Ch. 1   Statistics, Data, and Statistical Thinking

1.1   The Science of Statistics

1   Define Statistics

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

Solve the problem.

1) Which of the following is not the job of a statistician?

    A) implementing new business practices based on the results of a study

    B) determining what information is relevant in a given problem

    C) collecting numerical information in the form of data

    D) determining whether the conclusions drawn from a study are to be trusted

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

2) What is statistics?

3) Define statistical thinking.

1.2   Types of Statistical Applications in Business

1   Define Descriptive and Inferential Statistics

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

Solve the problem.

1) A recent report stated "Based on a sample of 250 truck drivers, there is evidence to indicate that, on average, independent truck drivers earn more than company–hired truck drivers." This statement is an example of _____.

    A) inferential statistics   B) descriptive statistics

2) A survey of high school teenagers reported that 89% of those sampled are interested in pursuing a college education. This statement illustrates _____.

    A) descriptive statistics   B) inferential statistics

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

3) In a survey of 3000 high school students, 16% of those surveyed read at least one best–seller each month. Give an example of a descriptive statement and an inferential statement that could be made based on this information.

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

4) Which of the following is not an element of descriptive statistical problems?

A) predictions are made about a larger set of data

B) information revealed in a data set is summarized

C) data are displayed visually in graphs

D) patterns in a data set are identified

Answer the question True or False.

5) When we take data obtained from a sample and make generalizations or predictions about the entire population, we are utilizing inferential statistics.

A) True   B) False

1.3   Fundamental Elements of Statistics

1   Identify Elements of Statistics

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

Solve the problem.

1) Parking at a university has become a problem. University administrators are interested in determining the average time it takes a student to find a parking spot. An administrator inconspicuously followed 160 students and recorded how long it took each of them to find a parking spot. Identify the population of interest to the university administration.

A) the entire set of students who park at the university

B) the 160 students about whom the data were collected

C) the entire set of faculty, staff, and students who park at the university

D) the students who park at the university between 9 and 10 AM on Wednesdays

2) Parking at a university has become a problem. University administrators are interested in determining the average time it takes a student to find a parking spot. An administrator inconspicuously followed 220 students and recorded the how long it took each of them to find a parking spot. Identify the variable of interest to the university administration.

A) time to find a parking spot   B) students who drive cars on campus

C) number of empty parking spots   D) number of students who cannot find a spot

3) An assembly line is operating satisfactorily if fewer than 2% of the phones produced per day are defective. To check the quality of a day's production, the company randomly samples 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 2% of the phones that are defective

4) An insurance company conducted a study to determine the percentage of cardiologists who had been sued for malpractice in the previous four years. The sample was randomly chosen from a national directory of doctors. What is the variable of interest in this study?

   A) the responses: have been sued/have not been sued for malpractice in the last four years

   B) the doctor's area of expertise (i.e., cardiology, pediatrics, etc.)

   C) the number of doctors who are cardiologists

   D) all cardiologists in the directory

5) A study published in 2000 attempted to estimate the proportion of Florida residents who were willing to spend more tax dollars on protecting the Florida coastline from environmental disasters. Twenty–six hundred Florida residents were surveyed.Which of the following is the population used in the study?

   A) all Florida residents

   B) the 2600 Florida residents who were surveyed

   C) Florida residents willing to spend more tax dollars protecting the coastline from environmental disasters

   D) all Florida residents who lived along the coastline

6) A study published in 2000 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–nine hundred Florida residents were surveyed.Which of the following describes the variable of interest in the study?

   A) the response to the question, "Are you willing to spend more tax dollars on protecting the Florida beaches from environmental disasters?"

   B) the response to the question "Do you live along the beach?"

   C) the response to the question "Do you use the beach?"

   D) the 4900 Florida residents surveyed

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

7) Parking at a university has become a problem. University administrators are interested in determining the average time it takes a student to find a parking spot. An administrator inconspicuously followed 260 students and recorded how long it took each of them to find a parking spot. Identify the population, sample, and variable of interest to the administrators.

