Measures of Spread

Understanding Measures of Spread

Measures of spread describe **how spread out** the data is.

Three common measures of spread are:

Measure	Meaning	Best used when
Range	The difference between the highest and lowest values	Initial measure to assess overall spread of data
Interquartile range	The spread of the middle 50% of the data	The data contains outliers or extreme values
Five-number summary	Provides a summary of the data distribution	Creating box plots and comparing datasets

1. Range

The range is the difference between the highest and lowest values.

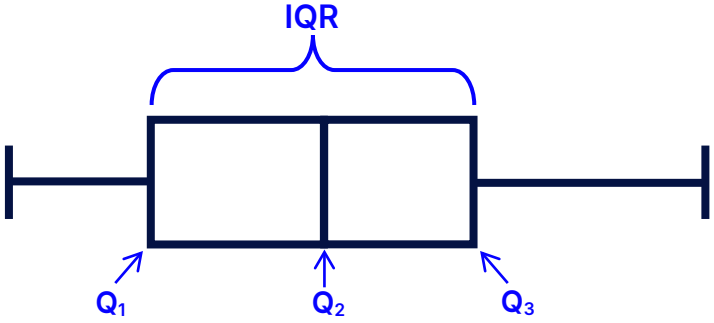
- A **small range** means the data is close together
- A **large range** means the data is spread out

Formula	Example
Range = maximum – minimum	Data: 5, 7, 9, 12, 18 Min = 5 Max = 18 $18 - 5 = 13$ Range = 13

2. Interquartile Range (IQR)

The Interquartile Range (IQR) measures the spread of the middle 50% of the data.

It is less affected by outliers.



Q_1: Middle of the lower half
Q_2: Median of the whole data set
Q_3: Middle of the upper half

Formula

$$IQR = Q_3 - Q_1$$

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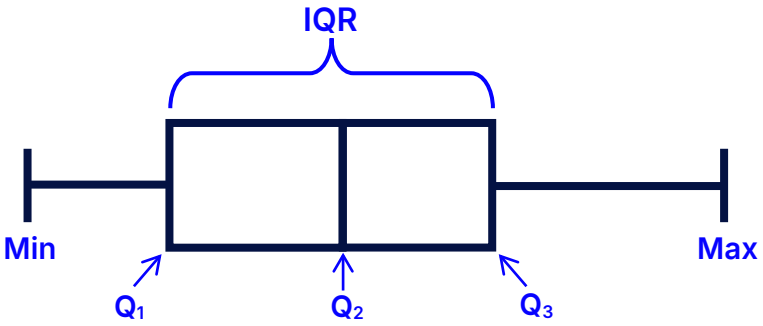
3. Five-number Summary

To find the range and IQR, you need:

1. Minimum value
2. Q_1 (Lower Quartile)
3. Q_2 (Median)
4. Q_3 (Upper Quartile)
5. Maximum value



This is called the **five-number summary**, which can be visually displayed in a box plot to compare the spread, consistency, and possible outliers in data sets.

Steps	Example
1. Put the data in order	10, 4, 9, 12, 18, 7, 15 ↓ 4, 7, 9, 10, 12, 15, 18
2. Find the median (Q_2)	4, 7, 9, **10**, 12, 15, 18 $Q_2 = 10$
3. Find the Q_1	4, **7**, 9, 10, 12, 15, 18 $Q_1 = 7$
4. Find the Q_3	4, 7, 9, 10, 12, **15**, 18 $Q_3 = 15$
5. Write the five-number summary	1. Min = 4 2. $Q_1 = 7$ 3. $Q_2 = 10$ 4. $Q_3 = 15$ 5. Max = 18
6. Find the range	Range = maximum – minimum = 18 – 4 Range = 14
7. Find the IQR	IQR = $Q_3 - Q_1$ = 15 - 7 IQR = 8

Comparing Data Sets

When comparing data sets:

- The **smaller** the range or IQR, the **more consistent** the data
- The **larger** the range or IQR, the **more spread out** the data

Related Helpsheets

- Standard Deviation
- Measures of Centre

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