

CBSE Class-10 Mathematics

NCERT solution

Chapter - 14

Statistics - Exercise 14.2

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

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

Ans. For Mode: In the given data, maximum frequency is 23 and it corresponds to the class interval 35 – 45.

∴ Modal class = 35 – 45

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

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

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

$$= 35 + \frac{2}{46 - 35} \times 10$$

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

$$= 35 + 1.8$$

= 36.8

For Mean:

Age (in years)	No. of patients (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
5 - 15	6	10	- 2	- 12
15 - 25	11	20	- 1	- 11
25 - 35	21	30	0	0
35 - 45	23	40	1	23
45 - 55	14	50	2	28
45 - 65	5	60	3	15
	$\sum f_i = 80$			$\sum f_i u_i = 43$

From given data, Assume mean (a) = 30, Width of the class (h) = 10

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{43}{80} = 0.5375$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = $30 + 10 (0.5375) = 30 + 5.375 = 35.37$

Hence mode of given data is 36.8 years and mean of the given data is 35.37 years.

Also, it is clear from above discussion that average age of a patient admitted in the hospital is 35.37 years and maximum number of patients admitted in the hospital are of age 36.8 years.

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

Life times (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.

Ans. Given: Maximum frequency is 61 and it corresponds to the class interval 60 – 80.

∴ Modal class = 60 – 80

And $l = 60$, $f_1 = 61$, $f_0 = 52$, $f_2 = 38$ and $h = 20$

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

$$= 60 + \left[\frac{61 - 52}{2(61) - 52 - 38} \right] \times 20$$

$$= 60 + \frac{9}{122 - 52 - 38} \times 20$$

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

$$= 60 + 5.625$$

$$= 65.625$$

Hence modal lifetimes of the components is 65.625 hours.

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

Ans. For Mode: Here, Maximum frequency is 40 and it corresponds to the class interval 1500 – 2000.

∴ Modal class = 1500 – 2000

And $l = 1500$, $f_1 = 40$, $f_0 = 24$, $f_2 = 33$ and $h = 500$

$$\begin{aligned}\therefore \text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 1500 + \left[\frac{40 - 24}{2(40) - 24 - 33} \right] \times 500 \\ &= 1500 + \frac{16}{80 - 24 - 33} \times 500 \\ &= 1500 + \frac{8000}{23} \\ &= 1500 + 347.83 \\ &= 1847.83\end{aligned}$$

For Mean:

Expenditure (in Rs.)	No. of families (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
1000 – 1500	24	1250	– 3	– 72
1500 – 2000	40	1750	– 2	– 80
2000 – 2500	33	2250	– 1	– 33
2500 – 3000	28	2750	0	0
3000 – 3500	30	3250	1	30
3500 – 4000	22	3750	2	44
4000 – 4500	16	4250	3	48
4500 – 5000	7	4750	4	28
	$\sum f_i = 200$			$\sum f_i u_i = -35$

From given data, Assume mean $(a) = 2750$, Width of the class $(h) = 500$

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-35}{200} = -0.175$$

Using formula, Mean $(\bar{x}) = a + h\bar{u} = 2750 + 500(-0.175) = 2750 - 87.50 = 2662.50$

Hence the modal monthly expenditure of family is Rs. 1847.83 and the mean monthly expenditure is Rs. 2662.50.

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.

No. 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

Ans. For Mode: Here, Maximum frequency is 10 and it corresponds to the class interval 30 – 35.

\therefore Modal class = 30 – 35

And $l = 30$, $f_1 = 10$, $f_0 = 9$, $f_2 = 3$ and $h = 5$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 30 + \left[\frac{10 - 9}{2(10) - 9 - 3} \right] \times 5$$

$$= 30 + \frac{1}{20-12} \times 5 = 30 + \frac{5}{8} = 30 + 0.625 = 30.63 \text{ (approx.)}$$

For Mean:

Expenditure (in Rs.)	No. of families (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	27.5	- 1	- 9
30 - 35	10	32.5	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
	$\sum f_i = 35$			$\sum f_i u_i = -23$

From given data, Assume mean (a) = 32.5, Width of the class (h) = 5

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-23}{35} = -0.65$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = $32.5 + 5(-0.65)$ = $32.5 - 3.25$ = 29.25 (approx.)

Hence mode and mean of given data is 30.63 and 29.25. Also from above discussion, it is clear that states/U.T. have students per teacher is 30.63 and on average, this ratio is 29.25.

5. The given distribution shows the number of runs scored by some top batsmen of the world in one-day 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 mode of the data.

Ans. In the given data, maximum frequency is 18 and it corresponds to the class interval 4000 – 5000.

\therefore Modal class = 4000 – 5000

And $l = 4000$, $f_1 = 18$, $f_0 = 4$, $f_2 = 9$ and $h = 1000$

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

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

$$= 4000 + \frac{14}{36 - 13} \times 1000$$

$$= 4000 + \frac{14000}{23}$$

$$= 4000 + 608.6956$$

$$= 4608.7 \text{ (approx.)}$$

Hence, mode of the given data is 4608.7 runs.

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:

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

Find the mode of the data.

Ans. In the given data, maximum frequency is 20 and it corresponds to the class interval 40 – 50.

∴ Modal class = 40 – 50

And $l = 40$, $f_1 = 20$, $f_0 = 12$, $f_2 = 11$ and $h = 10$

$$\begin{aligned}\therefore \text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 40 + \left[\frac{20 - 12}{2(20) - 12 - 11} \right] \times 10 \\ &= 40 + \frac{8}{40 - 23} \times 10 \\ &= 40 + \frac{80}{17} = 40 + 4.70588 = 44.7 \text{ (approx.)}\end{aligned}$$

Hence, mode of the given data is 44.7 cars.