Ch. 1 Data Collection

1.1 Introduction to the Practice of Statistics

1 Define Statistics and Statistical Thinking

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

1) What is statistics?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) Which of the following is not true of statistics?
   A) Statistics is used to answer questions with 100% certainty.
   B) Statistics involves collecting and summarizing data.
   C) Statistics can be used to organize and analyze information.
   D) Statistics is used to draw conclusions using data.

2 Explain the Process of Statistics

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) A survey of 1598 American households found that 77% of the households own a DVD recorder. Identify the population, the sample, and the individuals in the study.

2) A survey of 1301 American households found that 66% of the households own at least two bicycles. Identify the population, the sample, and the individuals in the study.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

3) Parking at a large university has become a very big problem. University administrators are interested in determining the average parking time (e.g. the time it takes a student to find a parking spot) of its students. An administrator inconspicuously followed 130 students and carefully recorded their parking times. Identify the population of interest to the university administration.
   A) the parking times of the entire set of students that park at the university
   B) the parking times of the 130 students from whom the data were collected
   C) the entire set of faculty, staff, and students that park at the university
   D) the students that park at the university between 9 and 10 AM on Wednesdays

4) A manufacturer of cellular phones has decided that an assembly line is operating satisfactorily if less than 0.0 2% of the phones produced per day are defective. To check the quality of a day's production, the company decides to randomly sample 40 phones from a day's production to test for defects. Define the population of interest to the manufacturer.
   A) all the phones produced during the day in question
   B) the 40 phones sampled and tested
   C) the 40 responses: defective or not defective
   D) the 0.02% of the phones that are defective

5) A study published in 1990 attempted to estimate the proportion of Florida residents who were willing to spend more tax dollars on protecting the Florida beaches from environmental disasters. Forty–one hundred Florida residents were surveyed. Which of the following is the population used in the study?
   A) all Florida residents
   B) the 4100 Florida residents surveyed
   C) the Florida residents who were willing to spend more tax dollars on protecting the beaches from environmental disasters
   D) all Florida residents who lived along the beaches

6) Parking at a large university has become a very big problem. University administrators are interested in determining the average parking time (e.g. the time it takes a student to find a parking spot) of its students. An administrator inconspicuously followed 100 students and carefully recorded their parking times. Identify the sample of interest to the university administration.
   A) parking times of the 100 students
   B) parking time of a student
   C) location of the parking spot
   D) type of car (import or domestic)

7) The legal profession conducted a study to determine the percentage of cardiologists who had been sued for malpractice in the last two years. The sample was randomly chosen from a national directory of doctors. Identify the individuals in the study.
   A) each cardiologist selected from the directory
   B) the responses: have been sued/have not been sued for malpractice in the last two years
   C) the doctor's area of expertise (i.e., cardiology, pediatrics, etc.)
   D) all cardiologists in the directory

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

8) Administrators at a large university want to know the average debt incurred by their graduates. Surveys were mailed to 210 graduating seniors asking them to report their total student loan debt. Identify the population, sample, and individuals in the study.

9) A study was conducted to determine if listening to heavy metal music affects critical thinking. To test the claim, 124 subjects were randomly assigned to two groups. Both groups were administered a basic math skills exam. The first group took the exam while heavy metal music was piped into the exam room, while the second group took the exam in a silent room. The mean exam score for the first group was 81, and the mean exam score for the second group was 87. The researchers concluded that heavy metal music negatively affects critical thinking. Identify (a) the research objective, (b) the sample, (c) the descriptive statistics, and (d) the conclusions made in the study.

10) A telephone poll asked 1414 registered voters "Would you vote for the current vice president if he ran for president?" Of these 1414 respondents, 34% would vote for the current vice president if he ran for president. The administrators of the study concluded that 34% of all registered voters would vote for the current vice president if he ran for president. Identify (a) the research objective, (b) the sample, (c) the descriptive statistics, and (d) the conclusions made in the study.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

11) Which branch of statistics deals with the organization and summarization of collected information?
   A) Descriptive statistics
   B) Inferential statistics
   C) Survey design
   D) Computational statistics

Determine whether the underlined value is a parameter or a statistic.

12) In a survey conducted in the town of Atherton, <u>25%</u> of adult respondents reported that they had been involved in at least one car accident in the past ten years.
   A) statistic
   B) parameter

13) 27.2% of the mayors of cities in a certain state are from minority groups.
A) parameter B) statistic

14) A study of 1800 college students in the city of Pemblington found that 6% had been victims of violent crimes.
A) statistic B) parameter

15) 51.7% of the residents of Idlington Garden City are female.
A) parameter B) statistic

16) Telephone interviews of 394 employees of a large electronics company found that 65% were dissatisfied with their working conditions.
A) statistic B) parameter

17) The average age of the 65 students in Ms Hope's political science class is 21 years 5 months.
A) parameter B) statistic

18) Mark retired from competitive athletics last year. In his career as a sprinter he had competed in the 100 –meters event a total of 328 times. His average time for these 328 races was 10.27 seconds.
A) parameter B) statistic

3 Distinguish Between Qualitative and Quantitative Variables

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Classify the variable as qualitative or quantitative.

