Chapter 1: Basic Ideas

Section 1.1

Exercises 1 – 6 are the Check Your Understanding exercises for this section. Answers to these exercises are on page 12 of the text book.

Understanding the Concepts

7. population
8. sample
9. simple random sample
10. sample of convenience
11. cluster
12. stratified
13. False. In some cases it is difficult or impossible to draw a sample in a truly random way. In these cases, the best one can do is to sample items by some convenient method. A sample of convenience is one way.
14. False. In a stratified sample, the population is divided into groups, and a random sample from each group is drawn.
15. True
16. True

Practicing the Skills

17. Statistic
18. Parameter
19. Parameter
20. Statistic
21. Answers will vary.
22. Answers will vary. Stratified sample
23. Answers will vary. Cluster sample
24. Answers will vary. Systematic sample

25. Stratified sample
26. Sample of convenience
27. Cluster sample
28. Systematic sample
29. Voluntary response sample
30. Cluster sample
31. Sample of convenience
32. Simple random sample
33. Stratified sample
34. Cluster sample
35. Simple random sample
36. Stratified sample
37. Systematic sample
38. Voluntary response sample

Working with the Concepts

39. It will be necessary to draw a sample of convenience. There is no list of all headache sufferers from which to draw a simple random sample.
40. It is feasible to draw a simple random sample of students from a list of all students enrolled.
41. Answers will vary. A simple random sample could be drawn from a list of all registered voters in the town.
42. Answers will vary. A systematic sample could be used in which every tenth item was sampled.
43. Answers will vary. A stratified sample, consisting of simple random samples of 100 men and 100 women, could be drawn.
44. Answers will vary. A simple random sample of tax forms could be drawn.

Extending the Concepts

45. Answers will vary.

46. Let's say we will sample every kth item. This determines $k - 1$ clusters; the first cluster consists of items $1, k + 1, 2k + 1, ...$; the second cluster consists of items $2, k + 2, 2k + 2, ...$; and so on. Choosing a systematic sample is like choosing one of these clusters at random.

Section 1.2

Exercises 1 – 4 are the Check Your Understanding exercises for this section. Answers to these exercises are on page 18.

Understanding the Concepts

5. variables
6. qualitative
7. Quantitative
8. nominal; ordinal
9. discrete
10. Continuous
11. False. Quantitative variables describe how much or how many of something there is.
12. True
13. True
14. True

Practicing the Skills

15. Qualitative
16. Quantitative
17. Quantitative
18. Qualitative
19. Quantitative
20. Quantitative
21. Qualitative
22. Qualitative

23. Qualitative
24. Quantitative
25. Ordinal
26. Nominal
27. Ordinal
28. Ordinal
29. Nominal
30. Nominal
31. Nominal
32. Ordinal
33. Continuous
34. Continuous
35. Discrete
36. Discrete
37. Continuous
38. Discrete
39. Discrete
40. Continuous

Working with the Concepts

41. Ordinal
42. Discrete
43. Ordinal
44. Quantitative
45. Nominal
46. Ordinal

47. (A) Game Title, System
(B) Release Year, Copies Sold
(C) System
(D) Game Title
48. (A) Movie Title, Genre
(B) Release Year, Ticket Sales, Running Time
(C) Genre
(D) Movie Title

Extending the Concepts

49. **(A)** Ordinal
    (B) Yes, it reflects a more favorable opinion of the construction of a new shopping mall.
    (C) No, we cannot say that Jason's opinion is twice as favorable.
    (D) Quantitative
    (E) Yes, Brenda's answer reflects the ownership of more cars, and specifically, the ownership of twice as many cars.
    (F) Nominal
    (G) No, Brenda's answer reflects neither more of something nor twice as much of something.

Section 1.3

Exercises 1 – 4 are the Check Your Understanding exercises for this section. Answers to these exercises are on page 26.

Understanding the Concepts

5. randomized
6. double-blind
7. observational
8. confounder
9. prospective
10. cohort
11. True
12. False. A confounder makes it harder to draw conclusions from a study.
13. False. In a randomized experiment, subjects are assigned to treatment groups at random.

14. False. Randomized experiments are generally more reliable than observational studies.
15. True
16. True

Practicing the Skills

17. **(A)** Randomized experiment
    (B) Yes, because the assignment to treatments is made at random, there is no systematic difference between the groups other than the drug taken that can explain the difference in pain relief.
18. **(A)** Observational study
    (B) No, because this is an observational study, the results may be due to confounding. For example, those in the low-exercise group may be older and have higher blood pressure as a result of age.
19. **(A)** Randomized experiment
    (B) Yes, because the assignment to treatments is made at random, there is no systematic difference between the groups other than the amount of exercise that can explain the difference in blood pressure.

20. **(A)** The four types of fertilizer
    (B) Randomized experiment
    (C) Yes, because the assignment to treatment is made at random.

Working with the Concepts

21. An observational study will be necessary, because one can't assign people to live in areas with high pollution levels.

22. A randomized experiment is possible, with cold sufferers being assigned randomly to the old or new drug.

23. The result may be due to confounding. Areas with denser populations may have both more crime and more taxicabs.

24. The result could be due to confounding. For example, more older people may live in larger houses than younger people, and also have less chance of recovering from a heart attack.

25. (A) False
   (B) True

26. Children with larger vocabularies tend to be older, and thus taller.

27. (A) Heart rate
   (B) Maternal smoking
   (C) Cohort
   (D) Prospective
   (E) Yes. The level of prenatal care may differ between smoking and nonsmoking mothers.

28. (A) Whether respiratory problems were experienced
   (B) The level of formaldehyde in the classroom
   (C) A cohort study
   (D) Cross-sectional
   (E) It is unlikely. For confounding to be an issue, children with more sensitive respiratory systems would have to have been more likely to be assigned to classrooms with higher exposure.

