

15.2.3: Chapter 4 Homework

1. A researcher wanted to know if students who use the library at a college have higher GPAs than students who do not use the library. The researcher decided used a random number generator to choose 20 random classes at the college. Students in each of these classes were given surveys that could be filled out anonymously. Students that completed the surveys were given a \$5 gift card for the bookstore. 82% of students in the sampled classes returned the surveys.

Here are the two questions of interest:

- i. How often do you use the library?
 - a. Never
 - b. Less than once a week
 - c. More than once a week, but not every day
 - d. Every day
 - ii. What is your current GPA? _____
- a. What method of sampling was used by the researcher?
 - b. Discuss the wording of the questions for possible bias.
 - c. Is this an observational study or an experiment? Explain.
 - d. The researcher concluded that students who use the library more frequently have higher GPAs. Is this a valid conclusion for this type of study? Explain.
2. A community college is considering using multiple measures to place students into math courses. The existing measure is that each student takes a standardized placement exam. On the basis of the score, the student will be placed in one of three math courses: Elementary Level, Intermediate Level and Transfer Level. A second measure is to use high school GPA to modify the needed placement exam score for each of the three courses.

200 incoming students who have high school GPAs were randomly split into two groups. The first group of 100 students was given the existing placement exam only. The second group of 100 students was placed by the new second measure, utilizing both placement exams and high school GPAs.

- a. Is this an observational study or an experiment? Explain.
- b. What is the explanatory variable and what is the response variable?

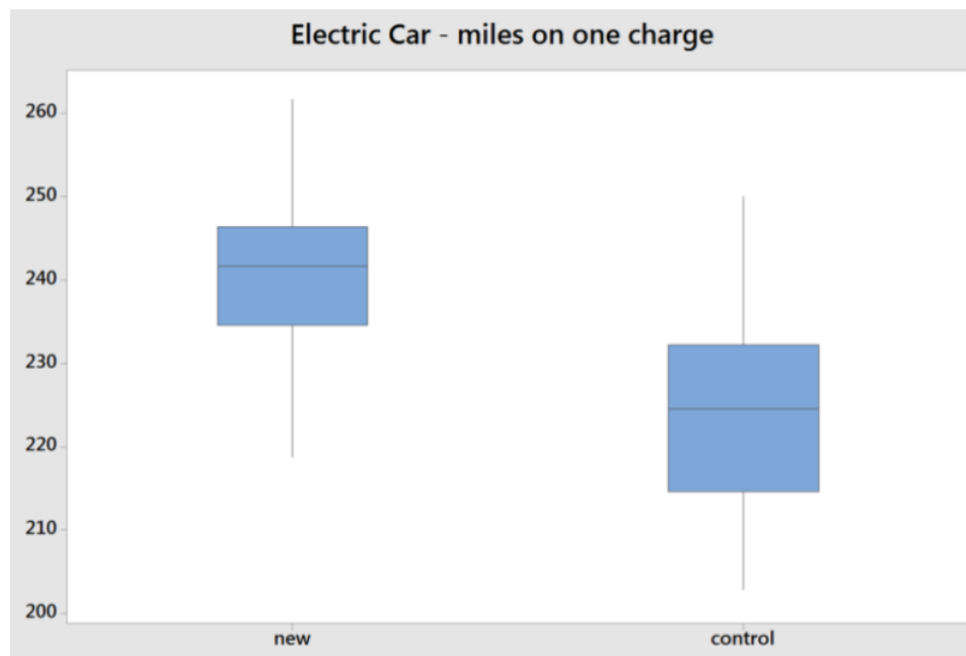
After three quarters, it was found that 17 of the first group completed the transfer level course, while 31 of the second group completed the transfer level course. Based on this result, the researcher decided that the new multiple measures method of placing students improved the percentage of students who pass the transfer level math course in three quarters.

3. A researcher for an electric car company was testing a new battery system. The goal of the battery system was to extend the life of the battery before recharging is necessary.

48 identical model electric cars were selected. 24 cars were given the new battery system (treatment group), while the remaining 24 cars kept the old system (control group). All cars were then fully charged. 24 drivers were then assigned a car. They were not told whether they were driving a car with the new batteries or a car with the regular batteries. The drivers were all given the same route to drive. The drivers drove the cars until the battery ran dead. The mileage driven was then recorded.

The 24 drivers then returned the next day to repeat the experiment with the remaining cars.

Each driver was assigned a new battery car and a regular battery car, but neither the driver nor the person assigning the car knew the order in which they drove the cars. The results are shown in the box plot. The researchers concluded that new battery system did extend the life of the battery by about 7%.



- a. In this experiment, what is the explanatory variable and what is the response variable?
- b. Was there blinding done in this experiment? Explain.
- c. Suppose the researcher instead chose 48 drivers and each driver drove a single car. Would this create any lurking variables for the experiment?
4. Identify the Steps of a Statistical Process for the library use/GPA example in problem 1. The steps are listed below:
 - a. Ask a question that can be answered with sample data.
 - b. Determine the information needed
 - c. Collect sample data that is representative of the population.
 - d. Summarize, interpret and analyze the sample data.
 - e. State the results and conclusion of the study.
5. Identify the Steps of a Statistical Process for the multiple measures example in problem 2. The steps are listed below:
 - a. Ask a question that can be answered with sample data.
 - b. Determine the information needed
 - c. Collect sample data that is representative of the population.
 - d. Summarize, interpret and analyze the sample data.
 - e. State the results and conclusion of the study.
6. Identify the Steps of a Statistical Process for the electric car example in problem 3. The steps are listed below:
 - a. Ask a question that can be answered with sample data.
 - b. Determine the information needed
 - c. Collect sample data that is representative of the population.
 - d. Summarize, interpret and analyze the sample data.
 - e. State the results and conclusion of the study.
7. A researcher wants to determine the average student loan debt for California students. The researcher understands that the cost of college could be dramatically different for students who attend community college, the California State System (CSU), The University of California system (UC), or private colleges. To account for this, the researcher decides to employ stratified sampling.
 - a. Why did the researcher choose stratified sampling?
 - b. Identify the 4 strata (groups) for this method.
 - c. Based on recent estimates, 2.1 million students attend community college, 478,000 attend the CSU system, 238,000 attend the UC system and 184,000 attend private colleges. If the researcher wants to sample a total of 2000 students, determine the sample size for each group.

8. The 2015 US Supreme Court Decision *Obergefell v. Hodges* established a constitutional right for same- sex couples to marry. Before this decision, many polls were conducted. Read the wording of the following actual polling questions and decide if the questions are unbiased or biased. Explain your reasoning and why you think some questions are biased.
- Do you think it should be legal or illegal for gay and lesbian couples to get married?
 - Do you favor or oppose allowing gay and lesbian couples to enter into same-sex marriages?
 - Should state governments give legal recognition to marriages between couples of the same sex?
 - Do you think gays and lesbians have a constitutional right to get married and have their marriage recognized by law as valid?
 - Do you think marriages between same-sex couples should or should not be recognized by the law as valid, with the same rights as traditional marriages?
 - Do you want homosexual marriage in your community even if it means schools will be required to teach sodomy to your children?
 - Would you support or oppose a law in your state that would allow same-sex couples to get married?
 - Do you support marriage equality?
 - Should states continue to discriminate against couples of the same gender who want to marry?
 - Should states be forced to legalize homosexual marriage over the wishes of a majority of the people?

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