<td>N 6</td>
<td>Y 5</td>
<td>Y N N</td>
</tr>
<tr>
<td>Non-linear</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td>Dummy regression</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td>Analysis of variance</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td>Analysis of covariance</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td>General Linear Models</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td>Forecasting</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 6</td>
<td>Y N N</td>
</tr>
<tr>
<td><strong>Nature of Output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'b' Coefficients</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Beta coefficients</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Correlation matrix</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Forced correlation matrix</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Means &amp; standard deviation</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Number of valid cases</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Actuals, predicted values &amp; errors</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Plot of residuals</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple R (beta)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>S.E. 'b' &amp; probability 'b' = 0</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Multiple R</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>R² &amp; S.E. of estimate (regression)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Partial/tolerance/F for variables</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Not in equation</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td><strong>ANALYSIS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lication test</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>T Test of variable coefficient</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Durbin Watson statistic</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>Von Neumann ratio</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>First order autocorrelation test</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td><strong>Variance/Covariance matrix of coefficient estimates</strong></td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y 8</td>
<td>Y N</td>
</tr>
<tr>
<td>'b' Confidence intervals</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 5</td>
<td>Y N N</td>
</tr>
<tr>
<td>'y' Confidence intervals</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 5</td>
<td>Y N N</td>
</tr>
<tr>
<td>Tests for multicollinearity</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N 5</td>
<td>Y N N</td>
</tr>
</tbody>
</table>

| **Total 'Yes'** | 27 | 16 | 14 | 17 | 21 | 10 |
| **Total 'No'**  | 8  | 19 | 21 | 18 | 14 | 25 |
| **Total 'Uncertain'** | 0  | 0  | 0  | 0  | 0  | 0  |

1. This module includes 3 separate sections: simple, multiple and general linear models (GLM). The latter has more sophisticated analysis capabilities than the first two, but requires putting data in two separate matrices.
2. All programs do bivariate analysis even when not specifically described as a separate routine.
3. Specifies limit of 10 independent variables.
4. Version of manual used in our review listed stepwise in contents but never described it.
5. Data entry module performs transformations on non-linear functions which can then be put in regression routine.
6. Explains and performs transformations (log, power, exponential).
7. Requires special procedure as a-stat normally calculates beta coefficient.
8. In GLM module only.
9. Obtained by using correlation module.
10. Could be obtained from module providing descriptive statistics.
11. Packages do not allow for missing value codes.
12. Can be done by saving residuals to an output file and interfacing it with apple plot program.
13. GLM module allows plots of original and normalized residuals against y or any x variable.
14. Provides sums of squares and f ratio and degrees of freedom but not mse.
TABLE VII
ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>PACKAGE NAME</th>
<th>SPSS</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO STAT</th>
<th>SPS</th>
<th>STAT PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODULE NAME</td>
<td>ANOVA</td>
<td>None</td>
<td>ANOVA</td>
<td>ANOVA</td>
<td>ANOVA</td>
<td>I-WAY</td>
</tr>
</tbody>
</table>

**CAPABILITIES**

<table>
<thead>
<tr>
<th>ACCEPTABLE DESIGN CHARACTERISTICS</th>
<th>EQUAL CELL SIZES</th>
<th>UNEQUAL CELL SIZES</th>
<th>CLASSICAL ANALYSIS</th>
<th>HIERARCHICAL ANALYSIS</th>
<th>REGRESSION ANALYSIS</th>
<th>FIXED EFFECT</th>
<th>RANDOM EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPLICATIONS DESCRIBED IN MANUAL</th>
<th>ONE-WAY ANALYSIS OF VARIANCE</th>
<th>RANDOMIZED BLOCK</th>
<th>N-WAY (NUMBER SHOWN = N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>5</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>2</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NATURE OF OUTPUT</th>
<th>ANOVA TABLES (SS,DF,MSE,F)</th>
<th>PROBABILITY</th>
<th>NO. OF CASES READ</th>
<th>NO. OF MISSING CASES</th>
<th>MULTIPLE CLASSIFICATION ANALYSIS TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR ONE-WAY ONLY</th>
<th>APRIORI/APOSTERIORI CONTRASTS</th>
<th>NO. CASES/TREATMENT</th>
<th>TREATMENT MEANS</th>
<th>TREATMENT S.D.</th>
<th>TREATMENT MIN/MAX</th>
<th>95% CI FOR MEAN</th>
<th>FIXED EFFECTS MEASURES</th>
<th>RANDOM EFFECTS MEASURES</th>
<th>COCHRAN'S C</th>
<th>BARTLETT-BOX F</th>
<th>MARTELL'S F MAX</th>
<th>POOLED ESTIMATE</th>
<th>SEPARATE ESTIMATE</th>
<th>BARTLETS CHI-SQUARE</th>
<th>ETA2</th>
<th>T-TEST BETWEEN GROUPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR N-WAY ANALYSIS</th>
<th>MAIN EFFECTS</th>
<th>COVARIATE EFFECTS</th>
<th>RESIDUAL</th>
<th>FACTOR-COVARIATE INTERACTION</th>
<th>N-WAY INTERACTION (NO. - N)</th>
<th>COLUMN/ROW/CELL MEANS + FRE-QUENCIES</th>
<th>BETA FOR COVARIATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

