2.3 Measures of Central Tendency

Mean, Median, and Mode ▸ Weighted Mean and Mean of Grouped Data ▸ The Shape of Distributions

▸ Mean, Median, and Mode

In Sections 2.1 and 2.2, you learned about the graphical representations of quantitative data. In Sections 2.3 and 2.4, you will learn how to supplement graphical representations with numerical statistics that describe the center and variability of a data set.

A **measure of central tendency** is a value that represents a typical, or central, entry of a data set. The three most commonly used measures of central tendency are the mean, the median, and the mode.

DEFINITION

The **mean** of a data set is the sum of the data entries divided by the number of entries. To find the mean of a data set, use one of the following formulas.

Population Mean: $\mu = \dfrac{\Sigma x}{N}$ Sample Mean: $\bar{x} = \dfrac{\Sigma x}{n}$

The lowercase Greek letter μ (pronounced mu) represents the population mean and $\bar{x}$ (read as "x bar") represents the sample mean. Note that N represents the number of entries in a *population* and n represents the number of entries in a *sample*. Recall that the uppercase Greek letter sigma (Σ) indicates a summation of values.

Study Tip

Notice that the mean in Example 1 has one more decimal place than the original set of data values. This *round-off rule* will be used throughout the text. Another important *round-off rule* is that rounding should not be done until the final answer of a calculation.

EXAMPLE 1

Finding a Sample Mean

The prices (in dollars) for a sample of roundtrip flights from Chicago, Illinois to Cancun, Mexico are listed. What is the mean price of the flights?

872 432 397 427 388 782 397

Solution   The sum of the flight prices is

$\Sigma x = 872 + 432 + 397 + 427 + 388 + 782 + 397 = 3695.$

To find the mean price, divide the sum of the prices by the number of prices in the sample.

$$\bar{x} = \frac{\Sigma x}{n} = \frac{3695}{7} \approx 527.9$$

So, the mean price of the flights is about $527.90.

▸ Try It Yourself 1

The ages of employees in a department are listed. What is the mean age?

34 27 50 45 41 37 24
57 40 38 62 44 39 40

a. *Find the sum* of the data entries.
b. *Divide the sum* by the number of data entries.
c. *Interpret* the results in the context of the data.   *Answer: Page A34*

DEFINITION

The **median** of a data set is the value that lies in the middle of the data when the data set is ordered. The median measures the center of an ordered data set by dividing it into two equal parts. If the data set has an odd number of entries, the median is the middle data entry. If the data set has an even number of entries, the median is the mean of the two middle data entries.

EXAMPLE 2

Finding the Median

Find the median of the flight prices given in Example 1.

Solution   To find the median price, first order the data.

388   397   397   427   432   782   872

Because there are seven entries (an odd number), the median is the middle, or fourth, data entry. So, the median flight price is $427.

▶ **Try It Yourself 2**

The ages for a sample of fans at a rock concert are listed. Find the median age.

24   27   19   21   18   23   21   20   19   33   30   29   21
18   24   26   38   19   35   34   33   30   21   27   30

a. *Order* the data entries.
b. *Find the middle* data entry.
c. *Interpret* the results in the context of the data.   *Answer: Page A34*

EXAMPLE 3

Finding the Median

In Example 2, the flight priced at $432 is no longer available. What is the median price of the remaining flights?

Solution   The remaining prices, in order, are

388, 397, 397, 427, 782, and 872.

Because there are six entries (an even number), the median is the mean of the two middle entries.

$$\text{Median} = \frac{397 + 427}{2}$$

$$= 412$$

So, the median price of the remaining flights is $412.

▶ **Try It Yourself 3**

The prices (in dollars) for a sample of MP3 players are listed. Find the median price of the MP3 players.

80   250   200   150   270   140   70   100   130   160

a. *Order* the data entries.
b. *Find the mean* of the two middle data entries.
c. *Interpret* the results in the context of the data.   *Answer: Page A34*

> **DEFINITION**
>
> The **mode** of a data set is the data entry that occurs with the greatest frequency. If no entry is repeated, the data set has no mode. If two entries occur with the same greatest frequency, each entry is a mode and the data set is called **bimodal.**

Insight

The mode is the only measure of central tendency that can be used to describe data at the nominal level of measurement. But when working with quantitative data, the mode is rarely used.
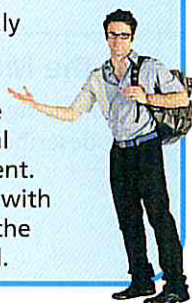
EXAMPLE 4

Finding the Mode

Find the mode of the flight prices given in Example 1.

