tools commonly used to monitor process data: run charts, R charts, and $\bar{x}$ charts. We begin with run charts.

Run Chart

A run chart is one of a few different tools commonly used to monitor a process to ensure that desired characteristics don't change.

DEFINITION A **run chart** is a sequential plot of *individual* data values over time. One axis (usually the vertical axis) is used for the data values, and the other axis (usually the horizontal axis) is used for the time sequence.

Example 2 Run Chart of Weights of Quarters

Treating the 100 weights of quarters from Table 14-1 as a string of consecutive measurements, construct a run chart using a vertical axis for the weights and a horizontal axis to identify the chronological order of the weights.

Solution

Figure 14-1 is the Minitab-generated run chart for the data in Table 14-1. In Figure 14-1, the horizontal scale identifies the sample number, so the number 1 corresponds to the first coin, the number 2 corresponds to the second coin, and so on. The vertical scale represents the measured weight.

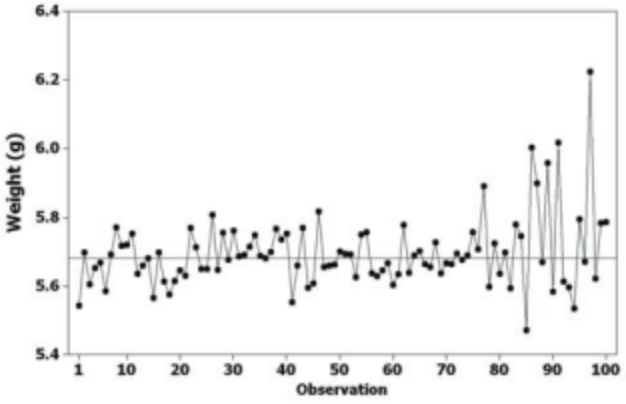

Figure 14-1 Run Chart

Interpretation

Examine Figure 14-1 and try to identify any *patterns*. From Figure 14-1 we see that as time progresses from left to right, the points appear to exhibit *greater variation*. If this pattern continues, some quarters will weigh too much while others will weigh too little. This pattern of increasing variation is a classic issue in quality control, and failure to recognize it has caused companies to go out of business.

Flynn Effect: Upward Trend of IQ Scores

An IQ (Intelligence Quotient) is measured from standard tests of intelligence. A run chart or control chart of IQ scores would reveal that they exhibit an upward trend, because IQ scores have been steadily increasing since they began to be used about 70 years ago. The trend is worldwide, and it is the same for different types of IQ tests, even those that rely heavily on abstract and nonverbal reasoning with minimal cultural influence. This upward trend has been named the *Flynn effect*, because political scientist James R. Flynn discovered it in his studies of U.S. military recruits. The amount of the increase is quite substantial: Based on a current mean IQ score of 100, it is estimated that the mean IQ in 1920 would be about 77. The typical student of today is therefore brilliant when compared to his or her great-grandparents. It is not yet clear whether the upward trend in IQ scores indicates an increasingly intelligent population or whether there are problems with the methods used for IQ testing.