

11.1 Exercises

✓ CONCEPT CHECK

1. Data are the _____, _____, or _____ gathered about a specific variable in a population.
2. During a census, data is obtained from _____ of the population being studied.
3. When a study has _____, it favors a certain outcome.
4. Stratified sampling is also referred to as _____ sampling.

🔗 APPLICATIONS

5. A study was taken to determine whether insulin level influences the course of polycystic ovary syndrome (PCOS). A group of women with PCOS was selected, and half of them were treated with metformin (a drug commonly used to treat diabetes) while the other half was in a control group. Researchers compared the symptoms of PCOS in the two groups. Identify the population of interest and the variables in this study.
6. Lactobacillus is very important for human health, specifically gut health. A group of researchers decided to study how the amount of sugar in a diet could affect the activity of lactobacillus in the gut. They selected a group of people who did not suffer from any gut diseases and divided them into three subgroups. The first subgroup got a diet with high sugar content, the second got a diet with low sugar content, and the third did not change their diet. Identify the population of interest and the variables in this study.
7. An experiment was designed to study the influence of noise level on people's stress level. Several volunteers of differing ages and social groups were subjected to noises of various types and intensities. During the study, researchers measured participants' level of cortisol, which is a hormone that is produced in response to stress. Identify the population of interest and the variables in this study.
8. Social research was conducted to determine if there is a correlation between annual income and the number of children in families. Researchers surveyed two-parent households where both parents were from 25- to 40-years old. Identify the population of interest and the variables in this study.

Decide if each numerical value from a statistical study is a population parameter or sample statistic.

9. After the presentation by the United Way representative, 67 of the night's 300+ attendees were interviewed about their reaction. Of the 67 people interviewed, 79% said they were motivated to donate more of their time and/or money to helping nonprofit organizations.

10. The Nashville Country Music Marathon reported an average finish time of 4:46:28 for the 4082 finishers.
11. A medical study showed that the heart-rate profile during exercise and recovery is a predictor of sudden death. Of the 5713 men studied, the mean maximum heart rate (expressed as the percentage of the predicted maximum heart rate) during exercise was found to be 96% in subjects who died suddenly from cardiac causes during the 23 years when the follow-up was conducted.²
12. An estimated 65% of drivers in rural or town areas view traffic conditions in a good light versus 39% of drivers in the city or suburbs based on a recent news report that aired nationally.

In each scenario, identify the population, the sample, and any population parameters or sample statistics that are given.

13. A medical study followed 675 cancer patients who received either the new drug *Lafent* or a standard chemotherapy drug. 76% of those who received *Lafent* were still living after eight months, compared to only 63% of those who received the standard chemotherapy drug.
14. US realtors across the country are encouraged by the latest reports on the real estate market. Taking into account seasonal factors, sales rose by nearly 9% in the West, 3.5% in the South, 3.4% in the Northeast, and 1% in the Midwest.
15. The online version of *Health* magazine, Health.com, reported the following: “Data from the Women’s Health Study . . . examined the medical records of more than 36,000 women who had no history of depression at the start of the study. Roughly 18% of the women were experiencing some form of migraine or had suffered from the headaches in the past. Over the next 14 years, 11% of the study participants received a depression diagnosis.” One of the conclusions of the study was that middle-aged women who experience migraines are 40% more likely to become depressed.³
16. In a recent study, US graduates of for-profit higher education institutions were between 4.8 and 6.7 percentage points more likely to be unemployed than those at nonprofit institutions and community colleges.⁴

2 Xavier Jouven et al., “Heart-Rate Profile during Exercise as a Predictor of Sudden Death.”

3 Matt McMillen, *Health*, <http://www.health.com>

4 Dan Berrett, *The Chronicle of Higher Education*, <http://www.chronicle.com>

17. Java Express is a company that sells high-end coffee appliances and gourmet coffee. Due to the current economic conditions, the company is looking into ways to change its strategy in order to appeal to more frugal consumers.

Before investing in costly setup expenses, Java Express needs to know the percentage of coffee consumers who would buy from a new line of less expensive products. To estimate this percentage, the company chooses 5 of its largest markets and surveys every registered customer from each of these chosen markets. A total of 6195 customers complete the survey.

The results show that 45% of those surveyed are very interested in the new line of products, 32% are somewhat interested, and the remaining 23% are not interested in the new products at all. Based on these results, the researchers estimate that approximately 77% of coffee consumers will be receptive to the new line of products. Java Express decides that it is worthwhile to introduce a new line of less expensive products to the market.

18. A study was conducted to investigate whether or not exercise is a factor in the overall outlook and positive spirit of Americans.

For the study, 400 Americans were selected at random from each of the following two categories: those who exercise on a regular basis and those who do not. For the purpose of the study, regular exercise was defined to be light to moderate activity at least three times per week. A total of 800 Americans completed the brief telephone survey. Of those who exercise regularly, 74% said that their overall outlook on life is positive. Of those who do not exercise regularly, 68% said that their overall outlook on life is positive.

Though not a definitive study, the researchers concluded that exercise does appear to influence the attitudes of Americans. In addition, the researchers estimated that approximately 71% of all Americans have a positive outlook. Further research would likely be conducted on the subject at a later time.

Determine which type of study should be conducted: an observational study or an experiment.

