

Cumulative frequency and box plots

Topic cliff notes / objectives, key ideas and examples

Learning objectives

- Estimate a median and quartiles from cumulative frequency.
- Compare the centre and spread of distributions using box plots.

Key ideas

- Cumulative frequency is a running total; plot it against upper class boundaries.
- For grouped graphs, locate quartiles using these cumulative frequency positions.

$$Q_1 : \frac{N}{4}, \quad \text{median} : \frac{N}{2}, \quad Q_3 : \frac{3N}{4}$$

- The interquartile range measures the spread of the middle half.

$$\text{IQR} = Q_3 - Q_1$$

- A box plot shows minimum, lower quartile, median, upper quartile and maximum. Compare centre and spread separately.

Worked example

For 80 journeys, readings at cumulative frequencies 20, 40 and 60 are 18, 26 and 34 minutes. Estimate the median and interquartile range.

$$\frac{80}{4} = 20, \quad \frac{80}{2} = 40, \quad \frac{3(80)}{4} = 60$$

$$Q_1 \approx 18, \quad \text{median} \approx 26, \quad Q_3 \approx 34 \text{ minutes}$$

$$\text{IQR} \approx 34 - 18$$

Answer

$$\text{median} \approx 26 \text{ minutes}, \quad \text{IQR} \approx 16 \text{ minutes}$$

Quick example

The lower quartile is sixteen and the upper quartile twenty-nine. Find the interquartile range.

$$\text{IQR} = Q_3 - Q_1 = 29 - 16$$

Answer

$$13$$

Watch out

Read the median at half the total cumulative frequency. Graph readings are estimates; interquartile range is not the full range.

