8.1 Confidence Intervals: The Basics

Learning Objectives:
1. Determine the point estimate and margin of error from a confidence interval.
2. *Interpret a confidence interval in context.*
3. *Interpret a confidence level in context.*
4. *Describe how the sample size and confidence level affect the length of a confidence interval.*
5. Explain how practical issues like nonresponse, under-coverage, and response bias can affect the interpretation of a confidence interval.

Vocabulary: point estimator, point estimate, confidence interval, margin of error, confidence level

ACTIVTY

Mystery Mean. Teacher will use TI-84 to get the mean of a normally distributed sample of size 16 with σ of 20 and a mystery population μ. The calculator will output $\bar{x}$ of the sample. You and your group (3-4 ppl/group) will address the tasks below.

1. Is the $\bar{x}$ output from the calculator equal to the mystery population mean μ? Why or why not?

2. Determine an interval of reasonable values for the population mean μ.

In Chapter 7, we pretended to know the true parameter _____ and asked questions about possible _____. Now we start to get more realistic – we begin with what we actually know, a _____, and ask questions about possible _____.

Read 477–480
A _____ is a single best guess for the value of a population parameter. It's called this because it represents a _____.
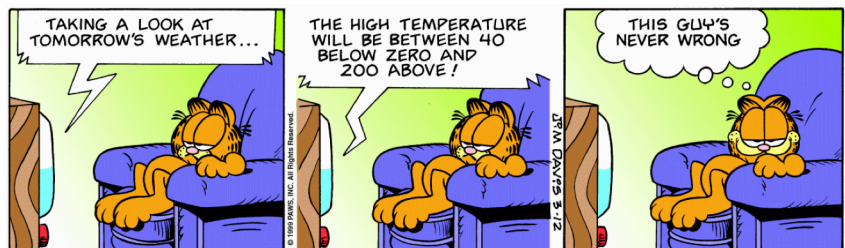
The MAXIMUM distance we expect the sample statistic to vary from the population parameter is called the _____.

MOE accounts for _____ (different samples will result in different estimates) and increase our chance of finding the true population parameter.

Three things to keep in mind with respect to confidence intervals:

Read 481-485
How do you interpret a confidence interval?

> *"We are _____% confident that the interval from _____ to _____ contains the true _____."*

Example. According to a Gallup poll published on January 9, 2013, a 95% confidence interval for the true proportion of American adults who support the death penalty is 63% ± 4%. This estimate was based on a random sample of 1038 American adults. Interpret this interval in context.

How do you interpret a confidence <u>level</u>? In other words, what does it mean to be 95% confident?

> *"If we were to take many, many samples of size n and calculate many intervals, about _____% of the intervals will capture the true _____."*

ACTIVITY	The Confidence Intervals Applet

AP Exam Tip: On the AP free response, you will be expected to interpret confidence intervals but NOT confidence levels (unless explicitly asked for in the problem).

<u>Alternate Example</u>: A large company is concerned that many of its employees are in poor physical condition, which can result in decreased productivity. To determine how many steps each employee takes per day, on average, the company provides a pedometer to 50 randomly selected employees to use for one 24-hour period. After collecting the data, the company statistician reports a 95% confidence interval of 4547 steps to 8473 steps.

(a) Interpret the confidence level.

(b) Interpret the confidence interval.

(c) What is the point estimate that was used to create the interval? What is the margin of error?

(d) Recent guidelines suggest that people aim for 10,000 steps per day. Is there convincing evidence that the employees of this company are not meeting the guideline, on average? Explain.

Read 485–488
What is the formula for calculating a confidence interval? Is this formula included on the formula sheet?

How can we reduce the margin of error in a confidence interval? Why do we want a small margin of error? Are there any drawbacks to these actions?

What are two important things to remember when constructing and interpreting confidence intervals?

Example. In a 2009 survey, researchers asked random samples of US teens and adults if they use social networking sites. Overall, 73% of the teens said yes and 47% of the adults said yes. A 90% confidence interval for the true difference in the proportion of teens and adults who would say yes is 0.229 to 0.291.

    (a) Interpret the confidence level.

    (b) Interpret the confidence interval.

    (c) Based on the interval, is there convincing evidence that the proportion of teens who would say yes is higher than the proportion of adults who would say yes? Explain.

    (d) How would the interval be affected if we used a 99% confidence level instead of a 90% confidence level?