

GLOBAL  
EDITION



# Statistics

THIRTEENTH EDITION

James McClave • Terry Sincich



# Chapter 1

## Statistics, Data, and Statistical Thinking

# 1.1

## The Science of Statistics

# Problem

- Which is not an ethical obligation of a statistician?
- etik yükümlülük
- To provide measures to support conclusions drawn from a study. ✓
  - To state ilgili relevant data for a given problem. ✓
  - To support client wishes in drawing conclusions from the data. ✗
  - To infer anlam veya sonuç çıkarmak conclusions supported by data. ✓  
sonuçlar

# 1.2


## Types of Statistical Applications

# Problem

❑ A recent report stated "Based on a sample of truck drivers, there is evidence to indicate that, on average, independent truck drivers earn more than company-hired truck drivers." Does this statement describe descriptive or inferential statistics?

- ☒ Inferential statistics
- ☐ Descriptive statistics

# Problem

- ❑ From past figures, it is predicted that 30% of the registered voters will vote in the March primary. Does this statement describe descriptive or inferential statistics?
  - ❑ Inferential statistics
  - ❑ Descriptive statistics

# Problem

❑ A survey of high school teenagers reported that 83% of those sampled are interested in pursuing a college education. Does this statement describe descriptive or inferential statistics?

takip etmek

❑ Inferential statistics

❑ Descriptive statistics

# Problem

- ❑ The average age of the students in a statistics class is 22 years. Does this statement describe descriptive or inferential statistics?

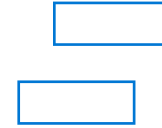
- ☐ Inferential statistics
- ☒ Descriptive statistics



# 1.3

## Fundamental Elements of Statistics

# Problem



- An assembly line is operating satisfactorily if fewer than 3% of the phones produced per day are defective. To check the quality of a day's production, the company randomly samples 10 phones from a day's production to test for defects. Define the population of interest to the manufacturer.
  - The 10 responses: defective or not defective
  - The 10 phones sampled and tested
  - 📞 All the phones produced during the day in question
    - The 3% of the phones that are defective

# Problem

- ❑ An insurance company conducted a study to determine the percentage of cardiologists who had been sued for malpractice in the previous years. The sample was randomly chosen from a national directory of doctors. What is the variable of interest in this study?
  - ❑ the doctor's area of expertise (i.e., cardiology, pediatrics, etc.)
  - ❑ the responses: have been sued/have not been sued for malpractice in the last two years
  - ❑ all cardiologists in the directory
  - ❑ the number of doctors who are cardiologists

# Problem

- 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 250 students and carefully recorded their parking times. Identify the experimental unit of interest.
- a single student that parks at the university
  - the parking time, defined to be the amount of time the student spent finding a parking spot
  - the entire set of students that park at the university ✗
  - the 250 students that data was collected from ✗

# Problem

❑ Which of the following is not typically an element of inferential statistical problems?

- ☒ Census ✗
- ☐ Variable of interest ✓
- ☐ Measure of reliability ✓
- ☐ Sample ✓

# 1.4

## Types of Data

# Problem

- ❑ 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 250 students and carefully recorded their parking times. What type of variable is the administration interested in collecting?

 quantitative data

☐ qualitative data

# Problem

- ❑ A study in the state of Georgia was conducted to determine the percentage of all community college students who have taken at least one online class. 1500 community college students were contacted and asked if they had taken at least one online class during their time at their community college. These responses were then used to estimate the percentage of all community college students who have taken at least one online class. What type of variable is being collected?


- ❑ quantitative data

- ☒ qualitative data

yes / no



# Problem

- ❑ Which data about paintings would not be qualitative?
  - ❑ The artist Leonardo da Vinci
  -  The value \$ 1,000,000,000
  - ❑ The style Oil Painting
  - ❑ The theme

# 1.5


## Collecting Data: Sampling and Related Issues

# Problem

- 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.

- ☒ From a survey ✓
- ☐ From a published source ✗
- ☐ From a designed experiment ✗
- ☐ observationally ✗

# Problem

- ❑ 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 \_\_\_\_\_.
  - ❑ From a survey
  - ❑ From a published source
  - ❑ From a designed experiment
  - ❑ observationally



# Problem

- ☐ In an observational study, the researcher exerts strict control over the units in the study.


