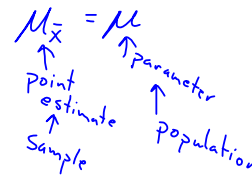


8.1

Confidence Intervals: The Basics

- ✓ DETERMINE the point estimate and margin of error from a confidence interval.
- ✓ INTERPRET a confidence interval in context.
- ✓ INTERPRET a confidence level in context.
- ✓ DESCRIBE how the sample size and confidence level affect the length of a confidence interval.
- ✓ EXPLAIN how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.

A point estimator is a statistic that provides an estimate of a population parameter. The value of that statistic from a sample is called a point estimate.



The Idea of a Confidence Interval

The big idea: The sampling distribution of \bar{x} tells us how close to μ the sample mean \bar{x} is likely to be. All confidence intervals we construct will have a form similar to this:

$$\text{estimate} \pm \text{margin of error}$$

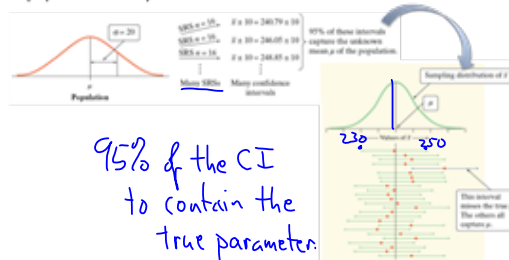
$$\bar{x} \pm ME$$

A C% confidence interval gives an interval of plausible values for a parameter. The interval is calculated from the data and has the form
point estimate \pm margin of error

The difference between the point estimate and the true parameter value will be less than the margin of error in C% of all samples.
The confidence level C gives the overall success rate of the method for calculating the confidence interval. That is, in C% of all possible samples, the method would yield an interval that captures the true parameter value.

Interpreting Confidence Levels and Intervals

The confidence level is the overall capture rate if the method is used many times. The sample mean will vary from sample to sample, but when we use the method estimate \pm margin of error to get an interval based on each sample, C% of these intervals capture the unknown population mean μ .



95% of the CI to contain the true parameter.

Interpreting Confidence Levels and Intervals

Interpreting Confidence Intervals

To interpret a C% confidence interval for an unknown parameter, say, "We are C% confident that the interval from _____ to _____ captures the actual value of the [population parameter in context]."

We are 99% confident that the interval from 10 min to 20 min captures the actual value of the response times for the fire station.

Interpreting Confidence Levels

To say that we are 95% confident is shorthand for "If we take many samples of the same size from this population, about 95% of them will result in an interval that captures the actual parameter value."

Constructing Confidence Intervals

Calculating a Confidence Interval

The confidence interval for estimating a population parameter has the form

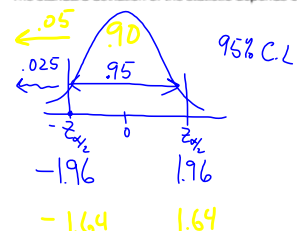
$$\text{statistic} \pm (\text{critical value}) \cdot (\text{standard deviation of statistic})$$

where the statistic we use is the point estimator for the parameter.

$$\bar{x} \pm \left(z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \right) ME$$

Properties of Confidence Intervals:

- The "margin of error" is the (critical value) \cdot (standard deviation of statistic)
- The user chooses the confidence level, and the margin of error follows from this choice.
- The critical value depends on the confidence level and the sampling distribution of the statistic.
- Greater confidence requires a larger critical value
- The standard deviation of the statistic depends on the sample size n



9. 95% C.I.

$(.63, .69)$

a) We are 95% confident that the interval from .63 to .69 captures the true proportion of US Adults who favor school prayer.

b) Point estimate: .66
ME: .03

d) His claim is false since our C.I. captures some values below the $\frac{2}{3}$'s.

19. 26.8 ± 0.6

$(26.2, 27.4)$

C - correct