



Conventional single-group IRT analysis

This example illustrates how the BILOG-MG program can be used for traditional IRT analyses. The data are responses to 15 multiple-choice mathematics items that were administered to a sample of eighth-grade students. The answer key and the omitted response key are in files called **exampl01.key** and **exampl01.omt**, respectively (defined on the INPUT command).

The data lines, of which the first few lines are shown below, contain 15 item responses. This is the simplest form in which raw data can be read from file: there is one line of data for each examinee, and the response to item 1, for example, can always be found in column 6. All items are used on the single subtest. Item responses start in column 6 as reflected in the format statement (4A1,1X,15A1).

```
1 242311431435242
2 243323413213131
3 142212441212312
4 341211323253521
```

Exampl01.key contains a single line:

```
KEY 341421323441413
```

With such a short test (15 items), item chi-squares are not reliable. For illustration purposes the minimum number of items needed for chi-square computations has been reduced from the default of 20 to the number of items in this test, using the CHI keyword on the CALIB command. With the item chi-squares computed, the PLOT=1 specification can now be used to plot all the item response functions.

Note that the ICCs produced with the IRTPLOT program in the Windows version of BILOG-MG display the χ^2 -test statistics, degrees of freedom, and probability, as well as the observed response probabilities only for those items that have a significance level below the value specified with the PLOT keyword.

The scoring phase includes an information analysis (INFO = 2) with expected information indices for a normal population (POP). Rescaling of the scores and item parameters to mean 0 and standard deviation 1 in the estimated latent distribution has been requested (RSC = 4). Printing of the students' scores on the screen is suppressed (NOPRINT), because that information is saved in the **exampl01.sco** file.

```
EXAMPL01.BLM - TRADITIONAL IRT ANALYSIS OF A FIFTEEN-ITEM PRETEST FROM
                A TWO-STAGE TEST OF MATHEMATICS AT THE EIGHTH-GRADE LEVEL
>GLOBAL  DFNAME='EXAMPL01.DAT', NPARM=3, SAVE;
>SAVE    PARM='EXAMPL01.PAR', SCORE='EXAMPL01.SCO';
>LENGTH NITEMS=15;
>INPUT   NTOTAL=15, NALT=5, NIDCHAR=4,
         KFNAME='EXAMPL01.KEY', OFNAME='EXAMPL01.OMT';
```

```
>ITEMS INAMES=(MATH01(1)MATH15);  
>TEST1 TNAME='PRETEST', INUMBER=(1(1)15);  
(4A1,1X,15A1)  
>CALIB NQPT=31, CYCLES=25, NEWTON=10, CRIT=0.001, ACCEL=0.0, CHI=15, PLOT=1;  
>SCORE NOPRINT, RSCTYPE=4, INFO=2, POP;
```

Phase 1 output

This is a standard 3-parameter, one-form, single-group analysis of a 15 item test. The Phase 1 classical item statistics for the first 5 items are as follows.

