Range Rule of Thumb for Understanding Standard Deviation

Three different concepts that can help us understand and interpret values of standard deviations are (1) the range rule of thumb, (2) the empirical rule, and (3) Chebyshev's theorem. Here we discuss the range rule of thumb. The empirical rule and Chebyshev's theorem will be discussed in Part 2 of this section.

The *range rule of thumb* is a crude but simple tool for understanding and interpreting standard deviation. It is based on the principle that for many data sets, the vast majority (such as 95%) of sample values lie within 2 standard deviations of the mean. We could improve the accuracy of this rule by taking into account such factors as the size of the sample and the distribution, but here we sacrifice accuracy for the sake of simplicity.

Range Rule of Thumb

Interpreting a Known Value of the Standard Deviation If the standard deviation of a collection of data is a known value, use it to find rough estimates of the minimum and maximum *usual* sample values as follows:

$$\text{minimum “usual” value} = (\text{mean}) - 2 \times (\text{standard deviation})$$

$$\text{maximum “usual” value} = (\text{mean}) + 2 \times (\text{standard deviation})$$

Estimating a Value of the Standard Deviation s To roughly estimate the standard deviation from a collection of known sample data, use

$$s \approx \frac{\text{range}}{4}$$

where range = (maximum data value) − (minimum data value).

Example 4   Range Rule of Thumb for Interpreting s

Using the 40 chocolate chip counts for the Chips Ahoy (regular) cookies in Table 3-1, the mean is 24.0 chocolate chips and the standard deviation is 2.6 chocolate chips. Use the range rule of thumb to find the minimum and maximum "usual" numbers of chocolate chips; then determine whether the cookie with 30 chocolate chips is "unusual."

Solution

With a mean of 24.0 and a standard deviation of 2.6, we use the range rule of thumb to find the minimum and maximum usual numbers of chocolate chips as follows:

$$\text{minimum “usual” value} = (\text{mean}) - 2 \times (\text{standard deviation})$$
$$= 24.0 - 2(2.6) = 18.8$$
$$\text{maximum “usual” value} = (\text{mean}) + 2 \times (\text{standard deviation})$$
$$= 24.0 + 2(2.6) = 29.2$$

Interpretation

Based on these results, we expect that typical Chips Ahoy (regular) cookies have between 18.8 chocolate chips and 29.2 chocolate chips. Because 30 falls above the maximum "usual" value, we can consider it to be a cookie with an unusually high number of chocolate chips.