Solution   Ordering the data helps to find the mode.

388   397   397   427   432   782   872

From the ordered data, you can see that the entry of 397 occurs twice, whereas the other data entries occur only once. So, the mode of the flight prices is $397.

▶ **Try It Yourself 4**

Find the mode of the ages of the residents of a small town. The data are given below.

25, 5, 18, 12, 60, 44, 24, 22, 2, 7, 15, 39, 58, 53, 36, 42,
16, 20, 1, 5, 39, 51, 44, 23, 3, 13, 37, 56, 58, 13, 47, 23,
1, 17, 39, 13, 24, 0, 39, 10, 41, 1, 48, 17, 18, 3, 72, 20, 3,
9, 0, 12, 33, 21, 40, 68, 25, 40, 59, 4, 67, 29, 13, 18, 19,
13, 16, 41, 19, 26, 68, 49, 5, 26, 49, 26, 45, 41, 19, 49

a. Write the data in *order*.
b. Identify the entry, or entries, that occur with the *greatest frequency*.
c. *Interpret* the results in the context of the data.   *Answer: Page A35*

Political party	Frequency, f
Democrat	34
Republican	56
Other	21
Did not respond	9

EXAMPLE 5

Finding the Mode

At a political debate a sample of audience members was asked to name the political party to which they belong. Their responses are shown in the table. What is the mode of the responses?

Solution   The response occurring with the greatest frequency is Republican. So, the mode is Republican.

Interpretation   In this sample, there were more Republicans than people of any other single affiliation.

▶ **Try It Yourself 5**

In a survey, 240 U.S. adults were asked if the United States will ever have a female president. Of those surveyed, 171 responded "yes," 45 responded "no," and 24 "didn't know." What is the mode of the responses?

a. Identify the entry that occurs with the *greatest frequency*.
b. *Interpret* the results in the context of the data.   *Answer: Page A35*

Although the mean, the median, and the mode each describe a typical entry of a data set, there are advantages and disadvantages of using each. The mean is a reliable measure because it takes into account every entry of a data set. But, the mean can be greatly affected when the data set contains outliers.

Ages in a class
20 20 20 20 20 20 21
21 21 21 22 22 22 23
23 23 23 24 24 65

Outlier —

DEFINITION

An **outlier** is a data entry that is far removed from the other entries in the data set.

A data set can have one or more outliers, causing **gaps** in a distribution. Conclusions that are drawn from a data set that contains outliers may be flawed.
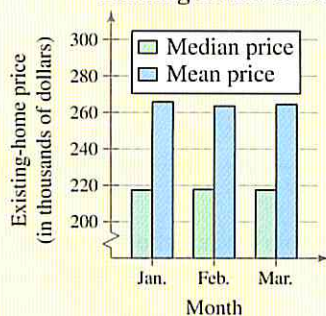
EXAMPLE 6

Comparing the Mean, the Median, and the Mode

Find the mean, the median, and the mode of the sample ages of a class shown at the left. Which measure of central tendency best describes a typical entry of this data set? Are there any outliers?

Solution

Mean: $\bar{x} = \dfrac{\sum x}{n} = \dfrac{475}{20} \approx 23.8$ years

Median: Median $= \dfrac{21 + 22}{2} = 21.5$ years

Mode: The entry occurring with the greatest frequency is 20 years.

Interpretation The mean takes every entry into account but is influenced by the outlier of 65. The median also takes every entry into account, and it is not affected by the outlier. In this case the mode exists, but it doesn't appear to represent a typical entry. Sometimes a graphical comparison can help you decide which measure of central tendency best represents a data set. The histogram shows the distribution of the data and the location of the mean, the median, and the mode. In this case, it appears that the median best describes the data set.

