1. **A**  
2. **E**  
3. **F**  
4. **B**  
5. **A**  
6. **13**  
7. **x = 9/15**  
8. **10 = x/100**  
9. **250 = x/1500**  
10. **20 > 13**  
11. **2/3 > 1/2**  
12. **3/4 < 7/9**  
13. **0.75 = 9/12**  
14. **1/8, 1/2, 3/4, 4/5**  
15. **0.12, 0.3, 1/3, 2/5, 3/4**  
16. **0.25 × 300 = 75**  
17. **0.5 × 4000 = 2000**  
18. **0.05 × 200 = 10**  
19. **0.125 × 9600 = 1200**  
20. **435 ÷ 10 = 43.5**  
21. **32 ÷ 100 = 0.32**  
22. **777 ÷ 1000 = 0.777**  
23. **295 ÷ 10,000 = 0.0295**  
24. **0.6**  
25. **0.45**  
26. **0.75**  
27. **0.08**  
28. **25%**  
29. **20%**  
30. **36%**  
31. **10%**

### 10-1 Organizing and Displaying Data

**Check It Out!**

1a. bread  
1b. cheese and mayonnaise

2. 2001, 2002, and 2005; about 13,000 people

3. The difference in temperature is about,  
   $80 - 62 = 18^\circ F$

4. Prices increased from January through July or August, and then prices decreased through Nov.

5. There is a total of $\frac{1}{2} + 1 + 2 + 2 + 2\frac{1}{2} = 8 \, \text{c}$  
   Therefore the percentage of cantaloupe in the fruit salad is $\frac{2\frac{1}{2}}{8} = 31.25\%$

6. A circle graph is appropriate for this data because it shows categories as parts of a whole.

   - Sleeping: $\frac{45}{120} = 0.375 = 37.5\%$
   - Eating: $\frac{8}{120} \approx 0.067 = 6.7\%$
   - School: $\frac{30}{120} = 0.25 = 25\%$
   - Sports: $\frac{10}{120} = 0.083 = 8.3\%$
   - Homework: $\frac{10}{120} \approx 0.083 = 8.3\%$
   - Other: $\frac{17}{120} \approx 0.142 = 14.2\%$

   Find the angle measure for each sector of the graph. Since there are $360^\circ$ in a circle, multiply each percent by $360^\circ$.

   - Sleeping: $0.375 \times 360^\circ = 135^\circ$
   - Eating: $0.067 \times 360^\circ \approx 24^\circ$
   - School: $0.25 \times 360^\circ = 90^\circ$
   - Sports: $0.083 \times 360^\circ \approx 30^\circ$
   - Homework: $0.083 \times 360^\circ \approx 30^\circ$
   - Other: $0.142 \times 360^\circ \approx 51^\circ$

   Use a compass to draw a circle. Mark the center and use a straightedge to draw one radius. Then use a protractor to draw each central angle.

### Think and Discuss

1. Possible answer: You can compare quantities.

2. Possible answer: The horizontal and vertical scales start at 0, time is placed on the horizontal axis, and even intervals are used between items on the horizontal axis.

3. [Graphs: Bar Graph, Line Graph, Circle Graph]
EXERCISES

GUIDED PRACTICE
1. one part of a whole
2. As the steepness of the line increases, the rate of change increases.
3. 82 animals
4. cats; rabbits
5. club level seat is about $15 more expensive in stadium A than at stadium B
6. box seats
7. Prices at stadium A are greater than prices at stadium B.
8. about 34,000 tickets
9. between weeks 4 and 5
10. 1 week before election
11. The difference in support 5 weeks before election was about 18%.
12. Support for candidate A generally decreased, and support for candidate B generally increased.
13. purple
14. Yellow balls are, 24% of 500 = 120
15. Blue and green are approximately equally represented.
16. A circle graph is appropriate for this data because it shows categories as parts of a whole.
   Clothing: \( \frac{35}{100} = 0.35 = 35\% \)
   Food: \( \frac{25}{100} = 0.25 = 25\% \)
   Entertainment: \( \frac{25}{100} = 0.25 = 25\% \)
   Other: \( \frac{15}{100} = 0.15 = 15\% \)

   Find the angle measure for each sector of the graph. Since there are 360° in a circle, multiply each percent by 360°.
   Clothing: \( 0.35 \times 360° = 126° \)
   Food: \( 0.25 \times 360° = 90° \)
   Entertainment: \( 0.25 \times 360° = 90° \)
   Other: \( 0.15 \times 360° = 54° \)

   Use a compass to draw a circle. Mark the center and use a straightedge to draw one radius. Then use a protractor to draw each central angle.
17. Difference between the tribes with largest and smallest population is about 225,000.
18. Total population is about 885,000.
   Therefore percentage of Cherokee is \( \frac{310,000}{885,000} \approx 35\% \)
19. Fri
20. Wed
21. There are about 180 dinner customers and 50 lunch customers. Therefore there are about 3.5 times as many dinner customers on Sunday.
22. games 1 and 2
23. games 3, 4 and 5
24. Value for stock X is $35, and value for stock Y is $30. So the average value for both stocks is $32.50.
25. Stock Y changed the most between Apr. and Jul. of 2004.
26. Both generally increased.
27. There is a total of 96 cars.
   So, there is \( \frac{8}{96} = \frac{1}{12} \) hopper cars.
28. Percentage of gondola or tank cars is, \( \frac{33 + 11}{96} = \frac{44}{96} \approx 46\% \)
29. A double-line graph is appropriate since it shows change over time for two things. It also allows you to compare two things.
   Determine the scale and interval for each data set of data. Time should be plotted on the horizontal axis because it is independent.
   Plot a point for each pair of values. Connect the points using line segments.
   Title the graph and label the horizontal and vertical scales.
30. line
31. double line
32. bar
33. circle
34. Possible answer: line graph: your height over time; circle graph: your CD collection divided into categories; double-bar graph: number of hours you spend on homework or sports each day of the week
35a. Greece; about 40%
35b. United States; about 15%
36. If the graph is generally increasing, you can predict that the value in the future will increase.
**TEST PREP**

37. D  
38. G

39. A bar graph allows you to compare categories.  
Determine an appropriate scale and interval. The  
scale must include all of the data values. The scale  
is separated into equal parts, called intervals.  
Use the data to determine the lengths of the bars.  
Draw bars of equal width.  
Title the graph and label the horizontal and vertical  
scales.

![Bar Graph Example](image)

**CHALLENGE AND EXTEND**

40. museum

41. About 32% of people who went to the museum were  
girls. So, $32\% \times 60 \approx 19$ girls

42. The graph shows only the percentages of each  
group made up of teachers, boys and girls. It does  
not tell how many people went to each trip.

**10-2 FREQUENCY AND HISTOGRAMS**

**CHECK IT OUT!**

1. Stem | Leaves  
---|---  
0 | 7  
1 | 9  
2 | 2 3 6 7 9  
3 | 0 1 2 4 5 6  
Key: | 9 means 19  

2. Identify the least and greatest values.  
The least value is 4. The greatest value is 15.  
Divide the data into equal intervals.  
For this data set, use intervals of 3.  
List the intervals in the first column of the table.  
Count the number of data values in each interval  
and list the count in the last column.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–6</td>
<td>5</td>
</tr>
<tr>
<td>7–9</td>
<td>4</td>
</tr>
<tr>
<td>10–12</td>
<td>4</td>
</tr>
<tr>
<td>13–15</td>
<td>2</td>
</tr>
</tbody>
</table>

3. Use the scale and interval from the frequency table.  
Draw a bar for the number of vacations in each  
interval.

![Bar Graph for Vacations](image)

4a. Choose intervals for the first column of the table.  
Record the frequency of values in each interval for  
the second column.  
Add the frequency of each interval to the  
frequencies of all the intervals before it. Put that  
number in the third column of the table.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>28–31</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>32–35</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>36–39</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>40–43</td>
<td>3</td>
<td>17</td>
</tr>
</tbody>
</table>

**THINK AND DISCUSS**

1. leaves

2. The stems are the intervals, and the number of  
leaves for each stem gives the height of the bar.

3. Bar Graphs vs. Histograms

   - How are they alike? Both use bars and categories. Both  
     make it easy to compare categories.
   - How are they different? In a histogram, the bars touch.  
     A histogram shows consecutive intervals.