☐ True

☒ False

# Problem


- ❑ Which type of problem has occurred when inaccuracies exist in the values of the data recorded?
  - ❑ Selection bias 
  -  ❑ Measurement error
  - ❑ Nonresponse bias

# Problem

- ❑ 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?
  - ❑ Selection bias
  - ❑ Measurement error
  -  ❑ Nonresponse bias

# Problem

- ❑ 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?

- ❑ Selection bias
  - ❑ Measurement error
  - ❑ Nonresponse bias



# 1.6

## The Role of Statistics in Critical Thinking and Ethics

# Problem

- ❑ A researcher studying malnutrition among children in a developing country collected weights of a random sample of children using a scale that she had set to give weights 2.5 kilograms less than the actual weight. Which statement best describes this situation?
  - ❑ Measurement error has not occurred, and the researcher is not guilty of unethical statistical practice.
  - ☒ Measurement error has occurred, and the researcher is guilty of unethical statistical practice.
  - ❑ Measurement error has occurred, but the researcher is not guilty of unethical statistical practice.
  - ❑ Measurement error has not occurred, but the researcher is guilty of unethical statistical practice.

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# Chapter 2

## Methods for Describing Sets of Data

# 2.1

## Describing Qualitative Data

# Problem

- ☐ In an eye color study, 25 out of 50 people in the sample had brown eyes. In this situation, what does the number .50 represent?
  - ☐ a class frequency
  - ☐ a class
  - ☒ a class percentage
  - ☐ a class relative frequency

# Problem

- ❑ What number is missing from the table?

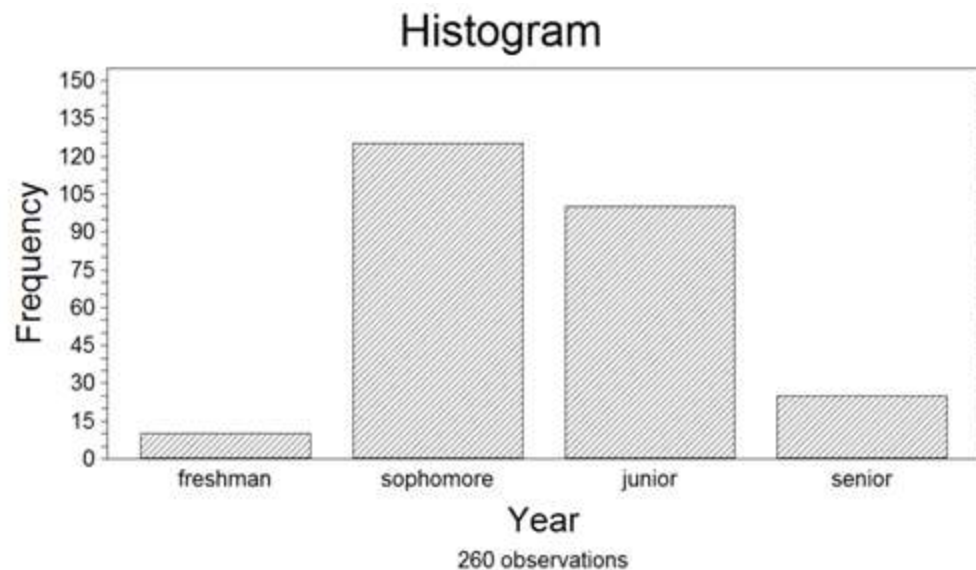
Year in College	Frequency	Relative Frequency
Freshman	600	.30
Sophomore	560	.28
Junior		.22
Senior	400	.20

- ☒ 440
- ☐ 220
- ☐ 480
- ☐ 520

# Problem

- 260 randomly sampled college students were asked, among other things, to state their year in school (freshman, sophomore, junior, or senior). The responses are shown in the bar graph below. How many of the students who responded would be classified as upperclassmen (e.g., juniors or seniors)?

- ☐ Approximately 25
- ☐ Approximately 10
- ☐ Approximately 100
- ☒ Approximately 125



# Problem

☐ Class relative frequencies must be used, rather than class frequencies or class percentages, when constructing a Pareto diagram.

