

## EXERCISE 14.2

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1. The following table shows the ages of the patients admitted to 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.

Solution:

To find out the modal class, let us consider the class interval with high frequency.

Here, the greatest frequency = 23, so the modal class = 35 – 45,

Lower limit of modal class =  $l = 35$ ,

class width ( $h$ ) = 10,

$f_m = 23$ ,

$f_1 = 21$  and  $f_2 = 14$

The formula to find the mode is

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

Substitute the values in the formula, we get

$$\text{Mode} = 35 + \left[ \frac{(23 - 21)}{(46 - 21 - 14)} \right] \times 10$$

$$= 35 + (20/11)$$

$$= 35 + 1.8$$

$$= 36.8 \text{ years}$$

So the mode of the given data = 36.8 years

Calculation of Mean:

First find the midpoint using the formula,  $x_i = (\text{upper limit} + \text{lower limit})/2$

Class Interval	Frequency ( $f_i$ )	Mid-point ( $x_i$ )	$f_i x_i$
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 $f_i = 80$		Sum $f_i x_i = 2830$

The mean formula is

$$\text{Mean} = \bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= 2830/80$$

$$= 35.375 \text{ years}$$

Therefore, the mean of the given data = 35.375 years

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

Lifetime (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.**

Solution:

From the given data the modal class is 60–80.

Lower limit of modal class =  $l = 60$ ,

The frequencies are:

$$f_m = 61, f_1 = 52, f_2 = 38 \text{ and } h = 20$$

The formula to find the mode is

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

Substitute the values in the formula, we get

$$\text{Mode} = 60 + \left[ \frac{(61 - 52)}{(122 - 52 - 38)} \right] \times 20$$

$$\text{Mode} = 60 + [(9 \times 20)/32]$$

$$\text{Mode} = 60 + (45/8) = 60 + 5.625$$

Therefore, modal lifetime of the components = 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

Solution:

Given data:

Modal class = 1500-2000,

$$l = 1500,$$

Frequencies:

$$f_m = 40 \quad f_1 = 24, \quad f_2 = 33 \text{ and}$$

$$h = 500$$

Mode formula:

$$\text{Mode} = l + [(f_m - f_1) / (2f_m - f_1 - f_2)] \times h$$

Substitute the values in the formula, we get

$$\text{Mode} = 1500 + [(40 - 24) / (80 - 24 - 33)] \times 500$$

$$\text{Mode} = 1500 + [(16 \times 500) / 23]$$

$$\text{Mode} = 1500 + (8000 / 23) = 1500 + 347.83$$

Therefore, modal monthly expenditure of the families = Rupees 1847.83

Calculation for mean:

First find the midpoint using the formula,  $x_i = (\text{upper limit} + \text{lower limit}) / 2$

Let us assume a mean, (a) be 2750.

Class Interval	$f_i$	$x_i$	$d_i = x_i - a$	$u_i = d_i / h$	$f_i u_i$
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 = a	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
	$f_i = 200$				$f_i u_i = -35$

The formula to calculate the mean,

$$\text{Mean} = \bar{x} = a + (\sum f_i u_i / \sum f_i) \times h$$

Substitute the values in the given formula

$$= 2750 + (-35 / 200) \times 500$$

$$= 2750 - 87.50$$

$$= 2662.50$$

So, the mean monthly expenditure of the families = 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

Solution:

Given data:

Modal class = 30 – 35,

$l = 30$ ,

Class width ( $h$ ) = 5,

$f_m = 10$ ,  $f_1 = 9$  and  $f_2 = 3$

Mode Formula:

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

Substitute the values in the given formula

$$\text{Mode} = 30 + \left[ \frac{(10 - 9)}{(20 - 9 - 3)} \right] \times 5$$

$$= 30 + (5/8)$$

$$= 30 + 0.625$$

$$= 30.625$$

Therefore, the mode of the given data = 30.625

Calculation of mean:

Find the midpoint using the formula,  $x_i = (\text{upper limit} + \text{lower limit})/2$

Class Interval	Frequency ( $f_i$ )	Mid-point ( $x_i$ )	$f_i x_i$
15-20	3	17.5	52.5
20-25	8	22.5	180.0
25-30	9	27.5	247.5
30-35	10	32.5	325.0
35-40	3	37.5	112.5
40-45	0	42.5	0
45-50	0	47.5	0
50-55	2	52.5	105.0
	Sum $f_i = 35$		Sum $f_i x_i = 1022.5$

$$\text{Mean} = \bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= 1022.5/35$$

$$= 29.2 \text{ (approx)}$$

Therefore, mean = 29.2

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

Run Scored	Number 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**

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**Find the mode of the data.**

Solution:

Given data:

Modal class = 4000 – 5000,

$l = 4000$ ,

class width ( $h$ ) = 1000,

$f_m = 18$ ,  $f_1 = 4$  and  $f_2 = 9$

Mode Formula:

$$\text{Mode} = l + [(f_m - f_1) / (2f_m - f_1 - f_2)] \times h$$

Substitute the values

$$\text{Mode} = 4000 + [(18 - 4) / (36 - 4 - 9)] \times 1000$$

$$= 4000 + (14000/23)$$

$$= 4000 + 608.695$$

$$= 4608.695$$

$$= 4608.7 \text{ (approximately)}$$

Thus, the 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. Find the mode of the data:**

Number of cars	Frequency
<b>0-10</b>	<b>7</b>
<b>10-20</b>	<b>14</b>
<b>20-30</b>	<b>13</b>
<b>30-40</b>	<b>12</b>
<b>40-50</b>	<b>20</b>

50-60	11
60-70	15
70-80	8

Solution:

Given Data:

Modal class = 40 – 50,  $l = 40$ ,

Class width ( $h$ ) = 10,  $f_m = 20$ ,  $f_1 = 12$  and  $f_2 = 11$

$$\text{Mode} = l + [(f_m - f_1) / (2f_m - f_1 - f_2)] \times h$$

Substitute the values

$$\text{Mode} = 40 + [(20 - 12) / (40 - 12 - 11)] \times 10$$

$$= 40 + (80/17)$$

$$= 40 + 4.7$$

$$= 44.7$$

Thus, the mode of the given data is 44.7 cars.