**EXERCISES**

**GUIDED PRACTICE**

1. stem-and-leaf plot

2. Stem | Leaves  
---|---  
1 | 8 9  
2 | 0 1 1 1 2 2 2 3 4  
Key: | 8 means 18  

3. Austin | Stem | New York  
---|---|---  
9 9 9 | 1 |  
1 2 3 4 | 2 |  
0 2 3 5 6 | 3 | 1 3 3 6 6 7 9  
4 | 1 1 2 2  
Key: | 1 means 3.1
4. Identify the least and greatest values.
The least value is 19. The greatest value is 34.
Divide the data into equal intervals.
For this data set, use intervals of 4.
List the intervals in the first column of the table.
Count the number of data values in each interval
and list the count in the last column.

| Interval   | Frequency | 19–22 | 4  |
|           |           | 23–26 | 6  |
|           |           | 27–30 | 5  |
|           |           | 31–34 | 3  |

5. Use the scale and interval from the frequency table.
Draw a bar for the number of breaths in each interval.

6a. Choose intervals for the first column of the table.
Record the frequency of values in each interval for
the second column.
Add the frequency of each interval to the
frequencies of all the intervals before it. Put that
number in the third column of the table.

| Interval   | Frequency | Cumulative Frequency |
|           |           |                    |
| 750–790   | 1         | 1                  |
| 700–740   | 2         | 3                  |
| 650–690   | 2         | 5                  |
| 600–640   | 3         | 8                  |
| 550–590   | 2         | 10                 |
| 500–540   | 5         | 15                 |

b. 5

**PRACTICE AND PROBLEM SOLVING**

7. | Summer | Winter |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9 7 7 6 5 5 3 3 2 2</td>
<td>0 4 9 9 1 1 2 3 4 9 9</td>
</tr>
<tr>
<td>4 2 4 8 9 9</td>
<td>9 7 6 3 5</td>
</tr>
<tr>
<td>4 3 5 6 7 8 9</td>
<td>3 4 5 6 7 8 9</td>
</tr>
</tbody>
</table>

Key: |1| means 11, 7|2| means 27

8. Stem Leaves
| 5 | 9 0 7 8 |
| 6 | 0 8 |
| 7 | 0 2 2 5 7 |
| 8 | 1 4 4 8 |

Key: 5|9 means 59

9. The least value is 2.0. The greatest value is 3.9.
For this data set, use intervals of 0.5.

| Interval   | Frequency |
|           |           |
| 2.0–2.4   | 2         |
| 2.5–2.9   | 7         |
| 3.0–3.4   | 5         |
| 3.5–3.9   | 3         |

10. Use the scale and interval from the frequency table.
Draw a bar for the number of elements in each interval.

**Nonmetal Elements**

11a. The least value is 36. The greatest value is 47.
For this data set, use intervals of 3.

| Interval   | Frequency | Cumulative Frequency |
|           |           |                    |
| 36–38     | 4         | 4                  |
| 39–41     | 6         | 10                 |
| 42–44     | 5         | 15                 |
| 45–47     | 1         | 16                 |

b. 10

12. City Mileage Highway Mileage
| 8 8 6 5 2 2 8 8 | 3 8 |
| 4 3 6 6 7 7 | 5 1 |
| 0 0 6 | 6 |

Key: 3|8 means 38, 8|4| means 48

13a. Stem Leaves
| 5 | 9 |
| 6 | 8 |
| 7 | 2 5 7 |
| 8 | 1 4 8 |

Key: 5|9 means 59
b. Use the scale and interval from the frequency table. Draw a bar for the number of grades in each interval.

Intervals of 5

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>50–54</td>
<td>3</td>
</tr>
<tr>
<td>55–59</td>
<td>2</td>
</tr>
<tr>
<td>60–64</td>
<td>1</td>
</tr>
<tr>
<td>65–69</td>
<td>3</td>
</tr>
<tr>
<td>70–74</td>
<td>2</td>
</tr>
<tr>
<td>75–79</td>
<td>1</td>
</tr>
<tr>
<td>80–84</td>
<td>1</td>
</tr>
<tr>
<td>85–89</td>
<td>2</td>
</tr>
</tbody>
</table>

13c. Use the scale and interval from the frequency table. Draw a bar for the number of grades in each interval.

Intervals of 10

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>50–59</td>
<td>1</td>
</tr>
<tr>
<td>60–69</td>
<td>5</td>
</tr>
<tr>
<td>70–79</td>
<td>4</td>
</tr>
<tr>
<td>80–89</td>
<td>3</td>
</tr>
</tbody>
</table>

13d. Use the scale and interval from the frequency table. Draw a bar for the number of grades in each interval.

Intervals of 20

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>50–69</td>
<td>9</td>
</tr>
<tr>
<td>70–89</td>
<td>2</td>
</tr>
</tbody>
</table>

13e. As the size of the intervals increases, the number of bars decreases.

13f. The histogram that uses intervals of 20; It makes Damien’s grades look higher because the bar for 70–89 is much taller than the bar for 50–69.

14. A; there is no stem for 56.

15a. The least value is 165. The greatest value is 210. For this data set, begin at 160 and use intervals of 10.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>160–169.9</td>
<td>2</td>
</tr>
<tr>
<td>170–179.9</td>
<td>4</td>
</tr>
<tr>
<td>180–189.9</td>
<td>3</td>
</tr>
<tr>
<td>190–199.9</td>
<td>1</td>
</tr>
<tr>
<td>200–209.9</td>
<td>2</td>
</tr>
<tr>
<td>210–219.9</td>
<td>1</td>
</tr>
</tbody>
</table>

b. Use the scale and interval from the frequency table. Draw a bar for the number of weights in each interval.

Weightlifting

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>160–169.9</td>
<td>4</td>
</tr>
<tr>
<td>170–179.9</td>
<td>3</td>
</tr>
<tr>
<td>180–189.9</td>
<td>2</td>
</tr>
<tr>
<td>190–199.9</td>
<td>1</td>
</tr>
<tr>
<td>200–209.9</td>
<td>0</td>
</tr>
<tr>
<td>210–219.9</td>
<td>1</td>
</tr>
</tbody>
</table>

15c. No; she did not lift one of the three greatest weights.

16. Use the scale and interval from the frequency table. Draw a bar for the number of movies in each interval.

Top Ten Movie Sales

<table>
<thead>
<tr>
<th>Gross (million $)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–9.9</td>
<td>6</td>
</tr>
<tr>
<td>10–19.9</td>
<td>5</td>
</tr>
<tr>
<td>20–29.9</td>
<td>3</td>
</tr>
</tbody>
</table>

17. The intervals are not the same size, so the histogram may not accurately represent ages under 18 or over 55.

TEST PREP

18. B
19. G
20. D

CHALLENGE AND EXTEND

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>12–16</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>17–20</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>21–24</td>
<td>41</td>
<td>57</td>
</tr>
<tr>
<td>25–28</td>
<td>66</td>
<td>123</td>
</tr>
</tbody>
</table>

345 Holt McDougal Algebra 1
10-3 DATA DISTRIBUTIONS

CHECK IT OUT!
1. 12, 14, 12, 16, 16
   mean: \( \frac{12 + 14 + 12 + 16 + 16}{5} = 14 \) lb
   median: 12, 12, 14, 16, 16
   The median is 14 lb.
   mode: 12 lb and 16 lb
   range: \( 16 - 12 = 4 \) lb
2. 21, 24, 3, 27, 30, 24
   Write the data in numerical order.
   3, 21, 24, 24, 27, 30
   The outlier is 3.
   With the Outlier:
   mean: \( \frac{21 + 24 + 3 + 27 + 30 + 24}{6} = 21.5 \)
   median: 3, 21, 24, 24, 27, 30
   The median is 24.
   mode: 24
   range: \( 30 - 3 = 27 \) range: \( 30 - 21 = 9 \)
   The outlier decreases the mean by 3.7 and
   increases the range by 18. It has no effect on the
   median and mode.
3. a. mode: 75
   b. Find the mean and median.
   mean: \( \frac{75 + 75 + 81 + 84 + 85}{5} = 80 \)
   median: 75, 75, 81, 84, 85
   The median is 81.
   Josh should use the median, 81, since it is greater
   than either the mean or the mode.
4. 13, 14, 18, 12, 17, 15, 12, 13, 19, 11, 14, 18, 22, 23
   Order the data from least to greatest.
   11, 12, 12, 13, 13, 13, 14, 14, 14, 15, 17, 18, 19, 22, 23
   Identify the five needed values.
   minimum: 11 first quartile: 13
   maximum: 23 third quartile: 18 median: 14

EXERCISES

GUIDED PRACTICE
1. The range is the difference between the greatest
   and least values. The interquartile range is the
   difference between the third and first quartiles.
2. 85, 83, 85, 82
   mean: \( \frac{85 + 83 + 85 + 82}{4} = 83.75 \)
   median: 82, 83, 85, 85
   The median is 84.
   mode: 85
   range: 85 – 82 = 3
3. 12, 22, 33, 34, 44, 44
   mean: \( \frac{12 + 22 + 33 + 34 + 44 + 44}{6} = 31.5 \)
   median: 12, 22, 33, 34, 44, 44
   The median is 33.5.
   mode: 44
   range: 44 – 12 = 32
4. 10, 26, 25, 10, 20, 22, 25, 20
   mean: \( \frac{10 + 26 + 25 + 10 + 20 + 22 + 25 + 20}{8} = 19.75 \)
   median: 10, 10, 20, 20, 22, 25, 25, 26
   The median is 21.
   mode: 10, 20, and 25
   range: 26 – 10 = 16
5. 71, 73, 75, 78, 78, 80, 85, 86
   mean: \( \frac{71 + 73 + 75 + 78 + 78 + 80 + 85 + 86}{8} = 78.25 \)
   median: 71, 73, 75, 78, 78, 80, 85, 86
   The median is 78.
   mode: 78
   range: 86 – 71 = 15

THINK AND DISCUSS
1. Either the data set has an odd number of values, or
   the data set has an even number of values and the
   two middle values are the same.

2. Possible answer: 1, 2, 9; start with two numbers
   and a variable, where the variable is the greatest
   number in the set: 1, 2, x. The median of this set
   is 2, so the mean must be 4. Write an equation for
   the mean: \( 1 + 2 + x = 4 \). Solve for x. Multiply both
   sides by 3: \( 3 \times 1 + 2 + x = 12 \). Solving yields \( x = 9 \).
3. Because the minimum and the first quartile are
   the same, the box-and-whisker plot would have no
   whisker on the left side.

4. Possible answer: 1, 2, 9; start with two numbers
   and a variable, where the variable is the greatest
   number in the set: 1, 2, x.
   The median of this set is 2, so the mean must be 4.
   Write an equation for the mean:
   \( 1 + 2 + x = 4 \). Solve for x. Multiply both
   sides by 3: \( 3 \times 1 + 2 + x = 12 \). Solving yields \( x = 9 \).

