

6. Repair Costs: Microwaves

- a. In a random sample of five microwave ovens, the mean repair cost was \$75.00 and the standard deviation was \$12.50. Assume the random variable is normally distributed and use a t-distribution to construct a 95% confidence interval for the population mean μ . What is the margin of error of the confidence interval?

Use t with df=4

$$75 \pm 2.776 \cdot \frac{12.50}{\sqrt{5}} = \$75.00 \pm \$15.51 = (\$59.49, \$90.51)$$

Margin of Error is \$15.51

- b. You did some research on repair costs of microwave ovens and found that the standard deviation is $\sigma = \$15$. Repeat Exercise 10a, using a **normal distribution** with the appropriate calculations for a standard deviation that is known. Compare the results.

Use Z

$$75 \pm 1.96 \cdot \frac{15.00}{\sqrt{5}} = \$75.00 \pm \$13.15 = (\$61.85, \$88.15)$$

Margin of Error is \$13.15 which is smaller than part a because Z is narrower than t-distribution.

- c. Assume you want a 95% confidence interval with a margin of error of \$2. Determine the needed sample size assuming $\sigma = \$15$.

$$n = \left(\frac{1.96 \cdot 15}{2} \right)^2 = 217 \quad \text{(round up to next integer)}$$

7. Mini-Soccer Balls A soccer ball manufacturer wants to estimate the mean circumference of mini-soccer balls within 0.015 inch. Assume that the population of circumferences is normally distributed.

- (a) Determine the minimum sample size required to construct a 99% confidence interval for the population mean. Assume the population standard deviation is 0.20 inch.

$$n = \left(\frac{2.575 \cdot 0.20}{0.015} \right)^2 = 1179$$

- (b) Repeat part (a) using a standard deviation of 0.10 inch. Which standard deviation requires a larger sample size? Explain.

$$n = \left(\frac{2.575 \cdot 0.10}{0.015} \right)^2 = 295$$

Smaller standard deviation means smaller needed sample size.

- (c) Repeat part (a) using a confidence level of 95%. Which level of confidence requires a larger sample size? Explain.

$$n = \left(\frac{1.96 \cdot 0.20}{0.015} \right)^2 = 683$$

Lower confidence level means smaller needed sample size.

8. If all other quantities remain the same, how does the indicated change affect the minimum sample size requirement?

- (a) Increase in the level of confidence

Increases sample size

- (b) Increase in the error tolerance (margin of error)

Decreases sample size

- (c) Increase in the standard deviation

Increases sample size