1) the colors of book covers on a bookshelf
A) qualitative B) quantitative

2) the number of calls received at a company's help desk
A) quantitative B) qualitative

3) the number of seats in a school auditorium
A) quantitative B) qualitative

4) the numbers on the shirts of a boy's football team
A) qualitative B) quantitative

Provide an appropriate response.

5) Quantitative variables classify individuals in a sample according to
A) numerical measure. B) physical attribute.
C) personality characteristic. D) exhibited trait.

4 Distinguish Between Discrete and Continuous Variables

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine whether the quantitative variable is discrete or continuous.

1) the number of bottles of juice sold in a cafeteria during lunch
A) discrete B) continuous

2) the weight of a player on the wrestling team
A) continuous B) discrete

3) the cholesterol levels of a group of adults the day after Thanksgiving
A) continuous B) discrete

4) the low temperature in degrees Fahrenheit on January 1st in Cheyenne, Wyoming
A) continuous B) discrete

5) the number of goals scored in a hockey game
A) discrete B) continuous

6) the speed of a car on a Boston tollway during rush hour traffic
A) continuous B) discrete

7) the number of phone calls to the police department on any given day
A) discrete B) continuous

8) the age of the oldest employee in the data processing department
A) continuous B) discrete

9) the number of pills in an aspirin bottle
A) discrete B) continuous

Provide an appropriate response.

10) The peak shopping time at a pet store is between 8–11:00 am on Saturday mornings. Management at the pet store randomly selected 35 customers last Saturday morning and decided to observe their shopping habits. They recorded the number of items that a sample of the customers purchased as well as the total time the customers spent in the store. Identify the types of variables recorded by the pet store.
A) number of items – discrete; total time – continuous
B) number of items – continuous; total time – continuous
C) number of items – continuous; total time – discrete
D) number of items – discrete; total time – discrete

11) The number of violent crimes committed in a city on a given day in a random sample of 50 days is a _____ random variable.
A) discrete B) continuous

12) Classify the following random variable: telephone area codes
A) qualitative data B) experimental data
C) quantitative continuous data D) quantitative discrete data

13) A student is asked to rate a guest speaker's ability to communicate on a scale of poor-average-good-excellent. The student is to fill in a corresponding circle on a bubble form. This is an example of collecting what type of data?
A) qualitative B) continuous C) discrete D) insightful

5 Determine the Level of Measurement of a Variable

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine the level of measurement of the variable.

1) the musical instrument played by a music student
A) nominal B) ratio C) ordinal D) interval

2) the medal received (gold, silver, bronze) by an Olympic gymnast
A) ordinal B) ratio C) nominal D) interval

3) height of a tree
A) ratio B) interval C) nominal D) ordinal

4) the native language of a tourist
A) nominal B) ratio C) ordinal D) interval

5) the day of the month
A) interval B) ratio C) nominal D) ordinal

6) an officer's rank in the military
A) ordinal B) ratio C) nominal D) interval

7) weight of rice bought by a customer
A) ratio B) interval C) nominal D) ordinal

8) a student's favorite sport
A) nominal B) ratio C) ordinal D) interval

9) ranking (first place, second place, etc.) of contestants in a singing competition
A) ordinal B) ratio C) nominal D) interval

10) capacity of a backpack
A) ratio B) interval C) nominal D) ordinal

11) an evaluation received by a physics student (excellent, good, satisfactory, or poor).
A) ordinal B) ratio C) nominal D) interval

12) the year of manufacture of a car
A) interval B) ratio C) nominal D) ordinal

13) time spent playing basketball
A) ratio B) interval C) nominal D) ordinal

14) category of storm (gale, hurricane, etc.)
A) ordinal B) ratio C) nominal D) interval

1.2 Observational Studies Versus Designed Experiments

1 Distinguish Between an Observational Study and an Experiment

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine whether the study depicts an observational study or an experiment.

