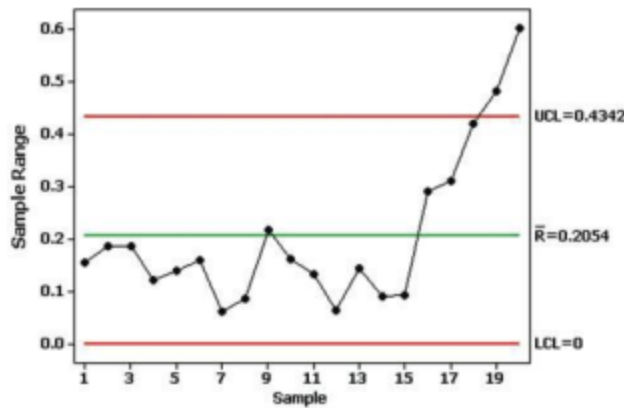


R CHART**Interpreting Control Charts**

When interpreting control charts, the following caution is important:

CAUTION Upper and lower control limits of a control chart are based on the *actual* behavior of the process, not the *desired* behavior. Upper and lower control limits are totally unrelated to any process *specifications* that may have been decreed by the manufacturer.

When investigating the quality of some process, there are typically two key questions that need to be addressed:

1. Based on the current behavior of the process, can we conclude that the process is within statistical control?
2. Do the process goods or services meet design specifications?

The methods of this chapter are intended to address the first question, but not the second. That is, we are focusing on the behavior of the process with the objective of determining whether the process is within statistical control. Also, we should clearly understand the specific criteria for determining whether a process is in statistical control (that is, whether it is statistically stable). See the following criteria.

Criteria for Determining That a Process Is Not Statistically Stable (Out of Statistical Control)

1. There is a pattern, trend, or cycle that is obviously not random.
2. There is at least one point lying outside of the region between the upper and lower control limits. (There is at least one point above the upper control limit or at least one point below the lower control limit.)
3. *Run of 8 Rule:* There are at least eight consecutive points all above or all below the centerline. (With a statistically stable process, there is a 0.5 probability that a point will be above or below the centerline, so it is very unlikely that eight consecutive points will all be above the centerline or all below it.)

In this book we will use only the three out-of-control criteria listed above, but some businesses use additional criteria such as these:

- There are at least six consecutive points all increasing or all decreasing.
- There are at least fourteen consecutive points all alternating between up and down (such as up, down, up, down, and so on).

Costly Assignable Variation

The Mars Climate Orbiter was launched by NASA and sent to Mars, but it was destroyed when it flew too close to Mars. The loss was estimated at \$125 million.

The cause of the crash was found to be

confusion between the use of units used for calculations. Acceleration data were provided in the English units of pounds of force, but the Jet Propulsion Laboratory assumed that those units were in metric "newtons" instead of pounds. The thrusters of the spacecraft subsequently provided wrong amounts of force in adjusting the position of the spacecraft. The errors caused by the discrepancy were fairly small at first, but the cumulative error over months of the spacecraft's journey proved to be fatal to its success.

In 1962, the rocket carrying the Mariner 1 satellite was destroyed by ground controllers when it went off course due to a missing minus sign in a computer program.

