

## 2.3

## Histograms

**NEW SKILLS: WORKING WITH HISTOGRAMS**

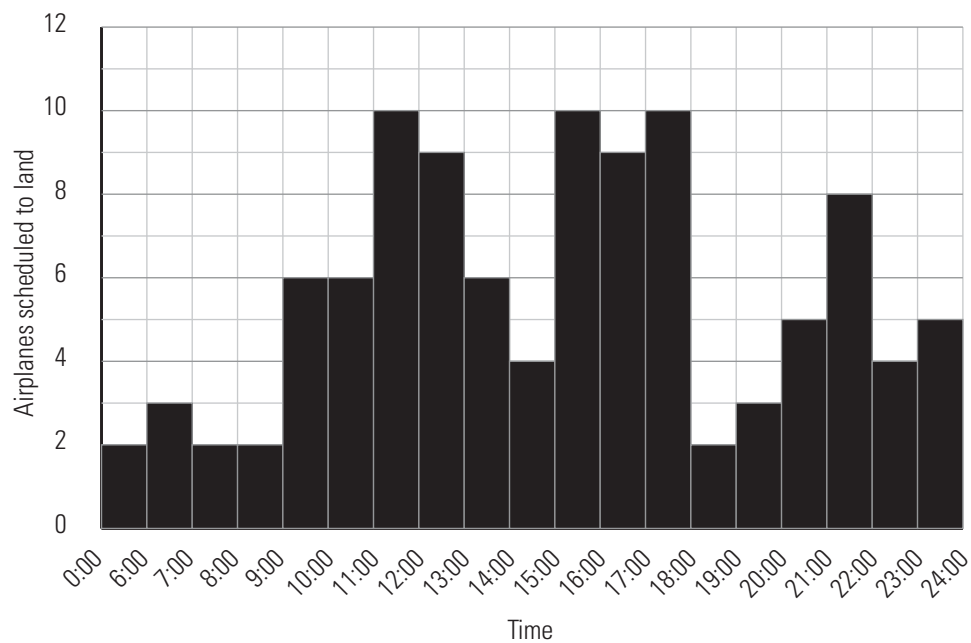
A histogram is like a bar graph except that it is used to represent continuous data so that the bars are touching. The width of each bar represents a range of numbers.

For more details, see page 85 of *MathWorks 11*.

**Example 1**

The histogram below shows the number of airplanes scheduled to arrive at the Calgary International Airport on a particular day.

**Number of Arrivals Scheduled, Calgary International Airport**



- How many airplanes are scheduled to arrive between 2:00 pm and 3:00 pm?
- What are the busiest times at the airport? How many airplanes are scheduled to arrive at these times?
- What is the quietest time?
- Are any airplanes scheduled to arrive between 4:00 am and 5:00 am?

**SOLUTION**

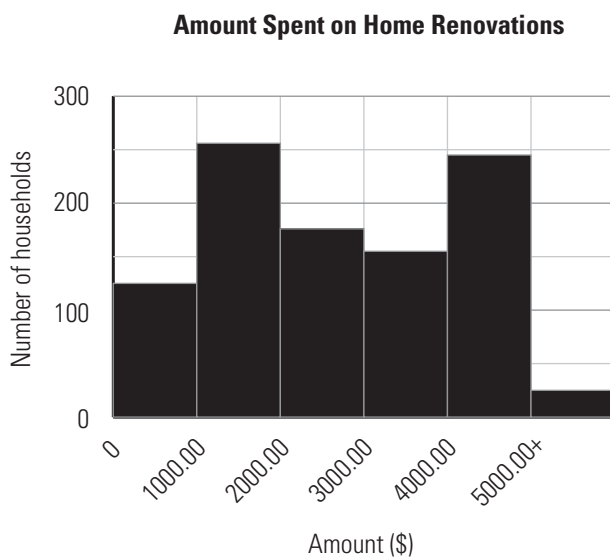
- Four airplanes are scheduled to arrive between 2:00 pm and 3:00 pm (14:00–15:00).
- The busiest times are between 11:00 and 12:00, between 15:00 and 16:00, and between 17:00 and 18:00. Ten airplanes are scheduled to arrive during each of these timeframes.
- The quietest time at the airport is from midnight (24:00) to 6:00 am. Although it looks like 7:00 to 8:00 and 8:00 to 9:00 are just as quiet, with only two arrivals as well, the interval for midnight to 6:00 am is larger than the others.
- The histogram shows that two planes arrived between midnight and 6:00 am, but you cannot be sure if one arrived at 4:00 am.



Airplane take-offs and landings must be carefully planned to ensure that they do not interfere with other airplanes' flight paths.

