

Chapter 13: Statistics

What You'll Learn

- How to calculate:
 - **Mean**
 - **Median**
 - **Mode**
- For **grouped data** (not just ungrouped)
- Using formulas and shortcuts like:
 - **Direct Method**
 - **Assumed Mean Method**
 - **Step-Deviation Method**
- Concepts of **Cumulative Frequency** and **Ogives** (curve graphs)

13.2 Mean of Grouped Data

◆ Direct Method

If **fi** = frequency and **xi** = class mark:

Mean(x):-

$$\bar{x} = \frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i}$$

◆ Assumed Mean Method

Choose any **a** as assumed mean:

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

where **di** = **xi** - **a**

Table 13.4

Class interval	Number of students (f_i)	Class mark (x_i)	$d_i = x_i - 47.5$	$f_i d_i$
10 - 25	2	17.5	-30	-60
25 - 40	3	32.5	-15	-45
40 - 55	7	47.5	0	0
55 - 70	6	62.5	15	90
70 - 85	6	77.5	30	180
85 - 100	6	92.5	45	270
Total	$\Sigma f_i = 30$			$\Sigma f_i d_i = 435$

📌 (See Table 13.4)

◆ Step-Deviation Method

Use when di values have a common factor h:

$$\bar{x} = a + h \left(\frac{\sum f_i u_i}{\sum f_i} \right)$$

here $u_i = (x_i - a) / h$

Table 13.5

Class interval	f_i	x_i	$d_i = x_i - a$	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
10 - 25	2	17.5	-30	-2	-4
25 - 40	3	32.5	-15	-1	-3
40 - 55	7	47.5	0	0	0
55 - 70	6	62.5	15	1	6
70 - 85	6	77.5	30	2	12
85 - 100	6	92.5	45	3	18
Total	$\sum f_i = 30$				$\sum f_i u_i = 29$

📌 (See Table 13.5)

🔍 All three methods give the **same mean** – choose based on ease of calculation.

📊 13.3 Mode of Grouped Data

◆ Formula:

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

Where:

- l = lower limit of modal class
- h = class width
- f1 = frequency of modal class
- f0 = frequency of class before modal
- f2 = frequency of class after modal

🧠 Use mode when you need the **most frequent value**.

📊 13.4 Median of Grouped Data

◆ Steps:

1. Find total frequency n
2. Find $n/2$
3. Locate the **median class** (class where $n/2$ lies in cumulative frequency)
4. Use this formula:

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

Where:

- l = lower boundary of median class
 - cf = cumulative frequency before median class
 - f = frequency of median class
 - h = class size
- 📌 (See Table 13.15)

🧠 Median gives the **middle value** — best when data has **extreme values**.

💡 13.5 Summary of Formulas

✅ Mean

- **Direct:**

$$\bar{x} = \Sigma(fi \times xi) / \Sigma(fi)$$

- **Assumed Mean:**

$$\bar{x} = a + [\Sigma(fi \times di) / \Sigma(fi)]$$

- **Step-Deviation:**

$$\bar{x} = a + h \times [\Sigma(fi \times ui) / \Sigma(fi)]$$

✅ Mode

$$\text{Mode} = l + [(f_1 - f_0) / (2f_1 - f_0 - f_2)] \times h$$

✅ Median

$$\text{Median} = l + [(n/2 - cf) / f] \times h$$

🧠 When to Use What?

Situation	Use
Want overall average	Mean
Data has outliers/extremes	Median
Need most repeated/common value	Mode

Empirical Relation

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