Ages of Students in a Class
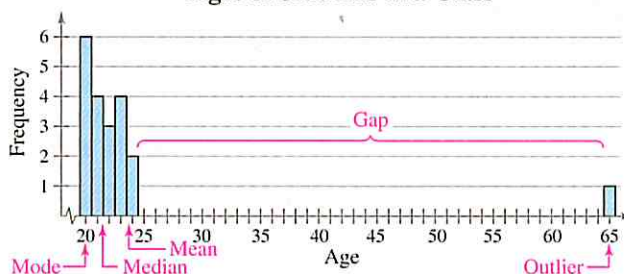
▶ Try It Yourself 6

Remove the data entry of 65 from the preceding data set. Then rework the example. How does the absence of this outlier change each of the measures?

a. Find the *mean*, the *median*, and the *mode*.
b. Compare these measures of central tendency with those found in Example 6.

Answer: Page A35

▶ **Weighted Mean and Mean of Grouped Data**

Sometimes data sets contain entries that have a greater effect on the mean than do other entries. To find the mean of such data sets, you must find the weighted mean.

DEFINITION

A **weighted mean** is the mean of a data set whose entries have varying weights. A weighted mean is given by

$$\bar{x} = \frac{\Sigma(x \cdot w)}{\Sigma w}$$

where w is the weight of each entry x.

EXAMPLE 7

Finding a Weighted Mean

You are taking a class in which your grade is determined from five sources: 50% from your test mean, 15% from your midterm, 20% from your final exam, 10% from your computer lab work, and 5% from your homework. Your scores are 86 (test mean), 96 (midterm), 82 (final exam), 98 (computer lab), and 100 (homework). What is the weighted mean of your scores? If the minimum average for an A is 90, did you get an A?

Solution   Begin by organizing the scores and the weights in a table.

Source	Score, x	Weight, w	xw
Test Mean	86	0.50	43.0
Midterm	96	0.15	14.4
Final Exam	82	0.20	16.4
Computer Lab	98	0.10	9.8
Homework	100	0.05	5.0
		$\Sigma w = 1$	$\Sigma(x \cdot w) = 88.6$

$$\bar{x} = \frac{\Sigma(x \cdot w)}{\Sigma w}$$

$$= \frac{88.6}{1}$$

$$= 88.6$$

Your weighted mean for the course is 88.6. So, you did not get an A.

▶ **Try It Yourself 7**

An error was made in grading your final exam. Instead of getting 82, you scored 98. What is your new weighted mean?

a. Multiply each score by its weight and *find the sum of these products*.
b. Find the *sum of the weights*.
c. Find the *weighted mean*.
d. *Interpret* the results in the context of the data.   *Answer: Page A35*

If data are presented in a frequency distribution, you can approximate the mean as follows.

DEFINITION

The **mean of a frequency distribution** for a sample is approximated by

$$\bar{x} = \frac{\Sigma(x \cdot f)}{n}$$ Note that $n = \Sigma f$

where x and f are the midpoints and frequencies of a class, respectively.

GUIDELINES

Finding the Mean of a Frequency Distribution

In Words	*In Symbols*
1. Find the midpoint of each class.	$x = \dfrac{(\text{Lower limit}) + (\text{Upper limit})}{2}$
2. Find the sum of the products of the midpoints and the frequencies.	$\Sigma(x \cdot f)$
3. Find the sum of the frequencies.	$n = \Sigma f$
4. Find the mean of the frequency distribution.	$\bar{x} = \dfrac{\Sigma(x \cdot f)}{n}$

EXAMPLE 8

Finding the Mean of a Frequency Distribution

Use the frequency distribution at the left to approximate the mean number of minutes that a sample of Internet subscribers spent online during their most recent session.

Class midpoint, x	Frequency, f	$(x \cdot f)$
12.5	6	75.0
24.5	10	245.0
36.5	13	474.5
48.5	8	388.0
60.5	5	302.5
72.5	6	435.0
84.5	2	169.0
	$n = 50$	$\Sigma = 2089.0$

Solution

$$\bar{x} = \frac{\Sigma(x \cdot f)}{n} = \frac{2089}{50} \approx 41.8$$

So, the mean time spent online was approximately 41.8 minutes.

