

CBSE Class-10 Mathematics

NCERT solution

Chapter - 14

Statistics - Exercise 14.1

1. A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.

Number of plants	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10	10 - 12	12 - 14
Number of houses	1	2	1	5	6	2	3

Which method did you use for finding the mean and why?

Ans. Since, number of plants and houses are small in their values, so we use direct method.

Number of plants	Number of houses (f_i)	Class Marks (x_i)	$f_i x_i$
0 - 2	1	1	1
2 - 4	2	3	6
4 - 6	1	5	5
6 - 8	5	7	35
8 - 10	6	9	54
10 - 12	2	11	22
12 - 14	3	13	39
Total	$\sum f_i = 20$		$\sum f_i x_i = 162$

$$\text{Mean } (\bar{x}) = \frac{\sum f_i x_i}{\sum f_i} = \frac{162}{20} = 8.1$$

Hence mean number of plants per house is 8.1.

2. Consider the following distribution of daily wages of 50 workers of a factory.

Daily wages (in Rs.)	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200
Number of workers	12	14	8	6	10

Find the mean daily wages of the workers of the factory by using an appropriate method.

Ans.

Daily wages (in Rs.)	No. of workers (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100 - 120	12	110	- 2	- 24
120 - 140	14	130	- 1	- 14
140 - 160	8	150	0	0
160 - 180	6	170	1	6
180 - 200	10	190	2	20
	$\sum f_i = 50$			$\sum f_i u_i = -12$

From given data, Assume mean (a) = 150, Width of the class (h) = 20

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-12}{50} = -0.24$$

Using formula, Mean (\bar{x}) = $a + h\bar{u} = 150 + 20(-0.24) = 150 - 4.8 = 145.2$

Hence mean daily wages of the workers of factory is Rs. 145.20.

3. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is Rs.18. Find the missing frequency (f).

Daily pocket allowance (in Rs.)	11 - 13	13 - 15	15 - 17	17 - 19	19 - 21	21 - 23	23 - 25
Number of houses	7	6	9	13	f	5	4

Ans.

Daily pocket allowance (in Rs.)	No. of children (f_i)	Class Marks (x_i)	$d_i = x_i - a$	$f_i d_i$
11 - 13	7	12	- 6	- 42
13 - 15	6	14	- 4	- 24
15 - 17	9	16	- 2	- 18
17 - 19	13	18	0	0
19 - 21	f	20	2	$2f$
21 - 23	5	22	4	20
23 - 25	4	24	6	24
	$\sum f_i = 44 + f$			$\sum f_i d_i = 2f - 40$

From given data, Assume mean (a) = 18

$$\therefore (\bar{x}) = a + \frac{\sum f_i d_i}{\sum f_i}$$

$$\Rightarrow 18 = 18 + \frac{2f - 40}{44 + f}$$

$$\Rightarrow \frac{2f - 40}{44 + f} = 0$$

$$\Rightarrow 2f - 40 = 0$$

$$\Rightarrow 2f = 40$$

$$\Rightarrow f = 20$$

Hence missing frequency is 20.

4. Thirty women were examined in a hospital by a doctor and the number of heart beats per minute were recorded and summarized as follows:

Number of heart beats per minute	65 - 68	68 - 71	71 - 74	74 - 77	77 - 80	80 - 83	83 - 86
Number of women	2	4	3	8	7	4	2

Ans.

No. of heart beats per min.	No. of women (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
65 - 68	2	66.5	- 3	- 6
68 - 71	4	69.5	- 2	- 8
71 - 74	3	72.5	- 1	- 3
74 - 77	8	75.5	0	0
77 - 80	7	78.4	1	7
80 - 83	4	81.5	2	8
83 - 86	2	84.5	3	6
	$\sum f_i = 30$			$\sum f_i u_i = 4$

(in the class interval 77-80 , 78.4 changes to 78.5)

From given data, Assume mean (a) = 75.5, Width of the class (h) = 3

$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{4}{30} = 0.13$ (approx.)

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = 75.5 + 3 (0.13) = 75.5 + 0.39 = 75.89

Hence mean heart beat per minute for women is 75.89.

5. In a retail market, fruit vendors were selling mangoes kept in packing boxes. These boxes contained varying number mangoes. The following was the distribution of mangoes according to the number of boxes.

