A User's Guide to

B I G S T E P S

**Rasch-Model
Computer Program**

John M. Linacre

Benjamin D. Wright

Winsteps.com

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January 2, 2006

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1. INTRODUCTION

1.1 Rasch analysis and BIGSTEPS

Rasch analysis is a method for obtaining objective, fundamental, linear measures (qualified by standard errors and quality-control fit statistics) from stochastic observations of ordered category responses. Georg Rasch, a Danish mathematician, formulated this approach in 1953 to analyze responses to a series of reading tests (Rasch G, *Probabilistic Models for Some Intelligence and Attainment Tests*, Chicago: MESA Press, 1992, with instructive Foreword and Afterword by B.D. Wright). BIGSTEPS implements Rasch's formulation by means of modified versions of the PROX and UCON estimation methods (for more information and further references, see *BTD* and *RSA*).

Flow of work using BIGSTEPS
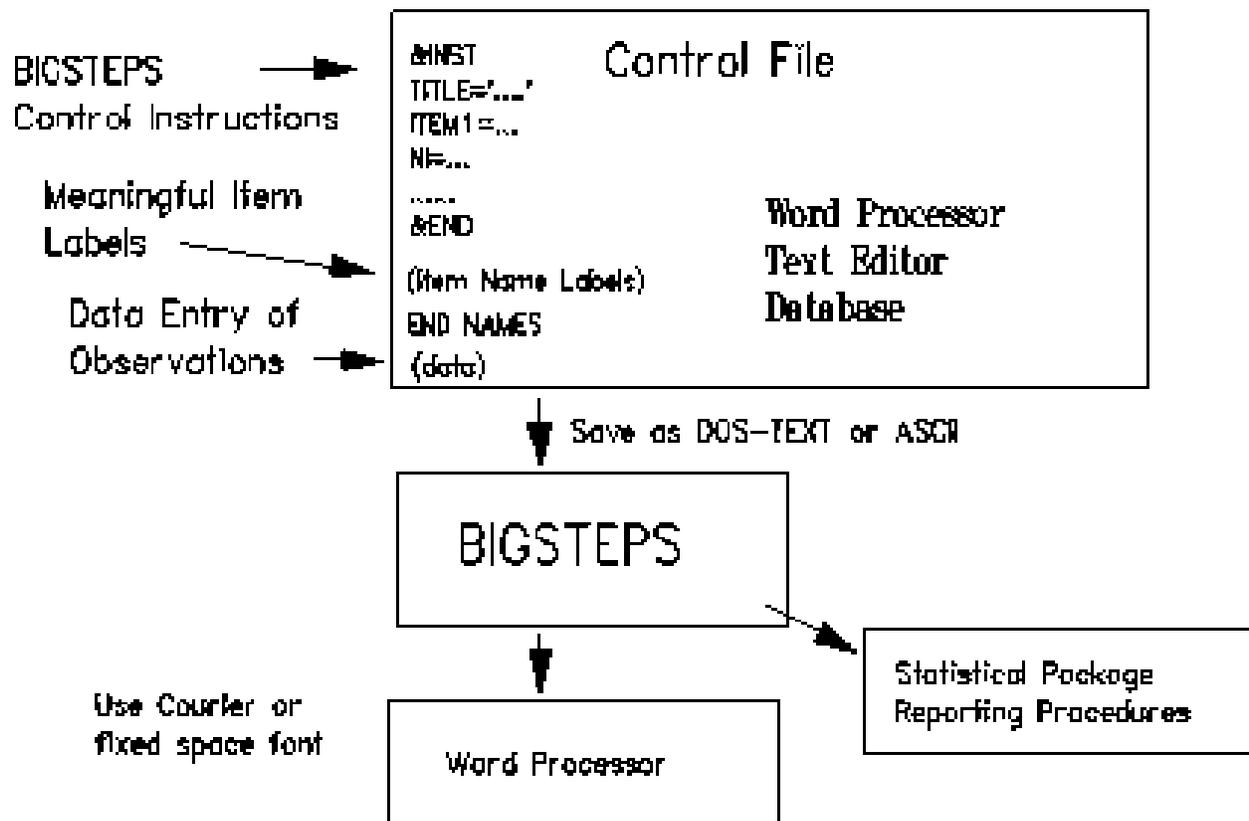
BIGSTEPS is designed to construct Rasch measurement from the responses of a set of persons to a set of items. Responses may be recorded as letters or integers and each recorded response may be of one or two characters. Alphanumeric characters, not designated as legitimate responses, are treated as missing data. This causes these observations, but not the corresponding persons or items, to be omitted from the analysis. The responses to an item may be dichotomous ("right"/"wrong", "yes"/"no"), or may be on a rating scale ("good"/ "better"/"best", "disagree"/"neutral"/"agree"), or may have "partial credit" or other hierarchical structures. The items may all be grouped together or be grouped into subsets of one or more items which share the same response structure.

BIGSTEPS begins with a central estimate for each person measure, item calibration and rating scale category step calibration, unless pre-determined, "anchor" values are provided by the analyst. An iterative version of the PROX (normal approximation) algorithm is used reach a rough convergence to the observed

data pattern. The UCON method is then iterated to obtain more exact estimates, standard errors and fit statistics. This implementation of the UCON (unconditional maximum likelihood, joint maximum likelihood) method used proportional curve fitting, rather than the Newton-Raphson method, for finding improved estimates.

Output consists of a variety of useful plots, graphs and tables suitable for import into written reports. The statistics can also be written to data files for import into other software. Measures are reported in Logits (log-odds units) unless rescaled. Fit statistics are reported as mean-square residuals, which have approximate chi-square distributions. These are also reported standardized, N(0,1).

References:
BTD means Wright B.D. & Stone M.H. *Best Test Design*, Chicago: MESA Press, 1979.
RSA means Wright B.D. & Masters G.N. *Rating Scale Analysis*, Chicago: MESA Press, 1982.

1.2 About the User's Guide
You don't need to know about every BIGSTEPS option in order to use the program successfully. Glance through the examples in Section 3 and find one similar to yours. Adapt the example to match your requirements. Then "fine tune" your analysis as you become familiar with further options.

1.3 Type style
Most of this Guide is in proportionately-spaced type.

When it is important to be precise about blanks or
spaces, or about
column alignment,
fixed-space type is used.

```
When it is important to show everything that appears on a long line, small type is used.
```

§ Suggestions that we have found helpful are shown like this.

1.4 Getting further help
BIGSTEPS is a powerful weapon in the struggle to wrest meaning from the chaos of empirical data. As you become skilled in using BIGSTEPS, you will find that it helps you to conceptualize what you are measuring, and to diagnose measurement aberrations.

You may also find that you can use a word of advice on occasion. The authors of BIGSTEPS, Ben Wright and Mike Linacre, are happy to answer questions to do with the operation of BIGSTEPS or the nature of Rasch analysis. More prolonged consultations can also be arranged.

We strongly recommend that you join the *Rasch Measurement Special Interest Group* of the American Educational Research Association, for which AERA membership is not required. The SIG publication, *Rasch Measurement Transactions*, contains instructive articles on the fundamentals of Rasch analysis as well as the latest ideas in theory and practice. Share your experiences with your colleagues at SIG meetings. The advance of science is an activity in which we can all participate to our mutual benefit. The SIG address is: Rasch Measurement SIG, www.rasch.org/rmt .

2. GENERAL DESCRIPTION

2.0 Installing BIGSTEPS

BIGDOS.EXE   To install BIGSTEPS under MS-DOS.

These create directory, C:\BIGSTEPS, and install in it BIGSTEPS. Sample control and data (.DAT) files are also installed to help you get started:

KCT.DAT is the Knox Cube Test data (*BTD* p.31 - see Section 1.1)

(The results in *BTD* were obtained with more approximate algorithms and do not agree exactly with BIGSTEPS results.)

SF.DAT is the Liking For Science data (*RSA* p.18)

There are EXAMPLE files described starting on p. 10 of this manual.

Under *DOS*:

At the DOS prompt:

C:>*A:\BIGDOS*

To Run BIGSTEPS:

C:>*CD BIGSTEPS*

C:>*BIGSTEPS SF.DAT SF.OUT(Enter)*

2.1 How to use BIGSTEPS

i)   Install BIGSTEPS.

ii)   Make sure it works " use one of the example data sets " see the following instructions.

iii)   Choose an example that is similar to your data " see 3. EXAMPLES, p. 10

iv)   Choose a word processor (e.g., WordPerfect) or text editor (e.g., EDIT or WordPad) that can write or save DOS TEXT or ASCII files.

v)   Open the example file with your word processor or text editor.

vi)   Edit the example file to match your data. This is now your BIGSTEPS control file.
§ Don't worry if your specifications are not exactly right. BIGSTEPS will tell you of anything it doesn't understand.

vii)   Key in your data at the end of the example file, or reference your data file with a DATA= specification.

viii)   Write or save your edited control as a DOS TEXT or ASCII file with the name of your choice, e.g., MYFILE.CON

ix)   If your data is in a separate file, check to make sure it has the format you specified and is in DOS TEXT or ASCII characters, i.e., it is not in SPSS or DBASE format.

When writing a file from SPSS, the syntax is:
FORMATS ITEM1 ITEM2 ITEM3 (F1). i.e., FORMATS varlist (format) [varlist..]
The procedure is FORMATS and then the variable list. Enclosed in parentheses is the format type.
F signifies numeric while 1 signifies the width. (F2) would signify a numeric with a width of 2

columns for XWIDE=2. See pages 216 and 217 of the SPSS Reference Guide (1990).

x)   Run BIGSTEPS. Specify MYFILE.CON as the control file. MYFILE.OUT as the output file.

xi)   Look at the BIGSTEPS output file using your word processor or text editor. Be prepared to rerun BIGSTEPS several times before you get results that make good sense.

2.4 Starting BIGSTEPS in DOS

A typical analysis requires two components: control information and data. These can be in separate computer files or can be combined in one file. The results of the analysis are written to an output file on disk.

To change to directory "BIGSTEPS", at the DOS prompt type:
C:> CD \BIGSTEPS (Press **Enter** Key)

To launch BIGSTEPS:
C:BIGSTEPS> **BIGSTEPS**(**Enter)**
Now BIGSTEPS asks you for the names of your input and output files.
>   C:> **BIGSTEPS**(**Enter)**
>   Please enter name of BIGSTEPS control file: **KCT.DAT**(**Enter)**
>   Please enter name of report output file: **NEWFILE**(**Enter)**

No check is done as to whether an output file already exists. If there is already a file with the same name as your output file, it will be overwritten.

You can streamline starting BIGSTEPS.
Enter BIGSTEPS then the name of the control file:
>   C:> **BIGSTEPS KCT.DAT**(**Enter)**
>   Please enter name of report output file: **NEWFILE**(**Enter)**

Or enter BIGSTEPS then the names of your control and output files:
C:> **BIGSTEPS CONTROL OUTPUT**(Press **Enter** Key)
>   where CONTROL is the name of the input file containing your control specifications and data (or
>   data location)
>   and OUTPUT is the name of the file to hold your output report
>   Example:
>   C:> **BIGSTEPS SF.DAT SF.OUT**(**Enter)**

2.4.1 Reading extra control variables from the DOS prompt line

BIGSTEPS expects to find the control variables in your control file. You may, however, specify one or more control variables on the DOS prompt line. These variables will be processed after all the variables in the control file and will supersede any conflicting instructions there. This is useful for making temporary changes to the control variables. These extra control variables *must not contain any blanks*.

Example 1:   You want to verify that your data is correctly formatted, so you only want to do one UCON iteration this time:

C:> **BIGSTEPS SF.DAT SF.OUT MUCON=1**(**Enter)**
>   where **MUCON=1** specifies only one UCON iteration is to be performed.

C:> **BIGSTEPS SF.DAT SF.OUT MUCON = 1**(**Enter**)
        is invalid since there are blanks included in **MUCON = 1**.

Example 2:   You want to produce an extra copy of the fit plot in Table 4 with specially chosen ranges
                on the axes:

C:> **BIGSTEPS SF.DAT SF.OUT TABLES=0001 MRANGE=3 FRANGE=4**(**Enter**)

2.5 Stopping BIGSTEPS

The BIGSTEPS program ceases execution when
1) The program stops itself:
      The estimation procedure has reached an acceptable level of convergence and all output has been
      produced. This happen when:
      a)   The estimates are within the convergence criteria (LCONV= and RCONV=)
      b)   The maximum number of iterations has been reached (MPROX= and then MUCON=)
      § To instruct BIGSTEPS to run indefinitely, set
          MUCON=0
          LCONV=0
          RCONV=0

2) You stop the iterative process:
      a) If you press **Ctrl** with **F** during PROX iterations:
          PROX iteration will cease as soon extreme scores have been identified and point-biserial
          correlations have been calculated. UCON iterations then start.
      b) If you press **Ctrl** with **F** during UCON iterations:
          UCON iteration will cease at the end of this iteration. Fit statistics will then be calculated
          and output tables written to disk.
      c) If you press **Ctrl** with **F** during the output phase:
          Output will cease at the end of the current output operation.

      Acknowledgement of your **Ctrl** with **F** instruction is shown by the replacement of = by # in the
      horizontal bar drawn across you screen which indicates progress through the current phase of
      analysis.

3) You cancel BIGSTEPS execution immediately:
          Press **Ctrl** and **Break** keys together or
          Press **Ctrl** and **C** keys together
      No more analysis or output is performed.

2.6 The BIGSTEPS control and data files
2.6.1 Using a word processor or text editor
a) Input files: all lines in your control and data files follow DOS text conventions. This means that files
      created with a Word Processor, such as "Word Perfect", *must be saved as "DOS text" or "ASCII"*
      files.

      1.   Lines must not contain tabs or word processor codes.

      2.   Lines cannot overflow onto the next line, except for data records which are processed using
          the FORMAT= control variable.

3. Lines must end with DOS or ASCII Carriage Return and Line Feed codes.

Be particularly careful to instruct your Word Processor to allow more characters within each line than are present in the longest line in your control or data files. Then your Word Processor will not break long data or control lines into two or more text lines with "Soft Return" codes. These cause BIGSTEPS to malfunction. Space for a large number of characters per line is obtained by specifying a very wide paper size and/or a very small type size to your Word Processor.

When using "Word Perfect" to edit control or data files, select the smallest available type size (often 20 cpi or 5 pt). Define and use a very wide (50 inch) page style. It does not matter whether your printer can actually print it. *Always save control and data files as "DOS Text" or ASCII files.*

With WordStar, use "Non-Document" mode to avoid these difficulties.

b) Output files: when importing BIGSTEPS output into a document file, the following options have proved useful:

Base Font - 17 cpi (or more) or 8 point (or smaller) or 132 characters per line (or more)
Left Justify
Page numbering
Margins: top = 1", bottom = 0.5", left = 1", right = 0"

2.6.2 The data file
§ If your data file is small, it is easiest merely to have it at the end of your control file. If your data is extensive, keep it in a separate data file.

Your data file is expected to contain a record for each person containing a person-id field and a string of responses to some items. Your data can be placed either at the end of your control file or in a separate disk file.

BIGSTEPS reads up to 30 columns of person-id information. Normally the person-id is assumed to end when the response data begin or when the end of your data record is reached. However, an explicit length of 30 characters or less can be given using the NAMLEN= control variable.

By the term "response" is meant a data value which can be a category label or value, score on an item or a multiple-choice option code. The responses can be one or two characters wide. Every record must contain responses (or missing data codes) to the same items. The response (or missing data code) for a particular item must be in the same position in the same format in every record. If every person was not administered every item then *mark the missing responses blank* or make them some otherwise unused code, so that the alignment of item responses from record to record is maintained.

A table of valid responses is entered using the CODES= character string. Any other response found in your data is treated as missing. By using the CODES=, KEYn=, NEWSCORE= and IVALUE= options, virtually any type of response, e.g. "01", "1234", " 1 2 3 4", "abcd", " a b c d", can be scored and analyzed. Missing responses are usually ignored, but the MISSING= control variable allows such responses to be treated as, say, "wrong".

When writing a file from SPSS, the syntax is:
FORMATS ITEM1 ITEM2 ITEM3 (F1). i.e., FORMATS varlist (format) [varlist..]
The procedure is FORMATS and then the variable list. Enclosed in parentheses is the format type. F

signifies numeric while 1 signifies the width. (F2) would signify a numeric with a width of 2 columns for XWIDE=2. See pages 216 and 217 of the SPSS Reference Guide (1990).

2.6.3 The control file
The control file tells what analysis you want to do. The easiest way to start is to look at one of the examples in the next section of this manual, or on the program diskette. The control file contains control variables. These are listed in the index of this manual. Only two control variables **must** have values assigned for every analysis: **NI=** and **ITEM1=**. Almost all others can be left at their automatic default values, which means that you can defer learning how to use most of the control variables until you know you need to use them.
> § When in doubt, don't specify control variables, then they keep their default values.

2.6.4 Syntax rules for assigning values to control variables (key-words)
> § Do not worry about these unless BIGSTEPS does not respond to your control file the way you expected. If possible, compare your control file with what is shown in Table 0 of your output file in order to isolate the problem.

1. Values are assigned to control variables by typing the name of the control variable (or enough of it to disambiguate it), an equal sign, "=", and the value, e.g.

    TABLES=11011011100

    or

    TAB=1101101110   ⇐ this is enough of TABLES to make clear what you mean.

2. You must use one line for each assignment, but continuation lines are permitted.
    To continue a line, put a + at the end of the line. Then put a + at the start of the text in the next line. The two lines will be joined together so that the + signs are squeezed out, e.g.,

    TITLE = "Analysis of medical+
      + research data"
    is interpreted as
    TITLE = "Analysis of medical research data"

    > § Continuation lines "+" are helpful to make control files fit on your screen.

    CODES = 01020304+
        +05060708
    is interpreted as
    CODES = 0102030405060708

3. The control variables may be listed *in any order*.

4. Character strings must be enclosed in 'single quotes' or "double quotes" when they contain blanks, e.g.,
    TITLE="Rasch Analysis of Test Responses"
    or
    TITLE='Rasch Analysis of Test Responses'
    Quotes are not required for single words containing no blanks, e.g. PFILE=kct.pf

5. The control variables may be in upper or lower case or mixed,
    e.g., Pfile = Person.Dat

6. Blanks before or after control variables, and before or after equal signs are ignored, e.g.

        TITLE="Test Report"

   and

       TITLE = "Test Report"

   are equally correct.

7. Commas at the end of lines are ignored, so equally correct are:

       NAME1 = 33,

   and

       NAME1 = 33

8. Control variables can be made into comments, and so be ignored, by entering a semi-colon in column 1, e.g.

       ; FITP=3 is ignored

9. Comments can appear on the same line as a control variable, as long as they are separated by at least one blank from the control value, e.g.

       FITP = 3   this is a comment

   or

       CODES = " ABCD12345" this is a comment - there is a code of "blank"

10. When all control variables (required or optional) have been assigned values, type **&END** (in upper or lower case) on the next line, e.g.,

       &INST   ⇐ This is optional

       Title ="A 30 Item test"

       NI = 30

       ; this is a comment: person names in columns 1-20.

       ITEM1= 21

       &END

2.7 How long will an analysis take?

A PC with a math co-processor processes about 1,000,000 observations per minute. Most analyses have reached convergence within 20 iterations, so a rule of thumb is:

       length of analysis in minutes = (number of persons)*(length of test)*2/100,000

2.8 How big an analysis can I do?

The upper limit is 32,000 persons by 3,000 items. Rating scale categories must be in the range 0 - 99. Since memory and disk space are assigned dynamically, large analyses may cause a report of "Not enough disk space" or "Not enough memory".

2.9 If BIGSTEPS does not work

1) Repeat the installation process. It will not delete any of your data files.

2) Check that the BIGSTEPS runs.

3) If the program will not run, or produces implausible results:

       a) There are some computers in which the Math Co-Processor does not work correctly. Disable your Math Co-processor by keying, at the DOS prompt:

       C:> **SET NO87=DISABLE**(**Enter**)

and run BIGSTEPS again.

b) There may not be enough disk space for work files, see "Not enough disk space".

c) There may not be sufficient RAM memory to execute. See "Not enough memory".

2.9.1 *Not enough disk space*
§ Files with names "BIGSTEPS.$.." and "WST......TMP" and files in the \TEMP directory are work files. These can be deleted.

You need about the twice as much work file space on your disk as the size of your data file. The work files are placed temporarily in the current directory (reported on your screen when BIGSTEPS starts). Delete unwanted files to give yourself more disk space, or log onto a different disk drive, with more available space, before executing BIGSTEPS. Type

C:> **CHKDSK /F**(**Enter**)

to verify that you have enough available space on your current disk drive.

The program, control file, output file and work files can be dispersed onto four different drives:

D:> **C:\BIN\BIGSTEPS A:KCT.DAT B:KCT.OUT**(**Enter**)

The work files will be placed on drive D:.

2.9.2 *Not enough memory*
BIGSTEPS does not use extended or expanded memory, but makes use of all free conventional RAM memory. To free up more memory, remove all DOS Shells, Device Drivers and Terminate-and-Stay-Resident (TSR) programs. This can be done by editing your AUTOEXEC.BAT and CONFIG.SYS files, and then rebooting your computer.

3. EXAMPLES OF CONTROL AND DATA FILES

Rather than attempting to construct a control file from scratch, it is usually easier to find one of these examples that is similar to your problem, and modify it.

Example 1: Simple control file with data included

A control file, EXAMPLE1.CON, for an analysis of the Knox Cube Test (see *BTD*) a test containing 18 items, each item is already scored dichotomously as 0,1. The person-id data begins in column 1 and the item string begins in column 11. No items will be deleted, recoded, or anchored. The default tables will appear in your output file: EXAMPLE1.OUT. The number of data lines is counted to determine how many children took the test. For an explanation of the output obtained, see section 6. Run this example with:

Control file: **EXAMPLE1.CON**
Output file: **EXAMPLE1.OUT**
Extra specifications:(**Enter**)

```
; This file is EXAMPLE1.CON
 &INST                      ⇦ start of control variable instructions
 TITLE='KNOX CUBE TEST'        ⇦ at top of each printout page
 NI=18                      ⇦ number of items
 ITEM1=11                        ⇦ location of response to first item
 NAME1=1                         ⇦ start of person-id
 TABLES=1110001001001          ⇦ Output default Tables
 PERSON=KID             ⇦ person label is KID
 ITEM=TAP                        ⇦ item label is TAP
 PFILE=EXAMPLE1.PF    ⇦ also write person measures to a file
 IFILE=EXAMPLE1.IF    ⇦ also write item calibrations to a file
 &END                   ⇦ end of  control variables
1-4                               ⇦ first item name
2-3
1-2-4
1-3-4
2-1-4
3-4-1
1-4-3-2
1-4-2-3
1-3-2-4
2-4-3-1
1-3-1-2-4
1-3-2-4-3
1-4-3-2-4
1-4-2-3-4-1
1-3-2-4-1-3
1-4-2-3-1-4
1-4-3-1-2-4
4-1-3-4-2-1-4        ⇦ last, 18th, item name
END NAMES                       ⇦ signals end of item names
Richard M 111111100000000000        ⇦ first data record
Tracie  F 111111111100000000
       .                        ⇦ more data records
Elsie   F 111111111101010000
Helen   F 111000000000000000      ⇦ last data record
```

Example 2: Control and anchor files
A control file, EXAMPLE2.CON, for the analysis of a test containing 18 items, each item already scored dichotomously as 0,1. The person-id data begins in column 1 and the item-response string begins in column 11. The default tables will be appear in the printout. There is user scaling. Items 2, 4, 6 and 8 are anchored at 400, 450, 550 and 600 units respectively, supplied in file EXAMPLE2.IAF. Your data is in file EXAMPLE2.DAT:

```
; This file is EXAMPLE2.CON
 &INST
 TITLE='KNOX CUBE TEST - ANCHORED'      ⇦ the title for output
 NI=18                  ⇦ the number of items
 ITEM1=11               ⇦ position of first response in data record
 NAME1=1                    ⇦ first column of person-id in data record
 PERSON=KID
 ITEM=TAP
 DATA=EXAMPLE2.DAT      ⇦ name of data file
 IAFILE=EXAMPLE2.IAF        ⇦ EXAMPLE2.IAF is item anchor file
 UIMEAN=500             ⇦ user scaling - item mean
 USCALE=100             ⇦ user scaling - 1 logit = 100
 UDECIM=0                   ⇦ print measures without decimals
 &END
1-4                        ⇦ item names
 .
4-1-3-4-2-1-4
END NAMES               ⇦ End of this file
```

The anchoring information is contained in file EXAMPLE2.IAF and contains the following lines, starting in column 1:

```
2 400    ⇦ item 2 anchored at 400 units: (if logits are rescaled, then anchor values must also be rescaled)
4 450    ⇦ item 4 anchored at 450 units
6 550    ⇦ item 6 anchored at 550 units
8 600    ⇦ item 8 anchored at 600 units
         § Item calibration files, IFILE=, from prior runs can be used as item anchor files,
         IAFILE=, of later runs.
```

Your data is in the separate file, EXAMPLE2.DAT, with person-id starting in column 1, and item responses starting in column 11:

```
Richard M 111111100000000000
Tracie  F 111111111100000000
   .
Elsie   F 111111111101010000
Helen   F 111000000000000000       ⇦ End of this file
```

Example 3: Item recoding and item deletion

The test has 25 items, specified in EXAMPLE3.CON. The item response string starts in column 12. Person-id's start in column 1 (the default value). Original item codes are "0", "1", "2" and "X". All items are to be recoded and the original-to-new-code assignments will be 0⇨0, 1⇨2, 2⇨1 and X⇨3, since the responses are on a rating scale. Items 5, 8, and 20 through 25 are to be deleted from the analysis, and are specified in the control. The misfit criterion for person or item behavior is 3.0. Tables 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, 17, 19, 20 and 21 are to appear in your output file EXAMPLE3.OUT. Sequence numbers are used as item names. Data are in file EXAMPLE3.DAT.

```
; This file is EXAMPLE3.CON
 &INST
TITLE="A test with 25 recoded items"    ⇦ informative title
NI=25                    ⇦ 25 items
ITEM1=12                      ⇦ item responses start in column 12
CODES =012X                   ⇦ valid codes
NEWSCORE=0213                 ⇦ corresponding response score
RESCORE=2            ⇦ specifies rescore all items
TABLES=1111111110101010101110   ⇦ selected tables
FITP=3.0                  ⇦ person misfit cut-off for reporting
FITI=3.0                  ⇦ item misfit cut-off for reporting
DATA=EXAMPLE3.DAT         ⇦ name of data file
IDFILE=*                  ⇦ list of items to delete. (Or IDFILE=EXAMPLE2.IDF)
5                         ⇦ delete item 5
8                         ⇦ delete item 8
20-25                     ⇦ delete items 20 through 25
*                         ⇦ end of list
INUMB=Y                   ⇦ use item sequence numbers as names
 &END
```

The data is in file EXAMPLE3.DAT

```
101F20FJDP 21XX2XXXXX111X1200001X2X
102M20PFNP X2210122211222211222120X2
     .
175F  FBDP 1X00X00000200012X02220100
176F23FEDP 21121022012002121 2202000        ⇦ person id's contain demographic information
```

Example 4: Selective item recoding
The test has 18 items, specified in file EXAMPLE4.CON. The response string starts in column 1. Person-id's start in column 41. Original codes are 0,1 in data file EXAMPLE4.DAT. Items 2, 3, and 4 are to be recoded as 1,0. All tables are to appear in report file EXAMPLE4.OUT, in a standardized form. An adjustment is to be made for UCON estimation bias.

```
; This file is EXAMPLE4.CON
 &INST
 TITLE="An example of selective item recoding" ⇐ page title
 NI=18                    ⇐ 18 items
 ITEM1=1                          ⇐ item responses start in column 1
 NAME1=41                         ⇐ person-id starts in column 41
 NAMLEN=9                         ⇐ person-id has 9 characters: Richard M
 NAMLMP=7                         ⇐ 7 characters to appear on maps: Richard
  CODES=01                        ⇐ the observed response codes
 NEWSCORE=10                      ⇐ the new scores for items 2, 3, 4
 RESCORE=011100000000000000       ⇐ rescore items indicated by "1"
 TABLES=111111111111111111111     ⇐  output all tables
 DATA=EXAMPLE4.DAT        ⇐ name of data file
 STBIAS=Y                         ⇐ adjust for UCON estimation bias
 MRANGE=5                         ⇐ plots and maps have half-range of 5 logits
 FRANGE=4                         ⇐ fit plots have half-range of 4 ZSTD units
 LINLEN=0                         ⇐ allow maximum line length
      § LINLEN=0 puts distractors for same item, or mapped elements with same
      measure, on one output line.
 MAXPAG=0                         ⇐ no maximum page length
      § MAXPAG=0 prints tables without breaks for new page headings.
 ASCII=Y                          ⇐ (Default) Replace PC characters + by ASCII + etc
      § Use ASCII=N if report file is to be printed by PC-DOS, not Windows.
 REALSE=Y              ⇐ Inflate standard errors by misfit
 LOCAL=Y              ⇐ Local standardizing of fit statistics
 &END
 1-4
 R2-3                   ⇐ R reminds us item coding was reversed
 R1-2-4
 2-1-4
  .
 4-1-3-4-2-1-4
 END NAMES
```

The data file, EXAMPLE4.DAT, is

```
100011100000000000                 Richard M
100011111100000000                 Tracie  F
   .
100100000000000000                 Helen   F
```

Example 5: Scoring key for items
A multiple choice adaptive test, in file EXAMPLE5.CON with responses "a", "b", "c", "d" and a scoring key for 69 items. Your data are in the control file.

```
; This file is EXAMPLE5.CON
&INST
TITLE="An MCQ Test" ⇦ the title
NI=69                   ⇦ 69 items
ITEM1=10                       ⇦ response string starts in column 10
NAME1=1                        ⇦ person-id starts in column 1
CODES=abcd                     ⇦ valid response codes
MISSING=255                    ⇦ default - blanks are ignored
KEY1 =    dcbbbbadbdcacacddabadbaaaccbddddcaadccccdbdcccbbdbcccbdcddbacaccbcddb
                       ⇦ scoring key of correct answers
ITEM=TOPIC              ⇦ items are topics
PERSON=STDNT                   ⇦ respondents are students
TABLES=111111111111111111111     ⇦ output all tables
NAMLMP=2                       ⇦ first 2 characters on maps, e.g., nl
PFILE=EXAMPLE5.PF ⇦ write out person measures
CSV=Y                  ⇦ separate values by commas in PFILE=
HLINES=N                       ⇦ write out no heading lines in PFILE=
        § Many spreadsheets and statistics programs expect a file of numbers separated
        by commas. Use IFILE= or PFILE= with CSV=Y and HLINES=N.

MUCON=0                        ⇦ allow as many UCON iterations as necessary
EXTRSC=0.5                     ⇦ most conservative extreme measures wanted
XFILE=EXAMPLE5.XF              ⇦ write out individual response residual file
&END
nl01  Month
nl02  Sign
 .
sb02  newspaper
sb03  newspaper
END NAMES
IM  CAT                         a           dcacc  ccabbcaa
NM  KAT        b badad accaaba aa c dd    ab   c
   .
NH  RIC  ddb  b dbdcbcaadba ba acd bad  db     c   d    cc
IL  HOL          a     a  da d   d ccbddd bcd  dc ca      ⇦ last data record
```

Example 6: Keys in data record FORMAT=
　　　§ Do **not** use FORMAT= unless there is no other way
A test of 165 multiple-choice items with multiple data lines per data record. The scoring key is formatted in the same way as the data lines:

; This file is EXAMPLE6.CON
　&INST
　TITLE='Demonstration of KEY1 record' ⇐ title
　FORMAT=(1X,10A,T23,50A,/,T23,50A,/,T23,50A,/,T23,15A)
　　　⇐ Use the first character is ignored, then 10 characters in first record are person id, then starting in column 23, 50 columns in first 3 records, and 15 responses in fourth record.
; In the reformatted record
　NAME1=1　　　　　　　　　⇐ Person-id starts in column 1
　ITEM1=11　　　　　　　　　⇐ Item responses start in column 11 of reformatted record
　NI=165　　　　　　　　　　⇐ There are 165 items
　CODES="ABCD "　　　　　⇐ The raw responses are ABCD and BLANK
　　　　§ Put character strings in " " if blanks are to be included.
　KEYFRM=1　　　　　　　　⇐ There is a KEY1 record after &END which is formatted exactly like a data record specifying the correct responses.
　&END　　　　　　　⇐ KEY1= formatted like your data
```
Key 1 Record        CDABCDBDABCADCBDBCADBABDDCDABCBABDCACBADACBADBAACD
after &END          CCBDACABDADCBDCABBCACDBAABCDADCDCADBCABCDCADABACDA
in FORMAT= format   BADCDBADCBADCDBACBADBCAADBCBBDCBACDBACBADCDADBACDB
before item names   ABDACDCDBADBCAB
```
.7 A1　　　　　　　⇐ First item name
1.1 A2
 .
4.1 A164
3.6 A165
END NAMES
```
090111000102    10001   BDABADCDACCDCCADBCBDBCDDACADDCACCCBCCADBDABADCAADD
                        ABDDDCABDADCBDACDBCACADABCDCCDCBDBCCABBCDCADDCDCDA
                        BDCCDBABCDCDDDCBADCACBDCBDBACBCBCADBABAADCDCBABAAC
                        DCBCCACABCDDCBC
090111000202    10002   BDCDCDCDADCBCCBDBDCABCBDACDABCAABCAACBBBACAADDAACA
                        ACBCACBBDADCBDCBBBCDCCDACCBCADCACCAACDBCCDADDBACDA
                        BADCDCBDBDCDCCBACCCBBAABDBCDBCCBAADBABBADBDDABDCAA
                        DCDBCDCDBADBCCB


    .


090111008402    10084   CDABCDADDDCDDDDCBDCCBCCDACDBBCACDBCCCBDDACBADCAACD
                        ACBDCCDBDADCCBCDDBBDCABACCBDBDCBCCACCBACDCADABACDA
                        BABBDCADBDDBCDADDDCDDBCABCBDCCCAACDBACBDDBDBCCAACB
                        DBACDBCDBADDCBC
090111008502    10085   CDABADADABCADCDDBDADBBCBACDABCCABACCCDAAACBADAAACD
                        ACBCDCBBDADCDDCADBCCCDBADDBBBDCACAABCBDDDCADABACDA
                        BADABBADBBADCADACDABBAACACAABDCBACDBADBACCDBACBADA
                        BCABCBCDBADDCCC
```

or, using **continuation lines** for the key:
　CODES="ABCD "　　　　　⇐ The raw responses are ABCD and BLANK

;KEYFRM=   ⇦ omit this, not needed
  KEY1 = CDABCDBDABCADCBDBCADBABDDCDABCBABDCACBADACBADBAACD+
         +CCBDACABDADCBDCABBCACDBAABCDADCDCADBCABCDCADABACDA+
         +BADCDBADCBADCDBACBADBCAADBCBBDCBACDBACBADCDADBACDB+
         +ABDACDCDBADBCAB
&END

Example 7: A partial credit analysis
A 30 item MCQ Arithmetic Test is to be analyzed in which credit is given for partial solutions to the questions. The analytical rating scale model is the Andrich model, but each item is conceptualized to have its own rating scale structure, as in the Masters' Partial Credit model.

```
; This file is EXAMPLE7.CON
&INST
TITLE="A Partial Credit Analysis"        ⇦ page heading
NAME1=1                    ⇦ Person-id starts in column 1
ITEM1=23                   ⇦ Item responses start in column 23
NI=30              ⇦ There are 30 items
CODES=ABCD         ⇦ Scores entered as A through D
KEY1=CDABCDBDABCADCBDBCADBABDDCDABC        ⇦ Fully correct
KEY2=ABCDABCCBADDABACABBBACCCCDABAB        ⇦ Partially correct
KEY3=DABABAAACC*CCABAC*************  ⇦ Some partially correct
                   ⇦ if no matching response, use a character not in CODES=, e.g., *
KEYSCR=211         ⇦ KEY1 fully correct (2 points),
                       KEY2, KEY3 partially correct (1 point each)
GROUPS=0                   ⇦ Each item is its own group
MODELS=R                   ⇦ Each item has an Andrich rating scale
STKEEP=Y                   ⇦ Keep in category 1 even if never observed
CURVES=111         ⇦ Print all 3 item curves in Tables 2 and 21
CATREF=2                   ⇦ Use category 2 for ordering in Table 2
STEPT3=N                   ⇦ Move step calibrations from Table 3 to Table 21
SFILE=EXAMPLE7.SF ⇦ Write step calibrations for anchoring later
ISFILE=EXAMPLE7.ISF        ⇦ Write item-step calibrations for plotting
;IDELQU=Y                  ⇦ Comment only: are any items are to be deleted?
      § IDELQU=Y, PDELQU=Y and SDELQU=Y are useful to place as "Extra
      Specifications" to initiate interactive deletion, e.g.,
      Extra specifications? IDELQU=Y(Enter)
&END
.7  A1
1.1  A2
 .
3.1  A29
2.7  A30
END NAMES
090111000102  10001  BDABADCDACCDCCADBCBDBCDDACADDC
090111000202  10002  BDCDCDCDADCBCCBDBDCABCBDACDABC
 .
090111005302  10053  BDABCDDDCCCDDCDBACBABABCMCDBDC
090111005402  10054  BDADCDCCDACBCCABBDADBBCBBDDDDC
```

Example 8: Items with various rating scale models {Note: Success/Failure may not estimate correctly}
A 4 item test. Items 1 and 2 are "success" (growth, development) items in which a score at a higher level is only possible if success at all lower levels has been achieved. Items 3 and 4 are "failure" (mastery) items at which successively lower levels of competence are tested only if success has not been attained at higher levels.

```
; This file is EXAMPLE8.CON
 &INST
 TITLE="Success and Failure scales"       ⇦ at top of page
 NAME1=8                        ⇦ Person-id starts in column 8
 ITEM1=1                        ⇦ Item responses start in column 1
 NI=4                           ⇦ There are 4 items
 CODES=0123456789    ⇦ Numeric responses are 0 through 9
 MODELS=SSFF                    ⇦ The four scale models, in order, as applied to the 4 items
        § In practice, choice of Success, Failure or Rating scale models has little effect on
          person measures unless theoretical structure is very clear.  Success and Failure
          models can be difficult to explain.
 GROUPS=0                       ⇦ Each item has its own scale
 TABLES=11111111111111111111111⇦ More than enough 1's for every Table!
 NORMAL=Y              ⇦ Also reports gross data-to-model fit
 &END
Maze
Passengers
Blocks
Egg race
END NAMES
5553  Richard
5975  Tracie
  .
5333  David
5777  Thomas
```

Example 9: Grouping and modeling items {Note: Success/Failure may not estimate correctly}
A 20 item test. Items 1, 2 are dichotomous items, coded "Y", "N". Item 3 is a "Success" item. Items 4-10 are all ratings on one Andrich scale (Group 1), and items 11-20 are all ratings on another Andrich scale (Group 2). Items 3-20 have response codes "A", "B", "C", "D", "E" or "a", "b", "c", "d", "e".

```
; This file is EXAMPLE9.CON
&INST
TITLE="Grouping and Modeling"
ITEM1=11                        ⇐ Item responses start in column 11
NI=20                  ⇐ There are 20 items
RESCORE=2                       ⇐ All responses are to be rescored
  CODES=YNABCDEabcde   ⇐ Response codes to all items
NEWSCORE=101234512345 ⇐ Rescored 0 through 5
MODELS=RRSRRRRRRRRRRRRRRRRRR  ⇐ The models in item order
GROUPS=00011111112222222222  ⇐ The groups in item order
DATA=EXAMPLE9.DAT       ⇐ Location of data file
&END
R0 Prompt 1              ⇐ Item id's remind us of models and groups
        § Models and groups are shown in item measure Tables 10, 13, 14, 15
R0 Prompt 2
S0 Logic
R1 Grammar 1
R1 Grammar 2
R1 Grammar 3
R1 Grammar 4
R1 Grammar 5
R1 Grammar 6
R1 Grammar 7
R2 Meaning 1
R2 Meaning 2
R2 Meaning 3
R2 Meaning 4
R2 Meaning 5
R2 Meaning 6
R2 Meaning 7
R2 Meaning 8
R2 Meaning 9
R2 Meaning 10
END NAMES
```

The data is in file EXAMPLE9.DAT:
```
Richard M 00bcDCDddCDddddCDccE
Tracie  F 00BcBABBccbBbbBbBBBb
   .
James   M 00ccaBbabBAcbacbaBbb
Joe     M 10BdBBBBccBccbbccbcC
```

Example 10: Combining tests with common items
Test A, in file EXAM10A.CON, and TEST B, in EXAM10B.CON, are both 20 item tests. They have 5 items in common, but the distracters are not necessarily in the same order. The responses must be scored on an individual test basis. Also the validity of each test is to be examined separately. Then one combined analysis is wanted to equate the tests and obtain bankable item difficulties. For each file of original test responses, the person information is in columns 1-25, the item responses in 41-60.

