The purpose of this announcement is to describe a collection of general macro programs for statistical graphics for use with the SAS System that have been made available in conjunction with the book, *SAS system for statistical graphics, first edition* (Friendly, 1991). The primary goals of the book are to survey the kinds of graphic displays that are useful for different questions and data, and to show how can these displays be done with the SAS System. It emphasizes displays that reveal aspects of data not easily captured in numerical summaries or tabular formats and diagnostic displays that help determine if assumptions of an analysis are met.

All of the programs use keywords for the required and optional parameters and supply default values where possible to parameters not specified when the macro is invoked. The names of parameters (e.g., DATA, VAR, ID, CLASS) generally follow SAS usage in procedure steps. For example, the NQPLOT program for normal Q-Q plots can be invoked as simply as

```
%nqplot (var = PRICE)
```

The name of the data set containing the variable PRICE defaults to the most recently created data set. Most of the programs return calculated results in an output data set. All of the programs are device independent. Some of the programs offer the choice of printer plots or high-resolution graphics.

The programs were developed under the VM/SP CMS mainframe version of the SAS System, Version 5.18. Where there is a single version of the program, the program should run under all releases (5.18 and later) of the SAS System on all operating systems. Where there are two versions of a macro provided, one version should run under Release 5.18 on all operating systems, and the other should run under all Version 6 releases on all systems. The programs all require the base SAS and SAS/GRAPH products; many require SAS/STAT and SAS/IML or both as well.

### Macro Programs

- **BIPLOT**: Implements the biplot technique (e.g., Gabriel, 1971) for plotting multivariate observations and variables together in a single display.
- **BOXANNO**: Provides univariate marginal boxplot annotations for two-dimensional and three-dimensional scatterplots.
- **BOXPLOT**: Produces standard and notched boxplots for a single response variable with one or more grouping variables.
Plots a bivariate scatterplot with a bivariate data ellipse for one or more groups with one or more confidence coefficients.

Performs correspondence analysis (also known as "dual scaling") on a table of frequencies in a two-way (or higher-way) classification. In Version 6 of the SAS System, this analysis is also performed by PROC CORRESP.

A version of the CORRESP macro that should be used with Version 6 of the SAS System.

Calculates a nonparametric density estimate for histogram smoothing of a univariate data distribution. The program uses the Gaussian kernel and calculates an optimal window half-width (Silverman, 1986) if not specified by the user.

Produces grouped and ungrouped dot charts of a single variable (Cleveland, 1984, 1985).

Performs robust, locally weighted scatterplot smoothing (Cleveland, 1979).

Produces theoretical normal quantile-quantile (Q-Q) plots for single variable. Options provide a classical ($\mu$, $\sigma$) or robust (median, IQR) comparison line, standard error envelope, and a detrended plot.

Detects multivariate outliers. The OUTLIER macro calculates robust Mahalanobis distances by iterative multivariate trimming (Gnanadesikan, 1977, Gnanadesikan & Kettenring, 1972), and produces a chisquare Q-Q plot.

Produces partial regression residual plots. Observations with high leverage and/or large studentized residuals can be individually labeled.

A version of the PARTIAL macro that should be used with Version 6 of the SAS System.

Draws a scatterplot matrix for all pairs of variables. A classification variable may be used to assign the plotting symbol and/or color of each point.

Draws a star plot of the multivariate observations in a data set. Each observation is depicted by a star-shaped figure with one ray for each variable, whose length is proportional to the size of that variable.

Produces a variety of diagnostic plots for assessing symmetry of a data distribution and finding a power transformation to make the data more symmetric.

Performs an exploratory analysis of two-way experimental design data with one observation per cell, including Tukey's (1949) one degree of freedom test for non-additivity. Two plots may be produced: a graphical display of the fit and residuals for the additive model, and a diagnostic plot for a power transformation for removable non-additivity. This version of the macro should only be used with Version 5 of the SAS System.

A version of the TWOWAY macro that should be used with Version 6 of the SAS System.