

EXAMPLE 2 Interpreting a Stem-and-Leaf Plot

Test Scores	
Stem	Leaf
6	6
7	0 5 7 8
8	1 1 3 4 4 6 8 8 9
9	0 2 9
10	0

Key: 9|2 = 92 points

The stem-and-leaf plot shows student test scores. (a) How many students scored less than 80 points? (b) How many students scored at least 90 points? (c) How are the data distributed?

- There are five scores less than 80 points: 66, 70, 75, 77, and 78.
 ❖ Five students scored less than 80 points.
- There are four scores of at least 90 points: 90, 92, 99, and 100.
 ❖ Four students scored at least 90 points.
- There are few low test scores and few high test scores. So, most of the scores are in the middle.

On Your Own

Now You're Ready
Exercises 12–15

- Use the grading scale at the right.
 - How many students received a B on the test?
 - How many students received a C on the test?

A: 90–100
B: 80–89
C: 70–79
D: 60–69
F: 59 and below

EXAMPLE 3 Making Conclusions from a Stem-and-Leaf Plot



Which statement is *not* true?

- Most of the plants are less than 20 inches tall.
- The median plant height is 11 inches.
- The range of the plant heights is 35 inches.
- The plant height that occurs most often is 11 inches.

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

Key: 1|5 = 15 inches

There are 15 plant heights. So, the median is the eighth data value, 10 inches.

❖ The correct answer is (B).

On Your Own

- You are told that three plants are taller than 20 inches. Is the statement true? Explain.

10.1 Exercises

Vocabulary and Concept Check

- VOCABULARY** The key for a stem-and-leaf plot is $3|4 = 34$. Which number is the stem? Which number is the leaf?
- WRITING** Describe how to make a stem-and-leaf plot of the data values 14, 22, 9, 13, 30, 8, 25, and 29.
- WRITING** How does a stem-and-leaf plot show the distribution of data?

Practice and Problem Solving

Make a stem-and-leaf plot of the data.

1

4.

Books Read			
26	15	20	9
31	25	29	32
17	26	19	40

5.

Hours Online			
8	12	21	14
18	6	15	24
12	17	2	0

6.

Test Scores (%)				
87	82	95	91	69
88	68	87	65	81
97	85	80	90	62

7.

Points Scored				
58	50	42	71	75
45	51	43	38	71
42	70	56	58	43

8.

Bikes Sold			
78	112	105	99
86	96	115	100
79	81	99	108

9.

Minutes in Line			
4.0	2.6	1.9	3.1
3.6	2.2	2.7	3.8
1.6	2.0	3.1	2.9

10. **ERROR ANALYSIS** Describe and correct the error in making a stem-and-leaf plot of the data.

51, 25, 47, 42, 55, 26, 50, 44, 55



Stem	Leaf
2	5 6
4	2 4 7
5	0 1 5 5

Key: $4|2 = 42$



11. **PUPPIES** The weights (in pounds) of eight puppies at a pet store are 12, 24, 17, 8, 18, 31, 24, and 15. Make a stem-and-leaf plot of the data. Describe the distribution of the data.



VOLLEYBALL The stem-and-leaf plot shows the number of *digs* for the top 15 players at a volleyball tournament.



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

Key: 5|0 = 50 digs

- 2 12. How many players had more than 60 digs?
13. Find the mean, median, mode, range, and interquartile range of the data.
14. Describe the distribution of the data.
15. Which data value is the outlier? Describe how the outlier affects the mean.
16. **REASONING** Each stem-and-leaf plot below has a mean of 39. Without calculating, determine which stem-and-leaf plot has the lesser mean absolute deviation. Explain your reasoning.

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

Key: 4|1 = 41

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

Key: 5|3 = 53

17. **TEMPERATURE** The stem-and-leaf plot shows the daily high temperatures (in degrees Fahrenheit) for the first 15 days of a month.

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

Key: 6|7 = 67°F

- a. Find and interpret the mean absolute deviation of the data.
- b. After you include the daily high temperatures for the rest of the month in the stem-and-leaf plot, the mean absolute deviation increases. Where do you think most of the data values for the rest of the month are located in the stem-and-leaf plot? Explain.