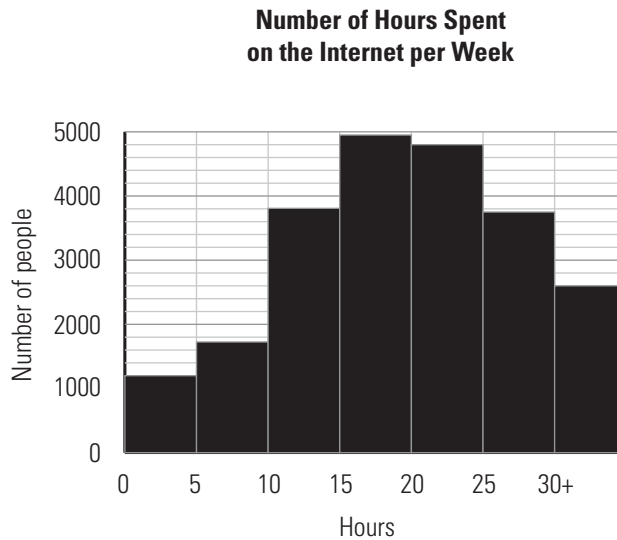
**BUILD YOUR SKILLS**

- The histogram below shows the amount of money that households in one province spent on home renovations during the past year.



- How many households spent less than \$1000.00 on renovations?
- What was the most common amount spent?
- What was the highest amount spent?

2. An internet service provider surveyed some of its customers across Canada to find out how much time people spend on the internet each week. The following histogram shows the results.



- How many people spend between 10 and 15 hours on the internet each week?
- How many people spend less than 15 hours on the internet each week?
- How many people spend more than 30 hours on the internet each week?
- Approximately how many people were surveyed?

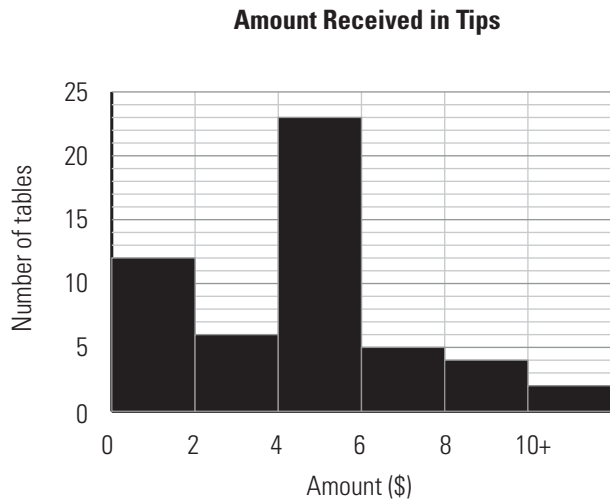
### Example 2

Arabella works as a server at a busy restaurant. She kept track of the amount of money she received in tips per table. Draw a histogram to represent the tips she received. What is more obvious from the histogram than in the table below?

Amount	Less than \$2.00	\$2.00–\$3.99	\$4.00–\$5.99	\$6.00–\$7.99	\$8.00–\$9.99	Over \$10.00
Number of tables	12	6	23	5	4	2

**SOLUTION**

To draw a histogram, put the intervals given for tip amounts on the horizontal axis. Choose a suitable scale for the vertical axis based on the number of tables. Here, since the maximum is 23, a suitable choice would be a scale of 1 or 2.



The variation in the number of people in each tip interval is more obvious from the graph than in the table.

**BUILD YOUR SKILLS**

3. An insurance company did a confidential survey of the ages of employees in a company, to estimate how many would be retiring in the coming years. The results are shown in the following table. Use the data to draw a histogram.

<b>SURVEY RESULTS, AGES OF EMPLOYEES</b>						
<i>Age</i>	<i>Less than 25</i>	<i>25–34</i>	<i>35–44</i>	<i>45–54</i>	<i>55–64</i>	<i>65 and older</i>
Number	1	6	8	16	24	6