8) A quality inspector tested 71 copiers in an attempt to estimate the average failure rate of the copier model. His study indicated that the number of failures decreased from two years ago, indicating an increase in the reliability of the copiers. Describe the variable of interest to the inspector.

9) A high school guidance counselor analyzed data from a sample of 300 community colleges throughout the United States. One of his goals was to estimate the annual tuition costs of community colleges in the United States. Describe the population and variable of interest to the guidance counselor.

10) Explain why it is not necessary to provide a measure of reliability when a census is used rather than a sample.

1.4   Processes (Optional)

1   Describe Processes

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

Solve the problem.

1) When we study a process, what is generally the focus?

   A) the input   B) the input   C) the subprocesses   D) the black box

2) In the context of processes, what is a sample?

   A) any set of output   B) any subset of the population

   C) any set of subprocesses   D) any set of input

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

3) What do we call a process whose operations are unknown or unspecified?

4) In the context of processes, what is a sample?

5) A chain of coffee shops has 45 stores in one metropolitan area. For liability purposes, the chain is interested in the average temperature of hot drinks served at the stores. Three stores were chosen and the temperature of every fifth hot drink served at each of these stores was recorded during a two–week period. At the end of the two–week period, the temperatures of 10,571 hot drinks had been recorded.

   a.   Identify the process of interest.
   b.   Identify the variable of interest.
   c.   Describe the sample.
   d.   Describe the inference of interest.

6) A department store receives customer orders through its call center and website. These orders as well as any special orders received in the stores are forwarded to a distribution center where workers pull the items on the orders from inventory, pack the items, and prepare the necessary paperwork for the shipping company that will pick the orders up and deliver them to the customers. In order to monitor the subprocess of pulling the items from inventory, every 15 minutes one order is checked to determine whether the worker has pulled the correct items.

   a.   Identify the process of interest.
   b.   Identify the variable of interest.
   c.   Describe the sample.
   d.   Describe the inference of interest.

1.5 Types of Data

1 Classify Data as Quantitative or Qualitative

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

Solve the problem.

1) The amount of television viewed by today's youth is of primary concern to Parents Against Watching Television (PAWT). 250 parents of elementary school–aged children were asked to estimate the number of hours per week that their child watches television. Identify the type of data collected by PAWT.

    A) quantitative   B) qualitative

2) The manager of a car dealership records the colors of automobiles on a used car lot. Identify the type of data collected

    A) qualitative   B) quantitative

3) A postal worker counts the number of complaint letters received by the United States Postal Service in a given day. Identify the type of data collected.

    A) quantitative   B) qualitative

4) An usher records the number of unoccupied seats in a movie theater during each viewing of a film. Identify the type of data collected.

    A) quantitative   B) qualitative

5) A fan observes the numbers on the shirts of a girl's soccer team. Identify the type of data collected.

    A) qualitative   B) quantitative

6) Which data about paintings would *not* be qualitative?

    A) the value   B) the artist   C) the style   D) the theme

1.6 Collecting Data

1 Identify Data Collection Method

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

Solve the problem.

1) The amount of television viewed by today's youth is of primary concern to Parents Against Watching Television (PAWT). 330 parents of elementary school–aged children were asked to estimate the number of hours per week that their child watches television. Identify how the data were collected in this study.

    A) from a survey   B) from a published source

    C) from a designed experiment   D) observationally

2) A personnel director studied the eating habits of a company's employees. The director noted whether employees brought their own lunch to work, ate at the company cafeteria, or went out to eat lunch. This type of data collection would best be considered as a(n) _____.

    A) observational study   B) designed experiment

3) A student worked on her statistics project in the library and found a reference book that contained the median family incomes for all 50 states. On her project, she would report her data as being collected _____.

    A) from a published source   B) from a designed experiment

    C) observationally   D) from a survey

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

4) What is meant by a *representative sample*?

5) What is the most common way to satisfy the representative sample requirement?

