**HOMEWORK #8 - DUE: Friday, April 12**

Write your name on everything you hand in. Show your work.

1. (Exercise 8.47 from textbook)
   (a) Find $P(T < 2.365)$ when $v = 7$.
   (b) Find $P(T > 1.318)$ when $v = 24$.
   (c) Find $P(-1.356 < T < 2.179)$ when $v = 12$.
   (d) Find $P(T > -2.567)$ when $v = 17$.

2. An electrical firm manufactures light bulbs that are known to have a population standard deviation of 40 hours. A sample of 49 bulbs are found to have an average life span of 780 hours.
   (a) Find a 97% confidence interval for the population mean.
   (b) If you want a narrower 97% confidence interval than the one found in the part (a), what can you do?
   (c) Find a 99% confidence lower bound for the population mean.
   **Note: If you can't find the exact entry you are looking for in the table, then use the closest one.**

3. An electrical firm manufactures light bulbs that have a life span that is approximately normally distributed. The population standard deviation is not known. A sample of 30 bulbs are found to have an average life span of 800 hours and a sample standard deviation of 45 hours.
   (a) Find a 90% confidence interval for the population mean.
   (b) Would a 99% confidence interval computed from the same sample be wider or narrower than the confidence interval found in part (a)?
   (c) Find a 85% confidence lower bound for the population mean.

4. As an engineer working for a electrical power company you need to design an experiment to determine a 95% confidence interval for $\mu$ the mean daily power usage for homes in Salt Lake City. Measuring the daily power usage of every single home is not practical; therefore you need to choose a sample. What size does your sample need to be to ensure that the confidence interval for $\mu$ is not larger than $\pm 5kWh$? Or in other words, what is the minimum sample size that can be used to be 95% confident that the error between the sample mean $\bar{x}$ and the population mean $\mu$ will not exceed 5 kWh? Assume that the standard deviation for the population distribution of power usage is known to be $\sigma = 50kWh$.

5. We are interested in evaluating the performance of two brands of CPUs in terms of their maximum sustainable clock speeds.

(a) A sample of 40 CPUs of brand 1 are found to have an average maximum sustainable clock speed of 550 MHz. A sample of 150 CPUs of brand 2 are found to have an average maximum sustainable clock speed of 530 MHz. The manufacturer for brand 1 reports that the population standard deviation for the maximum sustainable clock speed of their CPUs is 10 MHz. The manufacturer for brand 2 reports that the population standard deviation for the maximum sustainable clock speed of their CPUs is 15 MHz. Find a 99% confidence interval for $\mu_1 - \mu_2$, the difference of the population means of the maximum sustainable clock speeds for brand 1 and 2. **Note: If you can't find the exact entry you are looking for in the table, then use the closest one. If there are two equally close entries, use their average.**

(b) This time lets consider the following scenario: Assume that the population distributions for the maximum sustainable clock speed is approximately normally distributed but the population variances are unknown. Assume that the population variances are equal. A sample of 41 CPUs of brand 1 are found to have a sample mean of 550 MHz and a sample variance of 400. A sample of 21 CPUs of brand 2 are found to have a sample mean of 530 MHz and a sample variance of 100. Find a 99% confidence interval for $\mu_1 - \mu_2$, the difference of the population means of the maximum sustainable clock speeds for brand 1 and 2.

6. A manufacturer of car batteries claims that his batteries will last, on average, 3 years with a variance of 1 year. If 5 of these batteries have lifetimes of 1.9, 2.4, 3.0, 3.5 and 4.2 years, construct a 95% confidence interval for $\sigma^2$ (the population variance).

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7. **(Turn your answer to this question in with your HW 9 on April 19 - You may work in groups of up to 5 people, write down the names of the other people in your group)**

   Assume that the one-way commute time of an UoU student from his house to school is a normally distributed random variable which we will call $X$. Furthermore, assume that the population standard deviation of X is $\sigma = 10$ minutes. Let $\mu$ be the unknown population mean for $X$.

   (a) Experimental design: Determine a minimum sample size such that we will be 95 % confident that the error will not exceed 5 minutes when the sample average $\bar{x}$ is used to estimate $\mu$. Let $n$ denote this sample size.

   (b) Randomly ask $n$ people on the UofU campus their commute times and record their answers.

   (c) Based on your sample, find a 95% confidence interval using the central limit theorem (z-distribution).

   (d) Now assume that we don't know the population standard deviation $\sigma$, use the t-distribution and the sample standard deviation $S$ to find a 95% confidence interval.

   (e) Test the null hypothesis that the mean commute time is 20 minutes at the significance level $\alpha = 0.01$. You may assume that $\sigma = 10$ minutes.