

Chapter 1 Introduction to Statistics

1.1 An Overview of Statistics

1 Distinguish Between a Population and a Sample

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

Determine whether the data set is a population or a sample.

- 1) The age of every fourth person entering a department store
A) sample B) population
- 2) The age of each employee at a local grocery store
A) population B) sample

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

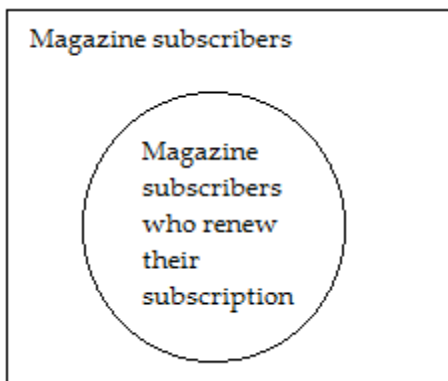
Identify the population and the sample.

- 3) A survey of 1212 American households found that 52% of the households own a computer.
- 4) When 1348 American households were surveyed, it was found that 57% of them owned two cars.
- 5) A survey of 2625 elementary school children found that 28% of the children could be classified as obese.

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

Use the Venn diagram to identify the population and the sample.

6)



- A) Population: Magazine subscribers; Sample: Magazine subscribers who renew their subscription
- B) Population: Magazine subscribers who renew their subscription; Sample: Magazine subscribers

2 Distinguish Between a Parameter and a Statistic

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

Determine whether the numerical value is a parameter or a statistic. Explain your reasoning.

- 7) A recent survey by the alumni of a major university indicated that the average salary of 10,500 of its 200,000 graduates was \$130,000.
- 8) The average salary of all assembly-line employees at a certain car manufacturer is \$44,000.
- 9) A survey of 1040 students was taken from a university with 19,000 students.

3 Distinguish Between Descriptive Statistics and Inferential Statistics

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

Identify whether the statement describes inferential statistics or descriptive statistics.

- 10) The average age of the students in a statistics class is 20 years.
A) descriptive statistics B) inferential statistics
- 11) The chances of winning the California Lottery are one chance in twenty-two million.
A) inferential statistics B) descriptive statistics
- 12) There is a relationship between smoking cigarettes and getting emphysema.
A) inferential statistics B) descriptive statistics
- 13) From past figures, it is predicted that 31% of the registered voters in California will vote in the June primary.
A) inferential statistics B) descriptive statistics
- 14) Based on previous clients, a marriage counselor concludes that the majority of marriages that begin with cohabitation before marriage will result in divorce.
A) inferential statistics B) descriptive statistics

4 Concepts

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

Provide an appropriate response.

- 15) Explain the difference between a sample and a population.
- 16) If you had to do a statistical study, would you use a sample or a population? Why?

1.2 Data Classification

1 Distinguish Between Qualitative and Quantitative Data

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

Determine whether the data are qualitative or quantitative.

- 1) the colors of automobiles on a used car lot
A) qualitative B) quantitative
- 2) the number of complaint letters received by the United States Postal Service in a given day
A) quantitative B) qualitative
- 3) the number of seats in a movie theater
A) quantitative B) qualitative
- 4) the numbers on the shirts of a girl's soccer team
A) qualitative B) quantitative

2 Classify Data with Respect to the Four Levels of Measurement

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

Identify the data set's level of measurement.

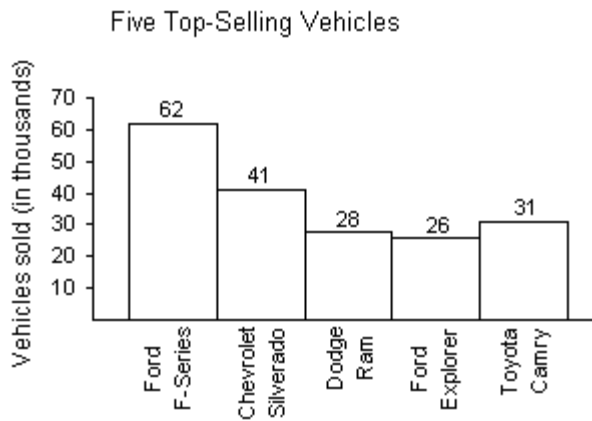
- 5) hair color of women on a high school tennis team
A) nominal B) ordinal C) interval D) ratio

