Chapter – 14
Statistics

Exercise 14.2

Question 1: The following table shows the ages of the patients admitted in a hospital during a year:

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

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

Answer:

As per the question:

Modal class = 35 -45

l = 35

h = 10

f1 = 23

f0 = 21

f2 = 14

$$Mode = l + \left(\frac{f1 - f0}{2f1 - f0 - f2}\right)h$$

$$= 35 + \left(\frac{23 - 21}{2 \times 23 - 21 - 14}\right)10$$

$$= 35 + \frac{2}{11} \times 10$$

= 36.8

The above given data can be represented in the form of table as below:

Class Interval	fi	xi	fixi
5 – 15	6	10	60
15 – 25	11	20	220
25 – 35	21	30	630
35 – 45	23	40	920
45 – 55	14	50	700
55 – 65	5	60	300
	$\sum fi = 80$		$\sum fixi = 2830$

Mean can be calculated as follows:

$$\bar{x} = \frac{\sum fixi}{\sum fi}$$

$$= \frac{2830}{80}$$

= 35.37

The mode of the data shows that maximum number of patients in the age group of 36.8, whereas the average age of all the patients is 35.37.

Question 2: 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.

Answer:

As per the question:

Modal class = 60-80

l = 60

h = 20

$f_1 = 61$

$f_0 = 52$

$f_2 = 38$

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

$$Mode = 60 + \left(\frac{61 - 52}{(2 \times 61) - 52 - 38}\right)h$$

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

Or Mode = 60 + 5.625

or Mode = 65.62

Thus, the modal lifetime of 225 electrical components is 65.62 hours

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 Rs)	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

As per the question:

Modal class = 1500 – 2000

l = 1500

h = 500

f1 = 40

f0 = 24

f2 = 33

Formula for calculating mode is

$$Mode = l + \left(\frac{f1-f0}{2f1-f0-f2}\right)h$$

where, l = lower limit of modal class f_1 = frequency of the modal class
f_0 = frequency of the class before modal class
f_2 = frequency of the class after modal class
h = width of modal class

Therefore, Mode $= 1500 + \frac{16}{23} \times 5000$

$= 1500 + 347.82$

$= 1847.82$

Mode of the data is Rs.1847.82

The above given data can be represented in the form of table as below:

Class Interval	fi	xi	di = xi − a	ui	fiui
1000 − 1500	24	1250	-1500	-3	-72
1500 − 2000	40	1750	-1000	-2	-80
2000 − 2500	33	2250	-500	-1	-33
2500 − 3000	28	2750	0	0	0
3000 − 3500	30	3250	500	1	30
3500 − 4000	22	3750	1000	2	44
4000 − 4500	16	4250	1500	3	48
4500 − 5000	7	4750	2000	4	28
	$\sum fi = 200$				$\sum fiui = -35$

Hence, the mean can be calculated as below:

$$\bar{x} = a + \frac{\sum fiui}{\sum fi} \times h$$

where, a = assumed mean
f_i = frequency of the ith class
h = class width
$u_i = \frac{a-x_i}{h}$

Mean $= 2750 + \frac{-35}{200} \times 500$

Mean $= 2750 - 87.5$

Mean $=$ Rs. 2662.50

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 U.T.
15 – 20	3
20 – 25	8
25 – 30	9
30 – 35	10
35 – 40	3
40 – 45	0
45 – 50	0
50 – 55	2

Answer:

As per the question:

Modal class = 30-35

l = 30

h = 5

f1 = 10

f0 = 9

f2 = 3

$Mode = l + \left(\frac{f1-f0}{2f1-f0-f2}\right)h$

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

$= 30 + \frac{1}{8} \times 5$

$= 30.625$

Class Interval	fi	xi	di = xi − a	ui	fiui
15 – 20	3	17.5	-15	-3	-9
20 – 25	8	22.5	-10	-2	-16
25 – 30	9	27.5	-5	-1	-9
30 – 35	10	32.5	0	0	0
35 – 40	3	37.5	5	1	3
40 – 45	0	42.5	10	2	0
45 – 50	0	47.5	15	3	0
50 – 55	2	52.5	20	4	8
	$\sum fi = 35$				$\sum fiui = -23$

Hence, the mean can be calculated as below:

$$\bar{x} = a + \frac{\sum fiui}{\sum fi} \times h$$

$$= 32.5 + \frac{-23}{35} \times h$$

$$= 32.5 - \frac{23}{7}$$

$$= \mathbf{29.22}$$

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

Answer:

As per the question:

Modal class = 4000-5000

l = 4000

h = 1000

f1 = 18

f0 = 4

f2 = 9

$$Mode = l + \left(\frac{f1-f0}{2f1-f0-f2}\right)h$$

$$= 4000 + \left(\frac{18-4}{2\times18-4-9}\right)1000$$

$$= 4000 + \frac{14}{23} \times 1000$$

= 4608.70s

Question 6: A student noted the number of cars passing through a spot on a road for 100periods each of 3 minutes and summarized it in the table given below. Find the mode of the data:

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

Answer:

For finding the mode, first we find the modal class i.e. class with maximum frequency.

In the given data, Modal class is 40 - 50and then we use the following formula for finding the mode $Mode = l + \left(\frac{f1-f0}{2f1-f0-f2}\right)h$

Where

l, lower limit of modal class = 40

h, width of modal class = 10

f1, frequency of modal class = 20

f0, frequency of class preceding modal class = 12

f2, frequency of class exceeding modal class = 11

Putting the values, we get

$$= 40 + \left(\frac{20-12}{2\times20-12-11}\right)10$$

$$= 40 + \frac{8}{17} \times 10$$

$$= 44.70$$