ABSTRACT

This handbook is for the student with little or no previous experience with computer utilization for data processing. Sample problems to be run on the computer are included. It gives: (1) an overview of the sequence of steps from obtaining data to receiving computer output, (2) a guide to common computer packages, (3) an illustration of the use of systems cards, (4) discussion and exercises on writing variable format cards, (5) coding considerations, (6) the rationale and illustrations of the use of transgeneration cards, and (7) an appendix of related descriptive materials. The book is designed to ease the transition from a nonuser to user of standard library (canned) computer programs—programs that satisfy most of the researcher's needs. The book is designed for the user who has access to a computer facility that has the BMD and/or other standard library packages. One section of this book is not entirely generalizable to other computer installations since system cards are indiosyncratic. Those employed illustrate the CDC 6400 system at the University of Colorado. (Author/SE)
USER'S GUIDE AND ORIENTATION TO
CANNED COMPUTER PROGRAMS

George L. Kretke
Kenneth D. Hopkins

Laboratory of Educational Research
University of Colorado

February 1973
**NCERD Reporting Form — Developmental Products**

<table>
<thead>
<tr>
<th>1. Name of Product</th>
<th>2. Laboratory or Center</th>
<th>3. Report Preparation</th>
</tr>
</thead>
</table>
| User's Guide to Canned Computer Programs. | Laboratory of Educational Research, University of Colorado | Date prepared 11/9/73  
Reviewed by K.D. Hopkins, director |

4. **Problem:** Description of the educational problem this product designed to solve.

The computer skills required for research and evaluation use are frequently insufficient for functional computer utilization.

5. **Strategy:** The general strategy selected for the solution of the problem above.

The strategy for this workbook was to give the user the basic minimal knowledge and skills needed for use of canned (library) programs. The workbook was developed for the CDC 6400 system at the University of Colorado, but will serve as a model for workbooks for other installations.

6. **Release Date:** Approximate date product was (or will be) ready for release to next agency.

12/1/73

7. **Level of Development:** Characteristic level (or projected level) of development of product at time of release. Check one.

- Ready for critical review and for preparation for Field Test  
  (i.e., prototype materials)  
- Ready for Field Test  
- Ready for publisher modification  
- Ready for general dissemination/diffusion

8. **Next Agency:** Agency to whom product was (or will be) released for further development/diffusion.

NIE
9. Product Description: Describe the following; number each description.

- 1. Characteristics of the product.
- 2. How it works.
- 3. What it is intended to do.
- 4. Associated products, if any.
- 5. Special conditions, time, training, equipment and/or other requirements for its use.

Characteristics of the Product:

The workbook gives (1) an overview of the sequence of steps from obtaining data to receiving computer output, (2) a guide to common computer packages, (3) an illustration of the use of systems cards, (4) discussion and exercises on writing variable format cards, (5) coding considerations, (6) the rationale and illustrations of the use of transgeneration cards, and (7) an appendix of related descriptive materials.

How it Works:

The product is a handbook for the student with little or no previous experience with computer utilization for data processing. Sample problems to be run on the computer are included.

What it is Intended to do:

The product is designed to ease the transition from a non-user to user of standard library (canned) computer programs -- programs that satisfy most of the researchers needs.

Special Conditions:

The product is designed for the user who has access to a computer facility that has the BMD and/or other standard library packages. One section of the product is not entirely generalizable to other computer installations -- system cards are idiosyncratic. Those employed illustrate the system at the University of Colorado.
10. Product Users: Those individuals or groups expected to use the product.

- Individuals with needed but unavailable data processing skills for using statistical library programs.

11. Product Outcomes: The changes in user behavior, attitudes, efficiency, etc. resulting from product use, as supported by data. Please cite relevant support documents. If claims for the product are not yet supported by empirical evidence pursue as indicated.

12. Potential Educational Consequences: Discuss not only the theoretical (i.e. conceivable) implications of your product but also the more probable implications of your product, especially over the next decade.

- Greater use and more appropriate selection and use of standard computer programs for statistical analyses. Savings in time, effort, and money of unnecessary proliferation of redundant computer programs.
### 13. Product Elements:

List the elements which constitute the product.

One self-contained product with suggested activities.