6) Three female students and two male students are to be chosen from a group of 30 female students and 20 male students. Does this sample of five students satisfy the conditions to be a random sample of the 50 students in the group? Explain.

1.7 The Role of Statistics in Managerial Decision Making

1 Identify Bias

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

Solve the problem.

1) What is meant by selection bias?

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

2) Which type of problem has occurred when inaccuracies exist in the values of the data recorded?

    A) measurement error   B) nonresponse bias   C) selection bias

3) A watchdog group is investigating how people are treated during the foreclosure process. Surveys were mailed to a random sample of 300 people who had recently been threatened with foreclosure. 75 of the surveys were returned by the postal service because the intended recipients had moved and left no forwarding address. What type of problem has occurred?

    A) nonresponse bias   B) selection bias   C) measurement error

4) A university was interested in student reaction to a proposal to spend more on athletic scholarships and less on academic scholarships. 35 student athletes were surveyed. What type of problem has occurred?

    A) selection bias   B) nonresponse bias   C) measurement error

2 Unethical Statistics

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

Solve the problem.

1) Give an example of unethical statistical practice.

2) A health food company has the folowing statement on their new product packaging: "Prevents all types of cancer!" (Fact: Past studies have shown that some ingredients in the new product have been know to possibly reduce the risk of many types of cancer). Discuss why it is unethical to make this statement.

Ch. 1   Statistics, Data, and Statistical Thinking
Answer Key

1.1   The Science of Statistics
1   Define Statistics
1) A
2) Statistics is the science of data that involves collecting, classifying, summarizing, organizing, analyzing, and interpreting numerical information.
3) Statistical thinking involves applying rational thought and the science of statistics to critically assess data and the inferences.

1.2   Types of Statistical Applications in Business
1   Define Descriptive and Inferential Statistics
1) A
2) A
3) Descriptive: 16% of the students sampled (or 480) read at least one best–seller each month.

   Inferential: Based on the survey, we estimate that about 16% of all high school
   students read at least one best–seller each month.
4) A
5) A

1.3   Fundamental Elements of Statistics
1   Identify Elements of Statistics
1) A
2) A
3) A
4) A
5) A
6) A
7) The population of interest are all students at the university who park. The sample is the parking times of the 260 students that were collected by the university administrator. The variable of interest to the administrators is the parking time variable.
8) The variable of interest to the researcher is the failure rate of the copiers.
9) The population of interest to the guidance counselor is all community colleges in the United States. The variable of interest is the annual tuition cost of the community college.
10) When a census is used, there should be no error.

1.4   Processes (Optional)
1   Describe Processes
1) A
2) A
3) a black box
4) any set of output (objects or numbers) produced by a process
5) a.   serving of hot drinks at coffee shops in the chain
   b.   temperature of hot drinks served
   c.   10,571 drinks that had their temperatures recorded over the two–week period
   d.   average temperature of all hot drinks served at all stores in the chain
6) a.   fulfilling customers' orders from receiving the order to pick up by shipping company
   b.   whether or not an order has been pulled correctly
   c.   the set of all orders that are checked (one every 15 minutes)
   d.   number or proportion of all orders that are pulled correctly (incorrectly)

1.5   Types of Data
1   Classify Data as Quantitative or Qualitative
1) A
2) A
3) A

4) A

5) A

6) A

1.6   Collecting Data

1   Identify Data Collection Method

1) A

2) A

3) A

4) a sample that exhibits characteristics typical of those possessed by the population of interest

5) selecting a random sample

6) No; not every sample of 5 students from the group has an equal chance of selection; for example, a sample consisting of 5 males has no chance of being selected.

1.7   The Role of Statistics in Managerial Decision Making

1   Identify Bias

1) When a subset of the experimental units in the population is excluded so that these units have no possibility of being selected in the sample.

2) A

3) A

4) A

2   Unethical Statistics

1) Researchers select a biased sample, with the intention of misleading the public.

2) Answers may vary. One possibile answer is that the past studies show that the ingredients only have possible cancer reducing effects on many, not all, types of cancer.