5. The data set for 2000; the distance between the
   points for the least and greatest values is less for
   Find the medians and subtract.
   2007 median: about $165 million
   2000 median: about $125 million
   $165 - $125 = $40
   The median ticket sales were about $40 million
   more.

6. a. The data set for 2000; the distance between the
   points for the least and greatest values is less for
   b. Find the medians and subtract.
   2007 median: about $165 million
   2000 median: about $125 million
   $165 - $125 = $40
   The median ticket sales were about $40 million
   more.

THINK AND DISCUSS
1. Either the data set has an odd number of values, or
   the data set has an even number of values and the
   two middle values are the same.
6. 10, 96, 12, 17, 15
Write the data in numerical order.
10, 12, 15, 17, 96
The outlier is 96.
With the Outlier:
mean: \[
\frac{10 + 96 + 12 + 17 + 15}{5} = 30
\]
median: 10, 12, 15, 17, 96
The median is 15.
mode: no mode
range: 96 - 10 = 86
The outlier increases the mean by 16.5, increases the median by 1.5, and increases the range by 79. It has no effect on the mode.

7. 64, 75, 72, 13, 64
Write the data in numerical order.
13, 64, 64, 72, 75
The outlier is 13.
Without the Outlier:
mean: \[
\frac{64 + 75 + 72 + 13 + 64}{5} = 57.6
\]
median: 13, 64, 64, 72, 75
The median is 64.
mode: 64
range: 75 - 13 = 62
The outlier decreases the mean by 11.15, decreases the median by 4, and increases the range by 51. It has no effect on the mode.

8. Find the mean, median, and mode.
mean: \[
\frac{82 + 54 + 85 + 91 + 8}{5} = 79
\]
median: 54, 82, 83, 85, 91
The median is 83.
mode: no mode
median: 83; the mean is lower than all but one of the scores because of the outlier. There is no mode.

9. median: 83; the median is greater than the mean, and there is no mode.

10. 21, 31, 26, 24, 28, 26
Order the data from least to greatest.
21, 24, 26, 26, 28, 31
Identify the five needed values.
minimum: 21 first quartile: 24
maximum: 31 third quartile: 28 median: 26

11. 12, 13, 42, 62, 62, 82
Identify the five needed values.
minimum: 12 first quartile: 13
maximum: 82 third quartile: 62 median: 52

12. Simon; the vertical line in the box for Simon is farther to the right than the vertical line in the box for Natasha.

13. Simon; the left point is farther to the left at about 3000 points.

PRACTICE AND PROBLEM SOLVING
14. 75, 63, 89, 91
mean: \[
\frac{75 + 63 + 89 + 91}{4} = 79.5
\]
median: 63, 75, 89, 91
The median is 82.
mode: no mode
range: 91 - 63 = 28

15. 1, 2, 2, 2, 3, 3, 4
mean: \[
\frac{1 + 2 + 2 + 2 + 3 + 3 + 4}{8} = 2.5
\]
median: 1, 2, 2, 2, 3, 3, 4
The median is 2.5.
mode: 2 and 3
range: 4 - 1 = 3

16. 19, 25, 31, 19, 34, 22, 31, 34
mean: \[
\frac{19 + 25 + 31 + 19 + 34 + 22 + 31 + 34}{8} = 26.875
\]
median: 19, 19, 22, 25, 31, 31, 34, 34
The median is 28.
mode: 19, 31, and 34
range: 34 - 19 = 15

17. 58, 58, 60, 60, 60, 61, 63
mean: \[
\frac{58 + 58 + 60 + 60 + 60 + 61 + 63}{8} = 60
\]
median: 58, 58, 60, 60, 60, 61, 63
The median is 60.
mode: 60
range: 63 - 58 = 5
18. 42, 8, 54, 37, 29
Write the data in numerical order.
8, 29, 37, 42, 54
The outlier is 8.
With the Outlier: Without the Outlier:
mean: \[ \frac{42 + 8 + 54 + 37 + 29}{5} = \frac{160}{5} = 32 \]
median: 8, 29, 37, 42, 54 median: 29, 37, 42, 54
The median is 37. The median is 39.5.
mode: no mode mode: no mode
range: 54 – 8 = 46 range: 54 – 29 = 25
The outlier decreases the mean by 6.5, decreases the median by 2.5, and increases the range by 21. It has no effect on the mode.

19. 3, 8, 3, 3, 23, 8
Write the data in numerical order.
3, 3, 3, 8, 8, 23
The outlier is 23.
With the Outlier: Without the Outlier:
mean: \[ \frac{3 + 8 + 3 + 3 + 23 + 8}{6} = \frac{60}{6} = 10 \]
median: 3, 3, 3, 8, 8, 23 median: 3, 3, 3, 8, 8
The median is 5.5. The median is 3.
mode: 3 mode: 3
range: 23 – 3 = 20 range: 8 – 3 = 5
The outlier increases the mean by 3, increases the median by 2.5, and increases the range by 15. It has no effect on the mode.

20. Find the mean, median, and mode.
mean: \[ \frac{153 + 145 + 148 + 166}{4} = 153 \]
median: 145, 148, 153, 166
The median is 150.5.
mode: no mode
The mean, 153, gives Lamont’s average score.

21. mean: 153; the mean is greater than the median and there is no mode.

22. 62, 63, 62, 64, 68, 62, 62
Order the data from least to greatest.
62, 62, 62, 62, 63, 64, 68
Identify the five needed values.
minimum: 62 first quartile: 62
maximum: 68 third quartile: 64 median: 62

23. 85, 90, 81, 100, 92, 85
Order the data from least to greatest.
81, 85, 85, 90, 92, 100
Identify the five needed values.
minimum: 81 first quartile: 85
maximum: 100 third quartile: 92 median: 87.5

24. Sneaks R Us, about $10
25. Sneaks R Us; the middle half of the data doesn’t vary as much at Sneaks R Us as at Jump N Run.

26. about $32
27. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
mean: \[ \frac{1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10}{10} = \frac{55}{10} = 5.5 \]
median: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
The median is 5.5.
mode: none
range: 10 – 1 = 9

28. 5, 5, 5, 6, 6
mean: \[ \frac{5 + 5 + 5 + 6 + 6}{5} = \frac{27}{5} = 5.4 \]
median: 5, 5, 5, 6, 6
The median is 5.
mode: 5
range: 6 – 5 = 1

29. 1.2, 2.1, 3.4, 4.3, 6.5
mean: \[ \frac{1.2 + 2.1 + 3.4 + 4.3 + 6.5}{5} = \frac{17.5}{5} = 3.5 \]
median: 1.2, 2.1, 3.4, 4.3, 6.5
The median is 3.4.
mode: none
range: 6.5 – 1.2 = 5.3

30. 0, 1, 1, 3, 4, 4, 4
mean: \[ \frac{0 + 1 + 1 + 3 + 4 + 4 + 4}{7} = \frac{15}{7} \]
median: 0, 1, 1, 3, 4, 4, 4
The median is \[ \frac{3}{2} \].
mode: none
range: 1 – 0 = 1

31. 23, 23, 25, 25, 26
mean: \[ \frac{23 + 23 + 25 + 25 + 26}{5} = \frac{122}{5} = 24.4 \]
median: 23, 23, 25, 25, 26
The median is 25.
mode: 23, 25
range: 26 – 23 = 3
32. \(-3, -3, -3, -2, -2, -1\)
   \[
   \text{mean: } \frac{(-3) + (-3) + (-3) + (-2) + (-2) + (-1)}{6} = \frac{-14}{6} = -2.33
   \]
   \[
   \text{median: } -3, -3, -3, -2, -2, -1
   \]
   The median is \(-2\).
   \[
   \text{mode: } -3
   \]
   \[
   \text{range: } (-1) - (-3) = 2
   \]

33. \(1, 4, 9, 16, 25, 36\)
   \[
   \text{mean: } \frac{1 + 4 + 9 + 16 + 25 + 36}{6} = \frac{91}{6} = 15.166\overline{6}
   \]
   \[
   \text{median: } 1, 4, 9, 16, 25, 36
   \]
   The median is \(15\).
   \[
   \text{mode: } 1
   \]
   \[
   \text{range: } 36 - 1 = 35
   \]

34. \(0, 0, 1, 1, 1, 4\)
   \[
   \text{mean: } \frac{0 + 0 + 1 + 1 + 1 + 4}{6} = \frac{7}{6} = 1.166\overline{6}
   \]
   \[
   \text{median: } 0, 0, 1, 1, 1, 4
   \]
   The median is \(1\).
   \[
   \text{mode: } 1
   \]
   \[
   \text{range: } 4 - 0 = 4
   \]

35. Possible answer: 17 Possible answer: 17

36. sometimes
37. sometimes
38. always
39. always
40. never

41. Median; the mean is affected by the outlier of 1218, and there is no mode.

42. 68, 71, 75, 74, 75, 71, 73, 71, 72, 74, 79
   Without 70 °F:
   \[
   \text{mean: } \frac{68 + 71 + 75 + 74 + 75 + 71 + 73 + 71 + 72 + 74 + 79}{11} = 73 °F
   \]
   \[
   \text{median: } 68, 71, 71, 72, 73, 74, 74, 75, 75, 79
   \]
   The median is 73 °F.
   \[
   \text{mode: } 71
   \]
   \[
   \text{range: } 79 - 68 = 11 °F
   \]
   With 70 °F:
   \[
   \text{mean: } \frac{(68 + 71 + 75 + 74 + 75 + 71 + 73 + 71 + 72 + 74 + 79 + 70)}{12} = 72.75 °F
   \]
   \[
   \text{median: } 68, 70, 71, 71, 71, 72, 73, 74, 74, 75, 75, 79
   \]
   The median is 72.5 °F.
   \[
   \text{mode: } 71
   \]
   \[
   \text{range: } 79 - 68 = 11
   \]
   The mean would decrease by 0.25 °F, the median would decrease by 0.5 °F, and the mode and range would not change.