19. A football coach wants to know the average weight of his offensive linemen.
20. A doctor wants to study the effect of ginseng on patients' memories.
21. A city planner wants to know the average number of vehicles parked in downtown parking lots on any given business day.
22. A cell phone company wants to know the average total length of time teenagers spend on the phone each day.
23. A dentist wants to look at the effects of a new dental material used for fillings.
24. A financial institution wants to know if customer behavior will change significantly when interacting with a new mobile app feature.

Identify the sampling technique used in each scenario.

25. To ensure the quality of its product, a company tests every 15th item off the assembly line.
26. A student committee in the biology department was formed by randomly choosing three biology majors from every level of student, that is, 1st year, 2nd year, etc.
27. In order to choose the winners of free tickets to the campus concert, student housing printed out all 60 pages of student ID's and then chose three of the pages randomly.
28. A candidate for the local school board surveyed parents picking up their children from the public school on three school days in the last month.
29. Surveying movie goers as they exited the late movie, researchers determined that only young adults under the age of 22 see movies in the theater anymore.
30. In order to sample the production yield of milk from the farm's herd of cows, random samples are taken from each of the five different types of cows.
31. Using Excel to generate an arbitrary list of customers, the marketing department sent promotional materials to the top 250 names on the list.

Determine an appropriate sampling method for each scenario. Give your reasons for choosing the method. Describe any potential biases that the researcher might need to consider.

32. A state senator wishes to survey his constituents on issues in the upcoming legislature session.
33. A pharmaceutical company wishing to test the outcomes of a new drug for a particular skin disease finds 1200 patients willing to participate in the study. They can only choose 100 of them for the actual study.
34. Medical scientists wish to evaluate the effects of vitamin E and low-dose aspirin in primary prevention of cardiovascular disease and cancer in apparently healthy women.
35. Researchers wish to study the effects of watching too much television at a young age for children diagnosed with autism.

- 36.** A pharmaceutical company claims their new antacid has fewer side effects than the leading drug and is more effective in relieving the pain of occasional heartburn in patients with reflux disease. To prove this claim, the company conducted a clinical trial on 50 patients with reflux disease. Half of them got the new antacid, and the other half got the leading drug. After a predetermined period of time, the patients were surveyed on their experience. The researchers, unlike the patients, knew what drug each patient was taking.
- Identify the explanatory and response variables.
 - Identify the treatment in the experiment.
 - Determine which group is the treatment group and which group is the control group.
 - State whether the experiment is a single-blind or double-blind study. Do you think this is the best choice for this study?
- 37.** A study was conducted to prove that a new virus-suppressing drug was more effective than the conventional antiviral agent. Patients susceptible to viral infection were randomized into two groups. Participants in Group A were given the new virus-suppressing drug and Participants in Group B were given the conventional antiviral agent. The patients were not informed which drug they were taking, but the researchers were. A viral load was calculated by estimating the number of viral particles per milliliter of blood plasma. The viral load was measured before and three weeks after the course of treatment.
- Identify the explanatory and response variables.
 - Identify the treatment in the experiment.
 - Determine which group is the treatment group and which group is the control group.
 - State whether the experiment is a single-blind or double-blind study. Do you think this is the best choice for this study?
- 38.** A clinical trial was aimed at studying a drug for chronic progressive degenerative disease. Researchers expected the drug to slow down or even reverse the disease's degenerative processes. A group of people with this disease was selected, and some of them were injected with the drug while some were given a placebo in the form of saline. Neither the subjects nor the researchers knew who was receiving the drug and who was receiving the placebo. Before, during, and after the trial, patients underwent various tests to identify and evaluate degenerative processes.
- Identify the explanatory and response variables.
 - Identify the treatment in the experiment.
 - Determine which group is the treatment group and which group is the control group.
 - State whether the experiment is a single-blind or double-blind study. Do you think this is the best choice for this study?

39. To test the hypothesis that vitamin C increases the absorption of iron, researchers recruited a group of people with iron deficiency. Some of the people were prescribed iron supplements, and the others were given iron with vitamin C. Both the researchers and the subjects knew what they were taking. After a month of taking the drugs, the patients' iron levels were remeasured.
- Identify the explanatory and response variables.
 - Identify the treatment in the experiment.
 - Determine which group is the treatment group and which group is the control group.
 - State whether the experiment is a single-blind or double-blind study. Do you think this is the best choice for this study?
40. *Self-selected* samples are a type of convenience sampling in which the participants volunteer to participate in the study rather than being chosen by the researcher. One issue with this type of sampling is that people who “self-select” to be in a survey often either have very strong opinions about an issue or desire monetary rewards for their participation. For instance, consider online polls regarding political views that are conducted by popular news outlets. Describe some of the potential responses from those who take the time to log on and respond. Is it reasonable to generalize the results from a study like this to include all of the American public? Why?
41. Often words like “best” and “worst” are used in reporting data. However, descriptive words like these are hard to measure in a concrete way. Consider how you could measure small towns to compile a list of “America’s 50 Best Small Towns to Live In.” Name at least five distinct measurements.
42. Researchers try to eliminate as many biases in studies as they can in order to get a true picture of the population they are studying. Describe as many potential sources of bias as you can if you were asked to study the effects of alcohol on college campuses.

 **WRITING & THINKING**

43. Explain how cluster sampling is different from stratified sampling.