

Ch. 1 Statistics: The Art and Science of Learning from Data

1.1 How Can You Investigate Using Data?

1 Statistics and Data

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

Answer true or false.

- 1) The information we gather with experiments and with surveys is collectively called data.
A) True B) False

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

Fill in the blank.

- 2) The information we gather with experiments and with surveys is collectively called _____.
- 3) _____ is the art and science of learning from data.

Provide an appropriate response.

- 4) What is statistics?

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

Select the most appropriate answer.

- 5) The following statement refers to which aspect of a statistical study: "A meteorologist constructs a graph showing the total precipitation in Phoenix, Arizona in each of the months of 2004"?
A) Description B) Design C) Inference
- 6) The following statement refers to which aspect of a statistical study: "The average age of the students in a statistics class is 25 years"?
A) Description B) Design C) Inference
- 7) The following statement refers to which aspect of a statistical study: "Based on a study of 25 hospitals nationwide, researchers have concluded that there is a relationship between smoking cigarettes and contracting emphysema"?
A) Inference B) Design C) Description
- 8) The following statement refers to which aspect of a statistical study: "Based on previous clients, a marriage counselor concludes that the majority of marriages that begin with cohabitation before marriage will result in divorce"?
A) Inference B) Design C) Description
- 9) Planning the methods for data collection to study the effects of Vitamin E on athletic strength would be classified as which aspect of statistics: design, inference or description?
A) Design B) Description C) Inference
- 10) The following statement refers to which aspect of a statistical study: "From past figures, it is predicted that 47% of the registered voters in Virginia will vote in the June primary"?
A) Inference B) Design C) Description

2 Statistical Methods

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

Fill in the blank.

- 1) The three main aspects of statistics are _____, _____, and _____.

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

Select the most appropriate answer.

- 2) Planning how to obtain data to answer the questions of interest refers to which aspect of statistics?

A) Design
B) Description
C) Inference
D) Sampling
E) None of these

- 3) Summarizing the data that are obtained refers to which aspect of statistics?

A) Description
B) Design
C) Inference
D) Sampling
E) None of these

- 4) Making decisions and predictions based on the data refers to which aspect of statistics?

A) Inference
B) Description
C) Design
D) Sampling
E) None of these

The owners of a coffee shop conducted a taste test to determine whether its customers preferred a new coffee brand to the current one sold by the shop. Customers who were willing to participate were given small samples of each of the two brands in random order and were asked to select which one they preferred without knowing the brand. Of the 100 participating customers, 90% chose the new brand. Based on these results, the owners determined that a majority of their customers preferred the new brand and therefore switched their coffee supplier.

- 5) Predicting the preference of all of the coffee shop customers based on the taste test results refers to which aspect of statistics?

A) Inference
B) Description
C) Design
D) Investigation
E) None of these

- 6) Randomizing the order in which the samples of each brand were given to each customer refers to which aspect of statistics?

A) Design
B) Inference
C) Description
D) Investigation
E) None of these

- 7) Stating that 90% of the taste testers preferred the new brand is an example of which type of statistics?
- A) Description
 - B) Design
 - C) Inference
 - D) Investigation
 - E) None of these

1.2 We Learn about Populations Using Samples

1 Samples and Populations

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

Answer true or false.

- 1) Parameter values are usually known.
- A) False
 - B) True

Fill in the blank.

- 2) The entities that we measure in a study are called the _____.
- A) subjects
 - B) statistics
 - C) parameters
 - D) data

Select the most appropriate answer.

- 3) A summary measure that is computed from a sample to describe a characteristic of interest is called
- A) a statistic
 - B) a data file
 - C) a poll
 - D) a parameter
 - E) a variable
- 4) A numerical summary of the population is called
- A) a parameter
 - B) a census
 - C) a data file
 - D) a statistic
 - E) a variable

Determine whether the summary measure is better described as a parameter or a statistic.

