**ST-314 Homework 3**

**Due Tuesday, May 13th at 5:00 PM**

*Please download this document. Then, complete your solutions and upload as PDF or Word Document.*

*No other formats will be accepted.*

*Typing or entering answers by hand is accepted as long as solutions are presented neatly and the document is uploaded as PDF. Give the solutions in the space provided.*

***Instructions***

* The homework is due on Tuesday, May 13th at 5:00 PM. The homework MUST be uploaded to Blackboard as PDF or Word document. No other formats will be accepted.
* The homework is worth 25 points.
* Late homeworks will not be accepted under ANY circumstances.
* You will have 3 attempts to successfully upload your homework. Only your last successful attempt will be graded.
* You may work in groups of 2-3 people, but must submit individual solutions.
* You must provide complete answers in order to receive full credit.
* Please, use the space assigned to provide solutions to the problems.
* Failing to follow any of these instructions may result in a deduction of points from your total score.

***Scanners***

If you need to scan your homework, eScanners are located in the 2nd floor Copy Center, 1st, 3rd and 5th floors. These scanners allow you to scan documents (color, gray, b/w) in searchable PDF or quick PDF and send them to an email address or store on a flash drive. It is recommended that you scan no more than 17 pages at a time to prevent the eScanners from freezing. Your mailbox will also need to have sufficient storage space for your documents or they will be lost when sent. There is no charge for the service at this time.

**Problem 1. (15 Points)**

In this problem you will explore the central limit theorem using R. Use the R-code provided with the homework to solve each ine of the following questions:

***Part 1*** Simulate a population of 10000 that has a uniform distribution from 0 to 2.

Take 10000 samples of size 3, size 30 and size 100 and plot the sample means and standard deviation with a histogram.

***Part 2*** Simulate a population of 10000 that has a chi-square distribution with a mean of 1. Take 10000 samples of size 3, size 30 and size 100 and plot the sample means and standard deviation with a histogram.

***Part 3*** Simulate a population of 10000 that has a binomial distribution with probability of success 0.5.Take 10000 samples of size 3, size 30 and size 100 and plot the sample proportions and standard deviation with a histogram.

***Part 4*** Simulate a population of 10000 that has a binomial distribution with probability of success 0.1.Take 10000 samples of size 3, size 30 and size 100 and plot the sample proportions and standard deviation with a histogram.

For each part:

1. Copy the graphical display from R.

2. Describe, in general, what you see from each sampling distribution with different size n and discuss when the sampling distribution reaches normality.

3. Compare the mean and standard deviation of each sampling distribution. How do they change as n increases?

4. Calculate the theoretical standard error for the mean/proportion from sample sizes of 100 for each part.

Hint: or . Compare each to the simulated standard deviation. How different are they?

**Problem 2. (5 Points)**

Suppose the probability density function (pdf) of weekly gravel sales Y (in 100’s of tons) is given by

1. Obtain the cumulative distribution function, F(y), for this distribution
2. What is the probability that less than 100 tons of gravel is sold in a given week?
3. What is the probability that between 200 and 300 tons of gravel are sold in a given week?
4. Determine the expected amount of gravel sold per week.
5. The profit P for weekly gravel sales is given by: P = 2500 Y – 1250. Find the expected profit for one week.

**Problem 3. (5 Points)**

Suppose the yield strength (in ksi) for specimens of A36 grade steel is normally distributed with mean  ksi and standard deviation  = 4.5 ksi. One specimen of this type of steel will be randomly selected.

1. What is the probability that the randomly selected specimen will have a yield strength of at least 50 ksi?
2. What is the probability that the randomly selected specimen will have a yield strength between 40 and 48 ksi?
3. What should the yield strength of the specimen be in order to put it in the 90th percentile of all specimens (i.e. 90% below the yield strength)