<table>
<thead>
<tr>
<th>Element</th>
<th>Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA</td>
<td>D</td>
</tr>
<tr>
<td>DNA</td>
<td>M</td>
</tr>
<tr>
<td>DNA</td>
<td>A</td>
</tr>
<tr>
<td>DNA</td>
<td>M</td>
</tr>
<tr>
<td>DNA</td>
<td>A</td>
</tr>
<tr>
<td>DNA</td>
<td>M</td>
</tr>
<tr>
<td>DNA</td>
<td>A</td>
</tr>
</tbody>
</table>

### 14. Origin:

Circle the most appropriate letter.

- D = Developed
- M = Modified
- A = Adapted

### 15. Start-up Costs:

Total expected costs to procure, install, and initiate use of the product.

Reproduction cost, computer time expenses.

### 16. Operating Costs:

Projected costs for continuing use of product after initial adoption and installation (i.e., fees, consumable supplies, special staff, training, etc.).

Reproduction costs, computer time expenses.

### 17. Likely Market:

What is the likely market for this product? Consider the size and type of the user group; number of possible substitute (competitor) products on the market; and the likely availability of funds to purchase product by (for) the product user group.

University students in research, evaluation, and statistics courses.
Table of Contents

Orientation to Research Use of Computers....................... 1

Introduction.......................................................... 2

Guide to Computer Program Packages............................... 2
Systems Cards (Program Access).................................. 3
  Job Card.......................................................... 5
  Account Card..................................................... 6
How to Call BMD Programs......................................... 6
7/8/9 Card............................................................ 7
Program Cards......................................................... 7
6/7/8/9 Card.......................................................... 7
Variable Format Card(s) in BMD Programs......................... 7
Terminology............................................................ 7
Exercise................................................................. 9
Miscellaneous Comments........................................... 9
Coding................................................................. 9
Transgeneration....................................................... 10

Appendix A Index of Programs..................................... 12

  International Mathematics and Statistical Library........... 13
  BMD Series........................................................ 14
  IBS Programs..................................................... 15

Appendix B Delivery Codes........................................ 16

Appendix C Program Access........................................ 18

Appendix D............................................................ 21
ORIENTATION TO RESEARCH USE OF COMPUTERS

The flow chart below illustrates the sequence of activities by the user and the computer in data processing.

**USER TASKS**

1. User obtains data for analysis
2. User selects canned program
3. User punches system cards, program cards and data card.
4. User submits program

**COMPUTER OPERATIONS**

(Functions)

1. Operator puts deck in card reader
2. Computer reads system cards
3. Computer locates and reads canned program from storage to central memory
4. Computer reads program cards
5. Computer reads data cards
6. Computer performs computations
7. Computer prints output
8. Operator collates output with data deck
9. Output is delivered to location indicated on job card
10. User picks up job

(1) allow charges made to correct account;
(2) indicates maximum amount of time and core to be used by this problem;
(3) indicates where the computer will find the canned program;
(4) determines where output should be delivered.

(1) give particulars of your problem (sample size, number of variables, etc.)
(2) give format of your data.
(3) indicate which program options are to be used.

---
INTRODUCTION

This manual is designed to familiarize the reader with the packaged computer programs available at the University of Colorado and how to gain access to them. No prior technical knowledge of computers is necessary to run many of the programs. The knowledge which is necessary to run some of the programs is provided by this manual. The manual also gives basic information about programs which do require one semester of Fortran programming.

Appendices A1-A4 give a list of the data analysis programs available in each package.

Guide to Computer Program Packages

The BMD package\(^1\) contains 76 programs which cover most of the widely used statistical analysis techniques in research. The programs are for the most part not difficult to run once the student has run a few programs. This is the main data analysis package available in the United States today. Most computing centers where social research is carried out will have the BMD package of programs available. The most widely used BMD programs are abstracted in Appendix A.

SPSS\(^2\) is a statistical package which is similar in purpose to the BMD programs but provides the operator with a greater amount of flexibility in organizing data.


IMSL \(^3\) is a large number of subroutines which cover many areas other than statistics. These programs are subroutines which means that by themselves one cannot feed directly into them. Generally at least one semester of Fortran programming is necessary to use these. The package is becoming available at many computer centers.

SAS \(^4\) package contains many programs which are among the most typical types of analysis problems. The advantage of this package is that many different types of analysis may be performed with only one submission of the data deck. This package is not available at C.U.

