

9-6

Box-and-Whisker Plots

Main IDEA

Display and interpret data in a box-and-whisker plot.



Targeted TEKS 8.12

The student uses statistical procedures to describe data. (C) Select and use an appropriate representation for presenting and displaying relationships among collected data, including line plots, line graphs, stem and leaf plots, circle graphs, bar graphs, **box and whisker plots**, histograms, and Venn diagrams, with and without the use of technology.

GET READY for the Lesson

WILDFIRES The table gives the number of acres burned in wildfires for various years.

1. What is the least value in the data?
2. What is the lower quartile of the data?
3. What is the median of the data?
4. What is the upper quartile of the data?
5. What is the greatest value in the data?
6. Name any outliers.

| Year | Number of Acres Burned |
|------|------------------------|
| 1871 | 3,780,000 |
| 1825 | 3,000,000 |
| 1910 | 3,000,000 |
| 1988 | 1,585,000 |
| 1881 | 1,000,000 |
| 1987 | 640,000 |
| 1903 | 637,000 |
| 1997 | 610,000 |

Source: National Interagency Fire Center

NEW Vocabulary

box-and-whisker plot

A **box-and-whisker plot** uses a number line to show the distribution of a set of data. The *box* is drawn around the quartile values, and the *whiskers* extend from each quartile to the extreme data points that are not outliers.

EXAMPLE Construct a Box-and-Whisker Plot

CONcepts in Motion

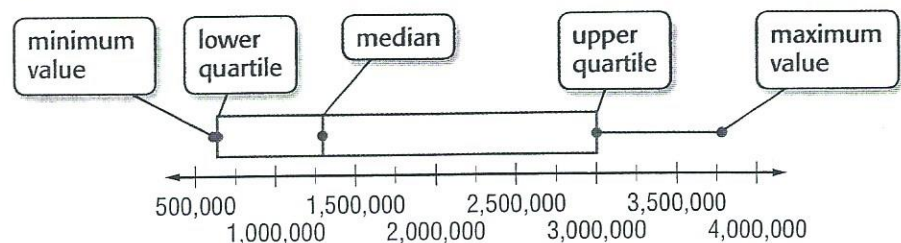
Animation tx.msmath3.com

- 1 **WILDFIRES** Use the data in the table above to construct a box-and-whisker plot.

Step 1 Draw a number line that includes the least and greatest number in the data.

Step 2 Mark the extremes, the median, and the upper and lower quartile above the number line.

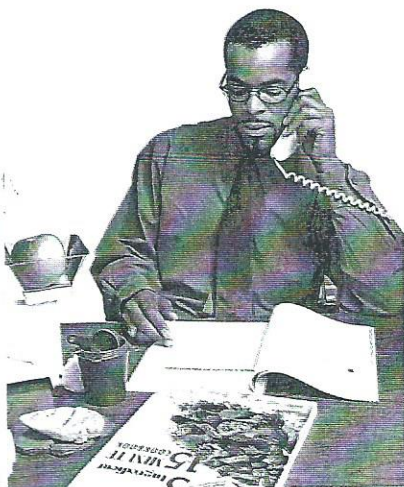
Step 3 Draw the box and the whiskers.



CHECK Your Progress

Construct a box-and-whisker plot for each set of data.

- a. Prices, in dollars, of admission to a hockey game:
42, 38, 42, 45, 43, 65, 55, 50, 34, 36, 40, 35
- b. Low temperatures for various cities:
52, 58, 67, 63, 47, 44, 52, 28, 49, 65, 52, 59



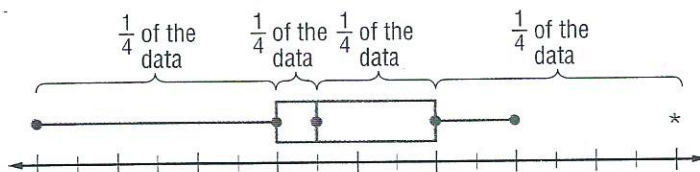
Real-World Career . . .
How Does a Dietitian Use Math?