1) A medical researcher obtains a sample of adults suffering from diabetes. She randomly assigns 52 people to a treatment group and 52 to a placebo group. The treatment group receives a medication over a period of three months and the placebo group receives a placebo over the same time frame. At the end of three months the patients' symptoms are evaluated.
A) experiment B) observational study

2) A poll is conducted in which professional musicians are asked their ages.
A) observational study B) experiment

3) A pollster obtains a sample of students and asks them how they will vote on an upcoming referendum.
A) observational study B) experiment

4) The personnel director at a large company would like to determine whether the company cafeteria is widely used by employees. She calls each employee and asks them whether they usually bring their own lunch, eat at the company cafeteria, or go out for lunch.
A) observational study B) experiment

5) A scientist was studying the effects of a new fertilizer on crop yield. She randomly assigned half of the plots on a farm to group one and the remaining plots to group two. On the plots in group one, the new fertilizer was used for a year. On the plots in group two, the old fertilizer was used. At the end of the year the average crop yield for the plots in group one was compared with the average crop yield for the plots in group two.
A) experiment B) observational study

6) A researcher obtained a random sample of 100 smokers and a random sample of 100 nonsmokers. After interviewing all 200 participants in the study, the researcher compared the rate of depression among the smokers with the rate of depression among nonsmokers.
A) observational study B) experiment

Provide an appropriate response.

7) True or False: Observational studies are not as useful as experiments to learn about the characteristics of a population.
A) False B) True

8) True or False: Experiments assist the researcher in isolating the causes of the relationships that exist between two variables.
A) True B) False

2 Explain the Various Types of Observational Studies

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine what type of observational study is described. Explain.

1) Researchers wanted to determine whether there was an association between high blood pressure and the suppression of emotions. The researchers looked at 1800 adults enrolled in a Health Initiative Observational Study. Each person was interviewed and asked about their response to emotions. In particular they were asked whether their tendency was to express or to hold in anger and other emotions. The degree of suppression of emotions was rated on a scale of 1 to 10. Each person's blood pressure was also measured. The researchers analyzed the results to determine whether there was an association between high blood pressure and the suppression of emotions.
A) cross-sectional; Information is collected at a specific point in time.
B) cohort; Individuals are observed over a long period of time.
C) retrospective; Individuals are asked to look back in time.

2) Researchers wanted to determine whether there was an association between city driving and stomach ulcers. They selected a sample of 900 young adults and followed them for a twenty-year period. At the start of the study none of the participants was suffering from a stomach ulcer. Each person kept track of the number of hours per week they spent driving in city traffic. At the end of the study each participant underwent tests to determine whether they were suffering from a stomach ulcer. The researchers analyzed the results to determine whether there was an association between city driving and stomach ulcers.
A) cohort; Individuals are observed over a long period of time.
B) cross-sectional; Information is collected at a specific point in time.
C) retrospective; Individuals are asked to look back in time.

3) A researcher wanted to determine whether women with children are more likely to develop anxiety disorders than women without children. She selected a sample of 900 twenty–year old women and followed them for a twenty–year period. At the start of the study, none of the women had children. By the end of the study 53% of the women had at least one child. The level of anxiety of each participant was evaluated at the beginning and at the end of the study and the increase (or decrease) in anxiety was recorded. The researchers analyzed the results to determine whether there was an association between anxiety and having children.
   A) cohort; Individuals are observed over a long period of time.
   B) cross–sectional; Information is collected at a specific point in time.
   C) retrospective; Individuals are asked to look back in time.

4) Vitamin D is important for the metabolism of calcium and exposure to sunshine is an important source of vitamin D. A researcher wanted to determine whether osteoperosis was associated with a lack of exposure to sunshine. He selected a sample of 250 women with osteoperosis and an equal number of women without osteoperosis. The two groups were matched – in other words they were similar in terms of age, diet, occupation, and exercise levels. Histories on exposure to sunshine over the previous twenty years were obtained for all women. The total number of hours that each woman had been exposed to sunshine in the previous twenty years was estimated. The amount of exposure to sunshine was compared for the two groups.
   A) retrospective; Individuals are asked to look back in time
   B) cross–sectional; Information is collected at a specific point in time.
   C) cohort; Individuals are observed over a long period of time.

5) Can money buy happiness? A researcher wanted to determine whether there was any association between economic status and happiness. She selected a sample of 1000 adults and interviewed them. Each person was asked about their financial situation and their level of happiness was evaluated. The researcher analyzed the results to determine whether there was an association between economic status and happiness.
   A) cross–sectional; Information is collected at a specific point in time.
   B) cohort; Individuals are observed over a long period of time.
   C) retrospective; Individuals are asked to look back in time.

6) A researcher wanted to determine whether colon cancer was associated with eating meat. He selected a sample of 500 men with colon cancer and an equal number of men without colon cancer. The two groups were matched – in other words they were similar in terms of age, occupation, income, and exercise levels. Histories on the amount of meat consumed over the previous twenty years were obtained for all men. The total amount of meat that each man eaten in the previous twenty years was estimated. The meat consumption was compared for the two groups.
   A) retrospective; Individuals are asked to look back in time
   B) cross–sectional; Information is collected at a specific point in time.
   C) cohort; Individuals are observed over a long period of time.

