SDGB 7844 HW 4: One-Sample t-Test

Instructor: Prof. Nagaraja

Due: 11/16 in class

Submit two files: (a) .Rmd R Markdown file with answers and code and (b) Word document of knitted R Markdown file. Email both files to fordhamRcomputing@gmail.com by the start of class with the subject line "HW4-[Full Name]-[Class Time]" and include HW 4 and your name in the file names (time of class is either 1:15 PM or 5:45 PM).

Please email your solutions only once! Complete your work individually and comment your code for full credit. For an example of how to format your homework see the files related to the Lecture 1 Exercises on Blackboard.

The company Performance Tires plans to engage in direct mail advertising. It is currently in negotiations to purchase a mailing list of the names of people who bought sports cars within the last three years. The owner of the mailing list claims that sales generated by contacting names on the list will more than pay for the cost of using the list. (Typically, a company will not sell its list of contacts, but provides the mailing services. For example, the owner of the list would handle addressing and mailing catalogs.)

Before it is willing to pay the asking price of \$3 per name, the company obtains a random sample of 225 names and addresses from the list in order to run a small experiment. It sends promotional mailings to each of these customers. The company makes a profit of 20% on the gross dollar of a sale (not including the \$3 cost of the name). For example, if a customer orders \$100 worth of goods (i.e., gross dollar) the company makes a \$20 profit. If we include the cost of the name, the \$20 profit reduces to a \$17 profit. Should the company purchase the mailing list?

Use the file "direct_mail.xlsx." The data in this file are the gross dollar values of individual customer's orders generated by the experimental mailing. Use the function `read.xlsx()` in the package ***openxlsx*** to upload this Excel file.

1. Why would a company want to run an experiment? Why not just buy the list and see what happens?

2. Why would the holder of the list agree to allow the potential purchaser to run an experiment?

3. If you wanted to run a hypothesis test on the profitability of the list at the $\alpha = 0.05$ level, what would your hypotheses be? What does μ represent?

4. Identify the population, parameter, sample, and statistic in this scenario.

5. In your hypotheses in question 3, what would it mean to make a Type I error in this context? What is the probability of making such an error?

6. With the data you will use to test your hypothesis, (a) construct a histogram, (b) compute summary statistics (minimum, median, mean, maximum, and standard deviation), and (c) compute the fraction of people who bought nothing from Performance Tires. Describe the shape of the data. Remember to include the units of measurement.

7. Check the assumptions for a one-sample t-test. Are they satisfied for this data? Explain your answer.

8. Test the hypotheses you specified in question 3 and provide a recommendation to the company. Remember to identify the test statistic, degrees of freedom, p-value, and conclusion (don't just show the output of your R code).