

Short Answer Type Questions – II

[3 marks]

Que 1. If the mean of the following distribution is 6, find the value of p.

X	2	4	6	10	P + 5
f	3	2	3	1	2

Sol. Calculation of mean

x_i	f_i	$f_i x_i$
2	3	6
4	2	8
6	3	18
10	1	10
P + 5	2	2p + 10
Total	$\Sigma f_i = 11$	$\Sigma f_i x_i = 2p + 52$

We have, $\Sigma f_i = 11$, $\Sigma f_i x_i = 2p + 52$, $\bar{x} = 6$

$$\therefore \text{Mean } (\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\Rightarrow 6 = \frac{2p+52}{11} \Rightarrow 66 = 2p + 52$$

$$\Rightarrow 2p = 14 \Rightarrow p = 7$$

Que 2. Find the mean of the following distribution:

x	4	6	9	10	15
f	5	10	10	7	8

Sol. Calculation of arithmetic mean

x_i	f_i	$f_i x_i$
4	5	20
6	10	60
9	10	90
10	7	70
15	8	120
Total	$\Sigma f_i = 40$	$\Sigma f_i x_i = 360$

$$\therefore \text{Mean } (\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{360}{40} = 9$$

Que 3. The following data gives the information on the observed lifetimes (in hours) of 225 electrical components:

Lifetimes (in hours)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	10	35	52	61	38	29

Determine the modal lifetimes of the components.

Sol. Here, the maximum class frequency is 61 and the class corresponding to this frequency is 60 – 80. So, the modal class is 60 – 80.

Here, $l = 60$, $h = 20$, $f_1 = 61$, $f_0 = 52$, $f_2 = 38$

$$\begin{aligned} \therefore \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{61 - 52}{2 \times 61 - 52 - 38} \times 20 = 60 + \frac{9}{122 - 90} \times 20 \\ &= 60 + \frac{9}{32} \times 20 = 60 + \frac{45}{8} = 60 + 5.625 = 65.625 \end{aligned}$$

Hence, modal lifetime of the components is 65.625 hours.

Weight (in kg)	40 – 45	45 – 50	50 – 55	55 – 60	60 – 65	65 – 70	70 – 75
Number of students	2	3	8	6	6	3	2

Que 4. The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Sol. Calculation of median

Weight (in kg)	Number of students (f_i)	Cumulative frequency (cf)
40 – 45	2	2
45 – 50	3	5
50 – 55	8	13
55 – 60	6	19
60 – 65	6	25
65 – 70	3	28
70 – 75	2	30
Total	$\Sigma f_i = 30$	

We have, $\Sigma f_i = n = 30 \Rightarrow \frac{n}{2} = 15$

The cumulative frequency just greater than $\frac{n}{2} = 15$ is 19, and the corresponding class is 55 – 60.

$\therefore$ 55 – 60 is the median class.

Now, we have $\frac{n}{2} = 15, l = 55, cf = 13, f = 6, h = 5$

$$\begin{aligned} \therefore \text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h \\ &= 55 + \left(\frac{15 - 13}{6} \right) \times 5 = 55 + \frac{2}{6} \times 5 = 55 + 1.67 = 56.67 \end{aligned}$$

Hence, median weight is 56.67 kg.

Length (in mm)	118–126	127–135	136–144	145–153	154–162	163–171	172–180
Number of Leaves	3	5	9	12	5	4	2

Que 5. The length of 40 leaves of a plant are measured correctly to the nearest millimeter, and the data obtained is represented in the following table:

Find the median length of the leaves.

Sol. Here, the classes are not in inclusive form. So, we first convert them in inclusive form by subtracting $\frac{h}{2}$ from the lower limit and adding $\frac{h}{2}$ to the upper limit of each class, where h is the difference between the lower limit of a class and the upper limit of preceding class. Now, we have

Class interval	Number of leaves	Cumulative frequency (cf)
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17
144.5 – 153.5	12	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38
171.5 – 180.5	2	40
Total	$\Sigma f_i = 40$	

We have, $n = 40 \Rightarrow \frac{n}{2} = 20$

And, the cumulative frequency just greater than $\frac{n}{2}$ is 29 and corresponding class is 144. – 153.5. So median class is 144.5 – 153.5.

Here, we have $\frac{n}{2} = 20$, $l = 144.5$, $h = 9$, $f = 12$, $cf = 17$

$$\begin{aligned} \therefore \text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 144.5 + \left(\frac{20 - 17}{12} \right) \times 9 \\ &= 144.5 + \frac{3}{12} \times 9 = 144.5 + \frac{9}{4} = 144.5 + 2.25 = 146.75 \text{ mm.} \end{aligned}$$

Hence, the median length of the leaves is 146.75 mm.