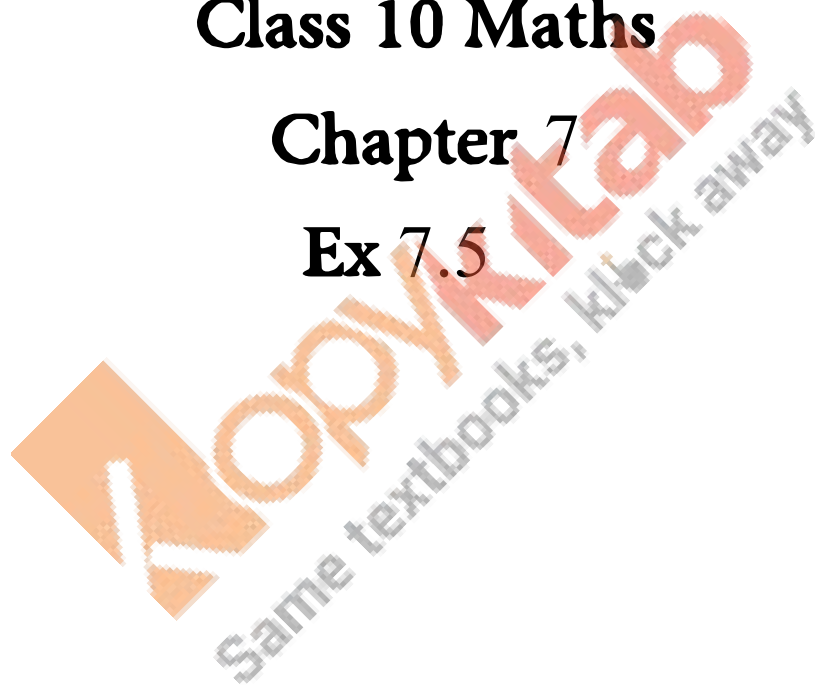# RD SHARMA

Solutions

Class 10 Maths

Chapter 7

Ex 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

Soln:

(i)

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

Mode = 5 because 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

Mode = 3 because it occurs maximum number of times.

(iii)

Value (x)	8	15	18	19	20	24	25	26
Frequency (f)	1	4	1	1	1	2	1	1

Mode = 15 because it occurs 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 36	25 17	39 15	41 12

Find the model shirt size worn by the group.

Soln:

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

Model shirt size = 40 because it occurs 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

(ii)

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

(iii)

Class interval:	25-30	30-35	35-40	40-45	45-50	50-60
Frequency:	25	34	50	42	29	15

Soln:

(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

Here the maximum frequency is 28 then the corresponding class 40 – 52 is the modal class

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

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

$$= 40 + \frac{28 - 12}{2 \times 28 - 12 - 20} \times 10$$

= 40 + 160/ 24

= 40 + 6.67

= 46.67

(ii)

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

Here the maximum frequency is 75, then the corresponding class 20 – 25 is the modal class

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

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

$$= 20 + \frac{75 - 45}{2 \times 75 - 45 - 35} \times 5$$

= 20 + 150/ 70

= 20 + 2.14

= 22.14

(iii)

Class interval	25-30	30-35	35-40	40-45	45-50	50-60
Frequency	25	34	50	42	38	14

Here the maximum frequency is 50 then the corresponding class 35 – 40 is the modal class

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

Mode $= l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$= 35 + \dfrac{50-34}{2\times 50-34-42} \times 5$

= 35 + 80/24

= 35 + 3.33

= 38.33

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

Soln:

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

Here the maximum frequency is 78, then the corresponding class 18 – 20 is model class

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

Mode $= l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$= 18 + \dfrac{78-50}{2\times 78-50-46} \times 2$

= 18 + 56/ 60

= 18 + 0.93

= 18.93 years

For group B

Here the maximum frequency is 89, then the corresponding class 18 – 20 is the modal class

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

Mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

= $18 + \dfrac{89-54}{2\times89-54-40} \times 2$

= 18 + 70/ 84

= 18 + 0.83

= 18.83 years

Hence the modal age for the Group A is higher than that for 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 60	10-20 60-70	20-30 70-80	30-40 80-90	40-50 90-100	50-
Frequency:	3 20	5 5	16 4	12 1	13 1	

Soln:

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

Here the maximum frequency is 20, then the corresponding class 50 – 60 is the modal class

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

Mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$$= 50 + \frac{20-13}{2\times20-13-5} \times 10 \quad 50 + \frac{20-13}{2\times20-13-5} \times 10$$

= 50 + 70/ 22

= 50 + 3.18

= 53.18

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

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

Find the average height of maximum number of students.