- 6) numbers on the shirts of a girl's soccer team
 A) nominal B) ordinal C) interval D) ratio
- 7) ages of students in a statistic class
 A) ratio B) ordinal C) interval D) nominal
- 8) temperatures of 26 selected refrigerators
 A) interval B) ordinal C) nominal D) ratio
- 9) number of milligrams of tar in 30 cigarettes
 A) ratio B) ordinal C) interval D) nominal
- 10) number of pages in your statistics book
 A) ratio B) ordinal C) interval D) nominal
- 11) marriage status (married, single, or divorced) of the faculty at the University of Colorado
 A) nominal B) ordinal C) interval D) ratio
- 12) list of 1240 social security numbers
 A) nominal B) ordinal C) interval D) ratio
- 13) the ratings of a movie ranging from "poor" to "good" to "excellent"
 A) ordinal B) nominal C) interval D) ratio
- 14) the final grades (A, B, C, D, and F) for students in a statistics class
 A) ordinal B) nominal C) interval D) ratio
- 15) the annual salaries for all teachers in California
 A) ratio B) ordinal C) interval D) nominal
- 16) list of zip codes for Chicago
 A) nominal B) ordinal C) interval D) ratio
- 17) the nationalities listed in a recent survey (for example, Asian, European, or Hispanic).
 A) nominal B) ordinal C) interval D) ratio
- 18) the amounts of fat (in grams) in 37 cookies
 A) ratio B) ordinal C) interval D) nominal
- 19) the years the summer Olympics were held in the United States
 A) interval B) ordinal C) nominal D) ratio
- 20) numbers of touchdowns scored by a major university in five randomly selected games
 5 3 1 3 4
 A) ratio B) ordinal C) interval D) nominal
- 21) the average daily temperatures (in degrees Fahrenheit) on five randomly selected days
 21 23 21 30 27
 A) interval B) nominal C) ordinal D) ratio
- 22) manuscripts rated "acceptable" or "unacceptable"
 A) ordinal B) nominal C) ratio D) interval

23) the lengths (in minutes) of the top ten movies with respect to ticket sales in 2007

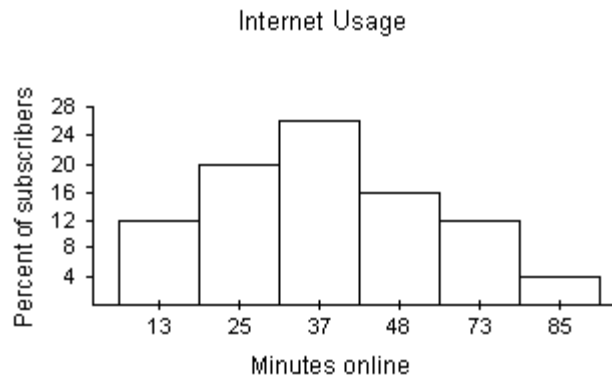
- A) ratio B) nominal C) ordinal D) interval

24) the data listed on the horizontal axis in the graph



- A) nominal B) interval C) ordinal D) ratio

25) the data listed on the horizontal axis in the graph



- A) ratio B) nominal C) ordinal D) interval

3 Concepts

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

Provide an appropriate response.

26) Explain the differences between the interval and ratio levels of measurement.

27) Explain why data expressed with the Celsius temperature scale is at the interval level of measurement rather than the ratio level.

1.3 Data Collection and Experimental Design

1 Decide Whether Study is Observational Study or Experiment

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

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

- 1) A medical researcher obtains a sample of adults suffering from diabetes. She randomly assigns 89 people to a treatment group and 89 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

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

Identify the experimental units and treatments used in the experiment.