The IBS programs \(^5\) are programs developed at the University of Colorado. These programs supplement several of the BMD programs, but also contain other ad hoc programs.

LER programs \(^6\) are a set of programs which have been developed by members of the Laboratory of Educational Research to meet special needs which are not available from other packages.

SYSTEMS CARDS
(PROGRAM ACCESS)

A brief outline of how to access each of the packages at the University of Colorado is given in Appendix C.

Figure 1 is an example, using the BMD package, illustrating the systems \(^7\) cards in more detail.

---

\(^3\)IMSL LIB 3., Ed 1 CDC 6200/64/65/66/7600, For 2.3.


\(^5\)Institute of Behavioral Science, University of Colorado, Boulder, Colo.

\(^6\)Laboratory of Educational Research, University of Colorado, Boulder, Colo.

\(^7\)Systems cards will differ among various computer centers, the control cards will not.
Columns 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 ...

J Ø B C A R D
ACCOUNT CARD
CALL (BMD (BMD = BMD _ _ _ ))
7 8 Card
9
Problem Card
:
Finish Card
Control Cards as explained in BMD Manual
6 7 Card
9

Figure 1. Outline of Card Deck for BMD Programs.
Job Card

Use an orange colored card with all square corners for the job card. This is the only place this color and shape card may be used in the deck.

Column 1: Delivery Code

Regardless from where the program is submitted, this code indicates where it and the associated output will be returned. The delivery codes are given in Appendix B.

Columns 2-7: Identification

This is your identification for your specific program. It must occupy at least 3 spaces and not more than six. Usually you will use your last name or some abbreviation of it, but the only rule you really need to follow is that the first punch (in Column 2) must be a letter. The rest can be letters or numbers. Following the last letter or number of your identification place a comma (,).

If there are lettered boxes for output at the delivery area chosen (Column 1) then your output will be in the box that corresponds to the first letter of your identification code (Column 2). If no lettered boxes are used all output is placed together.

Core Length. Following the comma, punch a C with the field length number immediately following. This is a base 8 number which has been divided by 100. See Appendices for field lengths for BMD and IBS programs. Contact the computer center for field lengths for other packages (443-2211, extension 6563). A comma (,) immediately follows the last number in the core length.

Time. After the comma, place a T followed by the maximum amount of time you expect the program to take. This number is in base 8 and is divided by 10. For most class problems T2 is sufficient. T2 will give you 16 seconds of computer time.

You may punch anything you like for identification purposes on the rest of the card.

Job Card Example:  Column:  1  2  3  4  5  6  7  8  9 10 11 12 13 14
                      N F R E D ,  C 4 5 0 ,  T 2 .

N = output will be delivered to computing center (see Appendix B for delivery codes)
F = output will be put in box F.
Account Card

Columns 1-8:

Punch the word ACCOUNT in columns 1-7 followed by a comma in Column 8.

Using a Sub-Account Number

Starting in Column 9 punch your account number followed by two commas and then the subaccount number followed by a period.

Account Card Example (with subaccount):

Columns: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

ACCOUNT, A 1 0 1 A , , D 6 0 0 .

A101A = Account number
D600 = Subaccount number

If a subaccount number is not to be used, starting in Column 9 punch your account number followed by a period.

Account Card Example (without subaccount):

Columns: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

ACCOUNT, C 6 1 0 B .

How to Call BMD Programs

To get specific BMD programs fill in the 3 blank spaces (columns 17-19) in CALL(BMD=BMD___) with the specific program name. To call BMD 01D, punch

CALL(BMD=BMD01D)

Note: The first character in 01D and many other BMD programs is a zero, not the letter O.
7/8/9 Card

This is called an end-of-run card which has the numbers 7, 8, and 9 all punched in Column 1. To punch this card, depress simultaneously the keys "Num" and "Mult Pun" and consecutively punch 7, 8, and 9 in Column 1.

Program Cards

These are the actual BMD program cards as explained in the BMD manual. The first card is the PROBLM card and the last is the FINISH card.

6/7/8/9 Card

This is an end of information card which has 6, 7, 8 and 9 punched in Column 1. Use the same method as described for the 7/8/9 card. This is the last card in every deck that you submit.