Extending the Concepts

29. (A) Yes, because the subjects were randomly assigned to treatment.
   (B) If a doctor knew whether a child had received the vaccine, it might influence the diagnosis.
   (C) It could be due to confounding. The children who received the placebo were more likely to be middle- or upper-income than those who did not participate, and this may be the reason that the rate of polio was higher.

30. (A) No
   (B) No
   (C) The treatment group consisted of children who had consent to participate; middle- and upper-income children were overrepresented in this group. Therefore, the children in the treatment group tended to be more susceptible to polio than those in the control group.

31. Smokers who quit are less healthy than smokers who don't. Upon quitting smoking, many people put on weight substituting food for tobacco.

32. Smokers tend to drink more alcohol on the average than non-smokers.

Section 1.4

Exercises 1 and 2 are the Check Your Understanding exercises for this section. Answers to these exercises are on page 30.

Understanding the Concepts

3. Voluntary response surveys
4. nonresponders
5. population
6. False. The way that a question is worded in a survey may have a large effect on the responses.
7. True
8. False. A large sample size does not make up for bias in questioning.

Practicing the Skills

9. Nonresponse bias
10. Voluntary response bias
11. Self-interest bias
12. Self-interest bias
13. Voluntary response bias
14. Social acceptability bias
15. Nonresponse bias
16. Social acceptability bias

Working with the Concepts

17. **(A)** No
    (B) No. Both questions are leading. The first question leads to a "yes" response, and the second leads to a "no" response.
18. Yes. People may be less likely to answer the phone when they don't recognize the number that is calling them.
19. Yes. People who do not have landline phones may tend to have different opinions on some issues than people who do have landline phones.
20. Yes, people may be more likely to pick the first choice.

Extending the Concepts

21. **(A)** The poll oversampled higher-income people.
    (B) The response rate was low — only 23%. This results in nonresponse bias.
    (C) A sample that is not drawn by a valid method can produce misleading results, even when it is large.

CHAPTER 1 Quiz

1. Answers will vary.
2. Qualitative
3. True
4. Continuous
5. False. Ideally a sample should represent the population as much as possible.
6. Stratified sample
7. acceptable
8. Sample of convenience
9. True
10. Observational study
11. Randomized experiment
12. differences in treatment
13. Seniors may be more likely to have better preparation for the class than sophomores.
14. True
15. Not reliable. This is a voluntary response survey, so the people who respond tend to hold stronger opinions than others.

CHAPTER 1 Review Exercises

1. Quantitative
2. Nominal

3. Continuous
4. **(A)** True
   (B) True
   (C) False
5. Stratified sample
6. Voluntary response sample
7. Cluster sample
8. Simple random sample
9. **(A)** Observational study
   (B) Yes. People who live in areas with fluoridated water may have different dental habits than those who live in areas without fluoridated water.
10. **(A)** Randomized experiment
    (B) Because this is a randomized experiment, the results are unlikely to be due to confounding.
11. **(A)** Observational study
    (B) Yes. People who talk on cell phones while driving may be more careless in general than those who do not.
12. **(A)** Randomized experiment
    (B) Because this is a randomized experiment, the results are unlikely to be due to confounding.
13. The sample is a voluntary response sample.
14. Nonresponse bias; living people are not included. People who are still alive are not included in the sample.
15. There is a considerable level of nonresponse bias.

Write About It

1. In both cluster sampling and stratified sampling, the population is divided into groups. In stratified sampling, a simple random sample is chosen from each group. In cluster sampling, a random sample of groups is chosen, and every member of the chosen groups is sampled.
2. A potential problem with samples of convenience is that they may differ systematically in some way from the population. For this reason, samples of convenience should not be used, except in situations where it is not feasible to draw a random sample. When it is necessary to draw a sample of convenience, it is important to think carefully about all the ways in which the sample might differ systematically from the population. If it is reasonable to believe that no important systematic difference exists, then it may be acceptable to use a sample of convenience.
3. Answer will vary.
4. Answers will vary.
5. Some qualitative variables may be numeric when the number represents a label. Examples include numbers on a football jersey or on a racecar.

6. A randomized experiment is a study in which the investigator assigns the treatments to the experimental units at random. An observational study is one in which the assignment to treatment groups is not made by the investigator. The main advantage to conducting a randomized experiment is that if there are large differences in outcomes among the treatment groups, we may conclude that the differences are due to the treatments.
7. The main advantage to conducting a double-blind study is that it is an impartial experiment which eliminates the potential

for bias from the investigator or the subject. There are various limitations. A double-blind experiment requires a third party to be involved in the experiment. Also, there may be factors that may influence the outcome that are not known when the experiment is double-blinded.

8. Answers will vary.

9. **(A)** This is an example of leading question bias. It highly encourages a "yes" response because of the phrase "or continue their wasteful spending." A more appropriate question would be "What is your opinion of Americans saving more money? Choices: Strongly disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Strongly agree."

(B) This is an example of leading question bias. It highly encourages a "yes" response because of the word "reputable." A more appropriate question would be "What is your opinion of the current level of funding for charities?"

10. People who respond by mail will be responding during a period of lower PM.

11. People with symptoms may tend to respond earlier; therefore, people with symptoms are more likely to be school-return people.

12. There would be no tendency for people with symptoms to respond earlier.

CHAPTER 1 Case Study

1. 450

2. 41

3. $\dfrac{41}{450} = 9.1\%$

4. 43

5. 2

6. $\dfrac{2}{43} = 4.7\%$

7. Yes, 9.1% is considerably larger than 4.7%.

8. The high-exposure people and the school-return people are the same people.

9. The low-exposure people and the mail-return people are the same people.