SpeedLabs
MATHS

CBSE 10th

TEEVRA EDUTECH PVT. LTD.

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

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

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

Sol: To find the class marks(x_i), the following relation is used.

$$x_i = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

Taking 30 as assured mean (a), d_i, and $f_i d_i$ can be calculated as follows.

Age (in years)	Number of patients	x_i	$d_i = x_i - 150$	$f_i u_i$
5 – 15	6	10	−20	−120
15 – 25	11	20	−10	−110
25 – 35	21	30	0	0
35 – 45	23	40	10	230
45 – 55	14	50	20	280
55 – 65	5	60	30	150
Total	50			430

From the table, it can be observed that

$$\sum f_i = 80$$

$$\sum f_i u_i = 430$$

$$\text{Mean } \bar{x} = a + \left(\frac{\sum f_i d_i}{\sum f_i}\right)$$

$$= 30 + \left(\frac{430}{80}\right)$$

$$= 30 + 5.375$$

$$= 35.375$$

$$= 35.38$$

Mean of this data is 35.38. It represents that on an average, the age of a patient admitted to hospital was 35.38 years.

It can be observed that the maximum class frequency is 23 belonging to class interval 35 − 45.

Modal class = 35 – 45

Lower limit (l) of modal class = 35

Frequency (f_1) of modal class = 23

Class size (h) = 10

Frequency (f_0) of class preceding the modal class = 21

Frequency (f_2) of class succeeding the modal class = 14

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

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

$$= 35 + \left[\frac{2}{46 - 35}\right] \times 10$$

$$= 35 + \frac{20}{11}$$

$$= 35 + 1.81$$

$$= 36.8$$

Mode is 36.8.

It represents that the age of maximum number of patients admitted in hospital was 36.8 years.

Q.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.

Sol: From the data given above, it can be observed that the maximum class frequency is 61, belonging to class interval 60 − 80.

Therefore, modal class = 60 − 80

Lower class limit (l) of modal class = 60

Frequency (f_1) of modal class = 61

Frequency (f_0) of class preceding the modal class = 52

Frequency (f_2) of class succeeding the modal class = 38

Class size (h) = 20

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

$$= 60 + \left(\frac{9}{122 - 90}\right)(20)$$

$$= 60 + \left(\frac{9 \times 20}{32}\right)$$

$$= 65.625$$

Therefore, modal lifetime of electrical components is 65.625 hours.

Q.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

Sol: It can be observed from the given data that the maximum class frequency is 40, belonging to $1500 - 2000$ intervals.

Therefore, modal class = $1500 - 2000$

Lower limit (l) of modal class = 1500

Frequency (f_1) of modal class = 40

Frequency (f_0) of class preceding modal class = 24

Frequency (f_2) of class succeeding modal class = 33

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

$$= 1500 + \left(\frac{40 - 24}{2(40) - 24 - 33}\right)(500)$$

$$= 1500 + \left(\frac{16}{80 - 57}\right)(500)$$

$$= 1500 + \frac{8000}{23}$$

$$= 1847.826$$

$$= 1847.83$$

Therefore, modal monthly expenditure was Rs 1847.83.

To find the class mark, the following relation is used.

$$x_i = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

Class size (h) of the given data = 500

Taking 2750 as assured mean (a), d_i, u_i, and $f_i u_i$ can be calculated as follows.

Expenditure (in Rs)	Number of families	x_i	$d_i = x_i - 2750$	$u_i = \dfrac{d_i}{500}$	$f_i u_i$
$1000 - 1500$	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	200	4	28
Total	200				-35

From the table we obtain

$$\sum f_i = 200$$

$$\sum f_i u_i = -35$$

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

$$= 2750 + \left(\frac{-35}{200}\right)(500)$$

$$= 2750 - 87.5$$

$$= 2662.5$$

Therefore, mean monthly expenditure was Rs 2662.50.

Q.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

Sol: It can be observed from the given data that the maximum class frequency is 10 belonging to class interval 30 − 35.

Therefore, modal class = 30 − 35

Class size (h) = 5

Lower limit (l) of modal class = 30

Frequency (f_1) of modal class = 10

Frequency (f_0) of class preceding modal class = 9

Frequency (f_2) of class succeeding modal class = 3

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

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

$$= 30 + \left(\frac{1}{20 - 12}\right)(5)$$

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

$$= 30.625$$

Mode = 30.625

It represents that most of the states/U.T have a teacher-student ratio as 30.6.

To find the class marks, the following relation is used.

$$x_i = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

Taking 32.5 as assured mean (a), d_i, u_i, and $f_i u_i$ can be calculated as follows.

Number of students per teacher	Number of states/U.T (fi)	x_i	$d_i = x_i - 32.5$	$u_i = \dfrac{d_i}{5}$	$f_i u_i$
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
Total	35				−23

Mean, $\bar{x} = a + \left(\dfrac{\sum f_i u_i}{\sum f_i}\right) \times h$

$= 32.5 + \left(\dfrac{-23}{35}\right)(5)$

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

$= 32.5 - 3.28$

$= 29.22$

Therefore, mean of the data is 29.2. It represents that on an average, teacher−student ratio was 29.2.

Q.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 − 800	6
8000 − 900	3
9000 − 1000	1
10000 − 11000	1

Find the mode of the data.

Sol: From the given data, it can be observed that the maximum class frequency is 18, belonging to class interval $4000 - 5000$.

Therefore,

modal class $= 4000 - 5000$

Lower limit (l) of modal class $= 4000$

Frequency (f_1) of modal class $= 18$

Frequency (f_0) of class preceding modal class $= 4$

Frequency (f_2) of class succeeding modal class $= 9$

Class size (h) $= 1000$

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

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

$$= 4000 + \left(\frac{14000}{23} \right)$$

$$= 4000 + 608.695$$

$$= 4608.695$$

Therefore, mode of the given data is 4608.7 runs

Q.6 A student noted the number of cars passing through a spot on a road for 100 periods 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

Sol: From the given data, it can be observed that the maximum class frequency is 20, belonging to $40 - 50$ class intervals.

Therefore,

modal class $= 40 - 50$

Lower limit (l) of modal class $= 40$

Frequency (f_1) of modal class $= 20$

Frequency (f_0) of class preceding modal class $= 12$

Frequency (f_2) of class succeeding modal class $= 11$

Class size $= 10$

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

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

$$= 40 + \left(\frac{80}{40 - 23}\right)$$

$$= 40 + \frac{80}{17}$$

$$= 40 + 4.7$$

$$= 44.7$$

Therefore, mode of this data is 44.7 cars.