

Measures of Variation

Measures of variation are used to describe the distribution, or spread, of the data. They describe how the values of a data set vary with a single number. A quartile is one measure of variation.

Measures of Variation

Quartiles are values that divide the data set into four equal parts.

First and Third Quartiles

The first and third quartiles are the medians of the data values less than the median and the data values greater than the median, respectively.

Interquartile Range (IQR)

The distance between the first and third quartiles of the data set.

Range

The difference between the greatest and least data values.

$$\text{Median} = Q_2$$

$$Q_3 - Q_1$$

$$\frac{3+4}{2} = \frac{7}{2}$$

Measures of variation of a data set are shown below.

$$\text{Median} = 3.5$$

$$Q_1 = 1.5$$

$$Q_3 = 6.5$$

$$\text{IQR} = 6.5 - 1.5 = 5$$

$$\text{Range} = 8 - 0 = 8$$



The median of the data values less than the median is the first quartile or Q_1 ; in this case, 1.5.

The median of the data values greater than the median is the third quartile or Q_3 ; in this case, 6.5.

① List data from $L \rightarrow G$

② Find Median (Q_2)

③ Identify the lower & upper halves.

④ Find Q_1 & Q_3 .

One fourth of the data lie below the first quartile and one fourth of the data lie above the third quartile. So, one half of the data lie between the first quartile and third quartile.

Interquartile Range

If the interquartile range is low, the middle data are grouped closely together.

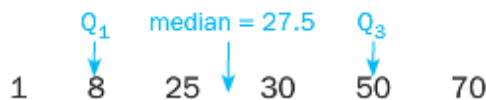
Show your work.

Example

1. Find the measures of variation for the data.

Range 70 - 1 or 69 mph

Quartiles Order the numbers.



Interquartile Range 50 - 8 or 42 $Q_3 - Q_1$

The range is 69, the median is 27.5, the first quartile is 8, the third quartile is 50, and the IQR is 42.

Animal	Speed (mph)
cheetah	70
lion	50
cat	30
elephant	25
mouse	8
spider	1



Got It? Do this problem to find out.

- a. Determine the measures of variation for the data ~~64~~, ~~61~~, ~~67~~, ~~59~~, ~~60~~, ~~58~~, ~~57~~, ~~71~~, ~~56~~, and ~~62~~.

~~56~~, ~~57~~, 58, ~~59~~, ~~60~~, ~~61~~, ~~62~~, 64, ~~67~~, ~~71~~

$$M = 60.5$$

$$Q_3 = 64$$

$$R = 71 - 56 = 15$$

$$Q_1 = 58$$

$$IQR = 64 - 58 = 6$$

Guided Practice

1. The average wind speeds for several cities in Pennsylvania are given in the table. (Examples 1 and 2)
- a. Find the range of the data. 3.5
- b. Find the median and the first and third quartiles.
8.9; 7.6; 9.5
- c. Find the interquartile range. 1.9
- d. Identify any outliers in the data. none
- e. Use the measures of variation to describe the data set.
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Wind Speed	
Pennsylvania City	Speed (mph)
Allentown	8.9
Erie	11.0
Harrisburg	7.5
Middletown	7.7
Philadelphia	9.5
Pittsburgh	9.0
Williamsport	7.6