| TOTAL 'YES' | 32 | 14 | 13 | 9 | 8 |
| TOTAL 'NO'  | 4  | 18 | 19 | 24 | 22 |
| TOTAL 'UNCERTAIN' | 2 | 6 | 6 | 5 | 8 |

1. The regression routine of ASTAT prints out an analysis of variance table showing regression and residual sum of squares with appropriate statistics. As this is not comparable to programs with specific ANOVA routines, we have not included it here.

2. SPS also has a general linear model ANOVA routine which has no apriori restrictions on the model. Its features are not described on this table.

3. One-way can be unequal; two-way must be equal.

4. For two-way F statistic calculation.

5. Can be obtained by using probability module.

6. Can be obtained by summing number of cases/treatment.

7. One-way only.

8. May be done with regression routine.
<table>
<thead>
<tr>
<th>CAPABILITY</th>
<th>ASTAT</th>
<th>ELF</th>
<th>MICRO</th>
<th>SPS</th>
<th>STAT-PAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA ENTRY</td>
<td>Y(^1)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y (^2)</td>
</tr>
<tr>
<td>DATA EDITING</td>
<td>N(^3)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>ADD NEW OBSERVATIONS AND/OR VARIABLES</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>NUMERICAL KEYPAD SIMULATOR</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>DATA TRANSFORMATIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADD/SUB/MULT/DIVIDE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>STANDARDIZE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>TRANSFORM VALUE TO RANK-ORDER</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>LINEAR (A + B \times X)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>EXPONENTIAL</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>LOGARITHMS COMMON</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>NATURAL</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SQUARE ROOTS</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>SINES</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>COSINES</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>TANGENTS</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>LAGS AND OR TIME SERIES ANALYSIS</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>RECIPROCAL</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>SUM ACROSS VARIABLES</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SUM ACROSS OBSERVATIONS</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>SELECT VARIABLE VALUE AND RECODE</td>
<td>Y(^6)</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y(^6)</td>
</tr>
<tr>
<td>OUT OF BOUNDS DATA CHECK</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>MERGE FILES</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>SORT DATA</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>SUB-GROUP FILE CREATION</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>STRIP FILES (CREATE SUBFILES W. SELECTED VARIABLES)</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>LIST DATA TO PRINTED</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>RANK-ORDER FILE DATA</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>REORDER OBSERVATIONS</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>AGGREGATE</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>ESTABLISH MISSING VALUE INDICATORS</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>DELETE CASES FROM CALCULATION ONLY</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**Total 'Yes':** 18 14 17 20 9
**Total 'No':** 4 15 9 2 18
**Total 'Uncertain':** 9 2 5 9 4

1. LIMIT OF 45 VARIABLES PER FILE.
2. ALLOWS FIXED OR FREE FORMAT DATA ENTRY.
3. RECOMMENDS USE OF COMPATIBLE TEXT FILE EDITORS--SOME ARE PUBLIC DOMAIN PROGRAMS.
4. ADDING AND MULTIPLYING A VARIABLE BY A CONSTANT ARE STRAIGHT FOPMPAD, VARIABLES/VARIABLE TRANSFORMATIONS REQUIRE MORE COMPLEX PROCEDURES USING BOTH TRANSFORM AND FORM INDICES PROGRAMS.
5. ALLOWS FOR CHOICE OF BASE.
6. ASTAT ALLOWS RECODE TO A MATHEMATICAL EXPRESSION. STAT-PAC RECODES TO SPECIFIC NUMBER ONLY.
We would like to point out here a few observations which we were unable to incorporate in other parts of section II. In general, we found that manuals are not consistent in information provided. Some particularly common deficiencies are:

-- failure to provide formulas used for calculations.

