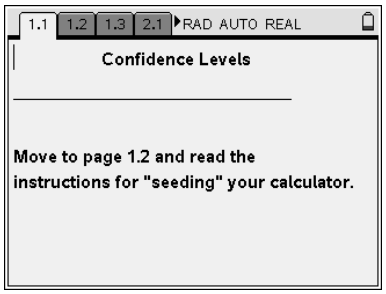
Confidence Levels
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Confidence Levels.tns.*



In your earlier work, you learned how to calculate a *confidence interval*. In this activity, you will investigate the *confidence levels* associated with confidence intervals and answer questions about how are they used.

Move to page 1.2.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Tech Tip: Page 1.2 gives instructions about how to seed the random number generator of the TI-Nspire. Page 1.3 is a calculator page for the seeding process. Carrying out this step will prevent you from generating data that is identical to others in the class. (Syntax: RandSeed #, where # should be a number unique to you.)

Move to page 2.1.

A confidence interval is an interval of plausible values for an unknown population parameter.

1. Click the up arrow (▲) to draw a sample. The segment represents the calculated confidence interval based on that sample. Note that the intervals displayed are t-intervals for a population mean, calculated according to the formula $\bar{x} \pm t^* \left(\frac{s}{\sqrt{10}} \right)$ using the same value of t^*.

   a. What do the points on the horizontal axis represent?

   b. Use the confidence interval to estimate the population mean. Are you confident that your estimate really captures the true mean of the population? Explain why or why not.

   c. Although in real situations one sample is usually all you have, suppose you could draw more than one sample from the same population to find more than one confidence interval for the mean of that population. Draw another sample, and estimate the population mean from this new confidence interval. Repeat this process four more times, and write down your interval estimate for the population mean each time.

Move to page 3.1.

2. a. Click ▲ to generate five confidence intervals. Using those intervals, estimate what you think the population mean is likely to be. Explain your reasoning.

   b. Click ▲ Sto generate five more confidence intervals. Make another estimate of the population mean using all ten of the intervals you generated. Explain your reasoning.

   c. Do you think all of the intervals you generated contain the population mean? Why or why not?

   d. Generate ten more confidence intervals, and indicate the proportion of the 20 intervals you think fail to contain the population mean. Explain your thinking.

3. Generate confidence intervals until you have 50. Identify the intervals that seem to be quite different from the others and so might not contain the population mean. How many are there, and why do these seem different?

Move to page 3.2.

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4. Page 3.2 shows the set of 50 confidence intervals you just generated and a vertical line that represents the true population mean, 70.
   a. What proportion of the 50 confidence intervals you had generated in question 3 actually captured the true mean?

b. Make a conjecture about the number of intervals in any set of 50 intervals generated from the same population with the same sample size that you think might actually contain the population mean.

c. Click the reset up arrow (▲) to clear the 50 confidence intervals you generated in 3. Then generate 50 new confidence intervals. How well do your results support your conjecture?

5. Amie announced that in every 50 confidence intervals generated for this population, about 90% of them contain 70, the actual population mean.

a. Do you agree or disagree with Amie? Explain why or why not.

b. The confidence ***level*** used to generate the confidence intervals on page 3.2 was 90%. Based on your work in questions 4 and 5, does 90% seem like a reasonable level? Why or why not?

Go to page 4.1

The CL up and down arrows (▲▼) on page 4.1 control the confidence level. (Note that the sample size stays constant.)

6. Set the confidence level to 80%. Generate 50 samples. Describe how well your confidence intervals support a confidence level of 80%.

7. a. If the confidence level is 95%, about what proportion of 50 confidence intervals generated from the same population for a given sample size do you think will contain the true population mean?

b. Use the reset ▲ to undo the confidence intervals you generated in question 6. Set the confidence level to 95. Generate 50 confidence intervals. How do the results match your estimate in 7a?

c. Repeat questions 7a and b for another confidence level of your choice.

8. Click ▲ to return to a screen with no confidence intervals.

a. Set the confidence level to 70%, and generate 50 confidence intervals. Then use the CL arrow to increase the confidence level to 99%. What effect does changing the confidence level from a low confidence level to a high confidence level seem to have on a confidence interval? Explain why your answer seems reasonable.

b. Think about what a confidence level represents. How does this help justify your conclusion in 8a?

9. Consider the following: a 95% confidence interval for the mean number of hours per weekend day that teenagers play video games is between 5.35 hours and 7.25 hours. Comment on each statement.

a. 95% of the time, the number of hours teenagers play video games on a weekend day is between 5.35 hours and 7.25 hours.

b. We are 95% confident that the mean number of hours that teenagers play video games on a weekend day is between 5.35 hours and 7.25 hours.

c. We are 95% confident that the mean number of hours that teenagers play video games on a weekend day is 6.3 ± 0.95.

d. 95% of the confidence intervals we construct for the mean number of hours teenagers play video games on a weekend day will give us the interval (5.35, 7.25).

e. There is 95% probability that the mean number of hours that teenagers play video games on a weekend day is between 5.35 and 7.25 hours.

10. Describe the difference between a confidence level and a confidence interval.

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