- 5) The average height of NASCAR Nextel Cup Series drivers during the 2005 season.
- A) Parameter
 - B) Statistic
- 6) The average gpa of Harvard's 2007 graduating class.
- A) Parameter
 - B) Statistic
- 7) The proportion of teenagers in a nationwide survey who stated that they consumed alcohol on a regular basis.
- A) Statistic
 - B) Parameter
- 8) The average weekly amount spent on groceries by a family of four based on a random sample of 100 families.
- A) Statistic
 - B) Parameter
- 9) The proportion of regional flights for United Airlines that were considered on-time during the month of December, 2007.
- A) Parameter
 - B) Statistic
- 10) The average age of 25 congressional members who were selected at random from all U.S. Congressmen.
- A) Statistic
 - B) Parameter

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

Provide an appropriate response.

- 11) Define the terms population and sample.
- 12) Briefly explain why survey data typically consists of data for a sample and not for an entire population.

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

Select the most appropriate answer.

- 13) In 2006, the General Social Survey asked "would you like to see more or less government spending on natural disasters?" Of the 1496 respondents, 723 responded "more" or "much more". The population of interest consists of
- A) all American adults
 - B) the 1496 respondents
 - C) the 723 respondents who responded "more" or "much more"
 - D) the proportion of American adults who would respond "more" or "much more"
 - E) the proportion of respondents who responded "more" or "much more"
- 14) In 2006, the General Social Survey asked "would you like to see more or less government spending on natural disasters?" Of the 1496 respondents, 723 responded "more" or "much more". The sample consists of
- A) the 1496 respondents
 - B) all American adults
 - C) the 723 respondents who responded "more" or "much more"
 - D) the proportion of American adults estimated to respond "more" or "much more"
 - E) the proportion of respondents who responded "more" or "much more"
- 15) In 2006, the General Social Survey asked "would you like to see more or less government spending on natural disasters?" Of the 1496 respondents, 723 responded "more" or "much more". The parameter of interest consists of
- A) all American adults
 - B) the 1496 respondents
 - C) the 723 respondents who responded "more" or "much more"
 - D) the proportion of American adults estimated to respond "more" or "much more"
 - E) the proportion of respondents who responded "more" or "much more"
- 16) In 2006, the General Social Survey asked "would you like to see more or less government spending on natural disasters?" Of the 1496 respondents, 723 responded "more" or "much more". The proportion of respondents who responded "more" or "much more" is an example of
- A) a statistic
 - B) the population
 - C) the sample
 - D) random sampling
 - E) a parameter
- 17) In October of 2007, 71% of 1052 adults polled nationwide by The Harris Poll answered "Yes" to the question "Do you believe the theory that increased carbon dioxide and other gases released into the atmosphere will, if unchecked, lead to global warming and an increase in average temperatures?" (www.pollingreport.com/enviro.htm) The sample consists of
- A) all American adults
 - B) the 1052 polled adults
 - C) the proportion of adults polled who responded "Yes" to the question
 - D) the proportion of American adults who are predicted to respond "Yes" to the question
 - E) 71% of American adults

- 18) In October of 2007, 71% of 1052 adults polled nationwide by The Harris Poll answered "Yes" to the question "Do you believe the theory that increased carbon dioxide and other gases released into the atmosphere will, if unchecked, lead to global warming and an increase in average temperatures?" (www.pollingreport.com/enviro.htm) The 71% responding "Yes" to the question is an example of
- A) a statistic
 - B) the population
 - C) the sample
 - D) random sampling
 - E) a parameter
- 19) In October of 2007, 71% of 1052 adults polled nationwide by The Harris Poll answered "Yes" to the question "Do you believe the theory that increased carbon dioxide and other gases released into the atmosphere will, if unchecked, lead to global warming and an increase in average temperatures?" (www.pollingreport.com/enviro.htm) The predicted proportion of all American adults who would respond "Yes" to the question is an example of
- A) a parameter
 - B) the population
 - C) the sample
 - D) random sampling
 - E) a statistic
- 20) 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. Twenty-four hundred Florida residents were surveyed. Which of the following is the population of interest in the study?
- A) all Florida residents
 - B) the 2400 Florida residents surveyed
 - C) all 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
 - E) all residents of the United States
- 21) A high school guidance counselor analyzed data from a sample of 600 community colleges taken throughout the United States. One of his goals was to estimate the annual tuition costs of community colleges in the United States. Identify the population of interest to the guidance counselor.
- A) all community colleges in the United States
 - B) all high school guidance counselors
 - C) the sample of 600 community colleges
 - D) all students attending community colleges in the United States
 - E) the average annual tuition cost of community colleges in the United States
- 22) A manufacturer of cellular phones has decided that an assembly line is operating satisfactorily if less than 6% of the phones manufactured per day are defective. To check the quality of a day's production, the company decides to randomly sample 30 phones from a day's production and test for defects. Define the population of interest to the manufacturer.
- A) all cellular phones manufactured during the day in question
 - B) the 30 cellular phones that were sampled and tested
 - C) the 30 responses: defective or not defective
 - D) the 6% of the cellular phones that were defective
 - E) all defective cellular phones manufactured by the company