The combined data file specified in EXAM10C.CON, is to be in RFILE= format. It contains
Person information	30 characters (always)
Item responses	Columns 31-64

The identification of the common items is:

Test	Item Number (=Location in item string)						
Combined:	1	2	3	4	5	6-20	21-35
A:	3	1	7	8	9	2,4-6,10-20	
B:	4	5	6	2	11		1,3,7-10,12-20

I. From Test A, make a response (RFILE=) file rearranging the items with FORMAT=.

```
; This file is EXAM10A.CON
&INST
TITLE="Analysis of Test A"
RFILE=EXAM10A.RF  ⇦ The constructed response file for Test A
NI=20
FORMAT=(25A,T43,A,T41,A,T47,3A,T42,A,T44,3A,T50,11A)
ITEM1=26                      ⇦ Items start in column 26 of reformatted record
CODES=ABCD#                   ⇦ Beware of blanks meaning wrong!
      § Use your editor to convert all "wrong" blanks into another code, e.g., #, so that
      they will be scored wrong and not ignored as missing.
KEYFRM=1                      ⇦ Key in data record format
&END
Key 1 Record                     CCBDACABDADCBDCABBCA
BANK 1   TEST A 3
 .
BANK 20  TEST A 20
END NAMES
Person 01 A                      BDABCDBDDACDBCACBDBA
 .
Person 12 A                      BADCACADCDABDDDCBACA
```
The RFILE= file, EXAM10A.RF, is:
```
Person 01 A              00001000010010001001
Person 02 A              00000100001110100111
   .
Person 12 A              00100001100001001011
```

II. From Test B, make a response (RFILE=) file rearranging the items with FORMAT=. Responses unique
to Test A are filled with 15 blank responses to dummy items.

; This file is EXAM10B.CON
&INST
TITLE=Analysis of Test B
RFILE=EXAM10B.RF ⇦ The constructed response file for Test B
NI=35
FORMAT=(25A,T44,3A,T42,A,T51,A,T100,15A,T41,A,T43,A,T47,4A,T52,9A)
                              ⇦ Blanks are imported from an unused part of the data
                                record to the right!
ITEM1=26   ⇦ Items start in column 26 of reformatted record
CODES=ABCD#   ⇦ Beware of blanks meaning wrong!
KEYFRM=1   ⇦ Key in data record format
&END
Key 1 Record   CDABCDBDABCADCBDBCAD
BANK 1 TEST B 4
 .
BANK 5 TEST B 11
BANK 6 TEST A 2
 .
BANK 20 TEST A 20
BANK 21 TEST B 1
 .
BANK 35 TEST B 20
END NAMES
Person 01 B   BDABDDCDBBCCCCDAACBC
 .
Person 12 B   BADABBADCBADBDBBBBBB

The RFILE= file, EXAM10B.RF, is:

Person 01 B   10111   010101001000100
Person 02 B   00000   010000000001000
 .
Person 11 B   00010   001000000000100
Person 12 B   00000   000101000101000

III. Analyze Test A's and Test B's RFILE='s together:

```
; This file is EXAM10C.CON
&INST
TITLE="Analysis of Tests A & B (already scored)"
NI=35
ITEM1=31                    ⇐ Items start in column 31 of RFILE=
CODES=01                    ⇐ Blanks mean "not in this test"
DATA=EXAM10A.RF+EXAM10B.RF  ⇐ Combine data files

;        or, first, at the DOS prompt,
;               C:> COPY EXAM10A.RF+EXAM10B.RF EXAM10AB.DAT(Enter)
;        then, in EXAM10C.CON,
;               DATA=EXAM10AB.DAT

PFILE=EXAM10C.PF   ⇐ Person measures for combined tests
IFILE=EXAM10C.IF            ⇐ Item calibrations for combined tests
tfile=*                ⇐ List of desired tables
3                          ⇐ Table 3 for summary statistics
10                         ⇐ Table 10 for item structure
*
PRCOMP=S                   ⇐ Principal components analysis of items
&END
BANK 1   TEST A 3 B 4
 .
BANK 35  TEST B 20
END NAMES
```

§ Shortening FORMAT= statements

If the required FORMAT= statement exceeds 512 characters, consider using this technique:

A)   Relocate an entire item response string, but use an IDFILE= to delete the duplicate items, i.e., replace them by blanks.

      E.g., for Test B, instead of
```
FORMAT=(25A, T44,3A,T42,A,T51,A, T100,15A, T41,A,T43,A,T47,4A,T52,9A)
NI=35
```

      Put Test 2 as items 21-40 in columns 51 through 70:

```
FORMAT=(25A, T44,3A,T42,A,T51,A, T100,15A, T41,20A)
NI=40
```

Blank out (delete) the 5 duplicated items with an IDFILE= containing:
```
        24-26
        22
        31
```

Example 11: Item responses two characters wide
The "Liking for Science" data (see *RSA*) is in file EXAM11.CON. Each observation is on a rating scale where 0 means "dislike", 1 means "don't care/don't know" and 2 means "like". The data has been recorded in two columns as 00, 01 and 02.

```
; This file is EXAM11.CON
 &INST
 TITLE='LIKING FOR SCIENCE (Wright & Masters p.18)'
 XWIDE=2                  ⇐ Responses are 2 columns wide
 CODES=000102             ⇐ Codes are 00 01 and 02
 ITEM1=1                  ⇐ Items start in column 1
 NI=25              ⇐ 25 Items
 NAME1=51                 ⇐ Person id starts in column 51
 NAMLMP=20          ⇐ Show 20 characters of id on maps
 TABLES=1111111111111111111111111
 CURVES=111         ⇐ Print all curves in Tables 2 and 21
 IFILE = EXAM11.IF   ⇐ Output item measure file
 PFILE = EXAM11.PF   ⇐ Output person measure file
 SFILE = EXAM11.SF   ⇐ Output step calibration file
 RFILE = EXAM11.RF  ⇐ Output reformatted response file
 XFILE = EXAM11.XF ⇐ Output observation and residual file
 UIMEAN = 455             ⇐ User scaling: mean 455
 USCALE = 94
 LINLEN = 0               ⇐ Print with minimum of split lines
 MAXPAG = 0         ⇐ Print with minimum of headings
 &END
WATCH BIRDS
READ BOOKS ON ANIMALS
 .
FIND OUT WHAT FLOWERS LIVE ON
TALK W/FRIENDS ABOUT PLANTS
END NAMES
01020101010002000102020202000201010202000201000200ROSSNER, MARC DANIEL
02020202020202020202020202020202020202020202020202ROSSNER, LAWRENCE F.
  .
02020200000202000002020202020202020202000202000102PATRIARCA, RAY
01020000010100010102010202020201000202000200000100PAULING, LINUS
                                      BLANK RECORD
```

Example 12: Comparing high and low samples with rating scales
Rasch estimates are constructed to be as sample independent as is statistically possible, but you must still take care to maintain comparability of measures across analyses. For instance, if a rating scale is used, and a high-low ability split is made, then the low rating scale categories may not appear in the data for the high ability sample and *vice versa*. To compare item calibrations for the two samples requires the rating scale to be calibrated on both samples together, and then the scale calibrations to be anchored for each sample separately. Comparison of patient measures from separate analyses requires both the rating scale calibrations and the item calibrations to share anchor calibrations.

35 arthritis patients have been through rehabilitation therapy. Their admission to therapy and discharge from therapy measures are to be compared. They have been rated on the 13 mobility items of the Functional Independence Measure (FIM"). Each item has seven levels. At admission, the patients could not perform at the higher levels. At discharge, all patients had surpassed the lower levels (Data courtesy of C.V. Granger & B. Hamilton, UDS).

A generic control file is in EXAM12.CON. The admission ratings are in EXAM12.LO and the discharge ratings in EXAM12.HI. Three analyses are performed: 1) joint analysis of the admission (low) and discharge (high) data to obtain rating scale calibrations, 2 & 3) separate runs for the admission (low) and discharge (high) data to obtain item calibrations.

```
; This common control file is EXAM12.CON
&INST
TITLE='GENERIC ARTHRITIS FIM CONTROL FILE'
ITEM1=7                    ⇦ Responses start in column 7
NI=13                ⇦ 13 mobility items
CODES=1234567               ⇦ 7 level rating scale
&END
A. EATING
B. GROOMING
C. BATHING
D. UPPER BODY DRESSING
E. LOWER BODY DRESSING
F. TOILETING
G. BLADDER
H. BOWEL
I. BED TRANSFER
J. TOILET TRANSFER
K. TUB, SHOWER
L. WALK/WHEELCHAIR
M. STAIRS
END NAMES
```

The admission data is in file EXAM12.LO:

```
21101 5523133322121   ⇦ Patient number in cols 1-5, ratings in 7-19
21170 4433443345454
 |
22618 4433255542141
22693 3524233421111
```

The discharge data is in file EXAM12.HI:

21101 5734366655453   ⇐ Ratings generally higher than at admission
21170 6466677777676
|
22618 7667656666565
22693 7776677676677

The batch job stream for BIGSTEPS to perform the three analyses is in EXAM12.BAT:

```
REM  COMPARISON OF ITEM CALIBRATIONS FOR HIGH AND LOW SAMPLES
BIGSTEPS EXAM12.CON EXAM12.OUT DATA=EXAM12.LO+EXAM12.HI TITLE=ADMIT&DISCHARGE SFILE=EXAM12.SF
BIGSTEPS EXAM12.CON EXAM12LO.OUT DATA=EXAM12.LO TITLE=ADMIT SAFILE=EXAM12.SF IFILE=EXAM12.IFL CSV=Y
BIGSTEPS EXAM12.CON EXAM12HI.OUT DATA=EXAM12.HI TITLE=DISCHARGE SAFILE=EXAM12.SF IFILE=EXAM12.IFH CSV=Y
```

To run this enter, at the DOS prompt,
C:> **EXAM12(Enter)**

The shared step calibration anchor file is EXAM12.SF:

```
; STEP DIFFICULTY FILE FOR
; ADMIT&DISCHARGE
; May 23 13:56 1993
; CATEGORY  STEP DIFFICULTY
  1    .00
  2  -2.11
  3  -1.61
  4  -1.25
  5    .06
  6   1.92
  7   2.99
```

The item calibrations measures for admission and discharge are written into IFILE= files, with comma-separated values (CSV=Y), so that they can easily be imported into a spreadsheet.   Here is the comparison:
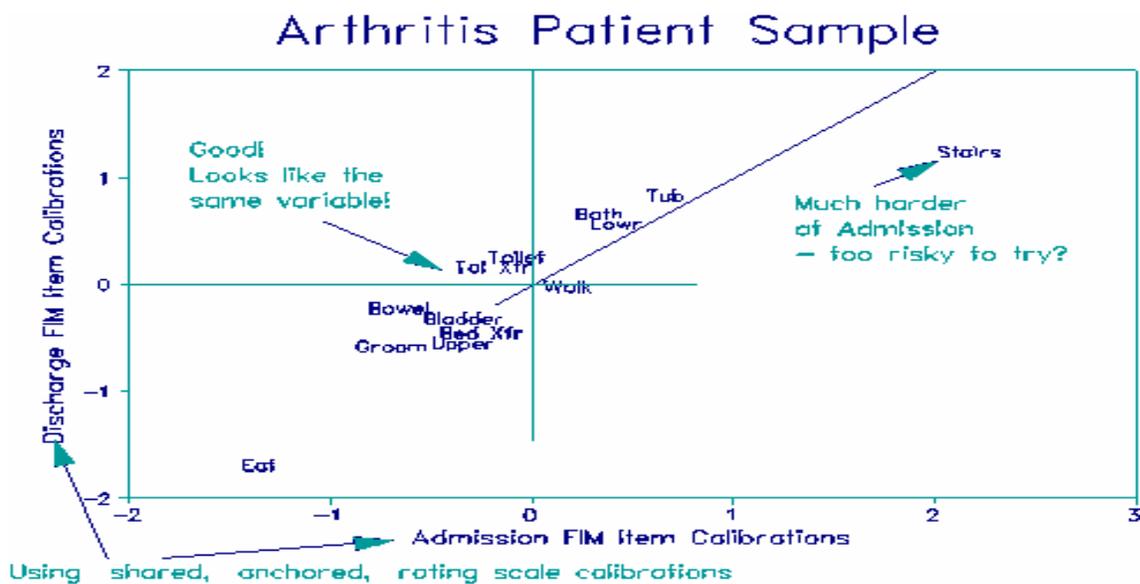
Example 13: Paired comparisons as the basis for measurement

Paired comparisons can be modeled directly with the *Facets* computer program. For BIGSTEPS a dummy facet of "occasion" must be introduced. On each occasion (in this example, each column), there is a winner '1', a loser '0', or a draw 'D' recorded for the two players. In column 1 of the response data in this example, Browne (1) defeated Mariotti (0). In column 2, Browne (D) drew with Tatai (D). Specifying PAIRED=YES adjusts the measures for the statistical bias introduced by this stratagem. Each player receives a measure and fit statistics. Occasion measures are the average of the two players participating. Misfitting occasions are unexpected outcomes. Point-biserial correlations have little meaning. Check the occasion summary statistics in Table 3 to verify that all occasions have the same raw score.

```
; This common control file is EXAM13.TXT
&INST
TITLE = 'Chess Matches at the Venice Tournament, 1971'
PERSON = PLAYER
ITEM  = MATCH        ; Example of paired comparison
CODES  = 0D1 ; 0 = loss, D = draw, 1 = win
NEWSCORE = 012
NAME1  = 1
ITEM1  = 11
NI    = 66              ; 66 matches (columns) in total
PAIRED = YES
INUMBER = YES          ; number the matches in the Output
&END
Browne    1D 0  1   1    1      1       D        D         1          1
Mariotti  0 1 D  0   1    1      1       D        1        D          1
Tatai       D0  0  1   D    D     1       1        1        1         D
Hort        1D1   D   D    1     D       D        D        1          0
Kavalek     010D    D   D    1     D       1        1        D
Damjanovic    00DDD     D    D     D       1        D        1
Gligoric        00D0DD      D     1       1        1        0
Radulov         000D0DD        D      1        D         1
Bobotsov          DD0DDD0D        0        0        1
Cosulich            D00D00001          1        1
Westerinen              0D000D0D10           1
Zichichi                  00D1D010000
```

Part of the output is:

```
                  PLAYER STATISTICS:  MEASURE ORDER
+------------------------------------------------------------------+
|ENTRY   RAW                       |  INFIT  |  OUTFIT |           |
|NUMBR  SCORE   COUNT  MEASURE  ERROR|MNSQ  ZSTD|MNSQ  ZSTD| PLAYER    |
|----------------------------------+---------+---------+----------|
|   1     17    11     1.09     .35|1.10   .2|1.02    .1| Browne    |
|   2     15    11      .68     .32|1.02   .0| .96   -.1| Mariotti  |
|                          ......                                  |
|  12      6    11     -.88     .33|1.86  1.8|1.90  1.7| Zichichi  |
|----------------------------------+---------+---------+----------|
| MEAN    11.   11.     .00     .32| .99  -.2| .99  -.2|           |
| S.D.     3.    0.     .59     .01| .37  1.1| .39  1.1|           |
+------------------------------------------------------------------+
```

4. READING YOUR DATA

4.1 Specifying the layout of your data
Where to find your data, its format, and the location of person and item identifying names.

4.1.1 DATA= name of data file (default: data at end of control file)
Your data can be the last thing in the control file (which is convenient if you only have a small amount of data), but if you have a large amount of data, you can place it in a separate file, and then use DATA= to say where it is.

Example 1:   Read the observations from file "A:\PROJECT\RESPONSE.DAT".
                    DATA=A:\PROJECT\RESPONSE.DAT

Example 2:   Read scanned MCQ data from file DATAFILE in the current directory.
                    DATA=DATAFILE

You may specify that several data files be analyzed together in one run, by listing their file names, separated by "+" signs. The list, e.g., FILE1.DAT+MORE.DAT+YOURS.D, can be up to 200 characters long. The layout of all data files must be identical.

Example 3:   A math test has been scanned in three batches into files "BATCH.1", "BATCH.2" and
                    "BATCH.3". They are to be analyzed together.
                    DATA=BATCH.1+BATCH.2+BATCH.3

4.1.2 ITEM1= column number of first response (required, no default)
Specifies the column position where the response-string begins in your data file record, or the column where the response-string begins in the new record formatted by FORMAT=.
If you have the choice, put the person-identifiers first in each record, and then the item responses with each response taking one column.

Example 1:   The string of 56 items is contained in columns 20 to 75 of your data file.
                    ITEM1=20   ⇦ response to item 1 in column 20
                    NI=56   ⇦ for 56 items
                    XWIDE=1   ⇦ one column wide (the default)

Example 2:   The string of 100 items is contained in columns 30 to 69 of the first record, 11 to 70 of the
                    second record, followed by 10 character person i.d.
                    XWIDE=1   ⇦ one column wide (the default)
                    FORMAT=(T30,40A,/,T11,60A,10A)   ⇦ two records per person
                    ITEM1=1   ⇦ item 1 in column 1 of reformatted record
                    NI=100   ⇦ for 100 items
                    NAME1=101   ⇦ person id starts in column 101
                    NAMLEN=10   ⇦ person id starts in 10 columns wide

4.1.3 NI= number of items (required, no default)
The total number of items to be read in (including those to be deleted by IDFILE= or IDELQU=). NI= is limited to about 3000 for one column responses or about 1500 for two column responses in the standard program. NI= is usually the length of your test (or the total number of items in all test forms to be combined into one analysis).

Example: If there are 230 items in your test, enter
                    NI=230 ⇐ 230 items

4.1.4 XWIDE= columns per response (default: 1)
The number of columns taken up by each response in your data file (1 or 2). If possible enter your data one column per response. If there are two columns per response, make XWIDE=2. If your data includes responses entered in both 1 and 2 character-width formats, use FORMAT= to convert all to XWIDE=2 format. When XWIDE=2, these control variables *require two columns* per item or per response code: CODES=, KEYn=, KEYSCR=, NEWSCORE=, IVALUE=. Either 1 or 2 columns can be used for RESCORE=, GROUPS=, RESCORE= and IREFER=

Example 1:   The responses are scanned into adjacent columns in the data records,
                    XWIDE=1   ⇐ Observations 1 column wide

Example 2:   Each response is a rating on a scale from 1 to 10, and so requires two columns in the date record,
                    XWIDE=2   ⇐ 2 columns per datum

Example 3:   Some responses take one column, and some two columns in the data record. Five items of 1-character width, code "a", "b", "c", or "d", then ten items of 2-character width, coded "AA", "BB", "CC", "DD". These are preceded by person-id of 30 characters.
                    XWIDE=2   ⇐ Format to two columns per response
                    FORMAT=(30A1,5A1,10A2)   ⇐ Name 30 characters,
                                                 5 1-chars, 10 2-chars
                    CODES   ="a b c d AABBCCDD"   ⇐ "a" becomes "a "
                    NEWSCORE="1 2 3 4 1 2 3 4 "   ⇐ response values
                    RESCORE=2   ⇐ rescore all items
                    NAME1=1   ⇐ person id starts in column 1
                    ITEM1=31   ⇐ item responses start in column 31
                    NI=15   ⇐ 15 items all now XWIDE=2

4.1.5 INUMB= name items by sequence numbers (default: N, names after &END)
Are item names provided, or are they to default to sequence numbers?
        INUMB=Y
                a name is given to each item based on its sequence number in your data records. The names are "I0001", "I0002", ..., and so on for the NI= items. This is a poor choice as it produces uninformative output.

        INUMB=N, the default
                Your item names are entered (by you) after the "&END" at the end of the control variables. *Entering detailed item names makes your output much more meaningful to you.*

The rules for supplying your own item names are:
1. Item names are entered, one per line, generally directly after **&END**, (see p. 112).
2. Item names begin in column 1.
3. Only the first 30 characters (or ITLEN=) in each item name line will be used, but you may enter longer names in the control file for your own record keeping.
4. The item names must be listed in exactly the same order as their responses appear in your data records.
5. There should be the same number of item names as there are items specified by "NI=". If there are too many or too few names, a message will warn you and sequence numbers will be used for the names

of any unnamed items. You can still proceed with the analysis.
6. Type **END NAMES** starting in column 1 of the line after the last item name.

Example: An analysis of 4 items for which you supply identifying labels.
       &INST   ⇐ these lines can start at any column
       NI=4   ⇐ four items
       ITEM1=10   ⇐ responses start in column 10
       INUMB=N   ⇐ item names supplied (the default)
       &END
       My first item name   ⇐ must start at column 1.
       My second item label
       My third item identifier
       My fourth and last item name
       END NAMES   ⇐ must start at column 1, in capital letters
       Person A 1100   ⇐ data records
       |
       Person Z 1001

4.1.6 ITLEN= maximum length of item name (default: 30)
ITLEN= specifies the maximum number of columns in the control file that are to be used as item names.

Example 1:   You only wish to use the first five columns of item information to identify the items on the
       output:
       &INST
       NI=4
       ITLEN=5
       &END
       AX123 This part is not shown on the output
       BY246 Trial item
       AZ476 This item may be biased
       ZZ234 Hard item at end of test
       END NAMES

Example 2:   Your item names may be up to 50 characters long:
       &INST
       NI=4
       ITLEN=50
       &END
       This item demonstrates ability for constructive reasoning
       This item flags rigid thinking
       This item detects moral bankruptcy
       This item is a throw-away
       END NAMES

4.1.7 NAME1= first column of person-id (default: 1)
NAME1= gives the column position where the person-id information starts in your data file or in the new record formatted by FORMAT=.

Example 1:   The person-id starts in column 10:
        NAME1=10   ⇐ starting column of person-id

Example 2:   The person id starts in column 23 of the second record.
                       FORMAT=(80A,/,80A) ⇦ concatenate two 80 character records
                       NAME1=103   ⇦ starts in column 103 of combined record

4.1.8 NAMLEN= length of person-id (default: calculated)
§ Use this if too little or too much person-id information is printed in your output
tables.
NAMLEN= allows you define the length of the person-id name with a value in the range of 1 to 30
characters. This value overrides the value obtained according to the rules which are used to calculate the
length of the person-id. These rules are:
     1) Maximum person-id length is 30 characters
     2) Person-id starts at column NAME1=
     3) Person-id ends at ITEM1= or end of data record.
     4) If NAME1= equals ITEM1= then length is 30 characters.

Example: The 9 characters including and following NAME1= are the person's Social Security
               number, and are to be used as the person-id.
                       NAMLEN=9

4.2 Specifying how data is to be recoded
4.2.1 CODES= valid data codes (default: 01)
Says what characters to recognize as valid codes in your data file. If XWIDE=1 (the default), use one
column/character per legitimate code.   If XWIDE=2, use two columns/characters per legitimate code.
Characters in your data not included in CODES= are given the MISSING= value.

Example 1:   A test has four response choices. These are "1", "2", "3", and "4". Each response uses 1
               column in your data file. Data look like: 1342123421323212343221
                       XWIDE=1   ⇦ one character wide (the default)
                       CODES=1234   ⇦ four valid 1-character response codes

Example 2:   There are four response choices. Each response takes up 2 columns in your data file and
               has leading 0's, so the codes are "01", "02", "03" and "04".   Data look like:
               030204010302010404040301
                       XWIDE=2   ⇦ two characters wide
                       CODES=01020304   ⇦ four valid 2-character response codes

Example 3:   There are four response choices entered on the file with leading blanks, so that codes are "
               1", " 2", " 3", and " 4". Data look like: 3 2 4 2 1 3 2
                       XWIDE=2   ⇦ two characters wide
                       CODES=" 1 2 3 4"   ⇦ " required: blanks in 2-character responses

Example 4:   Your data is a mixture of both leading blanks and leading 0's in the code field, e.g. "01", "
               1", " 2", "02" etc. The numerical value of a response is calculated, where possible, so that
               both "01" and " 1" are analyzed as 1. Data look like: 02 1 20102 1 2 01
                       XWIDE=2   ⇦ two characters wide
                       CODES=" 1 2 3 401020304"   ⇦ two characters per response

Example 5:   The valid responses are percentages in the range 00 to 99.
                       XWIDE = 2   ⇦ two columns each percent

; uses continuation lines
```
        CODES = 000102030405060708091011121314151617181 9+
                +20212223242526272829303132333435363738 39+
                +40414243244546474849505152535455565758 59+
                +60616263646566676869707172737475767778 79+
                +808182838485868788899091929394959697989 9
```

Example 6:   The valid responses to an attitude survey are "a", "b", "c" and "d". These responses are to
              be recoded "1", "2", "3" and "4". Data look like: adbdabcd
```
        CODES  =abcd          ⇦ four valid response codes
        NEWSCORE=1234         ⇦ new values for codes
        RESCORE=2             ⇦ rescore all items
```

              Typically, "abcd" data implies a multiple choice test. Then KEY1= is used to specify the
              correct response.   But, in this example, "abcd" always mean "1234", so that the
              RESCORE= and NEWSCORE= options are easier to use.

Example 7:   Five items of 1-character width, "abcd", then ten items of 2-character width "AA", "BB",
              "CC", "DD". These are preceded by person-id of 30 characters. Data look like:
              George Washington Carver III dabcdBBAACCAADDBBCCDDBBAA
```
        FORMAT=(30A1,5A1,10A2)     ⇦ Name 30 characters,
                                     5 1-chars, 10 2-chars
        XWIDE =2                   ⇦ all converted to 2 columns
        CODES ="a b c d AABBCCDD"      ⇦ "a" becomes "a "
        NEWSCORE="1 2 3 4 1 2 3 4 "    ⇦ response values
        RESCORE=2                 ⇦ rescore all items
        NAME1=1                   ⇦ name starts column 1 of reformatted record
        ITEM1=31                  ⇦ items start in column 31
        NI=15                ⇦ 15 items, all XWIDE=2
```

Example 8:   Items are to rescored according to Type A and Type B. Other items to keep original
              scoring.
```
        CODES = 1234
        IREFER = AAAAAAAABBBBBBBB*******   ⇦ 3 item types
        IVALUEA = 1223            ⇦ Recode Type A items
        IVALUEB = 1123            ⇦ Recode Type B items
        IVALUE* = 1234            ⇦ Recode Type * item. Can be omitted
```

4.2.2 MISSING= treatment of missing data (default: 255, ignore)
MISSING= says what to do with characters that are not valid response codes, e.g. blanks and data entry
errors. By default, any characters not in CODES= are treated as missing data, and assigned a value of 255
which means "ignore this response."   This is usually what you want when such responses mean "not
administered". If they mean "I don't know the answer", you may wish to assign missing data a value of 0
meaning "wrong".

Non-numeric codes included in CODES= (when there are no KEYn= or RESCORE= variables) or in
NEWSCORE= are always assigned a value of "not administered", 255.

Example 1:   Assign a code of "0" to any responses not in CODES=
```
        MISSING=0     ⇦ missing responses are scored 0.
```

Example 2:   In an attitude rating scale with three categories (0, 1, 2), you want to assign a middle code of "1" to missing values
                   MISSING=1   ⇦ missing responses scored 1

Example 3:   You want blanks to be treated as "wrong" answers, but other unwanted codes to be ignored items, on a questionnaire with responses "Y" and "N".
                   CODES= "YN "   ⇦ blank included as valid response
                   NEWSCORE=100   ⇦ new response values
                   RESCORE=2   ⇦ rescore all items
                   MISSING=255 ⇦ ignore missing responses (default)

Example 4:   Your optical scanner outputs an "@" if two bubbles are marked for the same response. You want to ignore these for the analysis, but you also want to treat blanks as wrong answers:
                   CODES ="1234 "   ⇦ blank is the fifth valid code
                   KEY1 =31432432143142314324   ⇦ correct answers
                   MISSING=255 ⇦ applies to @ (default)

Example 5:   Unexpected codes are scored "wrong", but 2's to mean "not administered".
                   CODES = 012
                   NEWSCORE= 01X   ⇦ X is non-numeric, matching 2's ignored
                   MISSING= 0   ⇦ all non-CODES= responses scored 0

4.2.3 RESCORE= response recoding (with NEWSCORE= or KEYn=) (default: " ")

The responses in your data file may not be coded as you desire. The responses to some or all of the items can be rescored or keyed using RESCORE=. RESCORE= and NEWSCORE= are ignored when KEYn= is specified, except as below.

RESCORE=" " or 2 or is omitted
                   All items are recoded using NEWSCORE=. RESCORE=2 is the default when NEWSCORE= is specified.

RESCORE= some combination of 1's and 0's
                   Only items corresponding to 1's are recoded with NEWSCORE= or scored with KEYn=. When KEYn is specified, NEWSCORE= is ignored.

If some, but not all, items are to be recoded or keyed, assign a character string to RESCORE= in which "1" means "recode (key) the item", and "0" (or blank) means "do not recode (key) the item". The position of the "0" or "1" in the RESCORE= string must match the position of the item-response in the item-string.

Example 1:   The original codes are "0" and "1". You want to reverse these codes, i.e., 1⇨0 and 0⇨1, for all items.
                   XWIDE=1   ⇦ one character wide responses (the default)
                   CODES =01   ⇦ valid response codes are 0 and 1 (the default)
                   NEWSCORE=10   ⇦ desired response scoring
                   RESCORE=2   ⇦ rescore all items - this line can be omitted

Example 2:   Your data is coded "0" and "1". This is correct for all 10 items except for items 1 and 7 which have the reverse meaning, i.e. 1⇨0 and 0⇨1.

```
                    NI=10              ⇦ ten items
                    CODES =01               ⇦ default, shown here for clarity
                    NEWSCORE=10                 ⇦ revised scoring
                    RESCORE=1000001000          ⇦ only for items 1 and 7
```

If XWIDE=2, use one or two columns per RESCORE= code, e.g., " 1" or "1 " mean recode (key). " 0" or "0 " mean do not recode (key).

Example 3:   The original codes are " 0" and " 1". You want to reverse these codes, i.e., 1⇨0 and 0⇨1, for items 1 and 7 of a ten item test.

```
                    NI   =10                    ⇦ ten items
                    XWIDE =2                    ⇦ two characters wide
                    CODES   =" 0 1"             ⇦ original codes
                    NEWSCORE=" 1 0"             ⇦ new values
                    RESCORE =" 1 0 0 0 0 0 1 0 0 0"    ⇦ rescore items 1 & 7
         or         RESCORE = 10000001000    ⇦ no blanks allowed
```

Example 4:   The original codes are "0", "1", and "2". You want to make 0⇨0, 1⇨1, and 2⇨1 for all items

```
                    XWIDE=1              ⇦ one character wide (default)
                    CODES =012           ⇦ valid codes
                    NEWSCORE=011         ⇦ desired scoring
```

Example 5:   The original codes are "0", "1", and "2". You want to make 0⇨2, 1⇨1, and 2⇨0, for even-numbered items in a twenty item test.

```
                    NI=20            ⇦ twenty items
                    CODES =012            ⇦ three valid codes
                    NEWSCORE=210              ⇦ desired scoring
                    RESCORE=01010101010101010101      ⇦ rescore "even" items
```

Example 6:   The original codes are "0", "1", "2", "3" and some others. You want to make all non-specified codes into "0", but to treat codes of "2" as missing.

```
                    CODES = 0123         ⇦ four valid codes
                    NEWSCORE= 01X3   ⇦ response code 2 will be ignored
                    MISSING=0            ⇦ treat all invalid codes as 0
```

Example 7:   The original codes are "0", "1", "2", "3". You want to rescore some items selectively using KEY1= and KEY2= and to leave the others unchanged - their data codes will be their rating values. For items 5 and 6, 0⇨0, 1⇨0, 2⇨1, 3⇨2; for item 7, 0⇨0, 1⇨0, 2⇨0, 3⇨1. Responses to other items are already entered correctly as 0, 1, 2, or 3.

```
                    CODES =0123  ⇦ valid codes
                    RESCORE=0000111000          ⇦ rescore items 5,6,7
                    KEY1  =****223***     ⇦ keyed for selected items
                    KEY2  =****33X***       ⇦ the X will be ignored
                           ⬆ read these columns vertically
```

4.2.4 NEWSCORE= recoding values (with RESCORE=) (default: " ", none)
Says which values must replace the original codes when RESCORE= is used. If XWIDE=1 (the default), use one column per code. If XWIDE=2, use two columns per code. The length of the NEWSCORE= string must match the length of the CODES= string. For examples, see RESCORE=. NEWSCORE= is ignored when KEYn= is specified.

