

Assignment

Write

Match each definition to its corresponding term.

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| 1. A study that gathers data about a characteristic of the population by simply observing and describing events in their natural settings. | a. biased sample |
| 2. A survey that poses one or more questions of interest to a sample of a targeted population. | b. sample survey |
| 3. The members of the sample for an experiment. | c. random sample |
| 4. The specific question that you are trying to answer or the specific information you are trying to gather. | d. characteristic of interest |
| 5. A situation that occurs when there are other possible reasons for the results to have occurred that were not identified prior to the study. | e. confounding |
| 6. A sample that is not representative of the population. | f. observational study |
| 7. An experimental condition that is used on treatment groups. | g. experiment |
| 8. A process that gathers data on the effect of one or more treatments on the characteristic of interest. | h. treatment |
| 9. A sample that is selected from the population in such a way that every member of the population has the same chance of being selected. | i. experimental unit |

Remember

To design a sample survey, observational study, or experiment: determine a characteristic of interest; identify the population; write a question(s) that can be answered by collecting quantitative data; collect a sample using a method that avoids bias; and eliminate elements of the design that may introduce confounding.

Practice

- Determine whether the given method of data collection is a sample survey, an observational study, or an experiment. Explain your reasoning. Then identify the population, the sample, and the characteristic of interest.
 - A high school principal wants to determine whether students who work in groups in geometry class receive higher grades than students who do not work in groups. He directs 5 of the geometry classes to participate in group work and 5 of the geometry classes to complete their work individually.

- b. You are curious about student interest in your school about doing volunteer work in the community. You ask 120 randomly selected students in your school whether they are interested in doing volunteer work in the community.
 - c. A researcher wants to know whether female professional athletes are more prone to knee injuries than male professional athletes. She gathers data from 6 different sports organizations that have injury records for all of their male and female professional athletes.
2. You are organizing a survey to learn about the exercise habits of students in your school. You are interested to know the number of hours students spend exercising during an average week.
 - a. What is the population of interest?
 - b. How could a representative random sample be selected?
 - c. What is the characteristic of interest?
 - d. Give an example of a question that is unbiased for this survey.
3. A medical researcher wants to determine whether there is a connection between the frequency of migraine headaches in adults and changes in weather. The researcher collects data on 75 adults who experience migraine headaches that live in temperate climates and 75 adults who experience migraine headaches that live in climates with varying extremes.
 - a. What is the population of interest?
 - b. What is the sample?
 - c. How could confounding be avoided or addressed?
4. Explain how each sampling method is biased.
 - a. One hundred fish caught in a bass tournament are arranged from largest to smallest. The fish are then clustered into 5 groups so that the 20 largest are in the first group, the next 20 largest are in the second group, and so on. You randomly choose 10 fish from the last group to perform an experiment to analyze the lengths of the fish caught in the tournament.
 - b. A scientist is preparing an experiment in which he will analyze the bacteria levels in a lake. He walks to the edge of the lake and fills 40 vials with water to represent the water supply in the lake.
 - c. You want to analyze the fitness levels of runners after they run in a marathon by performing a blood test. There are 1000 runners in the marathon. You choose the first 25 runners that finish the marathon to represent the population of runners for your experiment.
 - d. You want to perform an experiment to determine the amount of money that Americans feel the government should be spending on public transit. You choose a random sample of 50 bus drivers and interview them to represent the population for your experiment.

Stretch

1. Suppose a study was done to see whether eating fried foods more than three times a week is related to coronary heart disease. The study sampled 2000 random men with coronary heart disease and found that there did appear to be a relationship. Name five possible confounding variables that could have affected the results.

2. Three groups of students in grades 7 through 9 are studying political polling. They are asked to come up with a way they would sample 50 adults age 18 and over about their preference for a mayoral candidate in an upcoming election. The sample should be as representative of the voting population in the city as possible. The first group said they would open a local phone book and randomly pick 50 phone numbers out of the book. The second group said they would put an ad in the newspaper and ask people to contact them with their preference. The third group said they would randomly select 50 students in the school and ask them to ask a parent or guardian.
- Which group's sample was the most convenient to obtain?
 - Which group's sample was the most reliant on volunteers?
 - Which group's sample was the most random?
 - Which of the samples, if any, seem most representative of the population of voter's in the city? Explain your reasoning.

Review

- Two different apple orchards record the diameter of apples that are in each bushel of apples picked. The mean diameter of apples from Orchard A is 60 millimeters with a standard deviation of 2 millimeters. The mean diameter of apples from Orchard B is 62 millimeters with a standard deviation of 3 millimeters. Each bushel contains 126 apples. Diameters of apples are normally distributed.
 - Apples that are between 55 and 58 millimeters in diameter are generally considered useful only for apple cider. If a farmer from each orchard randomly selects an apple from a bushel on their orchard, who is more likely to select an apple that is only useful for apple cider? Explain your reasoning.
 - Apples that are more than 63 millimeters in diameter are sold for a profit of \$0.55 per apple. Estimate the amount of profit each orchard will generate from each bushel of apples.
- A random sample of 250 students in a high school were asked how many hours they spent outdoors over the past weekend.
 - Complete the table to determine the relative frequency for each interval of the number of hours spent outdoors. Round your answers to the nearest thousandth.
 - Does the distribution of the time spent outdoors data appear to be a normal distribution? Explain your reasoning.
- Solve each equation for $0 \leq x \leq 2\pi$.
 - $2 \sin^2 x - 1 = 0$
 - $3 \tan^3 x = \tan x$

Hours Outdoors	Number of Students	Relative Frequency
0 – 2	53	
2 – 4	61	
4 – 6	51	
6 – 8	40	
8 – 10	35	
10 – 12	10	