Math 155 MINITAB Assignment #2
Due Date: Friday, November 4

Follow all instructions carefully – make sure to print out *only* what you are specifically told to print out in the instructions. (This will save you a lot of time and effort!) Everything that you'll be asked to turn in will be highlighted in **bold, underlined** type.

The premise: You are a quality control inspector working for Goodstone Tire and Rubber Company. Your job is to make sure that your company's claims about the life of its tires are statistically sound. To this end, one of your tasks is to select a *random sample* of newly manufactured Goodstone tires, and have them road tested to measure the lifetime (in miles) of each tire. Then, you determine whether your results seem to support Goodstone's public claim about the distribution of its tires' lifetimes:

> *Goodstone's claim:*
> *Under normal driving conditions and with regular maintenance, the average (mean) lifetime of a Goodstone tire is 50,000 miles, with a standard deviation of 8,500 miles.*

Minitab assignment:
1. Use Minitab to *simulate* a random 100-tire sample, assuming that the Goodstone claim is true.
   Proceed as follows:
   a) Select [Calc/Random Data/Normal...] from the Minitab menu.
   b) Enter 100 for "number of rows of data to generate", and enter the mean and standard deviation as given in "Goodstone's claim." Enter C1 as the column in which to store your data. Click "OK" to generate the sample, and check to make sure your 100 measurements (each of which represents one tire's lifetime, measured in miles) are all there. Select [Stat/Display Descriptive Statistics], enter C1 in the "Variables" box, then click OK to generate the descriptive statistics for this sample.

2. Now that you've got the idea, repeat part 1, but this time enter C1-C25 (instead of just C1) in the "store in column(s)" box. This will simulate 25 random samples of 100 tires each. (Note: *do not* print out this worksheet!) Then, generate the descriptive statistics for all 25 of these samples, by entering C1-C25 (instead of just C1) in the "Variables" box.

3. Create a new worksheet. [File/New.../Minitab Worksheet]. In a column of the new worksheet, enter the sample means from your 25 samples you generated in part 2. You'll find these listed together in the session window. (*See the attached page for instructions on how to do this quickly, rather than manually typing all 25 numbers into a Minitab column*.) Generate the descriptive statistics for this set of sample means. **Print out this worksheet, and print out the session window**, which should include *all* of the descriptive statistics you generated in parts 1, 2 and 3. (NOTE: Make sure you're only printing out the worksheet you've created in Part 3; it only has 25 rows. Do NOT print out the worksheet with 100 rows that you created for Part 2!)

4. Compare the mean and standard deviation of the collection of sample means from Part 3 to the mean (50,000) and standard deviation (8,500) of the overall distribution of Goodstone tire lifetimes. What do you notice? **Write a few sentences that describe your observations.** Write your observations on a separate sheet of paper; do NOT write them on this assignment sheet.

Note: there is a front and a back to these instructions. (You're not finished yet!)

Parts 5-6 below are almost the same as parts 2-3; the difference is that we will increase our sample size from 100 to 10,000. (Notice that's four zeros, not three!) To be precise: we will now simulate random selections of 10,000 tires, rather than 100 tires as before. You will be asked to observe the effects of this increase in sample size on the mean and the standard deviation of the set of sample means.

5. Create a new worksheet [File/New.../Minitab Worksheet]. Repeat part 2, but this time enter 10000 (instead of 100) for the "number of rows." This will simulate 25 random samples of 10000 tires each. (Please *do not* print this worksheet! It is huge!) Then, generate the descriptive statistics for all 25 of these samples, as before.

6. Create another new worksheet [File/New.../Minitab Worksheet]. In a column of the new worksheet, enter the sample means from your 25 samples you generated in part 5. Generate the descriptive statistics for this set of sample means. **Print out this worksheet, and print out the session window**, which should include *all* of the descriptive statistics you generated in parts 5 and 6. (Note: make sure you're only printing the worksheet you created for Part 6; it should only have 25 rows. Do NOT print the giant worksheet you created in Part 5!)

7. Compare the *mean* of the collection of sample means from Part 6 (sample size n=10000) to the *mean* of the sample means from Part 4 (sample size n=100). What do you notice? Specifically, how does increasing the sample size tend to affect the *mean* of the collection of sample means? (In other words: if we were to repeat the above sequence of steps for larger and larger sample sizes -- say, n=1 million, then n=1 billion, etc. – what do you think would happen to the mean of the collection of sample means?) **Write your response to this question.** Write your response on a separate sheet of paper; do NOT write it on this assignment sheet.

8. Compare the *standard deviation* of the collection of sample means from Part 6 (sample size n=10000) to the *standard deviation* of the sample means from Part 4 (sample size n=100). What do you notice? Specifically, how does increasing the sample size tend to affect the *standard deviation* of the collection of sample means? (In other words: if we were to repeat the above sequence of steps for larger and larger sample sizes -- say, n=1 million, then n=1 billion, etc. – what would happen to the standard deviation of the collection of sample means?) **Write your response to this question.** Write your response on a separate sheet of paper; do NOT write it on this assignment sheet.

Summary: **Here is what you will turn in:**
- Printouts of the worksheets and session windows from parts 3 and 6 of the assignment. (These are the *only* printouts you should turn in.)
- Your written (or typed) responses to the questions in parts 4, 7, and 8.
- Nothing else!

Please put all written (or typed) responses on the same sheet of paper, and clearly indicate which sentence(s) are related to which part of the assignment. (Don't make me guess!) As always, write legibly (or type), and write all responses using complete sentences with proper grammar. Finally, please staple all pages together before turning them in.

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Note: Here's a quick way to copy all 25 sample means into a new worksheet (for parts 3 and 6) without having to manually enter them all into a Minitab column.

Step 1. After generating the descriptive statistics for C1-C25, use your mouse to select (highlight) all 25 columns, plus the column headers, as shown in the screenshot below:

Then, copy the text you just selected [Edit/Copy]. Make sure to include the column headers – "Variable," "N," etc. – in your selection; these will become the column headers in your new Minitab worksheet (below).

Step 2. Now, open a new worksheet. Select the grey cell (not a white cell) at the top of column C1:

Now, select [Edit/Paste Cells]. A dialog box should appear. Make sure the option "use spaces as delimiters" is selected, and then click "OK." You should now see something like this:

Note that all of the sample means are now in one column (probably C4, as in the above screenshot). This is the column for which you'll want to find the mean and standard deviation for parts 3 and 6 of the assignment.