Dietitians keep track of Calories, fat, salt, and nutrients in food. They use this information to help people maintain an appropriate diet.

Math Online

For more information, go to tx.msmath3.com.

Box-and-whisker plots separate data into four parts. Although the parts usually differ in length, each part contains one-fourth of the data.

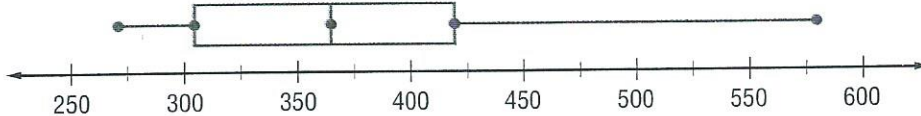


A long whisker or box indicates that the data in that quartile or quartiles have a greater range. A short whisker or box indicates the data in that quartile or quartiles have a lesser range. An asterisk (*) indicates an outlier and is not connected to a whisker.

EXAMPLE Interpret Data

- 2 DIET** What does the length of the box-and-whisker plot tell you about the data?

Calories in Fast-Food Sandwiches

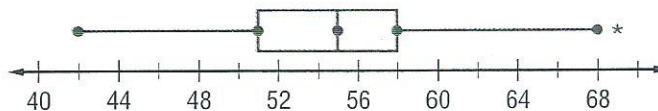


The median line seems to divide the box into two approximately equal parts, so data in the second and third quartiles are similarly spread out. The whisker at the right is longer than the other parts of the plot, so the data in the fourth quartile are more spread out.

CHECK Your Progress

- c. **WORK** Compare the lower quartile and the upper quartile of the data.

Average Daily Commute Time (minutes) to Work for Selected U.S. States

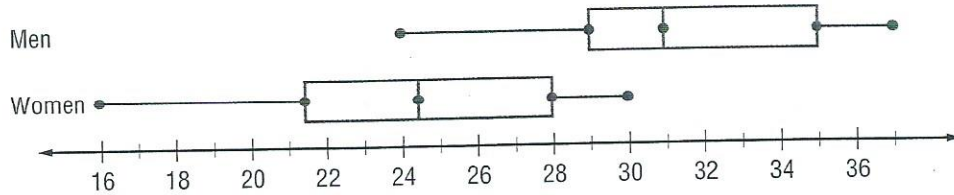


Source: U.S. Census Bureau

EXAMPLE Compare Data

- 3 OLYMPICS** Refer to the double box-and-whisker plot below. Were about half the men and women in the same age group? Justify your reasoning.

Ages of the U.S.A. 2002 Olympic Hockey Players



Source: USA Today

The youngest age of the men was 24 years, and the median was 31 years. So half of the men were 24 to 31 years old.

The median age of the women was 24.5 years, and the oldest age was 30. So half the women were 24.5 to 30 years old.

So, about half the men and women were in the same age group.

CHECK Your Progress

- d. **OLYMPICS** Describe the ages of the women compared to the ages of the men in the double box-and-whisker plot above.

CHECK Your Understanding

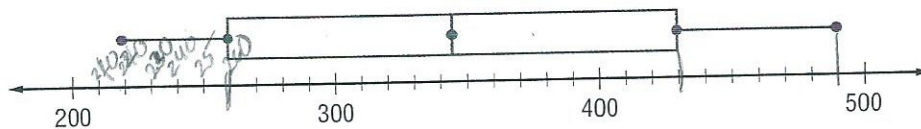
Example 1 Draw a box-and-whisker plot for each set of data.
(p. 497)

1. Hours per month volunteering at the community center:
38, 43, 36, 37, 32, 37, 29, 51

2. Points earned on a test:
100, 70, 70, 90, 50, 90, 50, 90,
100, 50, 90, 100, 90, 50, 25, 80

Example 2 **FOOD** For Exercises 3–4, use the following box-and-whisker plot.
(p. 498)