-- failure to indicate limits on data base configurations (eg. max number variables and/or observations for specific routines)

-- failure to clearly state missing value capabilities and procedures.

-- failure to include detailed indexes for manuals.

A few particular strengths or weaknesses of specific packages which may not have been revealed in our tables are noted below.

1. ASTAT

Data handling and transformation capabilities of ASTAT are very extensive compared to most other packages. ASTAT interfaces with Apple Plot, File Cabinet and Visicalc DIF files. Compiled version now available. Program is not menu driven.

2. ELF

Manual is easy to read and leads user through program prompts. Package interfaces with TWG-ARIMA to perform time series analysis. Users have had numerous problems with bugs in early versions.

3. Micro-Stat

Good data handling. Excellent documentation on formulas used in calculations (this is lacking in most packages). Manual leads user through prompts.
4. **SPS**

Good documentation on formulas used. Quite a bit of instructional information on proper use of various routines. Interfaces with Mainframe SPSS easily.

5. **STAT-PAC**

Data management is a strong point. Excellent cross-tabs output.

We invite all readers who have knowledge of packages described in this paper to contact us with any additional observations and/or corrections to material presented. Interpreting a manual (as we have done in most cases) and actually running a program will not necessarily result in identical descriptions of a package. Feedback from those with hands-on experience is very much desired.
III. Outline of Detailed Program Documentation Contained in Staff Paper 82-23.

A. A-Stat

1. General Information
   a. Descriptive Publicity
   b. User Manual Table of Contents
   c. Minimum System Requirements
   d. Default Limits on Data Size

2. A-Stat Disk Catalog

3. Sample Page of Manual Instructions

4. File Formats and Configuration Procedures (Sample Printouts)
   a. A-Stat data file format (ADATA.filename)
   b. A-Stat dictionary file of variables (ADICT.filename)
   c. System configuration procedures

5. A-Stat Statistics and Output Tables - Examples
   a. Descriptive Statistics (NO.OP IN=) - Minimum, Maximum, sum, mean, std. dev., and number of observations.
   b. Frequency Distributions (FREQ=) - Frequency and cumulative frequency.
   c. Correlations (CORRELATE IN=)
   d. Multiple Regression (PATHS COR=) - Beta, simple R, multiple R, R squared, and Determinant.
   e. Analysis of Variance Table (PATHS COR=) - Beta, simple R, multiple Regression with multiple R, R squared, Determinant, 'b'-weight, Std. Error, probability, Std. Error of Estimate, Adjusted R square, Deg. of Freedom, Sum of Squares, Mean square, F-test, probability.
   f. Cross-tabulations (TABLES=) - Cell contents: Frequ., Row %, col. %, Expected Value, cell Chi square, also table Chi square, Prob. of Chi-square, Phi, Contingency.

6. Data Management
   a. List of Data (LIST IN=)
   b. Transformation with Descriptive Statistics (NO.OP IN=)
   c. A Data File with New Variables Added (Dictionary + Data Files)
   d. A-STAT Descriptive Statistics File
   e. A-STAT Correlation Matrix File
   f. Purge A-STAT Files (PURGE=)

7. USER Comments
B. AIDA - Apple Interactive Data Analysis

Index of Materials, Routines, Statistics and Tables

A. Overview

B. Getting Used to the Program

C. AIDA Data I/O and Manipulation Commands

--Enter, Edit, Transform, Missing (data), Restore
--Data - display data set characteristics
--List, Print, Save, Read (load)

D. Univariate Statistics

Oneway: Frequencies and percentages
Histogram: Frequencies and percentages in grouped data with bar chart.
Describe: Range, Mean, Variance and Std. Dev.