VARIABLE FORMAT CARD(S) IN BMD PROGRAMS

The format card is one of the control cards and it specifies just which data and its location will be used in the analysis. This card allows the user to arrange information on the data card to his convenience, and hence gives the canned programs much more generality and flexibility than would otherwise be possible.

Terminology

A variable is a set of values -- such as IQ scores, age, sex, or test scores which appear in specified columns on the data cards.

A field is a group of consecutive columns in which data appears on a data card. A field may be occupied by a variable, blanks, or information to be ignored.
Floating point (F) fields are fields in which a decimal point may occur. Letters would not have decimal points and thus could not be designated by F fields. A and I are other types of fields. Most BMD programs require F-type format cards.

Skip fields (X) are fields which are not to be read by the computer. These may be blank or may contain information not required for the program.

The variable format card begins with a left parenthesis in Column 1 and ends with a right parenthesis. The field designations are separated by commas. The writing of variable format cards is most easily accomplished by using examples.

F fields are designated by keypunching the letter F, followed by the number of columns in the field, followed by a decimal point, followed by the number of spaces from the right-hand edge of the field the decimal point is.

Example:

<table>
<thead>
<tr>
<th>Field Code</th>
<th>Number as punched</th>
<th>Number as would be read by computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(F3.0)</td>
<td>231</td>
<td>231</td>
</tr>
<tr>
<td>(F3.0)</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>(F3.1)</td>
<td>231</td>
<td>23.1</td>
</tr>
<tr>
<td>(F3.2)</td>
<td>231</td>
<td>2.31</td>
</tr>
<tr>
<td>(F3.3)</td>
<td>231</td>
<td>.231</td>
</tr>
</tbody>
</table>

Skip fields are designated by keypunching the number of columns to be skipped followed by the letter "X."
Example:

<table>
<thead>
<tr>
<th>Field Code</th>
<th>Number as Punched</th>
<th>Number as would be read by computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2X,F3.0)</td>
<td>92345</td>
<td>345</td>
</tr>
<tr>
<td>(3X,F2.1)</td>
<td>92345</td>
<td>4.5</td>
</tr>
<tr>
<td>(1X,F2.0, 2X, F1.0)</td>
<td>923456</td>
<td>23 and 6</td>
</tr>
<tr>
<td>(1X,F2.1, 1X, F1.0)</td>
<td>923456</td>
<td>2.3 and 5</td>
</tr>
</tbody>
</table>

Repeated identical fields may be represented by preceding the field designation by the number of fields.

Example:

<table>
<thead>
<tr>
<th>Field Code</th>
<th>Number as Punched</th>
<th>Number as would be read by computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3F1.0)</td>
<td>823</td>
<td>8.2, and 3</td>
</tr>
<tr>
<td>(1X, F2.0, 2F2.1)</td>
<td>823456789</td>
<td>23, 4.5, and 6.7</td>
</tr>
<tr>
<td>(F1.0, 2F3.1, F2.2)</td>
<td>823456789</td>
<td>8, 23.4, 56.7, and .89</td>
</tr>
</tbody>
</table>

For further examples see pages 23-24 in the BMD manual or any introductory Fortran Programming text.

Exercise

Suppose you have age in Columns 4 and 5, Verbal IQ score in Columns 10, 11, and 12, Nonverbal IQ score in Columns 13, 14, 15, and wages (dollars and cents per hour) in Columns 70, 71, and 72. Write the variable format card to instruct the computer to read these four variables. (See the bottom of the following page for the answer.)

Miscellaneous Comments

Coding

1. **Zero and 0**

   The number zero and the letter Ø are two different and noninterchangeable symbols in computer work. To keep them straight in coding a 'Ø' is used to represent the letter and a '0' is used to represent zero.
Example:  PROBLM
        2905.3

2. Punching Numbers in Specified Fields

Whenever you are given more columns than necessary for your problem's parameters be sure the number is punched in the farthest column to the right (right justified). If you do not right justify, blank columns to the right will be read as zeros thus increasing the size of the number.

Example:

If the number of subjects is to be punched in Columns 7-12 and you have 56 subjects, the number should be punched as follows:

<table>
<thead>
<tr>
<th>Column</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you punched it like this:

<table>
<thead>
<tr>
<th>Column</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

it would mean there were 560 subjects.