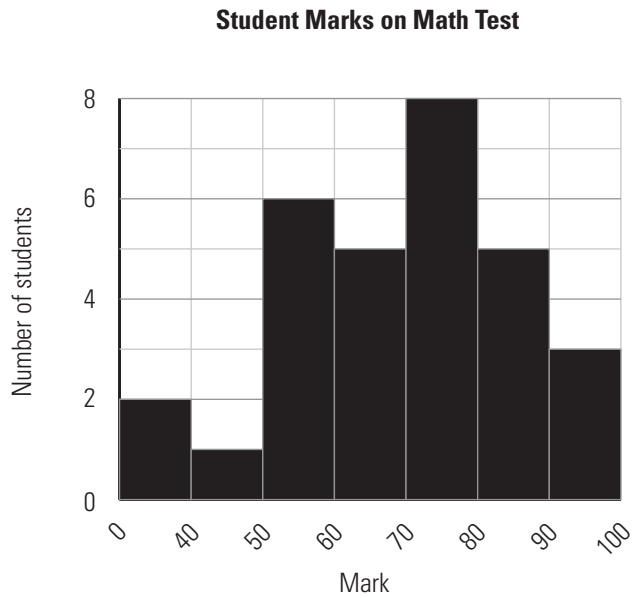
4. a) Draw a histogram to represent the ages of people attending a theatre presentation.

<b>AGES OF AUDIENCE MEMBERS AT THEATRE PRESENTATION</b>							
<i>Age</i>	<i>&lt;20</i>	<i>20–29</i>	<i>30–39</i>	<i>40–49</i>	<i>50–59</i>	<i>60–69</i>	<i>&gt;70</i>
Number of people	35	68	73	92	55	49	21

- b) How many people under the age of 30 attended the presentation?
- c) From the table, can you tell the age of the youngest audience member?  
Why or why not?

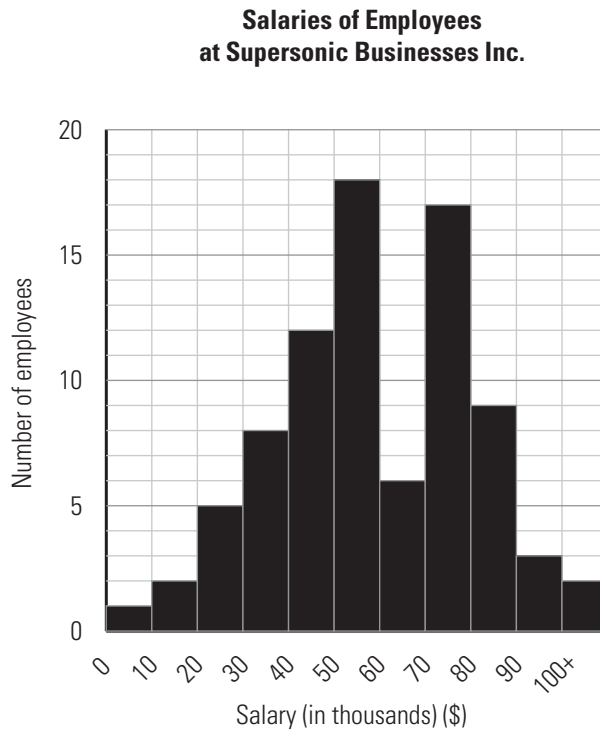
**PRACTISE YOUR NEW SKILLS**

1. The following histogram represents the scores of a math class on a recent test.



- a) How many students received a mark between 70% and 80%?
- b) How many students got below 60%?
- c) What was the highest mark received by a student?

2. The histogram below shows the salaries of the employees at Supersonic Businesses Inc.



a) How many employees earn over \$100 000.00?

b) How many employees earn between \$30 000.00 and \$50 000.00?

3. Rodney has recorded the housing sales over a period of time for his real estate company, Fixed Rate Real Estate. The data has been grouped based on the selling price.

<b>FIXED RATE REAL ESTATE HOUSING SALES</b>						
<i>Selling price (in thousands) (\$)</i>	<i>Less than 100</i>	<i>100–200</i>	<i>200–300</i>	<i>300–400</i>	<i>400–500</i>	<i>Over 500</i>
Number of houses	5	2	7	12	5	3

- a) Draw a histogram to represent the data.

- b) What was the lowest selling price?

- c) How many houses sold for between \$100 000.00 and \$300 000.00?



Real estate agents earn a commission on the houses they sell.



4. Hurricanes are more likely to occur at certain times of the year than at others. The table below indicates the percentage of hurricanes that began at different times of the year.

<b>HURRICANE OCCURRENCES, BY TIME OF YEAR</b>						
<i>Dates</i>	<i>Mar. 21– Jun. 20</i>	<i>Jun. 21– Jul. 20</i>	<i>Jul. 21– Aug. 20</i>	<i>Aug. 21– Sep. 20</i>	<i>Sep. 21– Oct. 20</i>	<i>Oct. 21– Nov. 20</i>
Percentage of hurricane occurrences	5	7	18	35	27	8

- a) Draw a histogram to represent the data.
- b) During what time of the year are hurricanes unlikely to occur?
- c) At what time of year is a hurricane most likely to occur?