43. Find the mean, median, and mode.
   \[
   \text{mean: } \frac{3 + 2 + 2 + 2 + 15}{5} = 4.80
   \]
   \[
   \text{median: } 2, 2, 2, 3, 15
   \]
   The median is $2.00.
   \[
   \text{mode: } $2.00
   \]
   The home-decorating store should advertise the median or mode. The store wants their prices to appear low, and the median and the mode are both $2.80 less than the mean.

44. 25, 28, 26, 16, 18, 15, 25, 28, 26, 16
   Order the data from least to greatest.
   15, 16, 16, 18, 25, 25, 26, 26, 28
   Identify the five needed values.
   \[
   \text{minimum: } 15 \quad \text{first quartile: } 16
   \]
   \[
   \text{maximum: } 28 \quad \text{third quartile: } 26 \quad \text{median: } 25
   \]

45. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31
   Identify the five needed values.
   \[
   \text{minimum: } 2 \quad \text{first quartile: } 5
   \]
   \[
   \text{maximum: } 31 \quad \text{third quartile: } 23 \quad \text{median: } 13
   \]

46. 1, 1, 1, 2, 2, 2, 3, 4, 4, 4
   Identify the five needed values.
   \[
   \text{minimum: } 1 \quad \text{first quartile: } 1
   \]
   \[
   \text{maximum: } 4 \quad \text{third quartile: } 4 \quad \text{median: } 2
   \]

47. 0, 52, 45, 62, 36, 55, 40, 50, 65, 33
   Order the data from least to greatest.
   33, 36, 40, 45, 50, 52, 55, 62, 65
   Identify the five needed values.
   \[
   \text{minimum: } 33 \quad \text{first quartile: } 40
   \]
   \[
   \text{maximum: } 65 \quad \text{third quartile: } 55 \quad \text{median: } 50
   \]
48. a. 5.96, 5.85, 5.70, 5.70, 5.70, 5.70, 5.60, 5.60, 5.60, 5.45, 5.45
   mean: \( \frac{5.96 + 5.85 + 5.70 + 5.70 + 5.70 + 5.70 + 5.60 + 5.60 + 5.60 + 5.45 + 5.45}{11} \) = 5.66
   median: 5.45, 5.45, 5.60, 5.60, 5.60, 5.70, 5.70, 5.70, 5.70, 5.85, 5.96
   The median is 5.70.
   mode: 5.70
   range: 5.96 – 5.45 = 0.51
   b. 5.96 m

49. Write the numbers from the stem-and-leaf plot. Then find the mean and median.
   20, 20, 23, 25, 25, 30, 35, 78
   mean: \( \frac{20 + 20 + 23 + 25 + 25 + 30 + 35 + 78}{8} \) = $32,000
   median: 20, 20, 23, 25, 25, 30, 35, 78
   The median is $25,000.
   The median describes the typical salary of an employee at this company better because the outlier of $78,000 increases the mean significantly.

50. a. 1, 2, 3, 5, 8, 13, 21, 34
   mean: \( \frac{1 + 2 + 3 + 5 + 8 + 13 + 21 + 34}{8} \) = 10.875
   b. The mean increases by 2.
   c. mean: \( \frac{2 + 4 + 6 + 10 + 16 + 26 + 42 + 68}{8} \) = 21.75
      The mean is multiplied by 2.

51. Let \( t \) represent the score Allison needs on her next test to have a mean of 90%.
   \( \frac{88 + 85 + 89 + 92 + 90 + t}{6} = 90 \)
   \( \frac{444 + t}{6} = 90 \)
   \( 6 - 444 + t = 90(6) \)
   \( 444 + t = 90(6) \)
   \( 444 + t = 540 \)
   \( t = 96 \)
   Allison needs a test score of 96 on her next test to have a mean of 90%.

52. 0, 0, 1, 2, 63, 60, 27, 13
   mean: \( \frac{0 + 0 + 1 + 2 + 63 + 60 + 27 + 13}{8} \) = 20.75
   Possible answer: No, Earth’s number of moons is much less than either the mean or median number moons per planet.

53. An outlier with a large value will increase the mean, and an outlier with a small value will decrease the mean.

54. B

55. G
   mean lengths of alligators: \( \frac{9 + 7 + 12 + 6 + 10}{5} \) = 8.8
   mean lengths of crocodiles: \( \frac{13 + 10 + 8 + 19 + 18 + 16}{6} = 14 \)
   14 – 8.8 = 5.2

56. C
   mean with Rex’s weight: \( \frac{23 + 15 + 21 + 34 + 19}{6} \) = 29
   mean without Rex’s weight: \( \frac{23 + 15 + 21 + 34 + 19}{5} \) = 22.4
   The mean decreases by 6.6 pounds.

57. possible answer: 6, 6, 7, 9, 12

58. possible answer: company D; because the fertilizer from company D appears to be more effective than the other fertilizers.

59. Check students’ work.

60. a. mean of homework scores: \( \frac{78 + 83 + 95 + 82 + 79 + 93}{6} = 85 \)
    mean of test scores: \( \frac{88 + 92 + 81}{3} = 87 \)
    b. weighted average: \( 85(0.25) + 87(0.30) + 90(0.45) = 21.25 + 26.1 + 40.5 = 87.85 \)
    c. mean score without weighted average:
       \( \frac{(78 + 83 + 95 + 82 + 79 + 93 + 88 + 92 + 81 + 90)}{10} = 86.1 \)

10-4 MISLEADING GRAPHS AND STATISTICS

CHECK IT OUT!
1. Possible answer: company D; because the fertilizer from company D appears to be more effective than the other fertilizers.
2. Possible answer: taxi drivers; the drivers could justify charging higher rates by using this graph, which seems to show that gas prices have increased dramatically.
3. Possible answer: Smith; Smith might want to show that he or she got many more votes than Atkins or Napier.
4. The sample size is much too small to make a conclusion for a large population.

THINK AND DISCUSS
1. Possible answer: someone selling a product might want to make it seem much better than other products.
2. A sample might not be large enough. The sectors of a circle graph might not add to 100%.

Ways that Graphs and Statistics can be Misleading

A sample might not be large enough. A sample might not be random.

EXERCISES

GUIDED PRACTICE

1. Random sample means that no member of a group is more likely to be picked for the sample than any other member of the group.

2a. The vertical scale does not start at 0. This exaggerates the difference in heights of the bars.

b. Employees at company Y make about twice as much as employees at company Z.

3a. The vertical scale does not start at 0, and the categories on the horizontal scale are not at equal time intervals.

b. Tourism is decreasing rapidly.

2c. Possible answer: company Y might want to use the graph to show how well its employees are paid; the graph makes it appear that company Y pays high salaries.

3c. Possible answer: someone who wants to increase spending on promoting tourism in San Francisco; the graph makes it appear that San Francisco is becoming a less popular travel destination.

4a. The sectors of the graph do not add up to 100%.

b. Because of the graph someone may believe that the granola bar is almost half protein.

5. The sample size is too small to make conclusions for a large population.

6. People shopping at the mall are more likely to favor a larger parking lot, while they may not be from the community next to the mall.

PRACTICE AND PROBLEM SOLVING

7a. The vertical scale does not start at 0.

b. Single men pay significantly more than single women.

7c. Possible answer: single men looking for apartments who want to negotiate a lower rent might want to use this graph; the graph makes it appear that single men are overcharged.

8a. The vertical scale does not start at 0, and it uses larger values beyond the needed ones.

b. Someone might believe that the price has not changed very much at all.

8c. Possible answer: coffee growers; the graph makes it appear that coffee prices are low.

9a. The sectors of the graph do not add up to 100%.

b. Someone might believe that almost half of the state’s spending was for welfare.

9c. Possible answer: Someone who wants to justify cutting spending on welfare; the graph makes it appear that a large part of the spending was for welfare.

10. Most of the classes have fewer than 53 students. The mean is not a good descriptor because there is an outlier.

11a. Average score: \( \frac{74.71}{8} = 9.339 \)

b. The lowest score, 8.500, brings the mean lower than most of the scores.

11c. Women’s Gymnastics Scores

<table>
<thead>
<tr>
<th>Rank</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
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<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

12. B; the vertical scale extends beyond what is needed, so it appears that the population grew slowly; however, the population is several 6 times the size that it started.

13a. Internet Service

<table>
<thead>
<tr>
<th>Provider</th>
<th>Connection Speed ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speedy Online</td>
<td>954</td>
</tr>
<tr>
<td>TelQuick Alacrity</td>
<td>914</td>
</tr>
<tr>
<td>Alacrity</td>
<td>858</td>
</tr>
</tbody>
</table>

b. Internet Service

<table>
<thead>
<tr>
<th>Provider</th>
<th>Connection Speed ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speedy Online</td>
<td>954</td>
</tr>
<tr>
<td>TelQuick Alacrity</td>
<td>914</td>
</tr>
<tr>
<td>Alacrity</td>
<td>858</td>
</tr>
</tbody>
</table>
13c. Possible answer: an objective report or Alacrity materials. Someone who has no reason to make one company look better than another might make this graph. Alacrity might make this graph to show that they are very similar to the other companies.

14. Possible answer: The scale of a graph can exaggerate the differences in the heights of bars or the slopes of lines. The data may be accurate, but the display encourages an inaccurate interpretation.