18. **Critical Thinking** The back-to-back stem-and-leaf plot shows the 9-hole golf scores for two golfers. Only one of the golfers can compete in a tournament. Use measures of center and measures of variation to give reasons why you would choose each golfer.

Rich	Will
7 5	3
8 5 4 3 2 1	4 2 3 4 4 6 7 7 8 9
5 0	5 0

Key: 1|4|2 = 41 and 42 strokes



Fair Game Review

what you learned in previous grades & lessons

Draw the solid. (Section 8.1)

19. square pyramid
20. hexagonal prism
21. **MULTIPLE CHOICE** In a bar graph, what determines the length of each bar?
(Skills Review Handbook)
- (A) frequency (B) data value (C) leaf (D) change in data

10.2 Lesson

Key Vocabulary

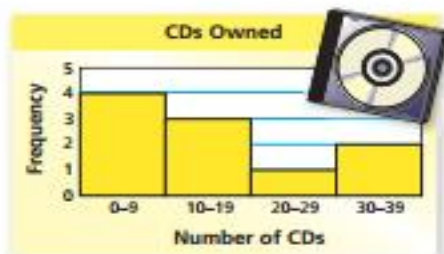
frequency table,
p. 441
frequency, p. 441
histogram, p. 442

Key Idea

Histograms

A **histogram** is a bar graph that shows the frequency of data values in intervals of the same size.

The height of a bar represents the frequency of the values in the interval.



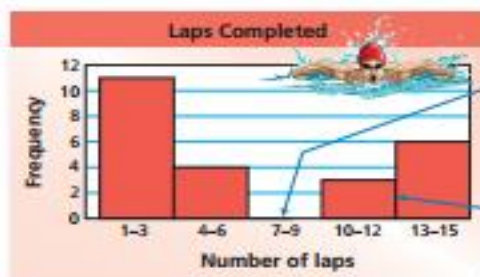
EXAMPLE 1 Making a Histogram

The frequency table shows the numbers of laps that people in a swimming class completed today. Display the data in a histogram.

Step 1: Draw and label the axes.

Step 2: Draw a bar to represent the frequency of each interval.

Number of Laps	Frequency
1-3	11
4-6	4
7-9	0
10-12	3
13-15	6



Include any interval with a frequency of 0. The bar height is 0.

There is no space between the bars of a histogram.

On Your Own

Now You're Ready
Exercises 6-8

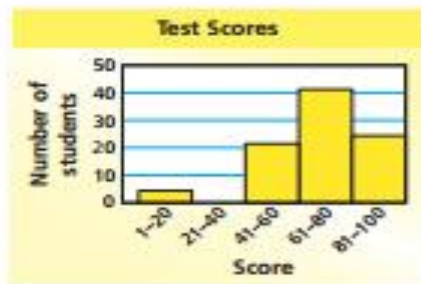
- The frequency table shows the ages of people riding a roller coaster. Display the data in a histogram.

Age	10-19	20-29	30-39	40-49	50-59
Frequency	16	11	5	2	4

10.2 Exercises

Vocabulary and Concept Check

- VOCABULARY** Which graph is a histogram? Explain your reasoning.
- REASONING** Describe the outliers in the histogram.
- REASONING** How can you tell when an interval of a histogram has a frequency of zero?



Practice and Problem Solving

Make a tally chart and a bar graph of the data.

4. **Members of Book Clubs**

6	17	13	19
13	9	18	24
11	15	21	14

5. **Points Scored**

42	45	57	39	55
38	48	36	48	46
51	29	45	54	42

Display the data in a histogram.