4.2.5 IREFER= identifying items for recoding (with IVALUE=) (default: " ", none)
Responses are revalued according to the matching codes in IVALUE=.

Example 1.   There are are 3 item types. Items are to rescored according to Type A and Type B. Other
                  items to keep original scoring.
                        CODES = 1234
                        IREFER = AAAAAAAABBBBBBBB*******   ⇐ 3 item types
                        IVALUEA = 1223   ⇐ Recode Type A items
                        IVALUEB = 1123   ⇐ Recode Type B items
                        IVALUE* = 1234   ⇐ Recode Type * item. Can be omitted

Example 2.   There are are 3 item types. Items are to rescored according to Type A and Type B. Other
                  items to keep original scoring. XWIDE=2
                        XWIDE=2
                        CODES = '1 2 3 4 '
                        IREFER = AAAAAAAABBBBBBBB*******   ⇐ 3 item types
                        IVALUEA = '1 2 2 3 '   ⇐ Recode Type A items
                        IVALUEB = '1 1 2 3 '   ⇐ Recode Type B items
                        IVALUE* = 1234   ⇐ Recode Type * item. Can be omitted

4.2.6 IVALUEx= recoding for x-type items (with IREFER=) (default: " ", none)
Responses are revalued according to the matching codes in IREFER=.

Example: Items identified by Y and Z in IREFER= are to be recoded.
                  Y-type items are 1-3, 7-8. Z-type items are 4-6, 9-10.
                        CODES= ABCD
                        NI = 10
                        IREFER = YYYZZZYYZZ
                        IVALUEY= 1234
                        IVALUEZ= 4321

4.2.7 KEYn= scoring key (default: " ", none)
      § Usually only KEY1= is needed for an MCQ scoring key.
Up to 99 keys can be provided for scoring the response choices, with control variables KEY1= through KEY99=. Usually KEY1= is a character string of "correct" response choices. The default is one column per correct response, or two columns if XWIDE=2.

By default, responses matching the characters in KEY1= are scored 1. Other valid responses are scored 0. KEY2= through KEY99= are character strings of successively "more correct" response choices to be used when more than one level of correct response choice is possible for one or more items. The default score value for KEY2= is 2, and so on up to the default score value for KEY99= which is 99. The values assigned to these keys can be changed by means of KEYSCR=. If XWIDE=1, only the values assigned to KEY1= through KEY9= can be changed, KEY10= through KEY99= retain their default values of 10 through 99. If XWIDE=2, the all KEYn= values can be changed.

Example 1:   A key for a 20-item multiple choice exam, in which the choices are coded "1", "2", "3" and "4", with one correct choice per item.
                    CODES=1234   ⇦ valid codes
                    KEY1 =31432432143142314324   ⇦ correct answers

Example 2:   A 20-item MCQ test with responses entered as "a", "b", "c", "d".
                    CODES=abcd   ⇦ valid responses
                    KEY1 =cadcbdcbadcadbcadcbd ⇦ correct answers

Example 3:   A 20 item multiple choice exam with two somewhat correct response choices per item. One of the correct choices is "more" correct than the other choice for each item, so the "less correct" choice will get a score of "1" (using KEY1=) and the "more correct" choice will get a score of "2" (using KEY2=). All other response choices will be scored "0":
          CODES=1234   ⇦ valid responses
          KEY1=23313141324134242113 ⇦ assigns 1 to these responses
          KEY2=31432432143142314324 ⇦ assigns 2 to these responses
                    ⇦ 0 is assigned to other valid responses

Example 4:   A 100 item multiple choice test key.
                    CODES= ABCD
                    KEY1 = BCDADDCDBBADCDACBCDADDCDBBADCDACBCDADDCA+
                            +DBBADCDACBCDADDCDBBADCDACBCDADDCDBBADCCD+
                            +ACBCDADDCDBBADCDACBC   ⇦ continuation lines

4.2.8 KEYSCR= reassign scoring keys (default: "123..")
          § This is only needed for complicated rescoring.
Specifies the score values assigned to response choices which match KEY1= etc. To assign responses matching key to the "missing" value of 255, make the corresponding KEYSCR= entry blank or some other non-numeric character.

When XWIDE=1, each value can only take one position, so that only KEY1= through KEY9= can be reassigned. KEY10= through KEY99= can also be used but keep their default values of 10 through 99.

When XWIDE=2, each value takes two positions, and the values corresponding to all keys, KEY1= through KEY99=, can be reassigned.

Example 1:   Three keys are used, and XWIDE=1.
                    Response categories in KEY1= will be coded "1"
                    Response categories in KEY2= will be coded "2"
                    Response categories in KEY3= will be coded "3"
                            KEYSCR=123 (default)

Example 2:   Three keys are used, and XWIDE=1.
                    Response categories in KEY1= will be coded "2"
                    Response categories in KEY2= will be coded "1"
                    Response categories in KEY3= will be coded "1"
                            KEYSCR=211

Example 3: Three keys are used, and XWIDE=2
Response categories in KEY1= will be coded "3"
Response categories in KEY2= will be coded "2"
Response categories in KEY3= will be coded "1"
            KEYSCR=030201
or
            KEYSCR=" 3 2 1"

Example 4: Three keys are used, and XWIDE=1
Response categories in KEY3= will be coded "1"
Response categories in KEY6= will be coded "missing"
Response categories in KEY9= will be coded "3"
            KEY3=BACDCACDBA   ⇦ response keys
            KEY6=ABDADCDCAB
            KEY9=CCBCBBBBCC
            KEYSCR=xx1xxXxx3   ⇦ scores for keys
The "x"s correspond to unused keys, and so will be ignored.
The "X" corresponds to specified KEY6=, but is non-numeric and so will cause responses
matching KEY6= to be ignored, i.e. treated as missing.

Example 5: Some items in a test have two correct answers, so two keys are used. Since both answers
are equally good, KEY1= and KEY2= have the same value, specified by KEYSCR=. But
some items have only one correct answer so in one key "*", a character not in CODES=, is
used to prevent a match.
            CODES=1234
            KEY1 =23313141324134242113
            KEY2 =31*324321*3142314***   ⇦ * is not in CODES=
            KEYSCR=11   ⇦ both KEYs scored 1

Example 6: More than 9 KEYn= lines, together with KEYSCR=, are required for a complex scoring
model for 20 items, but the original data are only one character wide.
            Original data: Person name: columns 1-10
                            20 Item responses: columns 21-40
            Looks like: M. Stewart..........1321233212321232134
            Solution: reformat from XWIDE=1 to XWIDE=2
                  &INST
                  TITLE="FORMAT= from XWIDE=1 to =2"
                  FORMAT=(10A1,10X,20A1)   ⇦ 10 of Name, skip 10, 20 of responses
                  NI=20
                  NAME1=1
                  ITEM1=11   ⇦ Responses in column 11 of reformatted record
                  XWIDE=2
                  CODES="1 2 3 4 "   ⇦ Original response now "response blank"
                  KEY1 ="1 2 1 3 2 1 2 3 1 4 3 2 1 1 1 1 1 2 1 1 " ⇦ Keying 20 items
                  KEY2 ="2 1 2 1 1 2 1 1 2 1 1 1 2 3 3 2 2 * 2 1 "
                  ....
                  KEY10="3 3 3 2 3 3 4 2 3 * * * 4 4 4 4 4 4 4 4 "
                  KEYSCR="1 2 3 2 2 2 2 3 4 1 4 " ⇦ Renumbering 10 KEYn=
                  &END

4.2.9 Disjoint strings of responses
When the responses are not arranged in one continuous string in the record, instructs to skip over or ignore the gaps.

Example: The 18 item string is in columns 40 to 49 and then 53 to 60 of your data file. The person-id is in columns 11-30. Data look like:
xxxxxxxxxxPocahontas Smith, Jrxxxxxxxxx1001001110xxx11001110

Method a: Delete unwanted "items" in columns 50, 51, 52 using an item delete file, IDFILE=.
NAME1 =11 ⇐ in original record
NAMLEN=20 ⇐ length in original record
ITEM1 =40 ⇐ in original record
NI   =21 ⇐ include deleted items
IDFILE =DEL5052 ⇐ file of deletions
The contents of DEL5052 are:
11 - 13 ⇐ Cols 50-52 are items 11-13

Method b: Rescore "items" in columns 50, 51, 52 as missing values with RESCORE=.
NAME1 =11 ⇐ in original record
NAMLEN=20
ITEM1 =40
NI   =21 ⇐ include rescored items
RESCORE=00000000011100000000 ⇐ rescore 50-52
CODES =01 ⇐ (the default)
NEWSCORE=XX ⇐ non-numerics specify "missing"

Method c: Make the items form one continuous string in a new record created with FORMAT=. Then the item string starts in the 21st column of the new record. Reformatted record looks like:
Pocahontas Smith, Jr100100111011001110
FORMAT=(T11,20A,T40,10A,T53,8A) ⇐ reformatting
NAME1 =1 ⇐ in the formatted record
ITEM1 =21 ⇐ in the formatted record
NI   =18 ⇐ the actual number of items

4.2.10 FORMAT= reformat data (default: " ", none)
§ Enables you to process awkwardly formatted data!
FORMAT= enables you to reformat one or more data record lines into one new line in which all the component parts of the person information are in one person-id field, and all the responses are put together into one continuous item-response string. A FORMAT= statement is required if
1) each person's responses take up several lines in your data file.
2) if the length of a single line in your data file is more than 3000 characters.
3) the person-id field or the item responses are not in one continuous string of characters.
4) you want to rearrange the order of your items in your data record, to pick out sub-tests, or to move a set of connected forms into one complete matrix.
5) you only want to analyze the responses of every second, or nth, person.

FORMAT= contains up to 512 characters of reformatting instructions, contained within (..), which follow special rules. Instructions are:
nA read in n characters starting with the current column, and then advance to the next column after them. Processing starts from column 1 of the first line, so that 5A reads in 5

characters and advances to the sixth column.

nX   means skip over n columns. E.g. 5X means bypass this column and the next 4 columns.

Tc   go to column c. T20 means get the next character from column 20.

        T55 means "tab" to column 55, not "tab" passed 55 columns (which is TR55).

TLc   go c columns to the left. TL20 means get the next character the column which is 20 columns to the left of the current position.

TRc   go c columns to the right. TR20 means get the next character the column which is 20 columns to the right of the current position.

/   means go to column 1 of the next line in your data file.

n(..)   repeat the string of instructions within the () exactly n times.

,   a comma is used to separate the instructions.

Set XWIDE=2 and you can reformat your data from original 1 *or* 2 column entries. Your data will all be analyzed as XWIDE=2. Then:

nA2   read in *n* pairs of characters starting with the current column into *n* 2-character fields of the formatted record. (For responses with a width of 2 columns.)

A1   read in n 1-character columns, starting with the current column, into n 2-character fields of the formatted record. Always use nA1 for person-id information. Use nA1 for responses entered with a width of 1-character when there are also 2-character responses to be analyzed. When responses in 1-character format are converted into 2-character field format (compatible with XWIDE=2), the 1-character response is placed in the first, left, character position of the 2-character field, and the second, right, character position of the field is left blank. For example, the 1-character code of "A" becomes the 2-character field "A ". Valid 1-character responses of "A", "B", "C", "D" must be indicated by CODES="A B C D " with a blank following each letter.

ITEM1= must be the column number of the first item response in the *formatted* record created by the FORMAT= statement. NAME1= must be the column number of the first character of the person-id in the *formatted* record.

Example 1:   Each person's data record file is 80 characters long and takes up one line in your data file. The person-id is in columns 61-80. The 56 item responses are in columns 5-60. Codes are "A", "B", "C", "D". No FORMAT= is needed. Data look like:

`xxxxDCBDABCADCDBACDADABDADCDADDCCDADDCAABCADCCBBDADCACDBBADCZarathrustra-Xerxes`

        Without FORMAT=

             XWIDE=1   ⇦ response width (the default)

             ITEM1=5   ⇦ start of item responses

             NI=56   ⇦ number of items

             NAME1=61   ⇦ start of name

             NAMLEN=20 ⇦ length of name

             CODES=ABCD⇦ valid response codes

        With FORMAT=

Reformatted record will look like:

`DCBDABCADCDBACDADABDADCDADDCCDADDCAABCADCCBBDADCACDBBADCZarathrustra-Xerxes`

             XWIDE=1   ⇦ response width (the default)

             FORMAT=(4X,56A,20A)   ⇦ skip unused characters

             ITEM1=1   ⇦ start of item responses

             NI=56   ⇦ number of items

              NAME1=57   ⇦ start of name

Example 2:   Each data record is one line of 80 characters. The person-id is in columns 61-80. The 28 item responses are in columns 5-60, each 2 characters wide. Codes are " A", " B", " C", " D". No FORMAT= is necessary. Data look like:

```
xxxx C D B A C B C A A D D D C D D C A C D C B A C C B A CZarathrustra-Xerxes
```

Without FORMAT=

XWIDE=2   ⇐ response width
ITEM1=5   ⇐ start of item responses
NI=28   ⇐ number of items
NAME1=61   ⇐ start of name
NAMLEN=20 ⇐ length of name
CODES=" A B C D"   ⇐ valid response codes

With FORMAT=

Columns of reformatted record:

```
1-2-3-4-5-6-7-8-9-0-1-2-3-4-5-6-7-8-9-0-1-2-3-4-5-6-7-8-90123456789012345678
 C B A C B C A A D D D C D D C A C D C B A C C B A CZarathrustra-Xerxes
```

XWIDE=2   ⇐ response width
FORMAT=(4X,28A2,20A1)   ⇐ skip unused characters
ITEM1=1   ⇐ start of item responses in formatted record
NI=28   ⇐ number of items
NAME1=29   ⇐ start of name in "columns"
NAMLEN=20 ⇐ length of name
CODES=" A B C D"   ⇐ valid response codes

Example 3:   Each person's data record is 80 characters long and takes one line in your data file. Person-id is in columns 61-80. 30 1-character item responses, "A", "B", "C" or "D", are in columns 5-34, 13 2-character item responses, "01", "02" or "99", are in 35-60.

```
xxxxDCBDABCADCDBACDADABDADCDADDCCA0199020101990201019902020 1Zarathrustra-Xerxes.
```

becomes on reformatting:

Columns:

```
12345678901234567890123456789 01-2-3-4-5-6-7-8-9-0-1-2-3-45678901234567890123
DCBDABCADCDBACDADABDADCDADDCCA0199020101990201019902020 1Zarathrustra-Xerxes
```

XWIDE=2   ⇐ analyzed response width
FORMAT=(4X,30A1,13A2,20A1)   ⇐ skip unused
ITEM1=1   ⇐ start of item responses in formatted record
NI=43   ⇐ number of items
NAME1=44   ⇐ start of name
NAMLEN=20 ⇐ length of name
CODES="A B C D 010299"   ⇐ valid responses
                    ⬆ 1-character code followed by blank

Example 4:   The person-id is 10 columns wide in columns 15-24 and the 50 1-column item responses, "A", "B", "C", "D", are in columns 4000-4019, then in 4021-50. Data look like:

```
xxxxxxxxxxxxxxJohn-Smithxxxx....xxxDCBACDADABCADCBCDABDxBDCBDADCBDABDCDDADCDADBBDCDABB
```

becomes on reformatting:

```
John-SmithDCBACDADABCADCBCDABDBDCBDADCBDABDCDDADCDADBBDCDABB
```

FORMAT=(T15,10A,T4000,20A,1X,30A)

```
            NAME1=1                 ⇦ start of person name in formatted record
            NAMLEN=10               ⇦ length of name (automatic)
            ITEM1=11                ⇦ start of items in formatted record
            NI=50                   ⇦ 50 item responses
            CODES=ABCD⇦ valid response codes
```

Example 5:   There are five records or lines in your data file per person. There are 100 items. Items
              1-20 are in columns 25-44 of first record; items 21-40 are in columns 25-44 of second
              record, etc. The 10 character person-id is in columns 51-60 of the last (fifth) record. Codes
              are "A", "B", "C", "D". Data look like:

```
xxxxxxxxxxxxxxxxxxxxxxxxACDBACDBACDCABACDACD
xxxxxxxxxxxxxxxxxxxxxxxxDABCDBACDBACDCABACDA
xxxxxxxxxxxxxxxxxxxxxxxxACDBACDBACDCABACDACD
xxxxxxxxxxxxxxxxxxxxxxxxxDABCDBACDBACDCABACDA
xxxxxxxxxxxxxxxxxxxxxxxxABCDBACDBACDCABACDADxxxxxxMary-Jones
```

becomes:

```
ACDBACDBACDCABACDACDDABCDBACDBACDCABACDAACDBACDBACDCABACDACDDABCDBACDBACDCABACDAABCDBACDBACDCABACDADMary-Jones
```

```
            FORMAT=(4(T25,20A,/),T25,20A,T51,10A)
            ITEM1=1                 ⇦ start of item responses
            NI=100           ⇦ number of item responses
            NAME1=101               ⇦ start of person name in formatted record
            NAMLEN=10               ⇦ length of person name
            CODES=ABCD⇦ valid response codes
```

Example 6:   There are three lines per person. In the first line from columns 31 to 50 are 10 item
              responses, each 2 columns wide. Person-id is in the second line in columns 5 to 17. The
              third line is to be skipped. Codes are "A ", "B ", "C ", "D ". Data look like:

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx A C B D A D C B A Dxxxxxxxx
xxxxJoseph-Carlosxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

becomes:
            Columns:
```
1-2-3-4-5-6-7-8-9-0-1234567890123
 A C B D A D C B A DJoseph-Carlos
```

```
            FORMAT=(T31,10A2,/,T5,13A1,/)
            ITEM1=1                 ⇦ start of item responses
            NI=10                   ⇦ number of items
            XWIDE=2                 ⇦ 2 columns per response
            NAME1=11                ⇦ starting "A" of person name
            NAMLEN=13               ⇦ length of person name
            CODES='A B C D '        ⇦ valid response codes
```

              If the third line isn't skipped, format a redundant extra column in the skipped last line.
              Replace the first control variable in this with:
                    FORMAT=(T31,10A2,/,T5,13A1,/,A1)   ⇦ last A1 unused

Example 7:   § Pseudo-random data selection

You have a file with 1,000 person records. This time you want to analyze every 10th record, beginning with the 3rd person in the file, i.e., skip two records, analyze one record, skip seven records, and so on. The data records are 500 characters long.

FORMAT = (/,/,500A,/,/,/,/,/,/,/)

4.2.11 RESFRM= location of RESCORE= (default: N, before &END)

§ Only use this if you have too many items to put conveniently on one line of the RESCORE= control variable.

Instructs where to find the RESCORE= information.

RESFRM=N

RESCORE= is a control variable between &INST and &END (the default).

RESFRM=Y

RESCORE= information follows after &END but *before the item names*, if any, (see p. 112), and is *formatted exactly like a data record*. It is helpful, for reference, to enter the label "RESCORE=" where the person name would go in your data record.

Example:　　　KEY1= and KEY2= information follows the RESCORE= information, all are formatted like your data. No item names are provided,

```
&INST
NAME1=5        ⇦ start of person-id
ITEM1=14       ⇦ start of responses
NI=10  ⇦ ten items
INUMB=Y        ⇦ use item sequence numbers as names
CODES=ABCDE         ⇦ valid codes
RESFRM=Y       ⇦ rescore information in data record format
KEYFRM=2       ⇦ two keys in data record format
&END
  RESCORE=  0000110000  ⇦ RESCORE= looks like data
  KEY1=    ****AB****  ⇦ KEY1= looks like data
  KEY2=    ****CA****  ⇦ KEY2= looks lie data record
  George   ABCDABCDAB    ⇦ first data record
     |                            ⇦ subsequent data records
```

4.2.12 KEYFRM= location of KEYn= (default: 0, before &END)

§ Only use this if you have too many items to put conveniently on one line of the KEYn= control variable.

Instructs where to find the KEYn= information.

KEYFRM=0

KEY1= through KEY99=, if used, are between &INST and &END.

KEYFRM=1

KEY1 information follows after &END, but *before the item names* (see p. 112). The key is *formatted exactly like a data record*. It is helpful to place the name of the key, e.g. "KEY1=", where the person name would usually go, for reference.

KEYFRM=n

KEY1=, then KEY2=, and so on up to KEYn= (where n is a number up to 99) follow &END, but placed before the item names (see p. 112). Each key is formatted exactly like a

data record. It is helpful to place the name of the key, e.g. "KEY2=", where the person name would usually go.

Example: KEY1 and KEY2 information are to follow directly after &END

```
            &INST
            NAME1=1              ⇦ start of person-id (the default)
            ITEM1=10             ⇦ start of response string
            NI=7                 ⇦ number of items
            CODES=abcd           ⇦ valid codes
            KEYFRM=2             ⇦ two keys in data record format
            &END
            KEY1=****bacddba     ⇦ keys formatted as data
            KEY2=****cdbbaac
            Item 1 name          ⇦ item names
                 |
            Item 7 name
            END NAMES
            Mantovanibbacdba     ⇦ first data record
                 |                        ⇦ subsequent data records
```

4.2.13 CUTHI= cut off responses with high probability of success (default: 0, no)

§ Use this if careless responses are evident. CUTHI= cuts off the top left-hand corner of the Scalogram in Table 22.

Eliminates (cuts off) observations where examinee ability is CUTHI= logits or more (as rescaled by USCALE=) higher than item difficulty, so the examinee has a high probability of success. Removing off-target responses takes place after PROX has converged. After elimination, PROX is restarted, followed by UCON estimation and fit calculation using only the reduced set of responses.

Example: Eliminate responses where examinee ability is 3 or more logits higher than item difficulty, to eliminate careless wrong responses:

CUTHI= 3

This produces a scalogram with eliminated responses blanked out:

```
RESPONSES SORTED BY MEASURE:
KID  |TAP
     |      111111111
     |12374569801 3245678
    +------------------
 15 +111     11100000 ⇦ observations for extreme scores remain
 14 +111   1110000000
 28 +111  111010000000
 30 +1111 1111000000000
 27 +111111100000000000
    +------------------
```

4.2.14 CUTLO= cut off responses with low probability of success (default: 0, no)

§ Use this if guessing or response sets are evident. CUTLO= cuts off the bottom right-hand corner of the Scalogram in Table 22.

Eliminates (cuts off) observations where examinee ability is CUTLO= logits or more (rescaled by USCALE=) lower than item difficulty, so that the examinee has a low probability of success. The

elimination of off-target responses takes place after PROX has converged. After elimination, PROX is restarted, followed by UCON estimation and point-biserial and fit calculation using only the reduced set of responses.

Example: Disregard responses where examinees are faced with too great a challenge, and so might guess wildly, i.e., where examinee ability is 2 or more logits lower than item difficulty:
                    CUTLO= 2

4.3 Specifying the structure of rating scales
4.3.1 MODELS= assigns model types to items (default: R, rating scale)
Estimates calibrations for four different ordered response category structures. *Dichotomies* are always analyzed the same way, regardless of what model is specified, but it is convenient to specify them as 2 category rating scales.

> MODELS=R   (default) uses the Andrich "Rating Scale" model. This is also the Masters' "Partial Credit" model, when GROUPS=0. *The response category is deliberately chosen with knowledge of all others*. This model is a stochastic parameterization of Guttman-pattern data.

> MODELS=S   uses the Glas-Verhelst "Success" (growth) model. *If and only if the person succeeds on the first category, another category is offered until the person fails, or the categories are exhausted*, e.g. an arithmetic item, on which a person is first rated on success on addition, then, if successful, on multiplication, then, if successful, on division etc. "Scaffolded" items often function this way. *{Note: Success/Failure may not estimate correctly}*

> MODELS=F   uses the Linacre "Failure" (mastery) model. *If a person succeeds on the first category, top rating is given and no further categories are offered. On failure, the next lower category is administered until success is achieved, or categories are exhausted. {Note: Success/Failure may not estimate correctly}*

When only one letter is specified with MODELS=, e.g., MODELS=R, all items are analyzed using that model. Otherwise
> MODELS=some combination of R's, F's, S's, and G's, e.g., MODELS=RRSF
> > Items are assigned to the model for which the serial location in the MODELS string matches the item sequence number. The item grouping default becomes each item with its own scale, GROUPS=0. XWIDE=2 requires two columns per MODELS= code, e.g, " S"or "S " mean "S".

Example 1:   All items are to be modelled with the "Success" model.
                    MODELS=S   ⇦ the Success model

Example 2:   A competency test consists of 3 success items followed by 2 failure items and then 10 dichotomies. The dichotomies are to be reported as one group.
                    NI=15   ⇦ fifteen items
                    MODELS=SSSFFRRRRRRRRRR   ⇦ matching models
                    GROUPS=000001111111111   ⇦ dichotomies grouped

4.3.2 STKEEP= keep non-observed steps/categories (default: N, no)
Unobserved categories are normally dropped from rating scales and the remaining category-steps recounted

during estimation. For intermediate categories only, recounting can be prevented and unobserved categories retained in the analysis. This is useful when the unobserved categories are important steps in the rating scale logic or are usually observed, even though they happen to have been unused this time. Steps for which anchor calibrations are supplied are always maintained wherever computationally possible, even when there are no observations in the current data set.

STKEEP=N   Eliminate unused categories and close up the observed categories.

STKEEP=Y   Retain unused non-extreme categories.

When STKEEP=Y, missing categories are retained in the rating scale, so maintaining the raw score ordering, but they distort the step difficulty calibrations. If these are to be used for anchoring later runs, compare these calibrations with the calibrations obtained by an unanchored analysis of the new data. This will assist you in determining what adjustments need to be made to the original calibrations in order to establish a set of anchor calibrations that maintain the same rating scale structure.

Example: Keep the developmentally important rating scale categories, whether they are observed or not.
                STKEEP=Y

4.3.3 Weighting items
There are some circumstances in which certain items are to be given more influence in constructing the measurement than others. For instance, certain items may be considered critical to the demonstration of competence.

Step 1. Analyze the data without weighting. Investigate misfit, construct validity etc.

Step 2. Weight the items:
Method 1. STKEEP= together with RESCORE= and KEYn= can be used to construct integer item weighting by converting 0,1 data into, say, 0,3 data. This rescoring makes the item maps difficult to comprehend, losing the construct definition.

Method 2. Enter the weighted items multiple times in the data using, say, the FORMAT= specification. This maintains the construct.

Example 1:   A 6 item MCQ test entered as "A","B","C","D", is to be scored. Items 1,2,3 are weighted 1, items 4,5 are weighted 3, and item 6 is weighted 7. Person name starts in column 1. Item responses start in column 21. Data looks like:
                `Mary-N.-Simmons-----BCDABC`
                Method 1. Rescoring:
                    NI=6   ⇦ six items
                    CODES=ABCD   ⇦ codes as entered
                    KEY1=BAD***   ⇦ key for weight 1, items 1-3
                    KEY3=***CA*   ⇦ key for weight 3, items 4,5
                    KEY7=*****D   ⇦ key for weight 7, item 6
                    STKEEP=Y   ⇦ keep the defined structure
                    NAME1=1
                    ITEM1=21

                Method 2. Response replication:

Data looks like:
```
Mary-N.-Simmons-----BCDABC
```
becomes:
```
Mary-N.-Simmons-----BCDABABABCCCCCCC
```

NI=16   ⇐ six items + replicates
NAME1=1   ⇐ person starts at column 1
ITEM1=21   ⇐ item starts at column 21
FORMAT=(20A,3A,3(T24,3A),6(T26,1A))   ⇐ replicate items
KEY1 = BADCACACADDDDDD   ⇐ Key1 matches replicates
&END
Item 1 name (1)
Item 2 name (2)
Item 3 name (3)
Item 4 name (4)
Item 5 name (5)
Item 4 name (6)
Item 5 name (7)
Item 4 name (8)
Item 5 name (9)
Item 6 name (10)
...
Item 6 name (16)
END NAMES

Example 2:   A ten item test, all scored 0,1. Items 9 and 10 are to be given double weight. Name starts in column 1. Item responses start in column 31.

Method 1. Rescoring:
NI=10   ⇐ ten items
CODES =01   ⇐ coded 0,1
NEWSCORE=02   ⇐ items 9,10 rescored 0,2
RESCORE=0000000011   ⇐ rescore items 9,10
STKEEP=Y   ⇐ keep the 0,2 structure

Method 2. Response replication:
NAME1=1   ⇐ person starts at column 1
ITEM1=31   ⇐ item starts at column 31
NI=12   ⇐ ten items+2 duplicated
FORMAT=(30A,10A,TL2,2A)   ⇐ enter items 9 & 10 twice
&END
Item 1 name
...
Item 10 name
Item 9 name (again)
Item 10 name (again)
END NAMES

4.3.4 GROUPS= assigns items to groups (default: " ", all in one group)

Items in the same group share the same rating scale definition. For tests comprising only dichotomous

items, or for tests in which all items share the same rating scale definition, all items belong to one group. For tests using the "Partial Credit" rating scale model, each item comprises its own group. For tests in which some items share one rating scale definition, and other items another scale definition, there can be two or more groups.

GROUPS=" "   (default if only one model specified with MODELS=)
            All items belong to one group.

GROUPS=0   (default if MODELS= specifies multiple models)
            Each item has a group of its own, so that a different rating scale is defined for each item, as in the "partial credit" model.

GROUPS= some combination of numbers and letters: 0's, 1's, 2's, A's, B's, etc.
            Items are assigned to the group label whose location in the GROUPS= string matches the item sequence number. Each item assigned to group 0 is allocated to a "partial credit" group by itself. Items in groups labelled "1" etc. share the scale definition with other items in the same labelled group.

Example 1:   Responses to all items are on the same 4-point rating scale.
                    GROUPS=" "

Example 2:   An arithmetic test in which partial credit is given for an intermediate level of success on some items. There is no reason to assert that the intermediate level is equivalent for all items. 0=No success, 1=Intermediate success (or complete success on items with no intermediate level), 2=Complete success on intermediate level items.
                    CODES=012   ⇐ valid codes
                    GROUPS=0   ⇐ each item has own scale

Example 3:   An attitude survey consists of four questions on a 0,1,2 scale (group 1), followed by three 0,1 items (group 2), and ends with one 0,1,2,3,4,5 question (grouped by itself, 0).
                    NI=8   ⇐ number of items
                    CODES=012345   ⇐ valid codes for all items
                    GROUPS=11112220   ⇐ the item groups

When XWIDE=2, use two columns for each GROUPS= code. Each GROUPS= code must be one character, a letter or number, specified once in the two columns, e.g. " 1" or "1 " mean "1", and " 0" or "0 " mean "0".

Example 4:   You wish most items on the "Liking for Science" Survey to share the same rating scale (in Group A). Items about birds (1, 10, 21) are to share a separate scale (in Group B). Items 5 (cans) and 18 (picnic) each has its own scale (Group 0).
                    NI=25   ⇐ number of items
                    XWIDE=2
                    CODES=000102   ⇐ valid codes for all items
                    GROUPS=' B A A A 0 A A A A B A A A A A A A 0 A A B A A A A'
                                    ⬆ item groups

4.3.5 MODFRM= location of MODELS= (default: N, before &END)
        § Only use this if you have too many items to put conveniently on one line of the MODELS= control variable. It is easier to us "+" continuation lines

Instructs where to find the MODELS= information.

MODFRM=N   MODELS= is a control variable between &INST and &END (the default).

MODFRM=Y   MODELS= information follows just after &END but before the item names (see p. 112). It is formatted exactly like a data record. It is helpful to enter "MODELS=" where the person name would go.

Example: A test consists of 10 two-step items. The highest level answer is scored with KEY2=. The next level with KEY1=. Some items have the "Success" structure, where the higher level is administered only after success has been achieved on the lower level. Some items have the "Failure" structure, where the lower level is administered only after failure at the higher level. The MODELS=, KEY1=, KEY2= are formatted exactly like data records. The data records are in a separate file.

&INST
NAME1=5   ⇐ start of person-id
ITEM1=20   ⇐ start of responses
NI=10   ⇐ ten items
CODES=ABCDE   ⇐ valid codes
MODFRM=Y   ⇐ MODELS= in data format
KEYFRM=2   ⇐ two keys in data format
DATA=DATAFILE   ⇐ location of data
&END
     MODELS=   SSSFFFSSSS   ⇐ data format
     KEY1=   BCDABCDABC
     KEY2=   ABCDDBCBAA
Item name 1   ⇐ first item name
|
Item name 10
END NAMES

4.3.6 GRPFRM= location of GROUPS= (default: N, before &END)

§ Only use this if you have too many items to put conveniently on one line of the GROUPS= control variable.

Instructs where to find the GROUPS= information.

GRPFRM=N

GROUPS= is a control variable between &INST and &END (the default).

GRPFRM=Y

GROUPS= information follows just after &END, but before the item names (see p. 112). It is formatted exactly like a data record. It is helpful to enter "GROUPS=", for reference, where the person name would go.

Example: An attitude survey of 10 items with 3 rating scale definitions. Items 1 through 3 on Scale 1, items 4 through 6 on Scale 2 and items 7 through 10 on Scale 3. The GROUPS= information is formatted like a data record and entered after &END and before the item names. The responses are in columns 1-10, and the person-id in column 11 onwards.

&INST
NAME1=11   ⇐ start of person-id
ITEM1=1   ⇐ start of responses

```
            NI=10            ⇐ number of items
            CODES=12345 ⇐ valid responses
            GRPFRM=Y              ⇐ GROUPS= formatted like data
            &END
            1112223333 GROUPS= ⇐ GROUPS= information
            Item name 1          ⇐ item names
            |
            Item name 10
            END NAMES
            2213243223 John Smith ⇐ first data record
            |
```

4.4 Deleting or anchoring items
4.4.1 IDFILE= name of item deletion file (default: no file)
Deletion or selection of items from a test for an analysis, but without removing the responses from your data file, is easily accomplished by creating a file in which each line contains the sequence number or numbers of items to be deleted or selected. Specify this file by means of the control variable, IDFILE=, or enter the deletion list in the control file using IDFILE=*.

a) Delete an item: enter the item number. E.g., to delete item 5, enter

        5

b) Delete a range of items: enter the starting and ending item number on the same line separated by a *blank or dash*. E.g., to delete items 13 through 24

        13-24
   or
        13 24

c) Select an item for analysis: enter a plus sign then the number.
      E.g., to select item 19 from a previously deleted range
        +19

d) Select a range of items for analysis: enter a plus sign, the starting number, a blank or dash, then the ending number. E.g., to select items 17 through 22
        +17-22
   or
        +17 22

e) If a + selection is the *first entry* in the deletion file, then all items are deleted before the first selection is undertaken, so that the items analyzed will be limited to those selected, e.g,
    if +10-20 is the only line in the item deletion file for a 250 item test, it means
        1-250   ; delete all 250 items
        +10-20 ; reinstate items 10 through 20.

f) You may specify an item deletion list in your control with
        IDFILE=*
        (List)
        *
   e.g.,
        IDFILE=*

```
          17                    ; delete item 17
          2                     ; delete item 2
          *
```

Example 1:   You wish to delete the fifth and tenth through seventeenth items from an analysis, but then
              keep item fourteen.
                      1. Create a file named, say, ITEM.DEL
                      2. Enter into the file, the lines:
```
                              5
                              10-17
                              +14
```

                      3. Specify, in the control file,
```
                              NI=50
                              ITEM1=63
                              IDFILE=ITEM.DEL
                              TABLES=1110111
                              &END
```

              or, specify in the control file,
```
                              NI=50
                              ITEM1=63
                              IDFILE=*
                              5
                              10-17
                              +14
                              *
                              TABLES=1110111
                              &END
```

Example 2:   The analyst wants to delete the most misfitting items reported in Table 10.
                      1. Set up a standard control file.
                      2. Specify
```
                              IDFILE=*
                              *
```
                      3. Copy the target portion of Table 10.
                      4. Paste it between the "*"
                      5. Delete characters before the entry numbers.
                      6. Type ; after the entry numbers to make further numbers into comments.

```
              &INST
              TITLE = 'Example of item deletion list from Table 10'
              IDFILE = *
```
⬇ Delete the border character before the entry number
```
;|ENTRY   RAW                      |  INFIT  |  OUTFIT  |    |                            |
;|  NUM  SCORE  COUNT  MEASURE  ERROR|MNSQ  ZSTD|MNSQ  ZSTD|PTBIS|  ACTS                   G |
     5 ; 2      4      .00   1.03|1.48   1.8|1.50   1.8|A-.83|  FIND BOTTLES AND CANS       0 |
     8 ; 2      4      .00   1.03|1.40   1.6|1.43   1.6|B-.71|  LOOK IN SIDEWALK CRACKS     0 |
     4 ; 3      4      .00    .62|1.33    .7|1.49    .9|C-.21|  WATCH GRASS CHANGE          0 |
     9 ; 4      4      .00    .74|1.51    .8|1.57    .9|D-.59|  LEARN WEED NAMES            0 |
    20 ; 1      4      .00   1.03|1.12    .5|1.14    .6|E-.05|  WATCH BUGS                  0 |
```

```
   24 ; 6    4     .30   1.03|1.15   .6|1.13   .5|F-.15| FIND OUT WHAT FLOWERS LIVE ON   0 |
```
⬆ Enter the ; to make other numbers into comments
                *

Example 3:   The analyst want to delete item 4 and items 18 to 23 on the DOS control (or Extra
               Specifications) line:
               Extra specifications? IDFILE=* 4 18-23 * (**Enter**)
               or
               C:>BIGSTEPS CONTROL.FIL OUTPUT.FIL IDFILE=* 4 18-23 *

4.4.2 *IDELQU= delete items interactively (default: N, no)*
§ Use this if you have one or two items to delete or will be running repeatedly with
different deletion and selection patterns, otherwise use IDFILE=.

