DOCUMENT RESUME

ED 096 353 95 TM 003 969

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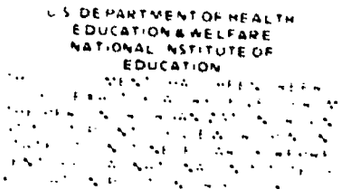
TITLE User's Guide and Orientation to Canned Computer Programs.
INSTITUTION Colorado Univ., Boulder. Lab. of Educational Research.
SPONS AGENCY National Center for Educational Research and Development (DHEW/OE), Washington, D.C.
PUB DATE Feb 73
NOTE 32p.; For related documents, see TM 003 967-973

EDRS PRICE MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS *Autoinstructional Aids; *Computer Programs; *Computer Science Education; *Guides; *Programing; Researchers; Statistical Analysis

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 form 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

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University of Colorado

February 1973

NCERD Reporting Form — Developmental Products

1. Name of Product	2. Laboratory or Center	3. Report Preparation
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.*	7. Level of Development: *Characteristic level (or projected level) of development of product at time of release. Check one.*	8. Next Agency: *Agency to whom product was (or will be) released for further development/diffusion.*
12/1/73	X *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*	NIE

10.71.A (D)

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 please so indicate.*

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.*	14. Origin: *Circle the most appropriate letter.*
One self-contained product with suggested activities.	(D) M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D M A
	D = Developed M = Modified A = Adopted

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.

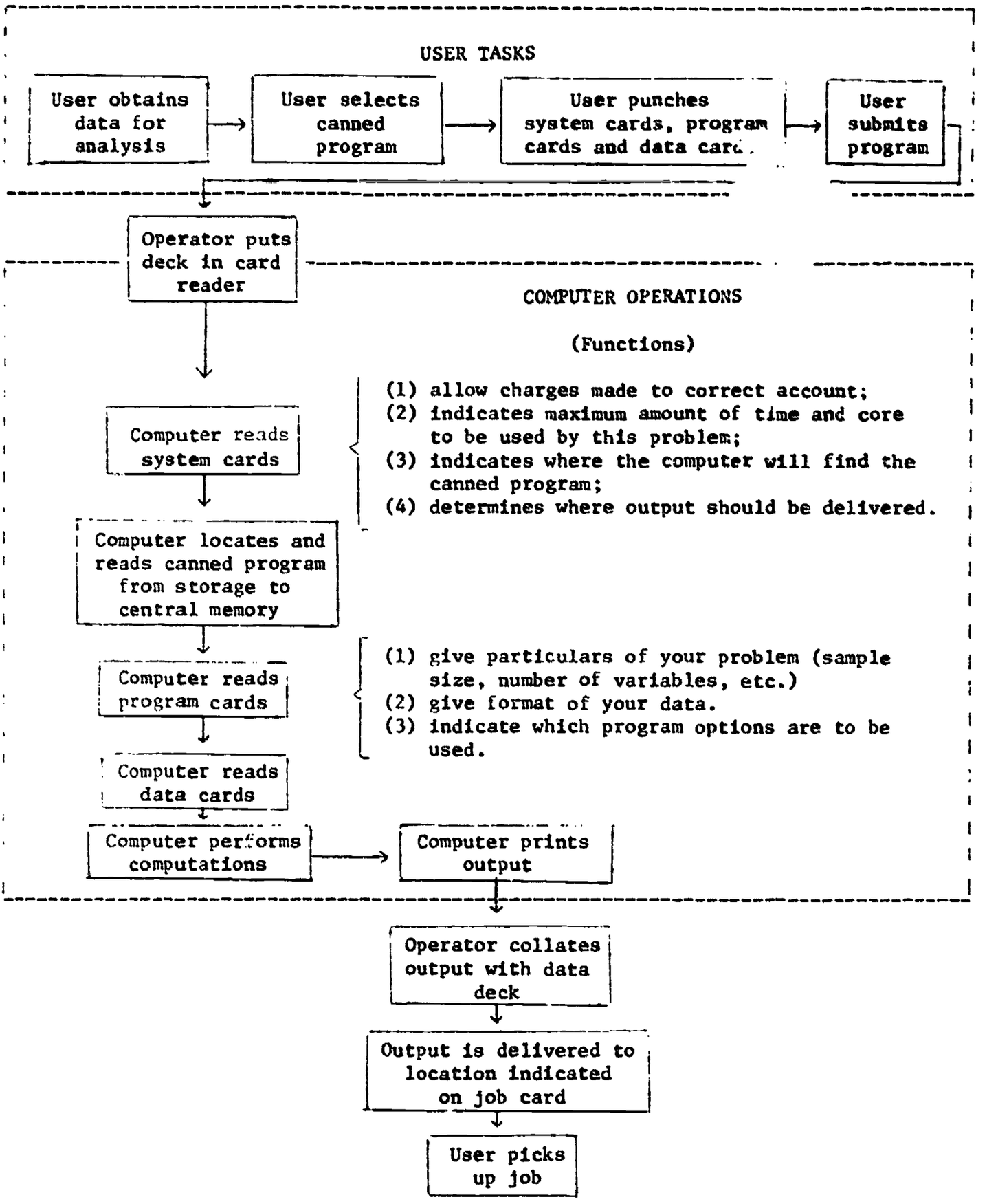
17. Likely Market: *What is the likely market for this product? Consider the size and type of the user group; number of possible substitute (competitor) products on the market; and the likely availability of funds to purchase product by (for) the product user group.*

