Chapter 23

Data tables charts averages and range

Learn the ideas below, follow each worked example, then attempt the practice before checking the answers.

23.1 Collecting and organising data

Data are values or observations collected to answer a question. Categorical data describe groups; numerical data describe quantities. Discrete numerical data are counted, while continuous data are measured. A frequency table records how often each value or category occurs. A fair sample should represent the population being studied.

Worked example Eye colour is categorical, number of siblings is discrete and height is continuous. If scores are 2, 3, 2, 4, 3, 2, the frequencies are 2: three, 3: two and 4: one. The total frequency is 6.

23.2 Bar charts pictograms and line graphs

Bar charts compare categories using separated bars. A pictogram uses a key, and part of a symbol may represent part of the key value. Line graphs display change across an ordered variable such as time. Give a title, labels, units and a consistent scale. Histograms show grouped continuous data with touching bars; unequal class widths require frequency density.

Worked example If one pictogram symbol represents 4 books, three and a half symbols represent 14 books. A bar reaching 25 on a scale increasing by 5 represents 25 items, not five items.

23.3 Pie charts and proportions

A pie chart shows parts of one whole. Sector angle = category frequency divided by total frequency, multiplied by 360°. All sector angles should total 360°. Compare proportions carefully when charts have different totals. A larger sector does not automatically mean a larger count across different groups.

Worked example In a class of 30, 12 choose football. The sector angle is $\frac{12}{30} \times 360° = 144°$. The percentage is $\frac{12}{30} \times 100\% = 40\%$.

23.4 Mean and weighted mean

The mean is the sum of values divided by the number of values. For a frequency table, multiply each value by its frequency, add the products and divide by total frequency. The mean uses every value and can be affected strongly by an extreme value.

Worked example For values 1, 2 and 3 with frequencies 2, 3 and 1, the total is $1 \times 2 + 2 \times 3 + 3 \times 1 = 11$. Total frequency is 6, so mean = $\frac{11}{6} = 1\ \frac{5}{6}$.

23.5 Median mode and range

Order data before finding the median. For an odd count, take the middle value; for an even count, average the middle two. The mode is the most frequent value and may be absent or not unique. Range = maximum − minimum and measures spread.

Worked example For 2, 4, 4, 7, 8, 11, the median is $(4 + 7) \div 2 = 5.5$, the mode is 4 and the range is $11 - 2 = 9$. The mean is $36 \div 6 = 6$.

23.6 Choosing and interpreting summaries

Use an average to describe a typical value and a measure of spread to describe variability. The median can be more representative when an extreme value pulls the mean away from most data. Check sample size and graph scales before drawing a conclusion. A truncated vertical axis can exaggerate differences visually.

Worked example Incomes 20, 22, 23, 25 and 210 have median 23 but mean 60. The unusually large value 210 raises the mean. Reporting the median and range gives more context than the mean alone.

Chapter 23 practice

Work in your notebook. Show your method and include units where needed.

1. Find the mean of 6, 8, 10 and 12.
2. Find the median of 9, 3, 7, 5 and 11.
3. Find the mode and range of 2, 5, 5, 6, 9.
4. A category contains 15 of 60 observations. Find its pie chart angle.
5. Scores 2 and 5 have frequencies 3 and 2. Find the mean.

Answers with methods

1. Sum = 36, count = 4, so mean = 9.

2. Ordered data are 3, 5, 7, 9, 11. The median is 7.

3. Mode = 5. Range = 9 − 2 = 7.

4. $\frac{15}{60} \times 360° = 90°$.

5. $(2 \times 3 + 5 \times 2) \div 5 = 16 \div 5 = 3.2$.

Common mistake to avoid

The mean is not the sum divided by the number of different values. Divide by the total number of observations, including repeated values.