If your system is interactive, items to be deleted or selected can be entered interactively by setting
IDELQU=Y. If you specify this, you will be asked if you want to delete any items. If you respond "yes", it
will ask if you want to read these deleted items from a file; if you answer "yes" it will ask for the file name
and process that file in the same manner as if IDFILE= had been specified. If you answer "no", you will be
asked to enter the sequence number or numbers of items to be deleted or selected one line at a time,
following the rules specified for IDFILE=. When you are finished, enter a zero.

Example: You are doing a number of analyses, deleting a few, but different, items each analysis. You
               don't want to create a lot of small delete files, but rather just enter the numbers directly into
               the program using:
                       &INST
                       NI=60
                       ITEM1=30
                       IDELQU=Y
                       &END

          You want to delete items 23 and 50 through 59.
                       BIGSTEPS asks you:
               DO YOU WANT TO DELETE ANY ITEMS?
                       respond **YES(Enter)**
               DO YOU WISH TO READ THE DELETED ITEMS FROM A FILE?
                       respond **NO(Enter)**
               INPUT ITEM TO DELETE (0 TO END):
                       respond **23(Enter)** (the first item to be deleted)
               INPUT ITEM TO DELETE (0 TO END): **50-59(Enter)**
               INPUT ITEM TO DELETE (0 TO END): **0(Enter)** (to end deletion)

          If you make a mistake, it is simple to start again, reinstate all items with
                       INPUT ITEM TO DELETE (0 TO END): **+1-999(Enter)**
          where 999 is the length of your test or more, and start selection again.

4.4.3 *IAFILE= name of item anchor file (default: " ", no file)*
§ The IFILE= from one analysis can be used unedited as the IAFILE= of another.

Anchoring facilitates equating test forms and building item banks. The items common to two test forms, or
in the item bank and also in the current form, can be anchored at their other form or bank calibrations. Then
the scale constructed from the current data and the measures reported will be equated to the scale of the
other form or bank.

In order to anchor items, a data file must be created of the following form:
1. Use one line per item-to-be-anchored.
2. Type the sequence number of the item, a blank, and the scale value at which to anchor the item (in logits if USCALE=1, or in your rescaled units otherwise).
    Further values in each line are ignored. An IFILE= works well as an IAFILE=.

Or this information may be specified in the control file using IAFILE=*.

Example 1:   The third item is to be anchored at 1.5 logits, and the fourth at 2.3 logits.
1. Create a file named, say, "ANC.FIL"
2. Enter the line "3 1.5" into this file, which means "item 3 is to be fixed at 1.5 logits".
3. Enter a second line "4 2.3" into this file, which means "item 4 is to be fixed at 2.3 logits".
3. Specify, in the control file,
    IAFILE=ANC.FIL

or place directly in the control file,
    IAFILE=*
    3 1.5
    4 2.3
    *

Example 2:   The calibrations from one run are to be used to anchor subsequent runs. The items have the same numbers in both runs. This is convenient for generating tables not previously requested.
1. Perform the calibration run, say,

C:> BIGSTEPS SF.DAT SOME.OUT IFILE=ANCHORS.SF TABLES=111

2. Perform the anchored runs, say,

C:> BIGSTEPS SF.DAT MORE.OUT IAFILE=ANCHORS.SF TABLES=0001111
C:> BIGSTEPS SF.DAT CURVES.OUT IAFILE=ANCHORS.SF CURVES=111

4.4.4 IANCHQ= anchor items interactively (default: N, no)

Items to be anchored can be entered interactively by setting IANCHQ=Y. If you specify this, you are asked if you want to anchor any items. If you respond "yes", it will ask if you want to read these anchored items from a file; if you answer "yes" it will ask for the file name and process that file in the same manner as if IAFILE= had been specified. If you answer "no", you will be asked to enter the sequence number of each item to be anchored, one at a time, along with its logit (or rescaled by USCALE=, UMEAN=) value. When you are finished, enter a zero.

Example: You are doing a number of analyses, anchoring a few, but different, items each analysis. You don't want to create a lot of small anchor files, but rather just enter the numbers at the terminal, so specify:
    IANCHQ=Y

You want to anchor items 4 and 8.
    BIGSTEPS asks you:
    DO YOU WANT TO ANCHOR ANY ITEMS?
    respond **YES(Enter)**

DO YOU WISH TO READ THE ANCHORED ITEMS FROM A FILE?
  respond **NO(Enter)**
INPUT ITEM TO ANCHOR (0 TO END):
  respond **4(Enter)** (the first item to be anchored)
INPUT VALUE AT WHICH TO ANCHOR ITEM:
  respond **1.45(Enter)** (the first anchor value)
INPUT ITEM TO ANCHOR (0 TO END): **8(Enter)**
INPUT VALUE AT WHICH TO ANCHOR ITEM:**-0.23(Enter)**
INPUT ITEM TO ANCHOR (0 TO END): **0(Enter)** (to end anchoring)

4.5 Deleting or anchoring persons
4.5.1 PDFILE= name of person deletion file (default: " ", no file)

Deletion or selection of persons from a test to be analyzed, but without removing their responses from your data file, is easily accomplished by creating a file in which each line contains the sequence number of a person or persons to be deleted or selected (according to the same rules given under IDFILE=), and then specifying this file by means of the control variable, PDFILE=, or enter the deletion list in the control file using PDFILE=*.

Example 1: You wish to delete the fifth and tenth persons from this analysis.
    1. Create a file named, say, "PERSON.DEL"
    2. Enter into the file, the lines:
      5
      10
    3. Specify, in the control file,
      PDFILE=PERSON.DEL

    or, enter directly into the control file,
      PDFILE=*
      5
      10
      *

Example 2: The analyst wants to delete the most misfitting persons reported in Table 6.
    1. Set up a standard control file.
    2. Specify
      PDFILE=*
      *
    3. Copy the target portion of Table 6.
    4. Paste it between the "*"
    5. Delete characters before the entry numbers.
    6. Type ; after the entry numbers to make further numbers into comments.

    &INST
    TITLE = 'Example of person deletion list from Table 6'
    IDFILE = *
⬇ Delete the border character before the entry number
```
;|ENTRY   RAW              |  INFIT  | OUTFIT  |    |   |
;| NUM  SCORE COUNT MEASURE  ERROR|MNSQ ZSTD|MNSQ ZSTD|PTBIS| PUP|
  73  ; 21   22     .14    .37| .95  -.3|1.03   .2|B-.19| SAN|
  75  ; 16   22    -.56    .39| .95  -.3|1.03   .2|C-.19| PAU|
```

⬆ Enter the ; to make other numbers into comments
       *   ⇦ closure of IDFILE=*

4.5.2 PDELQU= delete persons interactively (default: N, no)

Persons to be deleted or selected can be entered interactively by setting PDELQU=Y. If you specify this, you will be asked if you want to delete any persons. If you respond "yes", it will ask if you want to read these deleted persons from a file; if you answer "yes" it will ask for the file name and process that file in the same manner as if PDFILE= had been specified. If you answer "no", you will be asked to enter the sequence number or numbers of persons to be deleted or selected one line at a time, following the rules specified for IDFILE=. When you are finished, enter a zero.

Example: You are doing a number of analyses, deleting a few, but different, persons each analysis. You don't want to create a lot of small delete files, but rather just enter the numbers at the terminal, so specify:
                PDELQU=Y

      You want to delete persons 23 and 50.
                BIGSTEPS asks you:
          DO YOU WANT TO DELETE ANY PERSONS?
                respond **YES**(**Enter)**
          DO YOU WISH TO READ THE DELETED PERSONS FROM A FILE?
                respond **NO**(**Enter)**
          INPUT PERSON TO DELETE (0 TO END):
                respond **23**(**Enter)** (the first person to be deleted)
          INPUT PERSON TO DELETE (0 TO END): **50**(**Enter)**
          INPUT PERSON TO DELETE (0 TO END): **0**(**Enter)** (to end deletion)

4.5.3 PSELECT= person selection criterion (default: *, all persons)

Persons to be selected may be specified by using the PSELECT= instruction to match characters within the person name. PSELECT= uses the same format as MS-DOS file selection. Persons deleted by PDFILE= or PDELQU= are never selected by PSELECT=. For multiple selections, specify only * and then follow it by a list.

Control characters to match person name:
       ?   matches any character
       *   matches any string of characters
       Other alphanumeric characters match only those characters.

Example 1:   Select for analysis only persons with M in the 5th column of person name. Person name starts in column 6 of the data record:
                NAME1=6   ⇦ Person name field starts in col. 6
                NAMLEN=8   ⇦ Person name field is 8 characters long
                PSELECT=????M*   ⇦ Column 5 of person name is sex
                |
                END NAMES
                xxxxxBPL M J 01101000101001   ⇦ selected
                xxxxxMEL F S 01001000111100   ⇦ omitted
                -----1234⬆ selection column

Example 2:   Select for analysis all persons with code "A 4" in columns 2-4 of their names. Person name

starts in column 23, so target characters starts in column 24:

      NAME1=23   ⇦ person name starts in column 23

      PSELECT="?A 4*"   ⇦ quotes because a blank is included. A is in col. 2 etc.

Selects: ZA 4PQRS

Example 3:   Select all persons with " M" anywhere in their person name field, which signifies Male:

      PSELECT="* M*"   ⇦ " M" matches the first blank+M.

Selects: 123456 MPQRS

Selects: 123 4M56 MPQRS

Does not select: 123 45MPQRS

Example 4:   Select Males (M in column 8) in School 23 (023 in column 14-16):

      PSELECT=???????M?????023*

Selects: 1234567MABCDE023XYZ

4.5.4 PAFILE= name of person anchor file (default: " ", no file)

§ The PFILE= from one run can be used unedited as the PAFILE= of another.

Person anchoring can also facilitate test form equating. The persons common to two test forms can be anchored at the values for one form. Then the measures constructed from the second form will be equated to the scale of the first form. In order to anchor persons, an anchor file must be created of the following form:

1. Use one line per person-to-be-anchored.
2. Type the sequence number of the person, a blank, and the scale value (in logits if USCALE=1, otherwise your rescaled units) at which to anchor the person.

Or this information may be specified in the control file using PAFILE=*.

Example: The third person in the test is to be anchored at 1.5 logits, and the eighth at -2.7.

      1. Create a file named, say, "PERSON.ANC"

      2. Enter the line "3 1.5" into this file, meaning "person 3 is fixed at 1.5 logits".

      3. Enter the line "8 -2.7", meaning "person 8 is fixed at -2.7 logits".

      4. Specify, in the control file,

          PAFILE=PERSON.ANC

     or, enter directly into the control file

      PAFILE=*

      3 1.5

      8 -2.7

      *

4.5.5 PANCHQ= anchor persons interactively (default: N, no)

If your system is interactive, persons to be anchored can be entered interactively by setting PANCHQ=Y between the &INST and &END lines. If you specify this, you will be asked if you want to anchor any persons. If you respond "yes", it will ask if you want to read these anchored persons from a file; if you answer "yes" it will ask for the file name and process that file in the same manner as if PAFILE= had been specified. If you answer "no", you will be asked to enter the sequence number of each person to be anchored, one at a time, along with the logit (or rescaled by USCALE=, UMEAN=) calibration. When you are finished, enter a zero.

Example: You are doing a number of analyses, anchoring a few, but different, persons each analysis. This time, you want to anchor person 4.

Enter on the DOS control line, or in the control file:

        PANCHQ=Y

You want to anchor person 4:

        BIGSTEPS asks you:

DO YOU WANT TO ANCHOR ANY PERSONS?

        respond **YES**(**Enter**)

DO YOU WISH TO READ THE ANCHORED PERSONS FROM A FILE?

        respond **NO**(**Enter**)

INPUT PERSON TO ANCHOR (0 TO END):

        respond **4**(**Enter**) (the first person to be anchored)

INPUT VALUE AT WHICH TO ANCHOR PERSON:

        respond **1.45**(**Enter**) (the first anchor value)

INPUT PERSON TO ANCHOR (0 TO END): **0**(**Enter**) (to end anchoring)

4.6 Categories and steps: labeling, deleting and anchoring
4.6.1 CFILE= name of category label file (default: " ", no file)

Rating scale output is easier to understand when the categories are shown with their substantive meanings. These meanings can be specified using CFILE= and a file name, or CFILE=* and placing the labels in the control file.   Each category number is listed (one per line), followed by its descriptive label.   If the observations have been rescored (NEWSCORE=) or keyed (KEYn=), then use the final category value in the CFILE= specification.   When there are different category labels for different GROUPS= of items, specify an example item from the group, followed immediately by "+" and the category number. Blanks or commas can be used a separators between category numbers and labels.

Example 1:   Identify the three LFS categories, 0=Dislike, 1=Don't know, 2=Like.

        CODES=012

        CFILE=*

        0 Dislike

        1 Don't know

        2 Like

        *

The labels are shown in Table 3 as:

```
+----------------+-----------------+---------+
|CATEGORY OBSERVED|AVGE  INFIT OUTFIT|  STEP  |
| LABEL    COUNT |MEASURE MNSQ  MNSQ| MEASURE |
+----------------+-----------------+---------+
|   0       378  | -.87  1.08  1.19|  NONE   | Dislike
|   1       620  |  .13   .85   .69|   -.85  | Don't know
|   2       852  | 2.23  1.00  1.46|    .85  | Like
+----------------+-----------------+---------+
```


Example 2:   Items 1-10 (Group 1) are "Strong Disagree, Disagree, Agree, Strongly Agree". Items 11-20 (Group 2) are "Never, Sometimes, Often, Always".

        NI=20

        CODES=1234

        GROUPS=11111111112222222222

        CFILE=*

        7+1 Strongly Disagree   ⇐ 7 is any item in Group 1

        7+2 Disagree

```
                    7+3 Agree
                    7+4 Strong Agree
                    13+1 Never                      ⇦ 13 is any item in Group 2
                    13+2 Sometimes
                    13+3 Often
                    13+4 Always
                    *
```

Example 3:   To enter CFILE= information on the DOS Prompt or Extra Specifications lines, using
              commas instead of blanks as separators:
              C:>BIGSTEPS SF.DAT SF.OUT CFILE=* 1,Dislike 2,Don't-know 3,Like *

Example 4:   One group of items has a unique response format other groups all have the same format.
              Here, each group has only one item, i.e., GROUPS=0

```
                    NI=20
                    CODES=1234
                    GROUPS=0
                    CFILE=*
                    1 Strongly Disagree      ⇦ This scale is used by most items
                    2 Disagree
                    3 Agree
                    4 Strong Agree
                    16+1 Never               ⇦ 16 is the one item using this scale
                    16+2 Sometimes
                    16+3 Often
                    16+4 Always
                    *
```

Example 5:   Several categories are collapsed into one category. The original codes are A-H. After
              rescoring there is only a dichotomy: 0, 1.

```
                    NI=30
                    CODES =ABCDEFGH
                    NEWSCORE=00011110
                    CFILE=*
                    0  Fail          ⇦ Specify the categories as reported
                    1  Pass
                    *
```

4.6.2 SDFILE= name of item step/category deletion file (default: " ", no file)
Deletion of categories from a test analysis (i.e. conversion of responses in these categories to "missing
data"), but without removing these responses from your data file, is easily accomplished by creating a file in
which each line contains
          if there is more than one group, the sequence number *of an item* representing a group followed by a
              blank
          the number of the category to be deleted from that item and its group
Specify this file by means of the control variable, SDFILE=, or this information may be specified in the
control file using SDFILE=*.

Since rating scales may be shared by groups of items, deletion of categories is performed by group:
a) If **no** GROUPS= control variable is specified, no item need be entered, since specifying deletion of a
          category deletes that category for *all* items.

b) If a GROUPS= control variables *is* specified, then specifying deletion of a category for one item deletes that category for all items *in the same group*.

c) If GROUPS=0 is specified, only the specified category for the specified item is deleted.

Example: You wish to delete particular categories for the fifth and tenth "partial credit" items for this analysis.

> 1. Create a file named, say, "CAT.DEL"
> 2. Enter into the file, the lines:
>> 5 3 (item 5 category 3)
>> 10 2 (item 10 category 2)
> 3. Specify, in the control file,
>> SDFILE=CAT.DEL
>> GROUPS=0

or, enter in the control file,
> SDFILE=*
> 5 3
> 10 2
> *
> GROUPS=0

4.6.2 *SDELQU= delete item step/categories interactively (default: N, no)*

If your system is interactive, categories to be deleted can be entered interactively by setting SDELQU=Y between the &INST and &END lines. If you specify this, you will be asked if you want to delete any categories/steps. If you respond "yes", it will ask if you want to read these deleted categories from a file; if you answer "yes" it will ask for the file name and process that file in the same manner as if SDFILE= had been specified. If you answer "no", you will be asked to enter

> a) the sequence number of each item (representing a group, as described under SDFILE=). This question is omitted if all items are in one group.
> b) the score value of one category to be deleted from that item and its group.

Enter these deletions one at a time. When you are finished, enter a zero.

4.6.3 *SAFILE= name of item step anchor file (default: " ", no file)*

§ The SFILE= of one analysis may be used **unedited** as the SAFILE= of another.

The anchoring option facilitates test form equating. The steps in the rating scales of two test forms, or in the item bank and in the current form, can be anchored at their other form or bank values. Then the common rating scale calibrations are maintained.

In order to anchor item steps, an anchor file must be created of the following form:

1. Use one line per item step-to-be-anchored.
2. If all items use the same rating scale (i.e. GROUPS=" ", the default, or you assign all items to the same group, e.g GROUPS=222222..), then type the category number, a blank, and the "step measure" scale value (in logits or your rescaled units) at which to anchor the step corresponding to that category (see Table 3). If you wish to force category 0 to stay in an analysis, anchors its calibration at 0.

   or

   If items use different rating scales (i.e. GROUPS=0, or items are assigned to different groups, e.g GROUPS=122113..), then type the sequence number of *any item* belonging to the group, a blank, the category number, a blank, and the "step measure" scale value (in logits if USCALE=1, otherwise your rescaled units) at which to anchor the *step up* to that category for that group. If you

wish to force category 0 to stay in an analysis, anchor its calibration at 0.
This information may be entered directly in the control file using SAFILE=*

Example 1:   A rating scale, common to all items, of three categories, 2, 4, and 6, is to be anchored at pre-set calibrations. The calibration of the step from category 2 to category 4 is -1.5, and of the step to category 6 is +1.5.
        1. Create a file named, say, "STANC.FIL"
        2. Enter the lines
            4 -1.5   ⇦ step to category 4, anchor at -1.5 logits
            6 1.5
        3. Specify, in the control file,
            GROUPS=" "   ⇦ (the default)
            SAFILE=STANC.FIL   ⇦ step anchor file

or, enter directly in the control file,
        SAFILE=*
        4 -1.5
        6 1.5
        *

Example 2:   A partial credit analysis (GROUPS=0) has a different rating scale for each item. Item 15 has four categories, 0,1,2,3 and this particular scale is to be anchored at pre-set calibrations.
        1. Create a file named, say, "PC.15"
        2. Enter the lines
            15 0 0   ⇦ Bottom categories are always at logit 0
            15 1 -2.0   ⇦ item 15, step to category 1, anchor at -2 logits
            15 2 0.5
            15 3 1.5
        3. Specify, in the control file,
            GROUPS=0
            SAFILE=PC.15

Example 3:   A grouped rating scale analysis (GROUPS=21134..) has a different rating scale for each group of items. Item 26 belongs to group 5 for which the scale is three categories, 1,2,3 and this scale is to be anchored at pre-set calibrations.
        1. Create a file named, say, "GROUP.ANC"
        2. Enter the lines
            26 2 -3.3   ⇦ for item 26, *representing group 5*, step to category 2,
                            anchored at -3.3

            26 3 3.3
        3. Specify, in the control file,
            GROUP =21134..
            SAFILE=GROUP.ANC

Example 4:   A questionnaire includes several rating scales, each with a pivotal step between two categories. The item difficulties are to be centered on those pivots.
        1. Use GROUPS= to identify the item-scale subsets.
        2. Look at the scales and identify the pivot point:
            e.g.,   Strongly Disagree   1
                       Disagree   2

<div align="center">

Neutral   3

Agree   4

Strongly Agree 5

</div>

If agreement is wanted, the pivot point is the step from 3 to 4.

If no disagreement is wanted, the pivot point is the step from 2 to 3.

3. Anchor the step corresponding to the pivot point at 0.

SAFILE=*

23 3 0   ⇦ 23 is an item in group, pivoted at agreement (3→4)

*

4.6.4 *SANCHQ= anchor steps interactively (default: N, no)*

If your system is interactive, steps to be anchored can be entered interactively by setting SANCHQ=Y between the &INST and &END lines. If you specify this, you will be asked if you want to anchor any steps. If you respond "yes", it will ask if you want to read these anchored items from a file; if you answer "yes" it will ask for the file name and process that file in the same manner as if SAFILE= had been specified. If you answer "no", you will be asked to enter the **step measures** (found in Table 3).

If there is only one rating scale, enter the category numbers for which the steps are to be anchored, one at a time, along with their logit (or rescaled by USCALE=) step measure calibrations. Bypass categories without measures. Enter 0 where there is a measure of "NONE". When you are finished, enter **-1** in place of the category number.

If there are several rating scales, enter one of the item numbers for each rating scale, then the step measures corresponding to its categories. Repeat this for each category of an item for each rating scale. Enter **0** where there is a step measure for a category of "NONE". Entering **0** as the item number completes anchoring.

Example 1:   You are doing a number of analyses, anchoring the common rating scale to different values each time. You want to enter the numbers at your PC:

            SANCHQ=Y

You want to anchor items 4 and 8.

            BIGSTEPS asks you:

DO YOU WANT TO ANCHOR ANY STEPS? respond **YES**(**Enter)**

DO YOU WISH TO READ THE ANCHORED STEPS FROM A FILE?

         respond **NO**(Enter)

INPUT STEP TO ANCHOR (-1 TO END):

         respond **2**(**Enter)** (the first step to be anchored)

INPUT VALUE AT WHICH TO ANCHOR STEP:

         respond **0**(**Enter)** (the first anchor value)

INPUT STEP TO ANCHOR (-1 TO END): **4**(**Enter)**

INPUT VALUE AT WHICH TO ANCHOR STEP:**-1.5**(**Enter)**

INPUT STEP TO ANCHOR (-1 TO END): **6**(**Enter)**

INPUT VALUE AT WHICH TO ANCHOR STEP:**1.5**(**Enter)**

INPUT STEP TO ANCHOR (-1 TO END): **-1**(**Enter)** (to end anchoring)

Example 2:   You wish to enter the step difficulty measures for several scales, each comprising a group
                    of items:SANCHQ=Y

                BIGSTEPS asks you:
                DO YOU WANT TO ANCHOR ANY STEPS? **YES**(**Enter)**
                DO YOU WANT TO READ THE ANCHORED STEPS FROM A FILE? **NO**
        Item 1 represents the first group of items, sharing a common scale:
                INPUT AN ITEM, REPRESENTING A GROUP (0 TO END): **1**
                INPUT STEP TO ANCHOR (-1 TO END): **0**   ⇐bottom category
                INPUT VALUE AT WHICH TO ANCHOR STEP: **0**   ⇐ "NONE"
                INPUT AN ITEM, REPRESENTING A GROUP (0 TO END): **1**
                INPUT STEP TO ANCHOR (-1 TO END): **1**
                INPUT VALUE AT WHICH TO ANCHOR STEP: **-0.5**
                INPUT AN ITEM, REPRESENTING A GROUP (0 TO END): **1**
                INPUT STEP TO ANCHOR (-1 TO END): **2**
                INPUT VALUE AT WHICH TO ANCHOR STEP: **0.5**
        Item 8 represents the second group of items, sharing a common scale:
                INPUT AN ITEM, REPRESENTING A GROUP (0 TO END): **8**
                INPUT STEP TO ANCHOR (-1 TO END): **0**   ⇐ bottom category
        When all are anchored, enter 0 to end:
                INPUT AN ITEM, REPRESENTING A GROUP (0 TO END): **0**

5. ANALYSIS CONTROL

5.1 Convergence control

5.1.1 MPROX= maximum number of PROX iterations (default: 10)

Specifies the maximum number of PROX iterations to be performed. PROX iterations will always be performed so long as inestimable parameters have been detected in the previous iteration, because inestimable parameters are always dropped before the next iteration. At least 2 PROX iterations will be performed. PROX iteration ceases when the spread of the persons and items no longer increases noticeably. The spread is the logit distance between the top 5 and the bottom 5 persons or items.

If you wish to continue PROX iterations until you intervene with **Ctrl** and **S**, set MPROX=0. UCON iterations will then commence.

Example: To set the maximum number of PROX iterations to 20, in order to speed up the final UCON estimation of a symmetrically-distributed set of parameters,
                MPROX=20

5.1.2 MUCON= maximum number of UCON iterations (default: 0, no limit)

§ UCON iterations may take a long time for big data sets, so initially set this to -1 for **no** UCON iterations. Then set MUCON= to 10 or 15 until you know that more precise measures will be useful.

Specifies the maximum number of UCON iterations to be performed. Iteration will always cease when both LCONV= *and* RCONV= criteria have been met. To specify no maximum number limitation, set MUCON=0. Iteration always be stopped by **Ctrl** with **F**, see "Stopping BIGSTEPS" in Section 2.

Example 1:   To allow up to 4 iterations in order to obtain rough estimates of a complex rating scale:
                MUCON=4   ⇦ 4 UCON iterations maximum

Example 2:   To allow up to as many iterations as needed to meet the other convergence criteria:
                MUCON=0   ⇦ Unlimited UCON iterations

Example 3:   Perform no UCON iterations, since the PROX estimates are good enough.
                MUCON=-1   ⇦ No UCON iterations

5.1.3 LCONV= logit change at convergence (default: .01 logits)

§ Measures are only reported to 2 decimal places, so a change of less than .01 logits will probably make no visible difference.

Specifies what value the largest change in any logit estimate for a person measure or item calibration must be less than, in the iteration just completed, for iteration to cease. The current largest value is listed in Table 0 and displayed on your screen.

Example: To set the maximum change at convergence to be less or equal to .001 logits:
                LCONV=.001

5.1.4 RCONV= score residual at convergence (default: 0.5)

§ Scores increment in integers so that 0.5 is about as precise a recovery of observed data as can be hoped for.

Specifies what value the largest score residual, corresponding to any person measure or item calibration, must be less than in the iteration just completed for iteration to cease. The current largest value is listed in Table 0, and displayed on your screen. In large data sets, the smallest meaningful logit change in estimates

may correspond to score residuals of several score points.

Example: To set the maximum score residual, when convergence will be accepted, at 5 score points. Your data consists of the responses of 5,000 students to a test of 250 items.
> NI=250 ⇦ 250 items
> RCONV=5   ⇦ score residual convergence at 5 score points

5.2 Estimate adjustments
5.2.1 REALSE= inflate S.E. for misfit (default: N, no misfit allowance)
§ The modelled, REALSE=N, standard errors are the *smallest* possible errors. These always overstate the measurement precision.

Controls the reporting of standard errors in all tables.

> REALSE=N
>> Report modelled, asymptotic, standard errors (the default).

> REALSE=Y
>> Report the modelled standard errors **inflated** by the square root of the maximum of the infit mean square and its inverse. This inflates the standard error to include uncertainty due to overall lack of fit of data to model.

5.2.2 STBIAS= correct for UCON estimation statistical bias (default: N, no)
§ Other Rasch programs may or may not attempt to correct for estimation bias. When comparing results from other programs, try both STBIAS=Y and STBIAS=N to find the closest match.

The UCON unconditional maximum likelihood estimation algorithm produces estimates that have a usually small statistical bias. This bias increases the spread of measures and calibrations, but usually less than the standard error of measurement. The bias quickly becomes insignificantly small as the number of persons and items increases. For paired comparisons and very short tests, estimation can double the apparent spread of the measures, artificially inflating test reliability. STBIAS=Y causes an approximate correction to be applied to measures and calibrations.

§ A useful correction for bias is to multiply the usual measures by (L-1)/L, where L is the smaller of the average person or item response count, so, for paired comparisons, multiply by ".

Example: You have a well-behaved test of only a few items, for which you judge the statistical bias correction to be useful:
> STBIAS=Y

5.2.3 TARGET= estimate using information-weighting (default: N, no)
§ TARGET=Y lessens the effect of guessing on the measure estimates, but increases reported misfit. A big discrepancy between the measures produced by TARGET=N and TARGET=Y indicates much anomalous behavior disturbing the measurement process.

Unwanted behavior (e.g. guessing, carelessness) can cause unexpected responses to off-target items. The effect of responses on off-target items is lessened by specifying TARGET=Y. This weights each response by its statistical information during estimation. Fit statistics are calculated as though the estimates were made in the usual manner. Reported displacements show how much difference targeting has made in the estimates.

Example: Some low achievers have guessed wildly on a MCQ test. You want to reduce the effect of their lucky guesses on their measures and on item calibrations.
TARGET=Y

How Targeting works:

a) for each observation:

        calculate probability of each category (0,1 for dichotomies)

        calculate expected score (= probability of 1 for dichotomy)

        calculate variance = information

                = probability of 1 * probability of 0 for dichotomies,

                so maximum value is 0.25 when ability=difficulty

b)   for targeting:

            weighted observation = variance * observation

            weighted expected score = variance * expected score

c)   sum these across persons and items (and steps)

d)   required "targeted" estimates are obtained when, for each person, item, step

              sum (weighted observations) = sum (weighted expected scores)

e)   for calculation of fit statistics and displacement, weights of 1 are used but with the targeted parameter estimates. Displacement size and excessive misfit indicate how much "off-target" aberrant behavior exists in the data.

For targeting, there are many patterns of responses that can cause infinite measures, e.g. all items correct except for the easiest one. The convergence criteria limit how extreme the reported measures will be.

5.2.4 EXTRSC= *extreme score correction for extreme measures (default: 0.5)*

§ This is the fractional score point value to subtract from perfect scores, and to add to zero scores, in order to estimate finite values for extreme scores. Look at the location of the E's in the tails of the test ogive in Table 20. If they look too far away, increase EXTRSC= by 0.1. If they look too bunched up, reduce EXTRSC= by 0.1.

The measure corresponding to an extreme (perfect or zero) score is not estimable, but the measure corresponding to a score of 0.5 score points less than perfect, or 0.5 score points more than zero, is estimable, and is often a useful measure to report. Extreme score estimates are *not* included in the summary statistics in Table 3.

§ Rasch programs differ in the way they estimate measures for extreme scores. Adjustment to the value of EXTRSC= can enable a close match to be made to the results produced by other programs.

There is no "correct" answer to the question: "How large should EXTRSC= be?" The most conservative value, and that recommended by Joseph Berkson, is 0.5. Some work by John Tukey indicates that 0.167 is a reasonable value. The smaller you set EXTRSC=, the further away measures corresponding to extreme scores will be located from the other measures.

Treatment of Extreme Scores	Tables	Output files

Placed at extremes of map	1, 12, 16	
Positioned by estimated measure	13, 17, 22	
Positioned by other criteria	14, 15, 18, 19	IFILE=, ISFILE=, PFILE=, RFILE=
Omitted	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 20, 21	SFILE=, XFILE=

Example: You wish to estimate conservative finite measures for extreme scores by subtracting 0.4 score points from each perfect score and adding 0.4 score points to each zero person score.
             EXTRSC=0.4

5.2.5 HIADJ= correction for top rating scale categories (default: 0.25)
The Rasch model models the measure corresponding to a top rating scale category as infinite. This is difficult to think about and impossible to plot. Consequently, graphically in Table 2.2 and numerically in Table 3.1 a measure is reported corresponding to a top category. This is the measure corresponding to an imaginary rating HIADJ= rating points below the top category.

Example: The standard spread in Table 2.2 is based on HIADJ=0.25. You wish the top category number to be printed more to the right, further away from the other categories.
             HIADJ=0.1

5.2.6 LOWADJ= correction for bottom rating scale categories (default: 0.25)
The Rasch model models the measure corresponding to a bottom rating scale category as infinite. This is difficult to think about and impossible to plot. Consequently, graphically in Table 2.2 and numerically in Table 3.1 a measure is reported corresponding to a bottom category. This is the measure corresponding to an imaginary rating LOWADJ= rating points above the bottom category.

Example: The standard spread in Table 2.2 is based on LOWADJ=0.25. You wish the bottom category number to be printed more to the right, close to the other categories.
             LOWADJ=0.4

5.2.7 PAIRED= correction for paired comparison data (default: N)
Paired comparison data is entered as only two observations in each row (or each column). The raw score of every row (or column) is identical. In the simplest case, the "winner" receives a '1', the "loser" a '0', and all other column (or rows) are left blank, indicating missing data.

Example: Data for a chess tournament is entered. Each row is a player. Each column a match. The winner is scored '2', the loser '0' for each match. For draws, each player recieves a '1'.
             PAIRED=YES ; paired comparisons
             CODES=012   ; valid outcomes
             NI=56   ; number of matches

5.3 User scaling
The conventional unit for Rasch analysis is the Logit (log-odds unit). The conventional origin is set at the center of the item difficulties (UIMEAN=0; USCALE=1). You can recenter and rescale the measures, calibrations and standard errors from logits into some other unit. The rescaled values are reported in the tables and in the IFILE=, ISFILE=, PFILE= and SFILE= files. Measures in anchor files must also be rescaled.

5.3.1 UIMEAN= the mean or center of the item scale (default: 0)
Assigns your chosen numerical value to the center the scale for items. Previous UPMEAN= values are ignored.

Example: You want to recenter the item difficulties at 10 logits, and so add 10 logits to all reported measures, to avoid reporting negative measures for low achievers:
            UIMEAN = 10

5.3.2 UPMEAN = them mean of center of the person scale (default: not used)
Assigns your chosen numerical value to the center the scale for persons. Previous UIMEAN= values are ignored

Example: You want to used norm-referenced scaling. With person mean of 0.
            UPMEAN = 0

5.3.3 USCALE= the scale value of 1 logit (default: 1)
Specifies the number of reported units per logit.

Example 1:   You want to rescale 1 logit into 45.5 units, so that differences of -100, -50, 0, +50, +100 correspond to success rates of 10%, 25%, 50%, 75%, 90%:
            USCALE = 45.5

Example 2:   You want to reverse the scale directions, since the data matrix is transposed so that the `items' are examinees and the `persons' are test questions:
            USCALE = -1
            KEYn=, RESCORE=, GROUPS= will still apply to the columns, not the rows, of the data matrix. Centering will still be on the column measures.