Number of mangoes	50 - 52	53 - 55	56 - 58	59 - 61	62 - 64
Number of boxes	12	14	8	6	10

{change the frequency in above table as: 50-52 (15) 53-55 (110) 56-58 (135) 59-61 (115) 62-64 (25)}

Find the mean number of mangoes kept in a packing box. Which method of finding the mean did you choose?

Ans. Since value of number of mangoes and number of boxes are large numerically. So we use step-deviation method
we convert the class interval firstly into exclusive form given as

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True Class Interval	No. of boxes (fi)	Class mark (xi)	$u_i = \frac{x_i - a}{h}$	fiui
49.5-52.5	15	51	-2	-30
52.5-55.5	110	54	-1	-110
55.5-58.5	135	57	0	0
58.5-61.5	115	60	1	115
61.5-64.5	25	63	2	50
	$\sum f_i = 400$			$\sum f_i u_i = 25$

From given data, Assume mean (a) = 57, Width of the class (h) = 3

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{25}{400} = 0.0625 \text{ (approx.)}$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = $57 + 3(0.0625)$ = $57 + 0.1875$ = 57.1875 = 57.19 (approx.)

Hence mean number of mangoes kept in a packing box is 57.19.

6. The table below shows the daily expenditure on food of 25 households in a locality:

Daily expenditure (in Rs.)	100 - 150	150 - 200	200 - 250	250 - 300	300 - 350
Number of households	4	5	12	2	2

Find the mean daily expenditure on food by a suitable method.

Ans.

Daily expenditure	No. of households (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
100 - 150	4	125	-2	-8
150 - 200	5	175	-1	-5
200 - 250	12	225	0	0
250 - 300	2	275	1	2
300 - 350	2	325	2	4
	$\sum f_i = 25$			$\sum f_i u_i = -7$

From given data, Assume mean $(\alpha) = 225$, Width of the class $(h) = 50$

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-7}{25} = -0.28$$

Using formula, Mean $(\bar{x}) = \alpha + h\bar{u} = 225 + 50(-0.28) = 225 - 14 = 211$

Hence mean daily expenditure on food is Rs. 211.

7. To find out the concentration of SO₂ in the air (in parts per million, i.e., ppm), the data was collected for 30 localities in a certain city and is presented below:

Concentration of SO ₂ (in ppm)	0.00 – 0.04	0.04 – 0.08	0.08 – 0.12	0.12 – 0.16	0.16 – 0.20	0.20 – 0.24
Frequency	4	9	9	2	4	2

Find the mean concentration of SO₂ in the air.

Ans.

Concentration of SO ₂ (in ppm)	Frequency (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
0.00 – 0.04	4	0.02	-2	-8
0.04 – 0.08	9	0.06	-1	-9
0.08 – 0.12	9	0.10	0	0
0.12 – 0.16	2	0.14	1	2
0.16 – 0.20	4	0.18	2	8
0.20 – 0.24	2	0.20	3	6
	$\sum f_i = 30$			$\sum f_i u_i = -1$

From given data, Assume mean $(\alpha) = 0.10$, Width of the class $(h) = 0.04$

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-1}{30} = -0.033 \text{ (approx.)}$$

Using formula, Mean $(\bar{x}) = a + hu = 0.10 + 0.04(-0.033) = 0.10 - 0.0013 = 0.0987$ (approx.)

Hence mean concentration of SO_2 in air is 0.0987 ppm.

8. A class teacher has the following absentee record of 40 students of a class for the whole term. Find the mean number of days a student was absent.

Number of days	0 - 6	6 - 10	10 - 14	14 - 20	20 - 28	28 - 38	38 - 40
Number of students	11	10	7	4	4	3	1

Ans.

Number of days	No. of students (f_i)	Class Marks (x_i)	$d_i = x_i - a$	$f_i d_i$
0 - 6	11	3	- 14	- 154
6 - 10	10	8	- 9	- 90
10 - 14	7	12	- 5	- 35
14 - 20	4	17	0	0
20 - 28	4	24	7	28
28 - 38	3	33	16	48
38 - 40	1	39	22	22
	$\sum f_i = 40$			$\sum f_i d_i = -181$

From given data, Assume mean (a) = 17

$$\therefore (\bar{x}) = a + \frac{\sum f_i d_i}{\sum f_i} = 17 + \frac{(-181)}{40} = 17 - 4.52 = 12.48$$

Hence mean 12.48 number of days a student was absent.