▶ **Try It Yourself 8**

Use a frequency distribution to approximate the mean number of touchdowns scored by all Division 1A football teams. (See Try It Yourself 2 on page 43.)

a. Find the *midpoint* of each class.
b. Find the *sum of the products* of each midpoint and corresponding frequency.
c. Find the *sum of the frequencies*.
d. Find the *mean of the frequency distribution*.   *Answer: Page A35*

▶ The Shape of Distributions

A graph reveals several characteristics of a frequency distribution. One such characteristic is the shape of the distribution.

DEFINITION

A frequency distribution is **symmetric** when a vertical line can be drawn through the middle of a graph of the distribution and the resulting halves are approximately mirror images.

A frequency distribution is **uniform** (or **rectangular**) when all entries, or classes, in the distribution have equal or approximately equal frequencies. A uniform distribution is also symmetric.

A frequency distribution is skewed if the "tail" of the graph elongates more to one side than to the other. A distribution is **skewed left (negatively skewed)** if its tail extends to the left. A distribution is **skewed right (positively skewed)** if its tail extends to the right.
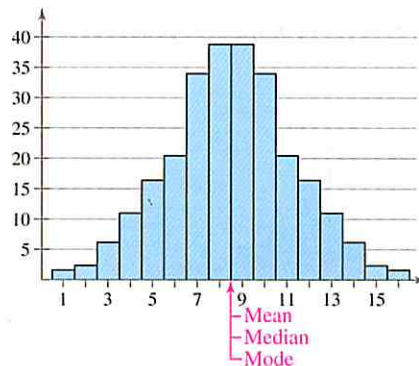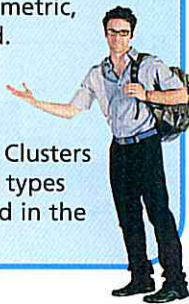

To explore this topic further, see Activity 2.3 on page 81.

When a distribution is symmetric and unimodal, the mean, median, and mode are equal. If a distribution is skewed left, the mean is less than the median and the median is usually less than the mode. If a distribution is skewed right, the mean is greater than the median and the median is usually greater than the mode. Examples of these commonly occurring distributions are shown.
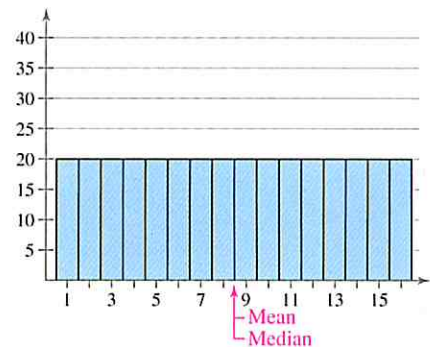

