BASIC programs for one-way through four-way between-subjects and within-subjects ANOVAs

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Described is a set of eight programs for performing one-way through four-way between-subjects and within-subjects analyses of variance. Means and standard deviations are computed for each treatment combination. All programs assume equal sample sizes and the fixed-effects model. The computational procedures used are those presented by Keppel (1973). The available listings are interactive versions of the programs that contain a correction routine that allows the user to correct erroneous entries. Although the present discussion focuses on the interactive versions, documentation describing simple procedures for converting from INPUT to READ-DATA statements is available from the authors. As currently dimensioned, the maximum amount of memory required by the program text and variables of any one of these programs is approximately 16K bytes, which is particularly appropriate for use with small systems.

Input. All of the programs start with a series of questions concerning the number of levels of each independent variable (e.g., "HOW MANY LEVELS OF A?" and "HOW MANY LEVELS OF B?"). Beyond this point the between-subjects and within-subjects programs have some differences in input procedures.

The between-subjects programs request the number of subjects per treatment (e.g., "HOW MANY SUBJECTS PER LEVEL OF A?"). Next, raw data entries are called for through the presentation of appropriate prompts (e.g., "ENTER SCORE FOR SUBJECT 1 IN TREATMENT A1"). After all of the scores for a particular treatment (e.g., A1) have been entered, they are displayed on the CRT for verification. If any errors are found, the user corrects them before proceeding to enter data for the next group.

The within-subjects programs request the total number of subjects (i.e., "HOW MANY SUBJECTS?").

Then, as above, raw data entries are cued with appropriate prompts. As soon as all scores for a particular subject (e.g., SUBJECT 1) have been entered, they are displayed for verification. All errors are corrected before starting to enter data for the next subject.

Output. Output is currently directed to a line printer. A table containing the labeled means and standard deviations for each treatment combination is printed out. The treatment labels are subscripted letters (e.g., A1B1). Next, an analysis of variance summary table is printed, including sources of variance, sums of squares, degrees of freedom, mean squares, and F ratios. The labels used for the sources of variance follow Keppel (1973).

Limitations. There are restrictions imposed on the number of levels of each treatment variable by the current array dimensions, which in turn are limited by the amount of free space available for array variables. The array dimensions can be changed to suit the requirements of a particular experimental design or the capacity of a particular machine. Instructions for doing so are included in the documentation.

Limitations on the number of subjects per treatment and the total number of subjects are different for the various types of programs. As indicated in the documentation, for the INPUT statement (interactive) versions of the between-subjects programs, the number of subjects per treatment is constrained by the dimensions of a particular array. In contrast, the total number of subjects permitted by the interactive within-subjects programs is limited only by the capacity of the machine to represent large numbers, such as the sum of the squared observations. For all READ-DATA statement programs, restrictions on the number of subjects per treatment (between subjects) and the total number of subjects (within subjects) depend primarily on the amount of memory required by DATA statements.

Language and Computer. The programs are written in BASIC and have been implemented on a WANG system 2200-B with 32K of memory. This particular form of BASIC includes such nonstandard commands as SELECT PRINT and PRINT HEX.

Availability. Program listings and documentation are available for $3 (to cover copying and mailing costs) from the Research Department, E. R. Johnstone Training and Research Center, Bordentown, New Jersey 08505. Make checks payable to: Research Discretionary Acct., Johnstone Ctr.

REFERENCE

KEPPEL, G. *Design and analysis: A researcher's handbook.* Englewood Cliffs, N.J: Prentice-Hall, 1973.