9. The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

Literacy rate (in percentage)	45 - 55	55 - 65	65 - 75	75 - 85	85 - 95
Number of cities	3	10	11	8	3

Ans.

Literacy rate (in %)	No. of cities (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
45 - 55	3	50	- 2	- 6
55 - 65	10	60	- 1	- 10
65 - 75	11	70	0	0
75 - 85	8	80	1	8
85 - 95	3	90	2	6
	$\sum f_i = 35$			$\sum f_i u_i = -2$

From given data, Assume mean (a) = 70, Width of the class (h) = 10

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-2}{35} = -0.057$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = $70 + 10(-0.057)$ = $70 - 0.57$ = 69.43

Hence mean literacy rate is 69.43%.

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Chapter - 14

Statistics - Exercise 14.2

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.

Ans. For Mode: In the given data, maximum frequency is 23 and it corresponds to the class interval 35 – 45.

\therefore Modal class = 35 – 45

And $l = 35$, $f_1 = 23$, $f_0 = 21$, $f_2 = 14$ and $h = 10$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 35 + \left[\frac{23 - 21}{2(23) - 21 - 14} \right] \times 10$$

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

$$= 35 + \frac{20}{11}$$

$$= 35 + 1.8$$

= 36.8

For Mean:

Age (in years)	No. of patients (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
5 - 15	6	10	- 2	- 12
15 - 25	11	20	- 1	- 11
25 - 35	21	30	0	0
35 - 45	23	40	1	23
45 - 55	14	50	2	28
45 - 65	5	60	3	15
	$\sum f_i = 80$			$\sum f_i u_i = 43$

From given data, Assume mean (a) = 30, Width of the class (h) = 10

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{43}{80} = 0.5375$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = 30 + 10 (0.5375) = 30 + 5.375 = 35.37

Hence mode of given data is 36.8 years and mean of the given data is 35.37 years.

Also, it is clear from above discussion that average age of a patient admitted in the hospital is 35.37 years and maximum number of patients admitted in the hospital are of age 36.8 years.

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

Life times (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.

Ans. Given: Maximum frequency is 61 and it corresponds to the class interval 60 – 80.

\therefore Modal class = 60 – 80

And $l = 60$, $f_1 = 61$, $f_0 = 52$, $f_2 = 38$ and $h = 20$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 60 + \left[\frac{61 - 52}{2(61) - 52 - 38} \right] \times 20$$

$$= 60 + \frac{9}{122 - 52 - 38} \times 20$$

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

$$= 60 + 5.625$$

$$= 65.625$$

Hence modal lifetimes of the components is 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 (in Rs.)	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

Ans. For Mode: Here, Maximum frequency is 40 and it corresponds to the class interval 1500 – 2000.

\therefore Modal class = 1500 – 2000

And $l = 1500$, $f_1 = 40$, $f_0 = 24$, $f_2 = 33$ and $h = 500$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 1500 + \left[\frac{40 - 24}{2(40) - 24 - 33} \right] \times 500$$

$$= 1500 + \frac{16}{80 - 24 - 33} \times 500$$

$$= 1500 + \frac{8000}{23}$$

$$= 1500 + 347.83$$

$$= 1847.83$$

For Mean:

Expenditure (in Rs.)	No. of families (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
1000 – 1500	24	1250	- 3	- 72
1500 – 2000	40	1750	- 2	- 80
2000 – 2500	33	2250	- 1	- 33
2500 – 3000	28	2750	0	0
3000 – 3500	30	3250	1	30
3500 – 4000	22	3750	2	44
4000 – 4500	16	4250	3	48
4500 – 5000	7	4750	4	28
	$\sum f_i = 200$			$\sum f_i u_i = -35$

From given data, Assume mean $(\alpha) = 2750$, Width of the class $(h) = 500$

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-35}{200} = -0.175$$

Using formula, Mean $(\bar{x}) = \alpha + h\bar{u} = 2750 + 500(-0.175) = 2750 - 87.50 = 2662.50$

Hence the modal monthly expenditure of family is Rs. 1847.83 and the mean monthly expenditure is Rs. 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

Ans. For Mode: Here, Maximum frequency is 10 and it corresponds to the class interval 30 – 35.

