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PROGRAM ABSTRACTS/ALGORITHMS

CARIF: A computational program for item information functions and item characteristic curves

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Item response theory (IRT) is a theory of mental measurement that can be used to address issues not adequately addressed by classical test theory. Evidence for this statement is provided by the growing number of IRT research papers in the areas of appropriateness measurement, test bias, adaptive testing, and the translation of psychological measurement instruments. The importance of IRT has also been recognized by practitioners. However, one of the main sources of concern for all users is the high financial cost and the number of programs needed (Ironson, Note 1) for IRT analyses. In this abstract, we present a computer program that computes four commonly used functions of IRT research: (1) the item characteristic curves, (2) the test information function, (3) the item information functions, and (4) the test information function.

This program has two important features. First, all of these analyses are incorporated into one single computer run. Second, the program uses direct output from the maximum likelihood estimation program, LOGIST (Wood, Wingersky, & Lord, Note 2).

Program. The CARIF program is written in FORTRAN 77 and may be run on any system that supports FORTRAN 77. The program also incorporates a plotting option (PLOTIT, written by Dave McWilliams, Note 3) that permits plots to be submitted directly to a Zeta plotter.

Input. The CARIF program accepts input data in two forms. The input data may be entered directly from a LOGIST output file (Tape 7) or manually, through a series of interactive outputs. If the manual option is chosen, the program asks for (1) the number of items on the test and (2) the estimated item parameters (a, b, c) for each item.

Functions. The program calculates four functions: (1) the item characteristic curve,

$$P(\theta) = c + \frac{1 - c}{1 + e^{-1.7a(\theta - b)}},$$

where a, b, and c are item parameters estimated by LOGIST and θ is the examinee parameter (600 points from $\theta = -3.0$ to $\theta = +3.0$ are used); (2) the test characteristic curve,

$$\xi = \sum_{i=1}^{n} P_i(\theta);$$

(3) the item information function,

$$I(\theta,u_i) = \left[\frac{P_i'^2}{P_iQ_i}\right]_\theta$$

where $P_i = P_i(\theta)$ is the item characteristic curve, $Q_i = 1 - P_i$, and P_i' is the first derivative of P_i with respect to θ; and (4) the test information function,

$$I(\theta) = \sum_i I(\theta,u_i).$$

Output. The CARIF program outputs five files. The first file contains the data from all four computations performed. This file may be submitted to a plotter using a simple plotting routine. An input program for Harris/7 and Zeta plotters is available upon request. The four remaining files contain the values for each of the functions calculated.

Availability. A source copy of the CARIF program, sample input, and sample output are available from the authors.

REFERENCE NOTES

1. Ironson, G. *Chi-square and latent trait approaches to the measurement of item bias.* Paper presented at the Third Annual Johns Hopkins University NSER: "Item Bias" The State of the Art," Washington, D. C., November 1980.

2. Wood, R. L., Wingersky, M. S., & Lord, F. M. *LOGIST—A computer program for estimating examinee ability and item characteristic curve parameters* (ETS RM 76-6). Princeton, N.J: Educational Testing Service, 1976.

3. McWilliams, D. *PLOTIT: A subroutine package for generating plots.* Unpublished manuscript, University of Illinois, 1977.

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