1.3 Simple Random Sampling

1 Obtain a Simple Random Sample

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The government of a town needs to determine if the city's residents will support the construction of a new town hall. The government decides to conduct a survey of a sample of the city's residents. Which one of the following procedures would be most appropriate for obtaining a sample of the town's residents?
   A) Survey a random sample of persons within each geographic region of the city.
   B) Survey a random sample of employees at the old city hall.
   C) Survey every 7th person who walks into city hall on a given day.
   D) Survey the first 200 people listed in the town's telephone directory.

2) The city council of a small town needs to determine if the town's residents will support the building of a new library. The council decides to conduct a survey of a sample of the town's residents. Which one of the following procedures would be most appropriate for obtaining a sample of the town's residents?
   A) Survey a random sample of persons within each neighborhood of the town.
   B) Survey a random sample of librarians who live in the town.
   C) Survey 400 individuals who are randomly selected from a list of all people living in the state in which the town is located.
   D) Survey every 14th person who enters the old library on a given day.

3) The policy committee at State University has 6 members: John, Prof. Rise, Dr. Hernandez, LaToyna, Ming, and Jose. A subcommittee of two members must be formed to investigate the visitation policy in the dormitories. List all possible simple random samples of size 2.
   A) John and Prof. Rise, John and Dr. Hernandez, John and LaToyna, John and Ming, John and Jose, Prof. Rise and Dr. Hernandez, Prof. Rise and LaToyna, Prof. Rise and Ming, Prof. Rise and Jose, Dr. Hernandez and LaToyna, Dr. Hernandez and Ming, Dr. Hernandez and Jose, LaToyna and Ming, LaToyna and Jose, Ming and Jose
   B) John and Prof. Rise, Dr. Hernandez and LaToyna, Ming and Jose
   C) John and Prof. Rise, Prof. Rise and Dr. Hernandez, Dr. Hernandez and LaToyna, LaToyna and Ming, Ming and Jose
   D) John and Prof. Rise, John and Dr. Hernandez, John and LaToyna, John and Ming, John and Jose

4) Select a random sample of five state capitals from the list below using the two digit list of random numbers provided. Begin with the uppermost left random number and proceed down each column. When a column is complete, use the numbers at the top of the next right column and proceed down that column.

State Capitals

1	Albany, NY	11	Charleston, WV	21	Hartford, CT	31	Madison, WI	41	Richmond, VA
2	Annapolis, MD	12	Cheyenne, WY	22	Helena, MT	32	Montgomery, AL	42	Sacramento, CA
3	Atlanta, GA	13	Columbia, SC	23	Honolulu, HI	33	Montpelier, VT	43	Salem, OR
4	Augusta, ME	14	Columbus, OH	24	Indianapolis, IN	34	Nashville, TN	44	Salt Lake City, UT
5	Austin, TX	15	Concord, NH	25	Jackson, MS	35	Oklahoma City, OK	45	Santa Fe, NM
6	Baton Rouge, LA	16	Denver, CO	26	Jefferson City, MO	36	Olympia, WA	46	Springfield, IL
7	Bismarck, ND	17	Des Moines, IA	27	Juneau, AK	37	Phoenix, AZ	47	St. Paul, MN
8	Boise, ID	18	Dover, DE	28	Lansing, MI	38	Pierre, SD	48	Tallahassee, FL
9	Boston, MA	19	Frankfort, KY	29	Lincoln, NE	39	Providence, RI	49	Topeka KS
10	Carson City, NV	20	Harrisburg, PA	30	Little Rock, AR	40	Raleigh, NC	50	Trenton, NJ

Random Numbers

46	81	17	60	92	59	40	9
53	78	45	14	53	78	8	43
3	99	46	86	41	42	36	95
39	14	16	59	84	18	5	48
45	41	77	91	11	43	76	28

   A) Springfield, IL; Atlanta,GA; Providence, RI; Santa Fe, NM; Columbus OH.
   B) Springfield, IL; Des Moines, IA; Boston, MA; Santa Fe, NM; Columbus OH.
   C) Carson City NV; Boise ID; Atlanta, GA; Cheyenne, WY; Boston, MA.
   D) Boston, MA; Concord, NH; Dover DE; Santa Fe, NM; Richmond, VA.

5) The top 38 cities in Wisconsin as determined by population are given below. Select a random sample of four cities from the list below using the two digit list of random numbers provided. Begin with the uppermost left random number and proceed down each column. When a column is complete, use the numbers at the top of the next right column and proceed down that column. Information was obtained from the web site http://www.citypopulation.de/USA-Wisconsin.html.