\therefore Modal class = 30 – 35

And $l = 30$, $f_1 = 10$, $f_0 = 9$, $f_2 = 3$ and $h = 5$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 30 + \left[\frac{10 - 9}{2(10) - 9 - 3} \right] \times 5$$

$$= 30 + \frac{1}{20-12} \times 5 = 30 + \frac{5}{8} = 30 + 0.625 = 30.63 \text{ (approx.)}$$

For Mean:

Expenditure (in Rs.)	No. of families (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
15 - 20	3	17.5	- 3	- 9
20 - 25	8	22.5	- 2	- 16
25 - 30	9	27.5	- 1	- 9
30 - 35	10	32.5	0	0
35 - 40	3	37.5	1	3
40 - 45	0	42.5	2	0
45 - 50	0	47.5	3	0
50 - 55	2	52.5	4	8
	$\sum f_i = 35$			$\sum f_i u_i = -23$

From given data, Assume mean (a) = 32.5, Width of the class (h) = 5

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-23}{35} = -0.65$$

Using formula, Mean (\bar{x}) = $a + h\bar{u}$ = 32.5 + 5 (− 0.65) = 32.5 − 3.25 = 29.25 (approx.)

Hence mode and mean of given data is 30.63 and 29.25. Also from above discussion, it is clear that states/U.T. have students per teacher is 30.63 and on average, this ratio is 29.25.

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

Runs scored	Number of batsmen
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 mode of the data.

Ans. In the given data, maximum frequency is 18 and it corresponds to the class interval 4000 – 5000.

\therefore Modal class = 4000 – 5000

And $l = 4000$, $f_1 = 18$, $f_0 = 4$, $f_2 = 9$ and $h = 1000$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 4000 + \left[\frac{18 - 4}{2(18) - 4 - 9} \right] \times 1000$$

$$= 4000 + \frac{14}{36 - 13} \times 1000$$

$$= 4000 + \frac{14000}{23}$$

$$= 4000 + 608.6956$$

$$= 4608.7 \text{ (approx.)}$$

Hence, 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:

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

Find the mode of the data.

Ans. In the given data, maximum frequency is 20 and it corresponds to the class interval 40 – 50.

\therefore Modal class = 40 – 50

And $l = 40$, $f_1 = 20$, $f_0 = 12$, $f_2 = 11$ and $h = 10$

$$\begin{aligned}\therefore \text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 40 + \left[\frac{20 - 12}{2(20) - 12 - 11} \right] \times 10 \\ &= 40 + \frac{8}{40 - 23} \times 10 \\ &= 40 + \frac{80}{17} = 40 + 4.70588 = 44.7 \text{ (approx.)}\end{aligned}$$

Hence, mode of the given data is 44.7 cars.

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Chapter - 14

Statistics - Exercise 14.3

1. 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 (in units)	Number of consumers
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	8
185 – 205	4

Ans. For Median:

Monthly consumption (in units)	Number of consumers (f_i)	Cumulative Frequency
65 – 85	4	4
85 – 105	5	9
105 – 125	13	22
125 – 145	20	42
145 – 165	14	56
165 – 185	8	64
185 – 205	4	68
Total	$\sum f_i = n = 68$	

Here, $\sum f_i = n = 68$, then $\frac{n}{2} = \frac{68}{2} = 34$, which lies in interval 125 – 145.

∴ Median class = 125 – 145

So, $l = 125$, $n = 68$, $f = 20$, $cf = 22$ and $h = 20$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 125 + \left[\frac{\frac{68}{2} - 22}{20} \right] \times 20$$

$$= 125 + \frac{34 - 22}{20} \times 20 = 125 + 12 = 137$$

For Mean:

Monthly consumption (in units)	No. of consumers (f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
65 – 85	4	75	– 3	– 12
85 – 105	5	95	– 2	– 10
105 – 125	13	115	– 1	– 13
125 – 145	20	135	0	0
145 – 165	14	155	1	14
165 – 185	8	175	2	16
185 – 205	4	195	3	12
	$\sum f_i = 68$			$\sum f_i u_i = 7$

From given data, Assume mean (a) = 135, Width of the class (h) = 20

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i}$$

$$= \frac{7}{68} = 0.102$$

Using formula, Mean $(\bar{x}) = a + hu = 135 + 20 (0.102)$

$$= 135 + 2.04 = 137.04$$

For Mode:

In the given data, maximum frequency is 20 and it corresponds to the class interval 125 – 145.

