Histograms

> GET READY for the Lesson

BASKETBALL Kylie researched the average ticket prices to NBA basketball games for 30 teams. The frequency table shows the results.

Price Interval ($)	Tally	Frequency
20.00–29.99	I	1
30.00–39.99	Ⅷ Ⅷ I	11
40.00–49.99	Ⅷ Ⅷ	10
50.00–59.99	Ⅷ	5
60.00–69.99	I	1
70.00–79.99	II	2

1. What do you notice about the price intervals in the table?

2. How many tickets were at least $20.00 but less than $50.00?

Data from a frequency table can be displayed as a histogram. A **histogram** is a type of bar graph used to display numerical data that have been organized into equal intervals.

EXAMPLE Construct a Histogram

1. **MOVIES** Choose intervals and make a frequency table of the data shown. Then construct a histogram to represent the data.

Running Time of Movies (minutes)

135	89	142	219	96
144	104	135	94	155
106	127	134	116	91
118	138	118	110	101

The least value in the data is 89 and the greatest is 219. An interval size of 30 minutes would yield the frequency table at the right.

To construct a histogram, follow these steps.

Running Time of Movies (minutes)

Time	Tally	Frequency
81–110	Ⅷ III	8
111–140	Ⅷ III	8
141–170	III	3
171–200		0
201–230	I	1

Step 1 Draw and label a horizontal and vertical axis. Include a title.

Step 2 Show the intervals from the frequency table on the horizontal axis.

Step 3 For each time interval, draw a bar whose height is given by its frequency.

There is no space between bars.
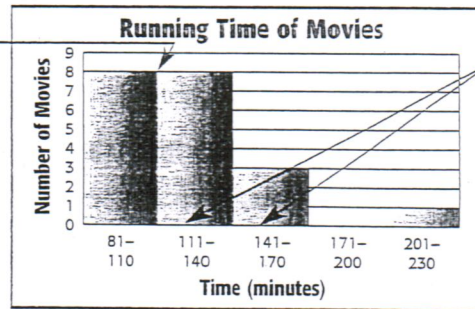
Because all of the intervals are equal, all of the bars have the same width.

Running Time of Movies

Study Tip

Gaps
Intervals with a frequency of 0 have a bar height of 0. This is referred to as a gap.

CHECK Your Progress

a. **SCHOOL** The list at the right gives a set of test scores. Choose intervals, make a frequency table, and construct a histogram to represent the data.

Test Scores

| 94	85	73	93	75	77	89	80
89	83	79	81	87	85	90	83
88	86	83	91	93	93	92	90
91	88	96	97	98	82	90	100
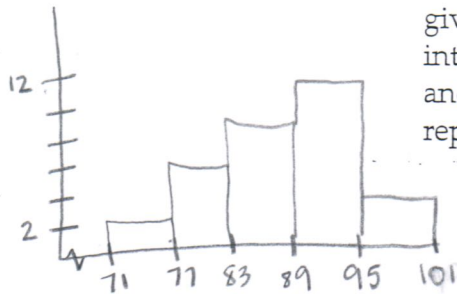
Int | #of scores
71-76 | 2
77-82 | 6
83-88 | 9
89-94 | 11
95-100 | 4
/32 tests

min = 73 max = 100
range = 100 - 73 = 27
round 30/5 bars = 6 → 6

EXAMPLES Analyze and Interpret Data

2. **BASEBALL** How many Cincinnati Reds players were at bat at least 400 time in 2006?

Five players were at bat 400–499 times, and 2 players were at bat 500–599 times. Therefore, 5 + 2 or 7 players were at bat at least 400 times.

Cincinnati Reds Players with Hits, 2006
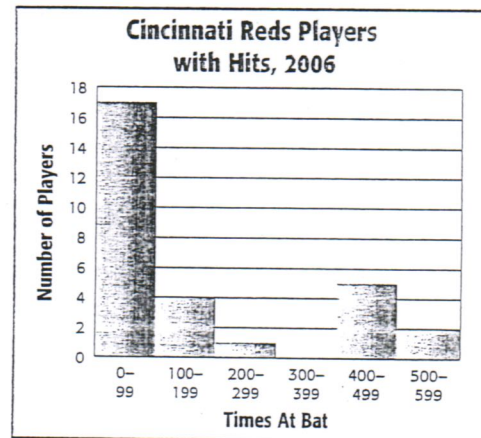
Source: Major League Baseball

3. **BASEBALL** What percent of the players were at bat 199 times or fewer?

There were 17 + 4 + 1 + 5 + 2 or 29 total players with hits, and there were 17 + 4 or 21 total players that were at bat 199 times or fewer. Since $\frac{21}{29}$ is about 0.72 or 72%, about 72% of the players were at bat 199 times or fewer.

CHECK Your Progress

b. What was the greatest number of times at bat of any one player?

c. Based on the data above, how many times is a Cincinnati Reds player most likely to be at bat?
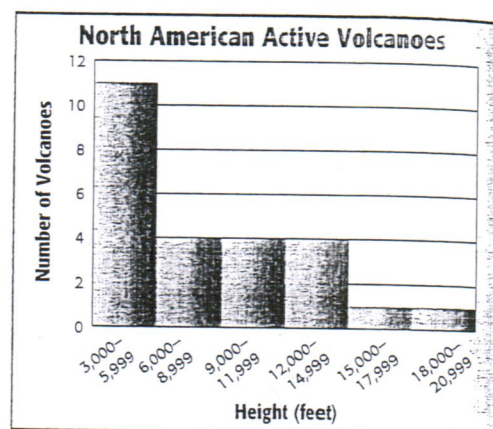
Example 1
(pp. 576–577)

1. POPULATION The list gives the approximate population density for each state. Choose intervals and make a frequency table. Then construct a histogram to represent the data.