☐ True

☒ False



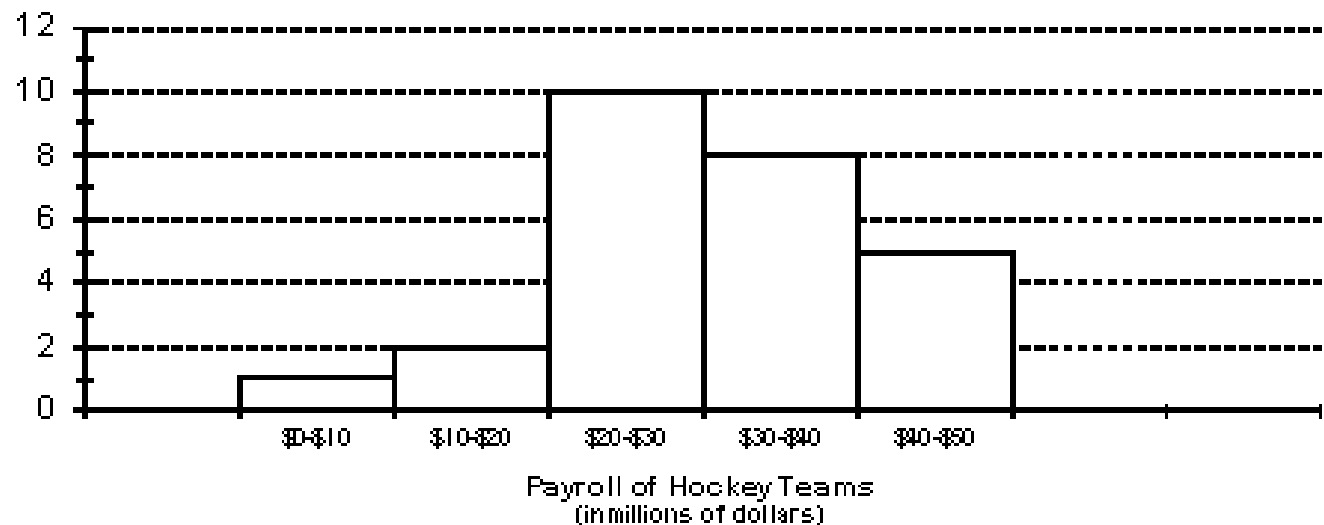
# 2.2

## Graphical Methods for Describing Quantitative Data

# Problem

- The payroll amounts for all teams in an international hockey league are shown below using a graphical technique from chapter 2 of the text. How many of the hockey team payrolls exceeded \$20 million (Note: Assume that no payroll was exactly \$20 million)?

- 8 teams
- 23 teams
- 10 teams
- 18 teams



# Problem

- A survey was conducted to determine how people feel about the quality of programming available on television. Respondents were asked to rate the overall quality from 0 (no quality at all) to 100 (extremely good quality). The stem-and-leaf display of the data is shown below. What percentage of the respondents rated overall television quality as very good (regarded as ratings of 80 and above)?

- 4%
- 1%
- 36%
- 9%

Stem	Leaf
3	2 3
4	0 3 4 7 8 9 9 9
5	0 1 1 2 3 4 5
6	1 2 5 6 6
7	4 9
8	
9	9

# 2.3

## Numerical Measures of Central Tendency

# Problem

- ❑ The amount spent on textbooks for the fall term was recorded for a sample of five university students - \$400, \$350, \$600, \$525, and \$450. Calculate the value of the sample mean for the data.
  - ❑ \$600
  - ❑ \$400
  - ❑ \$450
  - ❑ \$465

# Problem

- The scores for a statistics test are as follows:

73 76 88 77 90 92 98 85 89 89  
79 79 50 70 85 61 85 74 18 80

Compute the mean score.

- 80.10
- 67.85
- 75
- 76.9

# 2.4

## Numerical Measures of Variability

# Problem

- Each year advertisers spend billions of dollars purchasing commercial time on network television. In the first 6 months of one year, advertisers spent \$1.1 billion. Who were the largest spenders? In a recent article, the top 10 leading spenders and how much each spent (in million of dollars) were listed:

Calculate the sample variance.

- 1919.040
- 2141.564
- 3883.082
- 391.238

Company A	\$72	Company F	\$27.3
Company B	63.6	Company G	25
Company C	57.3	Company H	23.8
Company D	54	Company I	23.1
Company E	31.1	Company J	19.2



# Problem

☐ Calculate the range of the following data set:

8, 7, 9, 1, 6, 10, 4, 7, 4

☐ 1

☐ 10

☐ 11

☐ 9

# Problem

- The total points scored by a basketball team for each game during its last season have been summarized in the table below. Which statement following the table must be true?