TEST PREP

15. B

16. H

CHALLENGE AND EXTEND

17a. The first question asks whether two people have the same fingerprint. The second question asks whether someone could have made a mistake.

b. The fingerprint had to belong to Dr. Arenson.

d. The fingerprint might not belong to Dr. Arenson.

e. Someone who wants to prove that the fingerprint does not belong to Dr. Arenson.

18a. Most deaths during the Crimean War were due to unclean conditions.

b. Possible answer: military officials who could control the conditions of military hospitals.

REady to go on? Section A Quiz

1. Paper/cardboard: $\frac{11}{20} = 0.55 = 55\%$
   Therefore, paper/cardboard represents over 50% of Don's recyclables.

2. Don recycles: $11 + 5 + 1 + 3 = 20$ lb

3. Glass: $\frac{5}{20} = 0.25 = 25\%$

4. A line graph shows change over time.

5. Stem | Leaves
   2 | 2 4 6 6 7 8
   3 | 0 2 3
   4 | 1

   Key 2|7 means $27,000

6a. The least value is 15.
   The greatest value is 25. For this data set, use intervals of 2.
<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–17</td>
<td>6</td>
</tr>
<tr>
<td>18–20</td>
<td>5</td>
</tr>
<tr>
<td>21–23</td>
<td>0</td>
</tr>
<tr>
<td>24–26</td>
<td>1</td>
</tr>
</tbody>
</table>

7a. mean: $\frac{680}{14} = 48.57$
   median: 38, 43, 45, 46, 47, 48, 49, 49, 51, 51, 51, 51, 52, 59
   The median is 49.
   mode: 51

b. mean

c. Median or mode; the mean is lower than most of the temperatures because one day had a high of only 38°F.

8. minimum: 38; first quartile: 46
   maximum: 59; third quartile: 51

9. The vertical axis begins at 80. This might make someone believe that the value of the stock has decreased dramatically. Another company might want to devalue this company’s stock.

10. The survey did not address a random sample.
    Because the survey was online, those who responded were probably already somewhat comfortable using technology.

10-5 EXPerimental probABility

CHECK IT OUT!

1. sample space: {1, 2, 3, 4, 5, 6}
   outcome shown: 3

2. A standard number cube is numbered 1 through 6. This event is certain.

3a. number of times event occurs $= \frac{7}{7 + 8 + 5} = \frac{7}{20}$
   number of trials
   b. number of times event occurs $= \frac{8 + 5}{7 + 8 + 5} = \frac{13}{20}$
   number of trials

4a. number of times event occurs $= \frac{1497}{1500}$ = 99.8%
   The experimental probability that a toothbrush does not have a defective motor is 99.8%.

b. Find 99.8% of 35,000.
   $0.998(35,000) = 34,930$
   There are 34,930 motors that are likely to have no defects.
THINK AND DISCUSS
1. Possible answer: An outcome is one possible result of an experiment. An event is a set of outcomes.
2. No; different outcomes may occur with different frequencies each time the experiment is carried out. The more trials performed, the more accurate the estimate is likely to be.

EXERCISES

GUIDED PRACTICE
1. picking a shoe at random from a pair of shoes
2. sample space: \{1, 2, 3, 4, 5, 6\}
   outcome shown: 2
3. sample space: \{blue, red, yellow, green\}
   outcome shown: red
4. sample space: \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}
   outcome shown: THT
5. Peter and Thomas were born in different months. This event is impossible.
6. The team won 9 of 10 games. The team is likely to win the next game.
7. Getting a number 6 out of 6 possible numbers. This event is unlikely.
8. number of times event occurs
   number of trials
   \[\frac{5 + 6 + 2 + 2 + 3 + 7}{25} = \frac{22}{25}\]
9. number of times event occurs
   number of trials
   \[\frac{5 + 6 + 2 + 2 + 3 + 7}{25} = \frac{15}{25} = \frac{3}{5}\]
10. number of times event occurs
    number of trials
    \[\frac{5 + 6 + 2 + 2 + 3 + 7}{25} = \frac{18}{25}\]
11a. number of times event occurs
    number of trials
    \[\frac{3}{10} = 30\%\]
    The experimental probability that Elyse will roll a strike on any frame is 30%.
12. A game consists of 10 frames.
    Find 30% of 180 frames.
    \[0.30(180) = 54\]
    Elyse is likely to throw 54 strikes in 18 games.

PRACTICE AND PROBLEM SOLVING
12. sample space: \{HH, HT, TH, TT\}
    outcome shown: TT

13. sample space: \{blue, red, yellow\}
    outcome shown: blue
14. sample space: \{blue, yellow, green, red\}
    outcome shown: green
15. Marlo takes one out of two shoes from the box. This event is as likely as not.
16. The bus has been late two out of ten days. This event is unlikely.
17. There can be either one or two quarters landing on heads. This event is likely.
18. number of times event occurs
    number of trials
    \[\frac{9}{4 + 6 + 6 + 9} = \frac{9}{25}\]
19. number of times event occurs
    number of trials
    \[\frac{6}{4 + 6 + 6 + 9} = \frac{6}{25}\]
20. number of times event occurs
    number of trials
    \[\frac{19}{4 + 6 + 6 + 9} = \frac{19}{25}\]
21a. number of times event occurs
    number of trials
    \[\frac{4}{80} = 5\%\]
The experimental probability that a ski chosen at random will be defective is 5%.
21b. Find 5% of 420.
    \[0.05(420) = 21\]
    There are 21 skis that are likely to be defective.
22. number of times event occurs
    number of trials
    \[\frac{51}{39 + 27 + 33 + 51} = \frac{17}{50}\]
The experimental probability that a student has a birthday during the summer is \[\frac{17}{50}\]
23. Movie: A 70% chance of rain means that it is likely to rain on Thursday, so you should plan to go to a movie.
24. An unlikely event may occur in any single experiment. Repeating the experiment many times gives a more accurate picture of experimental probabilities.
25. The event is as likely to happen as not.
26. There are 6 outcomes for each number cube, any combination of the two cubes will be an outcome of an experiment consisting of rolling two number cubes. So, there are 36 outcomes in the sample space of rolling two standard number cubes. Examples of outcomes \{(1, 1), (1, 2), (1, 3),
   \(0.01)(5680) = 57\)
   There are about 57 units that are likely to be defective.
28a. 
\[
\text{number of times event occurs} \quad \text{number of trials} \\
\frac{8}{7 + 7 + 8 + 6} = \frac{2}{7} 
\]

The experimental probability that a club is drawn is \(\frac{2}{7}\).

b. 
\[
\text{number of times event occurs} \quad \text{number of trials} \\
\frac{7 + 6 + 8 + 6}{7 + 7 + 8 + 6} = \frac{1}{2} 
\]

The experimental probability that a black suit is drawn summer is \(\frac{1}{2}\).

TEST PREP

29. B

Three outcomes result in a sum of less than 4, out of 36 possible outcomes.

30. G

residents with pets: \(\left(\frac{2}{3}\right)(84) = 56\)

residents with dogs: \(\left(\frac{1}{2}\right)(56) = 28\)

31. B

\[
3x + 2 \leq 23 \\
-2 - 2 \\
x \leq 21 \\
\frac{3x}{3} \leq \frac{21}{3} \\
x \leq 7 
\]

\[
\text{number of times event occurs} \quad \text{number of trials} \\
\frac{16}{18} = \frac{8}{9} 
\]

32. Let \(h\) represent the number of times heads occurred, and \(h - 6\) represent tails.

\[
h + h - 6 = 50 \\
2h - 6 = 50 \\
+ 6 + 6 \\
2h = 56 \\
\frac{2h}{2} = 28 \\
h = 28 
\]

\[
\text{number of times event occurs} \quad \text{number of trials} \\
\frac{28}{50} = \frac{14}{25} 
\]

The experimental probability of the coin landing on heads is \(\frac{14}{25}\).

CHALLENGE AND EXTEND

33. There are 4 outcomes in this event (HHH, HHT, HTH, THH) among 8 outcomes in the sample space. This event is as likely as not.

34. There are 3 outcomes in this event (HHT, HTH, THH) among 8 outcomes in the sample space. This event is unlikely.

35. There are 3 outcomes in this event (TTH, THT, HTT) among 8 outcomes in the sample space. This event is unlikely.

36. There is 1 outcome in this event (TTT) among 8 outcomes in the sample space. This event is unlikely.

37a. Coin showing heads: 65% of 20 = 0.65(20) = 13,
because there are only two possible outcomes, the number of times the coin shows tails is, 20–13 = 7

b. Tossing the coin 10 more times makes the number of trials for this experiment 30.

For experimental probability of tails to be 50%, find 50% of 30 = 15.

Because the coin showed tails 7 times already, the coin must show tails 8 more times for the experimental probability of tails to be 50%.

10-6 THEORETICAL PROBABILITY

CHECK IT OUT!

1a. 
\[
\frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}} = \frac{3}{6} = 0.5 = 50% 
\]

b. 
\[
\frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}} = \frac{2}{6} = 0.3 = 33\frac{1}{3}\% 
\]

2. \(P\text{(green)} + P\text{(blue)} + P\text{(purple)} + P\text{(white)} = 1\)

\[
0.2 + 0.3 + 0.1 + P\text{(white)} = 1 \\
0.6 + P\text{(white)} = 1 \\
-0.6 \quad P\text{(white)} = 0.4 
\]

3. 
\[
\frac{\text{number of ways event can happen}}{\text{total possible outcomes}} = \frac{1}{25} 
\]

The probability of winning a free drink is \(\frac{1}{25}\).

