MAS 250 Homework Assignment 5

Due: November 8 (Tuesday) 1 pm

Instruction: Turn in homework as **a single pdf file**.

1. Let $X_1, \ldots, X_n$ be a random sample from a population with density function

$$f(x|\theta) = \frac{3x^2}{\theta^3}, \quad 0 \le x \le \theta.$$

   (a) Find the MSE of $\hat{\theta}_1 = \frac{4}{3}\bar{X}$.

   (b) Find the MLE for θ, $\hat{\theta}_2$.

   (c) Find the probability density function of $\hat{\theta}_2$.

   (d) Find the MSE of $\hat{\theta}_2$ using (c).

2. The authors of the paper "Driven to Distraction" (Psychological Science 2001, 462-466) describe an experiment to evaluate the effect of using a cell phone on reaction time. Subjects were asked to perform a simulated driving task while talking on a cell phone. While performing this task, occasional red and green light flashed on the computer screen. If a green light flashed, subjects were to continue driving, but if a red light flashed, subjects were to brake as quickly as possible and the reaction time (in msec) was recorded. The following summary statistics are based on a graph that appeared in the paper:

$$n = 48, \quad \bar{x} = 530, \quad s = 70$$

   (a) **Construct and interpret** a 95% confidence interval for μ, the mean time to react to a red light while talking on a cell phone. What assumption must be made in order to generalize this confidence interval to the population of a ll drivers?

   (b) Suppose that the researchers wanted to estimate the mean reaction time to within 5 msec with 95% confidence. Using the sample standard deviation from the study described as a preliminary estimate of the standard deviation of reaction times, compute the required sample size.

3. In a study of government financial aid for college students, it becomes necessary to estimate the percentage of full-time college students who earn a bachelor's degree in four years or less.

   (a) Determine the sample size required to estimate the percentage with 92% confidence and a margin of error of 0.05. Assume nothing is known about the percentage to be estimated.

   (b) Determine the sample size required to estimate the percentage with 92% confidence and a margin of error of 0.05. Assume that prior studies have shown that about 40% of full-time students earn bachelor's degrees in four years or less.

4. In a large University System, the mean salary for 12 female assistant professors in CLAS turned out to be \$41,000 whereas the mean salary for 15 male assistant professors turned out to be \$42,500. The sample standard deviations were \$3000 for females and \$4000 for males. Assume the equal variances and calculate a 95% confidence interval for the difference of population means and interpret the result (is there a difference?).

5. In adults, a certain bacterium is responsible for 100p% of pneumonia cases. A random sample of 84 adults who have pneumonia is taken, as a result 52 of the cases were caused by this bacterium. Construct and interpret a 95% confidence interval for the proportion of the bacterium cause the pneumonia, p, for this experiment.

6. From the exercise problems in Chapter 7:

   11, 17 (interpret the meaning of the obtained intervals), 32, 39, 46 (interpret the meaning of the obtained intervals), 61

7. (Suggested: no submission)

   1, 2, 4, 5, 7, 9, 13-15, 22, 40, 41, 45, 47, 50, 53, 55, 60, 63, 65