

### Exercise 7.5

**1. Find the mode of the following data:**

- (i) 3, 5, 7, 4, 5, 3, 5, 6, 8, 9, 5, 3, 5, 3, 6, 9, 7, 4
- (ii) 3, 3, 7, 4, 5, 3, 5, 6, 8, 9, 5, 3, 5, 3, 6, 9, 7, 4
- (iii) 15, 8, 26, 25, 24, 15, 18, 20, 24, 15, 19, 15

**Solution:**

(i)

Value (x)	3	4	5	6	7	8	9
Frequency (f)	4	2	5	2	2	1	2

Thus, the mode = 5 since it occurs the maximum number of times.

(ii)

Value (x)	3	4	5	6	7	8	9
Frequency (f)	5	2	4	2	2	1	2

Thus, the mode = 3 since it occurs the maximum number of times.

(iii)

Value (x)	8	15	18	19	20	24	25
Frequency (f)	1	4	1	1	1	2	1

Thus, the mode = 15 since it occurs the maximum number of times.

**2. The shirt size worn by a group of 200 persons, who bought the shirt from a store, are as follows:**

<b>Shirt size:</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>
<b>Number of persons:</b>	<b>15</b>	<b>25</b>	<b>39</b>	<b>41</b>	<b>36</b>	<b>17</b>	<b>15</b>	<b>12</b>

**Find the model shirt size worn by the group.**

**Solution:**

Shirt size:	37	38	39	40	41	42	43	44
Number of persons:	15	25	39	41	36	17	15	12

From the data its observed that,

Model shirt size = 40 since it was the size which occurred for the maximum number of times.

### 3. Find the mode of the following distribution.

(i)

<b>Class interval:</b>	<b>0 – 10</b>	<b>10 – 20</b>	<b>20 – 30</b>	<b>30 – 40</b>	<b>40 – 50</b>	<b>50 – 60</b>	<b>60 – 70</b>	<b>70 – 80</b>
<b>Frequency:</b>	<b>5</b>	<b>8</b>	<b>7</b>	<b>12</b>	<b>28</b>	<b>20</b>	<b>10</b>	<b>10</b>

**Solution:**

Class interval:	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Frequency:	5	8	7	12	28	20	10	10

It's seen that the maximum frequency is 28.

So, the corresponding class i.e., 40 – 50 is the modal class.

And,

$$l = 40, h = 50 - 40 = 10, f = 28, f_1 = 12, f_2 = 20$$

Using the formula for finding mode, we get

$$\begin{aligned} \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\ &= 40 + \frac{28 - 12}{2 \times 28 - 12 - 20} \times 10 \\ &= 40 + 160/24 \\ &= 40 + 6.67 \\ &= 46.67 \end{aligned}$$

(ii)

<b>Class interval</b>	<b>10 – 15</b>	<b>15 – 20</b>	<b>20 – 25</b>	<b>25 – 30</b>	<b>30 – 35</b>	<b>35 – 40</b>
<b>Frequency</b>	<b>30</b>	<b>45</b>	<b>75</b>	<b>35</b>	<b>25</b>	<b>15</b>

**Solution:**

Class interval	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40
Frequency	30	45	75	35	25	15

It's seen that the maximum frequency is 75.

So, the corresponding class i.e., 20 - 25 is the modal class.

And,

$$l = 20, h = 25 - 20 = 5, f = 75, f_1 = 45, f_2 = 35$$

Using the formula for finding mode, we get

$$\begin{aligned}
 \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\
 &= 20 + \frac{75 - 45}{2 \times 75 - 45 - 35} \times 5 \\
 &= 20 + 150/70 \\
 &= 20 + 2.14 \\
 &= 22.14
 \end{aligned}$$

(iii)

Class interval	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Frequency	25	34	50	42	38	14

**Solution:**

Class interval	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Frequency	25	34	50	42	38	14

It's seen that the maximum frequency is 50.  
So, the corresponding class i.e., 35 - 40 is the modal class.  
And,

$$l = 35, h = 40 - 35 = 5, f = 50, f_1 = 34, f_2 = 42$$

Using the formula for finding mode, we get

$$\begin{aligned}
 \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\
 &= 35 + \frac{50 - 34}{2 \times 50 - 34 - 42} \times 5 \\
 &= 35 + 80/24 \\
 &= 35 + 3.33 \\
 &= 38.33
 \end{aligned}$$

**4. Compare the modal ages of two groups of students appearing for an entrance test:**

Age in years	16 – 18	18 – 20	20 – 22	22 – 24	24 – 26
Group A	50	78	46	28	23
Group B	54	89	40	25	17

**Solution:**

Age in years	16 – 18	18 – 20	20 – 22	22 – 24	24 – 26

Group A	50	78	46	28	23
Group B	54	89	40	25	17

For Group A:

It's seen that the maximum frequency is 78.

So, the corresponding class 18 – 20 is the modal class.

And,

$$l = 18, h = 20 - 18 = 2, f = 78, f_1 = 50, f_2 = 46$$

Using the formula for finding mode, we get

$$\begin{aligned} \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\ &= 18 + \frac{78 - 50}{2 \times 78 - 50 - 46} \times 2 \\ &= 18 + 56/60 \\ &= 18 + 0.93 \\ &= 18.93 \text{ years} \end{aligned}$$

For group B:

It's seen that the maximum frequency is 89

So, the corresponding class 18 - 20 is the modal class.

And,

$$l = 18, h = 20 - 18 = 2, f = 89, f_1 = 54, f_2 = 40$$

Using the formula for finding mode, we get

$$\begin{aligned} \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\ &= 18 + \frac{89 - 54}{2 \times 89 - 54 - 40} \times 2 \\ &= 18 + 70/84 \\ &= 18 + 0.83 \\ &= 18.83 \text{ years} \end{aligned}$$

Therefore, the modal age of the Group A is higher than that of Group B.

**5. The marks in science of 80 students of class X are given below. Find the mode of the marks obtained by the students in science.**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Frequency	3	5	16	12	13	20	5	4	1	1

**Solution:**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Frequency	3	5	16	12	13	20	5	4	1	1

It's seen that the maximum frequency is 20.  
So, the corresponding class 50 - 60 is the modal class.

And,

$$l = 50, h = 60 - 50 = 10, f = 20, f_1 = 13, f_2 = 5$$

Using the formula for finding mode, we get

$$\begin{aligned} \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\ &= 50 + \frac{20 - 13}{2 \times 20 - 13 - 5} \times 10 \\ &= 50 + 70/22 \\ &= 50 + 3.18 \\ &= 53.18 \end{aligned}$$

**6. The following is the distribution of height of students of a certain class in a city:**

<b>Height (in cm):</b>	<b>160 – 162</b>	<b>163 – 165</b>	<b>166 – 168</b>	<b>169 – 171</b>	<b>172 – 174</b>
<b>No of students:</b>	<b>15</b>	<b>118</b>	<b>142</b>	<b>127</b>	<b>18</b>

**Find the average height of maximum number of students.**

**Solution:**

Heights(exclusive)	160 – 162	163 – 165	166 – 168	169 – 171	172 – 174
Heights (inclusive)	159.5 – 162.5	162.5 – 165.5	165.5 – 168.5	168.5 – 171.5	171.5 – 174.5
No of students	15	118	142	127	18

It's seen that the maximum frequency is 142.  
So, the corresponding class 165.5 – 168.5 is the modal class.

And,

$$l = 165.5, h = 168.5 - 165.5 = 3, f = 142, f_1 = 118, f_2 = 127$$

Using the formula for finding mode, we get

$$\begin{aligned}
 \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\
 &= 165.5 + \frac{142 - 118}{2 \times 142 - 118 - 127} \times 3 \\
 &= 165.5 + 72/39 \\
 &= 165.5 + 1.85 \\
 &= 167.35 \text{ cm}
 \end{aligned}$$

**7. The following table shows the ages of the patients admitted in a hospital during a year:**

Ages (in years):	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
No of students:	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 the mean:

For the given data let the assumed mean (A) = 30

Age (in years)	Number of patients $f_i$	Class marks $x_i$	$d_i = x_i - 275$	$f_i d_i$
5 – 15	6	10	- 20	-120
15 – 25	11	20	- 10	-110
25 – 35	21	30	0	0
35 – 45	23	40	10	230
45 – 55	14	50	20	280
55 – 65	5	60	30	150
	N = 80			$\Sigma f_i d_i = 430$

It's observed from the table that  $\Sigma f_i = N = 80$  and  $\Sigma f_i d_i = 430$ .

Using the formula for mean,

$$\begin{aligned}
 \text{Mean } (\bar{x}) &= A + \frac{\Sigma f_i d_i}{\Sigma f_i} \\
 &= 30 + 430/80 \\
 &= 30 + 5.375 \\
 &= 35.375 \\
 &= 35.38
 \end{aligned}$$

Thus, the mean of this data is 35.38. It can also be interpreted as that on an average the age of a patients admitted to hospital was 35.38 years.

It is also observed that maximum class frequency is 23 and it belongs to class interval 35 – 45

So, modal class is 35 – 45 with the Lower limit (l) of modal class = 35

And, Frequency (f) of modal class = 23

Class size (h) = 10

Frequency (f<sub>1</sub>) of class preceding the modal class = 21

Frequency (f<sub>2</sub>) of class succeeding the modal class = 14

$$\begin{aligned}
 \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\
 &= 35 + \frac{23 - 21}{2 \times 23 - 21 - 14} \times 10 \\
 &= 35 + \frac{2}{46 - 35} \times 10 \\
 &= 35 + 1.81 = 36.8
 \end{aligned}$$

Therefore, the mode is 36.8. This represents that maximum number of patients admitted in hospital were of 36.8 years.

Hence, it's seen that mode is greater than the mean.

**8. 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
No. of components:	10	35	52	61	38	29

**Determine the modal lifetimes of the components.**

**Solution:**

From the data given as above its observed that maximum class frequency is 61 which belongs to class interval 60 – 80.

So, modal class limit (l) of modal class = 60

Frequency (f) of modal class = 61

Frequency (f<sub>1</sub>) of class preceding the modal class = 52

Frequency (f<sub>2</sub>) of class succeeding the modal class = 38

Class size (h) = 20

Using the formula for find mode, we have

$$\begin{aligned}
 \text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\
 &= 60 + \frac{61 - 52}{2 \times 61 - 52 - 38} \times 20 \\
 &= 60 + \frac{9}{122 - 90} \times 20 \\
 &= 60 + \frac{9 \times 20}{32} \\
 &= 60 + \frac{90}{16} \\
 &= 60 + 5.625 = 65.625
 \end{aligned}$$

Thus, the modal lifetime of electrical components is 65.625 hours

**9. The following table gives the daily income of 50 workers of a factory:**

Daily income	100 – 120	120 – 140	140 – 160	160 – 180	180 – 200
Number of workers	12	14	8	6	10

Find the mean, mode and median of the above data.

**Solution:**

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
100 – 120	110	12	1320	12
120 – 140	130	14	1820	26
140 – 160	150	8	1200	34
160 – 180	170	6	1000	40
180 – 200	190	10	1900	50
		N = 50	Σfx = 7260	

We know that,

$$\begin{aligned}
 \text{Mean} &= \frac{\Sigma fx}{N} \\
 &= \frac{7260}{50} \\
 &= 145.2
 \end{aligned}$$

Then,



We have,  $N = 50$   
 $\Rightarrow N/2 = 50/2 = 25$

So, the cumulative frequency just greater than  $N/2$  is 26, then the median class is 120 - 140  
Such that  $l = 120$ ,  $h = 140 - 120 = 20$ ,  $f = 14$ ,  $F = 12$

$$\begin{aligned}\text{Median} &= l + \frac{\frac{N}{2} - F}{f} \times h \\ &= 120 + \frac{25 - 12}{14} \times 20 \\ &= 120 + 260/14 \\ &= 120 + 18.57 \\ &= 138.57\end{aligned}$$

From the data, its observed that maximum frequency is 14, so the corresponding class 120 - 140 is the modal class

And,

$$l = 120, h = 140 - 120 = 20, f = 14, f_1 = 12, f_2 = 8$$

$$\begin{aligned}\text{Mode} &= l + \frac{f - f_1}{2f - f_1 - f_2} \times h \\ &= 120 + \frac{14 - 12}{2 \times 14 - 12 - 8} \times 20 \\ &= 120 + \frac{40}{8} \\ &= 120 + 5 \\ &= 125\end{aligned}$$

Therefore, mean = 145.2, median = 138.57 and mode = 125