Transgeneration (BMD)

At times the data which is on a computer card is not quite in the form one needs. Some of the data might have to be combined in some form before analysis takes place. For example, you might have pre and post scores and want to do the analysis on the gains between the two tests. In such circumstances the transgeneration (BMD only) option may be useful. The types of transgeneration
possible depend on the individual program but a complete list is given on pages 17-19 of the BMD manual.

Example: Difference between Pre and Post tests.

Given that the pretest is punched first and the posttest next on your data card, you can create a third variable--post minus pretest by using code #12. Code 12 is \( X_i - X_j = X_k \).

Since the pretest is to be subtracted from the posttest, \( i = 2 \) (because the posttest is the second variable on the data card) and \( j = 1 \) (because the pretest is the first variable on the data card). \( k = 3 \) in this case which creates a new variable for each subject, that of post minus pre test score. Now there are 3 variables (pre, post and post minus pre) for every subject using Code 12 \( (X_2 - X_1 = X_3) \). The transgeneration card would thus read:

```
TRNGEN_312_2____1
```

(If you wanted the pre minus post test score you would set \( i = 1, j = 2, \) and \( k = 3 \) given \( X_1 - X_2 = X_3 \).

If one had two scores he needed to combine, he could accomplish this using transgeneration 11. Suppose of the 25 variables specified on the variable format card, one wished to add variables 4 and variable 22. The following transgeneration card would accomplish this, the total of variables 4 and 22 being labelled variable 26.

```
TRNGEN_2611_4_____22
```

The particular transgeneration codes vary among the BMD programs (see Appendix D or the BMD manual in this regard).
Appendix A

Index of Programs
International Mathematics and Statistical Library
(IMSL, this is only a partial listing of the programs)

Balanced incomplete block design
Latin square analysis
Newman-Keuls multiple comparison tests
Frequency tables (1 and 2 way)
Descriptive data
Variance and covariance computations
Geometric and harmonic means
Contrast estimates and sums of squares
Analyze 2-way classification design data
Tally observations into 1 or 2-way frequency and table
BMD Series

Programs available include: (Required field length, in octal, is indicated following each program description).

Class D - Data Description and Tabulation

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>01D</td>
<td>Simple data description</td>
<td>410</td>
</tr>
<tr>
<td>02D</td>
<td>Correlation with transgeneration</td>
<td>610</td>
</tr>
<tr>
<td>03D</td>
<td>Correlation with item deletion</td>
<td>530</td>
</tr>
<tr>
<td>04D</td>
<td>Alphanumeric frequency count</td>
<td>650</td>
</tr>
<tr>
<td>05D</td>
<td>General plot including histogram</td>
<td>650</td>
</tr>
<tr>
<td>06D</td>
<td>Description of strata</td>
<td>650</td>
</tr>
<tr>
<td>09D</td>
<td>Cross-tabulation, incomplete data</td>
<td>640</td>
</tr>
</tbody>
</table>

Class M - Multivariate Analysis

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>01M</td>
<td>Principal component analysis</td>
<td>640</td>
</tr>
<tr>
<td>03M</td>
<td>Factor analysis</td>
<td>650</td>
</tr>
<tr>
<td>04M</td>
<td>Discriminant analysis for two groups</td>
<td>610</td>
</tr>
<tr>
<td>05M</td>
<td>Discriminant analysis for several groups</td>
<td>630</td>
</tr>
<tr>
<td>06M</td>
<td>Canonical analysis</td>
<td>470</td>
</tr>
<tr>
<td>07M</td>
<td>Stepwise discriminant analysis</td>
<td>645</td>
</tr>
</tbody>
</table>

Class R - Regression Analysis

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>01R</td>
<td>Simple linear regression</td>
<td>620</td>
</tr>
<tr>
<td>02R</td>
<td>Stepwise regression</td>
<td>600</td>
</tr>
<tr>
<td>03R</td>
<td>Multiple regression with case combinations</td>
<td>610</td>
</tr>
<tr>
<td>04R</td>
<td>Periodic regression with harmonic analysis</td>
<td>630</td>
</tr>
<tr>
<td>05R</td>
<td>Polynomical regression</td>
<td>410</td>
</tr>
</tbody>
</table>

Class S - Special Programs

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>02S</td>
<td>Contingency table analysis</td>
<td>660</td>
</tr>
<tr>
<td>09S</td>
<td>Transgeneration</td>
<td>520</td>
</tr>
</tbody>
</table>

