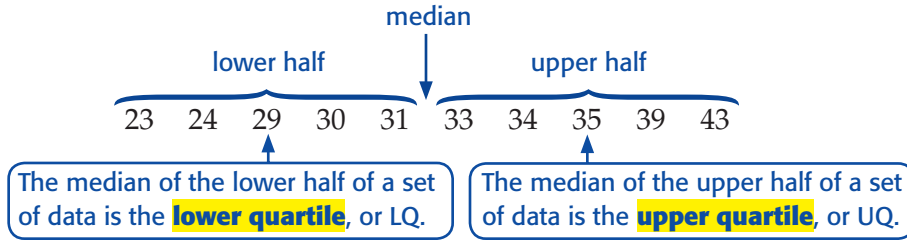
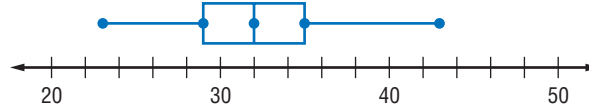


# Box-and-Whisker Plots

In a set of data, **quartiles** are values that divide the data into four equal parts.



To make a **box-and-whisker plot**, draw a box around the quartile values, and lines or *whiskers* to represent the values in the lower fourth of the data and the upper fourth of the data.

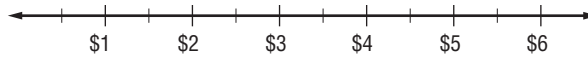


## EXAMPLE

**1 MONEY** The amount spent in the cafeteria by 20 students is shown. Display the data in a box-and-whisker plot.

Amount Spent			
\$2.00	\$2.00	\$1.00	\$4.00
\$1.00	\$2.50	\$2.50	\$2.00
\$2.50	\$1.00	\$4.00	\$2.50
\$3.50	\$2.00	\$3.00	\$2.50
\$4.00	\$4.00	\$5.50	\$1.50

**Step 1** Find the least and greatest number. Then draw a number line that covers the range of the data. In this case, the least value is 1 and the greatest value is 5.5.



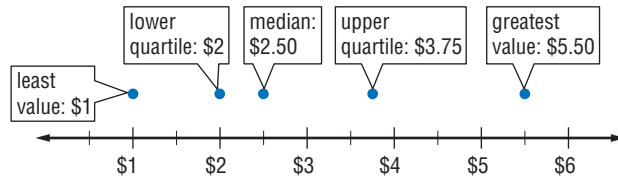
**Step 2** Find the median, the extreme values, and the upper and lower quartiles. Mark these points above the number line.

1, 1, 1, 1.5, 2, 2, 2, 2, 2.5, 2.5, 2.5, 2.5, 2.5, 3, 3.5, 4, 4, 4, 4, 5.5

$$LQ = \frac{2 + 2}{2} \text{ or } 2$$

$$M = \frac{2.5 + 2.5}{2} \text{ or } 2.5$$

$$UQ = \frac{3.5 + 4}{2} \text{ or } 3.75$$



**Step 3** Draw a box and the whiskers.



The **interquartile range (IQR)** is the range of the middle half of the data and contains 50% of the data in the set.

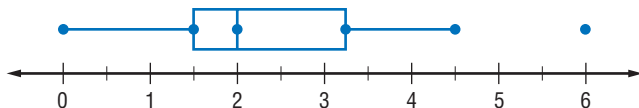
$$\text{Interquartile range} = UQ - LQ$$

The interquartile range of the data in Example 1 is  $3.75 - 2$  or 1.75.

An **outlier** is any element of a set that is at least 1.5 interquartile ranges less than the lower quartile or greater than the upper quartile. The whisker representing the data is drawn from the box to the least or greatest value that is not an outlier.

**EXAMPLE**

- 2 SCHOOL** The number of hours José studied each day for the last month is shown in the box-and-whisker plot below.



- a. **What percent of the data lies between 1.5 and 3.25?**  
The value 1.5 is the lower quartile and 3.25 is the upper quartile. The values between the lower and upper quartiles represent 50% of the data.
- b. **What was the greatest amount of time José studied in a day?**  
The greatest value in the plot is 6, so the greatest amount of time José studied in a day was 6 hours.
- c. **What is the interquartile range of this box-and-whisker plot?**  
The interquartile range is  $UQ - LQ$ . For this plot, the interquartile range is  $3.25 - 1.5$  or 1.75 hours.
- d. **Identify any outliers in the data.**  
An outlier is at least  $1.5(1.75)$  less than the lower quartile or more than the upper quartile. Since  $3.25 + (1.5)(1.75) = 5.875$ , and  $6 > 5.875$ , the value 6 is an outlier, and was not included in the whisker.