5.3.4 UDECIM= number of decimal places reported (default: 2)
This is useful for presenting your output measures and calibrations in a clear manner by removing meaningless decimal places from the output. Range is 0 (12345.) to 4 (1.2345).

Example 1:   You want to report measures and calibrations to the nearest integer:
            UDECIM = 0

Example 2:   You want to report measures and calibrations to 4 decimal places because of a highly precise, though arbitrary, pass-fail criterion level:
            UDECIM = 4

5.3.5 UANCHOR= anchor values supplied in user-scaled units (default: Y)
This simplifies conversion from a logit measures to user scaled measures. UANCHOR=N specifies that the anchor values are in logits. Reported measures, however, will be rescaled by UMEAN= and USCALE=.

Example: Your item bank calibrations are maintained in logits, but you want to report person measures in CHIPS (*BTD* p.201):
            UMEAN=50
            USCALE=4.55
            UANCHOR=N

5.3.6 User-friendly rescaling

Transforming logits into other units, more meaningful for particular applications, is discussed in Chapter 8 of *BTD*.

Example 1:   CHIPs are a useful transformation, in which 1 logit = 4.55 CHIPs. In this scaling system, standard errors tend to be about 1 CHIP in size. The recommended control variable settings are:

    USCALE = 4.55
    UIMEAN = 50
    UDECIM = 1
    MRANGE = 50

The probability structure of this relationship is:

Probability of Success	Difference between Person Ability and Item Difficulty in CHIPs
.10	-10
.25	-5
.50	0
.75	5
.90	10

Example 2:   WITs are one tenth the size of CHIPs, enabling the elimination of decimals from your output tables.

    USCALE = 45.5
    UIMEAN = 500
    UDECIM = 0
    MRANGE = 500

Example 3:   You want the lowest reportable person measure to be 0 and the highest to be 100. Looking at Table 20, you see the extreme values are -4.53 and +5.72. You have not used USCALE= and UMEAN=.

    USCALE= (wanted range)   / (current range)
    USCALE=   (100 - 0)   / (5.72 - -4.53)
          = 100 / 10.25 = 9.76

    UMEAN= (wanted low) - (current low * USCALE=)
          = 0 - (-4.53 * 9.76) = 44.20

    Required values are:
    USCALE = 9.76
    UIMEAN = 44.20
    UDECIM = 0   ⇦ to show no decimal places in report

Example 4:   You want the lowest reportable person measure to be 0 and the highest to be 100. Looking at Table 20, you see the extreme values are -4.53 and +5.72. The current values in the output are USCALE=1 and UIMEAN=0.

USCALE= (previous USCALE=)   * (wanted range)   / (current range)

USCALE=   1   * (100 - 0)   / (5.72 - -4.53)

           = 1 * 100 / 10.25 = 9.76

UMEAN= (wanted low) -

         (current low - previous UMEAN=)*(wanted range)/(current range)

         = 0 - (-4.53 - 0)*100/10.25 = 44.20

Double checking, when previous UMEAN=0, USCALE=1:

         low value = (current low)*(USCALE=) + (UMEAN=)

                = (-4.53 * 9.76) + 44.20 = -0.01

         high value = (current high)*(USCALE=) + (UMEAN=)

                = (5.72 * 9.76) + 44.20 = 100.02

Required values are:

         UIMEAN = 44.20

         USCALE = 9.76

         UDECIM = 0   ⇦ to show no decimal places in report

Example 5:   You want the lowest reportable person measure to be 100 and the highest to be 900. Looking at Table 20, you see the extreme values are -4.53 and +5.72. Looking at the second page of output, you see the current values are USCALE=1 and UMEAN=0.

         USCALE= (previous USCALE=) * (wanted range: 900 - 100) / (reported range: 5.72 - - 4.53) = 1 * 800 / 10.25 = 78.05

         UMEAN= (wanted low) - (reported low - previous UMEAN=)*(wanted range)/(reported range) = 100 - (-4.53 - 0)*800/10.25 = 453.56

         Required values are:

         UIMEAN = 453.56

         USCALE = 78.05

         UDECIM = 0   ⇦ to show no decimal places in report

Example 6:   You want norm-referenced scaling, such that

         the person mean is 0.0, and

         the person standard deviation is 1.0.

In the standard run, according to Table 3.0, the person S.D. is 0.8.

Then in the rescaled run:

USCALE = (wanted S.D.)/(reported S.D.) = 1.0/0.8 = 1.25

UPMEAN = 0

6. OUTPUT CONTROL

6.1 Overall reporting
These options enable you to make the tabular output more meaningful.

6.1.1 TITLE= *title for output listing (default: control file name)*
§ Use this option to label output distinctly and uniquely.
Up to 60 characters of title. This title will be printed at the top of each page of output.

Example: You want the title to be: Analysis of Math Test
                          TITLE="Analysis of Math Test"

                 Quote marks " " or ' ' are required if the title contains any blanks.

6.1.2 TABLES= *output tables (default: 1110011001001000100000)*
§ If in doubt, omit TABLES= and obtain the default the tables.
A 22 character string that tells BIGSTEPS which output tables to prepare for printing. The sequence number of the "1" or "0" in the TABLES= string matches the table number. For more elaborate table selection, use TFILE=.

       "1" means prepare the corresponding table.
       "0" or anything else means do *not* prepare the corresponding table.

See p. 120 for the list of output tables.

Example 1:   You want only Tables 2,4,6,8,10 and 20 to be prepared
                       TABLES=0101010101010000000000100

                    This is the same as specifying:
                        TFILE=*
                        2
                        4
                        6
                        8
                        10
                        20
                        *

Example 2:   You want only Tables 1-4.
                       TABLES=1111

6.1.3 FORMFD= *the form feed character (default: ^, MS-DOS standard)*
§ Do not change FORMFD= unless you have problems printing the tables or importing them into some other program.
The form feed character indicates the start of a new page of print-out. The DOS standard is Ctrl+L (ASCII 12) which is what represented by ^ (Shift+6). The DOS standard is understood by most word-processing software and PC printers as the instruction to skip to the top of a new page, i.e., form feed. The ASA (FORTRAN) form feed character is 1.

Example 1: You want your EPSON LQ-500 printer to form feed automatically at each new page of output. (You have already set the printer to use compressed print, at 15 cpi, because output lines contain up to 132 characters):
        FORMFD=^   (the default)

Example 2: Your main-frame software understands a "1" in the first position of a line of print-out to indicate the top of a new page:
        FORMFD=1

6.1.4 MAXPAG= *the maximum number of lines per page (default: 0, no limit)*
§ For no page breaks inside Tables, leave MAXPAG=0

If you prefer a different number of lines per page of your output file, to better match the requirements of your printer or word processor, give that value (see *Using a Word Processor or Text Editor* in Section 2). If you prefer to have no page breaks, and all plots at their maximum size, leave MAXPAG=0.

Example: You plan to print your output file on standard paper with 60 lines per page (pages are 11 inches long, less 1 inch for top and bottom margins, at 6 lpi):
        MAXPAG=60 (set 60 lines per page)
        FORMFD=^   (default: Word Processor form feed)

6.1.5 ITEM= *title for item names (default: ITEM)*
Up to 6 characters to use in table headings to describe the kind of items, e.g.
        ITEM=MCQ.
Choose a word which makes its plural with an "s", e.g. MCQS, since an S is added to whatever you specify.

6.1.6 PERSON= *title for person names (default: PERSON)*
Up to 6 characters to use in table headings to describe the persons, e.g.
        PERSON=KID
Choose a word which makes its plural with an "s", e.g. KIDS.

6.1.7 ASCII= *output only ASCII characters (default: Y, yes)*
Tables include graphic characters such as ╫ and +, which some printers can't print. These graphics characters can be replaced by the ASCII characters | and -.
    ASCII=N   use graphics characters
    ASCII=Y   replace graphics characters with ASCII characters (the default).

Example:
    ASCII=N produces what follows, or else accented letters, e.g., àâà:

```
+----------------------------------+----------------------------------+
|    OVERVIEW TABLES               |    ITEM CALIBRATIONS             |
+----------------------------------+----------------------------------+
| 1* PERSON AND ITEM DISTRIBUTION MAP | 12* ITEM MAP BY NAME           |
```

    ASCII=Y always produces:

```
+-----------------------------------------------------------------------+
|    OVERVIEW TABLES               |    ITEM CALIBRATIONS             |
|----------------------------------+----------------------------------|
| 1* PERSON AND ITEM DISTRIBUTION MAP | 12. ITEM MAP BY NAME           |
```

TFILE= Parameters: (enter unused parameters with "-")						
1: Table number. subtable	2	3	4	5	6	7
Distribution map 1.0, 1.1	Lowest measure	Highest measure	Rows per unit	-	Persons per `#'	Items per `#'
Response plot 2	Lowest measure	Highest measure	Columns per marked division	Reference category for sorting	High rating adjust-ment	Low rating adjust-ment
Person fit plots 4, 5	Lowest measure	Highest measure	Columns per marked division			
Person/Item list: 6, 10, 13, 14, 15, 17, 18, 19	Low fit bar	High fit bar				
Item fit plots 8, 9	Lowest measure	Highest measure	Columns per marked division			
Item map 12, 1.2	Lowest measure	Highest measure	Rows per unit	Sort column within item name	-	Items per `#'
Item list alphabetical 15	-	-	-	Sort column within item name		
Person map 16, 1.3	Lowest measure	Highest measure	Rows per unit	Sort column within person name	Persons per `#'	
Person list alphabetical 19	-	-	-	Sort column within person name		
Score table 20	-	-	Columns per marked division			
Category curves 21	Lowest measure	Highest measure	Columns per marked division			

6.1.8 TFILE= input file listing tables to be output (default: none)

TABLES= selects the tables in a fixed sequence, and prints only one copy. TFILE= allows the analyst to print multiple copies of tables to different specifications. TFILE= specifies the name of an input ASCII file. Each line of the file contains a table number or table number.sub-table and other control parameters, separated by blanks or commas. Unused control values are specified with "-". The list may be entered directly into the control file with TFILE=* (see Example 2).

Example 1:   The analyst wishes to select and print several tables:
                    TFILE=TABLES.TF
               TABLES.TF is a DOS (ASCII) file with the following lines:

; Table	Low	High	Columns		
; number	Range	Range	per Unit		
2					; print Tables 2.1, 2.2, 2.3
10.2	0.5	1.5			; print Table 10.2 with fit bars at 0.5 and 1.5
8	-5	5			; print Table 8 with range -5 to +5 logits
9	-2	7	10		; range -2 to +7 logits, 10 columns per logit
9	-5	5	10		; print Table 9 again, different range
15	-	-	-	4	; print Table 15, sorted on column 4 of item name

               or enter directly into the control file,
               TFILE=*
               2
               10.2
               8 -5 5
               9 -2 7 10
               9 -5 5 10
               15 - - - 4
               *

Example 2:   Analyst wishes to specify on the DOS control line, Table 15 sorted on item name column 4.
                Values are separated by commas, because blanks act as end-of-line separators.
               C:>BIGSTEPS SF.DAT SF.OUT TFILE=* 15,-,-,-,4 *

6.2 *Misfit selection*

Rasch measurement does not make any presumptions about the underlying distribution of the parameters. Maximum likelihood estimation expects "errors" in the observations to be more or less normally distributed around their expected values. Since all observations are integral values, this expectation can be met only asymptotically as the number of persons and items becomes infinite. The information-weighted fit statistic, "infit", and the outlier-sensitive fit statistic, "outfit", are described in *BTD* and *RSA*. Possible values, and hence interpretation, of these statistics is influenced by the observed distribution the person and item statistics. This is particularly true of their standardized values which are designed to follow standard normal (0,1) distributions. The local significance of these statistics is best interpreted in terms of their means and standard deviations reported in Table 3. Start investigating the misfit causing the most extreme values of these statistics, and stop your investigation when the observed responses become coherent with your intentions.

The fit statistics reported will not exactly match those printed in *BTD* or *RSA*, or those produced by another program. This is because the reported values of these statistics are the result of a continuing process of development in statistical theory and practice. Neither "correct" fit statistics nor "correct" values exist, but see p. 113 for guidance.

Report measure in Tables 6 and 10 if any of:

Statistic	Less than	Greater than
standardized INFIT	-(FITP or FITI)	FITP or FITI
standardized OUTFIT	-(FITP or FITI)	FITP or FITI
mean-square INFIT	1 - (FITP or FITI)/10	1 + (FITP or FITI)/10
mean-square OUTFIT	1 - (FITP or FITI)/10	1 + (FITP or FITI)/10
point-biserial correlation	negative	

To include every person, specify FITP=0. For every item, FITI=0.

6.2.1 FITI= *item misfit criterion (default: 2.0)*
Specifies the minimum standardized fit value at which items are selected for reporting as misfits. For Table 10, the table of item calibrations in fit order, an item is *omitted* only if the absolute values of both standardized fit statistics are less than FITI=, both mean-square statistics are closer to 1 than (FITI=)/10, and the item point-biserial correlation is positive.

For Table 11, the diagnosis of misfitting items, all items with a standardized fit greater than FITI= are reported. Selection is based on the OUTFIT statistic, unless you set OUTFIT=N in which case the INFIT statistic is used.

Example 1:   You wish to focus on grossly "noisy" items in Tables 10 and 11.
                         FITI=4 ⇦ an extreme positive value

Example 2:   You wish to include all items in Tables 10 and 11.
                         FITI=-1000   ⇦ a value more negative than any fit statistic

6.2.2 FITP= *person misfit criterion (default: 2.0)*
Specifies the minimum standardized fit value at which persons are selected for reporting as misfits. For Table 6, person measures in fit order, a person is *omitted* only if the absolute values of both standardized fit statistics are less than FITP=, both mean-square statistics are closer to 1 than (FITP=)/10, and the person point-biserial correlation is positive.

For Table 7, the diagnosis of misfitting persons, persons with a standardized fit greater than FITP= are reported. Selection is based on the OUTFIT statistic, unless you set OUTFIT=N in which case the INFIT statistic is used.

Example 1:   You wish to examine wildly guessing persons in Tables 6 and 7.
                         FITP=3 ⇦ an extreme positive value

Example 2:   You wish to include all persons in Table 6.
                         FITP=0 ⇦ includes all in Table 6, but not all in Table 7

6.2.3 OUTFIT= *sort misfits on infit or outfit (default: Y, Outfit)*
          § Other Rasch programs may use infit, outfit or some other fit statistic. There is no
          "correct" statistic. Use the one you find most useful.
Specifies whether standardized infit or standardized outfit is used as your output sorting and selection criterion for the diagnosis of misfits.

OUTFIT=Y   Outfit is used as the fit statistic for sorting and selection (the default).

OUTFIT=N   Infit is used as the fit statistic for sorting and selection.

6.2.4 NORMAL= *normal distribution for standardizing fit (default: N, chi-square)*
§ The default generally matches the statistics used in *BTD* and *RSA*.

Specifies whether distribution of squared residuals is hypothesized to accord with the chi-square or the normal distribution. Values of standardized fit statistics are obtained from squared residuals by means of one of these distributions.

NORMAL=N   Standardized fit statistics are obtained from the squared residuals by means of the chi-square distribution and the Wilson-Hilferty transformation (the default).

NORMAL=Y   Standardized fit statistics are obtained from the squared residuals by means of an asymptotic normal distribution (F.A.G. Windmeijer, *The asymptotic distribution of the sum of weighted squared residuals in binary choice models*, Statistica Neerlandica, 1990, 44:2, 69-78).

6.2.5 LOCAL= *locally restandardize fit statistics (default: N, no)*
§ LOCAL=N accords with large-sample statistical theory.

Standardized fit statistics test report on the hypothesis test: "Do these data fit the model?" With large sample sizes and consequently high statistical power, the hypothesis cannot be accepted, because all empirical data exhibit some degree of misfit to the model. This can make standardized statistics meaninglessly large.

LOCAL=N   Standardized fit statistics are not rescaled. Even the slightest item misfit in tests taken by many persons will be reported as very significant. Columns reporting this option are headed "ZSTD", for theoretically standardized.

LOCAL=Y   Standardized fit statistics are rescaled to reflect their level of significance in the context of the amount of disturbance in the data being analyzed. The rescaling factor is chosen to make the variance of the rescaled positive fit statistics, away from the origin, 1. Negative standardized statistics are rescaled by the same factor, so that no fit statistic crosses over from one side of the origin to the other. Thus, the mean and standard deviation of the standardized statistics are also rescaled by the same factor. The effect of the rescaling is make the fit statistics more useful for interpretation. Columns reporting this option are headed "EMP", for empirically restandardized.

LOCAL=L   Instead of standardized statistics, the natural logarithm of the mean-square fit statistic is reported. This is a linearized form of the ratio-scale man-square. Columns reporting this option are headed "LOG", for mean-square logarithm.

6.2.6 PTBIS= *compute point-biserial correlation coefficients (default: Y, yes)*
§ specify PTBIS=N whenever missing data makes the conventional
point-biserial meaningless.

PTBIS=Y   Compute and report conventional point bi-serial correlation coefficients, r_{pbis}. These are reported not only for items but also for persons. In Rasch analysis, r_{pbis} is a useful diagnostic indicator of data miscoding or item miskeying: negative or zero values indicate items or persons with response strings that contradict the variable.

PTBIS=N   (or PTBIS=RPM). Compute and report point-measure correlation coefficients, r_{pm}. These are reported for items and persons. They correlate an item's (or person's) responses with the measures of the encountered persons (or items). r_{pm} maintains its meaning in the presence of missing data. Negative or zero values indicate response strings that contradict the variable. PTBIS=N is set whenever CUTLO= or CUTHI= is specified.

6.3 Special table control
See TFILE= options on p. 70 for greater control over individual output tables.

6.3.1 CATREF= reference category for Table 2 (default: 0, item difficulty)
        § If a particular category corresponds to a criterion level of performance, choose
        that category for CATREF=.
Table 2, "most probable responses/scores", maps the items vertically and the most probable responses, expected scores, and Thurstone thresholds horizontally. By default, the vertical ordering is item difficulty calibration. If, instead, a particular category is to be used as the reference for sorting, give its value as *scored and recoded*.

Special uses of CATREF= are:
        CATREF=-3   for item entry order
        CATREF=-2   for item measure order
        CATREF=-1   for items measure order with GROUPS=
        CATREF=0   for item measure order
        CATREF=1...99 for item measure order based on this category.

Example 1:   You have 4-point partial-credit items, entered in your data as A,B,C,D, and then scored as 1,2,3,4. You wish to list them based on the challenge of category C, rescored as 3,
            CODES =ABCD   ⇐ original responses
            NEWSCORE=1234   ⇐ rescored values
            RESCORE=2   ⇐ rescore all

            CATREF=3   ⇐ Table 2 reference category
            GROUPS=0   ⇐ partial credit: one item per group
        If, for an item, the category value "3" is eliminated from the analysis or is the bottom category, the nearest higher category is used for that item.

Example 2:   You have 6 3-category items in Group 1, and 8 4-category items in Group 2. You wish to list them in Table 2.2 by difficulty within group, and then by difficulty overall.
            CODES=1234
            NI= 14
            GROUPS= 11111122222222
            TFILE=*
            2.2 0 0 0 -1   ⇐ -1 means CATREF=-1
            2.2 0 0 0 0   ⇐ last 0 means CATREF=0
            *

6.3.2 CURVES= probability curves for Table 21 and Table 2 (default: 110, 1st and 2nd)
        § Interpreting rating scale structure is an art, and sometimes counter-intuitive. See
        the examples in *RSA*.

Table 21 provides three curves for each rating scale definition. Table 2 provides the equivalent response locations for each item. The first curve shows the probability of response in each category. The second curve shows the expected score ogive. The third curve shows the cumulative probability of response in each category or below. The Thurstone thresholds are at the intersections of these curves with the .5 probability line. The control indicators of "1" and "0", in the 1st, 2nd or 3rd position of the CURVES= variable, select or omit output of the corresponding curve.

> CURVES=000   indicates no curves are to be drawn - Table 21 will be skipped, unless STEPT3=N,
>   in which case only the step summaries are output.
> CURVES=111   draw all 3 curves in Table 21 (and 3 versions of Table 2)
> CURVES=001   draw only the 3rd, cumulative probability score, curve.

6.3.3 DISTRT= output option counts in Tables 10, 13-15 (default: Y, output)

This variable controls the reporting of counts of option, distracter or category usage. The default is DISTRT=Y, if more than two values are specified in CODES=.

> DISTRT=N   Omit the option or distracter information.

> DISTRT=Y   Include counts, for each item, for each of the values in CODES=, and for the number of responses counted as MISSING=

6.3.4 LINLEN= length of printed lines in Tables 7, 10-16, 22 (default: 80)

The misfitting responses, name maps, scalogram, and option frequency tables can be output in any convenient width. Specify *LINLEN=0* for the maximum page width (132 characters).

> Example: You want to print the map of item names with up to 100 characters per line.
>   LINLEN=100   ⇦ set line length to 100 characters

6.3.5 FRANGE= half-range of fit statistics on plots (default: 0, auto-size)

Specifies the standardized fit Y-axis half-range, (i.e. range away from the origin), for the standardized fit plots. FRANGE= is in units of standardized fit (i.e., expected mean = 0, standard deviation = 1).

> Example: You want the fit plots to display from -3 to +3 units of standardized fit:
>   FRANGE=3

6.3.6 MRANGE= half-range of measures on plots (default: 0, auto-size)

Specifies the measure (X-axis on most plots) half-range, (i.e. range away from the origin or UMEAN=), of the maps, plots and graphs. This is in logits, unless USCALE= is specified, in which case it must be specified in the new units defined by USCALE=. See TFILE= for instructions on customizing particular tables.

> Example 1:   You want to see the category probability curves in the range -3 to +3 logits:
>   MRANGE=3

> Example 2:   With UMEAN=500 and USCALE=100, you want the category probability curves to cover
>   a range from 250 to 750:
>   UMEAN=500   ⇦ new item mean calibration
>   USCALE=100   ⇦ value of 1 logit
>   MRANGE=250 ⇦ to be plotted each way from UMEAN=

6.3.7 NAMLMP= id length for Tables 12, 16 (default: calculated)

The id fields are truncated for Tables 12 and 16. The name-length for maps variable, NAMLMP=, overrides

the calculated truncation.

Example:　　　　The 9 characters including and following NAME1= are the person''s Social Security number, and are to be used as the person-id on the maps.
　　　　　　　　　NAMLMP=9

6.3.8 STEPT3= include step summary in Table 3 or 21 (default: Y, in Table 3)
The step summary statistics appear, by default or if there is only one GROUP=, in Table 3. For grouped analysis this part of Table 3 can become long, in which case it can be moved to Table 21.

Example:　　　　Don't output partial credit step summaries in Table 3. Move them to Table 21:
　　　　　　　　　GROUPS=0　　　⇦ each item has own scale
　　　　　　　　　STEPT3=N　　　⇦ report scale statistics in Table 21

6.3.9 T1I#= number of items summarized by "#" symbol in Table 1 (default: auto-size)
For ease in comparing the outputs from multiple runs, force consistent scaling by using MRANGE=, T1I#= and T1P#=. Choose T1I#= to be the largest number of items summarized by one "#" from any of the separate runs.

Example:　　　　In one run, the bottom of Table 1 states that
　　　　　　　　　　　EACH "#" IN THE ITEM COLUMN IS 20 ITEMS
　　　　In another run: EACH "#" IN THE ITEM COLUMN IS 15 ITEMS
　　　　　　　　To make the runs visually comparable, specify the bigger value:
　　　　　　　　　T1I#=20

6.3.10 T1P#= number of persons summarized by "#" symbol in Table 1 (default: auto-size)
For ease in comparing the outputs from multiple runs, force consistent scaling by using MRANGE=, T1I#= and T1P#=. Choose T1P#= to be the largest number of persons summarized by one "#" from any of the separate runs.

Example:　　　　In one run, the bottom of Table 1 states that
　　　　　　　　　　　EACH "#" IN THE PERSON COLUMN IS 250 PERSONS
　　　　In another run: EACH "#" IN THE PERSON COLUMN IS 300 PERSON
　　　　　　　　To make the runs visually comparable, specify the bigger value:
　　　　　　　　　T1P#=300

6.3.11 ISORT= column within item name for alphabetical sort in Table 15 (default: 1)
Table 15 lists items alphabetically. By default, the whole item name is used. To sort starting on a column after the first item name column, specify ISORT=.

Example 1:　　　The item name is entered in the specification file as sequence number, followed by identification in column 6. Sort by identification for Table 15.
　　　　　　　　　NI=4
　　　　　　　　　TABLES=1111111111111111111111111
　　　　　　　　　ISORT=4
　　　　　　　　　&END
　　　　　　　　　0001 Addition Item
　　　　　　　　　0002 Subtraction Item
　　　　　　　　　0003 Multiplication item
　　　　　　　　　0004 Division item

⬆ sort column
END NAMES

Example 2: The item name contains several important classifiers. Table 15 is required for each one:
TFILE=*
15 - - - 1   ⇦ sort starts with column 1 of item name
15 - - - 6   ⇦ sort starts with column 6
15 - - - 13   ⇦ sort starts with column 13
  ⬆ - entered as place-holders, see TFILE=
*
&END
MCQU Geogrp 1995-0234
⬆ sort column
    ⬆ sort column
       ⬆ sort column
|
END NAMES

Example 3: A version of Table 15, sorted on item name column 13, is to be specified on the DOS command line or on the Extra Specifications line. Commas are used as separators, and "-" as place-holders:
TFILE=* 15,-,-,-,13 *

6.3.12 PSORT= *column within person name for alphabetical sort in Table 19 (default: 1)*
Table 19 lists persons alphabetically. By default, the whole person name is used. To sort starting on a column after the first person name column, specify PSORT=.

Example 1: The person name is entered in the data file starting in column 20. It is a 6-digit student number followed by a blank and then gender identification in column 8 **of the person name**. Sort by gender identification for Table 19.
NAME1=20
NAMLEN=8   ⇦ student number + gender
PSORT=8   ⇦ alphabetical sort on gender
TABLES=111111111111111111111111
&END
|
END NAMES
xxxxxxxxxxxxxxxxxxx123456 M 001010110100100201010211 0011
xxxxxxxxxxxxxxxxxxx229591 F 110201002010010020100201 0021
                          ⬆ sort column

Example 2: The person name contains several important classifiers. Table 19 is needed for each one:
NAME1=14   ⇦ Person name starts in column 14
ITEM1=24   ⇦ Response start in column 24
TFILE=*
19 - - - 1   ⇦ sort starts with column 1 of person name
19 - - - 8   ⇦ sort starts with column 8 of person name
19 - - - 6   ⇦ sort starts with column 6 of person name
  ⬆ - entered as place-holders, see TFILE=
*

```
                              &END
                              |
                              END NAMES
                              xxxxxxxxxxxxx1234 M 12 00101011010010020101022110011
                              xxxxxxxxxxxxx2295 F 09 11020100202100100201002010021
                                      ⬆ sort column
                                                  ⬆ sort column
                                          ⬆ sort column
```

Example 3:   A version of Table 19, sorted on person name column 6, is to be specified on the DOS
                command line or on the Extra Specifications line. Commas are used as separators, and "-"
                as place-holders:
                        TFILE=* 19,-,-,6 *

6.3.13 PRCOMP= principal components analysis of item residuals in Table 10 (default: N, no)

Principal components analysis of item-response residuals can help identify structure in the misfit patterns
across items. Specifying principal components analysis with PRCOMP= automatically produces Table 10.

PRCOMP=S   Analyze the standardized residuals, (observed - expected)/(model standard error).
          § Simulation studies indicate that PRCOMP=S gives the most accurate reflection
          of secondary dimensions in the items.

PRCOMP=R   Analyze the raw score residuals, (observed - expected) for each observation.

PRCOMP=L   Analyze the logit residuals, (observed - expected)/(model variance).

PRCOMP=O   Analyze the observations themselves.

Example 1:   Perform a Rasch analysis, and then see if there is any meaningful other dimensions in the
                residuals:
                        PRCOMP=S   ⇦ Standardized residuals

Example 2:   Analysis of the observations themselves is more familiar to statisticians.
                        PRCOMP=O   ⇦ Observations

6.4 Special-purpose output files

These output files are useful, if you want to continue analysis with other computer programs, such as
spreadsheet, graphing or statistical programs.

6.4.1 CSV= comma-separated values in output files (default: N, no)

To facilitate importing the IFILE=, ISFILE=, PFILE=, SFILE= and XFILE= files into spreadsheet and
database programs, the fields can be separated by commas, and the character values placed inside " " marks.
        CSV=N   Use fixed field length format (the default)
        CSV=Y or CSV=,   Separate values by commas with character fields in " " marks.
        CSV=T Separate values by tab characters with character fields in " " marks.

6.4.2 HLINES= heading lines in output files (default: Y, yes)

To facilitate importing the IFILE=, PFILE=, SFILE= and XFILE= files into spreadsheet and database programs, the heading lines can be omitted from the output files.

> HLINES=Y   Include heading lines in the output files (the default)
> HLINES=N   Omit heading lines.

6.4.3 IFILE= item output file (default: " ", no file)

IFILE=filename produces an output file containing the information for each item. This file contains 4 heading lines (unless HLINES=N), followed by one line for each item containing:

Columns:

Start	End	Format	Description
1	1	A1	Blank or ";" if no responses or deleted (status = -2, -3)
2	6	I5	1. The item sequence number (ENTRY)
7	14	F8.2	2. Item's calibration (rescaled by UMEAN=, USCALE=, UDECIM) (MEASURE)
15	17	I3	3. The item's status (STATUS)
			1 = Estimated calibration
			2 = Anchored (fixed) calibration
			0 = Extreme minimum (estimated using EXTRSC=)
			-1 = Extreme maximum (estimated using EXTRSC=)
			-2 = No responses available for calibration
			-3 = Deleted by user
18	23	I6	4. The number of responses used in calibrating (COUNT)
24	30	I7	5. The raw score used in calibrating (SCORE)
31	37	F7.2	6. Calibration's standard error (rescaled by USCALE=, UDECIM=) (ERROR)
38	44	F7.2	7. Item mean square infit (IN.MSQ)
45	51	F7.2	8. Item infit:
			standardized (ZSTD), locally standardized (ZEMP) or log-scaled (LOG)
52	58	F7.2	9. Item mean square outfit (OUT.MS)
59	65	F7.2	10. Item outfit:
			standardized (ZSTD), locally standardized (ZEMP) or log-scaled (LOG)
66	72	F7.2	11. Item displacement (rescaled by USCALE=, UDECIM=) (DISPLACE)
73	79	F7.2	12. Item by test-score correlation:
			point-biserial (PTBS) or point-measure (CORR)
80	80	1X	13. Blank
81	81	A1	14. Group to which item belongs (G)
82	82	1X	15. Blank
83	83	A1	16. Model used for analysis (R=Rating, S=Success, F=Failure) (M)
84	84	1X	17. Blank
85	114	A30	18. Item name (NAME)

The format descriptors are:

> In = Integer field width n columns
> Fn.m = Numeric field, n columns wide including n-m-1 integral places, a decimal point and m decimal places
> An = Alphabetic field, n columns wide
> nX = n blank columns.

When CSV=Y, commas separate the values, which are squeezed together without spaces between. Quotation marks surround the "Item name", e.g., 1,2,3,4,"Name". When CSV=T, the commas are replaced

by tab characters.

Example: You wish to write a file on disk called "ITEM.CAL" containing the item statistics for use in updating your item bank, with values separated by commas:
                IFILE=ITEM.CAL
                CSV=Y

6.4.4 PFILE= person output file (default: " ", no file)

PFILE=filename produces an output file containing the information for each person. This file contains 4 heading lines (unless HLINES=N), followed by one line for each person containing:

Columns:

Start	End	Format	Description
1	1	A1	Blank or ";" if no responses or deleted (status = -2, -3)
2	6	I5	1. The person sequence number (ENTRY)
7	14	F8.2	2. Person's measure (rescaled by UMEAN=, USCALE=, UDECIM=) (MEASURE)
15	17	I3	3. The person's status (STATUS)
			1 = Estimated measure
			2 = Anchored (fixed) measure
			0 = Extreme minimum (estimated using EXTRSC=)
			-1 = Extreme maximum (estimated using EXTRSC=)
			-2 = No responses available for measure
			-3 = Deleted by user
18	23	I6	4. The number of responses used in measuring (COUNT)
24	30	I7	5. The raw score used in measuring (SCORE)
31	37	F7.2	6. Measure's standard error (rescaled by USCALE, UDECIM) (ERROR)
38	44	F7.2	7. Person mean square infit (IN.MSQ)
45	51	F7.2	8. Person infit: standardized (ZSTD), locally standardized (ZEMP) or log-scaled (LOG)
52	58	F7.2	9. Person mean square outfit (OUT.MSQ)
59	65	F7.2	10. Person outfit: standardized (ZSTD), locally standardized (ZEMP) or log-scaled (LOG)
66	72	F7.2	11. Person displacement (rescaled by USCALE=, UDECIM=) (DISPLACE)
73	79	F7.2	12. Person by test-score correlation: point-biserial (PTBS) or point-measure (CORR)
80	80	1X	16. Blank
81	110	A30	17. Person name (NAME)

The format descriptors are:
    In = Integer field width n columns
    Fn.m = Numeric field, n columns wide including n-m-1 integral places, a decimal point and m decimal places
    An = Alphabetic field, n columns wide
    Nx = n blank columns.

When CSV=Y, commas separate the values with quotation marks around the "Person name". When CSV=T, the commas are replaced by tab characters.

Example: You wish to write a file on disk called "STUDENT.MES" containing the person statistics

for import later into a student information database:
PFILE=STUDENT.MES

6.4.5 RFILE= scored response file (default: " ", no file)
§ useful for reformatting data from a family of test forms, linked by a network of common items, into a single common structure suitable for one step item banking.

If this parameter is specified in the control file with RFILE=filename, a file is output which contains a scored/keyed copy of the input data. This file can be used as input for later analyses. Items and persons deleted by PDFILE= or the like are replaced by blank rows or columns in the scored response file. The file format is:

1. Person-id   A30
2. Responses   one per item:
        A1 if largest scored response is less than or equal to 9
        A2 if largest scored response is more than 9.
                The width of the responses is *not* determined by XWIDE=.

6.4.6 SFILE= step/category output file (default: " ", no file)
If SFILE=filename is specified, a file is output which contains the item and category information needed for anchoring steps. It has 4 heading lines (unless HLINES=N), and has the format:

1. The item sequence number (I6) (CATEGORY)
2. The category value (I3) (STEP)
3. Step calibration (F7.2) (rescaled by USCALE=) (DIFFICULTY)

If CSV=Y, these values are separated by commas. When CSV=T, the commas are replaced by tab characters.

6.4.7 ISFILE= item step output file (default: " ", no file)
ISFILE=filename produces an output file containing the step/category measure information for each item. All measures are added to the corresponding item's calibration and rescaled by USCALE and UDECIM. This file contains 4 heading lines (unless HLINES=N), followed by one line for each item containing:

Columns:

Start	End	Format	Description
1	1	A1	Blank or ";" if no responses or deleted (status = -2, -3)
2	6	I5	1. The item sequence number (ENTRY)
7	11	I5	2. The item's status (ST)
			1 = Estimated calibration
			2 = Anchored (fixed) calibration
			0 = Extreme minimum (estimated using EXTRSC=)
			-1 = Extreme maximum (estimated using EXTRSC=)
			-2 = No responses available for calibration
			-3 = Deleted by user
12	5	I5	3. Number of active categories (MAX)
17	5	I5	4. Lowest active category number (LOW)
22	29	F8.2	2. Measure for an expected score of 0.25 (AT.25)

The following fields are repeated for the remaining active categories

30	34	I5	4. Active category number (CAT)
35	39	I5	4. Step number (STEP)
40	47	F8.2	2. Step calibration (MEASURE)
48	55	F8.2	6. Step calibration's standard error (ERROR)

56	63	F8.2	2. Measure for an expected score of category " 0.5 score points (AT-0.5)
64	71	F8.2	2. Measure for an expected score of category score points (ATSTEP)
72	79	F8.2	6. Measure at the Thurstone threshold (THRESH)

Since the ISFILE= has the same number of category entries for every item, the repeated fields are filled out with "0" for any further categories up to the maximum categories for any item.

The format descriptors are:

> In = Integer field width n columns
> Fn.m = Numeric field, n columns wide including n-m-1 integral places, a decimal point and m decimal places
> An = Alphabetic field, n columns wide

When CSV=Y, commas separate the values with quotation marks around the "Item name". When CSV=T, the commas are replaced by tab characters.

