Math 326 – Homework 03 (8.5 – 8.9)
Due (via upload to Canvas) Wednesday, February 09, 2022 at 11:59 PM

1. Let Y have probability density function $f_Y(y) = \dfrac{2(\theta - y)}{\theta^2}$ on support $0 < y < \theta$.
   (a) Determine the cumulative distribution function for Y and explain why it is not pivotal.
   (b) Show that the change of variables $U = Y/\theta$ is a pivotal quantity.
   (c) For a single observation of Y, construct a 90% lower confidence interval for θ.

2. AAA reports a study in which 171 out of 880 randomly selected drivers admitted running a red light in the recent past. Assuming those polled answered honestly, find a 90% confidence interval for the percentage of all drivers who have run a red light in the recent past.

3. A study reported by Steele and Torrie wanted to measure the strength of hydrogen sulfide produced by sewage over 42 hours in warm conditions. As the actual contents of the sewage varied from run to run, $n = 9$ different observations were collected; these observations had mean $\bar{X} = 218$ ppm and $S = 11.1$ ppm. We want to estimate μ, the mean amount of hydrogen sulfide produced over the population of all sewage situations.
   (a) Determine the standard error of the mean.
   (b) Find a 99% confidence interval for μ.

4. A phone poll survey is undertaken to see if men and women have a difference of opinions on a specific topic.
   (a) If 1000 men and 1000 women are to be interviewed, how accurately could you estimate the difference in the proportions? Find an error bound on the estimation.
   (b) Suppose that you were designing the survey and wished to estimate the difference in a pair of proportions, correct to within 2%, with probability 90%. How many interviewees should be included in each sample.

5. Last semester 7 of the 19 MTH 325 students filled out the end of the semester course evaluations. When asked how much time (in hours) they spent outside of class per week on the course, they answered

$$15, 6, 6, 7, 4, 10, \text{and } 8.$$

   (a) Find a 98% confidence interval for the average time spent outside of class on the course per week for all student.
   (b) Find a 95% confidence interval for the true variance in the time students spent outside of class on the course per week.