6. **States Visited**

States	Frequency
1-5	12
6-10	14
11-15	6
16-20	3

7. **Chess Team**

Wins	Frequency
10-13	3
14-17	4
18-21	4
22-25	2

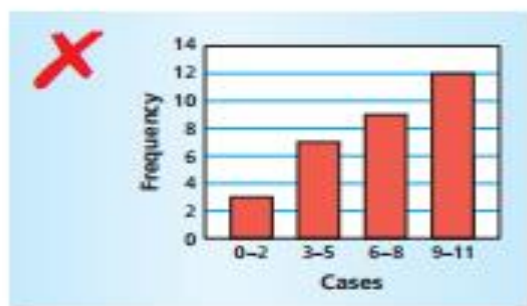
8. **Movies Watched**

Movies	Frequency
0-1	5
2-3	11
4-5	8
6-7	1

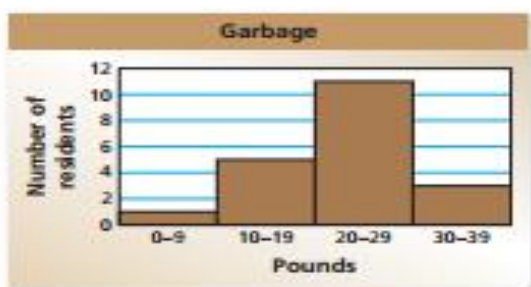
9. **ERROR ANALYSIS** Describe and correct the error made in displaying the data in a histogram.

Confirmed Flu Cases per School

Cases	Frequency
0-2	3
3-5	7
6-8	9
9-11	12



14. **GARBAGE** The data displays show how many pounds of garbage apartment residents produced in 1 week. Which data display can you use to find how many residents produced more than 25 pounds of garbage? Explain.



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

Key: 1 | 5 = 15 pounds

15. **REASONING** Determine whether you can make each statement by using the data displays in Exercise 14. Explain your reasoning.

- One resident produced 10 pounds of garbage.
- Twelve residents produced between 20 and 29 pounds of garbage.

16. **NUMBER SENSE** Can you find the range and the interquartile range of the data in Exercise 7? If so, find them. If you cannot find them, explain why not.



17. **CRITICAL THINKING** The table shows the weights of guide dogs enrolled in a training program.
- Make a histogram of the data starting with the interval 51–55.
 - Make another histogram of the data using different-sized intervals.
 - Compare and contrast the two histograms.

81	88	57	82	70	85
71	51	82	77	79	77
83	80	54	80	81	73
59	84	75	76	68	78
83	78	55	67	85	79

18. **Logic** What are the possible values for the median in Exercise 10?



Fair Game Review

What you learned in previous grades & lessons

Find the percent of the number. (Section 5.6)

19. 25% of 180 20. 30% of 90 21. 16% of 140 22. 64% of 80

23. **MULTIPLE CHOICE** Which is the solution of the inequality represented by "Four times a number n is at least 28"? (Section 7.7)

- (A) $n < 7$ (B) $n > 7$ (C) $n \leq 7$ (D) $n \geq 7$

10.1–10.2 Quiz

Make a stem-and-leaf plot of the data. (Section 10.1)

1. **Cans Collected Each Month**

80	90	84	92
76	83	79	59
68	55	58	61

2. **Miles Driven Each Day**

21	18	12	16	10
16	9	15	20	28
35	50	37	20	11

3. **Ages of Tortoises**

86	99	100	124
92	85	110	130
115	129	83	104



4. **Kilometers Run Each Day**

6.0	5.6	6.2	3.0	2.5
3.5	2.0	5.0	3.9	3.1
6.2	3.1	4.5	3.8	6.1

Display the data in a histogram. (Section 10.2)

5. **Soccer Team Goals**

Goals per Game	Frequency
0–1	5
2–3	4
4–5	0
6–7	1

6. **Minutes Practiced**

Minutes	Frequency
0–19	8
20–39	10
40–59	11
60–79	2

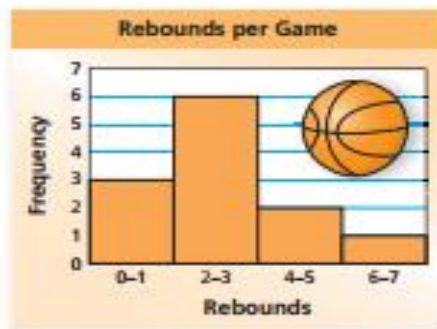
7. **Poems Written for Class**

Poems	Frequency
0–4	6
5–9	16
10–14	4
15–19	2
20–24	2

8. **WEIGHTS** The weights (in ounces) of nine packages are 7, 22, 16, 12, 6, 18, 15, 13, and 25. Make a stem-and-leaf plot of the data. Describe the distribution of the data. (Section 10.1)

9. **REBOUNDS** The histogram shows the number of rebounds per game for a middle school basketball player this season. (Section 10.2)

- Which interval contains the most data values?
- How many games did the player play this season?
- What percent of the games did the player have 4 or more rebounds?



