

Unit 4 Outline

Unit 4: Central Limit Theorem and Confidence Intervals

In this unit, you will learn how to use the central limit theorem and confidence intervals, the latter of which enable us to estimate unknown population parameters. The central limit theorem provides us a way to make inference from samples of non-normal populations. This theorem states that given any population (regardless of whether or not it is a normal distribution), as the sample size increases, the sampling distribution of the means approaches a normal distribution. It is a powerful theorem because it allows us to assume that given a large enough sample, the sampling distribution will be normally distributed. The central limit theorem is one of the most important ideas in statistics, so be sure to spend time on it.

You will also learn about confidence intervals, which provide a way to estimate a population parameter. Instead of giving just a one-number estimate of a variable, a confidence interval gives a range of likely values for it. This is useful because sample results will vary from sample to sample, so a range of values is better than a one-number estimate. After completing this unit, you will know how to construct confidence intervals and calculate their margin of error. You will learn to how to come up with a range of values for a parameter and the level of confidence for the intervals.

For example, suppose you want to know the amount of soda that an average high school student in New York drinks per day. The average volume of soda for the entire population of New York high school students who drink soda is the parameter you are trying to estimate. Suppose you take a random sample and find out the average amount is 0.5 liters. Then, you also want to know how much you expect the average to vary from one sample to the next, with a certain level of confidence. The number that you use to represent this precision, i.e. to measure how close you expect your results to be to the truth, is called the margin of error.

Sections:

4.1 The Central Limit Theorem

4.2 Confidence Intervals

4.1 The Central Limit Theorem

4.1.1 The Central Limit Theorem for Sample Means (Averages)

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 7: The Central Limit Theorem: "Section 1: The Central Limit Theorem" and "Section 2: The Central Limit Theorem for Sample Means (Averages)"
- Lecture: Khan Academy's Statistics: "Central Limit Theorem"
- Lecture: Khan Academy's Statistics: "Sampling Distribution of the Sample Mean" and "Sampling Distribution of the Sample Mean 2"
- Lecture: Khan Academy's Statistics: "Standard Error of the Mean" and "Sampling Distribution Example Problem"

4.1.2 The Central Limit Theorem for Sums

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 7: The Central Limit Theorem: "Section 3: The Central Limit Theorem for Sums"

4.1.3 Using the Central Limit Theorem

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 7: The Central Limit Theorem: "Section 4: Using the Central Limit Theorem"
- Lecture: Barbara Illowsky and Susan Dean's Collaborative Statistics: "Video Lecture 7: The Central Limit Theorem"
- Assessment: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 7: The Central Limit Theorem: "Practice: The Central Limit Theorem"

4.2 Confidence Intervals

4.2.1 Confidence Interval, Single Population Mean, Population Standard Deviation Known, Normal

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 8: Confidence Intervals: "Section 1: Confidence Intervals" and "Section 2: Confidence Interval, Single Population Mean, Population Standard Deviation Known, Normal"
- Lecture: Khan Academy's Statistics: "Confidence Interval 1"
- Lecture: Khan Academy's Statistics: "Margin of Error 1" and "Margin of Error 2"
- Lecture: Khan Academy's Statistics: "Confidence Interval Example"

4.2.2 Confidence Interval, Single Population Mean, Standard Deviation Unknown, Student-T

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 8: Confidence Intervals: "Section 3: Confidence Interval, Single Population Mean, Standard Deviation Unknown, Student-T"
- Lecture: Khan Academy's Statistics: "Small Sample Size Confidence Intervals" and "Small Sample Hypothesis Test"

4.2.3 Confidence Interval for a Population Proportion

- Reading: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 8: Confidence Intervals: "Section 4: Confidence Interval for a Population Proportion"
- Lecture: Barbara Illowsky and Susan Dean's Collaborative Statistics: "Video Lecture 8: Confidence Intervals"
- Assessment: Barbara Illowsky and Susan Dean's Collaborative Statistics: Chapter 8: Confidence Intervals: "Practice 1: Confidence Intervals for Averages, Known Population Standard Deviation," "Practice 2: Confidence Intervals for Averages, Unknown Population Standard Deviation," and "Practice 3: Confidence Intervals for Proportions"