

Ex - 14.2

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, $\ell = 35$, $f_m = 23$, $f_1 = 21$, $f_2 = 14$ and $h = 10$.

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

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
Total	200		5,32,500

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

Modal class = 1500 – 2000

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

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

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

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, $\ell = 30$, $f_m = 10$, $f_1 = 9$, $f_2 = 3$, $h = 5$.

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

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 Secored	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

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