Wisconsin Cities by Population

1	Milwaukee	9	Eau Claire	17	New Berlin	25	West Bend	33	Watertown
2	Madison	10	Janesville	18	Wausau	26	Superior	34	Muskego
3	Green Bay	11	West Allis	19	Greenfield	27	Mount Pleasant	35	De Pere
4	Kenosha	12	La Crosse	20	Beloit	28	Neenah	36	Fitchburg
5	Racine	13	Sheboygan	21	Manitowoc	29	Stevens Point	37	South Milwaukee
6	Appleton	14	Wauwatosa	22	Menomonee Falls	30	Caledonia	38	Grand Chute
7	Waukesha	15	Fond du Lac	23	Franklin	31	Sun Prairie		
8	Oshkosh	16	Brookfield	24	Oak Creek	32	Mequon		

Random Numbers

21	49	6	6	19	15	11	17
12	43	4	31	7	18	1	43
23	30	2	24	21	18	6	48
44	12	20	32	2	28	12	38
8	30	38	43	41	29	3	13

A) Manitowoc, La Crosse, Franklin, Oshkosh.
B) Manitowoc, Appleton, Greenfield, Fond du Lac.
C) Milwaukee, Madison, Green Bay, Kenosha.
D) Milwaukee, Eau Claire, New Berlin, West Bend.

1.4 Other Effective Sampling Methods

1 [Obj 1,2,3] Obtain a Stratified/Systematic/Cluster Sample

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine the sampling technique which is used.

1) Thirty-five math majors, 64 music majors and 35 history majors are randomly selected from 454 math majors, 309 music majors and 567 history majors at the state university. What sampling technique is used?
A) stratified B) random C) cluster D) convenience E) systematic

2) Every fifth adult entering an airport is checked for extra security screening. What sampling technique is used?
A) systematic B) random C) cluster D) convenience E) stratified

3) At a local technical school, five auto repair classes are randomly selected and all of the students from each class are interviewed. What sampling technique is used?
A) cluster B) random C) convenience D) systematic E) stratified

4) A writer for an art magazine randomly selects and interviews fifty male and fifty female artists. What sampling technique is used?
A) stratified B) random C) cluster D) convenience E) systematic

5) A travel industry researcher interviews all of the passengers on five randomly selected cruises. What sampling technique is used?
A) cluster B) random C) convenience D) systematic E) stratified

6) A statistics student interviews everyone in his apartment building to determine who owns a cell phone. What sampling technique is used?
A) convenience B) random C) cluster D) systematic E) stratified

7) A lobbyist for the oil industry assigns a number to each senator and then uses a computer to randomly generate ten numbers. The lobbyist contacts the senators corresponding to these numbers. What sampling technique was used?
A) random B) convenience C) cluster D) stratified E) systematic

8) Based on 12,500 responses from 46,500 questionnaires sent to all its members, a major medical association estimated that the annual salary of its members was $111,000 per year. What sampling technique was used?
A) random B) stratified C) cluster D) convenience E) systematic

9) In a recent online survey, participants were asked to answer "yes" or "no" to the question "Are you in favor of stricter gun control?" 6571 responded "yes" while 5737 responded "no". There was a fifty-cent charge for the call. What sampling technique was used?
A) convenience B) random C) cluster D) stratified E) systematic

10) A sample consists of every 35th worker from a group of 4000 workers. What sampling technique was used?
A) systematic B) random C) cluster D) stratified E) convenience

11) A market researcher randomly selects 100 homeowners under 55 years of age and 500 homeowners over 55 years of age. What sampling technique was used?
A) stratified B) random C) cluster D) convenience E) systematic

12) To avoid working late, the plant foreman inspects the first 60 microwaves produced that day. What sampling technique was used?
A) convenience B) random C) cluster D) stratified E) systematic

13) The names of 20 employees are written on 20 cards. The cards are placed in a bag, and three names are picked from the bag. What sampling technique was used?
A) random B) stratified C) cluster D) convenience E) systematic

14) An education researcher randomly selects 85 of the nation's junior colleges and interviews all of the professors at each school. What sampling technique was used?
A) cluster B) random C) stratified D) convenience E) systematic

15) The United States can be divided into four geographical regions: Northeast, South, Midwest, and West. The Northeast region consists of 9 states; the South region consists of 16 states; the Midwest consists of 12 states; and the West consists of 13 states. If a survey is to be administered to the governors of 10 of the states and we want equal representation for the states in each of the four regions, how many states from the South should be selected? Round to the nearest whole state.
A) 3 B) 4 C) 2 D) 5

1.5 Bias in Sampling

1 Explain the Sources of Bias in Sampling

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) An online newspaper conducted a survey by asking, "Do you support the lowering of air quality standards if it could cause the death of millions of innocent people from pollution related diseases?" Determine the type of bias.

