Homework: Observational Studies and Experiments

1. A study follows two groups of students, who are randomly selected from a school, for one year. Students decide which group to join depending on which category they feel they belong to: I watch more than 10 hours of TV per week OR I watch fewer than 5 hours of TV per week. Students who watch no television, or who watch between 5 and 10 hours a week, were excluded from participating in the study. The study records the average grades and the percent of students who participate in team sports. Is this an observational study or an experiment? Explain.

   Observational - No treatment was imposed. Data was recorded based on each category the students were in.

2. A study was done to answer the question, “What is the effect of different durations of light and dark on the growth of radish seedlings?” Three similar growth chambers (plastic bags) were created in which 30 seeds randomly chosen from a package were placed in each chamber. One chamber was randomly selected and placed in 24 hours of light, another for 12 hours of light and 12 hours of darkness, and a third for 24 hours of darkness. After three days, researchers measured and recorded the lengths of radish seedlings for the germinating seeds. Is this an observational study or an experiment? Explain.

   Experiment - Different treatments were given to each group of seedlings and then length was recorded.

3. A medical researcher wants to determine whether exercising can lower blood pressure. At a health fair, he measures the blood pressure of 100 individuals, and interviews them about their exercise habits. He divides the individuals into two categories: those whose typical level of exercise is low, and those whose level of exercise is high. Those in the low-exercise group had considerably higher blood pressure, on average, than those in the high-exercise group. Can the researcher conclude that exercise causes blood pressure to decrease?

   1. Yes, a causal relationship can be established because this is an observational study.
   2. No, a causal relationship cannot be established because this is an observational study.
   3. Yes, a causal relationship can be established because this is a well-designed experiment.
   4. No, a causal relationship cannot be established because this is a well-designed experiment.
4. Some researchers have proposed a new treatment for Alzheimer's disease. They divide their subjects into two random groups: one group gets this new treatment, while the other group gets the standard treatment. At the end of the study, the quality of life of all the subjects is assessed. Explain why the researchers decided to use two groups – one with the old treatment and one with the new – rather than just giving everyone the new treatment.

The old treatment group serves as a control group and allows the researchers to compare the new treatment with the old. If you only used the new treatment, there is nothing to compare to.

5. In an experiment to determine how caffeine affects our bodies, some subjects were asked to push a button as quickly as they could after taking a caffeine pill and some after taking a placebo pill. The subjects were placed in the groups randomly. The mean reaction time for the subjects taking the caffeine pill was 158 milliseconds, and the mean reaction time for the subjects taking the placebo pill was 197 milliseconds.

a.) Which group is the control group?

The group that takes the placebo.

b.) What is the purpose of this control group?

It serves as a baseline and allows them to compare the effects of caffeine to no caffeine.

c.) Find the difference in the mean reaction time of the two groups (placebo - caffeine)

\[ 197 - 158 = 39 \text{ milliseconds} \]

d.) The researchers were not surprised by the difference calculated in this study. Explain why they might think this way.

We would expect the caffeine group to have quicker reaction times, producing a positive difference.

6. Glenn just bought a new air fryer. Despite poor reviews, the company that manufactures the air fryer claims it can cook pizza logs in half the time as a regular deep-fryer. Glenn purchases 100 pizza logs. Describe how Glenn could design an experiment to test the company's claim.

He would randomly place 50 pizza logs in a group that gets cooked by the air fryer and 50 pizza logs in a group that gets cooked by the deep fryer. Cook time will be measured and compared. (After he is done, he will have to invite several friends over to help him eat all of pizza logs!)