- 23) A manufacturer of cellular phones has decided that an assembly line is operating satisfactorily if less than 6% of the phones manufactured per day are defective. To check the quality of a day's production, the company decides to randomly sample 30 phones from a day's production and test for defects. Define the sample of interest to the manufacturer.
- A) the 30 cellular phones that were sampled and tested
 - B) all cellular phones manufactured during the day in question
 - C) the 30 responses: defective or not defective
 - D) the 6% of the cellular phones that were defective
 - E) all defective cellular phones manufactured by the company

2 Identify Population, Sample, and Subjects

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

Provide an appropriate response.

- 1) Every year the U.S. Census Bureau releases the Current Population Report based on a survey of 50,000 households within the United States. Identify the population, the sample, and the subjects for this study.
- 2) Gallup News Service conducted a survey of 1004 Americans 18 years and older, April 3–9, 2000. The respondents were asked, "Do you have a great deal of concern regarding global warming (the greenhouse effect)?" Identify the population, the sample, and the subjects for this study.
- 3) A poll conducted from November 30 to December 3, 2007 by the Los Angeles Times asked 1,245 registered voters nationwide "Which party do you think can do a better job of handling immigration issues?" 31% of the respondents answered "Republicans" (www.pollingreport.com/immigration.htm). With a margin of error of $\pm 3\%$, it is estimated that between 28 and 34 percent of registered voters nationwide feel that the Republican party can do a better job of handling immigration issues. Identify which part of this example is inferential.
- 4) A poll conducted from November 30 to December 3, 2007 by the Los Angeles Times asked 1,245 registered voters nationwide "Which party do you think can do a better job of handling immigration issues?" 31% of the respondents answered "Republicans" (www.pollingreport.com/immigration.htm). With a margin of error of $\pm 3\%$, it is estimated that between 28 and 34 percent of registered voters nationwide feel that the Republican party can do a better job of handling immigration issues. Identify which part of this example is descriptive.

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

- 5) A poll conducted from November 30 to December 3, 2007 by the Los Angeles Times asked 1,245 registered voters nationwide "Which party do you think can do a better job of handling immigration issues?" 31% of the respondents answered "Republicans" (www.pollingreport.com/immigration.htm). With a margin of error of $\pm 3\%$, it is estimated that between 28 and 34 percent of registered voters nationwide feel that the Republican party can do a better job of handling immigration issues. Does the proportion of the sample answering "Republican" refer to a statistic or a parameter?
 - A) statistic
 - B) parameter
- 6) The average salary of all General Motors workers is \$42,000. Is this value a parameter or a statistic?
 - A) parameter
 - B) statistic
- 7) A survey of 1103 students was taken from a college with 14,500 students. Is this value a parameter or a statistic?
 - A) statistic
 - B) parameter
- 8) A survey of 1500 American households found that 33% of the respondents own a computer. Is this value a parameter or a statistic?
 - A) statistic
 - B) parameter