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

10. **STAGE CREW** The stem-and-leaf plot shows the number of hours 11 stage crew members spent building sets. Find the mean, median, mode, range, and interquartile range of the data. (Section 10.1)

Key: 0|9 = 9 hours

10.3 Lesson



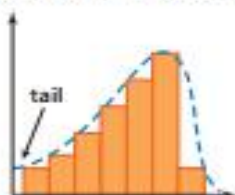
You can use dot plots and histograms to identify shapes of distributions.

Key Ideas

Study Tip

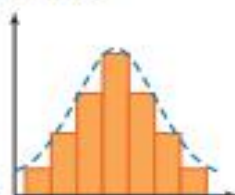
If all the dots of a dot plot or bars of a histogram are about the same height, then the distribution is a *flat*, or *uniform*, distribution. A uniform distribution is also symmetric.

Symmetric and Skewed Distributions



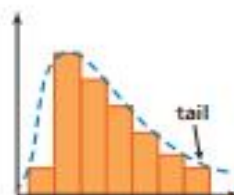
Skewed left

- The "tail" of the graph extends to the left.
- Most data are on the right.



Symmetric

- The left side of the graph is a mirror image of the right side of the graph.



Skewed right

- The "tail" of the graph extends to the right.
- Most data are on the left.

EXAMPLE 1 Describing the Shapes of Distributions

Describe the shape of each distribution.

a. Daily Snowfall Amounts



Most of the data are on the left, and the tail extends to the right.

- So, the distribution is skewed right.

b.



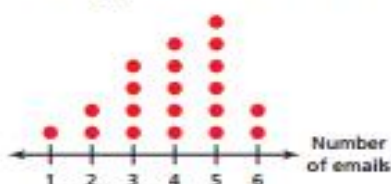
The left side of the graph is approximately a mirror image of the right side of the graph.

- So, the distribution is symmetric.

On Your Own

1. Describe the shape of the distribution.

Daily Spam Emails Received



Now You're Ready
Exercises 5–8

10.3 Exercises

Vocabulary and Concept Check

- VOCABULARY** How does the shape of a symmetric distribution differ from the shape of a skewed distribution?
- VOCABULARY** For a distribution that is skewed right, which direction does the tail extend? Where do most of the data lie?

Practice and Problem Solving

Make a dot plot of the data. In your own words, how would you describe the shape of the distribution?

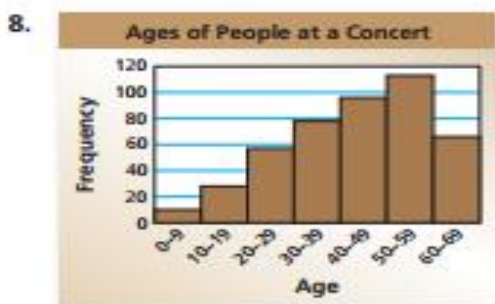
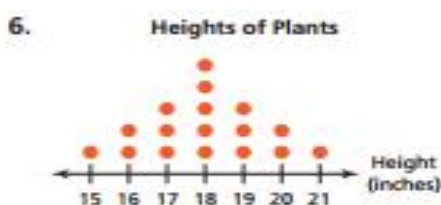
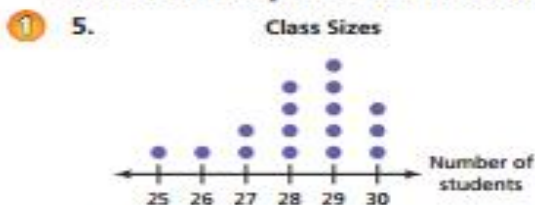
3.

Miles Run per Day										
1	4	2	0	3	2	1	2	4	2	3
2	1	6	3	2	4	0	5	3	1	5

4.

Raffle Tickets Sold								
15	12	16	15	13	14	16	13	
13	16	14	12	15	12	14		

Describe the shape of each distribution.



9. **POLICE** The frequency table shows the years of service for the police officers of Jones County and Pine County. Display the data for each county in a histogram. Describe the shape of each distribution. Which county's police force has less experience? Explain.