ITEM STATISTICS FOR SUBTEST PRETEST

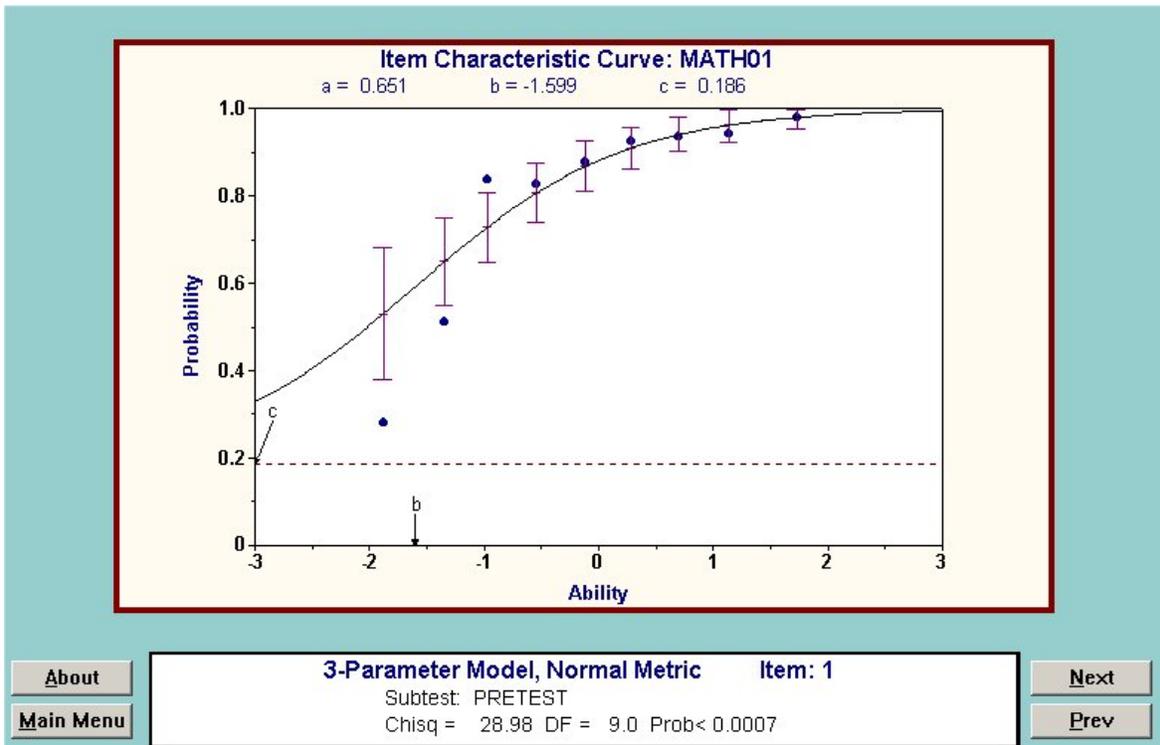
| ITEM | NAME | #TRIED | #RIGHT | PCT | ITEM*TEST CORRELATION | | |
|------|--------|--------|--------|------|-----------------------|---------|----------|
| | | | | | LOGIT/1.7 | PEARSON | BISERIAL |
| 1 | MATH01 | 1000.0 | 844.0 | 84.4 | -0.99 | 0.274 | 0.415 |
| 2 | MATH02 | 1000.0 | 972.0 | 97.2 | -2.09 | 0.112 | 0.285 |
| 3 | MATH03 | 1000.0 | 696.0 | 69.6 | -0.49 | 0.356 | 0.468 |
| 4 | MATH04 | 1000.0 | 503.0 | 50.3 | -0.01 | 0.442 | 0.553 |
| 5 | MATH05 | 1000.0 | 594.0 | 59.4 | -0.22 | 0.477 | 0.603 |