Symmetric Distribution

Uniform Distribution

Skewed-Left Distribution

Skewed-Right Distribution

Insight

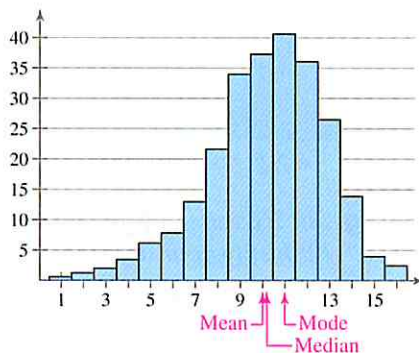Be aware that there are many different shapes of distributions. In some cases, the shape cannot be classified as symmetric, uniform, or skewed. A distribution can have several gaps caused by outliers, or **clusters** of data. Clusters occur when several types of data are included in the one data set.
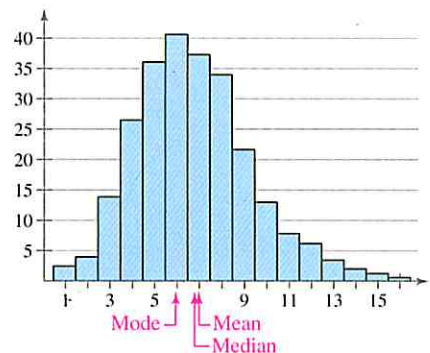
The mean will always fall in the direction the distribution is skewed. For instance, when a distribution is skewed left, the mean is to the left of the median.
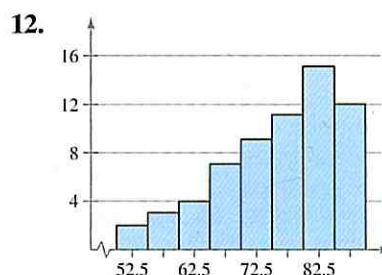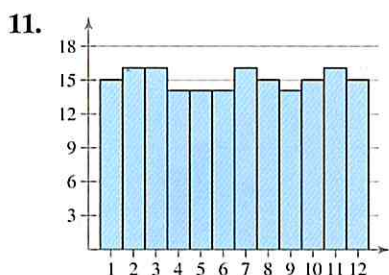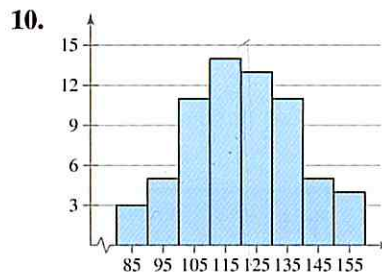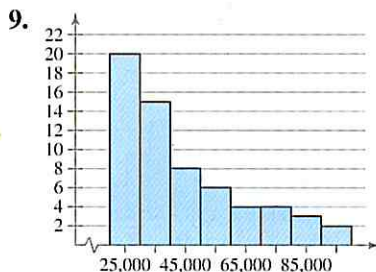
2.3 EXERCISES

■ Building Basic Skills and Vocabulary

True or False? *In Exercises 1–6, determine whether the statement is true or false. If it is false, rewrite it as a true statement.*

1. The mean is the measure of central tendency most likely to be affected by an extreme value (an outlier).

2. Every data set must have a mode.

3. Some quantitative data sets do not have a median.

4. The mean is the only measure of central tendency that can be used for data at the nominal level of measurement.

5. When each data class has the same frequency, the distribution is skewed right.

6. When the mean is greater than the median, the distribution is skewed left.

7. Construct a data set in which the mean is *not* representative of a typical number in the data set.

8. Construct a data set in which the median and the mode are the same.

Graphical Analysis *In Exercises 9–12, determine whether the approximate shape of the distribution in the histogram is symmetric, uniform, skewed left, skewed right, or none of these. Justify your answer.*

9.

10.

11.

12.

Matching *In Exercises 13–16, match the distribution with one of the graphs in Exercises 9–12. Justify your decision.*

13. The frequency distribution of 180 rolls of a dodecagon (a 12-sided die)

14. The frequency distribution of salaries at a company where a few executives make much higher salaries than the majority of employees

15. The frequency distribution of scores on a 90-point test where a few students scored much lower than the majority of students

16. The frequency distribution of weights for a sample of seventh grade boys

■ Using and Interpreting Concepts

Finding and Discussing the Mean, Median, and Mode   *In Exercises 17–34, find the mean, median, and mode of the data, if possible. If any of these measures cannot be found or a measure does not represent the center of the data, explain why.*

17. SUVs   The maximum number of seats in a sample of 13 sport utility vehicles

6 6 9 9 6 5 5 5 7 5 5 5 8

18. Education   The education cost per student (in thousands of dollars) from a sample of 10 liberal arts colleges

30 35 19 22 22 20 23 21 35 25

19. Sports Cars   The times (in seconds) for a sample of seven sports cars to go from 0 to 60 miles per hour

3.7 4.0 4.8 4.8 4.8 4.8 5.1

20. Cholesterol   The cholesterol levels of a sample of 10 female employees

154 240 171 188 235 203 184 173 181 275

21. NFL   The average points per game scored by each NFL team during the 2006 regular season   *(Source: NFL)*

19.6 18.2 22.1 18.8 16.9 26.7 23.3 14.9
26.6 19.9 19.1 18.8 16.7 26.7 23.2 20.7
16.2 17.6 24.1 25.8 19.8 22.2 10.5 24.9
22.1 30.8 18.6 20.9 22.9 13.2 20.2 19.2

22. Power Failures   The durations (in minutes) of power failures at a residence in the last 10 years

18 26 45 75 125 80 33 40 44 49
89 80 96 125 12 61 31 63 103 28

23. Air Quality   The responses of a sample of 1040 people who were asked if the air quality in their community is better or worse than it was 10 years ago

