AVAILABILITY

A complete input form and FORTRAN listing is available free upon request.

REFERENCES

- Adkins, D. C. A rational comparison of item-selection techniques. *Psychological Bulletin*, 1938, 35, 655.
Carter, H. D. How reliable are the common means of difficulty and validity of objective test items? *Journal of Psychology*, 1942, 13, 31-39.
Draper, N., & Smith, H. *Applied regression analysis*. New York: Wiley, 1966. Pp. 234-260.
DuBois, P. H. A note on the computation of biserial r in item validation. *Psychometrika*, 1942, 7, 143-146.
Fischer, R. A. *Statistical methods for research workers*. 10th ed. London: Olives & Boyd, 1948. P. 356.
Guilford, J. P. *Psychometric methods*. New York: McGraw-Hill, 1936. P. 566.
Guilford, J. P. *Psychometric methods*. New York: McGraw-Hill, 1954. Pp. 373-464.
Gulliksen, H. *Theory of mental tests*. New York: Wiley, 1950. Pp. 363-394.
Taylor, C. W. Maximizing predictive efficiency for a fixed total testing time. *Psychometrika*, 1950, 15, 391-406.

(Received for publication November 16, 1973;
accepted November 23, 1973.)

SUMRAT9: Generalized item analyses for educational and psychological scales

RICHARD G. LANDRY and KENNETH V. PETERSON

*University of North Dakota
Grand Forks, North Dakota 58201*

SUMRAT9 is a FORTRAN program designed to provide multiple item analyses for summated rating or Likert-type scales of any format. It can also be used with dichotomously scored items (yes-no; right-wrong), semantic differential-type scales, and various types of Q or R sorts. The uniqueness of this program stems from the fact that it provides (1) as many item analyses as requested by the investigator, (2) two forms of discrimination indices, and (3) printouts of all steps in the calculation process.

INPUT

SUMRAT can be used with any type of scale data, provided individual item responses are on a numerical continuum (e.g., 1-0, 1-5, or 1-11). Selector cards at the end of the data deck indicate how many item analyses are to be performed and which items belong on which scale (an individual item may be used on as many scales as required).

OUTPUT

The output includes for each scale: (1) total scores for each individual and his rank; (2) mean, standard deviation, and Cronbach's alpha (reliability); (3) item means, item standard deviations, and item discriminations (correlation of each item with total score); (4) item means for top third of group and item means for bottom third of group; (5) ranking of items in order of significance.

COMPUTER AND LANGUAGE

SUMRAT9 was written in FORTRAN IV, Level F, for an IBM 360/70 with no auxiliary components.

RESTRICTIONS

There basically are no data restrictions on the program, as any type of data may be used. However, the

program as written may not exceed 500 items or 500 observations, with a maximum of 65 items per selection on the scales. The parameters can easily be modified to adapt to local restrictions.

AVAILABILITY

A copy of the program, the documentation for the program, and sample output from the program are available free on request and can be obtained from the author, Richard G. Landry, Bureau of Educational Research, University of North Dakota, Grand Forks, N. Dak. 58201.

(Received for publication November 16, 1973;
accepted November 23, 1973.)

CLIQUE: A FORTRAN IV program for the Needham-Moody-Hollis cluster-listing algorithm*

MICHAEL SHAFTO

Princeton University, Princeton, New Jersey 08540

Jardine & Sibson (1971) presented a general axiomatic treatment of the class of data-simplification techniques known as *cluster analysis*. They defined two classes of methods, one for rank-order data, the other for interval-scaled data. Both classes of methods yield stratified (multilevel) clusterings based on a square symmetric matrix of dissimilarities. The rows and columns of the input matrix correspond to the points or items to be clustered. Entries in the matrix represent the dissimilarity or distance between each pair of points.

The clustering methods isolate sets of points such that points within the same set are relatively similar, while points not in the same set are relatively dissimilar. Both methods of Jardine and Sibson allow the user to control the amount of overlap between clusters at the same level, with zero overlap producing hierarchical solutions. The rank-order method is a generalization of the well known "single-link" method [cf. Johnson's (1967) "connectedness method"].

In computing the clustering solution for an input dissimilarities matrix, that matrix is transformed, and the clusters at each level are defined with respect to the transformed matrix. The clusters at Level h are defined as follows: (a) Construct an undirected graph from the transformed dissimilarities matrix by letting all pairs of points as close as h units to each other be connected and those further than h units apart be disconnected. (b) List the vertex sets of the maximal complete subgraphs of this graph. These sets are called the *ML sets* at Level h .

(In an undirected graph, a complete subgraph is a subgraph in which any two vertices are connected. A complete subgraph is maximal if it is not contained in another complete subgraph.)

The usefulness of the cluster-analysis methods mentioned above is "crucially dependent on the availability of an efficient cluster listing method [Jardine & Sibson, 1971, p. 238], i.e., a method for finding the *ML sets* for a given dissimilarity matrix and Cutoff Value h . Jardine and Sibson described such an algorithm,

*This work was supported by Research Grant 19223 from the National Institute of Mental Health, United States Public Health Service, to T. Trabasso, Principal Investigator. Computer time was made available through the Department of Psychology, Princeton University.