U.S. State Population Density (per square mile)									
88	42	189	33	810	6	15	50	10	179
1	703	16	102	175	22	402	36	138	89
45	401	223	103	62	18	165	274	80	75
51	296	170	41	61	138	9	1,003	27	99
217	141	52	542	81	1,135	277	133	66	5

Source: *The World Almanac*

Examples 2, 3
(p. 577)

VOLCANOES For Exercises 2–4, use the histogram at the right.

2. What percent of the volcanoes are 8,999 feet or less?

3. How likely is it that any given volcano is at least 15,000 feet tall? Explain your reasoning.

4. What is the height of the tallest volcano?

North American Active Volcanoes

Source: *The World Almanac*

## Practice and Problem Solving

For each problem, choose intervals and make a frequency table. Then construct a histogram to represent the data.

5.

Hours Spent Exercising per Week						
3	0	9	1	4	2	0
3	6	14	4	2	5	3
7	3	0	8	3	10	

6.

Average Speed (mph), Selected Animals						
70	61	50	50	50	45	8
43	42	40	40	40	35	0.17
35	32	32	30	30	30	1.17
30	25	20	9	18	12	200

**COUNTRIES** For Exercises 7–10, use the histogram below.

7. How many countries have an area less than 401 square kilometers?

8. What percent of the countries have an area of 201–600 square kilometers?

9. How likely is it that any given country will have an area greater than 800 square kilometers?

10. Which country is the smallest?

Area of the Smallest Countries
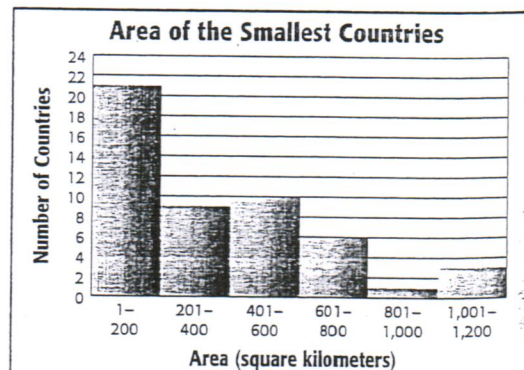
ECLIPSES For Exercises 11–14, use the histogram at the right.

11. What percent of the solar eclipses lasted at least 7 minutes 31 seconds?

12. How long was the shortest solar eclipse?

13. What is the duration of a typical solar eclipse during the decade? Explain your reasoning.

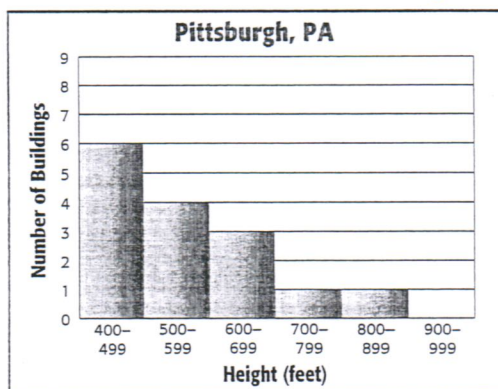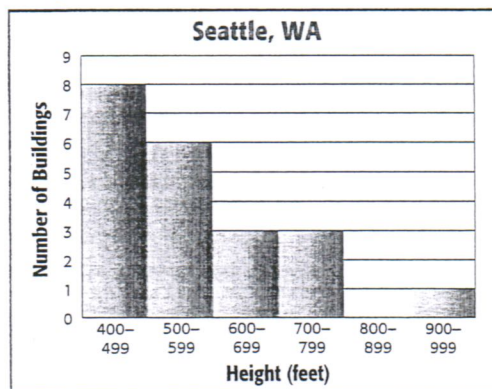14. How many solar eclipses lasted between 1 second and 5 minutes?
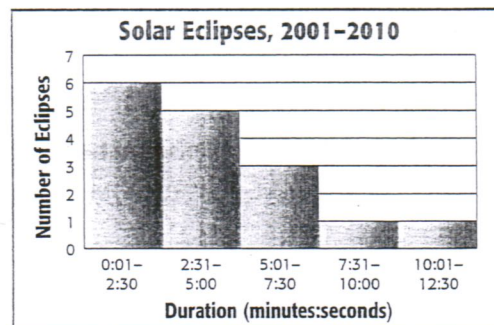
Solar Eclipses, 2001–2010

Source: NASA

BUILDINGS For Exercises 15–18, use the histograms shown.

Tall Buildings in Pittsburgh and Seattle

Source: *The World Almanac*   Source: *The World Almanac*

15. Which city has the tallest building?

16. Determine which city has more buildings that are 800–899 feet tall.

17. Determine which city has more buildings that are at least 600 feet tall. What percent of the buildings in that city are at least 600 feet tall?

18. What is the height of the shortest building in each city?

19. **COLLECT THE DATA** Conduct a survey of your classmates to determine the number of hours each person spends on the Internet during a typical week. Then choose intervals, make a frequency table, and construct a histogram to represent the data.

20. **RESEARCH** Use the Internet or other resource to find the populations of each county, census division, or parish in your state. Make a histogram using your data. How does your county, census division, or parish compare with others in your state?

21. **OPEN ENDED** Construct a histogram that has a vertical line of symmetry and two gaps. Then construct a histogram that has a vertical line of symmetry and one gap.