University students in research, evaluation, and statistics courses.

Table of Contents

ORIENTATION TO RESEARCH USE OF COMPUTERS

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



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.

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[1] Dixon, W.J. (ed.), BMD Biomedical Computer Programs, University of California Press, 1971.

[2] Statistical Package for the Social Sciences, NIE, N., et al., McGraw-Hill, 1970.

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.

[4]Statistical Analysis System, North Carolina State University, Dept. of Statistics, Raleigh, North Carolina.

[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.

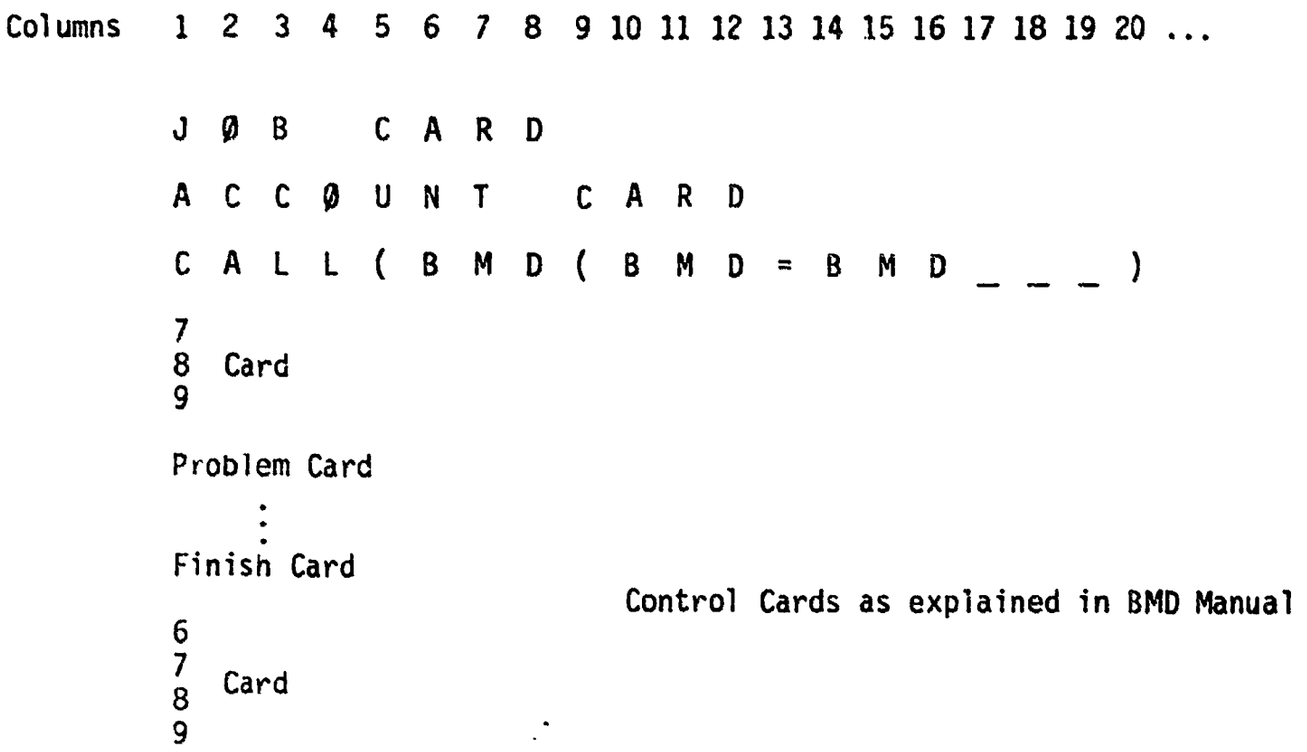

Figure 1. Outline of Card Deck for BMD Programs.

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 lengtns 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 ACCØUNT in columns 1-7 follwed 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
         A  C  C  Ø  U  N  T  ,  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
         A  C  C  Ø  U  N  T  ,  C  6  1  0  B  .
```

How to Call BMD Programs

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

CALL(BMD(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:

Field Code	Number as punched	Number as would be read by computer
(F3.0)	231	231
(F3.0)	23	23
(F3.1)	231	23.1
(F3.2)	231	2.31
(F3.3)	231	.231

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

Example:

Field Code	Number as Punched	Number as would be read by computer
(2X,F3.0)	92345	345
(3X,F2.1)	92345	4.5
(1X,F2.0, 2X, F1.0)	923456	23 and 6
(1X,F2.1, 1X, F1.0)	923456	2.3 and 5

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

Example:

Field Code	Number as Punched	Number as would be read by computer
(3F1.0)	823	8,2, and 3
(1X, F2.0, 2F2.1)	823456789	23, 4.5, and 6.7
(F1.0, 2F3.1, F2.2)	823456789	8, 23.4, 56.7, and .89

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 O

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: PRØBLM

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:

Column	7	8	9	10	11	12
					5	6

If you punched it like this:

Column	7	8	9	10	11	12
					5	6

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).

		Field Length
Class D - Data Description and Tabulation		