2) A local hardware store wants to know if its customers are satisfied with the customer service they receive. The store posts an interviewer at the front of the store to ask the first 50 shoppers who leave the store, "How satisfied, on a scale of 1 to 10, were you with this store's customer service?" Determine the type of bias.

3) Before opening a new dealership, an auto manufacturer wants to gather information about car ownership and driving habits of the local residents. The marketing manager of the company randomly selects 1000 households from all households in the area and mails a questionnaire to them. Of the 1000 surveys mailed, she receives 70 back. Determine the type of bias.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

4) Which type of bias occurs because we do not obtain complete information about a population?
A) sampling bias B) response bias C) nonresponse bias D) no bias

5) A researcher wants to study the effects of advertising by female models upon high school boys in small Midwestern towns. The research methodology calls for selecting several small Midwestern towns that have high schools. What is the frame for this study?
A) all high school boys from small Midwestern towns
B) all students attending high school from small Midwestern towns
C) high school boys from the small Midwestern towns selected
D) high school students from the small Midwestern towns selected

6) Multiple choice questions on a test that include as one of the choices "none of the above" are an example of what type of question?
A) closed question B) open question
C) framing question D) reader response question

1.6 The Design of Experiments

1 Describe the Characteristics of an Experiment

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) What is a designed experiment?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) The variable measured in the experiment is called _____ .
A) the response variable B) a sampling unit
C) the treatment D) the predictor variable

3) The object upon which the response variable is measured is called _____ .
A) an experimental unit B) the factor
C) the predictor variable D) a treatment

4) _____ is a condition applied to the experimental units involved in an experiment.
A) A treatment B) The sampling design
C) The factor level D) The design

5) An experiment in which the experimental unit (or subject) does not know which treatment he or she is receiving is called a _____ .
A) single-blind experiment B) double-blind experiment
C) randomized block design D) matched-pairs design

6) An experiment in which neither the experimental unit nor the researcher in contact with the experimental unit knows which treatment the experimental unit is receiving is called a _____ .
A) double-blind experiment B) single-blind experiment
C) randomized block design D) matched-pairs design

2 Explain the Steps in Designing an Experiment

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A salesman boasts to a farmer that his new fertilizer will increase the yield of the farmer's crops by 15%. The farmer wishes to test the effects of the new fertilizer on her corn yield. She has four equal sized plots of land —one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal sized portions and randomly labels them A, B and C. The four A portions are treated with her old fertilizer. The four B portions are treated with the new fertilizer. The four C portions receive no fertilizer. At harvest time, the corn yield is recorded for each section of land. What is the claim she is testing?
   A) The new fertilizer yielded at least a 15% improvement.
   B) The total yield increased at least 15%.
   C) The A sections had at least a 15% increase in yield.
   D) The average soil field had at least a 15% increase in yield.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

2) What is a factor?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

3) Which of the following is not true about factors?
   A) Factors whose effect on the response variable is not of interest can be set after the experiment.
   B) Factors whose effect on the response variable interests us should be set at predetermined levels.
   C) One way to control factors is to fix their level at one predetermined value throughout the experiment.
   D) Any combination of the values of the factors is called a treatment.

4) What will help insure that the effect of a treatment is not due to some characteristic of a single experimental unit?
   A) replication B) blinding C) randomizing D) blocking

3 Explain the Completely Randomized Design

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A drug company wanted to test a new depression medication. The researchers found 600 adults aged 25–35 and randomly assigned them to two groups. The first group received the new drug, while the second received a placebo. After one month of treatment, the percentage of each group whose depression symptoms decreased was recorded and compared. What is the response variable in this experiment?
   A) the percentage who had decreased depression symptoms
   B) the type of drug (medication or placebo)
   C) the 600 adults aged 25–35
   D) the one month treatment time

2) A drug company wanted to test a new indigestion medication. The researchers found 200 adults aged 25–35 and randomly assigned them to two groups. The first group received the new drug, while the second received a placebo. After one month of treatment, the percentage of each group whose indigestion symptoms decreased was recorded and compared. What is the treatment in this experiment?
   A) the drug
   B) the percentage who had decreased indigestion symptoms
   C) the 200 adults aged 25–35
   D) the one month treatment time

3) A drug company wanted to test a new depression medication. The researchers found 700 adults aged 25–35 and randomly assigned them to two groups. The first group received the new drug, while the second received a placebo. After one month of treatment, the percentage of each group whose depression symptoms decreased was recorded and compared. How many levels does the treatment in this experiment have?
   A) 2 (medication or placebo)
   B) 700 (number of respondents)
   C) 1 (months of treatment)
   D) 10 (age span of respondents)

