Introduction

The CUSUM procedure creates cumulative sum control charts, also known as *cusum charts*, which display cumulative sums of the deviations of measurements or subgroup means from a target value. Cusum charts are used to decide whether a process is in statistical control by detecting a shift in the process mean.

You can use the CUSUM procedure to

- apply a *one-sided cusum scheme*, also referred to as a *decision interval scheme*, which detects a shift in one direction from the target mean. You can specify the scheme with the decision interval h and the reference value k.

- apply a *two-sided cusum scheme* with a V-mask, which detects a shift in either direction from the target mean. You can specify the scheme with geometric parameters (h and k) for the V-mask or with error probabilities (α and β).

- implement cusum schemes graphically or computationally

- specify the shift to be detected as a multiple of standard error or in data units

- estimate the process standard deviation σ using a variety of methods

- compute average run lengths (ARLs)

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

- analyze multiple process variables. If used with a BY statement, PROC CUSUM produces charts separately for groups of observations.

- save cusums and cusum scheme parameters in output data sets

- tabulate the information displayed on the chart

- read cusum scheme parameters from an input data set

- read numeric- or character-valued subgroup variables

- display subgroups with date and time formats

- enhance cusum charts with special legends and symbol markers that indicate the levels of stratification variables

- superimpose plotted points with stars (polygons) whose vertices indicate the values of multivariate data related to the process

- display a trend chart below the cusum chart that plots a systematic or fitted trend in the data

- display 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 CUSUM Procedure

If you are using the CUSUM procedure for the first time, begin by reading Chapter 11, "PROC CUSUM Statement," to learn about input data sets. Then turn to "Getting Started" on page 362 in Chapter 12, "XCHART Statement." This chapter also provides syntax information and advanced examples.

If you are not familiar with cusum charts, read "Formulas for Cumulative Sums", "Defining the Decision Interval for a One-Sided Cusum Scheme", and "Defining the V-Mask for a Two-Sided Cusum Scheme" in the "Details" section on page 391. The "References" section on page 423 lists articles and textbooks that provide more detailed information on cusum charts. The expository articles by Lucas (1976) and Goel (1982) and the textbooks by Montgomery (1996) and Ryan (1989) are recommended introductory reading.

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