01D	Simple data description	410
02D	Correlation with transgeneration	610
03D	Correlation with item deletion	530
04D	Alphanumeric frequency count	650
05D	General plot including histogram	650
06D	Description of strata	650
09D	Cross-tabulation, incomplete data	640
Class M - Multivariate Analysis		
01M	Principal component analysis	640
03M	Factor analysis	650
04M	Discriminant analysis for two groups	610
05M	Discriminant analysis for several groups	630
06M	Canonical analysis	470
07M	Stepwise discriminant analysis	645
Class R - Regression Analysis		
01R	Simple linear regression	620
02R	Stepwise regression	600
03R	Multiple regression with case combinations	610
04R	Periodic regression with harmonic analysis	630
05R	Polynomical regression	410
Class S - Special Programs		
02S	Contingency table analysis	660
09S	Transgeneration	520
Class T - Time Series Analysis		
02T	Auto covariance and power spectral analysis	520
Class V - Variance Analysis		
01V	Analysis of variance for one-way design	643
02V	Analysis of variance for factorial design	650
05V	General linear hypothesis	630
07V	Multiple range tests	560
08V	Analysis of variance	653

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.

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

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

Code	Location	Comments
B	Business Building*	8-5 M-F
C	Ketchum	
D	Denver Center*	
E	Engineering Center*	8-12 p.m. M-Th 8-5 F
F	LASP*	
G	Muenzinger	
I	IBS*	
P	Physics	8-5 M-F
S	Medical Center*	
T	Colorado Springs*	
Y	Metro State*	
Ø	Educ. Annex	

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.
LØAD, LGØ,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
CØPYN,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.
LGØ.
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 RØ
REWIND, LERT.
CØPYN,0,LER,LERT.
RETURN,LERT.
LER,LC=40000.
7/8/9
REWIND,LERT
_____,/,LERT
7/8/9
(Data)
6/7/8/9
```

LERTAP Program

```
Job Card (include a M1, C770)
Account Card
REQUEST,NELSON,HY.  PLS MT UQ 2211 RØ
REWIND,NELSON.
COPYBF(NELSON,PART1,1)
COPYBF(NELSON,PART2,1)
REWIND,PART1,PART2.
PART1.
PART2.
7/8/9
[Lertap control cards]
[Your data deck]
6/7/8/9
```

Line Count Changing

With normal cards you are allowed $10{,}000_8$ 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=_____.

