

Assignment 3

1. The USA Federal Government has proposed labeling large home appliances (e.g., refrigerators, stoves, dishwashers, washers and dryers) indicating electrical efficiency as a moderate way to encourage better energy usage. A survey was taken to see who would consider the labels when purchasing large home appliances. The sample resulted in the following data.

Question: Would energy efficiency labelling impact your decision when purchasing large home appliances?

Gender	Yes	No	Undecided
Men	115	32	8
Women	135	16	8

- a. Suppose the investigator wishes to see if there is a relationship between gender and the answer to the question. State the null and alternate hypotheses for this setting.
 - b. Compute the appropriate test statistic.
 - c. Compute the p-value for testing the hypothesis in part a..
 - d. State the conclusion to the study question using a significance level of $\alpha = 0.05$.
2. The 2020 USA census reported the following percentages for modes of commuting to work for workers over the age of 15.

Mode of transportation	Percentage
Driving alone	75.7
Carpooling	12.2
Public transit	4.7
Walking	2.9
Other	1.2
Worked at home	3.3

A study was conducted to see if there was evidence that Canadians commuted to worked with the same proportions as Americans. A random sample of Canadian workers aged 15 and older were sampled. It was found that 320 drove alone, 100 people carpooled, 30 people used public transit, 20 people walked, 10 people used other modes of transport, and 20 worked at home.

Use these data to assess whether there is evidence to conclude that the percentage of Canadian workers, aged 15 and older, using each type of transportation differs from the USA. (State, the hypotheses, test statistic, p-value and conclusions at a significance level of $\alpha = 0.01$).

3. There has been much interest upon the effects of humidity upon the mean yield of two varieties (B52 and Northern Light) of the plant *C. sativa*. In many cases a high humidity level is required to get good growth. An experiment is to be run where the purpose is to see if there are differences in the mean yield for the two plants

To conduct the experiment, many mini-greenhouses are available. Each greenhouse can house up to 4 pots and each pot can hold a single seedling of the plant. You must use all plots in the greenhouse. When running an experiment, the humidity in the greenhouse is set, and the 4 pots each contain a plant (you can have different varieties of plant in each pot). After one month, the yield in each pot is measured in kilograms (kg).

Suppose a pilot study suggested that the standard deviation in the yield between greenhouses was 1 kg, and the standard deviation in the yields for plants within the same greenhouse was 0.5 kg. The experimenter would like to discover if there are conditions under which the mean yield for the different plant varieties differ by 1 kg using a statistical test with $\alpha = 0.05$ and a power of 0.80.

Suppose you are going to fit a statistical model that has only main effects but does not contain the interaction between humidity and plant variety. Find the number of greenhouses necessary to do this with each humidity assigned the same number of times. Use a balanced design.