∴ Modal class = 125 – 145

And $l = 125$, $f_1 = 20$, $f_0 = 13$, $f_2 = 14$ and $h = 20$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 125 + \left[\frac{20 - 13}{2(20) - 13 - 14} \right] \times 20$$

$$= 125 + \frac{7}{40 - 27} \times 20$$

$$= 125 + \frac{140}{13}$$

$$= 125 + 10.76923$$

$$= 125 + 10.77$$

$$= 135.77$$

Hence, median, mean and mode of given data is 137 units, 137.04 units and 135.77 units.

2. If the median of the distribution given below is 28.5, then find the values of x and y .

Class interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	Total
Frequency	5	x	20	15	y	5	60

Ans.

Monthly consumption (in units)	Number of consumers (f_i)	Cumulative Frequency
0 – 10	5	5
10 – 20	x	$5 + x$
20 – 30	20	$25 + x$
30 – 40	15	$40 + x$
40 – 50	y	$40 + x + y$
50 – 60	5	$45 + x + y$
Total	$\sum f_i = n = 60$	

Here, $\sum f_i = n = 60$, then $\frac{n}{2} = \frac{60}{2} = 30$, also, median of the distribution is 28.5, which lies in interval 20 – 30.

\therefore Median class = 20 – 30

So, $l = 20$, $n = 60$, $f = 20$, $cf = 5 + x$ and $h = 10$

$$\therefore 45 + x + y = 60$$

$$\Rightarrow x + y = 15 \text{(i)}$$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$\Rightarrow 28.5 = 20 + \left[\frac{30 - (5 + x)}{20} \right] \times 10$$

$$\Rightarrow 28.5 = 20 + \frac{30 - 5 - x}{2}$$

$$\Rightarrow 28.5 = \frac{40 + 25 - x}{2}$$

$$\Rightarrow 2(28.5) = 65 - x$$

$$\Rightarrow 57.0 = 65 - x$$

$$\Rightarrow x = 65 - 57 = 8$$

$$\Rightarrow x = 8$$

Putting the value of x in eq. (i), we get,

$$8 + y = 15$$

$$\Rightarrow y = 7$$

Hence the value of x and y are 8 and 7 respectively.

3. A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are only given to persons having age 18 years onwards but less than 60 years.

Ages (in years)	Number of policy holders
Below 20	2
Below 25	6
Below 30	24
Below 35	45
Below 40	78
Below 45	89
Below 50	92
Below 55	98
Below 60	100

Ans.

Ages (in years)	Cumulative Frequency	Number of consumers (f_i)
Below 20	2	2
20 – 25	6	$6 - 2 = 4$
25 – 30	24	$24 - 6 = 18$
30 – 35	45	$45 - 24 = 21$
35 – 40	78	$78 - 45 = 33$
40 – 45	89	$89 - 78 = 11$
45 – 50	92	$92 - 89 = 3$
50 – 55	98	$98 - 92 = 6$
55 – 60	100	$100 - 98 = 2$
Total		$\sum f_i = n = 100$

Here, $\sum f_i = n = 100$, then $\frac{n}{2} = \frac{100}{2} = 50$, which lies in interval 35 – 40.

\therefore Median class = 35 – 40

So, $l = 35$, $n = 100$, $f = 33$, $cf = 45$ and $h = 5$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 35 + \left[\frac{\frac{100}{2} - 45}{33} \right] \times 5$$

$$= 35 + \frac{50 - 45}{33} \times 5$$

$$= 35 + \frac{25}{33}$$

$$= 35 + 0.7575$$

$$= 35 + 0.76 \text{ (approx.)}$$

$$= 35.76$$

Hence median age of given data is 35.76 years.

4. The lengths of 40 leaves of a plant are measured correct to the nearest millimeter and data obtained is represented in the following table. Find the median length of the leaves.

Length (in mm)	Number of leaves
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

Ans. Since the frequency distribution is not continuous, so firstly we shall make it continuous.

Length (in mm)	Number of leaves (f_i)	Cumulative Frequency
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17
144.5 – 153.5	12	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38
171.5 – 180.5	2	40
Total	$\sum f_i = n = 40$	

Here, $\sum f_i = n = 40$, then $\frac{n}{2} = \frac{40}{2} = 20$, which lies in interval 144.5 – 153.5.

