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## Of Questions and Statements

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Statistical thinking involves making claims or summaries about phenomena using numerical values, proportions, probabilities, or predictions. A **statistical statement** is such a claim expressed numerically. A **statistical question** is one that can be answered by collecting and analyzing data.

For example, the question "How tall are Grade 7 students in our school?" is statistical because it requires data collection and analysis. In contrast, "Do you like reading?" is not statistical as it is subjective and not based on numerical data.

Examples of statistical questions include:

- What fraction of the students in your class like walking up a hill?
- What was the rainfall pattern in Barmer last year?

Non-statistical questions include:

- What is the price of a tennis ball in India?

- Do you like reading?

The study of statistics involves collecting, organizing, analyzing, interpreting, and presenting data to answer such questions.

## Practice Set

- Identify which of the following are statistical questions: (a) What is the price of a tennis ball in India? (b) How old are the dogs that live on this street? (c) What fraction of the students in your class like walking up a hill? (d) Do you like reading? (e) Approximately how many bricks are in this wall? (f) Who was the best bowler in the match yesterday? (g) What was the rainfall pattern in Barmer last year?

## Answer Key

- Statistical questions: (b), (c), (e), (g)
- Non-statistical questions: (a), (d), (f)

## Quick Reference

- **Statistical statement:** Numerical claim about a phenomenon.
- **Statistical question:** Question answerable by data collection and analysis.

## Glossary

- **Statistical statement:** A claim expressed numerically about data.
- **Statistical question:** A question that requires data to answer.

## Representative Values

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When comparing groups of numbers, a single number can represent the group to summarize performance or characteristics. The **arithmetic mean** or **average** is commonly used for this purpose.

**Formula for Arithmetic Mean (Average):**

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Number of values}}$$

For example, if a player scores runs in matches as 110 runs in 5 matches, the average runs per match is:

$$\frac{110}{5} = 22$$

This helps compare performances even when the number of matches played differs.

## Worked Illustration

Given runs scored by two players in a series:

Match	Player A	Player B
1	0	67
2	38	45
3	90	20
4	0	43

Calculate the average for each player:

Player A total runs =  $0 + 38 + 90 + 0 = 128$ ; matches played = 4

$$\text{Mean}_A = \frac{128}{4} = 32$$

Player B total runs =  $67 + 45 + 20 + 43 = 175$ ; matches played = 4

$$\text{Mean}_B = \frac{175}{4} = 43.75$$

Player B has a higher average.

## Practice Set

- Calculate the average runs per match for a player who scored 5, 10, 15, 20, and 25 runs in 5 matches.
- Two groups collected guavas: Group 1 collected 3, 8, 10, 5, 4; Group 2 collected 5, 4, 6, 3, 4, 8. Find the average guavas per person if Group 1 has 5 members and Group 2 has 6 members.
- Find the average number of flowers blooming per day if the counts over 5 days are 2, 7, 9, 4, and 3.

## Answer Key

- Average runs =  $(5 + 10 + 15 + 20 + 25) / 5 = 75 / 5 = 15$

- Group 1 total = 30; average per person =  $30 / 5 = 6$
- Group 2 total = 30; average per person =  $30 / 6 = 5$
- Average flowers =  $(2 + 7 + 9 + 4 + 3) / 5 = 25 / 5 = 5$

## Quick Reference

- **Arithmetic Mean:** Sum of values divided by number of values.

## Glossary

- **Arithmetic Mean:** The average value representing a data set.

## Average as Fair-Share

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The average can be interpreted as a fair or equal share of a total quantity among members of a group.

For example, if a group collects a total of 30 guavas and has 5 members, each member's fair share is:

$$\frac{30}{5} = 6$$

This concept helps in distributing resources equally.

## Worked Illustration

Two groups collected guavas:

- Group 1: 3, 8, 10, 5, 4 guavas; 5 members
- Group 2: 5, 4, 6, 3, 4, 8 guavas; 6 members

Calculate total guavas and fair share per member:

Group 1 total =  $3 + 8 + 10 + 5 + 4 = 30$ ; fair share =  $30 / 5 = 6$

Group 2 total =  $5 + 4 + 6 + 3 + 4 + 8 = 30$ ; fair share =  $30 / 6 = 5$

Group 1 members get 1 more guava each than Group 2 members.

