

Name _____

STT 3850 Test 3

- A. (60 Points) A researcher randomly assigns six 3 ft. by 3 ft. agricultural plots to two conditions (with sunlight and without sunlight), planted 10 seeds of a certain plant species on each of the plots, then after a month counted how many seeds germinated. He obtained the following data on each plot and the count of seeds that germinated on each plot:

Plots with Sunlight: Plot 1 Plot 4 Plot 5

 10 8 6

Plots without Sunlight: Plot 2 Plot 3 Plot 6

 4 6 5

1.
 - a. Obtain and interpret a 90% confidence interval estimate of the difference in the mean number of seeds per plot that will germinate for plots with and without sunlight.
 - b. What is the margin of error of the estimate?
 - c. Does this interval estimate in part a provides a statistically significant evidence that there is a difference in germination rates for plots with and without sunlight? Explain.
 - d. Discuss the effect of increasing the confidence level on the margin of error of the interval estimate of the difference in mean germination rates.
 - e. Obtain and interpret a 95% confidence interval estimate of the mean number of seeds that will germinate for plots with sunlight.

2. Another researcher realized that the sample sizes in the experiment were too small. He repeated the study and recorded the following data:

860 out 1000 seeds exposed to sunlight have germinated while 640 out of 1000 seeds not exposed to sunlight have germinated

- a. Obtain and interpret a 90% confidence interval estimate of the difference in the proportion of seeds that germinated with and without sunlight.
- b. What is the margin of error of the estimate?
- c. Does this interval estimate in part a provide statistically significant evidence that there is a difference in germination rates with and without sunlight? Explain.
- d. Obtain and interpret a 95% confidence interval estimate of the proportion of seeds that will germinate for seed exposed to sunlight.
- e. How many seeds should be planted so that the proportion of seeds that will germinate can be estimated with a margin of error not exceeding 2% (or .02) and with a confidence level of 96%?

- B. (40 points). Start R Studio and enter the command **attach(mtcars)** on the R console. This will allow you to access the contents of the data frame **mtcars**. Enter the command **help(mtcars)** to get a description of this data frame then answer the following questions:
1. Fit a simple linear regression model that can possibly be used to predict a car's **mpg** based on its engine's horsepower (**hp**). What is the estimate of the slope and what does this say about cars' **mpg** and **hp**?
 2. Obtain and interpret a 90% confidence interval of the slope of the model.
 3. Based on the appropriate output after fitting the simple linear regression model, is the car's engine horsepower a statistically significant predictor of its **mpg**? Explain.
 4. Based on the appropriate regression diagnostic procedure, is the assumption of normality of the error terms in the model reasonable? Explain.
 5. Based on the appropriate regression diagnostic procedure, is the assumption of constant variance in the error terms of the model reasonable? Explain.
 6. Interpret the R-squared value after fitting the model in part 1. Would this value indicate that the model will give a really good, a reasonable or a really bad prediction, on average? Explain.
 7. Fit a multiple linear regression model that can possibly be used to predict a car's **mpg** based on **hp** and **disp**. Use the model to predict the average **mpg** of cars with **hp =120** and **disp = 200**.
 8. Which of the two predictors in #7 is /are statistically significant at the 5% level?