- 9) A survey of 1500 American households found that 33% of the households own a computer. Identify the population.
- The collection of all American households
 - The 1500 American households surveyed
 - 33% of American households
 - All American households owning a computer
 - The 33% of the 1500 households sampled that own a computer
- 10) A survey of 1500 American households found that 33% of the households own a computer. Identify the sample.
- The 1500 American households surveyed
 - The collection of all American households
 - 33% of American households
 - All American households owning a computer
 - The 33% of the 1500 households sampled that own a computer
- 11) A study is conducted on a group of 10,000 high school students nationwide. Each week for a period of 13 weeks, participants must take an unannounced urine analysis to screen for illegal drug use. Identify the subjects of the study.
- high school students
 - 13 weeks
 - researchers
 - illegal drugs detected by urine analysis
 - the urine analysis test
- 12) The average salary of all General Motors workers is \$42,000. Identify a subject of the study.
- A General Motors worker
 - The average salary of a General Motors worker
 - All General Motors wage workers
 - All General Motors salary workers
 - All U.S. automotive workers

3 Random Sampling

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

Fill in the blank.

- The basis of _____ is that each subject in the population has the same chance of being in the sample.

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

Answer true or false.

- Random sampling enables the sample to be a good reflection of the population.
 - True
 - False
- Based on 12,000 responses from 55,000 questionnaires sent to its alumni, a major university estimated that the annual salary of its alumini was \$98,500 per year. This sample was collected using random sampling.
 - False
 - True
- A lobbyist for a major airspace firm assigns a number to each legislator and then uses a computer to randomly generate ten numbers. The lobbyist contacts the legislators corresponding to these numbers. This technique produces a random sample.
 - True
 - False

- 5) A lobbyist for a major aerospace firm wants to get the opinion of state legislators on an issue of importance to his industry. The lobbyist contacts 10 state legislators at the Top of the Mark Restaurant during a lunch break and each one is polled about the issue. This technique produces a random sample.
 A) False B) True
- 6) A large company would like to know what percentage of its employees would utilize an on-site daycare facility. Rather than asking its 5000 employees, each employee is assigned a number from 1 to 5000 and then a computer program is used to randomly select 100 numbers between 1 and 5000. These employees are then contacted and asked whether they would use an on-site daycare facility. The method used to collect the sample of 100 responses produces a random sample.
 A) True B) False
- 7) To estimate the percentage of defective items a machine is producing, a quality control analyst inspects the first 100 items produced in a day. This technique produces a random sample.
 A) False B) True
- 8) In a recent television survey, participants were asked to answer "yes" or "no" to the question "Are you in favor of the death penalty?". Six thousand five hundred responded "yes" while 3700 responded "no". There was a fifty-cent charge for the call. The sampling technique used produces a random sample.
 A) False B) True

4 Descriptive Statistical Analysis

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

Answer true or false.

- 1) Descriptive statistics refers to methods of making decisions or predictions about a population, based on data obtained from a sample of that population; while inferential statistics refers to methods for summarizing the data.
 A) False B) True

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

Fill in the blank.

- 2) The _____ is the set of all subjects of interest; while the _____ is a subset of the entire set of interest.
- 3) A _____ is a numerical summary of the population; while a _____ is a numerical summary of the sample.

Provide an appropriate response.

- 4) Merck Pharmaceutical Company manufactures Propecia, a drug that claims to treat male pattern scalp hair loss in men. For 12 months, doctors studied over 1800 men aged 18 to 41 with mild to moderate amounts of ongoing hair loss (see www.merck.com). Whether they were receiving Propecia or a placebo (a pill containing no medication), all men were given a medicated shampoo. In general, men who took Propecia maintained or increased the number of visible scalp hairs; while scalp hair counts in men who took the placebo continued to decrease. Merck concluded that Propecia is effective in maintaining or increasing the amount of scalp hair in men. Which statement of this example can be referred to as descriptive statistics?

5 Inferential Statistical Analysis

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

Answer true or false.

- 1) Inferential statistics are used when data are available only for a sample; however, descriptive statistics are used when data are available for either a sample or a population.
- A) True B) False

Select the most appropriate answer.

