

Lesson 45: Confidence Intervals

The Empirical Rule and the Normal Curve (Review of Section 2-1)

_____ % of observations will be within 1 Standard Deviation of the mean.

_____ % of observations will be within 2 Standard Deviations of the mean.

_____ % of observations will be within 3 Standard Deviations of the mean.

Rules for inference (Review of Section 4-3)

Were the individuals randomly selected? If yes, then you can make inferences about _____

Were the treatments randomly assigned? If yes, then you can make inferences about _____

Confidence Intervals: The Basics

If we want to estimate the value of some parameter from a population, we can take a sample and calculate a statistic from that sample. The sample statistic is an estimate of the population parameter. But we know from the previous chapters and from common sense that selecting different samples will yield different statistics and therefore different estimates for the population parameter. It would therefore make more sense to, instead of giving just one estimate of the population parameter to give an entire interval of reasonable values based on the sample data.

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A **confidence interval** for a population parameter is an interval of plausible values for that parameter. It is constructed in such a way so that, with a chosen degree of confidence, the value of the parameter will be captured inside the interval. In the above example, the confidence interval was 3 to 7.

The chosen degree of confidence is called the **confidence level**. The confidence level gives information about how much "confidence" we have in the *method* used to construct the interval. In other words, a confidence level gives the *success rate of the method* used to construct the interval. In the above example, the confidence level was 95%

Example:

Suppose I take an SRS of 35 seniors at NWHS and ask them how many colleges they applied to. Suppose the mean, \bar{x} , of this SRS was 5 colleges. It is very unlikely that if I were to sample the entire senior class that the average number of colleges applied to would be exactly 5. Therefore, I am going to say that I am pretty confident, say 95% confident, that the average number of colleges that seniors applied to, while not exactly 5, is somewhere between 3 and 7. How I got the interval from 3 to 7 and how I got the "95% confidence" we'll discuss later, but at least the concept of what we call a confidence interval is demonstrated in this example.

What is the point estimator used?

What is the benefit to using a confidence interval?

A Note about standard deviation when working with sample means:

If the standard deviation of the population is known, use σ .

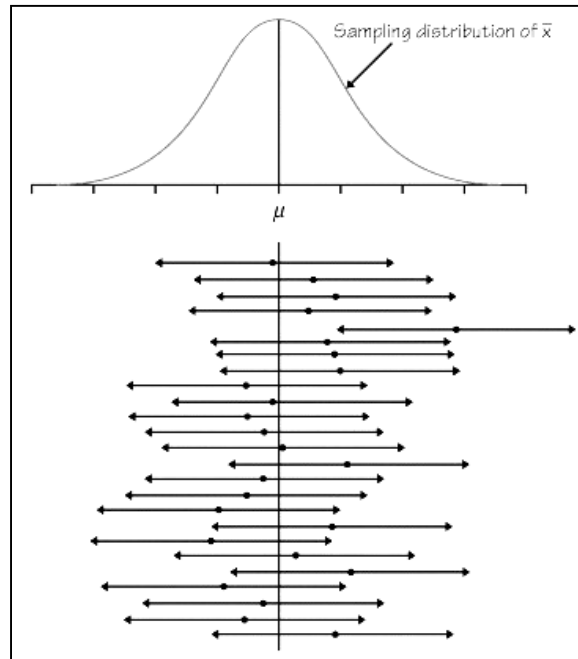
If the standard deviation of the population is not known, it will be calculated from the data, use S_x .

Note: Sometimes additional sources of error exist. This could make the true interval wider. Examples: non-response bias, lying, volunteer response bias.

What does it mean to capture the population parameter?

μ is the population parameter. Some intervals "capture" μ and some do not capture μ .

At the 95% confidence level, we expect 95 out of 100 intervals to capture μ and 5 to not capture μ



Examples:

I survey 20 students in detention to find the proportion of students with internet access at home. 65% of these students have internet access. Is this a good predictor of the population proportion?

Find the critical z-value for the following confidence levels

75% =

85% =

98% =

Daily Data Collection

The local newspaper reports that 40% of teens lie to their parents during the weekend.
Describe the following:

How can we test this claim?

What is the correct point estimator?

Test the claim...

Quality control inspectors want to estimate the mean lifetime μ of the AA batteries produced in an hour at a factory. They select a random sample of 30 batteries during each hour of production and then drain them under conditions that mimic normal use. Here are the lifetimes (in hours) of the batteries: (also on page 470)

16.91 18.83 17.58 15.84 17.42 17.65 16.63 16.84 15.63 16.37 15.80 15.93
15.81 17.45 16.85 16.33 16.22 16.59 17.13 17.10 16.96 16.40 17.35 16.37
15.98 16.52 17.04 17.07 15.73 16.74

What is the correct point estimator?

Find the point estimator.