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GANOVA: A General Personal Computer Program for Univariate and Multivariate Analysis of Variance

GANOVA is an interactive program, developed for 64K (or larger) personal computers, that performs general univariate and multivariate analysis of variance. It was constructed to provide flexibility for types of designs and hypotheses that can be handled while maintaining an easy-to-use format. From the user's answers to a few simple questions (same questions, regardless of design), GANOVA automatically specializes to many designs, including crossed or nested factorial; isolated control group; designs with repeated measures including one sample, *n* sample, split plot, with or without nesting in both between- and within-subject factors; and multivariate repeated measures.

These designs can include any of the following general features: univariate or multivariate; orthogonal (equal sample sizes) or nonorthogonal (unequal sample sizes); fixed or random factors (program automatically selects appropriate error terms for random or mixed models); or no program limit to number of subjects. Hypothesis testing covers major effects (main effects and interactions) and planned comparisons (contrasts or comparisons on marginal means, simple main effects or simple interactions, interaction contrasts, or others of the user's choice, as well as contrasts on the dependent measures in MANOVA designs).

User convenience features include an interactive analysis format, error detection and recovery procedures, an accompanying data-management program with capabilities such as creation or revision of data files, data correction, addition or deletion of subjects, and variable selection. A manual provides documentation, annotated output, and complete problem setup for numerous designs. Major effects can be specified by using simple labels, or planned comparisons can be specified by using a simple vocabulary, with the user entering contrasts of interest for each factor separately and the program constructing the complicated hypothesis matrix.

GANOVA gives the traditional *F* test and its approximate *p* value for major effects and planned comparisons. Multivariate tests include Wilks' Lambda and Pillai-Bartlett trace. A choice of the univariate or the multivariate test is available for hypotheses involving a repeated factor. Algorithms such as the Cholesky inverse and Björck-modified Gram-Schmidt orthogonalization procedure are used to maximize program accuracy and efficiency.

Maximum allowable problem size depends on number of cells, dependent measures, and degrees of freedom. Fairly large problems can be run on the 64K Apple DOS personal computer (e.g., 2^7 ANOVA, 2^5 MANOVA with 20 dependent measures, split plot with 3×4 between and 3×9 within subject).

The program is writen in BASIC and is available on diskettes for 64K (or larger) Apple (DOS or CP/M), IBM-PC, Kaypro, Sanyo MBC 1000, Northstar Horizon, and Osborne systems. Eight-inch single-side single-density diskettes are also available. GANOVA is composed of two overlays (in the Apple version), the first containing 90 lines of concatenated code (approximately 7K bytes) and the second containing 200 lines (approximately 15K bytes). Translation to other systems is in progress. The program, documentation, handling, and program-related consultation cost $100. For more information write to the authors, M.L. Brecht and J.A. Woodward, 1302 Preston Way, Venice, CA 90291.

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SUREX: Testing Survival Data for Exponentiality on the VIC-20 Microcomputer

SUREX is a 250-line BASIC program that tests for exponentiality in uncensored survival data using the Gail-Gastwirth (1978) Ln (.5) statistic. It is designed for a VIC-20 with cassette storage and can drive a printer without modification and will run with only 3K RAM expansion.

SUREX could be easily adapted for use on other microcomputers supporting BASIC and could also be easily modified for use with a disk drive.

The SUREX program can accept individual survival data from either key entry or a cassette tape. If the data are not ordered on entry, SUREX will place them in

ascending order and also provide a subroutine for changing individual survival times. This feature is useful for making corrections. Data can also be saved on a cassette tape while running under SUREX.

Once data are placed in ascending order by SUREX, the Gail-Gastwirth Ln(.5) statistic is computed along with its normalized score. In addition, the maximum likelihood estimate of the constant hazard rate (λ) for the data is computed.

Statistics and case listings of original, corrected, and ordered survival times can be listed on either a monitor screen or hard copy.

A program listing along with example runs and user documentation is available from the author for $5, which includes reproduction and mailing charges. For an additional $5, a cassette tape copy of SUREX will also be sent.

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