STAT 400: Homework 10

Fall 2017, UIUC

Due: Friday, November 17, 2:00 PM

Please see the **detailed homework policy document** for information about homework formatting, submission, and grading.

Exercise 1

Before it closed, Ron Swanson was a frequent patron of Charles Mulligan's Steakhouse in Indianapolis, Indiana. Ron enjoyed the experience so much, during each visit he took a picture with his steak.

Ron also weighed each steak he consumed. He has a record of eating six "22 ounce" Charles Mulligan's porterhouse steaks. Ron found that these six steaks weighed

$$22.4 \text{ oz},\ 20.8 \text{ oz},\ 21.6 \text{ oz},\ 20.2 \text{ oz},\ 21.4 \text{ oz},\ 22.0 \text{ oz}$$

Suppose that "22 ounce" Charles Mulligan's porterhouse steaks follow a $N(\mu, \sigma^2)$ distribution and that Ron's six steaks were a random sample.

(a) Compute the sample standard deviation, s, of these six steaks. Do not use a computer. You may only use $+$, $-$, $\times$, $\div$, and $\sqrt{}$ on a calculator. Show **all** work.

(b) Construct a 95% two-sided confidence interval for the true mean weight of a "22 ounce" Charles Mulligan's porterhouse steak, μ.

(c) Construct a 95% confidence lower bound for the true mean weight of a "22 ounce" Charles Mulligan's porterhouse steak, μ.

(d) Construct a 90% two-sided confidence interval for the true standard deviation of the weight of a "22 ounce" Charles Mulligan's porterhouse steak, σ.

(e) Construct a 90% confidence upper bound for the true standard deviation of the weight of a "22 ounce" Charles Mulligan's porterhouse steak, σ.

Exercise 2

Last year, ballots in Champaign-Urbana contained the following question to assess public opinion on an issue:

> "Should the State of Illinois legalize and regulate the sale and use of marijuana in a similar fashion as the State of Colorado?"

Suppose that we would like to understand Champaign-Urbana's 2017 opinion on marijuana legalization. To satisfy our curiosity, we obtain a random sample of 120 Champaign-Urbanians and find that 87 support marijuana legalization.

(a) Construct a 99% confidence interval for p, the true proportion of Champaign-Urbanians that support marijuana legalization.

(b) Suppose that a pollster wants to estimate the true proportion of Champaign-Urbanians that support marijuana legalization to within 0.04, with 95% confidence. How many Champaign-Urbanians should this pollster poll? Assume the pollster has no prior knowledge about the proportion.

(c) Now assume the pollster believes that support for legalization is somewhere between 65% and 85% and they would like to estimate the true proportion of Champaign-Urbanians that support marijuana legalization to within 0.04, with 90% confidence. How many Champaign-Urbanians should this pollster poll?

Exercise 3

Suppose students in a Statistics class are interested in the average score of an exam, but the instructor has only graded (a random sample of) 13 of the (many) exams. The instructor states that a 90% confidence interval for the true mean is given by $(79.14, 82.86)$ and that you can assume the grades follow a normal distribution.

Using only this information, calculate $\bar{x}$, s, and finally, a 95% confidence interval for μ, the true mean of the exam.

Exercise 4

Suppose that 10 students visit the Stars Hollow Apple Orchard and each pick (a random sample of) 15 Fuji apples, weigh them, then create a 90% confidence interval for the true mean weight of a Fuji apple at the Stars Hollow Apple Orchard. What is the probably that at most 2 of these intervals do not contain the true mean weight of a Fuji apple at the Stars Hollow Apple Orchard?