

## Interquartile Range

### Starter

#### Review of the median

The **median** is the middle number when values are written in **ascending (or descending) order**. If there is an **even number of values**, the **median** is the **mean average of the two middle values**.

1. Find the median for the following data:

(a) 7, 2, 9, 4, 8, 1, 5

(b) 12, 11, 19, 15, 17, 14

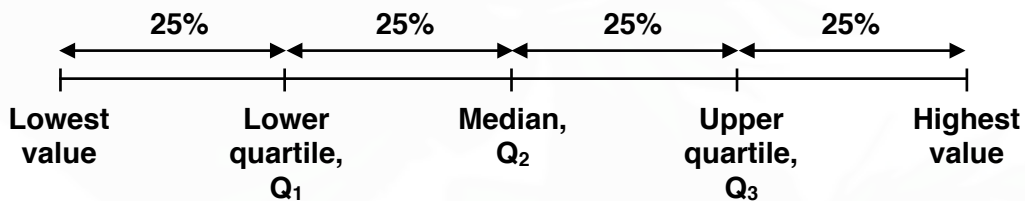
### Notes

The **median** is the value that is **half-way** along the data values, when written in ascending order. It is sometimes called the “second quartile”, denoted  $Q_2$ , because it is **two-quarters** of the way along.

$$\text{Median, } Q_2 = \frac{1}{2}(n + 1)\text{th value} \quad \text{where } n \text{ is the number of data values}$$

### Quartiles

The **upper and lower quartiles** are two useful statistical values which, along with the median, help to split the data into quarters.



25% of the data are between the lowest value and the **lower quartile** ( $Q_1$ ).

25% of the data are between the **lower quartile** ( $Q_1$ ) and the median ( $Q_2$ ) etc.

Important: 50% of the data are between the **lower quartile** ( $Q_1$ ) and the **upper quartile** ( $Q_2$ ).

**N.B.** It does not mean though that the data is evenly spread out

#### How to find the upper and lower quartiles

$$\text{Lower quartile, } Q_1 = \frac{1}{4}(n + 1)\text{th value}$$

$$\text{Upper quartile, } Q_3 = \frac{3}{4}(n + 1)\text{th value}$$

**N.B.** The **lower quartile**,  $Q_1$ , is the value that is **one-quarter** of the way along  
The **upper quartile**,  $Q_3$ , is the value that is **three-quarters** of the way along  
The data must be in **ascending order**

### Interquartile range

The **interquartile range**, **IQR**, is the range of the **middle 50%** of the data set.

$$\text{Interquartile range} = \text{Upper quartile} - \text{Lower quartile} = Q_3 - Q_1$$

The **interquartile range** is a useful measure when there are **extreme values** at either or both the ends.

**E.g. 1** For the data values 7, 9, 9, 13, 13, 17, 18, 20, 27, 28, 81 find:

- (a) the median
- (b) the upper and lower quartiles
- (c) the interquartile range

**Working:** (a) The middle value is 17 so median = 17

(b) The number of values is 11 so  $n = 11$

$$Q_1 = \frac{1}{4}(n + 1)\text{th value} = \frac{1}{4}(11 + 1)\text{th value} = 3\text{rd value}$$

So the lower quartile,  $Q_1 = 9$

$$Q_3 = \frac{3}{4}(n + 1)\text{th value} = \frac{3}{4}(11 + 1)\text{th value} = 9\text{th value}$$

So the upper quartile,  $Q_3 = 27$

(c)  $\text{IQR} = Q_3 - Q_1 = 27 - 9 = 18$

**N.B.** The range for these data values is  $81 - 7 = 74$  but due to the extreme value (81), it does not represent the data very well

The IQR is a better description of the spread of the data

**E.g. 2** Calculate the IQR for the values: 80 70 34 21 21 56 75 89 84 20 17 45 87

**Video:** [Quartiles and interquartile range](#)

[Solutions to Starter and E.g.s](#)

### Exercise

9-1 class textbook:	p477 E14.1 Qu 1-6
A*-G class textbook:	p433 M14.6 Qu 1-6
9-1 homework book:	p477 E14.1 Qu 1-6
A*-G homework book:	p122 M14.6 Qu 1-4

### Summary

$$\text{Median, } Q_2 = \frac{1}{2}(n + 1)\text{th value}$$

$$\text{Lower quartile, } Q_1 = \frac{1}{4}(n + 1)\text{th value}$$

$$\text{Upper quartile, } Q_3 = \frac{3}{4}(n + 1)\text{th value}$$

$$\text{Interquartile range} = \text{Upper quartile} - \text{Lower quartile} = Q_3 - Q_1$$

[Homework book answers \(only available during a lockdown\)](#)