Soln:

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

Here the maximum frequency is 142, then the corresponding class 165.5 – 168.5 is the modal class

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

$$\text{Mode} = l + \frac{f-f_1}{2f-f_1-f_2} \times h \quad l + \frac{f-f_1}{2f-f_1-f_2} \times h$$

$$= 165.5 + \frac{142-118}{2\times142-118-127} \times 3 \quad 165.5 + \frac{142-118}{2\times142-118-127} \times 3$$

= 165.5 + 72/ 39

= 165.5 + 1.85

= 167.35 cm

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.

Soln: We may compute class marks (xi) as per the relation

x_i = upperclasslimit+lowerclasslimit2 $\dfrac{\text{upperclasslimit+lowerclasslimit}}{2}$

Now taking 30 as assumed mean (a) we may calculate d_i and $f_i d_i$ as follows.

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
Total	80			430

From the table we may observe that

$\Sigma f_i \Sigma f_i$ = 80

$\Sigma f_i d_i \Sigma f_i d_i$ = 430

Mean $\overline{x} = a + \Sigma f_i d_i \Sigma f_i \overline{x} = a + \dfrac{\Sigma f_i d_i}{\Sigma f_i}$

30 + 430/ 80

30 + 5.375

35.375

≈ 35.38

Clearly, mean of this data is 35.38. It represents that on an average the age of a patients admitted to hospital was 35.38 years.

As we may observe that maximum class frequency is 23 belonging to class interval 35 – 45

So, modal class = 35 – 45

Lower limit (l) of modal class = 35

Frequency (f) of modal class = 23

Class size (h) = 10

Frequency (f_1) of class preceding the modal class = 21

Frequency (f_2) of class succeeding the modal class = 14

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

$$= 35 + \frac{23 - 21}{2 \times 23 - 21 - 14} \times 10$$

$$= 35 + \frac{2}{46 - 35} \times 10$$

$$= 35 + 1.81$$

$$= 36.8$$

Clearly mode is 36.8. It represents that maximum number of patients admitted in hospital were of 36.8 years.

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

Lifetimes (in hours):	0-20 100-120	20-40	40-60	60-80	80-100
No of components:	10 38	35 29	52	61	

Determine the modal lifetimes of the components.

Soln: From the data given as above we may observe that maximum class frequency is 61 belonging to class interval 60 – 80

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

Frequency (f) of modal class = 61

Frequency (f_1) of class preceding the modal class = 52

Frequency (f_2) of class succeeding the modal class = 38

Class size (h) = 20

Mode = $l + \dfrac{f - f_1}{2f - f_1 - f_2} \times h$

$= 60 + \dfrac{61 - 52}{2 \times 61 - 52 - 38} \times 20$

$= 60 + \dfrac{9}{122 - 90} \times 20$

$= 60 + \dfrac{9 \times 20}{32}$

= 60 + 90/16

= 60 + 5.625

= 65.625

So, 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.