- 7) A medical researcher center wants to test the effectiveness of a new diabetes medication. The company identifies 98 adults suffering from a similar form of diabetes. The subjects are randomly assigned to two groups. One group is given a medication and the other is given a placebo that looks exactly like the medication. After three months, the subjects' symptoms are studied and compared.

2 Identify a Biased Sample

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

Provide an appropriate response.

- 8) Explain what bias there is in a study done entirely online.
- 9) A report sponsored by the California Citrus Commission stated that cholesterol levels can be lowered by drinking at least one glass of a citrus product each day. Determine if the report is biased.
- 10) A local newspaper ran a survey by asking, "Do you support the deployment of a weapon that could kill millions of innocent people?" Determine whether the survey question is biased.

3 Identify Sampling Techniques

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

Identify the sampling technique used.

- 11) Thirty-five sophomores, 30 juniors and 33 seniors are randomly selected from 281 sophomores, 242 juniors and 529 seniors at a certain high school.
A) stratified B) random C) cluster D) convenience E) systematic
- 12) Every fifth person boarding a plane is searched thoroughly.
A) systematic B) random C) cluster D) convenience E) stratified
- 13) At a local community college, five statistics classes are randomly selected out of 20 and all of the students from each class are interviewed.
A) cluster B) random C) convenience D) systematic E) stratified
- 14) A researcher randomly selects and interviews fifty male and fifty female teachers.
A) stratified B) random C) cluster D) convenience E) systematic
- 15) A researcher for an airline interviews all of the passengers on five randomly selected flights.
A) cluster B) random C) convenience D) systematic E) stratified
- 16) A community college student interviews everyone in a particular statistics class to determine the percentage of students that own a car.
A) convenience B) random C) cluster D) systematic E) stratified
- 17) Based on 12,500 responses from 36,500 questionnaires sent to its alumni, a major university estimated that the annual salary of its alumni was \$116,000 per year.
A) random B) stratified C) cluster D) convenience E) systematic
- 18) 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 4700 responded "no". There was a fifty-cent charge for the call.
A) convenience B) random C) cluster D) stratified E) systematic
- 19) A lobbyist for a major aerospace 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.
A) random B) convenience C) cluster D) stratified E) systematic
- 20) To ensure customer satisfaction, every 20th phone call received by customer service will be monitored.
A) systematic B) random C) cluster D) stratified E) convenience
- 21) A market researcher randomly selects 400 drivers under 45 years of age and 100 drivers over 45 years of age.
A) stratified B) random C) cluster D) convenience E) systematic
- 22) To avoid working late, the quality control manager inspects the last 60 items produced that day.
A) convenience B) random C) cluster D) stratified E) systematic
- 23) The names of 70 contestants are written on 70 cards. The cards are placed in a bag, and three names are picked from the bag.
A) random B) stratified C) cluster D) convenience E) systematic
- 24) A researcher randomly selected 70 of the nation's middle schools and interviewed all of the teachers at each school.
A) cluster B) random C) stratified D) convenience E) systematic

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

Provide an appropriate response.

- 25) After a hurricane, a disaster area is divided into 200 equal grids. Thirty of the grids are selected and every occupied household in the grid is interviewed to help focus relief efforts. Select the numbers of the first five grids that belong to the cluster sample.

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- 26) There are 750 incoming freshmen attending a university this fall. A researcher wishes to send questionnaires to a sample of 30 of them to complete regarding their drinking habits. Select the numbers of the first five freshmen who belong to the simple random sample.

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- 27) A college employs 85 faculty members. Without replacement, select the numbers of the five members who will serve on the tenure committee next year.

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- 28) Of the 5000 outpatients released from a local hospital in the past year, one hundred were contacted and asked their opinion on the care they received. Select the first five patients who belong to the simple random sample.

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

Determine whether you would take a census or use a sampling. If you would use a sampling, decide what sampling technique you would use.

- 29) The average age of the 80 residents of an assisted living center.

A) census B) random sampling C) stratified sampling D) cluster sampling

4 Concepts

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

Provide an appropriate response.