4) A drug company wanted to test a new acne medication. The researchers found 500 adults aged 25–35 and randomly assigned them to two groups. The first group received the new drug, while the second received a placebo. After one month of treatment, the percentage of each group whose acne symptoms decreased was recorded and compared. What type of experimental design is this?
   A) completely randomized design
   B) randomized block design
   C) matched–pairs design
   D) single–blind design

5) A drug company wanted to test a new depression medication. The researchers found 700 adults aged 25–35 and randomly assigned them to two groups. The first group received the new drug, while the second received a placebo. After one month of treatment, the percentage of each group whose depression symptoms decreased was recorded and compared. Identify the experimental units.
   A) the 700 adults aged 25–35
   B) the percentage who had decreased depression symptoms
   C) the drug (medication or placebo)
   D) the one month treatment time

4 Explain the Matched–Pairs Design

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A medical journal published the results of an experiment on anorexia. The experiment investigated the effects of a controversial new therapy for anorexia. Researchers measured the anorexia levels of 68 adult women who suffer moderate conditions of the disorder. After the therapy, the researchers again measured the women's anorexia levels. The differences between the the pre– and post–therapy anorexia levels were reported. What is the response variable in this experiment?
   A) the differences between the the pre– and post–therapy anorexia levels
   B) the 68 adult women who suffer from anorexia
   C) the disorder (anorexia or no anorexia)
   D) the therapy

2) A medical journal published the results of an experiment on depression. The experiment investigated the effects of a controversial new therapy for depression. Researchers measured the depression levels of 95 adult women who suffer moderate conditions of the disorder. After the therapy, the researchers again measured the women's depression levels. The differences between the the pre– and post–therapy depression levels were reported. What is the treatment in this experiment?
   A) the therapy
   B) the 95 adult women who suffer from depression
   C) the disorder (depression or no depression)
   D) the differences between the the pre– and post–therapy depression levels

3) A medical journal published the results of an experiment on insomnia. The experiment investigated the effects of a controversial new therapy for insomnia. Researchers measured the insomnia levels of 48 adult women who suffer moderate conditions of the disorder. After the therapy, the researchers again measured the women's insomnia levels. The differences between the the pre– and post–therapy insomnia levels were reported. How many levels does the treatment have in this experiment?
   A) 2 (pre– and post–therapy)
   B) 1 (therapy)
   C) 48 (the adult women who suffer from insomnia)
   D) 96 (the adult women who suffer from insomnia measured pre– and post–therapy)

4) A medical journal published the results of an experiment on anorexia. The experiment investigated the effects of a controversial new therapy for anorexia. Researchers measured the anorexia levels of 72 adult women who suffer moderate conditions of the disorder. After the therapy, the researchers again measured the women's anorexia levels. The differences between the the pre– and post–therapy anorexia levels were reported. What type of experimental design is this?
   A) matched–pairs design
   B) completely randomized design
   C) randomized block design
   D) single–blind design

5) A medical journal published the results of an experiment on depression. The experiment investigated the effects of a controversial new therapy for depression. Researchers measured the depression levels of 52 adult women who suffer moderate conditions of the disorder. After the therapy, the researchers again measured the women's depression levels. The differences between the the pre– and post–therapy depression levels were reported. Identify the experimental units.
   A) the 52 adult women who suffer from depression
   B) the differences between the pre– and post–therapy depression levels
   C) the disorder (depression or no depression)
   D) the therapy time period (pre or post)

5 Explain the Randomized Block Design

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A farmer wishes to test the effects of a new fertilizer on her corn yield. She has four equal–sized plots of land–– one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal–sized portions and randomly labels them A, B, and C. The four A portions of land are treated with her old fertilizer. The four B portions are treated with the new fertilizer, and the four C's are treated with no fertilizer. At harvest time, the corn yield is recorded for each section of land. What is the response variable in this experiment?
   A) the corn yield recorded for each section of land
   B) the type of fertilizer (old, new, or none)
   C) the section of land (A, B, or C)
   D) the four types of soil

2) A farmer wishes to test the effects of a new fertilizer on her tomato yield. She has four equal–sized plots of land–– one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal–sized portions and randomly labels them A, B, and C. The four A portions of land are treated with her old fertilizer. The four B portions are treated with the new fertilizer, and the four C's are treated with no fertilizer. At harvest time, the tomato yield is recorded for each section of land. What is the treatment in this experiment?
   A) the fertilizers
   B) the tomato yield recorded for each section of land
   C) the section of land (A, B, or C)
   D) the four types of soil

3) A farmer wishes to test the effects of a new fertilizer on her wheat yield. She has four equal–sized plots of land–– one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal–sized portions and randomly labels them A, B, and C. The four A portions of land are treated with her old fertilizer. The four B portions are treated with the new fertilizer, and the four C's are treated with no fertilizer. At harvest time, the wheat yield is recorded for each section of land. How many levels does the treatment have in this experiment?