Soln:

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	ΣfxΣfx = 7260	

Mean = $\text{Σfx}50 \dfrac{\text{Σfx}}{50}$ = 145.2

We have,

N = 50

Then, N/2 = 50/2 = 25

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

Median = $l+ \text{N2−Ff×hl} + \dfrac{\frac{N}{2}-F}{f} \times h$

= $120+ 25-1214×20 120 + \dfrac{25-12}{14} \times 20$

= 120 + 260/ 14

= 120 + 18.57

= 138.57

Here the maximum frequency is 14, then the corresponding class 120 – 140 is the modal class

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

Mode = $l+ \text{f−f}_12\text{f−f}_1\text{−f}_2\text{×hl} + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

= $120+ 14-122×14-12-8×20 120 + \dfrac{14-12}{2×14-12-8} \times 20$

= 120 + 40/ 8

= 120 + 5

= 125

10.The following distribution gives the state-wise teachers-students ratio in higher secondary schools of India. Find the mode and mean of this data. Interpret the two measures:

Number of students per teacher	Number of states/ U.T	Number of students per teacher	Number of states/ U.T
15 – 20	3	35 – 40	3
20 – 25	8	40 – 45	0
25 – 30	9	45 – 50	0
30 – 35	10	50 – 55	2

Soln: WE may observe from the given data that maximum class frequency is 10 belonging to class interval 30 – 35.

So, modal class = 30 – 35

Class size (h) = 5

Lower limit (l) of modal class = 30

Frequency (f) of modal class = 10

Frequency (f_1) of class preceding modal class = 9

Frequency (f_2) of class succeeding modal class = 3

Mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$= 30 + \dfrac{10-9}{2\times10-9-3} \times 5$

$= 30 + \dfrac{1}{20-12} \times 5$

= 30 + 5/8

= 30.625

Mode = 30.6

It represents that most of states/ U.T have a teacher- student ratio as 30.6

Now we may find class marks by using the relation

Class mark = $\dfrac{upperclasslimit+lowerclasslimit}{2}$

Now taking 32.5 as assumed mean (a) we may calculate d_i, u_i, and f_iu_i as following

Number of students per teacher	Number of states/U.T (f_i)	x_i	$d_i = x_i - 32.5$	U_i	$f_i u_i$
15 – 20	3	17.5	-15	-3	-9
20 – 25	8	22.5	-10	-2	-16
25 – 30	9	27.5	-5	-1	-9
30 – 35	10	32.5	0	0	0
35 – 40	3	37.5	5	1	3
40 – 45	0	42.5	10	2	0
45 – 50	0	47.5	15	3	0
50 – 55	2	52.5	20	4	8
Total	35				-23

Now Mean $\overline{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i} \times h \, \overline{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i} \times h$

$= 32.5 + \frac{-23}{35} \times 5 \, 32.5 + \frac{-23}{35} \times 5$

$= 32.5 - 23/7$

$= 32.5 - 3.28$

$= 29.22$

So mean of data is 29.2

It represents that on an average teacher-student ratio was 29.2

11. Find the mean, median and mode of the following data:

Classes:	0 – 50	50 – 100	100 – 150	150 – 200	200 – 250	250 – 300	300 – 350
Frequency:	2	3	5	6	5	3	1

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
0 – 50	35	2	50	2
50 – 100	75	3	225	5
100 – 150	125	5	625	10
150 – 200	175	6	1050	16
200 – 250	225	5	1127	21
250 – 300	275	3	825	24
300 – 350	325	1	325	25
		N = 25	Σfx = 4225	

Mean = $\dfrac{\Sigma fx}{N} = \dfrac{4225}{25}$ = 169

We have,

N = 25

Then, N/ 2 =25/ 2 = 12.5

The cumulative frequency just greater than N/2 is 16, then the median class is 150 – 200 such that

l = 150, h = 200 – 150 = 50, f = 6, F = 10

Median = $l + \dfrac{\frac{N}{2} - F}{f} \times h$

= $150 + \dfrac{12.5 - 10}{6} \times 50$

= 150 + 125/ 6

= 150 + 20.83

= 170.83

Here the maximum frequency is 6, then the corresponding class 150 – 200 is the modal class

l = 150, h = 200 – 150 = 50, f = 6, f_1 = 5, f_2 = 5

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $150 + \frac{6-5}{2\times6-5-5} \times 50$

= 150 + 50/ 2

= 150 + 25

= 175

12.A students noted the number of cars pass through a spot on a road for 100 periods each of 3 minute and summarized it in the table given below. Find the mode of the data.

