**EGN 3443**

**HOMEWORK 3**

**(Due on July 17th, Tuesday)**

Before solving the following exercises, please download the data provided on BlackBoard for the homework #3. Please copy and save your results to a Microsoft Word file.

1. **(1.0 point)** Data set for this question is given within the excel file (at the first sheet).
   1. Find the descriptive statistics and draw histogram, stem and leaf diagram, and box plot using MS Excel.
   2. Construct a normal probability plot of the yield data. Does it seem reasonable to assume that yield value is normally distributed?
2. **(9-45) (1.0 point)** Supercavitation is a propulsion technology for undersea vehicles that can greatly increase their speed. It occurs above approximately 50 meters per second, when pressure drops sufficiently to allow the water to dissociate into water vapor, forming a gas bubble behind the vehicle. When the gas bubble completely encloses the vehicle, supercavitation is said to occur. Eight tests were conducted on a scale model of an undersea vehicle in a towing basin with the average observed speed *sample mean is* 102.2 meters per second. Assume that speed is normally distributed with known standard deviation σ = 4 meters per second.
   1. Test the hypotheses H0: μ = 100 versus H1: μ < 100 using α = 0.05.
   2. What is the P-value for the test in part (a)?
   3. Compute the power of the test if the true mean speed is as low as 95 meters per second.
   4. What sample size would be required to detect a true mean speed as low as 95 meters per second if we wanted the power of the test to be at least 0.85?
   5. Explain how the question in part (a) could be answered by constructing a one-sided confidence bound on the mean speed.
3. **(9-15) (1.0 points)** A consumer products company is formulating a new shampoo and is interested in foam height (in millimeters). Foam height is approximately normally distributed and has a standard deviation of 20 millimeters. The company wishes to test *H*0: μ = 175 millimeters versus *H*1: μ > 175 millimeters, using the results of *n* = 10 samples.
   1. Find the type I error probability α if the critical region is *x* > 185.
   2. What is the probability of type II error if the true mean foam height is 185 millimeters?
   3. Find β for the true mean of 195 millimeters.
   4. Find the boundary of the critical region if the type I error probability is α = 0.01 and *n* = 10
   5. Find the boundary of the critical region if the type I error probability is α = 0.05 and *n* = 16
   6. Calculate the *P*-value if the observed statistic sample mean is 180
   7. Calculate the *P*-value if the observed statistic sample mean is 190
4. **(9-61) (1.0 point)** The sodium content of thirty 300-gram boxes of organic corn flakes was determined. The data (in milligrams) are as follows: 131.15, 130.69, 130.91, 129.54, 129.64, 128.77, 130.72, 128.33, 128.24, 129.65, 130.14, 129.29, 128.71, 129.00, 129.39, 130.42, 129.53, 130.12, 129.78, 130.92, 131.15, 130.69, 130.91, 129.54, 129.64, 128.77, 130.72, 128.33, 128.24, and 129.65.
   1. Can you support a claim that mean sodium content of this brand of cornflakes differs from 130 milligrams? Use α = 0.05.
   2. Find the P-value.
   3. Compute the power of the test if the true mean sodium content is 130.5 milligrams.
   4. What sample size would be required to detect a true mean sodium content of 130.1 milligrams if we wanted the power of the test to be at least 0.75?
   5. Explain how the question in part (a) could be answered by constructing a two-sided confidence interval on the mean sodium content.
5. **(7-12) (0.6 point)** The amount of time that a customer spends waiting at an airport check-in counter is a random variable with mean 8.2 minutes and standard deviation 1.5 minutes. Suppose that a random sample of n = 49 customers is observed. Find the probability that the average time waiting in line for these customers is
   1. Less than 10 minutes
   2. Between 5 and 10 minutes
   3. Less than 6 minutes
6. **(8-4?) (0.4 point)** A confidence interval estimate is desired for the gain in a circuit on a semiconductor device. Assume that gain is normally distributed with standard deviation 20.
   1. How large must n be if the length of the 95% CI is to be 40? Show your calculations. Stating results alone is not acceptable.
   2. How large must n be if the length of the 99% CI is to be 40? Show your calculations. Stating results alone is not acceptable.
7. **(8-9) (1.0 point)** Suppose that n=100 random samples of water from a freshwater lake and calcium concentration (milligrams per liter) measured. A 95% CI on the mean calcium concentration is 0.49  μ  0.82.
   1. Would a 99% CI calculated from the same sample data be longer or shorter? Please comment. Answers like ‘longer’ or ‘shorter’ alone are not acceptable.
   2. Consider the following statement: There is a 95% chance that μ is between 0.49 and 0.82. Is this statement correct? Explain your answer. Answers like ‘yes’ or ‘no’ alone are not acceptable.
   3. Consider the following statement: If n=100 random samples of water from lake were taken and the 95% CI on μ computed around 950 of the CIs would contain the true value of μ. Is this statement correct? Explain your answer. Answers like ‘yes’ or ‘no’ alone are not acceptable.

1. **(0.4 point)** Devore (textbook) – 8th edition: Exercise 7.56 (only section b) on page 298. You may assume that the population is normally distributed.
2. **(0.6 point)** Devore (textbook) – 8th edition: Exercise 7.45 on page 296. Provide explanation where asked. Answers like ‘yes’ or ‘no’ alone are not acceptable.

**You need to solve 6 out of these 9 questions. (Question1 should be included so you can pick 5 more)**

**Good Luck.**