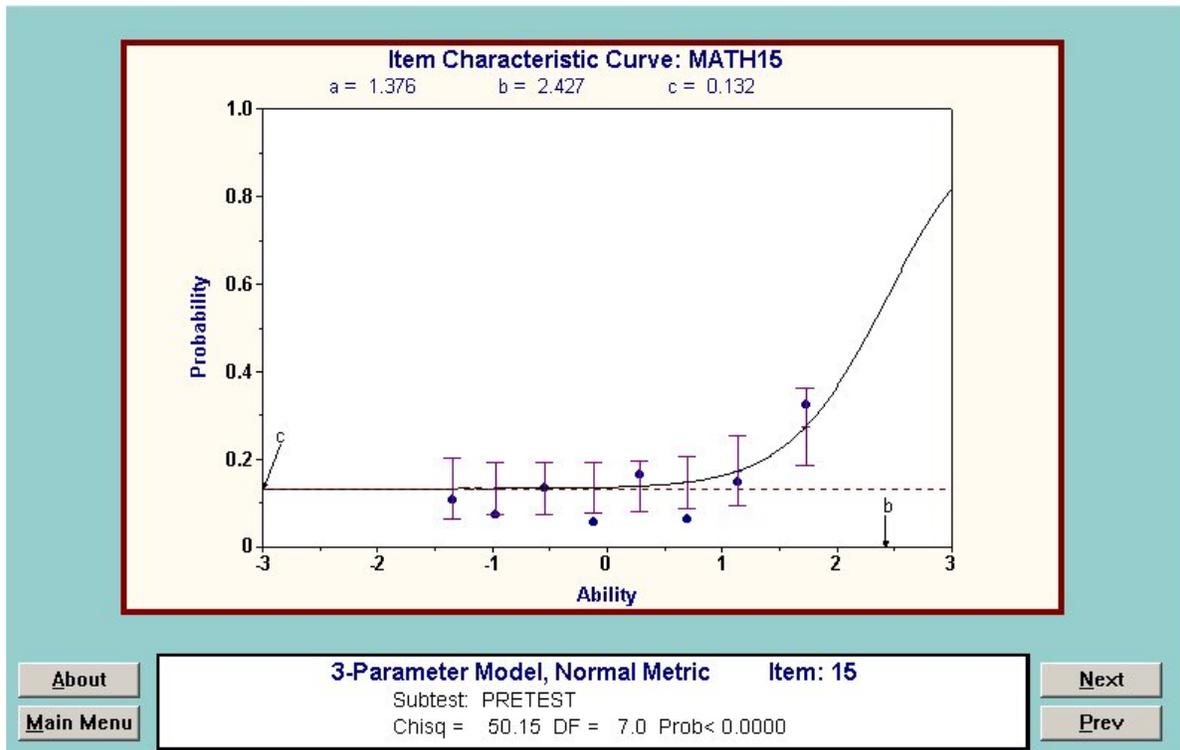
Phase 2 output

No new features are illustrated in the Phase 2 analysis, except that the plot criterion has been set to include all items.

```
>CALIB  NQPT=31, CYCLES=25, NEWTON=10, CRIT=0.001, ACCEL=0.0, CHI=15, PLOT=1;
```

The first and last item response function plots are shown below. The first item is extremely easy and the last extremely difficult. These plots were produced using the IRTGRAPH procedure, which is accessed via the **Plot** option on the **Run** menu after completion of the analysis. Note that the Phase 2 output file also contains similar line plots.





Phase 3 output

With this short, wide range test, ten quadrature points are sufficient for scoring. The item parameters are rescaled so that the scores have mean zero and standard deviation one in the latent distribution estimated from the full sample of 1000 examinees. Population characteristics of the score information, including the IRT estimate of test reliability (equal to $[\text{score variance} - 1/\text{average information}] / \text{score variance}$) are shown with the information plot.

```
>SCORE, NOPRINT, RSCTYPE = 4, INFO = 2, POP;
```

| TEST | NAME | QUAD POINTS | RESCALING SCALE | CONSTANTS LOCATION |
|------|---------|-------------|-----------------|--------------------|
| 1 | PRETEST | 10 | 1.000 | 0.000 |

```
ITEM INFORMATION STATISTICS FOR TEST PRETEST FORM 1
FOR A NORMAL POPULATION WITH MEAN = 0.000 AND S.D. = 1.000
```

| ITEM | MAXIMUM INFORMATION STANDARD ERROR * | POINT OF MAX INFORMATION STANDARD ERROR * | MAXIMUM EFFECTIVENESS POINT OF MAX EFFECTIVENESS * | AVERAGE INFORMATION INDEX OF RELIABILITY |
|--------|--------------------------------------|---|--|--|
| MATH01 | 0.2142 0.0579* | -1.3703 0.2226* | 0.0587 -0.5284* | 0.1206 0.1076* |

(Similar output omitted)

| | | | | |
|--------|-------------------|-------------------|--------------------|-------------------|
| MATH15 | 1.0608 0.8638* | 2.5110 0.3388* | 0.0375 -1.9279* | 0.0476 0.0454* |
|--------|-------------------|-------------------|--------------------|-------------------|

Using the **Plot** option on the **Run** menu to access the IRTGRAPH program, the following plot of test information is obtained:

