🟦 Chapter 14: Statistics and Probability

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🔹 A. STATISTICS

Statistics involves collecting, organizing, and analyzing numerical data.

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🧠 Key Definitions

- **Data:** A collection of numerical facts.
- **Primary Data:** Collected directly by the investigator.
- **Secondary Data:** Collected from already existing sources.
- **Raw Data**: Unorganized data (just numbers).
- **Range**: Difference between the highest and lowest value in data.
  Range = Maximum − Minimum

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📊 Organizing Data

1. **Frequency:** Number of times a value occurs.
2. **Frequency Distribution Table:** A table that organizes data into classes and shows frequencies.
3. **Class Interval:** A group like 10–20, 20–30, etc.
4. **Class Width:** Difference between upper and lower class limits.
   Width = Upper Limit − Lower Limit
5. **Class Mark** (Mid-point): Average of lower and upper limits of a class.
   Class Mark = (Lower Limit + Upper Limit) / 2

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📉 Graphical Representation

1. **Bar Graph:**
   - Uses rectangles to represent data.
   - Suitable for discrete data.
2. **Histogram:**
   - Bars touch each other.
   - For continuous frequency distribution.
   - Height represents frequency.
   - When class widths are unequal, we adjust heights using:
   Adjusted height = (Frequency / Width) × Common Width
3. **Frequency Polygon:**
   - Uses midpoints (class marks) plotted and joined by lines.
   - Can be drawn with or without histogram.

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📌 Measures of Central Tendency

These are the values that represent the entire data set.

✅ **Mean (Average):**

- For ungrouped data:
  Mean = $(x_1 + x_2 + \ldots + x_n) / n$
- For frequency data:
  Mean = $(\Sigma f_i x_i) / \Sigma f_i$
  (where f_i = frequency, x_i = data value)

✅ **Median:**

- Arrange data in ascending order.
- If n is odd: Median = value at (n + 1)/2 position.
- If n is even: Median = average of n/2 and (n/2 + 1)th values.

✅ **Mode:**

- The value that appears most frequently.
- No mode if all values are different.
- Can have one, two (bimodal), or multiple modes.

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🔷 B. PROBABILITY

Probability is the measure of the chance of an event happening.

🧠 **Key Concepts:**

- Experiment: An action like tossing a coin, rolling a die.
- Outcome: Result of an experiment.
- Trial: Each performance of an experiment.

✅ **Empirical (Experimental) Probability:**

P(E) = (Number of trials in which event E happened) / (Total number of trials)

📝 **Notes:**

- Probability of any event lies between 0 and 1.
- P(E) = 0 → Impossible event
- P(E) = 1 → Certain event

🧠 Example:
If a die is rolled 200 times and number 6 appears 40 times:
P(rolling a 6) = 40 / 200 = 0.2

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✅ Summary Table

Concept	Formula / Rule
Mean (ungrouped data)	$(x_1 + x_2 + \ldots + x_n) / n$
Mean (frequency table)	$\Sigma f_i x_i / \Sigma f_i$
Median (odd n)	Value at (n+1)/2 position
Median (even n)	Average of (n/2)th and (n/2 + 1)th values
Mode	Most frequent observation
Probability	P(E) = successful trials / total trials
Range	Max value – Min value
Class mark (midpoint)	(Lower limit + Upper limit) / 2
Adjusted height (histogram)	Frequency / Class width × Common width

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🟦 **Example Explanation:**

Q: Find mean of: 6, 14, 15, 17, 19
Mean = (6 + 14 + 15 + 17 + 19) / 5 = 71 / 5 = 14.2

Q: What is the probability of getting head if coin tossed 400 times, and head appears 210 times?
P(head) = 210 / 400 = 0.525 ✅