- 2) Using statistics to draw conclusions about parameters is called
- A) inferential statistics.
B) sampling.
C) designing a study.
D) descriptive statistics.
E) deductive statistics.
- 3) The estimation of the population average age of registered voters in the state of Ohio based on the sample average age of 1,000 registered voters in that state and its corresponding margin of error is an example of
- A) inferential statistics.
B) descriptive statistics.
C) a parameter.
D) a statistic.
E) deductive statistics.

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

Provide an appropriate response.

- 4) Merck Pharmaceutical Company manufactures Propecia, a drug that claims to treat male pattern scalp hair loss in men. For 12 months, doctors studied over 1800 men aged 18 to 41 with mild to moderate amounts of ongoing hair loss (see www.merck.com). Whether they were receiving Propecia or a placebo (a pill containing no medication), all men were given a medicated shampoo. In general, men who took Propecia maintained or increased the number of visible scalp hairs; while, scalp hair counts in men who took the placebo continued to decrease. Merck concluded that Propecia is effective in maintaining or increasing the amount of scalp hair in men. For this example, which statement can be characterized as inferential statistics?

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

- 5) From past figures, it is predicted that 39% of the registered voters in California will vote in the June primary. Which type of statistics does this statement reflect: inferential statistics or descriptive statistics?
- A) Inferential statistics B) Descriptive statistics

1.3 What Role Do Computers Play in Statistics?

1 Statistics and Technology

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

Answer true or false.

- 1) One method of learning about the impact of randomness and variability from sample to sample is simulation.
- A) True B) False

Select the most appropriate answer.

- 2) A short application program for performing a specific task is called a/an
- A) applet.
 - B) sampling.
 - C) parameter.
 - D) time series.
 - E) None of these.
- 3) Existing archived collections of data files are called
- A) databases.
 - B) samples.
 - C) rich text files.
 - D) mini-tabs.
 - E) None of these.

Provide an appropriate response.

- 4) Using an computer to mimic what would actually happen if you selected a sample and used statistics in real life is called
- A) simulation
 - B) database
 - C) time series
 - D) mini-tab
 - E) random sampling
- 5) If you are interested in creating a data file for a survey you conducted of 25 students, each answering 5 questions, of how many numerical entries will your data file consist?
- A) 125 B) 5 C) 25 D) 100 E) 30

Ch. 1 Statistics: The Art and Science of Learning from Data

Answer Key

1.1 How Can You Investigate Using Data?

1 Statistics and Data

- 1) A
- 2) data
- 3) Statistics
- 4) Statistics is the art and science of learning from data.
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A

2 Statistical Methods

- 1) design, description, inference
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A

1.2 We Learn about Populations Using Samples

1 Samples and Populations

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A
- 11) The population is the total set of subjects in which we are interested. A sample is the subset of the population for whom we have data.
- 12) Collecting data for an entire population, a census, is too expensive and time consuming.
- 13) A
- 14) A
- 15) A
- 16) A
- 17) A
- 18) A
- 19) A
- 20) A
- 21) A
- 22) A
- 23) A

2 Identify Population, Sample, and Subjects

- 1) The population is all U.S. households. The sample is the 50,000 households surveyed within the United States. The subjects are the U.S. households.
- 2) The population is all Americans 18 years and older. The sample is the 1004 surveyed Americans 18 years and older. The subjects are Americans 18 years and older.

- 3) It is estimated that between 28 and 34 percent of registered voters nationwide feel that the Republican party can do a better job of handling immigration issues.
- 4) 31% of the respondents answered "Republican"
- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A
- 11) A
- 12) A

3 Random Sampling

- 1) random sampling
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) A
- 8) A

4 Descriptive Statistical Analysis

- 1) A
- 2) population; sample
- 3) parameter; statistic
- 4) Scalp hair counts in the men who took Propecia maintained or increased; scalp hair counts in the men who took the placebo decreased

5 Inferential Statistical Analysis

- 1) A
- 2) A
- 3) A
- 4) Propecia is effective in maintaining or increasing the amount of scalp hair in men.
- 5) A

1.3 What Role Do Computers Play in Statistics?

1 Statistics and Technology

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