THINK AND DISCUSS

1. Subtract the probability of the event from 1.

2. 
\[
P\text{(grey)} = \frac{1}{4} \\
P\text{(not grey)} = \frac{3}{4} 
\]

Odds in favor of grey: 1:3

Odds against grey: 3:1

EXERCISES

GUIDED PRACTICE

1. complement

2. 
\[
\frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}} = \frac{2}{6} = 0.33\frac{1}{3}\% 
\]

3. 
\[
\frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}} = \frac{1}{4} = 0.25 = 25% 
\]
4. number of ways the event can occur
   total number of equally likely outcomes
   \[ \frac{2}{5} = 0.4 = 40\% \]
5. number of ways the event can occur
   total number of equally likely outcomes
   \[ \frac{3}{6} = \frac{1}{2} \]
6. \( P(\text{green}) + P(\text{red}) + P(\text{blue}) = 100\% \)
   \[ 15\% + 35\% + P(\text{blue}) = 100\% \]
   \[ 50\% + P(\text{blue}) = 100\% \]
   \[ \frac{50\%}{100\%} = \frac{1}{2} \]
   \[ P(\text{blue}) = 50\% \]
7. \( P(\text{red}) + P(\text{not red}) = 1 \)
   \[ \frac{1}{3} + P(\text{not red}) = 1 \]
   \[ \frac{1}{3} - \frac{1}{3} = P(\text{not red}) = \frac{2}{3} \]
8. \( P(\text{win}) + P(\text{not win}) = 1 \)
   \[ \frac{1}{50} + P(\text{not win}) = 1 \]
   \[ \frac{1}{50} - \frac{1}{50} = P(\text{not win}) = \frac{49}{50} \]
9. \( P(\text{chosen}) + P(\text{not chosen}) = 1 \)
   \[ \frac{1}{10} + P(\text{not chosen}) = 1 \]
   \[ \frac{1}{10} - \frac{1}{10} = P(\text{not chosen}) = \frac{9}{10} \]
10. number of ways event can happen
    total possible outcomes
    \[ \frac{1}{4} \]
    The probability of spinner landing on blue is \( \frac{1}{4} \).
11. Odds in favor = 1:12
    The odds in favor of choosing an ace are 1:12.
12. Odds in favor = 20:80, or 1:4
    The odds of winning are 1:4.
13. number of ways event can happen
    total possible outcomes
    \[ \frac{1}{4} \]
    The probability of spinner landing on blue is \( \frac{1}{4} \).

**PRACTICE AND PROBLEM SOLVING**

14. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{1}{6} = 0.16 = 16\frac{2}{3}\% \]
15. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{2}{4} = 0.5 = 50\% \]
16. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{5}{20} = 0.25 = 25\% \]
17. \( P(\text{yellow}) + P(\text{not yellow}) = \frac{4}{9} \)
    \[ P(\text{yellow}) = \frac{1}{4} \]
    \[ \frac{4}{9} - \frac{1}{4} = \frac{4}{9} \]
    \[ P(\text{not yellow}) = \frac{5}{9} \]
18. \( P(\text{win}) + P(\text{not win}) = 100\% \)
    \[ 3\% + P(\text{not win}) = 100\% \]
    \[ -3\% = -3\% \]
    \[ P(\text{not win}) = 97\% \]
19. \( P(\text{snow}) + P(\text{rain}) + P(\text{no snow/rain}) = 100\% \)
    \[ 15\% + 15\% + P(\text{no snow/rain}) = 100\% \]
    \[ 30\% + P(\text{no snow/rain}) = 100\% \]
    \[ -30\% = -30\% \]
    \[ P(\text{no snow/rain}) = 70\% \]
20. number of ways event can happen
    total possible outcomes
    \[ \frac{99}{100} \]
    The probability of not winning is \( \frac{99}{100} \).
21. number of ways event can happen
    total possible outcomes
    \[ \frac{9}{10} \]
    The probability of not choosing white marble is \( \frac{9}{10} \).
22. Odds against 75:25, or 3:1.
    The odds of the spinner not landing on green are 3:1.
23. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{1}{5} \]
24. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{1}{5} \]
25. number of ways the event can occur
    total number of equally likely outcomes
    \[ \frac{4}{5} \]
26. Odds in favor of yellow are 1:4.
27. Odds against red are 4:1.
28. Odds against green are 4:1.
29. Rolling a number greater than 3 because there are three outcomes in this event (4, 5, 6), whereas rolling a number less than 3 has two outcomes (1, 2).
30. Student A; since odds in favor are 1:4, there is 1 way the event can happen and 4 ways the event can fail to happen. So the probability of the event not happening is \( \frac{4}{5} \).
31. Odds in favor are the same as odds against: 1:1.
    So the probability of the event occurring is \( \frac{1}{2} \).
32a. number of ways event can happen
    total possible outcomes
    \[ \frac{1}{6} \]
32b. number of ways event can happen
    total possible outcomes
    \[ \frac{3}{6} = \frac{1}{2} \]
32c. number of ways event can happen
    total possible outcomes
    \[ \frac{4}{6} = \frac{2}{3} \]
33. If the odds in favor of an event are \(a:b\), then there is a total of \(a + b\) outcomes, where \(a\) is number of ways the event can occur. So the probability of the event is \(\frac{a}{a + b}\).

34. \[
\text{area of red circle} \quad \frac{\pi(2)^2}{\pi(6)^2} = \frac{4\pi}{36\pi} = \frac{1}{9}
\]

TEST PREP

35. D
\[
\text{number of ways event can happen} \quad = \frac{3}{4} = 75\%
\]

36. H
\[
P(\text{even}) = \frac{3}{6} \quad \text{area of yellow} \quad \frac{\pi(2)^2}{\pi(6)^2} = \frac{4\pi}{36\pi} = \frac{1}{9}
\]

37. B
\[
P(\text{less than 5}) = \frac{4}{6} \quad \text{area of entire square} \quad \frac{(3)(3) - (1)(1)}{(6)(6)}
\]

38a. \[
\frac{\text{number of times event occurs}}{\text{number of trials}} = \frac{4}{10} = 0.4
\]

b. \[
\frac{\text{number of times event occurs}}{\text{number of trials}} = \frac{48}{100} = 0.48
\]

38c. \[
\frac{\text{number of times event occurs}}{\text{number of trials}} = \frac{502}{1000} = 0.502
\]

38d. \[
\frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}} = \frac{1}{2} = 0.5
\]

38e. The experimental probability is closer to the theoretical probability in the experiments with more tosses.

10-7 INDEPENDENT AND DEPENDENT EVENTS

CHECK IT OUT!

1a. Independent; the result of rolling the number cube the 1st time does not affect the result of the 2nd roll.

1b. Dependent; choosing the 1st student leaves fewer students to choose from the 2nd time.

2. The result of one spin does not affect any following spins. The events are independent. The probability of getting an odd number once is,
\[
P(\text{odd}) = \frac{3}{6} = \frac{1}{2}
\]
\[
P(\text{odd, odd}) = P(\text{odd}) \cdot P(\text{odd}) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}
\]

3. Choose a blue from 10 red, 12 white and 8 blue; Choose a red from 10 red, 12 white and 7 blue; \(P(\text{blue and red}) = P(\text{blue}) \cdot P(\text{red after blue})\)
\[
= \frac{8}{30} \cdot \frac{10}{29}
= \frac{8}{87}
\]

THINK AND DISCUSS

1. Possible answer: Choosing an ace from a deck of cards and then choosing a king; the events are dependent because the sample space changes after the first card is selected.

EXERCISES

GUIDED PRACTICE

1. dependent

2. Dependent; the choice of the 1st card affects the sample space for the choice of the 2nd card.

3. Independent; the guess for the 1st question does not affect the sample space for the 2nd question.

4. Dependent; after you have selected your kitten, there are fewer kittens for your friend to choose from.

5. Independent; your order does not affect what your friend orders.

6. Dependent; the appointments that were already scheduled affected the appointment times available to you.

7. The result of one coin toss does not affect any following tosses. The events are independent. The probability of getting heads on first toss is,
\[
P(H) = \frac{1}{2}
\]
\[
P(H, H, H) = P(H) \cdot P(H) \cdot P(H) = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}
\]

8. Since the card is replaced, the first card selection does not affect the second selection. The events are independent. Probability of getting odd number on first draw is,
\[
P(\text{odd}) = \frac{4}{7}
\]
\[
P(\text{odd, odd}) = P(\text{odd}) \cdot P(\text{odd}) = \frac{4}{7} \cdot \frac{4}{7} = \frac{16}{49}
\]
9. The result on the first roll does not affect the second roll. The events are independent. Pairs that sum to 7 are: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1). All pairs have equal chance of happening. Consider the first pair (1, 6). 
\[ P(1) = \frac{1}{6}, \quad P(6) = \frac{1}{6} \]
\[ P(1, 6) = P(1) \cdot P(6) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]
Similarly the probability of any of the pairs occurring is \( \frac{1}{36} \). Since there are 6 pairs,
\[ P(\text{sum is 7}) = P(\text{possible pair with sum is 7}) \cdot 6 = \frac{1}{36} \cdot 6 = \frac{1}{6} \]

10. The first roll does not affect the second roll, and neither rolls affect the coin toss. The events are independent.
Probability of getting a 2 once is,
\[ P(2) = \frac{1}{6} \]
Probability of getting heads is,
\[ P(H) = \frac{1}{2} \]
\[ P(2, H) = P(2) \cdot P(H) = \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12} \]

