

Exercise 9C

1.

Sol:

Here, the maximum class frequency is 45, and the class corresponding to this frequency is 30 – 40. So, the modal class is 30- 40.

Now,

Modal class = 30 – 40, lower limit (l) of modal class = 30, class size (h) = 10,

frequency (f_1) of the modal class = 45,

frequency (f_0) of class preceding the modal class = 35,

frequency (f_2) of class succeeding the modal class = 25

Now, let us substitute these values in the formula:

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 30 + \left(\frac{45 - 35}{90 - 35 - 45} \right) \times 10 \\ &= 30 + \left(\frac{10}{30} \right) \times 10 \\ &= 30 + 3.33 \\ &= 33.33\end{aligned}$$

Hence, the mode is 33.33.

2.

Sol:

Here, the maximum class frequency is 28, and the class corresponding to this frequency is 40 – 60. So, the modal class is 40 – 60.

Now,

Modal class = 40 – 60, lower limit (l) of modal class = 40, class size (h) = 20,

frequency (f_1) of the modal class = 28,

frequency (f_0) of class preceding the modal class = 16,

frequency (f_2) of class succeeding the modal class = 20

Now, let us substitute these values in the formula:

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 40 + \left(\frac{28 - 16}{56 - 16 - 20} \right) \times 20 \\ &= 40 + \left(\frac{12}{20} \right) \times 20 \\ &= 40 + 12 \\ &= 52\end{aligned}$$

Hence, the mode is 52.

3.

Sol:

Here, the maximum class frequency is 20, and the class corresponding to this frequency is 160 – 165. So, the modal class is 160 – 165.

Now,

Modal class = 160 – 165, lower limit (l) of modal class = 160, class size (h) = 5,

frequency (f_1) of the modal class = 20,

frequency (f_0) of class preceding the modal class = 8,

frequency (f_2) of class succeeding the modal class = 12

Now, let us substitute these values in the formula:

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 160 + \left(\frac{20 - 8}{40 - 8 - 12} \right) \times 5 \\ &= 160 + \left(\frac{12}{20} \right) \times 5 \\ &= 160 + 3 \\ &= 163\end{aligned}$$

Hence, the mode is 163.

It represents that the height of maximum number of students is 163cm.

Now, to find the mean let us put the data in the table given below:

Height (in cm)	Number of students (f_i)	Class mark (x_i)	$f_i x_i$
150 – 155	15	152.5	2287.5
155 – 160	8	157.5	1260
160 – 165	20	162.5	3250
165 – 170	12	167.5	2010
170 – 175	5	172.5	862.5
Total	$\Sigma f_i = 60$		$\Sigma f_i x_i = 9670$

$$\begin{aligned} \text{Mean} &= \frac{\sum_i f_i x_i}{\sum_i f_i} \\ &= \frac{9670}{60} \\ &= 161.17 \end{aligned}$$

Thus, mean of the given data is 161.17.

It represents that on an average, the height of a student is 161.17cm.

4.

Sol:

As the class 26 – 30 has the maximum frequency, it is the modal class.

Now, $x_k = 26$, $h = 4$, $f_k = 25$, $f_{k-1} = 20$, $f_{k+1} = 22$

$$\begin{aligned} \therefore \text{Mode, } M_0 &= x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\} \\ &= 26 + \left\{ 4 \times \frac{(25-20)}{(2 \times 25 - 20 - 22)} \right\} \\ &= 26 + \left\{ 4 \times \frac{5}{8} \right\} \\ &= (26 + 2.5) \\ &= 28.5 \end{aligned}$$

5.

Sol:

As the class 1500-2000 has the maximum frequency, it is the modal class.

Now, $x_k = 1500$, $h = 500$, $f_k = 40$, $f_{k-1} = 24$, $f_{k+1} = 31$

$$\therefore \text{Mode, } M_0 = x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\}$$

$$= 1500 + \left\{ 500 \times \frac{(40 - 24)}{(2 \times 40 - 24 - 31)} \right\}$$

$$= 1500 + \left\{ 500 \times \frac{16}{25} \right\}$$

$$= (1500 + 320)$$

$$= 1820$$

Hence, mode = Rs 1820

6.

Sol:

As the class 5000-10000 has the maximum frequency, it is the modal class.

Now, $x_k = 5000$, $h = 5000$, $f_k = 150$, $f_{k-1} = 90$, $f_{k+1} = 100$

$$\therefore \text{Mode, } M_0 = x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\}$$

$$= 5000 + \left\{ 5000 \times \frac{(150 - 90)}{(2 \times 150 - 90 - 100)} \right\}$$

$$= 5000 + \left\{ 5000 \times \frac{60}{110} \right\}$$

$$= (5000 + 2727.27)$$

$$= 7727.27$$

Hence, mode = Rs 7727.27

7.

Sol:

As the class 15 – 20 has the maximum frequency, it is the modal class.

Now, $x_k = 15$, $h = 5$, $f_k = 24$, $f_{k-1} = 18$, $f_{k+1} = 17$

$$\begin{aligned}
 \therefore \text{Mode, } M_0 &= x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\} \\
 &= 15 + \left\{ 5 \times \frac{(24-18)}{(2 \times 24 - 18 - 17)} \right\} \\
 &= 15 + \left\{ 5 \times \frac{6}{13} \right\} \\
 &= (15 + 2.3) \\
 &= 17.3 \\
 \text{Hence, mode} &= 17.3 \text{ years}
 \end{aligned}$$

8.

Sol:

As the class 85 – 95 has the maximum frequency, it is the modal class.

Now, $x_k = 85$, $h = 10$, $f_k = 32$, $f_{k-1} = 30$, $f_{k+1} = 6$

$$\begin{aligned}
 \therefore \text{Mode, } M_0 &= x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\} \\
 &= 85 + \left\{ 10 \times \frac{(32-30)}{(2 \times 32 - 30 - 6)} \right\} \\
 &= 85 + \left\{ 10 \times \frac{2}{28} \right\} \\
 &= (85 + 0.71) \\
 &= 85.71 \\
 \text{Hence, mode} &= 85.71
 \end{aligned}$$

9.

Sol:

Clearly, we have to find the mode of the data. The given data is an inclusive series. So, we will convert it to an exclusive form as given below:

Class interval	0.5 – 5.5	5.5 – 10.5	10.5 – 15.5	15.5 – 20.5	20.5 – 25.5	25.5 – 30.5	30.5 – 35.5	35.5 – 40.5	40.5 – 45.5	45.5 – 50.5
Frequency	3	8	13	18	28	20	13	8	6	4

As the class 20.5 – 25.5 has the maximum frequency, it is the modal class.

Now, $x_k = 20.5$, $h = 5$, $f_k = 28$, $f_{k-1} = 18$, $f_{k+1} = 20$

$$\begin{aligned}
 \therefore \text{Mode, } M_0 &= x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\} \\
 &= 20.5 + \left\{ 5 \times \frac{(28-18)}{(2 \times 28 - 18 - 20)} \right\} \\
 &= 20.5 + \left\{ 5 \times \frac{10}{18} \right\} \\
 &= (20.5 + 2.78)
 \end{aligned}$$

$$= 23.28$$

Hence, mode = 23.28

10.

Sol:

It is given that the sum of frequencies is 181.

$$\therefore x + 15 + 18 + 30 + 50 + 48 + x = 181$$

$$\Rightarrow 2x + 161 = 181$$

$$\Rightarrow 2x = 181 - 161$$

$$\Rightarrow 2x = 20$$

$$\Rightarrow x = 10$$

Thus, $x = 10$

Here, the maximum class frequency is 50, and the class corresponding to this frequency is 13 – 15. So, the modal class is 13 – 15.

Now,

Modal class = 13 – 15, lower limit (l) of modal class = 13, class size (h) = 2,

frequency (f_1) of the modal class = 50,

frequency (f_0) of class preceding the modal class = 30,

frequency (f_2) of class succeeding the modal class = 48

Now, let us substitute these values in the formula:

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 13 + \left(\frac{50 - 30}{100 - 30 - 48} \right) \times 2 \\ &= 13 + \left(\frac{20}{22} \right) \times 2 \\ &= 13 + 1.82 \\ &= 14.82\end{aligned}$$

Hence, the mode is 14.82.