

# STAT 3202: Homework 04

*Autumn 2018, OSU*

*Due: Friday, September 28*

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

Due to the nature of the exercises in this homework, instead of the usual 0 - 1 - 2 grading for each exercise, we will instead utilize 0 - 0.5 - 1 grading for each exercise **part**.

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## 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 oz, 20.8 oz, 21.6 oz, 20.2 oz, 21.4 oz, 22.0 oz

Suppose that the weight of “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.
- (b) Construct a 95% two-sided confidence interval for the true mean weight of a “22 ounce” Charles Mulligan's porterhouse steak,  $\mu$ .
- (c) Construct a 95% confidence *lower bound* for the true mean weight of a “22 ounce” Charles Mulligan's porterhouse steak,  $\mu$ .

(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,  $\sigma$ .

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## Exercise 2

In 2017, 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-Urbansians and find that 87 support marijuana legalization.

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

(b) Suppose that a pollster wants to estimate the true proportion of Champaign-Urbansians that support recreational marijuana legalization to within 0.04, with 95% confidence. How many Champaign-Urbansians 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-Urbansians that support recreational marijuana legalization to within 0.04, with 90% confidence. How many Champaign-Urbansians should this pollster poll?

(d) Instead, suppose we obtain a random sample of 80 Champaign voters, of which 55 support recreational marijuana legalization. We also obtain a random sample of 100 Urbana voters, of which 75 support recreational recreational marijuana legalization. Let  $p_C$  be the true proportion of Champaign voters who support recreational marijuana legalization and let  $p_U$  be the true proportion of Urbana voters who support recreational marijuana legalization. Calculate a 99% confidence interval for  $p_U - p_C$ .

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## 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  $\mu$ , the true mean of the exam.

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## Exercise 4

Professor Professorson, a researcher at Greendale Community College, is interested in the effect of caffeine on the typing speed of students. Professorson obtains a random sample of 8 students who are given 400 mg of caffeine then given a typing test. (Don’t try this at home.) They type an average of 51.4 words per minute (wpm), with a sample standard deviation of 12.3 wpm. He also obtains a random sample of 13 students who

are given a placebo before the typing test. The placebo group types an average of 43.9 wpm, with a sample standard deviation of 15.1 wpm. Assume typing speeds follow a normal distribution in both groups.

Construct a 99% confidence interval for  $\mu_C - \mu_P$ , the true difference in average typing speed between the caffeine and placebo groups. Assume that the two population variances are equal.

