Stat 401 Minitab 17 Project 1

The following instructions are for Minitab 17. The commands and menu selections for Minitab 15, Minitab 16 and Mintab Express should be similar. (If there are differences, I suggest you use the Help menu, or Internet search, to help figure things out.)

Purpose: I. To use MINITAB to conduct a simulation experiment to illustrate the Central Limit Theorem.
II. To use MINITAB to conduct simulation experiments to illustrate the concept of a confidence interval.

Reading: Text, section 5.4 on the Central Limit Theorem and 7.1-7.2 on Confidence Intervals.

Turn in: I. Session window and three histograms of the distributions of the sample means
II. A print out of the 90%, 95%, and 80% confidence intervals for the normal distribution
III. The answers to the questions at the end of this assignment.

General Instructions: What follow are the Minitab commands for producing histograms and basic statistics from randomly generated data. Words in capital letters followed by the symbol > indicate a sequence of menu items to be selected/clicked.

I. The Central Limit Theorem.

Begin by producing 1000 random samples from a uniform population on the interval [0,1].
(The population distribution has mean 0.5 and standard deviation 0.2887, rounded to 4 decimal places).
CALC > RANDOM DATA > UNIFORM, then type 1000 for "rows of data" and store them in column C1.
Click OK.

STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS, then type C1 in "variables".
Click OK.

To create a histogram of the sample means in C1 for sample size $n = 1$ (in this case this is just the data itself), use GRAPH > HISTOGRAM > WITH FITS, then enter "Graph variables" C1. Click OK.
(This will superimpose a normal curve over your histogram.)
Then, right click on the *x*-axis; select "Edit X Scale"; select "Position of ticks" and set positions to:
0 0.2 0.4 0.6 0.8 1
(You may copy and paste this sequence of numbers into the dialog box.)
Still in "Edit X Scale", under "Scale Range" deselect "Auto" and set "Minimum" to 0 and "Maximum" to 1.
Click OK.
Then, right click on the bars and use EDIT BARS > BINNING; under "Interval Type" select "Cutpoint"; under "Interval Definition" select "Midpoint/Cutpoint positions" and set positions to:
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1
(You may copy and paste this sequence of numbers into the dialog box.)
Click OK.
Then, right click on the title, then select EDIT TITLE and change the text to "Histogram for n = 1".
(side note: Minitab output uses N for sample size, as opposed to n which we will use in class.)
Click OK.

Repeat the procedure to produce 1000 samples of size $n = 2$. Produce the samples by
CALC > RANDOM DATA > UNIFORM 1000 rows in column C1-C2 (overwriting the old data). Click OK.
CALC > ROW STATISTICS select mean, input variables C1-C2, store in C3. Click OK.
STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS, then type C3 in "variables".
Click OK.
Create a histogram using the same steps as outlined above and title it "Histogram for n = 2".

Repeat the procedure to produce 1000 samples of size $n = 9$. Produce the samples by
CALC > RANDOM DATA > UNIFORM 1000 rows in columns C1-C9 (overwriting the old data). Click OK.
CALC > ROW STATISTICS select mean, input variables C1-C9, store in C10. Click OK.
STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS, then type C10 in "variables". Click OK.
Create a histogram using the same steps as outlined above and title it "Histogram for n = 9".

Delete the data in columns C1-C20 when this is done.

II. Confidence Intervals.

You'll simulate random sampling from a normal population with $\mu = 50$ and $\sigma = 10$.
Create 20 random samples of size 50:
CALC >RANDOM DATA >NORMAL, 50 rows, store in C1-C20, set $\mu = 50, \sigma = 10$.
To calculate 95% confidence intervals for your 20 samples:
STAT > BASIC STATISTICS > 1-SAMPLE Z; under "One or more samples, each in a column" enter C1-C20 in the dialog box; Standard Deviation = 10; select "Perform Hypothesis test" – Hypothesized mean = 50; click OPTIONS and set confidence interval to 95 and "Alternative" to "Not Equal".0 Click OK > OK.

To observe the effect a change in confidence level has on the intervals, go to
EDIT > EDIT LAST DIALOG > OPTIONS; change 95% to 90%. Click OK > OK.
MINITAB will display the 90% intervals below the 95% intervals.

Now repeat the above commands to produce 80% confidence intervals for your 20 samples.

Go back to your "Histogram for n = 1", click on it, then EDITOR > LAYOUT TOOL and place all three of your histograms in the layout in order. Click FINISH, then print this layout.

Then, delete superfluous lines in your session window and print your session window.

III. Questions: Answer precisely and concisely the following questions.

For part I:

1.a. What are the mean and standard deviation for sampling distribution N = 2? For sampling distribution N = 9? Do they conform to the predictions of the Central Limit Theorem? Compare the numbers with theory when answering this question.

1.b. What are the shapes of the histograms? Are they in agreement with the Central Limit Theorem? Why or why not?

For part II:

2.a. Determine the number of 95% confidence intervals that capture the population mean. Approximately how many would be expected to contain the population mean?
(Count your intervals carefully; it is easy to miss this. Your answer must match your confidence intervals, and may not be the same as someone else's answer.)

2.b. Answer the above for the 90% confidence intervals.

2.c. Answer the above for the 80% confidence intervals.

2.d. In general, what effect does decreasing the confidence level have on the width of the intervals?