Example: You wish to write a file on disk called "ITEMSTEP.FIL" containing the item statistics reported in Table 2.2, for use in constructing your own tables:

> ISFILE=ITEMSTEP.FIL

6.4.8 XFILE= analyzed response file (default: " ", no file)

> § The size and significance of differential item functioning (item bias) can be obtained by examination of this file.

If XFILE=filename is specified in the control file, a file is output which enables a detailed analysis of individual response anomalies. This file contains 4 heading lines (unless HLINES=N) followed by one line for each person-by-item response used in the estimation. Each line contains:

> 1. Person number (I7) (PERSON)
> 2. Item number (I7) (ITEM)
> 3. Original response value (after keying/scoring) (I4) (OBS)
> 4. Observed response value (after recounting) (I4) (ORD)
> 5. Expected response value (F7.3) (EXPECT)
> 66. Modelled variance of observed values around the expected value (F7.3) (VAR)
>> This is also the statistical information in the observation.
>> Square root(modelled variance) is the observation's raw score standard deviation.
> 7. Standardized residual: (Observed - Expected)/Square root Variance (F7.3) (ZSCORE)
> 8. Score residual: (Observed - Expected) (F7.3) (RESID)

If CSV=Y, these values are separated by commas. When CSV=T, the commas are replaced by tab characters.

This file enables a detailed analysis of individual response anomalies. The response residual can be analyzed in three forms:

1) in response-level score units, from [(observed value - expected value)].
2) in logits, from [(observed value - expected value)/variance].
3) in standard units, [(observed value - expected value)/(square root of variance)].

Example: You wish to write a file on disk called "MYDATA.XF" containing response-level information for use in examining particularly response patterns:

> XFILE=MYDATA.XF

6.4.9 GRFILE= probability curve coordinate output file (default: " ", no file)

If GRFILE=filename is specified, Table 21 is produced and a file is output which contains a list of measures

(x-axis coordinates) and corresponding expected scores and category probabilities (y-axis coordinates) to enable you to use your own plotting program to produce plots like those in Table 21. This file contains:

1. The rating scale table sub-heading number (I5) - matches Table 21.
2. The measure (F7.2) (rescaled by USCALE=)
3. Expected score (F7.2)
4. Probability of observing lowest category (F7.2)
5 etc. Probability of observing higher categories (F7.2).

If CSV=Y, values are separated by commas. When CSV=T, values are separated by tab characters.

Example: You wish to write a file on disk called "MYDATA.GR" containing x- and y-coordinates for plotting your own category response curves.
                        GRFILE=MYDATA.GR

6.4.10 Automating file selection
Assigning similar names to similar disk files can be automated using DOS commands.

For example, suppose you want to analyze your data file, and always have your output file have suffix ".OUT", the PFILE have suffix ".PF" and the IFILE have suffix ".IF". Key in your control file and data, say "ANAL1", omitting PFILE= and IFILE= control variables. Then key in the following DOS Batch file, called, say, MYBATCH.BAT, using EDIT or your word processor, saving the file as an ASCII or DOS text file:

        REM   the MYBATCH.BAT batch file to automate BIGSTEPS
        BIGSTEPS %1 %1.OUT PFILE=%1.PF IFILE=%1.IF

To execute this, type at the DOS prompt:
        C:> **MYBATCH ANAL1** (Press **Enter** Key)
This outputs the tables in ANAL1.OUT, PFILE= in ANAL1.PF and IFILE= in ANAL1.IF.

You can also edit the files BIGBATCH.BAT or WINBATCH.BAT. These can be executed from the DOS prompt or from their Windows icons.

6.5 Supplemental control files

6.5.1 SPFILE= supplementary control file (default: " ", no file)
There is often a set of control instructions that you wish to make a permanent or temporary part of every control file. Such files can be specified with SPFILE=. Multiple SPFILE= specifications can be included in one control file. Supplemental files called with SPFILE= can also include SPFILE= specifications.

Example 1:   The analyst has a standard set of convergence criteria and other control instructions to include in every control file.
                a) Enter these into a standard DOS TEXT/ASCII file, e.g, SUPPL.CON
                The analyst's SUPPL.CON contains:
                        LCONV=.01
                        ITEM=TASK
                        PERSON=CLIENT
                        TABLES=101110011

                b) Specify this supplemental file in the main control file, say, MAIN.CON

```
                    &INST
                    TITLE='NEW YORK CLIENTS'
                    SPFILE=SUPPL.CON
                    ITEM1=37
                    NI=100
```

Example 2:   The analyst has a set of control instructions that are used only for the final run. These are
               coded in a separate DOS TEXT file called FINAL.SPC
               C:>BIGSTEPS CONTROL.FIL OUTPUT.FIL SPFILE=FINAL.SPC

Example 3:   Keyn= is a particularly useful application of SPFILE=.
               Put the KEY1= instruction for each test form in its own DOS TEXT file, then reference
               that file rather than including the key directly in the control file.

               Here is FORMA.KEY:
```
                    NI=23
                    CODES=ABCD
                    KEY1=ABCDDADBCDADDABBCAADBBA
```

               Here is the control file:
```
                    &INST
                    TITLE='FORM A READING RASCH ANALYSIS'
                    ITEM1=20
                    SPFILE=FORMA.KEY
                    TABLES=111011011
                    |
```

7. THE ITERATION SCREEN

While BIGSTEPS is running, information about the analysis is displayed on the screen. Here is an example based on the "Liking for Science" data. The analysis was initiated with:

C:> **BIGSTEPS SF.DAT SF.OUT**(Enter)

The "|======|" is a horizontal bar-chart which moves from left to right to show progress through the work file during each phase of the analysis.

The screen display includes:

```
BIGSTEPS  Version: 2.58         Program running - shows version number
 Reading Control Variables ..   Processing your control variables
 Reading keys, groups etc..        Processing special scoring instructions
 Input in process ..               Reading in your data
       76 person records input     Total person records found
 Writing response file             if RFILE= specified
|=========================================================================|
To stop iterations: Press Ctrl with S
                         press Ctrl with C to cancel program
                       CONVERGENCE TABLE reported in Table 0
+Control: sf.dat----------------------Output: sf.out--------------------+
|    PROX         ACTIVE COUNT      EXTREME 5 RANGE     MAX LOGIT CHANGE  |
| ITERATION    PERSONS ITEMS   CATS    PERSONS ITEMS     MEASURES   STEPS |
|=========================================================================|
|      1          76      25     3     3.78    3.20       3.8918    .0740 |
|=========================================================================|
|      2          74      25     3     4.53    3.67        .7628   -.6167 |
| DROPPING OUT OF RANGE OBSERVATIONS                                      |
This is reported for CUTLO= and CUTHI=


|=========================================================================|
|      3          74      25     3     4.73    3.85        .2143   -.0991 |
|=========================================================================|
|      4          74      25     3     4.82    3.90        .0846   -.0326 |
+Control: sf.dat----------------------Output: sf.out--------------------+
|   UCON     MAX SCORE   MAX LOGIT   LEAST CONVERGED     CATEGORY   STEP  |
| ITERATION  RESIDUAL*    CHANGE    PERSON  ITEM   CAT   RESIDUAL  CHANGE |
|=========================================================================|
|      1        3.01      -.4155      60     24*    2      27.64   -.0184 |
|=========================================================================|
|      2         .50      -.0258      53     24*    1       6.88    .0198 |
|=========================================================================|
|      3        -.37       .0292      53      5*    1       3.10    .0091 |
|=========================================================================|
|      4         .26       .0206      53     21*    1       2.74    .0079 |
|=========================================================================|
|      5         .20       .0154      53     21*    0      -1.90    .0056 |
|=========================================================================|
|      6         .15       .0113      53     21*    0      -1.42    .0042 |
|=========================================================================|
|      7         .11       .0083      53     21*    0      -1.05    .0030 |
```

```
+------------------------------------------------------------------------------+
 Calculating Fit Statistics              an extra pass to calculate fit statistics
|==============================================================================|
 Processing Misfitting PERSONS for Table  7
|==============================================================================|
 Calculating Correlations for Table 10
|==============================================================================|
 Calculating Principal Components for Table 10
|...............*............*.*| ⇐ one . per iteration, one * per factor.
 Processing Misfitting ITEMS   for Table 11    ⇐ misfitting items
|==============================================================================|
 Sorting ITEMS   for Table 12
|==============================================================================|
 Sorting ITEMS   for Table 15
|==============================================================================|
 Sorting PERSONS for Table 16
|==============================================================================|
 Sorting PERSONS for Table 19
|==============================================================================|
 Calculating Scores for Table 20
|==============================================================================|
 Writing Sorted Responses in Table 22   ⇐ Guttman Scalogram
|==============================================================================|
Analysis completed of SF.DAT          ⇐ name of control file
LIKING FOR SCIENCE-(Wright-&-Masters-p.18)---------------
+--------------------------------------------------------------------------------+
|   76 KIDS    IN    74 KIDS   MEASURED            INFIT          OUTFIT     |
|          SCORE     COUNT    MEASURE    ERROR    IMNSQ   ZSTD  OMNSQ   ZSTD |
| MEAN      26.4      16.8     56.99     5.74     1.01    -.2    .82    -.3 |
| S.D.      11.9       5.7     23.67     1.33      .65    1.4    .78    1.2 |
| REAL RMSE  5.90  ADJ.SD  22.93  SEPARATION  3.89  KID    RELIABILITY  .94 |
|--------------------------------------------------------------------------------|
|   25 TAPS    IN    25 TAPS   MEASURED            INFIT          OUTFIT     |
| MEAN      78.2      49.7     50.00     3.48     1.06    .0     .89    -.1 |
| S.D.      43.0      22.5     27.56     1.04      .36    1.3    .43     .7 |
| REAL RMSE  3.63  ADJ.SD  27.32  SEPARATION  7.53  TAP    RELIABILITY  .98 |
+--------------------------------------------------------------------------------+
|  NUM  SCORE  COUNT  MEASURE  ERROR|IMNSQ ZSTD|OMNSQ ZSTD|CORR.| KID
|  73    15     14     33.18   4.75|3.46   4.5|4.52   5.4|A-.16| SANDBERG, RYN
|  71    24     19     47.29   4.32|3.25   4.8|5.19   5.1|B .14| STOLLER, DAVE
|  14    15     11     37.24   5.48|2.09   2.1|1.77   1.3|C .45| HWA, NANCY MA
|  32    21     13     50.17   5.77|1.14    .3|2.04   1.2|D .13| ROSSNER, JACK
|  NUM  SCORE  COUNT  MEASURE  ERROR|IMNSQ ZSTD|OMNSQ ZSTD|CORR.| TAPS
|  23     8     10    103.87   5.68|2.06   2.1|2.18   2.3|A .19| WATCH A RAT
|   9    49     37     62.83   3.12|1.67   2.5|1.81   1.4|B .47| LEARN WEED NA
|  16    53     40     60.93   3.01|1.73   2.8|1.54   1.0|C .38| MAKE A MAP
|   7    40     29     66.62   3.51|1.20    .7|1.31    .6|D .47| WATCH ANIMAL
   ⬆ Summary statistics from Table 3 and the largest misfitting persons and items


Output written to SF.OUT          name of output file
```

For details of the numbers, see the description of output Tables 0, 3, 10 and 14.

8. INTERPRETING OUTPUT TABLES

The statistics reported and labeled in the tables are intended to be self-explanatory (or more details see *BTD* and *RSA*). Some of the terms are explained here.

Note: The tables shown here are examples, *not* the results of one an actual analysis.

Table 0 is the last Table printed, see p. 108.

8.1 Table 1.1 Distribution map
        (controlled by MRANGE=, ITEM=, PERSON=, MAXPAG=)
These tables show the distribution of the persons and items. The variable is laid out vertically with the most able persons, and most difficult items at the top.

```
   TABLE 1.1 LIKING FOR SCIENCE (Wright & Masters p.18)   SF.OUT Dec  1 18:33 1996
      76 PUPILS    25 ACTS    ANALYZED:    74 PUPILS    25 ACTS     3 CATEGS v2.67
```

76 PUPILS 25 ACTS   Number of persons in data file and items in NI= specification.
ANALYZED: 74 PUPILS 25 ACTS 3 CATEGSNumber of persons, items and categories that with non-extreme scores.
v2.67   BIGSTEPS version number.

```
                    MAP OF KIDS    AND TAPS
MEASURE                            |                        MEASURE
 <more> -------------------- KIDS  -+-  TAPS  -------------------- <rare>
   5.0                             + X                         5.0
                                   |
                                   |
                                   | XXX   (items too hard for persons)
                                   |
                                   |
   4.0                             +                           4.0
                                   |
                                XX |
                                   |
                                   |
                                   | X
   3.0                             +                           3.0
                                 X |
                                   |
                                   |
                                   |
                                   | X
   2.0                        XXXX +                           2.0
                                   | X
                                   |
                                   |
                                   |
                                   |
   1.0                       XXXXX +                           1.0
                                   | X
                                   |
                                   |
```

```
                               |
                               |
    .0                         +                                     .0
                               |
             XXXXXXXXXXXX | (gap!)
                               |
                               |
                               |
   -1.0                        +                                   -1.0
                               |
                       XXX |
                           | X
                               |
                               |
   -2.0                        +                                   -2.0
                      XX | X
                               |
                               |
                     X | X
                           | XX
   -3.0              XX + X                                        -3.0
    <less> -------------------- KIDS   -+-  TAPS  ----------------<frequent>
```
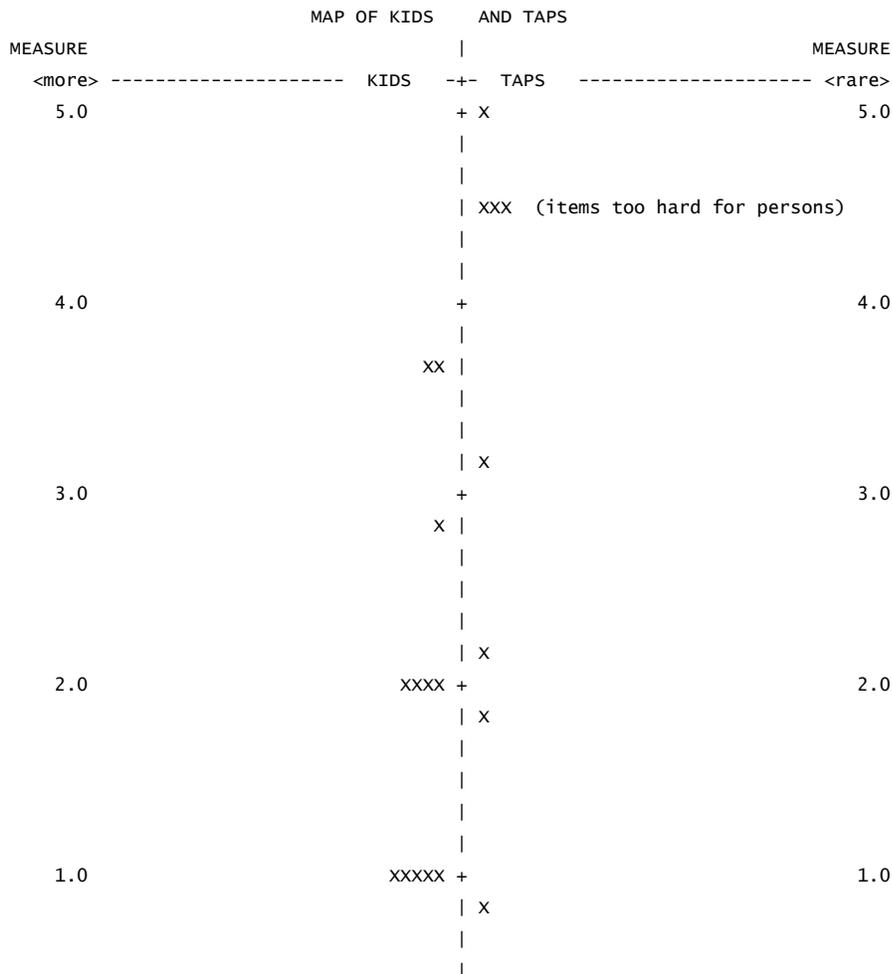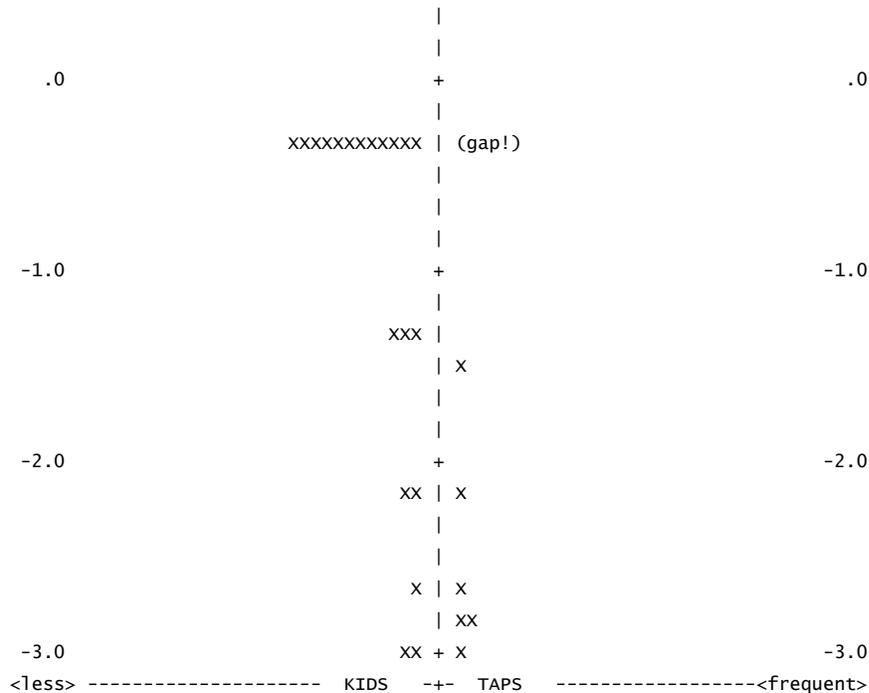
In Table 1, each person or item is indicated by an "X", or, when there are too many "X"s to display on one line, several persons or items are represented by a "#". The left-hand column locates the person ability measures along the variable. For dichotomous items, the right-hand column locates the item difficulty calibrations along the variable. Look for an even spread of items along the variable (the Y-axis) with no gaps, indicating poorly defined or tested regions of the variable. The persons often show a normal distribution. Good tests usually have the items targeted (lined up with) the persons.

For rating scales, each item is shown three times. In the center item column, each item is placed at its mean calibration, i. e., this is the location of the center of the rating scale - the location at which being ratings in the top and bottom category are equally probable. In the left-hand item column, the item is shown at the ability level corresponding to a probability of .5 of exceeding (or being rated in) the bottom rating scale category. In the right-hand item column, the item is shown at the ability level corresponding to a probability of .5 of being rated in (or falling below) the top rating scale category. Dichotomous items, "D", have only one location.

```
                  MAP OF PUPILS  AND ACTS
MEASURE                  |        P=50%|                |       P=50%  MEASURE
 <more> ------PUPILS -+-ACTS     BOTTOM+-ACTS    CENTER+-ACTS   TOP -- <rare>
   4.0           X +              +               +                   4.0
                   |              |               |
                   |              |               |
               X |              |               |
                   |              |               | X
               X |              |               | X
   3.0             +              +               +                   3.0
               X |              |               | X
               X |              |               | XX
              XX |              |               |
              XX |              | X             |
```

```
                 XX |             | X             |
      2.0        XXX +            +            + X                    2.0
                 XX |             | X             |
                 XX |             | XX            | X
                 XX |             |               | XX
                 XX | X           |               | XXX
                XXX | X           |               | X
      1.0     XXXXXX +            + X           + X                    1.0
                XXX | X           |               |
              XXXXX | XX          | X             | XX
                XXX |             | XX            | X
        XXXXXXXXXXX |             | XXX           | X
               XXXX |             | X             | X
       .0     XXXXXXX + X         + X           + X                     .0
                  X |             |               |
                    | X           | XX            | X
                  X | XX          | X             | X
                 XX | XXX         | X             |
                  X | X           | X             |
     -1.0          X + X          + X           + X                  -1.0
                    |             |               |
                 XX | XX          | X             |
                    | X           | X             | X
                  X | X           |               |
                    | X           |               |
     -2.0           + X           + X           + X                  -2.0
                    |             |               |
                    | X           |               |
                    | X           | X             |
                    |             |               |
                    |             |               |
     -3.0           + X           + X           +                    -3.0
                    |             |               |
                    |             |               |
                    | X           |               |
                    |             |               |
                    |             |               |
     -4.0           + X           +             +                    -4.0
     <less> ------PUPILS -+-ACTS    BOTTOM+-ACTS    CENTER+-ACTS    TOP -- <frequ>
```

Observe that the top pupil (left column) is well above the top category of the most difficult act item (right-most column), but that all pupils are above the top category of the easiest item (bottom X in right-most column). "Above" means with greater than 50% chance of exceeding.

8.2 Tables 1.0, 1.2, 1.3, 12 and 16 Distribution maps
         (controlled by MRANGE=, MAXPAG=, NAMLMP=)

In Table 12, the item names are shown located at their calibrations, along with the person distribution. Table 1.2 is printed if the item map can be squeezed into one page. In Table 16, the person names are shown with an item distribution. Table 1.3 is printed if the person map can be squeezed into one page. If person and item maps can be squeezed into one page, Table 1.0 is printed. You can use NAMLMP= to control the number of characters of each name reported. "QSMSQ" summarize the distributions. An "M" marker represents the location of the mean measure. "S" markers are placed one standard deviation away from the mean. "Q" markers are placed two standard deviations away.

§ Look for the hierarchy of item names to spell out a meaningful construct from easiest at the bottom to hardest at the top.

```
     KIDS              MAP OF TAPS
 120                +
              X  |  FIND BOTTLES AND CAN
 110          X  +
               Q|Q WATCH A RAT
 100          X  +
              X  |
  90         XXX +
             XXX |  LOOK IN SIDEWALK CRA  WATCH BUGS
  80       XXXXX S+S WATCH GRASS CHANGE
            XXX  |
  70       XXXX  +
           XXXXX |  LEARN WEED NAMES      WATCH ANIMAL MOVE
  60       XXXXX +  MAKE A MAP
            XXX M|  LOOK AT PICTURES OF   LOOK UP STRANGE ANIM  TALK W/FRIENDS ABOUT
  50 XXXXXXXXXXXX +M READ BOOKS ON PLANTS
           XXXXX |  FIND OUT WHAT ANIMAL  WATCH WHAT ANIMALS E
  40        XXXX +  FIND OUT WHAT FLOWER  WATCH BIRDS
       XXXXXXXX S|  READ ANIMAL STORIES
                 |
```

8.3 Table 2 *Most probable response, expected score, Thurstone threshold plots*
(controlled by MRANGE=, CATREF=, CURVES=)
§ Each plot answers a different question:
What category is most likely? The maximum probability (mode) plot.
What is the average or expected category value? The expected score (mean) plot.
What part of the variable corresponds to the category? The Thurstone (median) plot.

The left-side of this table lists the items in descending order of difficulty. Anchored items are indicated by an * between the sequence number and name. A particular category can be used as the reference for sorting the items by specifying the CATREF= variable.

Across the bottom is the logit (or rescaled) scale of the variable with the distribution of the person abilities shown beneath it. An "M" marker represents the location of the mean person ability. "S" markers are placed one standard deviation away from the mean. "Q" markers are placed two standard deviations away.

The "Most Probable Response" Table, selected with CURVES=001, answers the question "which category is a person of a particular measure most likely to choose?" This is the most likely category with which the persons of logit (or rescaled) ability shown below would respond to the item shown on the left. The area to the extreme left is all "0"; the area to the extreme right is at the top category. Each category number is shown to the left of its modal area. If a category is not shown, it is never a most likely response. An item with an extreme, perfect or zero, score is not strictly estimable, and is omitted here. Blank lines are used to indicate large gaps between items along the variable.

This table presents in one picture the results of this analysis in a form suitable for inference. We can predict for people of any particular ability measure what responses they would probably make. "M" depicts an "average" person. The left "Q" a low performer. The right "Q" a high performer. Look straight up from those letters to read off the expected response profiles.

```
              MOST PROBABLE RESPONSE: MODE   (BETWEEN "0" AND "1" IS "0", ETC.)
         NUM  ITEM       -5    -4    -3    -2    -1     0     1     2     3     4     5

                         +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
           5 FIND BOTTLES 0                                     1           2           2
          20 WATCH BUGS   0                               1           2           2
           8 LOOK IN SIDE 0                               1           2           2
           7 WATCH ANIMAL 0                         1           2                 2
          17 WATCH WHAT A 0                   1           2                       2
deliberate space →|                                                              |
          21 WATCH BIRD M 0             1           2                             2
          10 LISTEN TO BI 0       1           2                                   2
          12 GO TO MUSEUM 0    1           2                                      2
          18 GO ON PICNIC 0  1           2                                        2
                         +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
                         -5    -4    -3    -2    -1     0     1     2     3     4     5


                                                                     1
         PERSON                             1 2 1121 1741353362222232221 11 1  1    11
                                            Q    S    M       S    Q
```

In the "Expected Score" Table, the default or selected with CURVES=010, answers the question "what is the average rating that we expect to observer for persons of a particular measure?" This rating information is expressed in terms of expected scores (with ":" at the half-score points). Extreme scores are located at expected scores .25 score points away from the extremes.

```
                      EXPECTED SCORE:MEAN (":" INDICATES HALF-SCORE POINT)
                     -5    -4    -3    -2    -1     0     1     2     3     4     5

                     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
        5 FIND BOTTLES 0                                 :     1     :           2
       23 WATCH A RAT   0                                :     1     :           2
        9 LEARN WEED N  0                          :     1     :                 2
       21 WATCH BIRD M  0                    :     1     :                        2
       11 FIND WHERE A  0                    :     1     :                        2
       19 GO TO ZOO     0        :     1     :                                   2
       18 GO ON PICNIC  0  :     1     :                                         2
                     +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
                     -5    -4    -3    -2    -1     0     1     2     3     4     5
```

The "Thurstone Threshold" Table, selected with CURVES=001, answers the question "whereabouts in the category ordering is a person of a particular measure located?" This information is expressed in terms of Thurstone thresholds (the point at which the probability of scoring in or above the category is .5).

```
                                   THURSTONE THRESHOLD: MEDIAN
                    -6        -4        -2         0         2         4         6

                    +---------+---------+---------+---------+---------+---------+
        5 FIND BOTTLES 0                                     1         2         2
       23 WATCH A RAT   0                                    1         2         2
        9 LEARN WEED N  0                              1           2             2
       21 WATCH BIRD M  0                     1             2                    2
       11 FIND WHERE A  0                    1           2                       2
       19 GO TO ZOO     0           1             2                             2
       18 GO ON PICNIC  0      1           2                                    2
                    +---------+---------+---------+---------+---------+---------+
                    -6        -4        -2         0         2         4         6
```

8.4 Table 3 Summary statistics
8.4.1 Summaries of persons and items
      (controlled by STBIAS=, REALSE=, UMEAN=, USCALE=)

This table summarizes the person, item and step information. Extreme scores (zero and perfect scores) have no exact measure under Rasch model conditions, so they are dropped from the main summary statistics. Using a Bayesian technique, however, reasonable measures are reported for each extreme score, see EXTRSC=. Totals including extreme scores are also reported, but are necessarily less inferentially secure than those totals only for non-extreme scores.

```
                    SUMMARY OF    74 MEASURED (NON-EXTREME) KIDS

+--------------------------------------------------------------------------+
|           RAW                      MODEL       INFIT        OUTFIT    |
|          SCORE     COUNT    MEASURE   ERROR    MNSQ   ZSTD   MNSQ   ZSTD |
+--------------------------------------------------------------------------+
| MEAN     26.4      16.8      56.99    5.74     1.01   -.2    .82    -.3 |
| S.D.     11.9       5.7      23.67    1.33      .65   1.4    .78    1.2 |
+--------------------------------------------------------------------------+
| REAL RMSE   6.47  ADJ.SD   22.77  SEPARATION  3.52  KID    RELIABILITY  .93 |
|MODEL RMSE   5.90  ADJ.SD   22.93  SEPARATION  3.89  KID    RELIABILITY  .94 |
| S.E. OF KID   MEAN   2.77                                               |
| WITH    1 EXTREME KIDS   =    75 KIDS   MEAN  60.13    S.D.  24.37       |
| REAL RMSE   6.80  ADJ.SD   24.47  SEPARATION  3.60  KID    RELIABILITY  .93 |
|MODEL RMSE   6.26  ADJ.SD   24.61  SEPARATION  3.93  KID    RELIABILITY  .94 |
+--------------------------------------------------------------------------+

                    MAXIMUM EXTREME SCORE:     1 KIDS
                        LACKING RESPONSES:     1 KIDS
                VALID RESPONSES: 67.1%       CUTLO= 1.0 CUTHI=   .0


                    SUMMARY OF    25 MEASURED (NON-EXTREME) TAPS

+--------------------------------------------------------------------------+
|           RAW                      MODEL       INFIT        OUTFIT    |
|          SCORE     COUNT    MEASURE   ERROR    MNSQ   ZSTD   MNSQ   ZSTD |
+--------------------------------------------------------------------------+
| MEAN     78.2      49.7      50.00    3.48     1.06    .0    .89    -.1 |
| S.D.     43.0      22.5      27.56    1.04      .36   1.3    .43     .7 |
+--------------------------------------------------------------------------+
| REAL RMSE   4.03  ADJ.SD   27.27  SEPARATION  6.76  TAP    RELIABILITY  .98 |
|MODEL RMSE   3.63  ADJ.SD   27.32  SEPARATION  7.53  TAP    RELIABILITY  .98 |
| S.E. OF TAP   MEAN   5.63                                               |
+--------------------------------------------------------------------------+
```

For valid observations used in the estimation,
SCORE is the raw score (number of correct responses).
COUNT is the number of responses made.
MEASURE is the estimated measure (for persons) or calibration (for items).
ERROR is the standard error of the estimate.

INFIT is an information-weighted fit statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's ability level.
      MNSQ is the mean-square infit statistic with expectation 1. Values substantially below 1 indicate dependency in your data; values substantially above 1 indicate noise.
      ZSTD is the infit mean-square fit statistic standardized to approximate a theoretical mean 0 and

variance 1 distribution. When LOCAL=Y, then EMP is shown, indicating a local {0,1} standardization. When LOCAL=L, then LOG is shown, and the logarithms of the mean-squares are reported.

OUTFIT is an outlier-sensitive fit statistic, more sensitive to unexpected behavior by persons on items far from the person's ability level.

MNSQ is the mean-square outfit statistic, with expectation 1. Values substantially less than 1 indicate dependency in your data; values substantially greater than 1 indicate the presence of unexpected outliers.

ZSTD is the outfit mean-square fit statistic standardized to approximate a theoretical mean 0 and variance 1 distribution. When LOCAL=Y, then EMP is shown, indicating a local {0,1} standardization. When LOCAL=L, then LOG is shown, and the logarithms of the mean-squares are reported.

RMSE is the root mean square standard error computed over the persons or over the items.

MODEL RMSE is computed on the basis that the data fit the model, and that all misfit in the data is merely a reflection of the stochastic nature of the model. This is a "best case" reliability, which reports an upper limit to the reliability of measures based on this set of items for this sample.

REAL RMSE is computed on the basis that misfit in the data is due to departures in the data from model specifications. This is a "worst case" reliability, which reports a lower limit to the reliability of measures based on this set of items for this sample.

ADJ.S.D. is the standard deviation of the estimates after subtracting from their observed variance the error variance attributable to their standard errors of measurement.

(ADJ.S.D.)" = (S.D. of MEASURE)" - (RMSE)"

The ADJ.S.D. is an estimate of the "true" standard deviation from which the bias caused by measurement error has been removed.

PERSON (or ITEM) SEP is the ratio of the ADJ.S.D. to RMSE. It provides a ratio measure of separation in RMSE units, which is easier to interpret than the reliability correlation.

PERSON (or ITEM) SEP REL. is a separation reliability, equivalent to KR-20, Cronbach Alpha, and the Generalizability Coefficient. The relationship between separation SEP and reliability REL is

REL = SEP"/(1+SEP")

or   SEP = √(REL/(1-REL))

S.E. OF MEAN is the standard error of the mean of the person (or item) sample.

WITH 1 EXTREME KIDS = 75 KIDS

MEAN is the mean of the measures including measures corresponding to extreme scores

S.D. is the standard deviation of those measures.

The separation and reliability computations are repeated, but including any elements with extreme measures. Since the measures for extreme scores are imprecise, these statistics are often lower than their non-extreme equivalents. Conventional computation of a reliability coefficient (KR-20, Cronbach Alpha) includes persons with extreme scores. The PERSON SEP REL. of this second analysis is the conventional reliability, and is usually between the MODEL and REAL values, closer to the MODEL.

8.4.2 Summary of rating scale steps
(controlled by STEPT3=, STKEEP=)

a) For dichotomies,

```
                      SUMMARY OF MEASURED STEPS
           +------------------------+------------------+
           |CATEGORY STEP  OBSERVED |AVGE  INFIT OUTFIT|
           | LABEL   VALUE   COUNT  |MEASURE MNSQ  MNSQ|
           +------------------------+------------------+
           |   0       0      240   | -3.47  1.01   .83|
           |   1       1      236   |  3.13  1.00   .62|
           +------------------------+------------------+
```

CATEGORY LABEL is the number of the category in your data set after scoring/keying.
STEP VALUE is the number of the step which the category represents after the scale categories have been ordinally recounted from the lowest observed category.
OBSERVED COUNT is the count of occurrences of this category used in the estimation.

AVGE MEASURE is the average of the measures that were modelled to produce the responses observed in the category. The average measure is expected to increase with category value. Disordering is marked by "*".

INFIT MNSQ is the average of the INFIT mean-squares associated with the responses in each category. The expected values for all categories are 1.0.

OUTFIT MNSQ is the average of the OUTFIT mean-squares associated with the responses in each category. The expected values for all categories are 1.0. This statistic is sensitive to grossly unexpected responses.

RESIDUL (when shown) is the residual difference between the observed and expected counts of observations in the category. Only shown if ≥1.0. Indicates lack of convergence, step anchoring, or large data set.

b) For rating scales, the step calibration table lists:

```
                      SUMMARY OF MEASURED STEPS
          FOR GROUP "0", MODEL "R", ACT    NUMBER:    1  WATCH BIRDS

              ACT    DIFFICULTY OF   -.87 ADDED TO MEASURES
   +----------------------------------------------------------------+
   |CATEGORY OBSERVED|AVERAGE EXP.| COHERENCE|INFIT OUTFIT|  STEP    |
   | LABEL    COUNT  |  MEASURE   | EXP% OBS%|  MNSQ  MNSQ CALIBRATN|
   |----------------+------------+---------+-----------+---------|
   |   0        3 |  -.94  -.42|  0%   0%|   .74   .73|  NONE    |
   |   1       35 |   .14   .32| 69%  82%|   .70   .52|  -1.64   |
   |   2       36 |  1.61  1.39| 81%  72%|   .75   .77|   1.64   |
   +----------------------------------------------------------------+


       +--------------------------------------------------------+
       |CATEGORY   STEP    STEP |  SCORE-TO-MEASURE  |THURSTONE|
       | LABEL   MEASURE   S.E. | AT CAT. ----ZONE----|THRESHOLD|
       |------------------------+--------------------+---------|
       |   0       NONE         |( -3.64) -INF   -2.61|         |
       |   1       -2.51    .61 |  -.87  -2.61    .87|  -2.55  |
```

```
|   2            .77    .26 |(  1.90)    .87  +INF |     .81 |
  +----------------------------------------------------+
```

DIFFICULTY ADDED TO MEASURES, is shown when the rating scale applies to only one item, e.g., when GROUPS=0. Then all measures in these tables are adjusted by the estimated item difficulty.

CATEGORY LABEL, the number of the category in your data set after scoring/keying.
OBSERVED COUNT, the count of occurrences of this category used in the estimation.

AVERAGE MEASURE is the empirical average of the measures that were modelled to produce the responses that were observed in the category, i.e, $\Sigma(B_n - D_i)/\Sigma 1$ for all observations in a category. The average measure is expected to increase with category value. Disordering is marked by "*".