∴ Median class = 144.5 – 153.5

So, $l = 144.5$, $n = 40$, $f = 12$, $cf = 17$ and $h = 9$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 144.5 + \left[\frac{20 - 17}{12} \right] \times 9$$

$$= 144.5 + \frac{3 \times 9}{12}$$

$$= 144.5 + 2.25$$

$$= 146.75$$

Hence median length of the leaves is 146.75 mm.

5. The following table gives the distribution of the life time of 400 neon lamps. Find the median life time of the lamps.

Life time (in hours)	Number of lamps
1500 – 2000	14
2000 – 2500	56
2500 – 3000	60
3000 – 3500	85
3500 – 4000	74
4000 – 4500	62
4500 – 5000	48

(change the frequency of class interval 3000-3500 from 85 to 86)

Ans.

Life time (in hours)	Number of lamps (f_i)	Cumulative Frequency
1500 – 2000	14	14
2000 – 2500	56	70
2500 – 3000	60	130
3000 – 3500	86	216
3500 – 4000	74	290
4000 – 4500	62	352
4500 – 5000	48	400
Total	$\sum f_i = n = 400$	

Here, $\sum f_i = n = 400$, then $\frac{n}{2} = \frac{400}{2} = 200$, which lies in interval 3000 – 3500.

\therefore Median class = 3000 – 3500

So, $l = 3000$, $n = 400$, $f = 86$, $cf = 130$ and $h = 500$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 3000 + \left[\frac{200 - 130}{86} \right] \times 500$$

$$= 3000 + \frac{70 \times 500}{86}$$

$$= 3000 + 406.9767441$$

$$= 3000 + 406.98 \text{ (approx.)}$$

$$= 3406.98$$

Hence median life time of a lamp is 3406.98 hours.

6. 100 surnames were randomly picked up from a local telephone directory and the frequency distribution of the number of letters in the English alphabets in the surnames was obtained as follows:

No. of letters	1 – 4	4 – 7	7 – 10	10 – 13	13 – 16	16 – 19
No. of surnames	6	30	40	16	4	4

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.

Ans. For Median:

No. of letters	Number of surnames (f_i)	Cumulative Frequency
1 – 4	6	6
4 – 7	30	36
7 – 10	40	76
10 – 13	16	92
13 – 16	4	96
16 – 19	4	100
Total	$\sum f_i = n = 100$	

Here, $\sum f_i = n = 100$, then $\frac{n}{2} = \frac{100}{2} = 50$, which lies in interval 7 – 10.

\therefore Median class = 7 – 10

So, $l = 7$, $n = 100$, $f = 40$, $cf = 36$ and $h = 3$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 7 + \left[\frac{50 - 36}{40} \right] \times 3$$

$$= 7 + \frac{14 \times 3}{40}$$

$$= 7 + 1.05$$

$$= 8.05$$

For Mean:

No. of letters	(f_i)	Class Marks (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
1 - 4	6	2.5	- 2	- 12
4 - 7	30	5.5	- 1	- 30
7 - 10	40	8.5	0	0
10 - 13	16	11.5	1	16
13 - 16	4	14.5	2	8
16 - 19	4	17.5	3	12
	$\sum f_i = 100$			$\sum f_i u_i = -6$

From given data, Assume mean $(a) = 8.5$, Width of the class $(h) = 3$

$$\therefore \bar{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{-6}{100} = -0.06$$

Using formula, Mean $(\bar{x}) = a + h\bar{u} = 8.5 + 3(-0.06) = 8.5 - 0.18 = 8.32$

For Mode:

In the given data, maximum frequency is 40 and it corresponds to the class interval 7 - 10.

\therefore Modal class = 7 - 10

And $l = 7$, $f_1 = 40$, $f_0 = 30$, $f_2 = 16$ and $h = 3$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 7 + \left[\frac{40 - 30}{2(40) - 30 - 16} \right] \times 3$$

$$= 7 + \frac{10}{80 - 46} \times 3$$

$$= 7 + \frac{30}{34}$$

$$= 7 + 0.88 \text{ (approx.)}$$

$$= 7.88$$

Hence, median, mean and mode of given data is 8.05 letters, 8.32 letters and 7.88 letters respectively.

7. The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Weight (in kg)	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75
No. of students	2	3	8	6	6	3	2

Ans.

Weight (in kg)	Number of students (f_i)	Cumulative Frequency
40 - 45	2	2
45 - 50	3	5
50 - 55	8	13
55 - 60	6	19
60 - 65	6	25
65 - 70	3	28
70 - 75	2	30
Total	$\sum f_i = n = 30$	

Here, $\sum f_i = n = 30$, then $\frac{n}{2} = \frac{30}{2} = 15$, which lies in interval 55 – 60.