11. The first spin does not affect the second spin. The events are independent.
Probability spinner lands on yellow,
\[ P(\text{yellow}) = \frac{1}{4} \]
Probability spinner lands on green,
\[ P(\text{green}) = \frac{1}{4} \]
\[ P(\text{yellow, green}) = P(\text{yellow}) + P(\text{green}) = \frac{1}{4} + \frac{1}{4} = \frac{1}{2} \]

12. Choose a red from 4 red, 3 white and 6 blue; Choose a white from 3 red, 3 white and 6 blue;
\[ P(\text{red and white}) = P(\text{red}) \cdot P(\text{white after red}) = \frac{4}{13} \cdot \frac{3}{12} = \frac{1}{13} \]

13. Selecting odd from 4 odd and 3 even; Selecting odd from 3 odd and 3 even;
\[ P(\text{odd, odd}) = P(\text{odd}) \cdot P(\text{odd after odd}) = \frac{4}{7} \cdot \frac{3}{6} = \frac{2}{7} \]

14. Selecting a girl from 15 boys and 14 girls; Selecting a girl from 15 boys and 13 girls;
\[ P(\text{girl, girl}) = P(\text{girl}) \cdot P(\text{girl after girl}) = \frac{14}{29} \cdot \frac{13}{28} = \frac{13}{58} \]

15. Dependent; the choice of the first student affects the sample space for the choice of the second student.
16. Independent; the results of rolling the number cube do not affect the sample space of the deck of cards.
17. Neither of the cube roll results affect each other. The events are independent.
Probability of rolling even number once is,
\[ P(\text{even}) = \frac{3}{6} = \frac{1}{2} \]
\[ P(\text{even, even, even}) = P(\text{even}) \cdot P(\text{even}) \cdot P(\text{even}) = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8} \]

18. The first card selection does not affect the second card selection. The events are independent.
Probability of selecting even once is,
\[ P(\text{even}) = \frac{5}{10} = \frac{1}{2} \]
\[ P(\text{even, even}) = P(\text{even}) \cdot P(\text{even}) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} \]

19. The cube roll does not affect the coin toss. The events are independent.
Probability of 5 is,
\[ P(5) = \frac{1}{6} \]
Probability of heads is,
\[ P(H) = \frac{1}{2} \]
\[ P(5, H) = P(5) \cdot P(H) = \frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12} \]

20. Selecting a red from 5 red, 3 white and 4 blue; Selecting a red from 4 red, 3 white and 4 blue;
\[ P(\text{red, red}) = P(\text{red}) \cdot P(\text{red after red}) = \frac{5}{12} \cdot \frac{4}{11} = \frac{5}{33} \]

21. Selecting even from 5 even and 5 odd; Selecting even from 4 even and 5 odd;
\[ P(\text{even, even}) = P(\text{even}) \cdot P(\text{even after even}) = \frac{5}{10} \cdot \frac{4}{9} = \frac{2}{9} \]
22. Selecting blue from red, yellow, green, blue, purple and white; Selecting yellow from red, yellow, green, purple and white; 

\[ P(\text{blue, yellow}) = P(\text{blue}) \cdot P(\text{yellow after blue}) = \frac{1}{6} \cdot \frac{1}{5} = \frac{1}{30} \]

23a. Answering the first question does not affect the sample space for the second or the third questions. The events are independent. 

Probability of answering one question wrong is, 

\[ P(\text{wrong}) = \frac{3}{4} \]

\[ P(\text{wrong, wrong, wrong}) = P(\text{wrong}) \cdot P(\text{wrong}) \cdot P(\text{wrong}) = \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} = \frac{27}{64} \]

b. Probability of answering one question right is, 

\[ P(\text{right}) = \frac{1}{4} \]

\[ P(\text{right, right, right}) = P(\text{right}) \cdot P(\text{right}) \cdot P(\text{right}) = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64} \]

24. Independent; the choice of the first name does not affect the sample space for the choice of the second name.

25. Dependent; the choice of the first name affects the sample space for the choice of the second name.

26. Independent; the roll of the number cube does not affect the sample space for tossing the coin.

27. Independent; each roll does not affect the sample space for the next roll.

28a. Number on first die does not affect number on second die, so the events are independent.

Probability of getting a 5 on a die is \( P(5) = \frac{1}{6} \).

\[ P(5, 5) = P(5) \cdot P(5) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]

b. The number rolled on either of the dice does not affect the sample space for the rest of the dice, so the events are independent.

Probability of getting a 3 on a die is \( P(3) = \frac{1}{6} \).

\[ P(3, 3) = P(3) \cdot P(3) \cdot P(3) = \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{216} \]

28c. The number rolled on either of the dice does not affect the sample space for the rest of the dice, so the events are independent.

Probability of getting a 6 on a die is \( P(6) = \frac{1}{6} \).

\[ P(6, 6, 6, 6, 6) = P(6) \cdot P(6) \cdot P(6) \cdot P(6) \cdot P(6) = \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{7776} \]

29a. Selection of first marble does not affect the sample space for the selection of the second marble, so the events are independent.

Selecting a red from 3 red, 5 blue, 2 white; Selecting a blue from 2 red, 5 blue, 2 white;

\[ P(\text{red, blue}) = P(\text{red}) \cdot P(\text{blue after red}) = \frac{3}{10} \cdot \frac{5}{9} = \frac{15}{90} = \frac{5}{30} \]

b. Selection of first marble affects the sample space for the selection of the second marble, so the events are dependent.

Selecting a red from 3 red, 5 blue, 2 white; Selecting a blue from 2 red, 5 blue, 2 white;

\[ P(\text{red, blue}) = P(\text{red}) \cdot P(\text{blue}) = \frac{3}{10} \cdot \frac{5}{6} = \frac{15}{60} = \frac{3}{10} \]

29c. Selection of first marble does not affect the sample space for the selection of the second marble, so the events are independent.

Selecting a red from 3 red, 5 blue, 2 white;

\[ P(\text{red}) = \frac{3}{10} \]

\[ P(\text{red, red}) = P(\text{red}) \cdot P(\text{red}) = \frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100} \]

29d. Selection of first marble affects the sample space for the selection of the second marble, so the events are dependent.

Selecting a red from 3 red, 5 blue, 2 white;

\[ P(\text{red, red}) = P(\text{red}) \cdot P(\text{red after red}) = \frac{3}{10} \cdot \frac{2}{9} = \frac{6}{90} = \frac{1}{15} \]
30a. The number rolled on the die does not affect the sample space for the rest of the dice, so the events are independent.

Probability of getting a 6 on a die is,
\[ P(6) = \frac{1}{6} \]

Probability for double 6’s on first turn is,
\[ P(6, 6) = P(6) \cdot P(6) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]

Similarly, probability of rolling double 6’s on the second turn is \( \frac{1}{36} \).

Since the events are independent,
\[ P(\text{double sixes on both turns}) = P(6, 6) \cdot P(6, 6) = \frac{1}{36} \cdot \frac{1}{36} = \frac{1}{1296} \]

b. The number rolled on the die does not affect the sample space for the rest of the dice, so the events are independent.

Only pair that sums up to 2 is (1, 1);
\[ P(\text{sum 2}) = P(1) \cdot P(1) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]

Only pair that sums up to 12 is (6, 6);
\[ P(\text{sum 12}) = P(6) \cdot P(6) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]

Since both events of rolling the dice are independent,
\[ P(\text{sum 2, sum 12}) = P(\text{sum 2}) \cdot P(\text{sum 12}) = \frac{1}{36} \cdot \frac{1}{36} = \frac{1}{1296} \]

30c. The players have the same probability of winning.

31. $2.50 in quarters implies Tamika has 10 quarters.

Draw 1 state quarter from 4 state quarters and 6 regular quarters;
\[ P(\text{state, state}) = P(\text{state}) \cdot P(\text{state after state}) = \frac{4}{10} \cdot \frac{3}{9} = \frac{2}{15} \]

Draw 1 state quarter from 3 state quarters and 6 regular quarters;
\[ P(\text{state, state}) = P(\text{state}) \cdot P(\text{state after state}) = \frac{3}{10} \cdot \frac{2}{9} = \frac{1}{15} \]

32. Draw number divisible by 3 from 3 divisible and 7 not divisible by 3 cards;

Draw number divisible by 3 from 2 divisible and 7 not divisible by 3 cards;
\[ P(\text{divisible by 3, divisible by 3}) = P(\text{divisible by 3}) \cdot P(\text{divisible by 3 after divisible by 3}) = \frac{3}{10} \cdot \frac{2}{9} = \frac{1}{15} \]

33. The probability is 0 because it is impossible for the coin to land heads up on both tosses if it lands on tails on the first toss.

34. Two events are independent if the occurrence of one event does not affect the probability of the other event.

TEST PREP

35. D

\[ P(2, 2) = P(2) \cdot P(2) = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36} \]

36. G

\[ P(\text{hit, hit}) = P(\text{hit}) \cdot P(\text{hit}) = \frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100} = 0.09 \]

37. A

\[ P(\text{man, man}) = P(\text{man}) \cdot P(\text{man after man}) = \frac{10}{30} \cdot \frac{9}{29} = \frac{3}{29} \]

38. J

\[ P(\text{blue, blue}) = P(\text{blue}) \cdot P(\text{blue after blue}) = \frac{2}{20} \cdot \frac{1}{19} = \frac{1}{95} \]

CHALLENGE AND EXTEND

39. Making a throw does not affect the rest of the throws, so the events are independent.
\[ P(\text{making, making, making}) = P(\text{making}) \cdot P(\text{making}) \cdot P(\text{making}) = 0.9 \cdot 0.9 \cdot 0.9 = 0.729 = 72.9\% \]
40. Rolling a number on the number cube does not affect the sample space for the next roll, so the events are independent.