Class T - Time Series Analysis

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>02T</td>
<td>Auto covariance and power spectral analysis</td>
<td>520</td>
</tr>
</tbody>
</table>

Class V - Variance Analysis

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>01V</td>
<td>Analysis of variance for one-way design</td>
<td>643</td>
</tr>
<tr>
<td>02V</td>
<td>Analysis of variance for factorial design</td>
<td>650</td>
</tr>
<tr>
<td>05V</td>
<td>General linear hypothesis</td>
<td>630</td>
</tr>
<tr>
<td>07V</td>
<td>Multiple range tests</td>
<td>560</td>
</tr>
<tr>
<td>08V</td>
<td>Analysis of variance</td>
<td>653</td>
</tr>
</tbody>
</table>
# IBS Programs

The following list replaces the list in the IBS User's Manual. CPD's for these programs can be found in the card file in Room 4, Building 1.

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Field Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>202*</td>
<td>Primary Data Analysis</td>
<td>610</td>
</tr>
<tr>
<td>203*</td>
<td>Biserial/Point Biserial Correlation</td>
<td>610</td>
</tr>
<tr>
<td>205</td>
<td>Pearson Correlation I</td>
<td>620</td>
</tr>
<tr>
<td>207</td>
<td>Tetrachoric Correlation</td>
<td>660</td>
</tr>
<tr>
<td>208</td>
<td>Gamma Statistic</td>
<td>640</td>
</tr>
<tr>
<td>209</td>
<td>t-test I</td>
<td>630</td>
</tr>
<tr>
<td>210*</td>
<td>t-test II</td>
<td>620</td>
</tr>
<tr>
<td>211</td>
<td>Mann-Whitney U-test</td>
<td>610</td>
</tr>
<tr>
<td>214</td>
<td>Multiple Regression I</td>
<td>570</td>
</tr>
<tr>
<td>218</td>
<td>Pre-Anova Data Checking</td>
<td>540</td>
</tr>
<tr>
<td>219*</td>
<td>ANOVA I</td>
<td>660</td>
</tr>
<tr>
<td>218A*</td>
<td>ANOVA II</td>
<td>710</td>
</tr>
<tr>
<td>220</td>
<td>One-way ANOVA I</td>
<td>630</td>
</tr>
<tr>
<td>221*</td>
<td>ANOVA III</td>
<td>700</td>
</tr>
<tr>
<td>222*</td>
<td>ANOVA IV</td>
<td>370</td>
</tr>
<tr>
<td>225</td>
<td>Multivariate ANOVA</td>
<td>570</td>
</tr>
<tr>
<td>226*</td>
<td>Discriminant Analysis</td>
<td>650</td>
</tr>
<tr>
<td>230*</td>
<td>Pearson Correlation II</td>
<td>750</td>
</tr>
<tr>
<td>235</td>
<td>Scale Scoring</td>
<td>750</td>
</tr>
<tr>
<td>244</td>
<td>Multivariate Cross Classification</td>
<td>630</td>
</tr>
<tr>
<td>248</td>
<td>Intraclass Correlation</td>
<td>770</td>
</tr>
<tr>
<td>250*</td>
<td>Multiple Regression II</td>
<td>670</td>
</tr>
<tr>
<td>251</td>
<td>Ill-Conditioned Matrix Analysis</td>
<td>620</td>
</tr>
<tr>
<td>252*</td>
<td>Stepwise Regression</td>
<td>570</td>
</tr>
<tr>
<td>253</td>
<td>Canonical Analysis</td>
<td>520</td>
</tr>
<tr>
<td>255*</td>
<td>One-Way Analysis of Covariance</td>
<td>470</td>
</tr>
<tr>
<td>260</td>
<td>Factor Analysis</td>
<td>760</td>
</tr>
<tr>
<td>270</td>
<td>Effect Parameters for Dichotomous Attributes</td>
<td>320</td>
</tr>
<tr>
<td>271</td>
<td>Interaction Means Program</td>
<td>310</td>
</tr>
<tr>
<td>301</td>
<td>Missing Data Recoding</td>
<td>230</td>
</tr>
<tr>
<td>302*</td>
<td>Random Data Generation</td>
<td>640</td>
</tr>
<tr>
<td>303</td>
<td>Z-score transformation</td>
<td>630</td>
</tr>
<tr>
<td>304</td>
<td>Rank-ordering transformation</td>
<td>500</td>
</tr>
<tr>
<td>305</td>
<td>Data Generation and Repunching II</td>
<td>5700</td>
</tr>
<tr>
<td>312</td>
<td>Wilcoxon Matched-pairs Signed-rank test</td>
<td>330</td>
</tr>
<tr>
<td>313</td>
<td>Difference Program</td>
<td>270</td>
</tr>
<tr>
<td>321</td>
<td>Spearman Rank Correlation</td>
<td>530</td>
</tr>
<tr>
<td>330</td>
<td>One-way Trend Analysis</td>
<td>220</td>
</tr>
<tr>
<td>331</td>
<td>Trend Analysis</td>
<td>500</td>
</tr>
<tr>
<td>333</td>
<td>One-way ANOVA II</td>
<td>560</td>
</tr>
<tr>
<td>340*</td>
<td>One-way Frequency Distributions</td>
<td>750</td>
</tr>
<tr>
<td>341*</td>
<td>Nominal Data Recoding</td>
<td>670</td>
</tr>
<tr>
<td>342*</td>
<td>Nominal Data Stacking</td>
<td>330</td>
</tr>
<tr>
<td>343*</td>
<td>Two-way Contingency Tables</td>
<td>1000</td>
</tr>
<tr>
<td>345</td>
<td>Frequency Distribution</td>
<td>630</td>
</tr>
<tr>
<td>345A</td>
<td>Frequency Distribution</td>
<td>560</td>
</tr>
<tr>
<td>370</td>
<td>Blocking Program</td>
<td>310</td>
</tr>
</tbody>
</table>

