Exercise 13.2

Question 1

The following table shows the ages of the patients admitted in a hospital during a year.

Age (in years)	No. of patients
5 – 15	6
15 – 25	11
25 – 35	21
35 – 45	23
45 – 55	14
55 – 65	5

Find the mode and the mean of the data given above. Compare and interpret the two measures of central tendency.

Solution

For Mode:

Age (in years)	5–15	15–25	25–35	35–45	45–55	55–65
Number of patients	6	11	21	23	14	5

$\because$ Maximum frequency = 23

$\therefore$ Modal class = 35 – 45

Here, $l = 35, f_1 = 23, f_0 = 21, f_2 = 14, h = 10$

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h = 35 + \left[\frac{23 - 21}{46 - 21 - 14}\right] \times 10 = 35 + \frac{2}{11} \times 10$$

$$= 35 + \frac{20}{11} = 36.8 \text{ years}$$

For Mean:

Age (in years)	**Class mark (x_i)**	**Number of patients (f_i)**	$u_i = \frac{x_i - 30}{10}$	$f_i u_i$
5 – 15	10	6	–2	–12
15 – 25	20	11	–1	–11
25 – 35	30 = a (Let)	21	0	0
35 – 45	40	23	1	23
45 – 55	50	14	2	28
55 – 65	60	5	3	15
Total		$\Sigma f_i = 80$		$\Sigma f_i u_i = 43$

Here, $a = 30, \Sigma f_i u_i = 43, \Sigma f_i = 80, h = 10$

We have, $\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 30 + \frac{43 \times 10}{80} = 30 + 5.37 = 35.37$ years

We conclude that the maximum number of patients in the hospital are of the age 36.8 years. While on an average the age of patient admitted to the hospital is 35.37 years.

Question 2

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

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

Determine the modal lifetimes of the components.

Solution

Modal class is 60 – 80, as 61 is maximum frequency.

Here, $l = 60$, $f_m = 61$, $f_1 = 52$, $f_2 = 38$, and $h = 20$.

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

$$= 60 + \left(\frac{61 - 52}{122 - 52 - 38}\right) \times 20$$

$$= 60 + \frac{9 \times 20}{32} = 60 + \frac{45}{8}$$

$$= 60 + 5.63 = \mathbf{65.63\ hr.}$$

Question 3

The following data gives the distribution of total monthly household expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure:

Expenditure (in ₹)	Number of families
1000 – 1500	24
1500 – 2000	40
2000 – 2500	33
2500 – 3000	28
3000 – 3500	30
3500 – 4000	22
4000 – 4500	16
4500 – 5000	7

Solution

Here, Maximum frequency = 40

$\therefore$ Modal class = 1500 – 2000 and $l = 1500, f_0 = 24, f_1 = 40, f_2 = 33$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 1500 + \left(\frac{40 - 24}{80 - 24 - 33}\right) \times 500$$

$$= 1500 + \frac{16}{23} \times 500 = 1500 + 347.83 = ₹\ 1847.83$$

For Mean

Expenditure (in ₹)	Class mark (x_i)	Number of families (f_i)	$u_i = \frac{x_i - 2750}{500}$	$f_i u_i$
1000 – 1500	1250	24	–3	–72
1500 – 2000	1750	40	–2	–80
2000 – 2500	2250	33	–1	–33
2500 – 3000	2750 = a (Let)	28	0	0
3000 – 3500	3250	30	1	30
3500 – 4000	3750	22	2	44
4000 – 4500	4250	16	3	48
4500 – 5000	4750	7	4	28
Total		$\Sigma f_i = 200$		$\Sigma f_i u_i = -35$

Here, $a = 2750, \Sigma f_i = 200, \Sigma f_i u_i = -35, h = 500$

$\therefore$ $$\text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 2750 + \frac{(-35)}{200} \times 500 = 2750 - \frac{175}{2}$$

$$= 2750 - 87.50 = ₹\ 2662.50$$

Question 4

Ex 14.2 Class 10 Maths Question 4.

The following distribution gives the state-wise teacher- student ratio in higher secondary schools of India. Find the mode and mean of this data. Interpret the two measures.

Number of students per teacher	Number of states/UT
15 – 20	3
20 – 25	8
25 – 30	9
30 – 35	10
35 – 40	3
40 – 45	0
45 – 50	0
50 – 55	2

Solution

Here, h = 5.

Class interval	Frequency f_i	Class marks x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
15 – 20	3	17.5	–3	–9
20 – 25	8	22.5	–2	–16
25 – 30	9 (f_1)	27.5	–1	–9
30 – 35	10 (f_m)	32.5 = a	0	0
35 – 40	3 (f_2)	37.5	1	3
40 – 45	0	42.5	2	0
45 – 50	0	47.5	3	0
50 – 55	2	52.5	4	8
	$\Sigma f_i = 35$			$\Sigma f_i u_i$ = –23

Since the maximum frequency is 10, so the modal class is (30 – 35).

Here, $l = 30, f_m = 10, f_1 = 9, f_2 = 3, h = 5$ and $a = 32.5$

$$\therefore \textbf{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 30 + \left(\frac{10 - 9}{2 \times 10 - 9 - 3}\right) \times 5$$

$$= 30 + \frac{5}{20 - 12} = 30 + 0.63$$

$$= \textbf{30.63}.$$

$$\textbf{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 32.5 + \frac{(-23)}{35} \times 5$$

$$= 32.5 - 3.28 = \textbf{29.22}.$$

Question 5

The given distribution shows the number of runs scored by some top batsmen of the world in one-day international cricket matches.

Runs scored	Number of batsmen
3000 – 4000	4
4000 – 5000	18
5000 – 6000	9
6000 – 7000	7
7000 – 8000	6
8000 – 9000	3
9000 – 10000	1
10000 – 11000	1

Find the mode of the data.

Solution

Runs scored	Number of batsmen (f_i)
3000 – 4000	4
4000 – 5000	18
5000 – 6000	9
6000 – 7000	7
7000 – 8000	6
8000 – 9000	3
9000 – 10000	1
10000 – 11000	1

Maximum frequency = 18,

$\therefore$ Modal class = 4000 – 5000; Here, $l = 4000, f_0 = 4, f_1 = 18, f_2 = 9$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 4000 + \left(\frac{18-4}{36-4-9}\right) \times 1000$$

$$= 4000 + \frac{14000}{23} = 4000 + 608.7 = 4608.7 \text{ runs}$$

Question 6

A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mode of the data:

Number of cars	Frequency
0 – 10	7
10 – 20	14
20 – 30	13
30 – 40	12
40 – 50	20
50 – 60	11
60 – 70	15
70 – 80	8

Solution

Since 20 is the maximun frequency, so modal class is (40 – 50)

Here, $l = 40$, $f_m = 20$, $f_1 = 12$, $f_2 = 11$ and $h = 10$.

$$\therefore \textbf{Mode} = l + \left(\frac{f_m - f_1}{2f_m - f_1 - f_2}\right) \times h$$

$$= 40 + \left(\frac{20 - 12}{2 \times 20 - 12 - 11}\right) \times 10$$

$$= 40 + \frac{80}{17} = 40 + 4.7 = \textbf{44.7 cars}.$$