

## Exercise 14.2

Page: 275

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.

**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,

$l = 35$ ,

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

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

$$\text{Mode} = 35 + (20/11) = 35 + 1.8$$

$$\text{Mode} = 36.8 \text{ year}$$

So the mode of the given data = 36.8 year

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

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

$$= 2830/80$$

$$= 35.37 \text{ years}$$

Therefore, the mean of the given data = 35.37 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.

$l = 60$ ,

The frequencies are:

$f_m = 61$ ,  $f_1 = 52$ ,  $f_2 = 38$  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	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 datas:

Modal class = 1500-2000,

$l = 1500$ ,

Frequencies:

$f_m = 40$ ,  $f_1 = 24$ ,  $f_2 = 33$  and

$h = 500$

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 formula, we get

$$\text{Mode} = 1500 + \left\{ \frac{40 - 24}{80 - 24 - 33} \right\} \times 500$$

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

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

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	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
	$\Sigma f_i = 200$				$\Sigma f_i u_i = -35$

The formula to calculate the mean,

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

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 = Rupees 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

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

$$\text{Mode} = 30 + (5/8) = 30 + 0.625$$

$$\text{Mode} = 30.625$$

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	105.5
	Sum $f_i = 35$		Sum $f_i x_i = 1022.5$

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

$$= 1022.5/35$$

$$= 29.2$$

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	1

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:

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

Substitute the values

$$\text{Mode} = 4000 + \left\{ \frac{18 - 4}{36 - 4 - 9} \right\} \times 1000$$

$$\text{Mode} = 4000 + (14000/23) = 4000 + 608.695$$

$$\text{Mode} = 4608.695$$

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

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
0-10	7
10-20	14
20-30	13
30-40	12
40-50	20
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  $f_2 = 11$

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

Substitute the values

$$\text{Mode} = 40 + \left\{ \frac{20 - 12}{40 - 12 - 11} \right\} \times 10$$

$$\text{Mode} = 40 + (80/17) = 40 + 4.7 = 44.7$$

Thus, the mode of the given data is 44.7 cars