

Range and Interquartile Range (IQR)

by Sophia



WHAT'S COVERED

This tutorial will explain the range and interquartile range (IQR). Our discussion breaks down as follows:

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1. Range

2. Interquartile Range

1. Range

One measure of variation is **range**. The range is one of the simplest ways to calculate variation. It is calculated by simply subtracting the minimum value from the maximum value.



FORMULA TO KNOW

Range

Maximum Value – Minimum Value

↪ **EXAMPLE** This chart shows the height of the Chicago Bulls basketball team for a particular year:

| Height of Chicago Bulls Players | |
|---------------------------------|----|
| Omer Asik | 84 |
| Carlos Boozer | 81 |
| Ronnie Brewer | 79 |
| Jimmy Butler | 79 |
| Luol Deng | 81 |
| Taj Gibson | 81 |
| Richard Hamilton | 79 |

| | |
|------------------|----|
| Mike James | 74 |
| Kyle Korver | 79 |
| John Lucas III | 71 |
| Joakim Noah | 83 |
| Derrick Rose | 75 |
| Brian Scalabrine | 81 |
| Marquis Teague | 74 |
| C.J. Watson | 74 |

It's easy to see from the list that the minimum value is 71 and the maximum value is 84. The range is actually the easiest measure of spread or variation to find: take the maximum value (in this case, the tallest person) and subtract the minimum value (in this case, the shortest person).

Therefore, 84 minus 71 equals 13 inches. This means that every individual on the team falls within a 13-inch range.



TERM TO KNOW

Range

The difference between the largest and smallest number in a data set.

2. Interquartile Range

Range and **interquartile range** are similar ideas in that they're both measured by subtraction, so they're not particularly difficult to calculate. While they are calculated similarly, they do measure different measures of variation.

The interquartile range, also abbreviated IQR, is another measure of spread, but it's median based. To review, the median is the middle number of an ordered data set.

The IQR represents the range in which the middle 50% of the data points lie. Finding the interquartile range takes a few steps.



STEP BY STEP

Step 1: First, order the data set from smallest to largest and then work your way in towards the center until you find the median.

71, 74, 74, 74, 75, 79, 79, 79, 81, 81, 81, 81, 83, 84

The median, in this case, is 79.

Step 2: Once you identify the two data sets on either side of the median--a small half and a high half--you can find the middle number of each of those halves. These three numbers together are called the quartiles.

- The first quartile, or Q1, is where 1/4 of the data falls at or below this point.
- The median, which can also be called the second quartile (Q2), is where half the data falls at or below this point.
- The third quartile, or Q3, is where 3/4 of the data falls at or below this point.

With this data set:

71, 74, 74, 74, 75, 79, 79, 79, 79, 81, 81, 81, 81, 83, 84,

- Q1 = 74
- Q2 (median) = 79
- Q3 = 81

Step 3: Finally, to calculate the interquartile range, find the difference between the third and first quartiles.



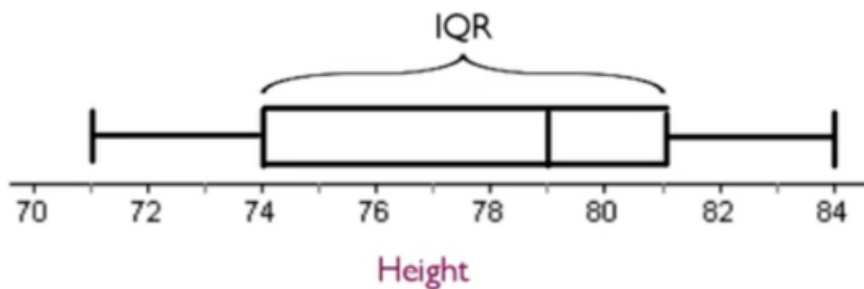
FORMULA TO KNOW

Interquartile Range

$$IQR = Q_3 - Q_1$$

Going back to our example, the IQR is calculated as Q3 minus Q1, or 81 minus 74, which equals 7 inches. This means that the middle half of the data set falls within a 7-inch range, whereas the entire data set falls within a 13-inch range.

Visually, the IQR is the box on a box plot, shown below:



The range gives the entire spread of the data set lowest to highest whereas the IQR gives the range of the middle 50%.



HINT

The advantage of using IQR over the range is if there are outliers, which would disproportionately affect the range, the IQR will not be affected by them.



TERM TO KNOW

Interquartile Range

The difference between the third and first quartiles. It represents the range in which the middle 50% of the data points lie.



SUMMARY

The range is not the most useful measure of variation, but it is the easiest to calculate. The interquartile range is more useful and measures the range of the middle 50%, the most typical middle 50% of the data. It's a useful measure of spread for distributions with outliers or skewed distribution. In fact, you should use IQR as your measure of variation when those factors are a concern. Because the IQR is based on finding the median, it should only be used as the measure of spread when the median is the measure of center. You should not, for instance, use the mean as the measure of center and then report IQR as the measure of spread.

Good luck!

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TERMS TO KNOW

Interquartile Range

The difference between the third and first quartiles. It represents the range in which the middle 50% of the data points lie.

Range

The difference between the largest and smallest number in a data set.



FORMULAS TO KNOW

Interquartile Range

$$IQR = Q_3 - Q_1$$

Range

$$\text{Maximum Value} - \text{Minimum Value}$$