AVERAGE EXP. MEASURE is the expected (optimum) value of the average measure for these data. Compare this with AVERAGE MEASURE to discover the amount of discrepancy in the data.

COHERENCE EXP% is the percentage of all observations whose expectations fell in this category that were actually observed in this category, i.e., EXP% = (Observations in cat. with expectations also in cat.)/(all **expectations** in cat.). This indicates to what extent measures corresponding to this category predict ratings in it. 100% is optimum. Less than 50% is inferential insecure.

COHERENCE OBS% is the percentage of all observations in this category whose expectations are also in this category, i.e., OBS% = (Observations in cat. with expectations also in cat.)/(all **observations** in cat.). This indicates to what extent ratings in this category measures corresponding to it. 100% is optimum. Less than 50% is inferential insecure.

INFIT MNSQ is the average of the INFIT mean-squares associated with the responses in each category. The expected values for all categories are 1.0. High infit signals this category was chosen when nearby categories were expected.

OUTFIT MNSQ is the average of the OUTFIT mean-squares associated with the responses in each category. The expected values for all categories are 1.0. High outfit mean-square signals that this category was observed when a far-away category choices were expected.

STEP CALIBRATN, the calibrated difficulty of this step (the transition from the category below to this category) relative to the prior step. The bottom step has no prior step, and so that the difficulty is shown as NONE. The step calibration is expected to increase with category value. Disordering is marked by "*".

STEP MEASURE, the calibrated difficulty of this step adjusted for item difficulty. The bottom step has no prior step, and so that the difficulty is shown as NONE. The step measure is expected to increase with category value. Disordering is marked by "*".

STEP S.E. is an approximate standard error of the step difficulty.

SCORE-TO-MEASURE
AT CAT is the measure (on an item of 0 logit difficulty) corresponding to an expected score equal to the
　　　　category label, which, for the rating scale model, is where this category has the highest probability.
( )　　　is printed where the matching calibration is infinite. The value shown corresponds to the measure
　　　　.25 score points (or LOWADJ= and HIADJ=) away from the extreme.
--ZONE-- is the range of measures from an expected score from " score-point below to the category to "

score-point above it. Measures in this range (on an item of 0 difficulty) are expected to be observed, on average, with the category value.

THURSTONE THRESHOLD gives the location of median probabilities. At these calibrations, the probability of observing the categories below equals the probability of observing the categories equal or above. The Thurstone threshold is the point on the variable at which the category interval begins.

CATEG RESIDUL (when shown) is the category residual, the difference between the observed and expected counts of observations in the category. Only shown if >=1.0. Indicates lack of convergence, step anchoring, or large data set.

8.5 Tables 4.1, 5.1 and 8.1, 9.1 Fit plots
(controlled by FRANGE=, LOCAL=, OUTFIT=)
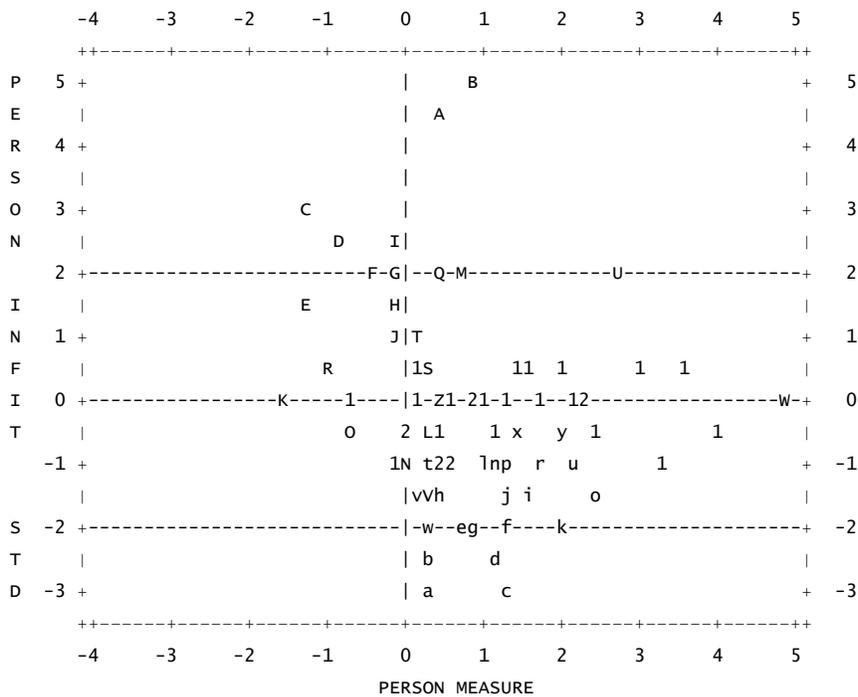
```
           -4    -3    -2    -1     0     1     2     3     4     5
          ++------+------+------+------+------+------+------+------+------++
P   5 +                             |    B                        +   5
E     |                             |  A                          |
R   4 +                             |                             +   4
S     |                             |                             |
O   3 +                      C      |                             +   3
N     |                          D   I|                            |
    2 +------------------------F-G|--Q-M------------U---------------+   2
I     |                   E      H|                                |
N   1 +                         J|T                               +   1
F     |                 R       |1S        11  1      1   1        |
I   0 +----------------K-----1----|1-Z1-21-1--1--12---------------W-+   0
T     |                    O    2 L1     1 x   y 1          1      |
   -1 +                         1N t22  1np  r  u        1         +  -1
      |                         |vVh    j i       o               |
S  -2 +-------------------------|-w--eg--f----k--------------------+  -2
T     |                         | b      d                        |
D  -3 +                         | a       c                       +  -3
          ++------+------+------+------+------+------+------+------+------++
           -4    -3    -2    -1     0     1     2     3     4     5
                             PERSON MEASURE


ITEMS        1    1  1   11 111 21  21221  1   21 1 1
                  Q       S        M        S        Q
```

These tables are plots of the standardized fit statistics, INFIT or OUTFIT, against the parameter estimates. INFIT is a standardized information-weighted mean square statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's ability level. OUTFIT is a standardized outlier-sensitive mean square fit statistic, more sensitive to unexpected behavior by persons on items far from the person's ability level. The standardization is approximate. Its success depends on the distribution of persons and items. Consequently, the vertical axis is only a guide and should not be interpreted too rigidly. The NORMAL= variable controls the standardization method used.

Letters on the plot indicate the misfitting person or items. Numbers indicate non-extreme fit or multiple references. The letters appear on Tables 6, 17, 18, 19 for persons, and Tables 10, 13, 14, 15 for items.

8.6 Tables 5.2 and 9.2 Fit plots
If both infit and outfit plots are requested, then a plot of outfit against infit is also produced to assist with the

identification of the different patterns of observations they diagnose. For interpretation of fit statistics, see Appendix 2.

```
              -4   -3   -2   -1    0    1    2    3    4    5    6    7    8    9
              ++----+----+----+----+----+----+----+----+----+----+----+----+----++
          6 +          |         |         |                    .                 +  6
    P         |        |         |         |                .B                    |
    E     5 +          |         |         |              .         A             +  5
    R         |        |         |         |            .                         |
    S     4 +          |         |         |          .                           +  4
    O         |        |         |         |        .                             |
    N     3 +          |         |         |    .          C                      +  3
              |        |         |         |I .        D                          |
    I     2 +----------+---------+--U-Q---M-+------2------------------------------+  2
    N         |        |         |    .|  H          E                            |
    F     1 +          |         | T  .    J                                      +  1
    I         |        |       24|    2    |                                      |
    T     0 +----------+-----453w------K-+------------------------------------+  0
              |        |     31.3|    PO  L |                                      |
    S    -1 +          |     2721 |     N   |                                      + -1
    T         |        |     .3ov |V        |                                      |
    D    -2 +----------+-2gk-w---+---------+----------------------------------+ -2
              |          b d      |         |                                      |
         -3 +          a  c|      |         |                                      + -3
              ++----+----+----+----+----+----+----+----+----+----+----+----+----++
              -4   -3   -2   -1    0    1    2    3    4    5    6    7    8    9
                                    PERSON OUTFIT ZSTD
```
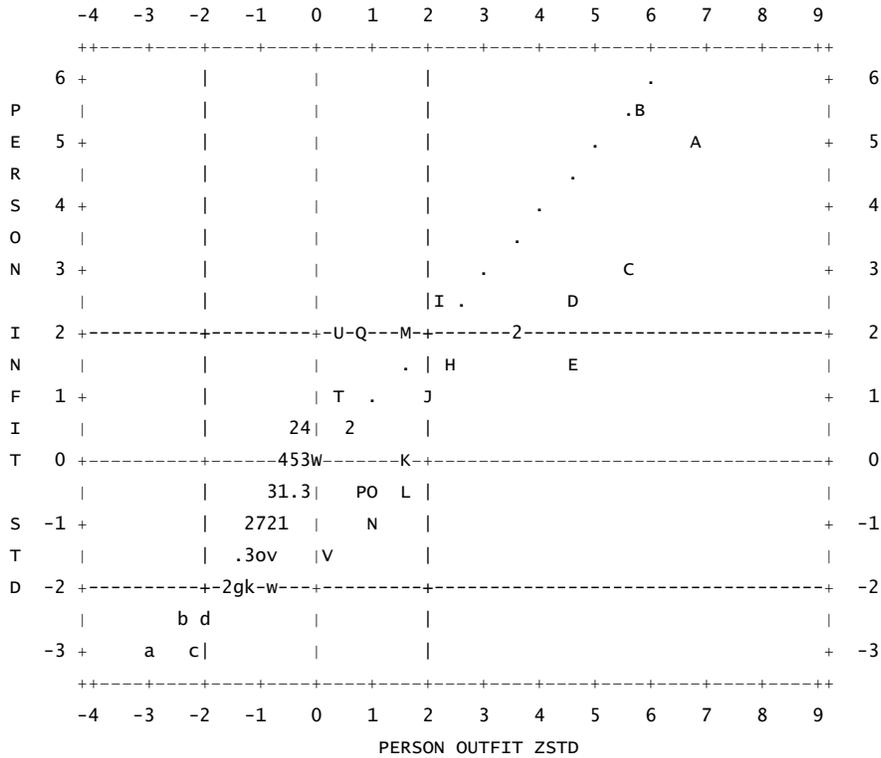
8.7 Tables 6.1, 10.1, 13.1, 14.1, 15.1, 17.1, 18.1, 19.1 Person and item statistics
(controlled by USCALE=, UMEAN=, UDECIM=, LOCAL=, ISORT=, PSORT=)

PERSON STATISTICS: OUTFIT ORDER

ENTRY RAW					INFIT	OUTFIT	PTBIS	
NUM SCORE	COUNT	MEASURE	ERROR	MNSQ ZSTD	MNSQ ZSTD	CORR.	PERSON
73 28	25	.38	.34	2.87 5.0	4.83 6.8	A-.01	SANDBERG, RYNE
71 33	25	.97	.35	3.15 5.3	4.93 5.8	B-.06	STOLLER, DAVE
72 14	25	-1.32	.37	2.01 2.8	5.13 5.7	C-.10	JACKSON, SOLOMON
BETTER FITTING OMITTED							
37 27	25	.26	.34	.44 -2.7	.42 -2.3	b .87	AIREHEAD, JOHN
21 28	25	.38	.34	.29 -3.9	.31 -3.0	a .84	EISEN, NORM L.
MEAN 31.	25.	.89	.39	.98 -.2	1.08 .1		
S.D. 8.	0.	1.21	.10	.50 1.6	1.03 1.9		

ITEM STATISTICS: MEASURE ORDER

ENTRY RAW					INFIT	OUTFIT	PTBIS	
NUMBR SCORE	COUNT	MEASURE	ERROR	MNSQ ZSTD	MNSQ ZSTD	CORR.	ACTS
20 49	75	1.74	.20	1.34 2.0	1.85 3.8	.21	WATCH BUGS
4 50	75	1.70	.20	.88 -.8	.89 -.6	.50	WATCH GRASS CHANGE
8 52	75	1.63	.19	1.09 .6	1.19 1.0	.35	LOOK IN SIDEWALK CRACKS

```
+--------------------------------+----------+----------+-----+----------------------+
```

NUM is the sequence number of the person, or item, in your data, and is the reference number used for deletion or anchoring.

NAME is the item name or person-id.

SCORE is the raw score corresponding to the parameter.

COUNT is the number of valid data points.

MEASURE is the estimate for the parameter. If the score is extreme, a value is estimated, but as MAXIMUM (perfect score) or MINIMUM (zero score). No measure is reported if the element is DROPPED (no valid observations remaining) or DELETED (you deleted the person or item).
§ If unexpected results are reported, check whether TARGET= or CUTLO= or CUTHI= are specified.

ERROR is the standard error of the estimate. For anchored values, an "A" is shown on the listing and the error reported is that which would have been obtained if the value had been estimated.

INFIT is a standardized information-weighted mean square statistic, which is more sensitive to unexpected behavior affecting responses to items near the person's ability level.
MNSQ is the mean-square infit statistic, with expectation 1. Values substantially less than 1 indicate dependency in your data; values substantially greater than 1 indicate noise. See p. 113.
ZSTD is the infit mean-square fit statistic standardized to approximate a theoretical mean 0 and variance 1 distribution. When LOCAL=Y, then EMP is shown, indicating a local {0,1} standardization. When LOCAL=LOG, then LOG is shown, and the logarithms of the mean-squares are reported.

OUTFIT is a standardized outlier-sensitive mean square fit statistic, more sensitive to unexpected behavior by persons on items far from the person's ability level.
MNSQ is the mean-square outfit statistic, with expectation 1. Values substantially less than 1 indicate dependency in your data; values substantially greater than 1 indicate the presence of unexpected outliers. See p. 113.
ZSTD is the infit mean-square fit statistic standardized to approximate a theoretical mean 0 and variance 1 distribution. When LOCAL=Y, then EMP is shown, indicating a local {0,1} standardization. When LOCAL=L, then LOG is shown, and the logarithms of the mean-squares are reported.

PTBIS is the point-biserial correlation, r_{pbis}, between the individual item (or person) response "scores" and the total person (or item) test score (less the individual response "scores"). Extreme scores are omitted from the computation. Negative values for items often indicate mis-scoring, or rating scale items with reversed direction. Letters indicating the identity of persons or items appearing on the fit plots appear under PTBIS. For adaptive tests, an r_{pbis} near zero is expected.

The formula for this product-moment correlation coefficient is:

$$r_{pbis} = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

where x = observation for this item (or person), y = total score for person **omitting this item** (or for item **omitting this person**).

Conventional computation of r_{pbis} includes persons with extreme scores. These correlation can be

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obtained by forcing observations for extreme measures into the analysis. The procedure is:

1)   Perform a standard analysis but specify PFILE= and IFILE=.

2)   Perform a second analysis setting PAFILE= to the name of the PFILE= of the first analysis, and IAFILE= to the name of the IFILE=. The PTBIS of this second analysis is the conventional r_{pbis}, which includes extreme scores.

RPM is reported instead of PTBIS when PTBIS=N or PTBIS=RPM is specified. RPM is the point-measure correlation, r_{pm}. It is computed in the same way as the point bi-serial, except that Rasch measures replace total scores. Since the point-biserial loses its meaning in the presence of missing data, r_{pm} is always reported when CUTLO= or CUTHI= are specified.

DISPLACE approximates the displacement of the estimate away from the statistically better value which would result from the best fit of your data to the model. Only meaningfully large values are displayed. They indicate lack of convergence, or the presence of anchored or targeted values. The best fit value can be approximated by *adding* the displacement to the reported measure or calibration.

8.7.1 Tables 6.1, 10.1   Person and item fit selection

(controlled by FITI=, FITP=)

These tables list the person measures and item calibrations in fit order.

Report measure in Tables 6 and 10, if any of:		
Statistic	Less than	Greater than
standardized INFIT	-(FITP or FITI)	FITP or FITI
standardized OUTFIT	-(FITP or FITI)	FITP or FITI
mean-square INFIT	1 - (FITP or FITI)/10	1 + (FITP or FITI)/10
mean-square OUTFIT	1 - (FITP or FITI)/10	1 + (FITP or FITI)/10
point-biserial correlation	negative	

To include every person, specify FITP=0. For every item, FITI=0. Tables 6 and 10 are sorted by Outfit, by default, or Infit if OUTFIT=N.

8.8 Tables 6.2, 10.2, 13.2, 14.2, 15.2, 17.2, 18.2, 19.2 Person and item statistics

(controlled by USCALE=, UMEAN=, UDECIM=, LOCAL=)

```
                        PUPIL FIT GRAPH:   OUTFIT ORDER
+----------------------------------------------------------------------------+
|ENTRY| MEASURE |  INFIT MEAN-SQUARE  | OUTFIT MEAN-SQUARE  |                  |
|NUMBR| -     + |0    0.7 1 1.3    2|0    0.7 1 1.3    2| PUPIL             |
|-----+---------+--------------------+--------------------+-------------------|
|   72|*        |       :   .  :    * |A      :   .  :   *| JACKSON, SOLOMON  |
|   47|   *     |       :   .  *:     |J      :   .  :  * | VAN DAM, ANDY     |
|   53|*        |       :  *. :      |K      :   .  :   * | SABOL, ANDREW     |
|   32|   *     |      *:   .  :      |w      *  . :       | ROSSNER, JACK     |
|   21|   *     |  *    :   .  :      |a *    :   .  :      | EISEN, NORM L.    |
+----------------------------------------------------------------------------+
```

The fit information is shown in graphical format to aid the eye in identifying patterns and outliers. The fit bars are positioned by default at 0.7 and 1.3. They may be repositioned using TFILE=.

8.9 Tables 10.3, 13.3, 14.3, 15.3 Item option frequencies
(controlled by DISTRT=Y)

ITEM OPTION FREQUENCIES are output if DISTRT=Y. These show occurrences of each of the valid CODES=, and also of MISSING= in the input data file. Counts of responses forming part of extreme scores are included. Only items included in the corresponding main table are listed.

```
                    ITEMS   OPTION/DISTRACTOR FREQUENCIES:  OUTFIT  ORDER
         +-------------+-------------+-------------+-------------+-------------+
         | NUM NONMISS|MISSING R% SCR|  00   % SCR |  01   % SCR |  02   % SCR |
         +-------------+-------------+-------------+-------------+-------------+
         |  23A    75 |   1  1  ** |  44  58   0 |  20  26   1 |  11  14   2 |
         |   5B    75 |   1  1  ** |  47  62   0 |  19  25   1 |   9  12   2 |
         |  18F    75 |   1  1  ** |   1   1   0 |   3   4   1 |  71  94   2 |
         +-------------+-------------+-------------+-------------+-------------+
```

NUM is the item sequence number.
    The letter next to the sequence number is used on the fit plots.
NONMISS is the number of non-missing responses to this item.
MISSING is the number of missing (not in CODES=) responses.
R% is the percent of all responses that are missing.
SCR is the scored value of the response. ** means ignored for estimation purposes.

00 is a code from the CODES= variable above the count of such responses.
% gives the percent of all non-missing responses that the count represents.
SCR gives the score value of the code.

8.10 Tables 6, 10 Unexpected Responses

8.10.1 Tables 6.4, 10.4 Most Misfitting Response Strings
These tables display the unexpected responses in the most misfitting response strings in a Guttman scalogram format.

```
                    MOST MISFITTING RESPONSE STRINGS
               ACT                          OUTMNSQ  |PUPIL
                                            |4314 452371 17667422 315231 4 4 31725
                                            |147578953418917534874255664 9769502293
                                         high----------------------------------
    23 WATCH A RAT                        5.68 A|1110.0.......2.2...2....1112.2211122.
    20 WATCH BUGS                         1.99 B|......0......2..2.....2.......11..21.
     9 LEARN WEED NAMES                   1.29 D|....0....0..........................1
                                            |--------------------------------low
                                            |4314745237181766742243152319464531725
                                            |1475 895341 91753487 255664 7 9 02293
```

The items (or persons) are ordered by descending mean-square misfit. Each column corresponds to a person. The entry numbers are printed vertically. The responses are ordered so that the highest expected responses are to the left (high), the lowest to the right (low). The category values of unexpected observations are shown. Expected values (with standardized residuals less than |2|) are shown by ".".

Missing values, if any, are left blank.

8.10.2 Tables 6.5, 10.5   Unexpected observations
These tables display the unexpected responses in Guttman scalogram format. The Guttman Scalogram of unexpected responses shows the persons and items with the most unexpected data points (those with the largest standardized residuals) arranged by measure, such that the high value observations are expected in the top-left of the data matrix, near the "high", and the low values are expected in the bottom of the matrix, near the "low". The category values of unexpected observations are shown. Expected values (with standardized residuals less than |2|) are shown by ".". Missing values, if any, are left blank.

```
MOST UNEXPECTED RESPONSES
PUPIL                     MEASURE  |ACT
                                   |1111112 122 1    22
                                   |89203112542669784035
                                high-------------------
   41 FATALE, NATASHA       4.77  |..................1.
   17 SCHATTNER, GAIL       3.55  |...................0
   71 STOLLER, DAVE          .96 B|.0.10....0.......222
   53 SABOL, ANDREW       -1.59 L|..............1....1
                                   |----------------low
                                   |11111122122619784225
                                   |8920311 542 6    03
```

8.11 Table 10 Item Dependency Diagnosis
8.11.1 Table 10.6   Largest Residual Correlations for Items
This Table shows items that may be locally dependent. Specify PRCOMP=R (for score residuals) or PRCOMP=S (for standardized residuals) or PRCOMP=L (for logit residuals) to obtain this Table. Residuals are those parts of the data not explained by the Rasch model. High correlation of residuals for two items indicates that they may not be locally independent, either because they duplicate some feature of each other or because they both incorporate some other shared dimension. Letters "C", "I", etc. relate items to misfit plots and reports.

```
                    LARGEST LOGIT RESIDUAL CORRELATIONS
                      USED TO IDENTIFY DEPENDENT ACTS

   +----------------------------------------------------------------+
   |RESIDUL| ENTRY                      | ENTRY                      |
   |CORRELN|NUMBER ACT                  |NUMBER ACT                  |
   |-------+----------------------------+----------------------------|
   |   .76 |C   20 WATCH BUGS           |A   23 WATCH A RAT          |
   |   .62 |I   13 GROW GARDEN          |G   19 GO TO ZOO            |
   |   .57 |M    2 READ BOOKS ON ANIMALS|d   11 FIND WHERE ANIMAL LIVES |
   |   .56 |l   12 GO TO MUSEUM         |F   18 GO ON PICNIC         |
   |   .55 |M    2 READ BOOKS ON ANIMALS|e   15 READ ANIMAL STORIES  |
   |   .54 |K    4 WATCH GRASS CHANGE   |C   20 WATCH BUGS           |
   |   .52 |M    2 READ BOOKS ON ANIMALS|j   21 WATCH BIRD MAKE NEST |
   |   .50 |k   10 LISTEN TO BIRD SING  |G   19 GO TO ZOO            |
   |-------+----------------------------+----------------------------|
   |  -.47 |M    2 READ BOOKS ON ANIMALS|A   23 WATCH A RAT          |
   +----------------------------------------------------------------+
```

8.11.2 Table 10.7   Principal Components Analysis of Residuals
This Table decomposes the matrix of item correlations based on residuals to identify possible other factors (dimensions) that may be affecting response patterns. Specify PRCOMP=S or =R or =L to obtain this Table.

The first factor (dimension) is that reported in Table 1 as the Rasch dimension. Residuals are those parts of the observations not explained by the Rasch dimension. According to Rasch specifications, these should be random and show no structure. The principal components analysis detects local patterns in inter-item correlations based on residuals or their transformations. Letters "C", "I", etc. relate items to misfit plots and reports.

```
                    PRINCIPAL COMPONENT ANALYSIS OF
                    LOGIT RESIDUAL CORRELATIONS FOR ACTS
   +-----------------------------------------------------------------+
   |      |       |            INFIT OUTFIT| ENTRY                   |
   |FACTOR|LOADING|MEASURE   MNSQ MNSQ |NUMBER ACT                   |
   |------+-------+------------------+----------------------------|
   |  1   |  .84  |   2.13 2.41 4.09 |A   23 WATCH A RAT            |
   |  1   |  .82  |   1.79 1.33 1.82 |C   20 WATCH BUGS             |
   |  1   |  .74  |   2.36 2.30 3.60 |B    5 FIND BOTTLES AND CANS  |
   |      |-------+------------------+----------------------------|
   |  1   | -.42  |  -1.45  .78  .57 |k   10 LISTEN TO BIRD SING    |
   |  1   | -.41  |  -1.26 1.22  .94 |I   13 GROW GARDEN            |
   |------+-------+------------------+----------------------------|
   |  2   |  .52  |   -.83  .84  .65 |j   21 WATCH BIRD MAKE NEST   |
   |      |-------+------------------+----------------------------|
   |  2   | -.47  |    .69 1.18 1.17 |E    9 LEARN WEED NAMES       |
   |  2   | -.40  |    .41  .82  .75 |g   14 LOOK AT PICTURES OF PLANTS |
   +-----------------------------------------------------------------+
```

8.11.3 Table 10.8, 9 Principal Components Plots of Item Loadings

These plots show the factor structure by plotting the linearized (*Fisher z*) loading on each factor against the item calibration. A random pattern with few high loadings is expected. Letters "C", "I", etc. relate items to misfit plots and reports. In this example, based on the *LFS* data, the second factor reflects idiosyncratic choice of the hard-to-like items (A-H).

```
               PRINCIPAL COMPONENTS (LOGIT RESIDUAL) MISFIT FACTOR PLOT
              -4         -3         -2         -1         0          1          2          3
              ++--------+--------+--------+--------+--------+--------+--------+--------++
               |                                   |                             |
   F           |                                   |                    A        |
   A   .8 +                                        |              C              +
   C           |                                   |                    B        |
   T   .7 +                                        |                             +
   O           |                                   |              D              |
   R   .6 +                                        |              K              +
               |                                   |        J                    |
   1   .5 +                                        |              H              +
       .4 +------------------------------------|----------------------------+
   L   .3 +                                        |  h                          +
   O   .2 +                                        |    fE                       +
   A   .1 +                                  b     |                             +
   D   .0 +------------------------------------|i--g-----------------------+
   I  -.1 +         F        G                 |c  a                         +
   N  -.2 +                        d     eL    |                             +
   G  -.3 +                  l                 |                             +
      -.4 +--------------------k-I--j-M-----|----------------------------+
      -.5 +                                        |                             +
```

```
 ++--------+--------+--------+--------+--------+--------+--------++
   -4       -3       -2       -1        0        1        2        3

                                          ACT    MEASURE
```
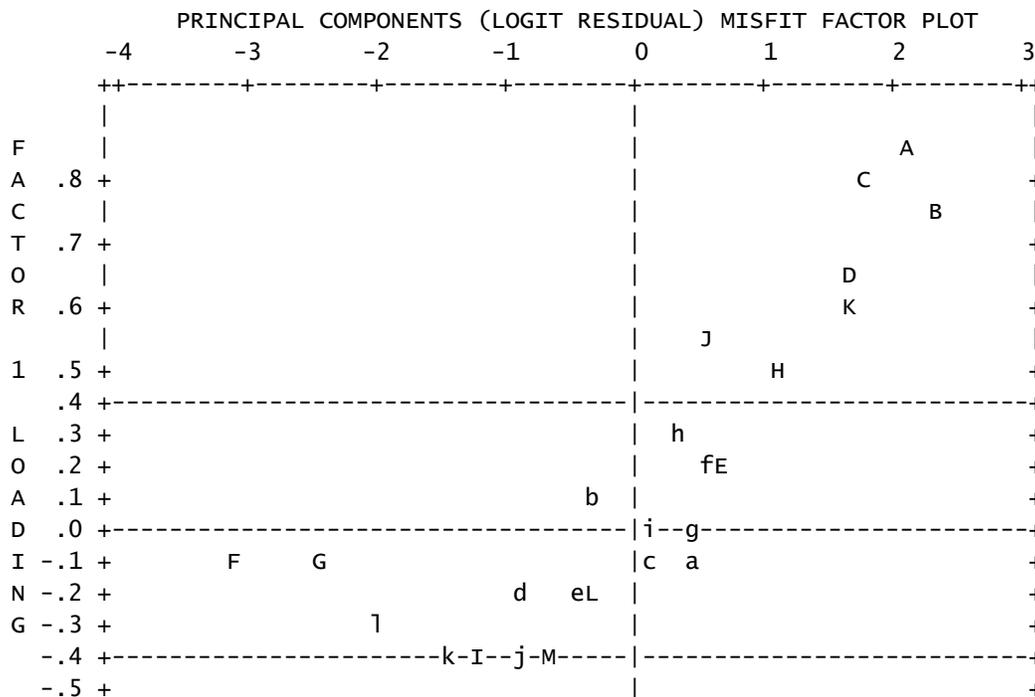
8.12 Tables 7 and 11 Misfitting responses
       (controlled by FITI=, FITP=)

These tables show the persons or items for which the standardized outfit (or infit, if OUTFIT=N) statistic is greater than the misfit criterion (FITP= or FITI=). Persons or items are listed in descending order of misfit. The response codes are listed in their sequence order in your data file. The residuals are standardized response score residuals, which have a modelled expectation of 0, and a variance of 1. Negative residuals indicate that the observed response was less correct (or, for rating scales, lower down the scale) than expected. The printed standardized residual is truncated, not rounded, so that its actual value is at least as extreme as that shown. Standardized residuals between -1 and 1 are not printed. "X" indicates that the item (or person) obtained an extreme score. "M" indicates a missing response.

```
TABLE OF POORLY FITTING ITEMS      (PERSONS IN ENTRY ORDER)
NUMBER - NAME -- POSITION ------ MEASURE - INFIT (ZSTD) OUTFIT - MISFIT OVER 2.0


   23 WATCH A RAT                      2.00      5.8    A    8.1
        RESPONSE:    1:  0 2 1 1 1  2 2 0 2 0   0 1 0 1 1  0 1 0 0 0   0 1 1 0 0
     Z-RESIDUAL:         X     2 3      3            2


        RESPONSE:   26:  1 2 0 2 1  M 0 0 1 1   1 0 1 0 0  1 0 0 0 0   0 0 0 2 1
     Z-RESIDUAL:         3   6 2                           -2      -2          4


                                          ⬇ This letter on fit plots
    5 FIND BOTTLES AND CANS             2.21      5.2    B    6.5
        RESPONSE:    1:  1 2 0 0 1  2 0 0 1 0   0 2 0 0 1  1 0 0 0 0   0 1 1 0 1
     Z-RESIDUAL:         X     2 4              6             -2
```

8.13 Table 20 Complete score-to-measure table on test of all items

A measure and standard error is estimated for every possible score on a test composed of all non-extreme items included in the analysis. The measures corresponding to extreme scores (all items right, or all items wrong) are marked by "E" and estimated using the EXTRSC= criterion. A graph of the score to measure conversion is also reported. `*' indicates the conversion, and `+' the one S.E. confidence interval. Since the 'S' and 'F' models specify that not all item levels are encountered, measures complete tests are only approximated here. In the Table of Measures on Complete Test:

SCORE   raw score on a complete test containing all calibrated items.
MEASURE   measure corresponding to score.
S.E.   standard error of the measure.

```
                           TABLE OF MEASURES ON COMPLETE TEST
  +----------------------+----------------------+----------------------+----------------------+
  | SCORE  MEASURE   S.E. | SCORE  MEASURE   S.E. | SCORE  MEASURE   S.E. | SCORE  MEASURE   S.E. |
  +----------------------+----------------------+----------------------+----------------------+
  |    0   -5.34E   1.44 |    4   -2.40    .77 |    8    .64     .92 |   12   3.94     .93 |
  |    1   -4.57    1.07 |    5   -1.77    .80 |    9   1.49     .89 |   13   4.98    1.12 |
  |    2   -3.66     .84 |    6   -1.06    .86 |   10   2.30     .88 |   14   5.80E   1.47 |
  |    3   -3.00     .77 |    7    -.23    .92 |   11   3.10     .89 |                     |
  +----------------------+----------------------+----------------------+----------------------+
```

```
                    RAW SCORE-MEASURE OGIVE FOR COMPLETE TEST
          ++---------+---------+---------+---------+---------+---------++
      14 +                                                    E +
   E  13 +                                              *       +
   X  12 +                                        *             +
   P  11 +                                    *                 +
   E  10 +                                *                     +
   C   9 +                            *                         +
   T   8 +                        *                             +
   E   7 +                    *                                 +
   D   6 +                *                                     +
       5 +             *                                        +
   S   4 +          *                                           +
   C   3 +       *                                              +
   O   2 +     *                                                +
   R   1 +    *                                                 +
   E   0 +  E                                                   +
          ++---------+---------+---------+---------+---------+---------++
           -6       -4        -2         0         2         4         6
                                      MEASURE
```
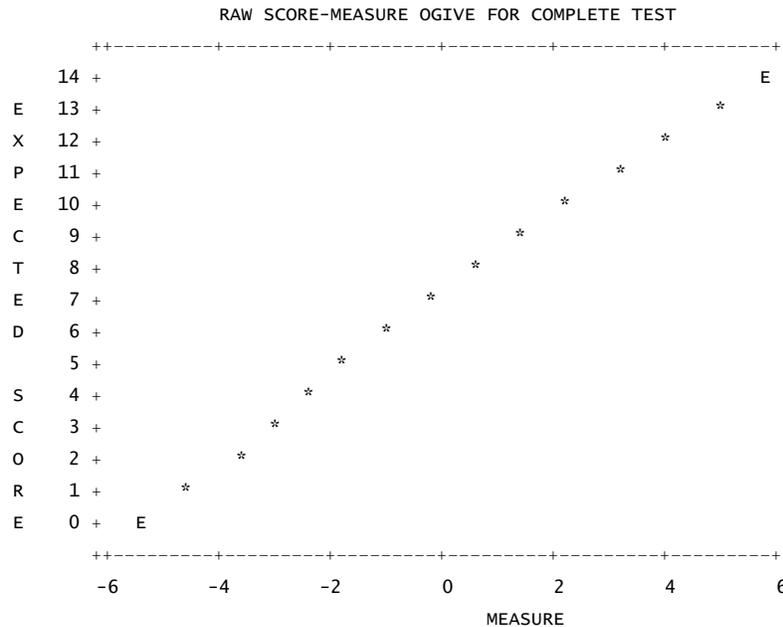
```
         TABLE OF SAMPLE NORMS (500/100) AND FREQUENCIES CORRESPONDING TO COMPLETE TEST
      +----------------------+-----------------------------------------------------+
      | SCORE    MEASURE    S.E.|NORMED S.E.  FREQUENCY %   CUM.FREQ. %  PERCENTILE|
      +----------------------+-----------------------------------------------------+
      |    0    -6.04E    1.45|  241   66      1   2.9      1   2.9         1   |
      |                       |                                                   |
      |    7     -.27    1.11|  504   51     12  34.3     23  65.7        49   |
      |   14     6.51E    1.47|  813   67      0    .0     35 100.0       100   |
      +----------------------+-----------------------------------------------------+
```

The columns in the Table of Sample Norms and Frequencies are:

Measures on the Complete Test:

SCORE raw score on a complete test containing all calibrated items.

MEASURE   measure corresponding to score.

S.E.   standard error of the measure.

Statistics for this sample:

NORMED   measures linearly rescaled so that the mean person measure **for this sample** is 500 and the sample measure standard deviation is 100.

S.E.   standard error of the normed measure.

FREQUENCY   count of sample with measures at or near (for missing data) the complete test measure

%   percentage of sample included in FREQUENCY.

CUM.FREQ.   count of sample with measures near or below the test measure, the cumulative frequency.

%   percentage of sample include in CUM. FREQ.

PERCENTILE   mid-range percentage of sample below the test measure, constrained to the range 1-99.

