Introduction

The MACONTROL procedure creates moving average control charts, which are tools for deciding whether a process is in a state of statistical control and for detecting shifts in a process average. The procedure creates the following two types of charts:

- *uniformly weighted moving average charts* (commonly referred to as *moving average charts*). Each point on a moving average chart represents the average of the w most recent subgroup means, including the present subgroup mean. The next moving average is computed by dropping the oldest of the previous w subgroup means and including the newest subgroup mean.

  The constant w, often referred to as the *span* of the moving average, is a parameter of the moving average chart. There is an inverse relationship between w and the magnitude of the shift to be detected; larger values of w are used to guard against smaller shifts.

- *exponentially weighted moving average (EWMA) charts*, also referred to as *geometric moving average (GMA) charts*. Each point on an EWMA chart represents the weighted average of all the previous subgroup means, including the mean of the present subgroup sample. The weights decrease exponentially going backward in time.

  The weight r $(0 < r \leq 1)$ assigned to the present subgroup sample mean is a parameter of the EWMA chart. Small values of r are used to guard against small shifts. If $r = 1$, the EWMA chart reduces to a Shewhart $\overline{X}$ chart.

In the MACONTROL procedure, the EWMACHART statement produces EWMA charts, and the MACHART statement produces uniformly weighted moving average charts.

In contrast to the Shewhart chart where each point is based on information from a single subgroup sample, each point on a moving average chart combines information from the current sample and past samples. Consequently, the moving average chart is more sensitive to small shifts in the process average. On the other hand, it is more difficult to interpret patterns of points on a moving average chart, since consecutive moving averages can be highly correlated, as pointed out by Nelson (1983).

You can use the MACONTROL procedure to

- read raw data (actual measurements) or summarized data (subgroup means and standard deviations) to create charts

- specify control limits as probability limits or in terms of a multiple of the standard error of the moving average

- adjust the control limits to compensate for unequal subgroup sample sizes
- accept numeric- or character-valued subgroup variables
- display subgroups with date and time formats
- estimate the process standard deviation σ using a variety of methods or specify a standard (known) value for σ
- analyze multiple process variables in the same chart statement
- provide multiple chart statements. If used with a BY statement, the procedure generates charts separately for BY groups of observations.
- tabulate the information displayed in the control chart
- save moving averages, control limits, and control limit parameters in output data sets
- superimpose plotted points with stars (polygons) whose vertices indicate the values of multivariate data related to the process
- display a trend chart below the moving average chart that plots a systematic or fitted trend in the data
- produce charts on line printers or on graphics devices. Charts produced on line printers can use special formatting characters that improve the appearance of the chart. Charts produced on graphics devices can be annotated, saved, and replayed.

Learning about the MACONTROL Procedure

If you are using the MACONTROL procedure for the first time, begin by reading Chapter 19, “PROC MACONTROL Statement,” to learn about input data sets. Then turn to the “Getting Started” section of Chapter 20, “EWMACHART Statement,” on page 610 or the “Getting Started” section of Chapter 21, “MACHART Statement” on page 664. These chapters also provide syntax information, computational details, and advanced examples.

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