

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:

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

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,

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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)

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

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)

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

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

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

(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
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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:

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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:

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

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

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

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.

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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 (f₁) of class preceding the modal class = 21

Frequency (f₂) 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 (f₁) of class preceding the modal class = 52

Frequency (f₂) of class succeeding the modal class = 38

Class size (h) = 20

Using the formula for find mode, we have

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

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	$\Sigma fx = 7260$	

We know that,

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

Then,

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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