\therefore Median class = 55 – 60

So, $l = 55$, $n = 30$, $f = 6$, $cf = 13$ and $h = 5$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 55 + \left[\frac{15 - 13}{6} \right] \times 5$$

$$= 55 + \frac{2 \times 5}{6}$$

$$= 55 + 1.66666$$

$$= 5 + 1.67 \text{ (approx.)}$$

$$= 56.67$$

Hence median weight of the students are 56.67 kg.

CBSE Class-10 Mathematics

NCERT solution

Chapter - 14

Statistics - Exercise 14.4

1. The following distribution gives the daily income of 50 workers of a factory:

Daily income (in Rs.)	100 – 120	120 – 140	140 – 160	160 – 180	180 – 200
No. of workers	12	14	8	6	10

Convert the distribution above to a less than type cumulative frequency distribution and draw its ogive.

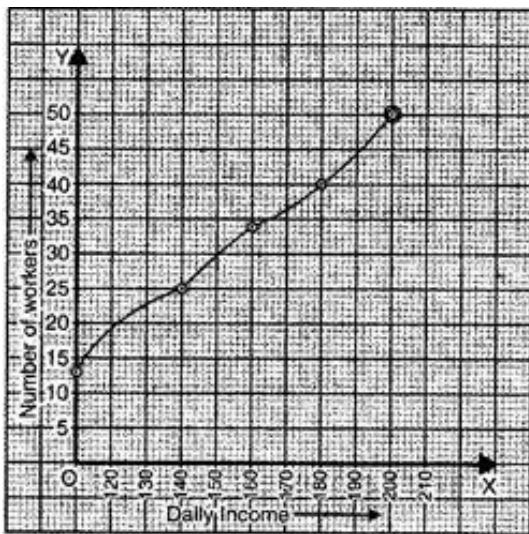
Ans.

Daily income (in Rs.)	Number of workers (f_i)	Cumulative Frequency Less than type (x_i)
100 – 120	12	12
120 – 140	14	26
140 – 160	8	34
160 – 180	6	40
180 – 200	10	50
Total	$\sum f_i = n = 50$	

Now, by drawing the points on the graph,

i.e., (120, 12); (140, 26); (160, 34); (180, 40); (200, 50)

Scale: On x – axis 10 units = Rs. 10 and on y – axis 10 units = 5 workers



(start the graph from 120 correspond to 12 on y axis)

2. During the medical checkup of 35 students of a class, their weights were recorded as follows:

Weight (in kg)	No. of students
Less than 38	0
Less than 40	3
Less than 42	5
Less than 44	9
Less than 46	14
Less than 48	28
Less than 50	32
Less than 52	35

Draw a less than type ogive for the given data. Hence obtain the median weight from the graph and verify the result by using the formula.

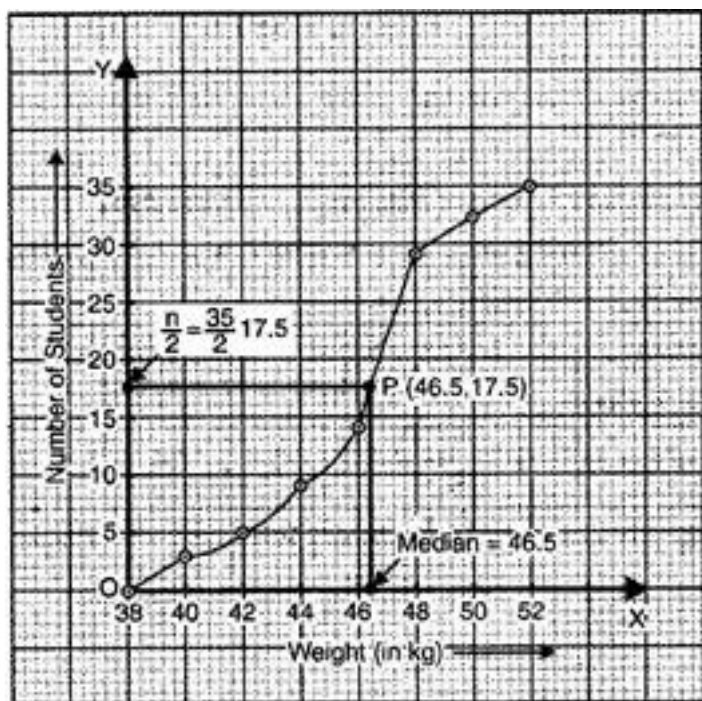
Ans.