FØRTRAN  LGO,LC=____.

LERTAP  PART2, LC=____.
```

Class [illegible] Check List

Program	Simple Data Description ✓	Correlation ✓	Correlation with Item Deletion ✓	Cross-tabulation with Variable Stacking ✓
	0SD	0SC	0SE	0SF
No. of cases	99,999	99,999	99,999	1,500
No. of variables, (original and transgenerated)	1,000	100	40	100
No. of transgen cards	100	100	40	99
Transgeneration codes	1-17, 20-24, 40	01-09, 41	01-10	08-13, 15, 16, 40, 41, 82-85*
Means	yes	yes		yes
Variances		yes		
Standard deviations	yes	yes		yes
Standard errors	yes			
Correl. coeff.		yes	yes	yes
Chi-square				yes
Frequency tables, size				31 x 99
Data listing or grouping based on a specified variable				
Boolean selection		yes		
Plots		yes		
Histograms				
No. of specified data codes which may be excluded	Any 4 methods	Any no. by case select.	10 for each variable	
Labels of variables in output				yes
Other features	Provides max, min. & range of each variable		Provides counts of excluded values	Provides stacking of 2-n variables in a single tabulation

02S

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 85 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.

Class R - Check List

Program	Stepwise Regression ✓	Multiple Regression with Case Combinations ✓
	02R	03R
no. of cases	9999	99,999
no. of variables (original and transgenerated)	80	50
variable format cards	10	10
no. of standard transgen. cards	99	50/selection
no. of special transgen. cards	-	-
transgeneration codes	01-17, 20-24	01-17
means	yes	yes
st. deviations	yes	yes
covariance matrix	yes	yes
correlation matrix	yes	yes
anova of regressions	yes	yes
partial correlations	yes	yes
residuals	yes	yes
plot of curve or residuals	yes	-
Other features	Intermediate output for each step. Zero intercept.	Groups may be formed from 28 subsamples. Analysis of extreme residuals is provided.

-149-

Class M - Check List

Program	General Factor Analysis ✓
	03M
Number of cases	9,999
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

Class V - Check List

Program	Analysis of Variance for One-Way Design 01V ✓	Anova for Factorial Design 02V ✓	Analysis of Covariance for Factorial Design 03V	Analysis of Covariance with Multiple Covariates 04V	General Linear Hypothesis 05V ✓	General Linear Hypothesis with Contrasts 06V	Multiple Range Tests 07V ✓	Analysis of Variance 08V ✓
Analysis of variance classifications	1	8	6	1	---	---	1	10
No. of levels of each anal. of var. classification	5000	999	999	99	---	---	100	999
Covariates	0	0	8	35	59	59	---	---
Unequal group sizes	yes	no	no	yes	yes	yes	yes	no
Total degrees of freedom in anova model	5000	18,000	1500	99	60	60	100	at least 5000
Replicates	20,000	999	999	999	no limit	9999	20,000	999
"Contrasts"	---	---	---	---	57	99	---	---
Tape input	yes	yes	yes	yes	yes	yes	yes	yes
Variable format cards	10	5	5	10	5	10	10	9
Transgeneration cards	9	1-special	64	99	60	99	9	---
Transgeneration codes	01-10	01-10	01-14	01-17, 21-24, 41	01-14	01-14	01-10	---
Case selection feature	no	no	no	yes	no	no	no	no
Data list	---	---	---	yes	---	yes	---	---
Means by cells or groups	yes	yes	---	yes	yes	yes	yes	yes
Contrasts	---	orthogonal	---	---	yes	yes	---	---
Covariance matrix	---	---	yes	yes	---	yes	---	---
Regression coefficients	---	---	yes	yes	yes	yes	---	---
Adjusted means or residuals	---	---	yes	yes	---	yes	yes	yes
Analysis of variance table	yes	yes	yes	yes	---	---	yes	yes
Group names	---	---	---	yes	---	---	---	---