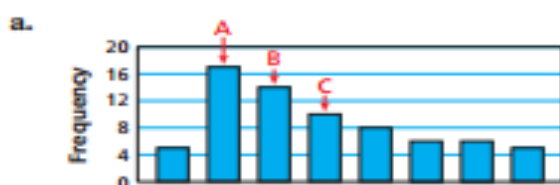
Years of Service	0-3	4-7	8-11	12-15	16-19	20-23	24-27
Frequency for Jones County	7	15	17	12	8	5	3
Frequency for Pine County	3	5	9	14	10	6	2

10. **REASONING** What is the shape of the distribution of the restaurant waiting times? Explain your reasoning.
11. **LOGIC** Are all distributions either approximately symmetric or skewed? Explain. If not, give an example.
12. **REASONING** Can you use a stem-and-leaf plot to describe the shape of a distribution? Explain your reasoning.
13. **CHARITY** The table shows the donation amounts received by a charity in one day.



Donations (dollars)												
20	15	40	70	20	5	25	50	47	20	62	55	40
10	50	18	20	100	40	80	60	20	80	3	30	50
25	30	10	33	20	50	7	35	40	25	70		

- a. Make a histogram of the data starting with the interval 0–14. Describe the shape of the distribution.
- b. A company adds \$5 to each donation. Make another histogram starting with the same first interval as in part (a). Compare the shape of this distribution with the distribution in part (a). Explain any differences in the distributions.
14. **Critical Thinking** Describe the shape of the distribution of each bar graph. Match the letters A, B, and C with the mean, the median, and the mode of the data set. Explain your reasoning.



Fair Game Review

what you learned in previous grades & lessons

Find the median, first quartile, third quartile, and interquartile range of the data. (Section 9.4)

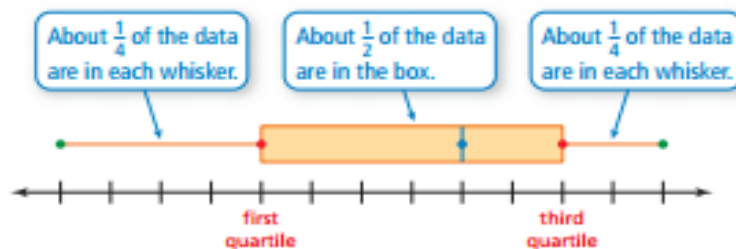
15. 68, 74, 67, 72, 63, 70, 78, 64, 76
16. 39, 48, 33, 24, 30, 44, 36, 41, 28, 53
17. **MULTIPLE CHOICE** Sixty people participate in a trivia contest. How many four-person teams can be formed? (Section 7.3)

- (A) 15 (B) 56 (C) 64 (D) 240

The figure shows how data are distributed in a box-and-whisker plot.

Study Tip

A long whisker or box indicates that the data are more spread out.



EXAMPLE 2 Analyzing a Box-and-Whisker Plot



The box-and-whisker plot shows the body mass index (BMI) of a sixth grade class.



- a. What fraction of the students have a BMI of at least 22?

The right whisker represents students who have a BMI of at least 22.

❖ So, about $\frac{1}{4}$ of the students have a BMI of at least 22.

- b. Are the data more spread out below the first quartile or above the third quartile? Explain.

The right whisker is longer than the left whisker.

❖ So, the data are more spread out above the third quartile than below the first quartile.

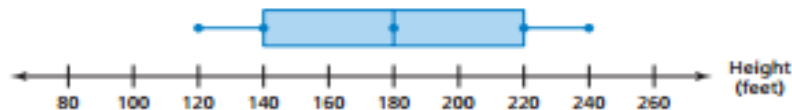
- c. Find and interpret the interquartile range of the data.

$$\begin{aligned} \text{interquartile range} &= \text{third quartile} - \text{first quartile} \\ &= 22 - 19 = 3 \end{aligned}$$

❖ So, the middle half of the students' BMIs varies by no more than 3.

On Your Own

2. The box-and-whisker plot shows the heights of the roller coasters at an amusement park. (a) What fraction of the roller coasters are between 120 feet tall and 220 feet tall? (b) Are the data more spread out below or above the median? Explain. (c) Find and interpret the interquartile range of the data.



