

Question:

Find the mean, median, and mode for the following distribution.

Heights of plants	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25
No. of plants	7	10	16	32	24

Step 1: Convert Inclusive to Exclusive Class Intervals

Since the given class intervals are **inclusive**, we convert them to **exclusive** by adjusting the boundaries by **subtracting 0.5 from the lower limit and adding 0.5 to the upper limit**.

Heights of plants (Exclusive)	Class Mark (x)	No. of Plants (f)	fx
0.5 - 5.5	3	7	21
5.5 - 10.5	8	10	80
10.5 - 15.5	13	16	208
15.5 - 20.5	18	32	576
20.5 - 25.5	23	24	552

Step 2: Calculate Mean

The formula for the mean is:

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

Total f (sum of frequencies) = $7 + 10 + 16 + 32 + 24 = 89$

Total fx (sum of class mark \times frequency) = $21 + 80 + 208 + 576 + 552 = 1437$

$$\text{Mean} = \frac{1437}{89} \approx 16.15$$

Step 3: Calculate Median

1. Find Cumulative Frequency (CF):

Class Interval (Exclusive)	f	Cumulative Frequency (CF)
0.5 - 5.5	7	7
5.5 - 10.5	10	17
10.5 - 15.5	16	33
15.5 - 20.5	32	65
20.5 - 25.5	24	89

2. Find Median Class:

$$\text{Median position} = \frac{N}{2} = \frac{89}{2} = 44.5$$

The cumulative frequency **just before 44.5** is **33**, and the next class is **15.5 - 20.5**, so this is the **median class**.

3. Use the Median Formula:

$$\text{Median} = L + \left(\frac{\frac{N}{2} - CF}{f} \right) \times h$$

Where:

- $L = 15.5$ (Lower boundary of median class)
- $N = 89$ (Total frequency)
- $CF = 33$ (Cumulative frequency before median class)
- $f = 32$ (Frequency of median class)
- $h = 5$ (Class width)

$$\text{Median} = 15.5 + \left(\frac{44.5 - 33}{32} \right) \times 5$$

$$= 15.5 + \left(\frac{11.5}{32} \right) \times 5$$

$$= 15.5 + (1.8) = 17.3$$

Step 4: Calculate Mode

Mode formula:

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

Where:

- **Modal Class:** The class with the highest frequency → 15.5 - 20.5 (as it has 32)
- $L = 15.5$ (Lower boundary of modal class)
- $f_1 = 32$ (Frequency of modal class)
- $f_0 = 16$ (Preceding class frequency)
- $f_2 = 24$ (Succeeding class frequency)
- $h = 5$ (Class width)

$$\begin{aligned}\text{Mode} &= 15.5 + \left(\frac{32 - 16}{2(32) - 16 - 24} \right) \times 5 \\ &= 15.5 + \left(\frac{16}{64 - 40} \right) \times 5 \\ &= 15.5 + \left(\frac{16}{24} \right) \times 5 \\ &= 15.5 + (3.33) = 18.83\end{aligned}$$