Weight (in kg)	No. of students (f_i)	Class interval	Cumulative frequency Less than type
Less than 38	0	36 – 38	0
Less than 40	$3 - 0 = 3$	38 – 40	3
Less than 42	$5 - 3 = 2$	40 – 42	5
Less than 44	$9 - 5 = 4$	42 – 44	9
Less than 46	$14 - 9 = 5$	44 – 46	14
Less than 48	$28 - 14 = 14$	46 – 48	28
Less than 50	$32 - 28 = 4$	48 – 50	32
Less than 52	$35 - 32 = 3$	50 – 52	35
Total	$\sum f_i = n = 35$		

Hence, the points for graph are:

(38, 0), (40, 3), (42, 5), (44, 9), (46, 14), (48, 28), (50, 32), (52, 35)

Scale: On x – axis, 10 units = 2 kg and on y – axis, 10 units = 5 students



change : (in graph :38 is plotted wrongly on graph on 38 its zero and at 40 38 is there)

From the above graph, Median = 46.5 kg, which lies in class interval 46 – 48.

Here, $\sum f_i = n = 35$, then $\frac{n}{2} = \frac{35}{2} = 17.5$, which lies in interval 46 – 48.

∴ Median class = 46 – 48

So, $l = 46$, $n = 35$, $f = 14$, $cf = 14$ and $h = 2$

$$\text{Now, Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 46 + \left[\frac{17.5 - 14}{14} \right] \times 2$$

$$= 46 + \frac{7}{14}$$

$$= 46 + 0.5$$

$$= 46.5$$

Hence median weight of students is 46.5 kg.

3. The following table gives production yield per hectare of wheat of 100 farms of a village.

Production yield (in kg/ha)	50 – 55	55 – 60	60 – 65	65 – 70	70 – 75	75 – 80
No. of farms	2	8	12	24	38	16

Change the distribution to a more than type distribution and draw its ogive.

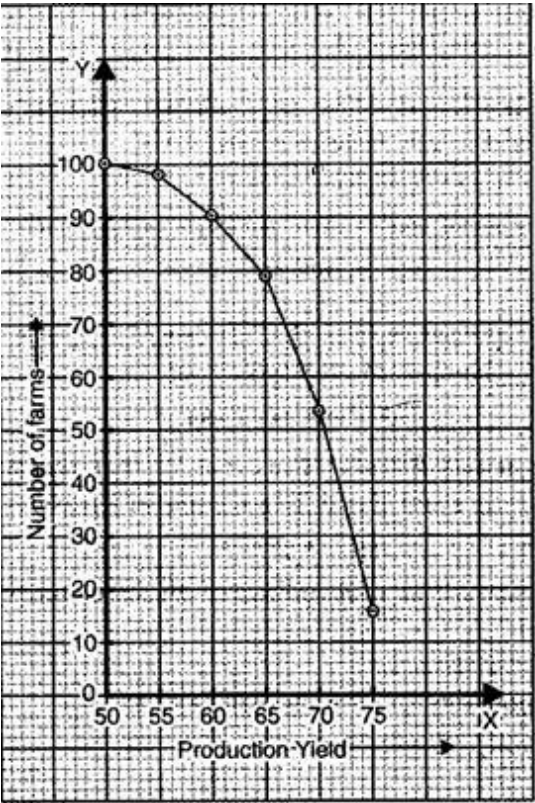
Ans.

Production yield (in kg/ha)	Number of farms (f_i)	Cumulative Frequency Less than type (x_i)
50 – 55	2	100
55 – 60	8	$100 - 2 = 98$
60 – 65	12	$98 - 8 = 90$
65 – 70	24	$90 - 12 = 78$
70 – 75	38	$78 - 24 = 54$
75 – 80	16	$54 - 38 = 16$
Total	$\sum f_i = n = 100$	

The points for the graph are:

(50, 100), (55, 98), (60, 90), (65, 78), (70, 54), (75, 16)

Scale: On x - axis, 10 units = 5 kg/ha and on y - axis, 10 units = 10 farms.



(change the place of 50 in the graph it must be at 55)