Score	Frequency
-------	-----------

41-60	3
-------	---

61-80	8
-------	---

81-100	12
--------	----

101-120	7
---------	---

a) The range is at least 41 but at most 120.

b) The range is at least 41 but at most 79.

c) The range is 79.

d) The range is at least 81 but at most 100.

# 2.5

## Using the Mean and Standard Deviation to Describe Data

# Problem

- ❑ At a Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed was 100 mph and the standard deviation of the serve speeds was 15 mph. Assume that the statistician also gave us the information that the distribution of serve speeds was mound-shaped and symmetric. What percentage of the player's serves were between 115 mph and 145 mph?
  - ❑ at most 2.5%
  - ❑ at most 13.5%
  - ❑ approximately 16%
  - ❑ at most 34%

# Problem

- ❑ At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed was 100 miles per hour (mph) and the standard deviation of the serve speeds was 15 mph. If nothing is known about the shape of the distribution, what percentage of the player's serve speeds are less than 70 mph?
  - ❑ approximately 2.5%
  - ❑ at most 12.5%
  - ❑ at most 25%
  - ❑ at most 11%
  - ❑ approximately 5%

# 2.6

## Numerical Measures of Relative Standing

# Problem

- A radio station claims that the amount of advertising each hour has a mean of 13 minutes and a standard deviation of 1.8 minutes. You listen to the radio station for 1 hour and observe that the amount of advertising time is 8 minutes. Calculate the z-score for this amount of advertising time.
  - - 2.78
  - 0.48
  - 2.78
  - - 0.48

# 2.7

## Methods for Detecting Outliers: Box plots and z-Scores



# Problem

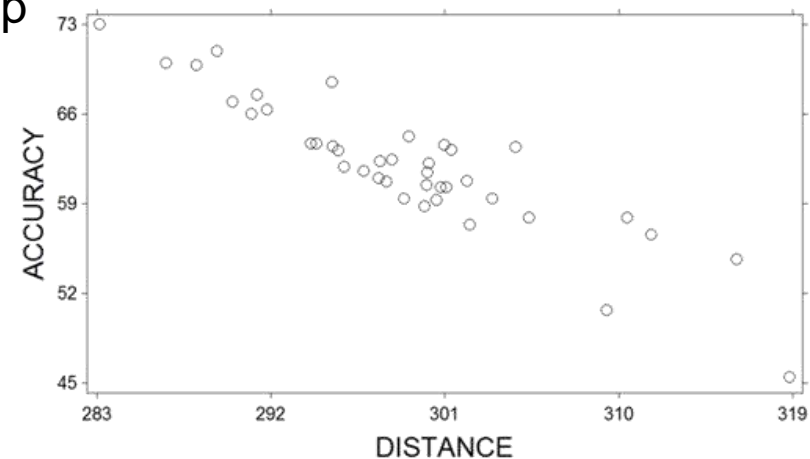
- ❑ At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 96 miles per hour (mph) and the standard deviation of the serve speeds was 9 mph. Using the z-score approach for detecting outliers, which of the following serve speeds would represent outliers in the distribution of the player's serve speeds? **65, 105, and 114**
- ❑ 65 is the only outlier.
  - ❑ They are all outliers
  - ❑ None of them.
  - ❑ 65 and 105 are outliers

# 2.8

## Graphing Bivariate Relationships (Optional)

# Problem

- ❑ A sample of professional golfers was taken and their driving distance (measured as the average distance as their drive off the tee) and driving accuracy (measured as the percentage of fairways that their drives landed in) were recorded. A scatterplot of the variables is shown below.
- ❑ What relationship do these two variables exhibit?
  - ❑ They exhibit a negative linear relationship
  - ❑ They exhibit a positive linear relationship
  - ❑ They exhibit a curvilinear relationship
  - ❑ They exhibit no relationship



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# Chapter 3

## Probability

# 3.1

## Events, Sample Spaces, and Probability

# Problem

- ❑ Which of the following assignments of probabilities to the sample points A, B, and C is valid if A, B, and C are the only sample points in the experiment?
  - ❑  $P(A) = 0, P(B) = 1/12, P(C) = 11/12$
  - ❑  $P(A) = 1/7, P(B) = 1/7, P(C) = 1/7$
  - ❑  $P(A) = -1/4, P(B) = 1/2, P(C) = 3/4$
  - ❑  $P(A) = 1/5, P(B) = 1/10, P(C) = 1/2$

# Problem

- ❑ There are 10 movies that Greg would like to rent but the store only allows him to have 4 movies at one time. In how many ways can Greg choose 4 of the 10 movies?
  - ❑ 10,000
  - ❑ 5,040
  - ❑ 210
  - ❑ 40

# 3.2

## Unions and Intersections



# Problem

- A pair of fair dice is tossed. Events A and B are defined as follows.