   Probability of not getting 5 is, \( P(\text{not } 5) = \frac{5}{6} \)

   Probability of not getting a single 5 is,
   \[ P(\text{no 5's}) = P(\text{not 5, not 5, not 5}) = P(\text{not 5}) \cdot P(\text{not 5}) \cdot P(\text{not 5}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216} \]

   Probability of not getting 5 is, \( P(\text{not 5}) = \frac{5}{6} \)

   Probability of not getting a single 5 is,
   \[ P(\text{no 5's}) = P(\text{not 5, not 5, not 5}) = P(\text{not 5}) \cdot P(\text{not 5}) \cdot P(\text{not 5}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216} \]

   Probability of not getting 5 is, \( P(\text{not 5}) = \frac{5}{6} \)

   Probability of not getting a single 5 is,
   \[ P(\text{no 5's}) = P(\text{not 5, not 5, not 5}) = P(\text{not 5}) \cdot P(\text{not 5}) \cdot P(\text{not 5}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216} \]

41. 80% 42. 60%
43. 48% 44. 8%

**READY TO GO ON? Section B Quiz**

1. \( \frac{5}{20} = 25\% \)
2. \( \frac{2}{20} = 10\% \)
3. \( \frac{14}{20} = 70\% \)
4. \( \frac{9}{20} = 45\% \)
5. \( \frac{12}{20} = 60\% \)
6. 6.25%
7. 25%
8. 25%
9. 12.5%
10. 20%

11. The probability of choosing a winning ticket is 20%.

12. Odds against are 30:70 or 3:7.
Odds of no snow are 3:7.

13. The selection of a captain on one day does not affect the selection of a captain on the next day, so the events are independent.

   Probability of selecting a girl on the first day is,
   \[ P(\text{girl}) = \frac{18}{30} = \frac{3}{5} \]

   Probability of selecting a girl on the first day is,
   \[ P(\text{girl}) = \frac{18}{30} = \frac{3}{5} \]

   \[ P(\text{girl, girl}) = P(\text{girl}) \cdot P(\text{girl}) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25} = 36\% \]

14. Selecting a scratch-n-sniff sticker from 9 zoo animals and 16 scratch-n-sniff stickers;
Selecting a zoo animal sticker from 9 zoo animals and 15 scratch-n-sniff stickers;
\[ P(\text{scratch-n-sniff, zoo}) = P(\text{scratch-n-sniff}) \cdot P(\text{zoo after scratch-n-sniff}) = \frac{16}{25} \cdot \frac{9}{24} = \frac{1}{25} \cdot \frac{1}{24} = 0.24 = 24\% \]

**STUDY GUIDE: REVIEW**

**10-1 ORGANIZING AND DISPLAYING DATA**

1. outcome 2. interquartile range
3. independent events 4. 2003
5. 57 boys and 43 girls participated during 2004.
Therefore, there were 14 more boys participating.

**10-2 FREQUENCY AND HISTOGRAMS**

6. **| Stem | Leaves **
   | 0 | 1 7 9 |
   | 1 | 2 4 8 9 |
   | 2 | 2 2 4 8 |
   | Key: 1|2 means 12 |

7. **| Comedy Camp | Stem | Days and Days **
   | 2 | 6 |
   | 3 | 1 8 0 2 |
   | 4 | 4 2 10 3 5 9 |
   | 6 | 2 0 12 8 |
   | 13 | 2 5 9 |
   | Key: |1|2| means 128 |
   | 4|10| means 104 |
The least value is 10. The greatest value is 26. For this data set use intervals of 5.

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
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<td>I</td>
<td>6</td>
</tr>
<tr>
<td>15 – 19</td>
<td>III</td>
<td>10</td>
</tr>
<tr>
<td>20 – 24</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>25 – 29</td>
<td>III</td>
<td>3</td>
</tr>
</tbody>
</table>

9. Use intervals from the frequency table. Draw a bar for the number of vehicles with given tank capacity in each interval.

10. 5, 7, 8, 10, 12, 12, 14, 25, 33
    mean: $= \frac{126}{9} = 14$
    median: 5, 7, 8, 10, 12, 12, 14, 25, 33
    The median is 12.
    mode: 12
    range: 33 – 5 = 28
11. Median; the mean is higher than four of the prices; the mode is the lowest price.
12. 2, 3, 6, 12, 18, 19, 21, 24, 25, 27, 28, 29, 31
    minimum: 2; first quartile: 12
    maximum: 31; third quartile: 28
    median: 22.5

10-3 DATA DISTRIBUTIONS
10. 5, 7, 8, 10, 12, 12, 14, 25, 33
    mean: $= \frac{126}{9} = 14$
    median: 5, 7, 8, 10, 12, 12, 14, 25, 33
    The median is 12.
    mode: 12
    range: 33 – 5 = 28
11. Median; the mean is higher than four of the prices; the mode is the lowest price.
12. 2, 3, 6, 12, 18, 19, 21, 24, 25, 27, 28, 29, 31
    minimum: 2; first quartile: 12
    maximum: 31; third quartile: 28
    median: 22.5

10-4 MISLEADING GRAPHS AND STATISTICS
13. The scale on the vertical axis is too large. This makes the slopes of the segments less steep.
14. Someone might believe that the price has been relatively stable, when in fact it has doubled.

10-5 EXPERIMENTAL PROBABILITY
15. number of times event occurs $= \frac{796}{800} = 99.5\%$
    The experimental probability that a battery has no defects is 99.5%.
16. Find 99.5% of 25,000.
    $(0.995)(25,000) = 24,875$
    24,875 batteries are likely to have no defects.
17. Find 0.5% of 50,000
    $(0.005)(50,000) = 250$
    There are 250 batteries that are likely to have defects.

10-6 THEORETICAL PROBABILITY
18. number of ways the event can occur
    total number of equally likely outcomes
    $= \frac{3}{6} = \frac{1}{2}$
19. number of ways the event can occur
    total number of equally likely outcomes
    $= \frac{3}{12} = \frac{1}{4}$
20. number of ways the event can occur
    total number of equally likely outcomes
    $= \frac{5}{8}$

10-7 INDEPENDENT AND DEPENDENT EVENTS
21. The result of the first random number does not affect the result of the second random number, so the events are independent.
22. The result of the first roll does not affect the result of the second, so the events are independent.
23. There are fewer people to choose from after the first person is called, so the events are dependent.
24. Draw a yellow from 64 green, 128 yellow, 1 gold and 3 silver;
    Draw a green from 64 green, 127 yellow, 1 gold and 3 silver;
    $P(yellow, green) = P(yellow) \cdot P(green after yellow)$
    $= \frac{128}{196} \cdot \frac{64}{195}$
    $= \frac{2048}{3880}$
    $= \frac{512}{9555}$

25. Draw a gold from 64 green, 128 yellow, 1 gold and 3 silver;
    Draw a gold from 64 green, 128 yellow, 0 gold and 3 silver;
    $P(gold, gold) = P(gold) \cdot P(gold after gold)$
    $= \frac{1}{196} \cdot \frac{0}{195}$
    $= 0$

26. The draw of the first ball does not affect the draw of the second ball, so events are independent.
    $P(green, green) = P(green) \cdot P(green)$
    $= \frac{64}{196} \cdot \frac{64}{195}$
    $= \frac{4096}{38808}$
    $= \frac{1024}{9555}$
1. A line graph is appropriate for this data because it will show the change in population over a period of time.

![Oakville Population Graph]

2. from 1970 to 1980
3. The population is decreasing, but by smaller amounts as time passes.

4. Stem | Leaves
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1 4 5 8 9</td>
</tr>
<tr>
<td>6</td>
<td>1 2 3 3 4 6 8</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

Key: 5|1 means 51

5. The least value is 51. The greatest value is 70. For this data set use intervals of 4.

<table>
<thead>
<tr>
<th>High Temperature for Two Weeks</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>51–54</td>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>55–58</td>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>59–62</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>63–66</td>
<td>###</td>
<td>5</td>
</tr>
<tr>
<td>67–70</td>
<td>II</td>
<td>2</td>
</tr>
</tbody>
</table>

6. Use intervals from the frequency table. Draw a bar for the number of frequencies of the temperatures in each interval.

![High Temperature Graph]

7. mean: \( \frac{200}{14} \approx 14.3 \)
   median: 2, 3, 5, 6, 8, 12, 13, 14, 14, 17, 21, 22, 25, 38
   The median is 13.5.
   mode: 14
   range: 38 – 2 = 36

8. minimum: 2; first quartile: 6
   maximum: 38; third quartile: 21

9. \( \frac{498}{500} = 99.6\% \)
   The experimental probability that a watch has no defects is 99.6%.

10. Find 99.6% of 30,000.
    \((0.996)(30,000) = 29,880\)
    29,880 watches are likely to have no defects.

11. The sectors of the graph do not add up to 100%.
    The total of the percentage is only 20%.

12. Someone might believe that most of the money raised goes to charitable causes.

13. Possible answer: the managers of the charity might be able to get more people to contribute under the invalid assumption that most of their money is going to charitable causes.

14. number of ways the event can occur
   total number of equally likely outcomes
   \( \frac{2}{12} = \frac{1}{6} \)

15. number of ways event can happen
   total possible outcomes
   \( \frac{7}{9} \)
   The probability of not spinning red is \( \frac{7}{9} \).

16. Selecting white from 14 red and 10 white marbles;
    Selecting white from 14 red and 9 white marbles;
    \( P(\text{white}, \text{white}) = P(\text{white}) \cdot P(\text{white after white}) \)
    \( \frac{10}{24} \cdot \frac{9}{23} \)
    \( \frac{90}{552} = \frac{15}{92} \)