Soln: From the given dat6a we may observe that maximum class frequency is 20 belonging to 40 – 50 class intervals.

So, modal class = 40 – 50

Lower limit (l) of modal class = 40

Frequency (f) of modal class = 20

Frequency (f_1) of class preceding modal class = 12

Frequency (f_2) of class succeeding modal class = 11

Class size = 10

Mode = $l + \frac{f-f_1}{2f-f_1-f_2} \times h$

= $40 + \frac{20-12}{2(20)-12-11} \times 10$

= $40 + \frac{80}{40-23}$

= 40 + 80/ 17

= 40 + 4.7

= 44.7

So mode of this data is 44.7 cars

13.The following frequency distribution gives the monthly consumption of electricity of 68 consumers of a locality. Find the median, mean and mode of the data and compare them.

Monthly consumption:	65-85 85-105 105-125 125-145 145-165 165-185 185-205
No of consumers:	4 5 13 20 14 8 4

Soln:

Class interval	Mid value x_i	Frequency f_i	Fx	Cumulative frequency
65 – 85	75	4	300	4
85 – 105	95	5	475	9
105 – 125	115	13	1495	22
125 – 145	135	20	2700	42
145 – 165	155	14	2170	56
165 – 185	175	8	1400	64
185 – 205	195	4	780	68
		N = 68		$\Sigma fx \Sigma fx$ = 9320

Mean = $\Sigma fxN = 932068 = 137.05 \dfrac{\Sigma fx}{N} = \dfrac{9320}{68} = 137.05$

We have, N = 68

N/ 2 = 68/ 2 = 34

The cumulative frequency just greater than N/ 2 is 42 then the median class is 125 – 145 such that

l = 125, h = 145 – 125 = 20, f = 20, F = 22

Median = $l + \dfrac{\frac{N}{2} - F}{f} \times h$

$= 125 + \dfrac{34 - 22}{20} \times 20$

= 125 + 12

= 137

Here the maximum frequency is 20, then the corresponding class 125 – 145 is the modal class

l = 125, h = 145 – 125 = 20, f = 20, f_1 = 13, f_2 = 14

Mode = $l + \dfrac{f - f_1}{2f - f_1 - f_2} \times h$

$= 125 + \dfrac{20 - 13}{2(20) - 13 - 14} \times 20$

= 125 + 140/ 13

= 135.77

14.100 surnames were randomly picked up from a local telephone directly and the frequency distribution of the number of letter English alphabets in the surnames was obtained as follows:

Number of letters:	1-4 16-19	4-7	7-10	10-13	13-16
Number surnames:	6 4	30 4	40	16	

Determine the median number of letters in the surnames. Find the mean number of letters in the surnames. Also, find the modal size of the surnames.

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
1 – 4	2.5	6	15	6
4 – 7	5.5	30	165	36
7 – 10	8.5	40	340	76
10 – 13	11.5	16	184	92
13 – 16	14.5	4	58	96

16 – 19	17.5	4	70	100
		N = 100	ΣfxΣfx = 832	

Mean = ΣfxN = 832100 = 8.32 $\frac{\Sigma fx}{N} = \frac{832}{100} = 8.32$

We have,

N = 100

N/ 2 = 100/ 2 = 50

The cumulative frequency just greater than N/ 2 is 76, then the median class is 7 – 10 such that

l = 7, h = 10 – 7 = 3, f = 40, F = 36

Median = l+ N2−Ff×hl $+ \frac{\frac{N}{2}-F}{f} \times h$

= 7+ 50−3640×37 $+ \frac{50-36}{40} \times 3$

= 7 + 52/ 40

= 7 + 1.05

= 8.05

Here the maximum frequency is 40, then the corresponding class 7 – 10 is the modal class

l = 7, h = 10 – 7 = 3, f = 40, f_1 = 30, f_2 = 16

Mode = l+ f−f₁2f−f₁−f₂×hl $+ \frac{f-f_1}{2f-f_1-f_2} \times h$

= 7+ 40−302×40−30−16×37 $+ \frac{40-30}{2\times40-30-16} \times 3$

= 7 + 30/ 34

= 7 + 0.88

= 7.88

15. Find the mean, median and mode of the following data:

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120	120 – 140

Frequency	6	8	10	12	6	5	3

Soln:

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
0 – 20	10	6	60	6
20 – 40	30	8	240	17
40 – 60	50	10	500	24
60 – 80	70	12	840	36
80 – 100	90	6	540	42
100 – 120	110	5	550	47
120 – 140	130	3	390	50
		N = 50	Σfx = 3120	

Mean = $\dfrac{\Sigma fx}{N} = \dfrac{3120}{50} = 62.4$

We have,

N = 50

Then, N/ 2 = 50/ 2 = 25

The cumulative frequency just greater than N/ 2 is 36, then the median class is 60 – 80 such that

l = 60, h = 80 – 60 = 20, f = 12, F = 24

Median = $l + \dfrac{\frac{N}{2} - F}{f} \times h$

$= 60 + \dfrac{25 - 24}{12} \times 20$

= 60 + 20/ 12

= 60 + 1.67

= 61.67

Here the maximum frequency is 12, then the corresponding class 60 – 80 is the modal class

I = 60, h = 80 – 60 = 20, f = 12, f_1 = 10, f_2 = 6

Mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$= 60 + \dfrac{12-10}{2\times12-10-6} \times 20$

= 60 + 40/ 8

= 65

16. 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	Frequency	Expenditure	Frequency
1000-1500	24	3000-3500	30
1500-2000	40	3500-4000	22
2000-2500	33	4000-4500	16
2500-3000	28	4500-5000	7

Soln: We may observe from the given data that maximum class frequency is 40 belonging to 1500 -200 intervals

So, modal class = 1500 -2000

Lower limit (l) of modal class = 1500

Frequency (f) of modal class = 40

Frequency (f_1) of class preceding modal class = 24

Frequency (f_2) of class succeeding modal class = 33

Class size (h) = 500

Mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

$$= 1500 + \frac{40-24}{2\times40-24-33} \times 500$$

$$= 1500 + \frac{16}{80-57} \times 500$$

$$= 1500 + 347.826$$

$$= 1847.826 \approx 1847.83$$

So modal monthly expenditure was Rs. 1847.83

Now we may find class mark as

Class mark $= \dfrac{\text{upperclasslimit} + \text{lowerclasslimit}}{2}$

Class size (h) of given data = 500

Now taking 2750 as assumed mean (a) we may calculate d_i u_i as follows:

Expenditure (in Rs)	Number of families f_i	x_i	$d_i = x_i - 2750$	U_i	$f_i u_i$
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
Total	200				-35

Now from table may observe that

Σf_i = 200

$\Sigma f_i d_i$ = -35

Mean $\overline{x} = a + \dfrac{\Sigma f_i d_i}{\Sigma f_i} \times h$

$\overline{x} = 2750 + \dfrac{-35}{200} \times 500$

$\overline{xx}$ = 2750 – 87.5

$\overline{xx}$ = 2662.5

So mean monthly expenditure was Rs. 2662.5

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

Runs scored	No of batsmen	Runs scored	No of batsmen
3000 – 4000	4	7000 – 8000	6
4000 – 5000	18	8000 – 9000	3
5000 – 6000	9	9000 – 10000	1
6000 – 7000	7	10000 – 11000	1

Find the mode of the data.

Soln: From the given data we may observe that maximum class frequency is 18 belonging to class interval 4000 – 5000.

So, modal class = 4000 – 5000

Lower limit (l) of modal class = 4000

Frequency (f) of modal class = 18

Frequency (f_1) of class preceding modal class = 4

Frequency (f_2) of class succeeding modal class = 9

Class size (h) = 1000

Now mode = $l + \dfrac{f-f_1}{2f-f_1-f_2} \times h$

= $4000 + \dfrac{18-4}{2(18)-4-9} \times 1000$

= 4000 + (14000/ 23)

= 4000 + 608.695

= 4608.695

So mode of given data is 4608.7 runs