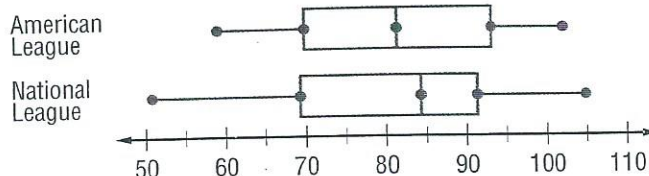
Calories in Muffins



3. What is the interquartile range of the data?
4. Three fourths of the muffins have at least how many Calories?

Example 3 **BASEBALL** Refer to the box-and-whisker plot below. In which league did more than half of the teams win more games than the other league? Justify your reasoning.
(p. 499)

Major League Baseball Team Wins, 2004



Source: mlb.com

Exercises

HOMEWORK HELP

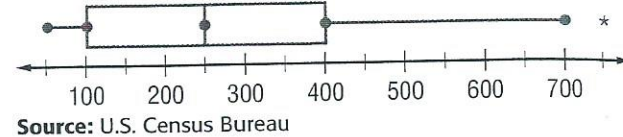
| For Exercises | See Examples |
|---------------|--------------|
| 6–9 | 1 |
| 10–13, 15 | 2 |
| 14, 16–18 | 3 |

Construct a box-and-whisker plot for each set of data.

- Ages of persons in line for a jazz concert:
49, 45, 55, 32, 28, 53, 26, 38, 35, 35, 51
- Speed, in miles per hour, of commercial airliners:
540, 460, 520, 350, 500, 480, 475, 525, 450, 515
- Number of miles between rest stops on a highway:
77, 85, 72, 76, 95, 90, 73, 82, 82, 80, 73
- Prices, in dollars, of plane tickets from Detroit to Atlanta:
225, 245, 220, 270, 350, 280, 230, 240, 225, 270

HISTORY For Exercises 10 and 11, use the box-and-whisker plot at the right.

Population of Thirteen Original States, 1790 (thousands)

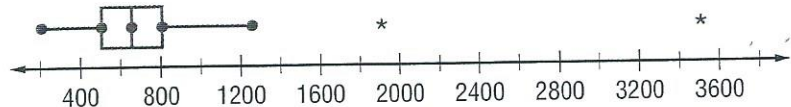


Source: U.S. Census Bureau

- Approximately what percent of the states had populations greater than 100,000?
- How does the length of the whisker after the upper quartile represent the data?

ZOOS For Exercises 12 and 13, use the following box-and-whisker plot.

Areas (acres) of the Ten Largest Zoos in the United States

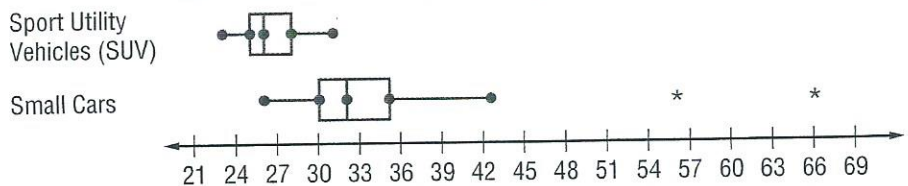


Source: *The Sacramento Bee*

- How many outliers are in the data?
- Describe the distribution of the data. What can you say about the areas of the major zoos in the U.S.?

GAS MILEAGE For Exercises 14–18, use the box-and-whisker plot below.

Highway Gas Mileage (miles per gallon) for 2006 Models



Source: fuelconomy.gov

- Which set of data has a greater range?
- How many outliers are in the data?
- What percent of the SUVs get at least 28 miles per gallon?
- What percent of the small cars get at least 30 miles per gallon?
- In general, do SUVs get more or less gas mileage than small cars? Justify your reasoning.



Real-World Link

The first official count of the U.S. population was conducted in 1790 by federal marshals on horseback. It took 18 months to question and record the answers of the 3.9 million U.S. inhabitants in notebooks or on bits of paper.

Source: Population Resource Center