Better: 346   Worse: 450   Same: 244

24. Crime   The responses of a sample of 1019 people who were asked how they felt when they thought about crime

Unconcerned: 34   Watchful: 672   Nervous: 125   Afraid: 188

25. Top Speeds   The top speeds (in miles per hour) for a sample of seven sports cars

187.3 181.8 180.0 169.3 162.2 158.1 155.7

26. Purchase Preference   The responses of a sample of 1001 people who were asked if their next vehicle purchase will be foreign or domestic

Domestic: 704   Foreign: 253   Don't know: 44

27. Stocks   The recommended prices (in dollars) for several stocks that analysts predict should produce at least 10% annual returns   *(Source: Money)*

41 20 22 14 15 25 18 40 17 14

28. Eating Disorders The number of weeks it took to reach a target weight for a sample of five patients with eating disorders treated by psychodynamic psychotherapy *(Source: The Journal of Consulting and Clinical Psychology)*

15.0   31.5   10.0   25.5   1.0

29. Eating Disorders The number of weeks it took to reach a target weight for a sample of 14 patients with eating disorders treated by psychodynamic psychotherapy and cognitive behavior techniques *(Source: The Journal of Consulting and Clinical Psychology)*

2.5   20.0   11.0   10.5   17.5   16.5   13.0
15.5   26.5   2.5   27.0   28.5   1.5   5.0

30. Aircraft The number of aircraft 11 airlines have in their fleets *(Source: Airline Transport Association)*

699   480   25   35   110   445
458   374   93   356   380

31. Weights (in pounds) of Dogs at a Kennel

```
 1 | 0 2     Key: 1|0 = 10
 2 | 1 4 7
 3 | 7 8
 4 | 1 5 5
 5 | 0 7
 6 | 5
 7 |
 8 |
 9 |
10 | 6
```

32. Grade Point Averages of Students in a Class

```
0 | 8         Key: 0|8 = 0.8
1 | 5 6 8
2 | 1 3 4 5
3 | 0 9
4 | 0 0
```

33. Time (in minutes) it Takes Employees to Drive to Work
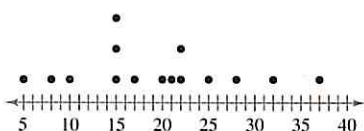
34. Top Speeds (in miles per hour) of High-Performance Sports Cars
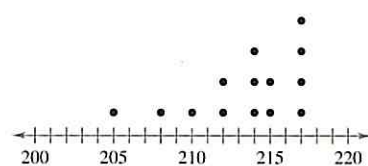
Graphical Analysis *In Exercises 35 and 36, the letters A, B, and C are marked on the horizontal axis. Describe the shape of the data. Then determine which is the mean, which is the median, and which is the mode. Justify your answers.*

35. Sick Days Used by Employees

36. Hourly Wages of Employees

In Exercises 37–40, without performing any calculations, determine which measure of central tendency best represents the graphed data. Explain your reasoning.

37.

Are You Getting Enough Sleep?

38.

Heights of Players on Two Opposing Basketball Teams

39.

Heart Rate of a Sample of Adults
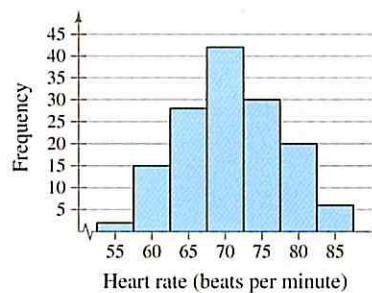
40.