8.14 Table 20.3 Complete score-to-calibration table for tests based on whole sample

This Table, which must be selected explicitly with TFILE=, shows an estimated item calibration for all possible rates of success by persons, i.e., the item difficulty corresponding to every observable *p-value* for

the entire sample. To select this Table, enter into your control file:
TFILE=*
20.3
*

```
                          TABLE OF ITEM MEASURES ON COMPLETE SAMPLE
                FOR GROUP "0", MODEL "R", ACT    NUMBER:    1  WATCH BIRDS

      +---------------------------------------------------------------------------+
      | SCORE  MEASURE   S.E. | SCORE  MEASURE    S.E. | SCORE  MEASURE    S.E. |
      |----------------------+------------------------+------------------------|
      |     0     8.71E   1.81 |    50     1.91     .22 |   100     -.51     .22 |
      |     1     7.47    1.02 |    51     1.86     .22 |   101     -.56     .22 |
      |     2     6.72     .74 |    52     1.82     .22 |   102     -.61     .22 |
      |     3     6.26     .62 |    53     1.77     .22 |   103     -.66     .23 |
      +---------------------------------------------------------------------------+
```

8.15 Table 21 Probability curves
   (controlled by MRANGE=, CURVES=)
The probability of each response is shown across the measurement continuum. The measure to be used for determining the probability of any particular response is the difference between the measure of the person and the calibration of the item. For dichotomies, only one curve is shown plotting the probability of scoring a "1" (correct), and also of scoring a "0" (incorrect) for any measure relative to item difficulty. For 'S' and 'F' models these curves are approximations.

```
                                    DICHOTOMOUS CURVES
          P       ++---------+---------+---------+---------+---------+---------++
          R   1.0 +0000000000000000                       1111111111111111+
          O       |                  000000            111111              |
          B    .8 +                    000        111                      +
          A       |                      00      11                        |
          B    .6 +                        00    11                        +
          I       |                          ***                           |
          L    .4 +                        11    00                        +
          I       |                      11        00                      |
          T    .2 +                    111          000                    +
          Y       |                 111111              000000             |
              .0 +1111111111111111                       0000000000000000+
                  ++---------+---------+---------+---------+---------+---------++
                  -6        -4        -2         0         2         4         6
                             PERSON [MINUS]  ITEM  MEASURE
```
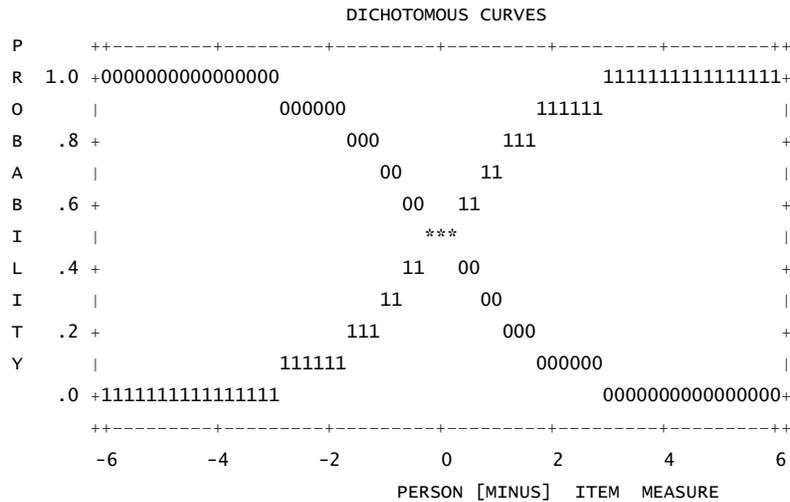
When there are more than two categories, the probability of each category is shown. For scales with three or more categories, two further graphs can be drawn. The second graph depicts the expected score ogive. The vertical "*" characters correspond to integer expected scores, and the "|" characters correspond to half-score point expected scores. For the purposes of inference, measures in the zone on the x-axis between `|' and `|' correspond, on average, to the rating given on the `y' axis, `1'. Similarly ratings on the y-axis can be thought of as corresponding to measures in the matching zone on the x-axis. The degree to which the data support this is given by the COHERENCE statistics in Table 3.

```
              CATEGORY PROBABILITIES: MODES - Step measures at intersections
    P        ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
    R   1.0  +00000000                                         22222222+
    O        |       0000000                             2222222         |
    B    .8  +             000                            222             +
    A        |               000                         222             |
    B    .6  +                 00                       22               +
    I    .5  +                   00*111111111*22                         +
    L    .4  +                 111 00     22 111                         +
    I        |               111      00 22     111                     |
    T    .2  +             1111          22*00       1111                +
    Y        |       1111111       22222     00000       1111111         |
        .0  +********222222222222222             000000000000000********+
             ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
             -5    -4    -3    -2    -1     0     1     2     3     4     5
                                PERSON [MINUS]  ITEM  MEASURE


                        EXPECTED SCORE OGIVE: MEANS
    E        ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
    X    2   +                                            222222222222+
    P        |                                         2222222         |
    E   1.5  +                                       2222              +
    C        |                                   111                   |
    T        |                                 111  |                   |
    E    1   +                               111    |                   +
    D        |                             111 *    |                   |
        .5  +                           111    *    |                   +
    S        |                       0000|     *    |                   |
    C        |                   0000000  |    *    |                   |
    O    0   +000000000000           |    *    |                       +
    R        ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
    E        -5    -4    -3    -2    -1     0     1     2     3     4     5
                                PERSON [MINUS]  ITEM  MEASURE
```

The third graph is of the zone curves which indicate the probability of an item score at or below the stated category for any particular difference between person measure and item calibration. The area to the left of the "0" ogive corresponds to "0". The right-most area corresponds to the highest category. The P=0.5 intercepts are the Thurstone "thresholds".

```
                    THURSTONE THRESHOLDS: MEDIANS - Cumulative probabilities
    P        ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
    R   1.0  +********222222222222222                                   +
    O        |0      1111111        22222                               |
    B    .8  +0            111          222                             +
    A        |0          111            22                              |
    B    .6  +0            11             22                            +
    I    .5  +0--------------------111--------222----------------------+
    L    .4  +0                  | 11       | 22                        +
    I        |0                  |  11      |  222                      |
    T    .2  +0                  |    111   |     222                   +
    Y        |0                  |       11111      2222222             |
        .0  +0                  |          |  1111111111111111********+
             ++-----+-----+-----+-----+-----+-----+-----+-----+-----+-----++
             -5    -4    -3    -2    -1     0     1     2     3     4     5
                                PERSON [MINUS]  ITEM  MEASURE
```
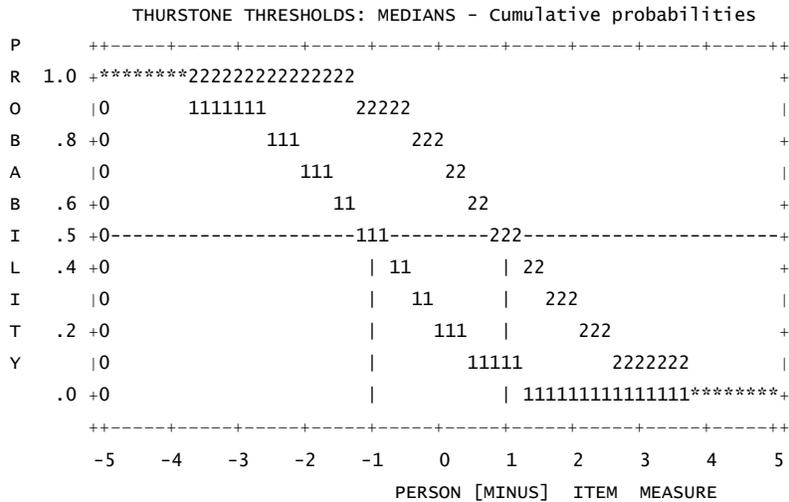
8.16 Table 22.1 Sorted observed data matrix (scalogram)

The observations are printed in order of person and item measures, with most able persons listed first, the easiest items printed on the left. This scalogram shows the extent to which a Guttman pattern is approximated.

```
            GUTTMAN SCALOGRAM OF RESPONSES:
                   PERSON| ITEM
                  |1111112 1 221 1 21    22
                  |89203112514276435697840 35
                  +------------------------
            41  +2222222222222222222222222212
            17  +2222222222222222222222222210
            45  +2222222222222222222222221200
            40  +2222222222222122212101100
            65  +22222222110111010201011 22
             1  +222222222121100101 1201001
                  +------------------------
                  |1111112211221613219784225
                  |8920311 5 427 4 56    03
```

8.17 Table 22.2 Guttman scalogram of zoned responses.

The scalogram is that of Table 22.1, but with each observation marked as to whether it conforms with its expectation or not. Observations within 0.5 rating points of their expectation are deemed to be in their expected categories, and are reported with their category values, e.g., `1', `2', etc. These ratings support the overall inferential relationship between observations and measures. Observations more than 0.5 rating points away from their expectations, i.e., in a "wrong" category, are marked with a letter equivalent: `A' = `0',`B' = `1',`C' = `2', etc. These contradict observation-to-measure inferences. The proportion of in- and out-of-category observations are reported by the COHERENCE statistics in Table 3.

```
            GUTTMAN SCALOGRAM OF ZONED RESPONSES:
                   PUPIL |ACT
                  |111111 2 1221  121   2 2
                  |89012311254276345697800435
                  |------------------------
            41  +22222222222222222222222222B2
            17  +22222222222222222222222222BA
            45  +2222222222222222222222CC1AA
            40  +2222222222222B222121A11AA
            70  +222222222222222BBCBCAACAA
            33  +222222222222221C1A11CACAA
            38  +222222222222B21111111C11A
            43  +2222222222221C111CCAAAA1
            74  +2222222222B22CCCCCACAAAAA
            60  +222222B2222BB1C111C1111A1
            65  +222222122BA1111AACA1A11CC
             1  +222222122CC11A1AA11CA010B
                  |------------------------
                  |1111111221221631219782425
                  |890123 1 5427  456   0 3
```

8.18 The title page

This page contains the authorship and version information, the TITLE=, control file, output file and the date of the analysis. A list of tables is provided to remind you of what you can request using TABLES=. Those you did request are marked by "*".

```
╔══════════════════════════════════════════════════════════════════════════╗
║                                                                          ║
║                    * * * *  B I G S T E P S  * * * *                     ║
║                    --------------------------------                      ║
║                                                                          ║
║                                                                          ║
╚══════════════════════════════════════════════════════════════════════════╝

                  TITLE= LIKING FOR SCIENCE (Wright & Masters p.18)
                      CONTROL FILE: /data/example/hold/sf.dat
                               OUTPUT FILE: sf.out
                              DATE: Nov 20 13:45 1996

       +-----------------------------------+------------------------------------+
       |      OVERVIEW TABLES               |       ITEM CALIBRATIONS            |
       +-----------------------------------+------------------------------------+
       | 1* PERSON AND ITEM DISTRIBUTION MAP | 12  ITEM MAP BY NAME              |
       | 2* MOST PROBABLE RESPONSES/SCORES   | 13  ITEM MEASURES IN DIFFICULTY ORDER|
       | 3* PERSON, ITEM AND STEP SUMMARY    | 14  ITEM MEASURES IN ENTRY ORDER  |
       +-----------------------------------+ 15* ITEM MEASURES IN ALPHA ORDER   |
       |      PERSON FIT                    +------------------------------------+
       +-----------------------------------+      PERSON MEASURES               |
       | 4  PERSON PLOT OF INFIT vs ABILITY +------------------------------------+
       | 5  PERSON PLOT OF OUTFIT vs ABILITY | 16* PERSON MAP BY NAME            |
       | 6  PERSON MEASURES IN FIT ORDER     | 17* PERSON MEASURES IN ABILITY ORDER |
       | 7* DIAGNOSIS OF MISFITTING PERSONS  | 18  PERSON MEASURES IN ENTRY ORDER |
       +-----------------------------------+ 19  PERSON MEASURES IN ALPHA ORDER |
       |      ITEM FIT                      +------------------------------------+
       +-----------------------------------+      REFERENCE TABLES              |
       | 8  ITEM PLOT OF INFIT vs DIFFICULTY +------------------------------------+
       | 9  ITEM PLOT OF OUTFIT vs DIFFICULTY| 20* SCORE TABLE                   |
       |10  ITEM MEASURES IN FIT ORDER       | 21  CATEGORY PROBABILITY CURVES   |
       |11  DIAGNOSIS OF MISFITTING ITEMS    | 22  SORTED RESPONSES LISTING      |
       +-----------------------------------+------------------------------------+
```

Tables selected by the TABLES= specification are flagged with `*' next to the Table number.

8.19 Table 0.1 Control variables report

On the second page are listed the settings of all the control variables for this analysis. Those not specified in your control file have been set to their default values.

```
         TITLE= LIKING FOR SCIENCE (Wright & Masters p.18)
CONTROL FILE: sf.dat
 OUTPUT FILE: sf.out
        DATE: Nov 24  9:18 1996
CONTROL VARIABLES:
Input Data Format        EXTRSC = .300              --------------
  DATA =                  HIADJ = .250              Item Delete/Anchor
 NAME1 = 51              LOWADJ = .250              IDFILE =
NAMLEN = 30              REALSE = N                 IDELQU = N
 ITEM1 = 1               STBIAS = Y                 IAFILE =
```

```
   ITLEN = 30          ---------------       IANCHQ = N
      NI = 25          Misfit Selection      ---------------
   XWIDE = 2             FITI = 2.000        Person Delete/Anchor
   INUMB = N             FITP = 2.000        PDFILE =
---------------         OUTFIT = Y           PDELQU = N
Data Scoring            LOCAL = N             PSEL = *
 CODES = "000102"       NORMAL = N           PAFILE =
MISSING = 255            PTBIS = Y           PANCHQ = N
RESCOR =               ---------------       ---------------
NEWSCORE =              Special Table Control  Step/Cat Delete/Anchor
KEY1   =               CATREF = 0            SDFILE =
KEYSCR =               CURVES = 111          SDELQU = N
 CUTHI = .000          DISTRT = Y            SAFILE =
 CUTLO = .000          FRANGE = .000         SANCHQ = N
---------------        LINLEN = 80           ---------------
Output Tables          NAMLMP = 20           Export Files
 TITLE = LIKING FOR SCIEN  STEPT3 = Y           CSV = Y
TABLES = 1111111111111111   T1I# = 0         HLINES = Y
 TFILE =                 T1P# = 0            IFILE = SF.IF
FORMFD = ^              ISORT = 1            ISFILE =
MAXPAG = 0              PSORT = 1            PFILE = SF.PF
  ITEM = ACT            ---------------      RFILE = SF.RF
PERSON = PUPIL          Convergence Control  SFILE = SF.SF
 ASCII = Y              MPROX = 10           XFILE = SF.XF
---------------         MUCON = 0            ---------------
User Scaling            LCONV = .010         Data Reformat
 UMEAN = .000           RCONV = .500         FORMAT =
USCALE = 1.000          TARGET = N           GRPFRM = N
UDECIM = 2             ---------------       KEYFRM = 0
 UANCH = Y              Scale Structure      MODFRM = N
MRANGE = .000           GROUPS =             RESFRM = N
---------------         MODELS = R           SPFILE =
Adjustment              STKEEP = N           ---------------
```

§ This is used to check that your specifications were understood correctly.

8.20 Table 0.2 Convergence report
(controlled by LCONV=, RCONV=, MPROX=, MUCON=, CUTLO=, CUTHI=)

```
                          CONVERGENCE TABLE
   +-----------------------------------------------------------------------+
   |   PROX        ACTIVE COUNT       EXTREME 5 RANGE    MAX LOGIT CHANGE  |
   | ITERATION  PERSONS ITEMS   CATS   PERSONS ITEMS     MEASURES    STEPS |
   +-----------------------------------------------------------------------+
   |     1         76      25      3    3.78    3.20      3.8918     .0740 |
   |     2         74      25      3    4.53    3.67       .7628    -.6167 |
   |     3         74      25      3    4.73    3.85       .2143    -.0991 |
   |     4         74      25      3    4.82    3.90       .0846    -.0326 |
   +-----------------------------------------------------------------------+
   |   UCON     MAX SCORE   MAX LOGIT   LEAST CONVERGED    CATEGORY   STEP  |
   | ITERATION  RESIDUAL*    CHANGE    PERSON  ITEM   CAT  RESIDUAL  CHANGE |
   +-----------------------------------------------------------------------+
   |     1        3.01      -.4155       60    24*    2     27.64   -.0184 |
   |     2         .50      -.0258       53    24*    1      6.88    .0198 |
```

```
|      3        -.37    .0292    53    5*    1      3.10    .0091 |
|      4         .26    .0206    53   21*    1      2.74    .0079 |
|      5         .20    .0154    53   21*    0     -1.90    .0056 |
|      6         .15    .0113    53   21*    0     -1.42    .0042 |
|      7         .11    .0083    53   21*    0     -1.05    .0030 |
+-----------------------------------------------------------------------+
        Standardized Residuals N(0,1)   Mean:  .06 S.D.: 1.05
```

§ Look for scores and residuals in last line to be close to 0, and standardized residuals to be close to mean 0.0, S.D. 1.0.

The meanings of the columns are:

PROX   normal approximation algorithm - for quick initial estimates

ITERATION   number of times through your data to calculate estimates

ACTIVE COUNT   number of elements participating in the estimation process after elimination of deletions and perfect/zero scores

      PERSONS   person parameters

      ITEMS item parameters

      CATS   scale categories - shows 2 for dichotomies

EXTREME 5 RANGE

      PERSONS   The current estimate of the spread between the average measure of the top 5 persons and the average measure of the bottom 5 persons.

      ITEMS The current estimate of the spread between the average measure of the top 5 items and the average measure of the bottom 5 items.

MAX LOGIT CHANGE

      MEASURES   maximum logit change in any person or item estimate. This i expected to decrease gradually until convergence, i.e., less than LCONV=.

      STEPS   maximum logit change in any step difficulty estimate - for your information - need not be as small as MEASURES.

UCON   unconditional maximum likelihood algorithm - for precise estimates

ITERATION   number of times through your data to calculate estimates

      § It is unusual for more than 100 iterations to be required

MAX SCORE RESIDUAL   maximum score residual (difference between integral observed core and decimal expected score) for any person or item estimate - used to compare with RCONV=. This number is expected to decrease gradually until convergence acceptable.

*   indicates to which person or item the residual applies.

MAX LOGIT CHANGE   maximum logit change in any person or item estimate - used to compare with LCONV=. This number is expected to decrease gradually until convergence is acceptable.

LEAST CONVERGED element numbers are reported for the person, item and category farthest from meeting the convergence criteria.

*   indicates whether the person or the item is farthest from convergence.

CATEGORY RESIDUAL   maximum count residual (difference between integral observed count and decimal expected count) for any scale category - for your information. This number is expected to decrease gradually. Values

less than 0.5 have no substantive meaning.

STEP CHANGE   maximum logit change in any step calibration. Not used to decide convergence, but only for your information. This number is expected to decrease gradually.

Standardized Residuals These are modeled to have a unit normal distribution. Gross departures from mean of 0.0 and standard deviation of 1.0 indicate that the data do not conform to the basic Rasch model specification that randomness in the data be normally distributed.

Appendix 1: Order of Elements in Control File

Element	Condition for Occurrence
&INST	optional
TITLE= title of analysis	recommended
ITEM1= starting column of items	**Required**
NI= number of items	**Required**
GROUPS= grouping information	optional, with GRPFRM=N (the default)
MODELS= model information	optional, with MODFRM=N (the default)
RESCORE= rescore information	optional, with RESFRM=N (the default)
KEY1= key information	optional, if KEYFRM= omitted (the default)
KEY2= ..	optional, if KEYFRM= omitted (the default)
KEYn= ..	optional, if KEYFRM= omitted (the default) (n=1 to 99, number of largest key)
other control variables	optional
; comments	optional
&END	**Required**
GROUPS= (in data file format)	required if GRPFRM=Y
MODELS= (in data file format)	required if MODFRM=Y
RESCORE= (in data file format)	required if RESFRM=Y
KEY1= (in data file format)	required if KEYFRM=1 or more
KEY2= ..	required if KEYFRM=2 or more, and so on up to
KEYn= (in data file format)	required if KEYFRM=n
Item Names (must be NI= names)	required if INUMB=N (the default)
END NAMES	required if INUMB=N (the default)
data records	required if DATA=" " (the default)

Appendix 2: Diagnosing misfit

<table>
<tr><td colspan="5" align="center">Diagnosing Misfit</td></tr>
<tr><td>Classification</td><td>INFIT</td><td>OUTFIT</td><td>Explanation</td><td>Investigation</td></tr>
<tr><td></td><td>Noisy</td><td>Noisy</td><td>Lack of convergence
Loss of precision
Anchoring</td><td>Final values in Table 0 large?
Many categories? Large logit range?
Displacements reported?</td></tr>
<tr><td rowspan="2">Hard Item</td><td>Noisy</td><td>Noisy</td><td>Bad item</td><td>Ambiguous or negative wording?
Debatable or misleading options?</td></tr>
<tr><td>Muted</td><td>Muted</td><td>Only answered by top people</td><td>At end of test?</td></tr>
<tr><td rowspan="4">Item</td><td rowspan="3">Noisy</td><td>Noisy</td><td>Qualitatively different item
Incompatible anchor value</td><td>Different process or content?
Anchor value incorrectly applied?</td></tr>
<tr><td>?</td><td>Biased (DIF) item</td><td>Stratify residuals by person group?</td></tr>
<tr><td>Muted</td><td>Curriculum interaction</td><td>Are there alternative curricula?</td></tr>
<tr><td>Muted</td><td>?</td><td>Redundant item</td><td>Similar items?
One item answers another?
Item correlated with other variable?</td></tr>
<tr><td rowspan="2">Rating scale</td><td>Noisy</td><td>Noisy</td><td>Extreme category overuse</td><td rowspan="2">Poor category wording?
Combine or omit categories?
Wrong model for scale?</td></tr>
<tr><td>Muted</td><td>Muted</td><td>Middle category overuse</td></tr>
<tr><td>Person</td><td>Noisy</td><td>?</td><td>Processing error
Clerical error
Idiosyncratic person</td><td>Scanner failure?
Form markings misaligned?
Qualitatively different person?</td></tr>
<tr><td>High Person</td><td>?</td><td>Noisy</td><td>Careless
Sleeping
Rushing</td><td>Unexpected wrong answers?
Unexpected errors at start?
Unexpected errors at end?</td></tr>
<tr><td rowspan="2">Low Person</td><td>?</td><td>Noisy</td><td>Guessing
Response set
"Special" knowledge</td><td>Unexpected right answers?
Systematic response pattern?
Content of unexpected answers?</td></tr>
<tr><td>Muted</td><td>?</td><td>Plodding
Caution</td><td>Did not reach end of test?
Only answered easy items?</td></tr>
<tr><td rowspan="2">Person/Judge Rating</td><td>Noisy</td><td>Noisy</td><td>Extreme category overuse</td><td>Extremism? Defiance?</td></tr>
<tr><td>Muted</td><td>Muted</td><td>Middle category overuse</td><td>Conservatism? Resistance?</td></tr>
<tr><td>Judge Rating</td><td></td><td></td><td>Apparent unanimity</td><td>Collusion?</td></tr>
<tr><td colspan="5">INFIT: information-weighted mean-square, sensitive to irregular inlying patterns
OUTFIT: usual unweighted mean-square, sensitive to unexpected rare extremes
Muted: unmodelled dependence, redundance, error trends
Noisy: unexpected unrelated irregularities</td></tr>
</table>

See *BTD* p. 2-4, 66-82, 23-24, 121-125, 165-190; *RSA* p. 19-23, 94-105, 108-111 for basics. *RSA* p. 132-135, 147-151, 171-178, 190-198 for examples.

Appendix 3: Diagnosis of Error Codes (IOSTAT=)

Error codes are reported for which no automatic action is possible. Errors codes may be reported as "IOSTAT=" followed by a number, or in some other manner.

0   Error not detected. Processing has stopped itself.
1   Invalid function.
2   File not found.
3   Path not found.
4   Too many open files.
5   Access denied.
6   Invalid internal file identifier.
7   Storage control blocks destroyed.
8   Insufficient memory.
9   Invalid block address.
10   Environment incorrect.
11   Incorrect program format.
12   Invalid access code.
13   Invalid data.
14   Insufficient memory.
15   Invalid drive.
16   Current directory cannot be removed.
17   File cannot be moved to a different disk drive.
18   No more files.
19   Media is write protected.
20   Specified drive cannot be found.
21   The drive is not ready.
22   The device does recognize the command.
23   Data error.
24   Command length is incorrect.
25   Drive seek error.
26   The specified disk cannot be accessed.
27   The specified sector cannot be found.
28   The printer is out of paper.
29   Cannot write to specified device.
30   Cannot read from specified device.
31   Device is not responding.
32   The file is already open by another process.
33   Another process has locked the file.
34   The wrong disk is the drive.
36   Too many files open for sharing.
38   Reached end of file.
39   The disk is full.

10000   File not open for read.
10001   File not open for write.
10002   File not found.
10003   Record length negative or 0.
10004   Buffer allocation failed.
10005   Bad iolist specifier.

10006   Error in format string.
10007   Illegal repeat count.
10008   Hollerith count exceeds remaining format string.
10009   Format string missing opening "(".
10010   Format string has unmatched parentheses.
10011   Format string has unmatched quotes.
10012   Non-repeatable format descriptor.
10013   Attempt to read past end of file.
10014   Bad file specification.
10015   Format group table overflow.
10016   Illegal character in numeric input.
10017   No record specified for direct access.
10018   Maximum record number exceeded.
10019   Illegal file type for namelist directed I/O.
10020   Illegal input for namelist directed I/O.
10021   Variable not present in current namelist.
10022   Variable type or size does not match edit descriptor.
10023   Illegal direct access record number.
10024   Illegal use of internal file.
10025   RECL= only valid for direct access files.
10026   BLOCK= only valid for unformatted sequential files.
10027   Unable to truncate file after rewind, backspace, or endfile.
10028   Can't do formatted 1/0 on an entire structure.
10029   Illegal (negative) unit specified.
10030   Specifications in re-open do not match previous open.
10031   No implicit OPEN for direct access files.
10032   Cannot open an existing file with STATUS='NEW'.
10033   Command not allowed for unit type.
10034   MRWE is required for that feature.
10035   Bad specification for window.
10036   Endian specifier not BIG§ENDIAN or LITTLE§ENDIAN.
10037   Cannot ENDIAN convert entire structures.
10038   Attempt to read past end of record.
10039   Attempt to read past end of record in non-advancing I/O.
10040   Illegal specifier for ADVANCE=.
10041   Illegal specifier for DELIM=.
10042   Illegal specifier for PAD=.
10043   SIZE= specified with ADVANCE=YES.
10044   EOR= specified with ADVANCE=YES.
10045   Cannot DEALLOCATE disassociated pointer or unallocated array.
10046   Cannot DEALLOCATE a portion of an original allocation.
10047   An allocatable array has already been allocated.
10048   Internal or unknown runtime library error.
10049   Unknown data type passed to runtime library.
10050   Illegal DIM argument to array intrinsic.
10051   Size of SOURCE argument to RESHAPE smaller than SHAPE array.
10052   SHAPE array for RESHAPE contains a negative value.
10053   Unallocated or disassociated array passed to inquiry function.
10054   The ncopies argument to REPEAT is negative.
10055   The S argument to NEAREST is negative.

10056   The ORDER argument to RESHARE contains an illegal value.
10057   Result of TRANSFER with no SIZE is smaller than source.
10058   SHAPE array for RESHAPE is zero sized array.
10059   VECTOR argument to UNPACK contains insufficient values.
10060   Attempt to write a record longer than specified record length.
10061   ADVANCE= specified for direct access or unformatted file.
10062   NAMELIST name is longer than specified record length.
10063   NAMELIST variable name exceeds maximum length.
10064   PAD= specified for unformatted file.
10065   NAMELIST input contains multiple strided arrays.
10066   Expected & or $ as first character for NAMELIST input.
10067   NAMELIST group does not match current input group.
10068   Pointer or allocatable array not associated or allocated.
10069   NAMELIST input contains negative array stride.
10070   Runtime memory allocation fails.

-1 & 6405 & 6501   End of file has been reached unexpectedly. Are all control variables, item names
                        and data records present, e.g., END NAMES (see Appendix 2)?
6100   You are trying to set an integer control variable outside the range ±32,676.
6101   An integer is expected, but something else has been found. Are there person, item or category
        numbers in your deletion and anchor files?
6103   A number is expected, but something else has been found. Are your anchor values specified
        correctly?
6209   You assigned two files with the same name.
6311   You are trying to process more than 32,676 persons.
6405   See -1 above.
6413   You have specified two different files with the same name, e.g. your output file and your IFILE=
        must have different names.
6414   You tried to access a protected file or a directory index.
6416   An input file cannot be found, or an output file cannot be written.
6417   DOS needs a larger file area. Increase the number in your FILES= statement in your CONFIG.SYS
        file.
6421   You tried to write to a read-only or locked file. In WINDOWS, does another program still have
        your file open?
6422   You've run out of disk space, see Section 2.11.2.
6501   See -1 above.
6700   Your analysis requires more RAM memory, see Section 2.11.1.
6701   Temporary file names exhausted. Delete all files "BIGSTEPS.$??"

If your FORMAT= control value is somewhat awry:
6205   "A" edit descriptor problem, e.g. ZA instead of 2A or l for 1, or O for 0
6502   Repeat field not a positive integer, e.g. 7.3A1 instead of 7A1
6503   Multiple repeat field, e.g. 2*3 instead of 6
6504   Invalid number, e.g. 7D mistyped for 70
6980   Integer expected, e.g. T2Z mistyped for T22
6981   Initial left parenthesis expected. FORMAT= must start with (
6982   Positive integer required, e.g. 0X is not allowed.
6983   Invalid repeat count, e.g 3T22 is not allowed, only T22
6984   An integer must precede X, e.g. X is not allowed, use 1X
6985   B must be followed by N or Z

6986   Parentheses () can go no more than 16 levels deep.
6987   F,D,E,G fields must contain a . e.g. F6 instead of F6.0
6988   Not enough) in format.
6989   Unknown or missing character in format, e.g. two commas together: ,,
6990   Too many leading zeroes specified in I format, e.g. I6.7 instead of I6.6
6991   Numerical value greater than 32766 in FORMAT= statement.
6099 & 6104   Your analysis has exceeded computational abilities; reduce the size of
Other codes   your analysis. Since these codes may indicate program malfunction, please report them to
           www.winsteps.com.

Error Messages and Common Diagnoses

1) Message: VARIABLE UNKNOWN OR VALUE INVALID: WPC
Diagnosis: Your control file is in WordPerfect format. The control file must be DOS Text or ASCII.
           Return to WordPerfect and save your control file as a DOS Text file. Then rerun.

2) Message: VARIABLE UNKNOWN OR VALUE INVALID: ⊥⊥α▦
Diagnosis: Your control file is in Word for Windows format. The control file must be DOS Text or
           ASCII files. Return to Word for Windows save your control file as MS-DOS Text. Then
           rerun.

3) Message: PROBLEM: BLANK LINE NEEDED AT END OF: *filename*
Diagnosis: The last line of file "*filename*" does not end with a line-feed (LF) code. This can be fixed
           by adding a blank line to the end of that file.

4) Message: BEYOND CAPACITY
Diagnosis: Your data file contains more person records than can be analyzed in one run. Some records
           have been bypassed.

Data sets that exceed program to analyze in one run offer opportunities, as well as challenges. There are several strategies.

I.   Analyze a sample of the data. Use this to produce anchor values. Then, using the anchor values, run all the data one section at a time.

II.   Analyze a sample of the data. Analyze another sample. Compare results to identify instability and compute reasonable anchor values. Remember that small random changes in item calibrations have negligible effect on person measures.

To select a sample of your data, use the FORMAT= statement. See the example on pseudo-random person selection.

Appendix 4: What is a Logit?

A logit (log-odds unit) is a unit of interval measurement which is well-defined within the context of a single homogeneous test. When logit measures are compared between tests, their probabilistic meaning is maintained but their substantive meanings may differ. This is often the case when two tests of the same construct contain items of different types. Consequently, logit scales underlying different tests must be equated before the measures can be meaningfully compared. This situation is parallel to that in Physics when some temperatures are measured in degrees Fahrenheit, some in Celsius, and others in Kelvin.

> § As a first step in the equating process, plot the pairs of measures obtained for the same elements (e.g. persons) from the two tests. You can use this plot to make a quick estimate of the nature of the relationship between the two logit scales. If the relationship is not close to linear, the two tests may not be measuring the same thing.

Logit-to-Probability Conversion Table

Logit difference between ability measure and item calibration	Probability of success on a dichotomous item	Logit difference between ability measure and item calibration	Probability of success on a dichotomous item
5.0	99%	-5.0	1%
4.6	99%	-4.6	1%
4.0	98%	-4.0	2%
3.0	95%	-3.0	5%
2.2	90%	-2.2	10%
2.0	88%	-2.0	12%
1.4	80%	-1.4	20%
1.1	75%	-1.1	25%
1.0	73%	-1.0	27%
0.8	70%	-0.8	30%
0.5	62%	-0.5	38%
0.4	60%	-0.4	40%
0.2	55%	-0.2	45%
0.1	52%	-0.1	48%
0	50%	0	50%

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Appendix 5: Rasch two-facet measurement models in BIGSTEPS

Type of Data	Observed Categories	Ordinal Interpretation	Step Score	Measurement Model for $\text{Log}[P_{nij}/P_{nij-1}] = ?$
Dichotomy Rasch	no yes	less more	0 1	$B_n - D_i$ $j=1$
Rating scale Andrich	1 2 . m+1	least most	0 1 . m	$B_n - D_i - F_j$ $j=1,m$
Partial credit Masters	A B . Z	highest lowest	m_i m_{i-1} . 0	$B_n - D_i - F_{ij}$ $j=1,m_i$
Rank order	1 2 . m_i m_i+1	first last	m_i m_{i-1} . 1 0	$B_n - F_j$ (complete) $B_n - F_{ij}$ (partial) $j=1,m_i$
Success Glas & Verhelst	0 1 . m_i-1 m_i	1st "item" wrong 2nd "item" wrong ... mth "item" wrong mth "item" *right*	0 10 11.. 11..10 11..11	$B_n - D_i - F_{ij}$ $j=1,m_i$
Failure	m_i m_i-1 . 1 0	mth "item" right m-1th "item" right ... 1st "item" right 1st "item" *wrong*	1 10 ..00 10..00 00..00	$B_n - D_i - F_{ij}$ $j=1,m_i$

B_n is the person (row) ability

D_i is the item (column) difficulty

F_j is the additional difficulty of the step into category *j* from category *j-1*

Appendix 6: Output Tables

Table	Description
0	**Control Variables and Convergence report**. Lists the control variables and shows the convergence of the PROX and UCON estimation procedures after each iteration.
1 *	**Joint distribution map**. Horizontal histograms of person and item distributions. Item and Person distribution maps, if small.
2 *	**Most probable response plot**. The most probable categories for each item, listed in difficulty order, are plotted against the range of person measures. If there are rating scales, this is followed by a similar plot of the expected scores and Thurstone thresholds.
3 *	**Summary statistics**. Person, item, and category/step distribution and fit statistics.
4	**Person infit plot**. Person infits plotted against person measures.
5	**Person outfit plot**. Person outfits plotted against person measures. Infit vs. outfit plot, if both Tables 4 and 5 requested.
6 *	**Person** statistics - **fit** order. Only misfitting persons are shown (see FITP=). Unexpected responses in Guttman format.
7 *	**Misfitting Persons**. Lists response details for persons with standardized fit greater than FITP=.
8	**Item infit plot**. Item infits plotted against item calibrations.
9	**Item outfit plot**. Item outfits plotted against item calibrations. Infit vs. outfit plot, if both Tables 8 and 9 requested.
10 *	**Item** statistics - **fit** order. Only misfitting items are shown (see FITI=) with option counts". Unexpected responses in Guttman format. If PRCOMP= specified, shows largest item correlations and principal components analysis.
11	**Misfitting Items**. Response details for items with standardized fit greater than FITI=.
12	**Item distribution map**. Horizontal histogram of item distribution with abbreviated item names.
13 *	**Item** statistics - **difficulty** order with option counts".
14	**Item** statistics - **entry** order with option counts".
15	**Item** statistics - **alphabetical** order with option counts".
16	**Person distribution map**. Horizontal histogram of person distribution, with abbreviated person-ids.
17 *	**Person** statistics - **measure** order.
18	**Person** statistics - **entry** order.
19	**Person** statistics - **alphabetical** order.
20	**Measures for all scores** on a test of all calibrated items, with percentiles. 20.3 for persons.
21	**Category probability curves**. Category probabilities plotted against the difference between person and item measures, then the expected score and cumulative probability and expected score ogives.
22	**Sorted observations**. Data sorted by person and item measures into a Guttman scalogram pattern.

* Recommended (default selection for TABLES=).   " Option (distracter) counts shown if DISTRT=Y (the default)

INDEX of CONTROL VARIABLES