

Math 160/263 – Assignment #4

Title: Confidence Intervals

Worksheet: None

The purpose of this assignment is to explore the characteristics of Confidence Intervals. This assignment uses material from Chapter 13 of the Minitab Manual.

Simulating the Data

1. In Minitab, go to the **Calc** \Rightarrow **Random Data** menu. We will use the Normal Distribution. Generate fifty rows of data in each of one hundred columns (C1-C100). Use $\mu = 100$ and $\sigma = 15$. Each column now is a sample of fifty from the $N(100, 15)$ Normal Distribution.

Calculating and Entering the Confidence Interval Endpoints

2. Using **Stat** \Rightarrow **Basic Statistics** go to the **1-Sample z** dialog box. Enter 15 in the “Standard Deviation” window. Enter 15 in the “Standard Deviation” window. Enter C1-C100 in the “Samples in columns” window. Calculate the one hundred 95% Confidence Intervals associated with the samples in C1-C100. They will appear in the Session Window. Put the first ten of them into your ReportPad.

3. We want to find out how many of these 95% Confidence Intervals actually contain the true mean of 100. We must move the numbers representing the endpoints of the one hundred Confidence Intervals into the Worksheet, so they can be used in calculations. This will be simpler to do than inspecting all 100 intervals one by one. Then place the cursor in the session window just after the first Confidence Interval lower endpoint. Press simultaneously, the “Shift,” “Ctrl,” and “Alt” keys on the keyboard and the left mouse button. Carefully drag the mouse to highlight just the column of lower Confidence Interval Endpoints. The numbers will be highlighted as you drag the mouse down the column. Be careful not to get either the parenthesis on the left nor the comma on the right, as this will cause Minitab to think the column is text (Also make sure that you have highlighted the numbers correctly). After the column of left endpoints is highlighted, press “Ctrl-c” to copy them to the Windows clipboard, and then click on the top cell in column C101, and paste (“Ctrl-v”) the column into the Worksheet (You may be prompted requiring you to select an option for embedded spaces, select the option “use spaces as delimiters”). Check that there is no “T” in the heading of the column. If

there is, you collected a comma or a parenthesis; you'll have to do it again. Label C101 "LE" for "Lower Endpoint."

4. Repeat the exact procedure with the column of upper endpoints and put them in Column C102, which should be labeled "UE."

5. Create a new column(C103) which is the length(UE-LE). Use the Minitab calculator(for example with expression "C102-C101")

Investigating the Results

6. Name C104 "TLE" which stands for "Test Lower Endpoint." Clearly a Confidence Interval will miss capturing the mean if its lower endpoint is above the mean. Since the underlying distribution has a known mean of 100, we will use Minitab's calculator to test them all at once. Go to **Calc** \Rightarrow **Calculator** The calculator will perform arithmetic on entire columns and put the results in another column. We wish to test the lower endpoints in C101 to see if they are above 100. Enter "C101 > 100," and place the results in C104. A 0 will appear if the statement is false, i.e. the number in C101 is less than 100, and a 1 will appear if the statement is true i.e. the lower endpoint is above 100 and the Confidence Interval does not capture the mean.

7. Do the same for testing if the Confidence Interval is too low. In that case the number in C102 will be less than 100. Put the results in C105, which should be labeled "TUE."

8. Now use **Calc** and column statistics to compute the sum of the two test columns(C104 and C105). The sum of these two numbers represent the number of Confidence Intervals which miss both high and Low. Are your results consistent with what you learned in class about the behavior of Confidence Intervals? Discuss fully. Now save and edit your report for submission.

9. Now do the same thing(Questions 2-8) except use t confidence intervals(In question 2 you need to use **Stat** \Rightarrow **Basic Statistics** go to the **1-Sample t** dialog box. In addition use different column names for the new columns).

10. Compare all the Z interval lengths to the t interval lengths(columns C103 and C108). You may use an appropriate statistical test for the analysis. Explain your findings.