Body Mass Index (BMI) of People in a Gym
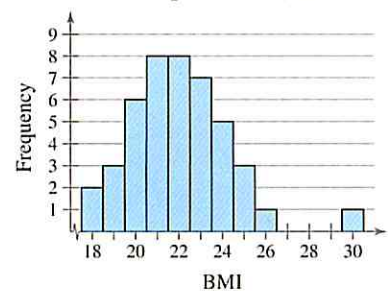
Finding the Weighted Mean   *In Exercises 41–46, find the weighted mean of the data.*

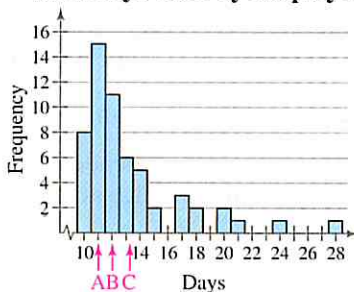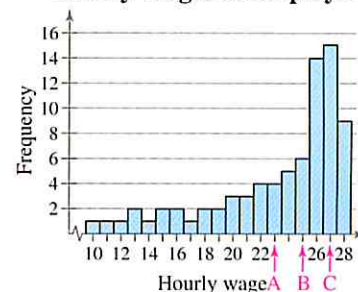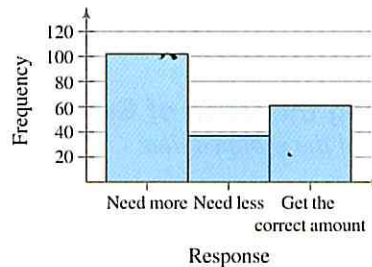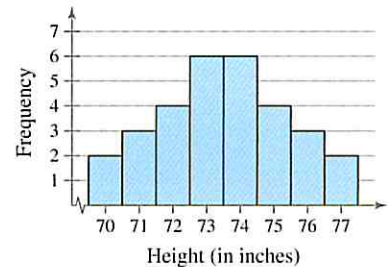**41. Final Grade**   The scores and their percents of the final grade for a statistics student are given. What is the student's mean score?

	Score	Percent of final grade
Homework	85	5%
Quizzes	80	35%
Project	100	20%
Speech	90	15%
Final Exam	93	25%

42. Salaries   The average starting salaries (by degree attained) for 25 employees at a company are given. What is the mean starting salary for these employees?

8 with MBAs: $45,500
17 with BAs in business: $32,000

43. Account Balance   For the month of April, a checking account has a balance of $523 for 24 days, $2415 for 2 days, and $250 for 4 days. What is the account's mean daily balance for April?

44. Account Balance   For the month of May, a checking account has a balance of $759 for 15 days, $1985 for 5 days, $1410 for 5 days, and $348 for 6 days. What is the account's mean daily balance for May?

45. Grades   A student receives the following grades, with an A worth 4 points, a B worth 3 points, a C worth 2 points, and a D worth 1 point. What is the student's mean grade point score?

B in 2 three-credit classes
A in 1 four-credit class

D in 1 two-credit class
C in 1 three-credit class

46. Scores   The mean scores for a statistics course (by major) are given. What is the mean score for the class?

9 engineering majors: 85
5 math majors: 90
13 business majors: 81

Finding the Mean of Grouped Data   *In Exercises 47–50, approximate the mean of the grouped data.*

47. Heights of Females   The heights (in inches) of 18 female students in a physical education class

Height (in inches)	Frequency
60–62	4
63–65	5
66–68	8
69–71	1

48. Heights of Males   The heights (in inches) of 23 male students in a physical education class

Height (in inches)	Frequency
63–65	3
66–68	6
69–71	7
72–74	4
75–77	3

49. Ages   The ages of residents of a town

Age	Frequency
0–9	55
10–19	70
20–29	35
30–39	56
40–49	74
50–59	42
60–69	38
70–79	17
80–89	10

50. Phone Calls   The lengths of long-distance calls (in minutes) made by one person in one year

Length of call	Number of calls
1–5	12
6–10	26
11–15	20
16–20	7
21–25	11
26–30	7
31–35	4
36–40	4
41–45	1

Identifying the Shape of a Distribution   *In Exercises 51–54, construct a frequency distribution and a frequency histogram of the data using the indicated number of classes. Describe the shape of the histogram as symmetric, uniform, negatively skewed, positively skewed, or none of these.*

51. Hospitalization

Number of classes: 6

Data set: The number of days 20 patients remained hospitalized

6	9	7	14	4
5	6	8	4	11
10	6	8	6	5
7	6	6	3	11

52. Hospital Beds

Number of classes: 5

Data set: The number of beds in a sample of 24 hospitals

149	167	162	127	130	180	160	167
221	145	137	194	207	150	254	262
244	297	137	204	166	174	180	151