E. Bivariate Statistics

Twoway: Row and/or column percentages, chi-square, significance of chi-square.
Correlate: Pearson r Correlation Coefficient
Means: One-Way Analysis of Variance, Students t test; Grouped Data

F. Multivariate Analysis

Mult: Multiple Regression (up to 10 independent variables)
Regression coeff. constant, Multiple R, R-Squared, F - Ratio, and significance of F

G. Miscellaneous Commands

?: Displays a summary of all AIDA commands
Special: Space for User-Written subroutines
Data Structure

H. AIDA Command Procedures and Options

I. Technical Issues

J. Sample AIDA Output

K. General Publicity and Vendor Correspondence
C. ELF

GENERAL INFORMATION, CATALOG, FILE FORMATS, STATISTICS, AND EXAMPLES OF OUTPUT TABLES

Index of Materials, Routines, Statistics and Tables

1. General Information
   a. User's Manual Table of Contents
   b. Vendor Publicity
   c. Algorithms

2. The Two ELF Catalogs
   a. File Management
   b. Statistics

3. The Two ELF Menus - Disk 1 and Analytical Menu (Disc 2)

4. File Formats
   a. ELF Data File (ELF.filename) (Serial file)
   b. ELF Dictionary File (ELF.filename Dict)

5. ELF Statistics and Output Tables - Examples
   a. T-Test (Separate and Pooled)
   b. Cross tabulations (2 way and 3 way) (-Cramer's V, Contingency Coeff. and Histogram)
   c. Descriptive Statistics - Mean, Std., Dev., Variance, Std. Error, Min, Max, Range, Sum, Skewness and Kurtosis.
   d. Correlations.
   e. Stepwise Regression (-Mean, s.d., R. Square, Adj. R Sq., Coeff, T. Statistic, S.S., Residuals, St. Error of Reg.)
   f. Analysis of Variance - Same Statistics as regression plus table of actual, predicted, and error and table of s.d. of actual, predicted and error.
   g. Scatter graph with Statistics and line of best fit (Correl. Coeff., R squared, T Statistic, Intercept, slope (B), Std. Error of Estimate, No. of observations, Max, and min.)
   h. Factor Analysis - Correlation Coefficients, unrotated factor factor Matrix, Communalities, Vari max, Rotated Factor Matrix, Transformation Matrix, Factor Score coefficients.

6. ELF File Management
   a. Transformations (Computer Module)

7. User Comments
D. MICROSTAT

1. User's Manual Table of Contents
3. Sample of User Instructions for ADOVA-One Way & Block (pg. 26)
5. Sample Explanation of Computational Equations ANOVA
6. User Comments
E. S.P.S. - Statistical Processing System

GENERAL INFORMATION, MENUS, STATISTICS
AND EXAMPLES OF OUTPUT TABLES

Index of Materials, Routines, Statistics, and Tables

1. Contents of Instruction Manual
2. Main Menu
3. Data File Creation, Manipulation, and File Operations
5. Parametric and Nonparametric Correlations - Pearson's $r$ and partial correlations, spearman's rho, Kendall's $W$ coefficient of concordance, and point biserial correlations.
6. Regression Analysis - Linear Models (plus log, power and exponential), multiple linear regression, and general linear models. (includes graphing).
7. Mean Tests: t-tests, one way ANOVA, and ANOVA - General Linear Models.
8. Test Distributions t, F, and Chi Square.
9. Crosstab - RxC contingency Tables - Chi Square, Phi Statistic, Cramer's $V$, and contingency coefficient.
10. Multiple Variable Plotting (up to 6 y variables against one x variable)
11. Monte Carlo Distribution Module - Distributions uniform, normal, lognormal.
12. Multivariate Analyses - Factor and principal component, and image
13. Univar, Bivar, Trivar (Qualitative) Analysis - Using data coded on an integer scale from 0 to 9.
14. Prepare/Link S.P.S. Files to Mainframe.
15. Appendix A - S.P.S. Sequential File Size Limitations
16. Appendix B - Program Files List.
17. Appendix C - Master Menu
18. Appendix D - Example of S.P.S. Session (TRS-80 Model I Version)
19. **Output Tables (Model II Version 3.2) - Examples**

