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**Class X : MATH**  
**Chapter 13 : Statistics**  
**Questions & Answers - Exercise : 13.2 - NCERT Book**

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**Q1.** 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
No. 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.** From the given data, we have the modal class 35-45.

{ $\because$  It has largest frequency among the given classes of the data}

So,  $l = 35$ ,  $f_m = 23$ ,  $f_1 = 21$ ,  $f_2 = 14$  and  $h = 10$ .

$$\begin{aligned}\text{Mode} &= l + \left\{ \frac{f_m - f_1}{2f_m - f_1 - f_2} \right\} \times h \\ &= 35 + \left\{ \frac{23 - 21}{46 - 21 - 14} \right\} \times 10 = 35 + \frac{20}{11} = 36.8 \text{ years}\end{aligned}$$

Now, let us find the mean of the data :

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

$a = 30$ ,  $h = 10$ ,  $n = 80$  and  $\sum f_i u_i = 43$

$$\begin{aligned} \text{Mean} &= a + h \times \frac{1}{n} \times \sum f_i u_i = 30 + 10 \times \frac{1}{80} \times 43 \\ &= 30 + 5.37 = 35.37 \text{ years} \end{aligned}$$

Thus, mode = 36.8 years and mean = 35.37 years.

So, we conclude that the maximum number of patients admitted in the hospital are of the age 36.8 years (approx), whereas on an average the age of a patient admitted to the hospital is 35.37 years.

**Q2.** 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.** Modal class of the given data is 60-80.

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

$$\begin{aligned}\text{Mode} &= \ell + \left\{ \frac{f_m - f_1}{2f_m - f_1 - f_2} \right\} \times h \\ &= 60 + \left\{ \frac{61 - 52}{122 - 52 - 38} \right\} \times 20 \\ &= 60 + \frac{9 \times 20}{32} = 60 + \frac{45}{8} \\ &= 60 + 5.625 \\ &= 65.625 \text{ hours}\end{aligned}$$

- Q3.** 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.)	No. 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.

Exp. (in Rs.)	No. of families ( $f_i$ )	Class marks ( $x_i$ )	$f_i x_i$
1000–1500	24	1250	30000
1500–2000	40	1750	70000
2000–2500	33	2250	74250
2500–3000	28	2750	77000
3000–3500	30	3250	97500
3500–4000	22	3750	82500
4000–4500	16	4250	68000
4500–5000	7	4750	33250
<b>Total</b>	<b>200</b>		<b>5,32,500</b>

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{532500}{200} = 2662.5$$

Modal class = 1500 – 2000

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

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

$$= 1500 + \frac{16}{80 - 57} \times 500 = 1847.83.$$

- Q4.** 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.

No. of students per teacher	No. 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.** Modal class is (30-35) and its frequency is 10.

So,  $l = 30$ ,  $f_m = 10$ ,  $f_1 = 9$ ,  $f_2 = 3$ ,  $h = 5$ .

$$\begin{aligned}\text{Mode} &= l + \left\{ \frac{f_m - f_1}{2f_m - f_1 - f_2} \right\} \times h \\ &= 30 + \left\{ \frac{10 - 9}{20 - 9 - 3} \right\} \times 5 = 30 + \frac{5}{8} = 30.6\end{aligned}$$

Number of students per teacher	Number of states/U.T. $f_i$	Class mark $x_i$	$u_i = \frac{x_i - 32.5}{5}$	$f_i \times u_i$
15-20	3	17.5	-3	-9
20-25	8	22.5	-2	-16
25-30	9	27.5	-1	-9
30-35	10	32.5=a	0	0
35-40	3	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
	n=35			-23

$a = 32.5$ ,  $h = 5$ ,  $n = 35$  and  $\sum f_i u_i = -23$ .

By step-deviation method,

$$\begin{aligned} \text{Mean} &= a + h \times \frac{1}{n} \times \sum f_i u_i \\ &= 32.5 + 5 \times \frac{1}{35} \times (-23) \\ &= 32.5 - \frac{23}{7} = 32.5 - 3.3 = 29.2 \end{aligned}$$

Hence, Mode = 30.6 and Mean = 29.2. We conclude that most states/U.T. have a student teacher ratio of 30.6 and on an average, the ratio is 29.2.

- Q5.** The given distribution shows the number of runs scored by some top batsmen of the world in one day international cricket matches :

Runs Scored	No. of batsman
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.

**Sol.** Modal class = 4000 – 5000

$$\begin{aligned}\text{Mode} &= \ell + \left\{ \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right\} \times h \\ &= 4000 + \left\{ \frac{18 - 4}{2 \times 18 - 4 - 9} \right\} \times 1000 \\ &= 4000 + \left\{ \frac{14}{23} \right\} \times 1000 \\ &= 4608.69\end{aligned}$$

**Q6.** 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.

No. 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

**Sol.** Modal class = 40 – 50

$$\begin{aligned}\text{Mode} &= 40 + \left\{ \frac{20-12}{2 \times 20 - 12 - 11} \right\} \times 10 = 40 + \left\{ \frac{8}{40-23} \right\} \times 10 \\ &= 40 + 4.706 = 44.706\end{aligned}$$