CHAPTER 13: STATISTICS

INTRODUCTION

Statistics is a branch of mathematics that deals with **collection, organization, analysis, and interpretation of data**.

Types of Data

1. Ungrouped Data

- Raw data without classification
- Example: 2, 5, 7, 8, 9

Easy to analyze when data is small.

2. Grouped Data

- Data arranged in **class intervals**
- Example:

Class Interval	Frequency
0–10	5
10–20	8

Used for large data → easier analysis

BASIC TERMS

Frequency (f)

Number of times a value occurs

Class Interval

Range in which data is grouped
Example: 10–20

Class Limits

- Lower limit = 10
- Upper limit = 20

Class Size (h)

$$h = \text{Upper limit} - \text{Lower limit}$$

Class Mark (Mid-point)

$$x_i = \frac{\text{Upper limit + Lower limit}}{2}$$

MEASURES OF CENTRAL TENDENCY

These give a **representative value** of data

Types:

1. Mean
2. Median
3. Mode

MEAN (AVERAGE)

Mean for Ungrouped / Discrete Data

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

Mean for Grouped Data

Step 1: Find class marks (xi)

Step 2: Multiply fi × xi

Step 3: Apply formula

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

METHODS TO FIND MEAN

1. DIRECT METHOD

Formula:

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

Table Format:

Class Interval fi xi fi xi

Best when values are small

2. ASSUMED MEAN METHOD

Used when calculations are large

Steps:

1. Choose assumed mean (a)
2. Find deviation:

$$d_i = x_i - a$$

3. Multiply:

$$f_i d_i$$

Formula:

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

3. STEP-DEVIATION METHOD

Simplified version of assumed mean

Formula:

$$u_i = \frac{x_i - a}{h}$$

$$\bar{x} = a + h \times \frac{\sum f_i u_i}{\sum f_i}$$

Important Points:

✓ All three methods give SAME answer
✓ Step-deviation is fastest
✓ Use when values are large

MODE

Definition:

Mode is the **most frequent value**

For Grouped Data:

Step 1: Find modal class (highest frequency**)**

Formula:

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

Symbol	Meaning
l	Lower limit of modal class
h	Class width
f□	Frequency of modal class
f□	Frequency before modal class
f□	Frequency after modal class

Important:

Modal class = class with highest frequency
Mode lies inside that class

MEDIAN

Definition:

Median divides data into **two equal parts**

For Grouped Data

Step 1: Find cumulative frequency (cf)

Step 2: Find:

$$\frac{n}{2}$$

Step 3: Identify Median Class

Class where cf ≥ n/2

Formula:

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

Where:

Symbol	Meaning
l	Lower limit
n	Total frequency
cf	Cumulative frequency before class
f	Frequency of median class
h	Class size

CUMULATIVE FREQUENCY

Definition:

Running total of frequencies

Types:

1. Less Than Type

Class	cf
<10	5
<20	12

2. More Than Type

Class	cf
≥10	50
≥20	40

OGIVE (GRAPH)

Definition:

Graph of cumulative frequency

Types:

1. Less than ogive
2. More than ogive

Important:

Intersection point = Median

RELATION BETWEEN MEAN, MEDIAN & MODE

OR

$$\text{Mode} = 3 \times \text{Median} - 2 \times \text{Mean}$$

$$3\text{Median} = \text{Mode} + 2\text{Mean}$$

IMPORTANT CONCEPTS & THEORY

Mean

Uses all values
Affected by extreme values

Median

Middle value
Not affected by extremes

Mode

Most frequent value
Used in real life (popular choice)

COMPARISON TABLE

Measure	Meaning	Use
Mean	Average	General calculation
Median	Middle value	Income, salary
Mode	Most frequent	Popular choice

IMPORTANT EXAM TIPS

- Always check class intervals are continuous
- Convert if needed (e.g., 10–20 → 9.5–19.5)

- Use step-deviation for big numbers
- Carefully identify median & modal class
- Don’t forget cumulative frequency column

SHORTCUTS

- Choose middle value as assumed mean
- Use step deviation if h is common
- Always make neat table

SAMPLE TABLE FORMAT (VERY IMPORTANT)

For Mean:

Class	fi	xi	di	ui	fiui

For Median:

Class	fi	cf

For Mode:

Class	fi

FINAL SUMMARY

✓ Mean = average value
✓ Median = middle value
✓ Mode = most frequent value
✓ Use proper formulas carefully
✓ Practice tables → key to scoring

FINAL REVISION FORMULA

✓ Mean (Direct)

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

✓ Mean (Assumed)

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

✓ Mean (Step-Deviation)

$$\bar{x} = a + h\frac{\sum f_i u_i}{\sum f_i}$$

✓ Median

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

✓ Mode

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$