   - Data File
   - Descriptive Statistics
   - Histograms and Frequency Distribution

20. **S.P.S. User Notes (10/81 adenda)**
    Version 3.2 for TRS-80 Model II
F. STAT-PRO

1. Vendor's Comparison with Mainframe Packages
2. Description of STAT MOD
3. Description of Plot MOD
4. Description of QVEST MOD
5. Description of Inventory System
6. Description of BIBLIOMOD
7. Description of MAILING SYSTEM
8. Price List
9. User Agreement
10. Sample Output via Plot MOD
IV. List of Microcomputer Statistics Packages

A. More Comprehensive Statistics Packages

<table>
<thead>
<tr>
<th>Package Name</th>
<th>Apple II</th>
<th>TRS-80</th>
<th>CP/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-STAT + *</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABSTAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple Interactive Data Analysis (AIDA)*</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Econometric Linear Forecasting (ELF) + *</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ed-Sci Statistics</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB MASTER STAT PAK</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSD STATS, ANOVA, REGRESSION°</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTERSTAT/ADVANCED MATH ROUTINES</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MICROSTAT+ *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT PAC + *</td>
<td>I,III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT PRO *</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATISTICAL ANALYSIS (or Advanced Stat Ana.)</td>
<td>I,II,III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATISTICAL PACKAGE FOR MICROCOMPUTERS (SPM)°</td>
<td>in process</td>
<td>I,III</td>
<td>in process</td>
</tr>
<tr>
<td>STATISTICAL PROCESSING SYSTEMS (SPS)++</td>
<td>I,II,III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATISTICIAN, THE°</td>
<td>I,II,III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATISTICS WITH DAISY°</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ These packages were included in the comparisons made in Section II of this paper.

* These packages are described in detail in Section III of Staff Paper 82-23. Sample printouts and extracts from manuals are provided.

° The annotated "diskography" in Section IV of Staff Paper 82-23 includes reviews of these programs and/or substantial descriptive materials received from software houses.
### B. Less Comprehensive Statistics Packages

<table>
<thead>
<tr>
<th>PROGRAM NAME</th>
<th>APPLE</th>
<th>TRS-80</th>
<th>CP/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive Statistical Inquiry System (ISIS)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micro Data Management &amp; Analysis System (MIDMAS)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAFOR</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Scientist</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>SOFTWARE PAC #3 - Statistics</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>STATISTICS PAC</td>
<td>X</td>
<td></td>
<td>I,III</td>
</tr>
</tbody>
</table>

### C. Single or Specialized Application Programs

<table>
<thead>
<tr>
<th>PROGRAM NAME</th>
<th>APPLE</th>
<th>TRS-80</th>
<th>CP/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOVA*</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Curve Plotting</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multilinear Regression*</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Multiple Regression</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression I*</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Regression II*</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sistema de Estadistica Agricola</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATPOWER (Designed to teach Statistics)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREND STATISTICAL PACKAGE</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSP</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TW6-ARIMA (box Jenkins)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These four programs are offered by Dynacomp, Inc. separately or as a package. There is a single annotation for all of them which is listed under title of 'ANOVA' in Section IV, C of Staff Paper 82-23.*
V. Related Papers

MICROCOMPUTER SOFTWARE FOR PROFESSIONAL USE
-- NOTES ON PROGRAMS WITH EMPHASIS ON
APPLE, TRS-80, AND CP/M

PART I Word Processors for Microcomputers - Comparisons and References by Robert D. Stevens, Staff Paper #82-16, pp. 160.

PART II Data Base Management and Other Programs for Professionals Using Microcomputers - Comparisons and Reference Materials, Robert D. Stevens, (pp. 80), Staff Paper #82-22.

PART III Statistics Packages for Microcomputer by Robert D. Stevens and Valerie Kelly, (pp. 70) Staff Paper #82-23.

Separate Summary Comparisons:


2. Comparisons of Data Base Management Programs for the Apple, TRS-80, and CP/M Microcomputer Systems by Robert D. Stevens, Staff Paper #82-31, pp. 16.