Now You're Ready
Exercises 11
and 12

10.4 Exercises

Vocabulary and Concept Check

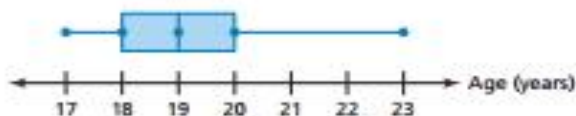
- VOCABULARY** Explain how to find the five-number summary of a data set.
- NUMBER SENSE** In a box-and-whisker plot, what fraction of the data is greater than the first quartile?
- DIFFERENT WORDS, SAME QUESTION** Which is different? Find “both” answers.

Is the distribution skewed right?

Is the left whisker longer than the right whisker?

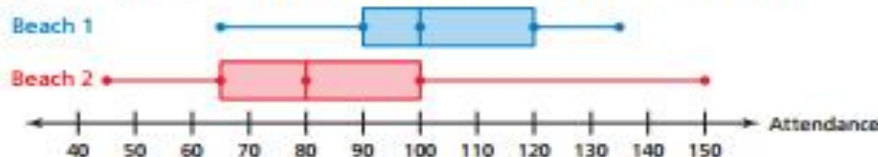
Are the data more spread out below the first quartile than above the third quartile?

Does the lower fourth of the data vary more than the upper fourth of the data?



Practice and Problem Solving

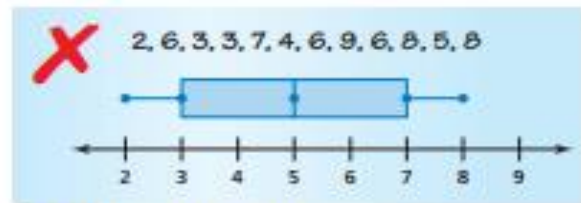
- The box-and-whisker plots represent the daily attendance at two beaches during July. Compare and contrast the attendances for the two beaches.



Make a box-and-whisker plot for the data.

- Ages of teachers (in years): 30, 62, 26, 35, 45, 22, 49, 32, 28, 50, 42, 35
- Quiz scores: 8, 12, 9, 10, 12, 8, 5, 9, 7, 10, 8, 9, 11
- Donations (in dollars): 10, 30, 5, 15, 50, 25, 5, 20, 15, 35, 10, 30, 20
- Ski lengths (in centimeters): 180, 175, 205, 160, 210, 175, 190, 205, 190, 160, 165, 195

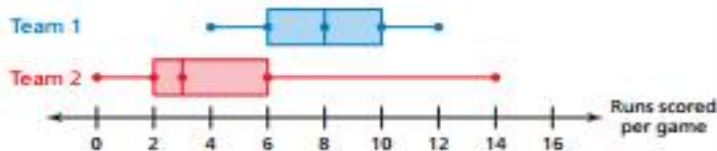
- ERROR ANALYSIS** Describe and correct the error in making a box-and-whisker plot for the data.



- CAMPING** The numbers of days 12 friends went camping during the summer are 6, 2, 0, 10, 3, 6, 6, 4, 12, 0, 6, and 2. Make a box-and-whisker plot for the data. What is the range of the data?

Make a box-and-whisker plot for the data.

- Temperatures (in °C): 5, 1, 4, 0, 9, 0, -8, 5, 2, 4, -1, 10, 7, -5
- Checking account balances (in dollars): 30, 0, 50, 20, 90, -15, 40, 100, 45, -20, 70, 0
- REASONING** The data set in Exercise 18 has an outlier. Describe how removing the outlier affects the box-and-whisker plot.
- CHOOSE TOOLS** What are the most appropriate measures to describe the center and the variation of the distribution in Exercise 12?
- OPEN-ENDED** Write a data set with 12 values that has a symmetric box-and-whisker plot.
- CRITICAL THINKING** When would a box-and-whisker plot *not* have one or both whiskers?
- STRUCTURE** Draw a histogram that could represent the distribution shown in Exercise 15.
- REASONING** The double box-and-whisker plot represents the runs scored per game by two softball teams during a 32-game season.



- Which team is more consistent at scoring runs? Explain.
 - In how many games did Team 2 score 6 runs or less?
 - Team 1 played Team 2 once during the season. Which team do you think won? Explain.
 - Which team do you think has the greater mean? Explain.
26. **Choose Tools** A market research company wants to summarize the variability of the SAT scores of graduating seniors in the United States. Do you think the company should use a stem-and-leaf plot, a histogram, or a box-and-whisker plot? Explain.