The column containing field lengths for the various programs is to be punched in Columns 53-58 (right adjusted) of the job card. An asterisk following a program number denotes that the program is on the IBS common file.
Appendix B

Delivery Codes
<table>
<thead>
<tr>
<th>Code</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Business Building*</td>
<td>3-5 M-F</td>
</tr>
<tr>
<td>C</td>
<td>Ketchum</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Denver Center*</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Engineering Center*</td>
<td>8-12 p.m. M-Th</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8-5 F</td>
</tr>
<tr>
<td>F</td>
<td>LASP*</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Muenzinger</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>IBS*</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Physics</td>
<td>8-5 M-F</td>
</tr>
<tr>
<td>S</td>
<td>Medical Center*</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Colorado Springs*</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Metro State*</td>
<td></td>
</tr>
<tr>
<td>Ø</td>
<td>Educ. Annex</td>
<td></td>
</tr>
</tbody>
</table>

Contact Operations Manager for a more exact schedule

*These areas have an actual terminal. All other areas are just pick up and delivery areas.
Appendix C

Program Access
IMSL

Job Card
Account Card
RUN.
ATTACH, IMSL/UN=LIBRARY.
LOAD, LGO, IMSL.
EXECUTE.
7/8/9
(Program)
7/8/9
(data)
6/7/8/9

BMD

Job Card
Account Card
CALL(BMD(BMD=BMD___))
7/8/9
(Program)
6/7/8/9

SPSS

Job Card
Account Card
ATTACH, SPSS/UN=1072P.
SPSS.
7/8/9
(Program)
6/7/8/9

IBS

Job Card
Account Card
REQUEST, IBS,HY. UQ1007 RØ
COPYN,0,XQT, IBS.
RETURN, IBS.
XQT(LC=100000)
7/8/9
REWIND(ibs)
IBS ..., IBS
7/8/9...
RUN(G)
7/8/9
(Program)
6/7/8/9
Appendix D
**Fortran Program**

Job Card
Account Card
RUN.
LG0.
7/8/9
(Program)
7/8/9
(Data)
6/7/8/9

**Run from Binary Deck**

Job Card
Account Card
7/8/9
(Binary Deck Program)
6/7/9
(Data deck)
6/7/8/9

**LER Tape**

Job Card (include a M1)
Account Card
REQUEST, LERT, HI. UQ1023 R0
REWIN, LERT.
COPY, LERT.
RETURN, LERT.
LER, LC=40000.
7/8/9
REWIN, LERT
---, /, LERT
7/8/9
(Data)
6/7/8/9

**Line Count Changing**

With normal cards you are allowed 10,000 lines of output. If you anticipate needing more make the following change:

When changing line count do not punch in any commas in the number and be sure the number is in base eight (8).

