ENGRD 2700: Basic Engineering Probability and Statistics
Fall 2019

Homework 7

Due **Friday Nov 22** at 11:59 pm. Submit to Gradescope by clicking the name of the assignment. See `https://people.orie.cornell.edu/yudong.chen/engrd2700_2019fa.html#homework` for detailed submission instructions.

The same stipulations from Homework 1 (e.g., independent work, computer code, etc.) still apply.

1. A sample of 100 service times at a call center has a sample mean of 9 minutes and a sample standard deviation of 6 minutes. Assume that the service times are independent and have a normal distribution.
   (a) Give a 95% confidence interval for the mean service time.
   (b) Approximately how many service times we would have to collect to return a 95% confidence interval whose width is at most 15 seconds (= 1/4 minutes)?

2. Harry owns a bakery. The number of chocolate chips that he adds to his cookies is normally distributed with mean μ and variance $\sigma^2 = 25$, where μ is unknown. A customer buys a dozen of these cookies, and obtains the simple random sample

   31, 23, 42, 44, 28, 34, 19, 29, 30, 25, 28, 27

   (a) Compute a 95% confidence interval for μ.
   (b) Compute 90% and 99% confidence intervals for μ.
   (c) Suppose the customer wants a 95% confidence interval that has a width of at most 2. How many cookies would he need to buy to achieve this?

3. Alice and Bob are running for state governor, and two polling agencies, Company X and Company Y, decide to gauge public opinion.
   (a) Company X interviews 453 people, and finds that 55% of individuals want to vote for Alice. Construct a 95% confidence interval for p, the proportion of all voters in the state supporting Alice.
   (b) Company Y conducts its own independent study, and obtains the interval $[0.492, 0.568]$ from a sample size of 378. What confidence level did Company Y use?
   (c) Suppose, contrary to the information specified in part (b), that Company Y obtained the 90% confidence interval $[0.509, 0.591]$ instead. How many individuals did Company Y interview?

4. The files `ithaca.csv` and `syracuse.csv` contain daily temperature data in Ithaca and Syracuse during the month of March. Import these datasets into R or RStudio.
   (a) Let μ_i and μ_s denote the mean temperatures in both cities during the month of March. Construct a 97% confidence interval for $\mu_i - \mu_s$.
   (b) Repeat part (a), assuming the temperature in Ithaca is independent of the temperature in Syracuse (which is not true in reality). How do your intervals compare?

5. Luigi is known far and wide for his meatball subs. Although he advertises that the subs weigh 400 g, Vinny, a regular, suspects that the subs weigh less. Vinny buys a sub each day for 81 consecutive days. He obtains the 95% confidence interval [393.08, 400.92] for the mean weight μ of a sub.
   (a) Find $\bar{x}$ and s, the mean and standard deviation of his sample.
   (b) Approximately how many subs would Vinny need to buy in order to halve the width of his confidence interval?
   (c) Compute 90% and 99% confidence intervals for μ.