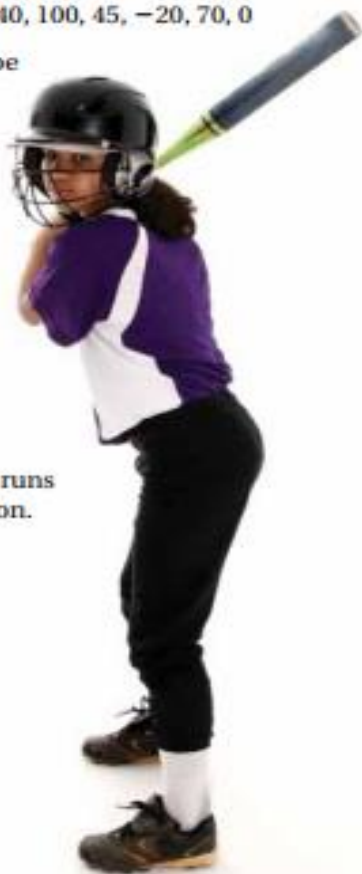
Fair Game Review what you learned in previous grades & lessons

Copy and complete the statement using $<$ or $>$. (Section 6.3)

27. $-\frac{2}{3}$ $-\frac{3}{4}$ 28. $-2\frac{1}{5}$ $-2\frac{1}{6}$ 29. -5.3 -5.5

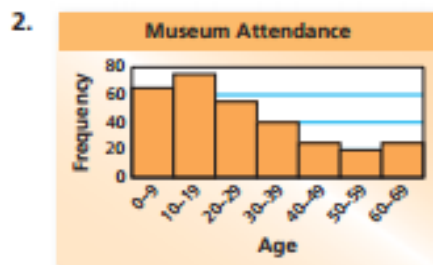
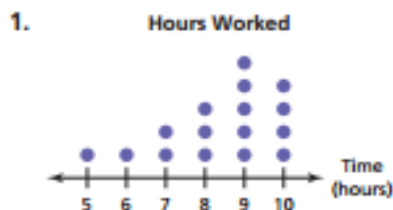
30. **MULTIPLE CHOICE** Which of the following items is most likely represented by a rectangular prism with a volume of 1785 cubic inches? (Section 8.4)

- (A) closet (B) computer tower
(C) filing cabinet (D) your math book



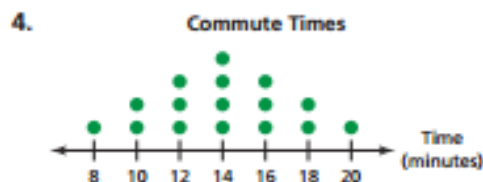
10.3–10.4 Quiz

Describe the shape of each distribution. (Section 10.3)



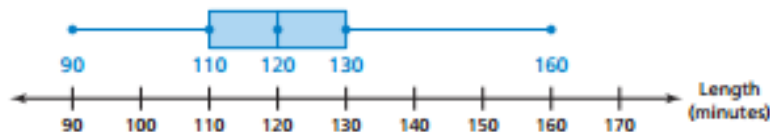
Choose the most appropriate measures to describe the center and the variation.

Find the measures you chose. (Section 10.3)



Make a box-and-whisker plot for the data. (Section 10.4)

- Science test scores: 85, 76, 99, 84, 92, 95, 68, 100, 93, 88, 87, 85
- Shoe sizes: 12, 8.5, 9, 10, 9, 11, 11.5, 9, 9, 10, 10, 10.5, 8
- MOVIES** The box-and-whisker plot represents the lengths (in minutes) of movies being shown at a theater. (Section 10.4)



- What percent of the movies are no longer than 120 minutes?
 - Is there more variability in the movie lengths longer than 130 minutes or shorter than 110 minutes? Explain.
 - Find and interpret the interquartile range of the data.
8. **EXPERIENCE** The frequency table shows the years of experience of employees at two branches of a company. Display the data for each branch in a histogram. Describe the shape of each distribution. Which branch has less experience? Explain. (Section 10.3)

Years of Experience	0–2	3–6	7–10	11–14	15–18	19–22	23–26
Frequency at Branch A	10	25	14	20	8	5	2
Frequency at Branch B	3	6	8	10	15	25	8