A: {The sum of the numbers on the dice is 3}

B: {At least one of the dice shows a 2}

Identify the sample points in the event  $A \cup B$ ?

- $\{(1, 2), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)\}$
- $\{(1, 2), (2, 1)\}$
- $\{(1, 2), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (4, 2), (5, 2), (6, 2)\}$
- $\{(2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (4, 2), (5, 2), (6, 2)\}$

# Problem

- A pair of fair dice is tossed. Events A and B are defined as follows.

A: {The sum of the numbers on the dice is 3}

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Identify the sample points in the event  $A \cap B$ .

- $\{(2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (4, 2), (5, 2), (6, 2)\}$
- $\{(1, 2), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (4, 2), (5, 2), (6, 2)\}$
- $\{(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)\}$
- $\{(1, 2), (2, 1)\}$

# 3.3

## Complementary Events

# Problem

- A clothing vendor estimates that 78 out of every 100 of its online customers do not live within 50 miles of one of its physical stores. Using this estimate, what is that probability that a randomly selected online customer lives within 50 miles of a physical store?
  - .28
  - .78
  - .22
  - .50

# 3.4

## The Additive Rule and Mutually Exclusive Events

# Problem

- ❑ If  $P(A \cup B) = 1$  and  $P(A \cap B) = 0$ , then which statement is true?
  - ❑ A and B are reciprocal events.
  - ❑ A and B are supplementary events.
  - ❑ A and B are complementary events.
  - ❑ A and B are both empty events.

# Problem

- ❑ In a box of 50 markers, 30 markers are either red or black and 20 are missing their caps. If 12 markers are either red or black and are missing their caps, find the probability that a randomly selected marker is red or black or is missing its cap.
  - ❑ 1
  - ❑ .38
  - ❑ .24
  - ❑ .76

# 3.5

## Conditional Probability



# Problem

- ❑ In a class of 40 students, 22 are women, 10 are earning an A, and 7 are women that are earning an A. If a student is randomly selected from the class, find the probability that the student is earning an A given that the student is a woman.
  - ❑  $5/11$
  - ❑  $7/22$
  - ❑  $7/40$
  - ❑  $1/4$

# Problem

- ❑ In a class of 40 students, 22 are women, 10 are earning an A, and 7 are women that are earning an A. If a student is randomly selected from the class, find the probability that the student is earning an A given that the student is a woman.
  - ❑  $5/11$
  - ❑  $7/22$
  - ❑  $7/40$
  - ❑  $1/4$

# 3.6

## The Multiplicative Rule and Independent Events

# Problem

- Suppose that for a certain experiment  $P(B) = 0.5$  and  $P(A) = 0.2$ . Find  $P(A \cap B)$ .
  - 0.1
  - 0.7
  - 0.4
  - 0.3

# Problem

- The table displays the probabilities for each of the six outcomes when rolling a particular unfair die. Suppose that the die is rolled once.

Outcome	1	2	3	4	5	6
Probability	.1	.1	.1	.2	.2	.3

- Events A, B, C, and D are defined as follows.

A: {The number is even}

B: {The number is less than 4}

C: {The number is less than or equal to 5}

D: {The number is greater than or equal to 5}

Identify one pair of independent events.

# 3.8

## Bayes's Rule (Optional)

# Problem

- ❑ Suppose the probability of an athlete taking a certain illegal steroid is 10%. A test has been developed to detect this type of steroid and will yield either a positive or negative result. Given that the athlete has taken this steroid, the probability of a positive test result is 0.995. Given that the athlete has not taken this steroid, the probability of a negative test result is 0.992. Given that a positive test result has been observed for an athlete, what is the probability that they have taken this steroid?
  - ❑ 0.0995
  - ❑ 0.9928
  - ❑ 0.9552
  - ❑ 0.9325