A) 3 (old, new, or no fertilizer)
B) 4 (rocky, sandy, clay, or average soil)
C) 12 (sections of land)
D) 1 (wheat yield)

4) A farmer wishes to test the effects of a new fertilizer on her potato yield. She has four equal–sized plots of land–– one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal–sized portions and randomly labels them A, B, and C. The four A portions of land are treated with her old fertilizer. The four B portions are treated with the new fertilizer, and the four C's are treated with no fertilizer. At harvest time, the potato yield is recorded for each section of land. What type of experimental design is this?

A) randomized block design
B) completely randomized design
C) matched–pairs design
D) double–blind design

5) A farmer wishes to test the effects of a new fertilizer on her potato yield. She has four equal–sized plots of land–– one with sandy soil, one with rocky soil, one with clay–rich soil, and one with average soil. She divides each of the four plots into three equal–sized portions and randomly labels them A, B, and C. The four A portions of land are treated with her old fertilizer. The four B portions are treated with the new fertilizer, and the four C's are treated with no fertilizer. At harvest time, the potato yield is recorded for each section of land. Identify the experimental units.

A) the potato plants on the various plots of land
B) the potato yield at harvest time
C) the three types of fertilizer
D) the four types of soil

6) When the effects of the explanatory variable upon the response variable cannot be determined, then

A) confounding has occurred.
B) a lurking variable is present.
C) there is sampling error.
D) the claim is invalid.

Ch. 1 Data Collection
Answer Key

1.1 Introduction to the Practice of Statistics

1 Define Statistics and Statistical Thinking

1) Statistics is the science of collecting, summarizing, organizing, and analyzing information in order to answer questions or draw conclusions.
2) A

2 Explain the Process of Statistics

1) population: collection of all American households; sample: collection of 1598 American households surveyed; individuals: each household
2) population: collection of all American households; sample: collection of 1301 American households surveyed; individuals: each household
3) A
4) A
5) A
6) A
7) A
8) The population of interest is the student loan debt incurred by all graduates of the university. The sample is student loan debt of the 210 graduating seniors that were collected by the university administrators. The individuals are each graduating senior whose student loan debt was recorded.
9) (a) if listening to heavy metal music affects critical thinking
   (b) the 124 subjects
   (c) the mean exam score for the first group = 81, and the mean exam score for the second group was 87
   (d) that heavy metal music negatively affects critical thinking
10) (a) to determine the percentage of registered voters who would vote for the current vice president if he ran for president
    (b) the 1414 registered voters surveyed
    (c) 34% of the respondents supported reelection
    (d) that 34% of all registered voters would vote for the current vice president if he ran for president
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A

3 Distinguish Between Qualitative and Quantitative Variables

1) A
2) A
3) A
4) A
5) A

4 Distinguish Between Discrete and Continuous Variables

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A

10) A
11) A
12) A
13) A

5 Determine the Level of Measurement of a Variable

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A

1.2 Observational Studies Versus Designed Experiments

1 Distinguish Between an Observational Study and an Experiment

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

2 Explain the Various Types of Observational Studies

1) A
2) A
3) A
4) A
5) A
6) A

1.3 Simple Random Sampling

1 Obtain a Simple Random Sample

1) A
2) A
3) A
4) A
5) A

1.4 Other Effective Sampling Methods

1 [Obj 1,2,3] Obtain a Stratified/Systematic/Cluster Sample

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A

10) A
11) A
12) A
13) A
14) A
15) A

1.5 Bias in Sampling

1 Explain the Sources of Bias in Sampling

1) Response bias; poorly worded question
2) Sampling bias; the customers are not chosen through a random sample.
3) Nonresponse bias
4) A
5) A
6) A

1.6 The Design of Experiments

1 Describe the Characteristics of an Experiment

1) A designed experiment is a controlled study in which treatments are applied to experimental units, and the effect of varying these treatments on a response variable is observed.
2) A
3) A
4) A
5) A
6) A

2 Explain the Steps in Designing an Experiment

1) A
2) A factor is the variable whose effect on the response variable is to be assessed by the experimenter.
3) A
4) A

3 Explain the Completely Randomized Design

1) A
2) A
3) A
4) A
5) A

4 Explain the Matched–Pairs Design

1) A
2) A
3) A
4) A
5) A

5 Explain the Randomized Block Design

1) A
2) A
3) A
4) A
5) A
6) A