## Practice Set

- Calculate the fair share of apples if 24 apples are collected by 8 children.
- Find the average number of pages read per day if a student reads 10, 12, 8, 15, and 5 pages over 5 days.

## Answer Key

- Fair share =  $24 / 8 = 3$  apples per child
- Average pages =  $(10 + 12 + 8 + 15 + 5) / 5 = 50 / 5 = 10$  pages per day

## Quick Reference

- **Fair share:** Equal division of total quantity among members.

## Glossary

- **Fair share:** Equal portion of a total amount for each member.

## Outliers and Medians

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The **mean** or average may not always represent data well, especially when there are **outliers**—values significantly different from the rest.

The **median** is the middle value in sorted data and is less affected by outliers.

### Finding the Median

To find the median:

- Sort the data in ascending order.
- If the number of values is odd, the median is the middle value.
- If even, the median is the average of the two middle values.

### Worked Illustration

Heights of Poovizhi's family: 170 cm, 173 cm, 165 cm, 118 cm, 175 cm

Sorted: 118, 165, 170, 173, 175

Median is the middle value: 170 cm

Heights of Yaangba's family: 169 cm, 173 cm, 155 cm, 165 cm, 160 cm, 164 cm

Sorted: 155, 160, 164, 165, 169, 173

Median is average of middle two:  $(164 + 165) / 2 = 164.5$  cm

## Practice Set

- Find the median of the data: 3, 7, 9, 15, 20
- Find the median of the data: 4, 8, 12, 16
- Given data with an outlier: 5, 6, 7, 8, 50, find the mean and median.

## Answer Key

- Median of first data: 9
- Median of second data:  $(8 + 12) / 2 = 10$
- Mean =  $(5 + 6 + 7 + 8 + 50) / 5 = 76 / 5 = 15.2$ ; Median = 7

## Quick Reference

- **Outlier:** A value significantly different from others.
- **Median:** Middle value in sorted data.

## Glossary

- **Outlier:** Data point far from the rest.
- **Median:** Central value in ordered data.

## Visualising Data

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Data visualisation helps understand data clearly by presenting it graphically. Common visualisations include bar graphs, dot plots, and clustered column graphs.

**Clustered Column Graphs:** These show grouped data side by side for comparison, such as monthly prices in two locations.

## Worked Illustration

Monthly onion prices in Yahapur and Wahapur are shown in tables and bar graphs. The clustered column graph places bars for both locations side by side for each month, allowing easy comparison.

## Practice Set

- Draw a clustered column graph for the following data: Monthly rainfall in two cities over 6 months.
- Interpret a given bar graph showing sales of two products over a year.

## Answer Key

- Students should create a bar graph with months on the x-axis and rainfall on the y-axis, with two bars per month representing the two cities.
- Interpretation should include identifying months with highest and lowest sales and comparing products.

## Quick Reference

- **Data visualisation:** Graphical representation of data.
- **Clustered column graph:** Side-by-side bars for grouped data.

## Glossary

- **Data visualisation:** Using graphs to show data.
- **Clustered column graph:** Bar graph with grouped bars.

## Data Detective

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Analyzing data carefully can reveal stories and mysteries. Comparing data from different groups or over time helps understand patterns and trends.

Measures like mean and median provide central tendency, while dot plots show variability and distribution.

### Worked Illustration

Comparing heights of boys and girls in two schools using dot plots and mean lines shows differences in average heights and spread.

Tables showing average heights of boys and girls across ages and years reveal growth trends and differences between genders.

### Practice Set

- Given data of scores from two schools, compare mean and median and describe differences.
- Analyze a dot plot of daily temperatures over a week and identify trends.
- Interpret a bar chart showing number of skyscrapers in different cities.

### Answer Key

- Students should calculate mean and median, note differences, and describe data spread.

- Identify increasing or decreasing temperature trends and variability.
- Estimate values from bar lengths and compare cities.

## Quick Reference

- **Mean:** Average value.
- **Median:** Middle value.
- **Dot plot:** Graph showing data points.

## Glossary

- **Central tendency:** Typical value of data (mean, median).
- **Variability:** Spread of data values.

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