

## Stat 100

## MINITAB Project 4 (modified for version 15)

**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 7.3 on the Central Limit Theorem and 8.3 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, and the answers to the questions at the end of this assignment.

**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 distribution has mean 0.5 and standard deviation 0.2887 (to 4 decimal places).

CALC>RANDOM DATA>UNIFORM then type 1000 for “rows of data” and store them in column C1, then OK.

STAT>BASIC STATISTICS>DISPLAY DESCRIPTIVE STATISTICS type C1 in variables.

To create a histogram of the sample means (in this case this is just the data itself) in C1, using GRAPH>HISTOGRAM>WITH FIT select histogram of data with normal curve, OK.

Right click on the x-axis and then EDIT X-AXIS and set the scale range from 0 to 1.

Right click on the bars and then EDIT BARS>BINNING. Set the Midpoint/Cutpoint 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.)

Right click on the title then EDIT TITLE and change the text to “Histogram for N = 1.”

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):

CALC>ROW STATISTICS select mean, input variables C1-C2, store in C3, OK.

Create a histogram as above and title it “Histogram for N = 2.”

Repeat the procedure to produce 1000 samples of size  $n = 9$ .

Produce the additional samples by

CALC>RANDOM DATA>UNIFORM 1000 rows in columns C1-C9

CALC>ROW STATISTICS select mean, input variables C1-C9, store in C10, OK.

STAT>BASIC STATISTICS>DISPLAY DESCRIPTIVE STATISTICS type C10 in variables, OK.

Create a histogram as above and title it “Histogram for N = 9.”  
Delete the data in the columns when this is done.

II. Confidence Intervals. A. We 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 the 20 samples:

STAT>BASIC STATISTICS>1-SAMPLE Z, Standard Deviation = 10, Perform Hypothesis test – Hypothesized mean = 50. Click Samples in Columns and enter C1-C20. Click OPTIONS set confidence interval to 95 and Alternative to “Not Equal.”  
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%, OK.

MINITAB will display the 90% intervals below the 95% ones.

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

Click on a graph and then EDITOR>LAYOUT TOOL and place your three histograms in the layout in order. Print this layout. Delete the superfluous lines in the session window and print this as well.

**Questions:** Answer precisely and concisely the following.

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

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

2. For part II.

a) Determine the number of 95% confidence intervals that contain the population mean. (Count them carefully; it is easy to miss this.) Approximately how many would be expected to contain the population mean?

b) Answer the above for the 80% confidence intervals.

c) Answer the above for the 90% confidence intervals.

3. What effect does increasing the confidence level have on the width of the intervals?