Overview

SAS/QC software provides a wide range of statistical and graphical tools that help you improve products, optimize processes, and increase levels of customer satisfaction. It enables you to go beyond basic process control by incorporating advanced statistical analyses for deeper understanding of process variation. SAS/QC 9.3 introduces two new experimental procedures for multivariate process monitoring: MVPMODEL and MVPMONITOR. This new release also delivers enhancements to the RELIABILITY, CAPABILITY, and FACTEX procedures.

Multivariate Process Monitoring

The new MVPMODEL and MVPMONITOR procedures are used together to monitor multivariate process variation over time in order to determine whether a process is stable or to detect and diagnose changes in a stable process. The MVPMODEL procedure builds statistical models, which the MVPMONITOR procedure then uses to create multivariate control charts.

Multivariate control charts detect unusual variation that would not necessarily be discovered by individually monitoring the measured variables with univariate control charts such as Shewhart charts. A multivariate control chart detects changes in the linear relationships of the variables in addition to changes in their marginal means and variances.

The MVPMODEL procedure constructs principal components analysis (PCA) models, which represent the data with a small number of principal components that capture most of the variation. The model-building process provides cross validation plots, which are useful for determining the number of principal components, in addition to plots of the principal component loadings and scores, scree plots, and plots of the variance proportion explained.

The MVPMONITOR procedure produces control charts for multivariate process data. It reads data sets that contain statistics and PCA model information, which are created by PROC MVPMODEL. PROC MVPMONITOR creates two multivariate control charts: $T^2$ charts and squared prediction error (SPE) charts. It also creates contribution plots and score plots.
The RELIABILITY Procedure

The RELIABILITY procedure provides tools for reliability and survival data analysis and for recurrent events data analysis. PROC RELIABILITY now fits parametric models for recurrent events data, such as the failures in a system that can be repaired. As a repairable system ages, it accumulates repairs and costs of repairs. You can now estimate the parameters of nonhomogeneous Poisson process models for recurrent events data, and you can plot the cumulative mean and intensity functions for the number of repairs.

![Mean Cumulative Function for Time](image)

For lifetime data, where units fail only once, you can now estimate parameters and construct probability plots for models based on a three-parameter Weibull distribution.

![Three-Parameter Weibull Probability Plot for Time](image)

The CAPABILITY Procedure

The CAPABILITY procedure compares the distribution of output from an in-control process to the specification limits of the process to determine the consistency with which the specification limits can be met. PROC CAPABILITY now fits the following distributions:

- Gumbel distribution
- inverse Gaussian distribution
- generalized Pareto distribution
- power function distribution
- Rayleigh distribution

These additional distributions are available in the CDFPLOT, HISTOGRAM, PPLOT, PROBPLOT, and QQPLOT statements.

![Distribution of Weight](image)

The FACTEX Procedure

The FACTEX procedure constructs orthogonal factorial experimental designs. It now enables you to request a design that maximizes the number of clear interactions. Clear interactions are those which are not aliased with any other effects that are either required to be estimable or assumed to be nonnegligible.

For example, in resolution 4 designs, some two-factor interactions are aliased with each other and cannot be jointly estimated. In this situation, PROC FACTEX can now construct a design that has as many two-factor interactions as possible that are unaliased with any other interaction.

For More Information

For more information, ask your organization's SAS representative to contact the SAS Customer Interaction Center at 1.800.727.0025.