Statistics and probability

OxfordAQA International GCSE Mathematics 9260 unit 3.4: statistics, Core and Extension

Statistics and probability

- recognise types of data and read tables, including two-way tables;
- draw and interpret charts, including histograms with **unequal class intervals** (Extension);
- draw cumulative frequency diagrams and box plots (Extension);

Statistics and probability (2)

- find the **mean**, median, **mode** and **modal class**, including estimates for grouped data;
- find quartiles, the inter-quartile range and percentiles, and compare distributions (Extension).

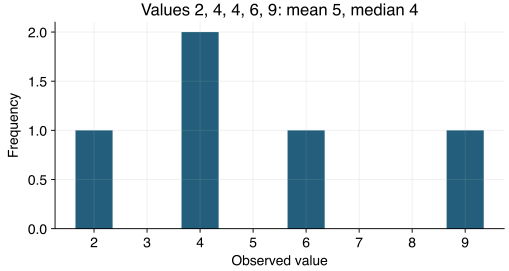
Data types, tables and charts

- **qualitative** data are words or categories, such as favourite fruit
- **discrete** data are counted and take separate values, such as the number of goals
- **continuous** data are measured and can take any value in a range, such as height.

Data types, tables and charts (2)

- Start with the cell you know: 7 play both.
- Cricket but not tennis: $18 - 7 = 11$. Tennis but not cricket: $15 - 7 = 8$. Neither: $30 - 7 - 11 - 8 = 4$.

Figure: Data types, tables and charts



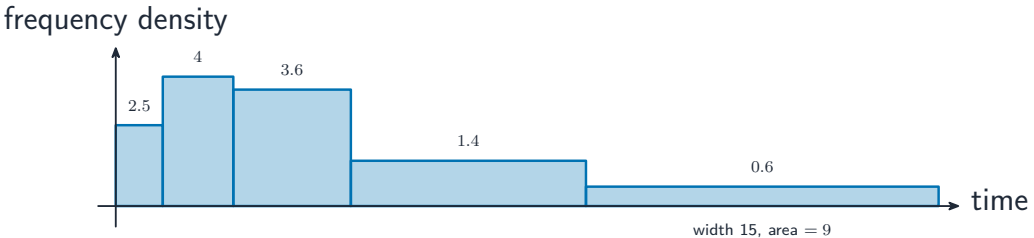
- For 2, 4, 4, 6, 9: **mean** $= 25 \div 5 = 5$
- Median $= 4$, **mode** $= 4$

Extension diagrams: unequal histograms, CF and box plots

- (Extension) A **histogram** can have **unequal class intervals** .
- Then the height of each bar is the **frequency density** :
- The area of each bar is the frequency.
- For classes of widths 2, 3, 5, 10 and 15 with frequencies 5, 12, 18, 14 and 9, the heights are 2.5, 4, 3.6, 1.4 and 0.6.

$$\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$$

Figure: Extension diagrams: unequal histograms, CF and box plots



area = frequency: height is
density = frequency over width

- Height = **frequency density**
- Area of each bar = frequency

Averages, quartiles and percentiles

- the **mean** : the total divided by the number of values
- the **median** : the middle value when the data are in order
- the **mode** : the most common value.

Averages, quartiles and percentiles (2)

- The midpoints are 2, 6, 10 and 16, so $\sum fx = 10 + 48 + 40 + 48 = 146$.
- Estimated **mean** $= 146 \div 20 = 7.3$ kg.
- The last class is wider, so compare frequency densities: $\frac{5}{4} = 1.25$, $\frac{8}{4} = 2$, $\frac{4}{4} = 1$, $\frac{3}{8} = 0.375$. The **modal class** is $4 < m \leq 8$.

Averages, quartiles and percentiles (3)

- The median is the 30th value: $20 + 5 \times \frac{30-27}{42-27} = 21$ hours.
- Q_1 is the 15th value: $10 + 5 \times \frac{15-6}{17-6} = 14.1$ hours.
- Q_3 is the 45th value: $25 + 5 \times \frac{45-42}{60-42} = 25.8$ hours.
- **Inter-quartile range** $= 25.8 - 14.1 = 11.7$ hours.

Sources for this lesson

- OxfordAQA, *International GCSE Mathematics (9260) specification*, for first assessment 2018, unit 3.4.
- OxfordAQA, 9260 specimen Papers 1 and 2 (Extension), 2016 (adapted).
- F. Nightingale, *Notes on Matters Affecting the Health, Efficiency, and Hospital Administration of the British Army* (London, 1858).

Common errors

- Adding the two groups in a **two-way table** without taking off the overlap.
- Pie chart angles that do not add up to $360°$.
- Using frequency as the height of a **histogram** bar when the class widths differ.

Common errors (2)

- Plotting cumulative frequency at the class midpoint instead of the upper end.
- Dividing $\sum fx$ by the number of classes instead of the total frequency.
- Comparing distributions with numbers only, without saying what they **mean**.

Key terms

- **Discrete**: data that can only take separate values, usually counted.
- **Continuous**: data that are measured and can take any value in a range.
- **Frequency density**: frequency divided by class width.

Key terms (2)

- **Box plot**: a diagram of the minimum, quartiles, median and maximum.
- **Inter-quartile range**: the upper quartile minus the lower quartile.

Check yourself

- 1.
- Is the time taken to run 100 m **discrete** or **continuous**? 2.
- In a pie chart for 72 people, 18 chose blue.
- Find the angle of the blue sector. 3.