Statistical Methods: A Computer Program to Calculate Orthogonal Polynomial Coefficients

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The Statistical Analysis System (1988) is a statistical software program commonly used in agricultural research. In a recent study, PC-SAS was identified as one of the easiest-to-use software programs available on the market (Milliken and Remmenga, 1989).

The General Linear Models (GLM) procedure of SAS is frequently used for performing regression analysis and orthogonal polynomials. Since orthogonal polynomials contrasts may have to be performed on unequally spaced quantitative treatment levels (e.g., four doses of an insecticide, etc.), a set of contrast coefficients must be generated, as they are not available through SAS. Coefficients for equally spaced treatment levels are readily found in the literature and most biometry books (Bliss, 1970; Steel and Torrie, 1980). The only difference between equally spaced and unequally spaced treatment levels is in the derivation of appropriate orthogonal single-degrees-of-freedom contrast coefficients to represent the orthogonal polynomials. However, once the contrast coefficients are specified, the computational procedures to calculate appropriate sums of squares are the same for both cases.

The procedure for deriving the orthogonal polynomial coefficients for treatments with unequally spaced levels is complex and time-consuming, especially when higher-degree polynomials are involved. Therefore, we have developed a user-friendly computer program (Khanizadeh, 1988) that uses Fisher’s argument (1950) to obtain a recursion formula to compute coefficients for linear and higher-degree polynomials for equally or unequally spaced treatment levels. The program was developed on an IBM/AT 486 33MHz 4MRAM using MS-DOS version 5.0 and GW-BASIC version 2.23 and then compiled to machine language with the Microsoft Basic Compiler. After execution, the user is asked to enter the number of levels for a factor (treatment) and its levels, at which point the program immediately generates sets of coefficients for linear, quadratic, and cubic regression lines. A screen dump (Fig. 1) illustrates the coefficients generated for a factor (treatment) with four equally spaced treatment levels (i.e., 1, 2, 3, or 4 ppm or 10, 20, 30, or 40 ppm of a herbicide). The program, Orthogonal Polynomial Contrasts, is part of a statistical software package (Khanizadeh, 1988) and available upon request from S.K. on 5.25- or 3.5-inch microflexible disks at a nominal cost ($10.00). It can be run on an IBM-PC/XT/AT/PS or compatible with 512K memory (RAM) equipped with any type of monitor (TTL, CGA, EGA, VGA, etc.).

Literature Cited
Resampling methods using many randomly computer-generated samples are finally introduced for estimating characteristics of a distribution and for statistical inference. The following section deals with methods for processing multivariate data. Methods for dealing with clinical trials are also briefly reviewed. Finally, a last section discusses statistical computer software and guides the reader through a collection of bibliographic references adapted to different levels of expertise and topics. Statistics can be called that body of analytical and computational methods by which characterist