53. Height of Males

Number of classes: 5

Data set: The heights (to the nearest inch) of 30 males

67	76	69	68	72	68	65	63	75	69
66	72	67	66	69	73	64	62	71	73
68	72	71	65	69	66	74	72	68	69

54. Six-Sided Die

Number of classes: 6

Data set: The results of rolling a six-sided die 30 times

1	4	6	1	5	3	2	5	4	6
1	2	4	3	5	6	3	2	1	1
5	6	2	4	4	3	1	6	2	4

55. Coffee Content   During a quality assurance check, the actual coffee content (in ounces) of six jars of instant coffee was recorded as 6.03, 5.59, 6.40, 6.00, 5.99, and 6.02.

(a) Find the mean and the median of the coffee content.

(b) The third value was incorrectly measured and is actually 6.04. Find the mean and median of the coffee content again.

(c) Which measure of central tendency, the mean or the median, was affected more by the data entry error?

56. U.S. Exports   The following data are the U.S. exports (in billions of dollars) to 19 countries for a recent year. *(Source: U.S. Department of Commerce)*

Country	Value		Country	Value
Canada	230.3		Japan	59.6
Mexico	134.2		United Kingdom	45.4
Germany	41.3		South Korea	32.5
Taiwan	23.0		Singapore	24.7
Netherlands	31.1		France	24.2
China	55.2		Brazil	19.2
Australia	17.8		Belgium	21.3
Malaysia	12.6		Italy	12.6
Switzerland	14.4		Thailand	8.2
Saudi Arabia	7.8			

(a) Find the mean and median.

(b) Find the mean and median without the U.S. exports to Canada.

(c) Which measure of central tendency, the mean or the median, was affected more by the elimination of the Canadian export data?

■ Extending Concepts

57. Golf   The distances (in yards) for nine holes of a golf course are listed.

336   393   408   522   147   504   177   375   360

(a) Find the mean and median of the data.

(b) Convert the distances to feet. Then rework part (a).

(c) Compare the measures you found in part (b) with those found in part (a). What do you notice?

(d) Use your results from part (c) to explain how to quickly find the mean and median of the given data set if the distances are measured in inches.

58. Data Analysis   A consumer testing service obtained the following miles per gallon in five test runs performed with three types of compact cars.

	Run 1	Run 2	Run 3	Run 4	Run 5
Car A:	28	32	28	30	34
Car B:	31	29	31	29	31
Car C:	29	32	28	32	30

(a) The manufacturer of Car A wants to advertise that its car performed best in this test. Which measure of central tendency—mean, median, or mode—should be used for its claim? Explain your reasoning.

(b) The manufacturer of Car B wants to advertise that its car performed best in this test. Which measure of central tendency—mean, median, or mode—should be used for its claim? Explain your reasoning.

(c) The manufacturer of Car C wants to advertise that its car performed best in this test. Which measure of central tendency—mean, median, or mode—should be used for its claim? Explain your reasoning.

59. Midrange   Another measure of central tendency that is rarely used but is easy to calculate is the **midrange**. It can be found by the formula

$$\frac{(\text{Maximum data entry}) + (\text{Minimum data entry})}{2}.$$

Which of the manufacturers in Exercise 58 would prefer to use the midrange statistic in their ads? Explain your reasoning.

60. Data Analysis   Students in an experimental psychology class did research on depression as a sign of stress. A test was administered to a sample of 30 students. The scores are given.

44   51   11   90   76   36   64   37   43   72   53   62   36   74   51
72   37   28   38   61   47   63   36   41   22   37   51   46   85   13

(a) Find the mean and median of the data.

(b) Draw a stem-and-leaf plot for the data using one row per stem. Locate the mean and median on the display.

(c) Describe the shape of the distribution.

61. Trimmed Mean   To find the 10% **trimmed mean** of a data set, order the data, delete the lowest 10% of the entries and the highest 10% of the entries, and find the mean of the remaining entries.

(a) Find the 10% trimmed mean for the data in Exercise 60.

(b) Compare the four measures of central tendency, including the midrange.

(c) What is the benefit of using a trimmed mean versus using a mean found using all data entries? Explain your reasoning.