BMD: CALL(BMD(BMD=___,10000 = ____).

SPSS: SPSS, LC=_____.

IBS: XQT, LC=_____.

LER: LER, LC=_____.

FORTRAN: LG0, LC=____.

LERTAP: PART2, LC=____.

**LERTAP Program**

Job Card (include a M1, C770)
Account Card
REQUEST, NELSON, HY. PLS MT UQ 2211 R0
REWIN, NELSON.
COPYBF(NELSON, PART1, 1)
COPYBF(NELSON, PART2, 1)
REWIN, PART1, PART2.
PART1.
PART2.
7/8/9
[Lertap control cards]
[Your data deck]
Maximum number of categories per variable = 10

Maximum number of intervals in each categorization = 22

Maximum frequency per cell = 9,999

Output: count of rejects
2 way-frequency Tables
Row, column and/or table percentages
Chi-square and df
Contingency coefficient
Maximum likelihood ratio

*Transgeneration Program is provided a general type of editing process for preparing a modified set of punched cards (or tape) for input into other programs. Although many of the programs provide some editing features, it may be desirable to perform any extensive modifications with the use of this program so that the data deck can be used directly with little further modification in a number of other programs.
<table>
<thead>
<tr>
<th>Program</th>
<th>Surmise Regression</th>
<th>Multiple Regression with Case Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>02R</td>
<td></td>
<td>03R</td>
</tr>
<tr>
<td>no. of cases</td>
<td>9999</td>
<td>99,999</td>
</tr>
<tr>
<td>no. of variables</td>
<td>80</td>
<td>50</td>
</tr>
<tr>
<td>variable format cards</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>no. of standard transgen. cards</td>
<td>99</td>
<td>50/selection</td>
</tr>
<tr>
<td>no. of special transgen. cards</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>transgeneration codes</td>
<td>01-17, 20-24</td>
<td>01-17</td>
</tr>
<tr>
<td>means</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>st. deviations</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>covariance matrix</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>correlation matrix</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>anova of regressions</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>partial correlations</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>residuals</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>plot of curve or residuals</td>
<td>yes</td>
<td>-</td>
</tr>
<tr>
<td>Other features</td>
<td>Intermediate output for each step. Zero intercept.</td>
<td>Groups may be formed from 28 sub-samples. Analysis of extreme residuals is provided.</td>
</tr>
</tbody>
</table>

Program: General Factor Analysis

03M

Number of cases | 6,999
No. of variables, (original + transgenerated) | 80
No. of Transgeneration Cards | No transgen.
Transgeneration codes | ---

Data list | ---
Correlation coefficients | yes
Eigenvalues | yes
Eigenvectors | yes
Rank order of cases | ---

Other features: Factor matrix, rotated factor matrix, input from data matrix, correlation matrix or factor matrix.
<table>
<thead>
<tr>
<th>Program</th>
<th>Analysis of Variance</th>
<th>Design</th>
<th>No. of levels of each analysis</th>
<th>Classification of variances</th>
<th>Covariances</th>
<th>Unequal group sizes</th>
<th>Observations</th>
<th>Replicates</th>
<th>Total degrees of freedom in ANOVA model</th>
<th>Tape input</th>
<th>Transgeneration codes</th>
<th>Transgeneration input</th>
<th>Case selection feature</th>
<th>Contrasts</th>
<th>Covariance matrix</th>
<th>Regression coefficients</th>
<th>Adjusted means or residuals</th>
<th>Analysis of variance table</th>
<th>Group names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class V</td>
<td>Analysis of variance</td>
<td>01V</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>20,000</td>
<td>no</td>
<td>01-10, 22-24, 21-24</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02V</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>1500</td>
<td>yes</td>
<td>01-10, 01-14</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>03V</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>1500</td>
<td>yes</td>
<td>01-10, 01-14</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Note:** The table represents a check list for a specific program with various specifications. Each row corresponds to a different analysis type or feature, with columns indicating whether it is included or excluded. Details include the number of levels, replication, total degrees of freedom, and various other parameters relevant to the analysis.