

# L13. Confidence Interval on the Mean; Single Population, Variance Known

## Example 1: Yarn Strength

Past experience has indicated that the breaking strength of yarn used in manufacturing drapery material is normally distributed and that  $\sigma = 2$  psi. A random sample of nine specimens is tested, and the average breaking strength is found to be 98 psi.

Find a 95% two-sided confidence interval on the true mean breaking strength.

## Solution

**Example 2: Cable Diameter**

The diameter of a cable is known to have a normal distribution with  $\sigma = 0.04$ . A random sample of 25 cables was taken, and the average diameter for this sample was found to be 1.50 inches.

- a. Find a 80% two-sided confidence interval for the mean diameter.
- b. Find a 90% two-sided confidence interval on the mean diameter of the cable.
- c. Find a 99% two-sided confidence interval on the mean diameter.
- d. Which of the above intervals is the longest?
- e. Which of the above intervals is the most precise?

**Solution**

**Example 3: Light Bulbs**

The lifetime in hours of a 75-watt light bulb is known to be normally distributed with  $\sigma = 25$  hours. A random sample of 20 bulbs has a mean life of  $\bar{x} = 1014$  hours.

- a. Construct a 95% two-sided confidence interval on the mean life.
- b. Suppose that we want the error for estimating the mean life to be at most five hours at 95% confidence. What sample size should be used?

**Solution**

**Example 4: Mortgage Payments**

A bank manager wants to know the mean amount paid per month by home owners living in the town of Saint-Augustin in Mirabel. A random sample of 50 residents selected from the area showed that they pay an average of \$1575 per month for their mortgages. The population standard deviation for such mortgages is \$215.

- a. Find a 97% confidence interval for the mean amount paid per month by all home owners in this area.
- b. How large of a sample should be selected so that the estimate for the average monthly mortgage payment is within \$50 of the true population mean with 97% confidence?
- c. How large of a sample should be selected so that the estimate for the average monthly mortgage payment is within \$50 of the true population mean with 95% confidence?

**Solution**

**Example 5: Concrete Strength**

Suppose that for a particular brand of concrete, the compressive strength of the material is known to be normally distributed with a variance of 6.25 psi. In a quality control test, 15 samples were taken, and their mean compressive strength was found to be 54.41 psi.

- a. Determine a 95% upper confidence bound for the average compressive strength of the concrete.
- b. Determine a 98% lower confidence bound for the true average compressive strength of the concrete.

**Solution**