- 30) Explain the differences between cluster sampling and stratified sampling.

- 31) Explain the difference between a census and a sampling and describe the advantages and disadvantages of each.

Chapter 1 Introduction to Statistics

Answer Key

1.1 An Overview of Statistics

1 Distinguish Between a Population and a Sample

- 1) A
- 2) A
- 3) population: collection of all American households; sample: collection of 1212 American households surveyed
- 4) population: collection of all American households; sample: collection of 1348 American households surveyed
- 5) population: elementary school children; sample: collection of 2625 elementary school children surveyed.
- 6) A

2 Distinguish Between a Parameter and a Statistic

- 7) It describes a statistic because the number \$130,000 is based on a subset of the population.
- 8) It describes a parameter because the \$44,000 is based on all the workers at the car manufacturer.
- 9) It describes a statistic because the number 1040 is based on a subset of the population.

3 Distinguish Between Descriptive Statistics and Inferential Statistics

- 10) A
- 11) A
- 12) A
- 13) A
- 14) A

4 Concepts

- 15) A population is the collection of *all* outcomes, responses, measurements, or counts that are of interest.. A sample is a subset of a population.
- 16) A sample would be used. It is usually impractical to obtain all the population data.

1.2 Data Classification

1 Distinguish Between Qualitative and Quantitative Data

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

2 Classify Data with Respect to the Four Levels of Measurement

- 5) A
- 6) A
- 7) A
- 8) A
- 9) A
- 10) A
- 11) A
- 12) A
- 13) A
- 14) A
- 15) A
- 16) A
- 17) A
- 18) A
- 19) A
- 20) A
- 21) A
- 22) A
- 23) A
- 24) A
- 25) A

3 Concepts

- 26) Data at the ratio level are similar to data at the interval level, but with the added property that a zero entry is an inherent zero (implies "none"). Also, for data at the ratio level a ratio of two data values can be formed so that one data value can be expressed as a multiple of another.
- 27) Such data is at the interval level rather than the ratio level because the temperature of 0°C does not represent a condition where no heat is present, so it is not an inherent zero as required by the ratio level. Also, ratios of two temperatures cannot be formed so that one data value is expressed as a multiple of the other. The temperature 2°C is not twice as warm as 1°C.

1.3 Data Collection and Experimental Design

1 Decide Whether Study is Observational Study or Experiment

- 1) A
- 2) A
- 3) A
- 4) A
- 5) A
- 6) A
- 7) The experimental units are the 98 adults in the study. The treatment is the new diabetes medication.

2 Identify a Biased Sample

- 8) The study may be biased because it is limited to people with computers.
- 9) A report sponsored by the citrus industry is much more likely to reach conclusions favorable to the industry.
- 10) The wording of the question is biased, as it tends to encourage negative responses.

3 Identify Sampling Techniques

- 11) A
- 12) A
- 13) A
- 14) A
- 15) A
- 16) A
- 17) A
- 18) A
- 19) A
- 20) A
- 21) A
- 22) A
- 23) A
- 24) A
- 25) 163, 169, 15, 92, 97
- 26) 163, 487, 693, 169, 513
- 27) 16, 34, 69, 38, 13
- 28) 1634, 3890, 1695, 1392, 1509
- 29) A

4 Concepts

- 30) In stratified sampling, members of the population are divided into two or more subsets, or strata, that share a similar characteristic. A sample is then randomly selected from each of the strata. A stratified sample has members from each segment of the population. In cluster sampling, the population is divided into naturally occurring subgroups, each having similar characteristics. All of the members in one or more (but not all) of the clusters are then selected. In a cluster sample, care must be taken to ensure that all clusters have similar characteristics.
- 31) A census is a count or measure of an entire population, while a sampling is a count or measure of part of a population. A census provides complete information but is often expensive, difficult, and time consuming to perform especially if the population is large. A sampling is less expensive and time consuming, however appropriate sampling techniques must be used to ensure that unbiased data are collected and that the sample is representative of the population. Even with the best sampling methods, sampling error can occur.