PROGRAM ABSTRACTS/ALGORITHMS

A FORTRAN IV program for testing differences in variance using a jackknife procedure

ROBERT J. HAERTEL and DAVID M. LANE
Rice University, Houston, Texas 77001

The robustness of analysis of variance (ANOVA) to rather large departures from homogeneity of variance has been firmly established in the case of equal n (Boneau, 1960; Box, 1953). However, when such departures are coupled with unequal n , an inflated Type I error probability occurs. Therefore, when group sizes are unequal, it is desirable to test for possible heterogeneity of variance.

One may also wish to test for differences in variance, not as a check on the assumptions of ANOVA but as a question of theoretical interest in its own right. For example, a drug that increased the performance of some subjects and decreased the performance of others could result in a difference in variance between the experimental and control conditions, but no difference in means. A significance test of the differences in variance could be used to reject the hypothesis that the drug had no effect.

Although several methods are available for testing equality of variance, these procedures tend to be sensitive to asymmetry as well as to heterogeneity of variance. On the basis of a Monte Carlo study, Church and Wike (1976) recommended using the jackknife test (Miller, 1968; Mosteller & Tukey, 1968), as it was least disturbed by asymmetry. The present program tests for unequal variances using the jackknife method.

Computation of the jackknife test begins with the transformation of each score into a measure representing the extent to which it contributes to the variance. This is accomplished using the formula

$$u_{ji} = n \log s_j^2 - (n-1) \log s_{j(i)}^2,$$

where s_j^2 is the sample variance of the j^{th} group and $s_{j(i)}^2$ is the sample variance of the j^{th} group with the i^{th} score deleted (Mosteller & Tukey, 1968). An ANOVA is then performed on the jackknife U scores, with a significant F ratio indicating heterogeneity of variance.

Input. On the first card, the user specifies the number of groups in the design and, optionally, requests that the transformed scores be printed and/or punched.

The variable format card specifying an alphanumeric

field for identification and a floating point field for data follows. The data are read in group by group, with the data from each group preceded by a card containing the group's label and the number of subjects in the group. Detailed instructions on card preparation are provided on comment cards.

Output. The program prints the group means and standard deviations of both the raw and transformed scores. If requested, the transformed scores are printed and/or punched. Homogeneity of variance is tested by an ANOVA on the transformed scores; the program prints the ANOVA summary table.

Limitations. The program can compute a test of homogeneity of variance for a one-way design with equal or unequal n . More complex designs can be analyzed by outputting the transformed scores on cards so that they can be read by other programs. Presently, a maximum of 500 subjects per group can be handled. This limit can be increased by changing the dimension statements.

Computer and Language. The program is written in FORTRAN IV and was developed on a IBM 370/155II computer. It should run with little or no modification on any computer system with a FORTRAN compiler.

Core and Time Requirements. The program has 78 statements aside from the comment cards and takes up 1.92K bytes in core. An additional 8.29K bytes are used for data storage. The program executes relatively quickly: It takes .41 sec on our system to analyze a four-group design with 10 subjects per group.

Availability. A listing of the program and instructions on its use can be obtained at no cost by writing to David M. Lane, Department of Psychology, Rice University, Houston, Texas 77001.

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