

NCERT Solutions for Class 10 Maths 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

Solution: The cumulative frequency of the table can be represented as:

Monthly consumption (in units)	Number of consumers	Cumulative frequency
65 – 85	4	4
85 - 105	5	
105 - 125	13	9
125 - 145	20	
145 - 165	14	22

165 - 185	8	
185 – 205	4	42
		56
		64
		68
	N= 68	

$$N = 68$$

$$\frac{N}{2} = 34$$

Hence,

Median class = 125-145

Cumulative frequency = 42

Lower limit, $l = 125$

$$cf = 22$$

$$f = 20$$

$$h = 20$$

Hence,

Median can be calculated as:

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

$$= 125 + \left(\frac{34 - 22}{20} \right) \times 20$$

$$= 125 + 12$$

$$= 137$$

Now, mode can be calculated as:

Modal class = 125-145

$$l = 125$$

$$h = 20$$

$$f_1 = 20$$

$$f_0 = 13$$

$$f_2 = 14$$

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

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

$$= 125 + \frac{7}{13} \times 20$$

$$= 125 + 10.77$$

$$= 135.77$$

Now, mean of the following data can be calculated as:

Class interval	fi	xi	di	ui	fiui

065-085	4	75	-60	-3	-12
085-105	5	95	-40	-2	-10
105-125	13	115	-20	-1	-13
125-145	20	135	0	0	0
145-165	14	155	20	1	14
165-185	8	175	40	2	16
185-205	4	195	60	3	12
	$\Sigma f_i =$ 68				$\Sigma f_i u_i =$ 7

$$\bar{x} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

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

$$= 137.05$$

Hence,

Mean, Median and Mode are more or less equal in this distribution.

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

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

Solution: As per the question,

$$N = 60$$

$$\frac{N}{2} = 30$$

Hence,

Median class = 20-30

Cumulative frequency = 25 + x

Lower limit, l = 20

$$cf = 5 + x$$

$$f = 20$$

$$h = 10$$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

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

$$28.5 = \frac{25-x}{2}$$

$$25 - x = 17$$

$$x = 25 - 17$$

$$x = 8$$

Now,

From the cumulative frequency we can find the value of $x + y$ as:

$$60 = 5 + 20 + 15 + 5 + x + y$$

$$45 + x + y = 60$$

$$x + y = 15$$

$$y = 15 - x$$

$$y = 15 - 8$$

$$y = 7$$

Hence,

Value of $x = 8$ and $y = 7$

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

Age (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

Solution: the cumulative frequency can be calculated as:

Class intervals	Frequency	Cumulative frequency
15-20	2	2
	4	6
20-25	18	24
	21	45
25-30	33	78
	11	89
30-35	3	92
	6	98
35-40	2	100
40-45		
45-50		
50-55		

55-60		
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As per the question,

$$N=100$$

$$\frac{N}{2} = 50$$

Hence,

Median class = 35-45

Cumulative frequency = 100

Lower limit, $l = 35$

$$cf = 45$$

$$f = 33$$

$$h = 5$$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

$$= 35 + \left(\frac{50 - 45}{33} \right) \times 5$$

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

$$= 35.75$$

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

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

Find the median length of the leaves

(Hint: The data needs to be converted to continuous classes for finding the median, since the formula assumes continuous classes. The classes then change to 117.5 - 126.5, 126.5 - 135.5, . . . , 171.5 - 180.5)

Solution: The cumulative frequency of the data can be calculated as:

Class interval	frequency	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

As per the question,

$$N = 40$$

$$\frac{N}{2} = 20$$

Hence,

Median class = 144.5-153.5

Lower limit, $l = 144.5$

$$cf = 17$$

$$f = 12$$

$$h = 9$$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

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

$$= 144.5 + \frac{9}{4}$$

$$= 146.75$$

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

Life time (in hours)	Number of lamps
1500 - 2000	14
2000 - 2500	56
2500 - 3000	60
3000 - 3500	86
3500 - 4000	74
4000 - 4500	62
4500 - 5000	48

Find the median life time of a lamp

Solution: The cumulative frequency of the given data can be calculated as:

Life time (in hours)	Number of lamps	Cumulative Frequency
1500 - 2000	14	14
2000 - 2500	56	70
2500 - 3000	60	130
	86	
	74	

3000 - 3500	62	
3500 – 4000	48	216
4000 - 4500		290
4500 – 5000		352
		400

As per the question,

$$N = 400$$

$$\frac{N}{2} = 200$$

Hence,

Median class = 3000-3500

Lower limit, $l = 3000$

$$cf = 130$$

$$f = 86$$

$$h = 500$$

Now,

Median can be calculated as:

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

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

$$= 3000 + 406.97$$

$$= 3406.97$$

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:

Number of letters	1 - 4	4 - 7	7 - 10	10 - 13	13 - 16	16 - 19
Number 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

Solution: The cumulative frequency of the given data can be calculated as:

Class interval	frequency	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

As per the question,

$$N = 100$$

$$\frac{N}{2} = 50$$

Hence,

Median class = 7-10

Lower limit, $l = 7$

$$cf = 36$$

$$f = 40$$

$$h = 3$$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{N}{2} - cf}{f} \right) \times$$

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

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

$$= 8.05$$

Now, mode can be calculated as:

Modal class = 7-10

$$l = 7$$

$$h = 3$$

$$f_1 = 40$$

$$f_0 = 30$$

$$f_2 = 16$$

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

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

$$= 7 + \frac{10}{34} \times 3$$

$$= 7.88$$

Now, mean of the following data can be calculated as:

Class interval	f_i	x_i	fix_i
1-4	6	2.5	15
4-7	30	5.5	165
7-10	40	8.5	340
10-13	16	11.5	184

13-16	4	14.5	51
16-19	4	17.5	70
	$\sum f_i =$ 100		$\sum fix_i =$ 825

$$\begin{aligned}\bar{x} &= \frac{\sum fix_i}{\sum f_i} \\ &= \frac{825}{100} \\ &= 8.25\end{aligned}$$



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
Number of students	2	3	8	6	6	3	2

Solution: The cumulative frequency of the given data can be calculated as:

Class interval	frequency	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

As per the question,

$$N = 30$$

$$\frac{N}{2} = 15$$

Hence,

Median class = 55-60

Lower limit, $l = 55$

$$cf = 13$$

$$f = 6$$

$$h = 5$$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

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

$$= 55 + \frac{5}{3} \times 5$$

$$= 56.67$$

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
Number of workers	12	14	8	6	10

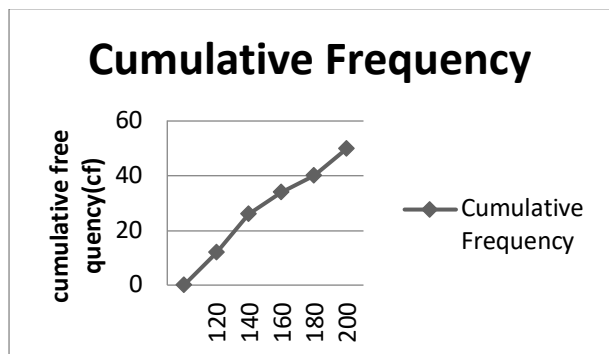
Convert the distribution above to a less than type cumulative frequency distribution, and draw its ogive

Solution: The frequency distribution table of less than type graph is as follows:

Daily income (in Rs) (upper class limits)	Cumulative Frequency
Less than 120	12
Less than 140	26
Less than 160	34
Less than 180	40
Less than 200	50

Now,

Taking upper class interval on x-axis and their respective frequencies on y-axis, ogive will be:



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

Weight (in kg)	Number 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

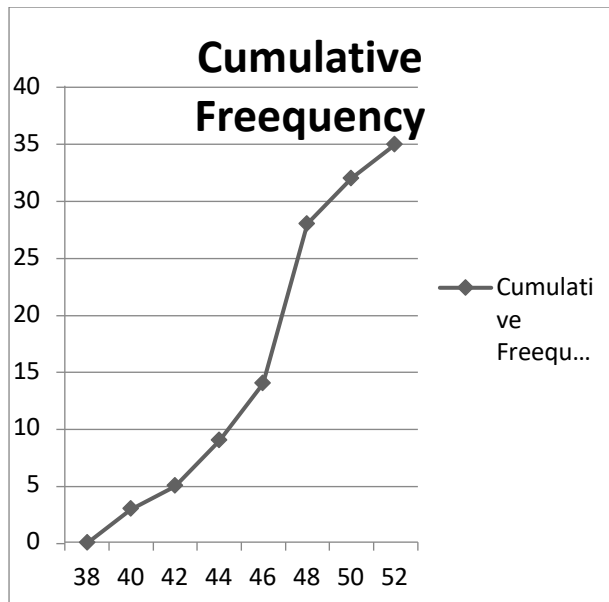
Draw a less than type ogive for the given data. Hence obtain the median weight from the graph and verify the result by using the formula

Solution: The frequency distribution table of less than type graph is as follows:

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

Now,

Taking upper class interval on x-axis and their respective frequencies on y-axis, ogive will be:



Here, $N = 35$

$$\frac{N}{2} = 17.5$$

Mark the point A whose ordinate is 17.5 and its x-ordinate is 46.5.

Hence,
Median of the data is 46.5

Now,

It can be observed that the difference between two consecutive upper class limits is 2.

The class marks with respective frequencies are obtained below:

Weight (in kg)	frequency	Cumulative Frrequency
Less than 38	0	0
38-40	3	3
40-42	2	5
42-44	4	9

44-46	5	14
46-48	14	28
48-50	4	32
50-52	3	35
N	35	

We can see that the cumulative frequency is greater than $n/2$ and is 28 which belongs to the interval 46-48

Hence,

Median class = 46-48

Lower limit, $l = 46$

$cf = 14$

$f = 14$

$h = 2$

Now,

Median can be calculated as:

$$Median = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times$$

$$= 46 + \left(\frac{17.5 - 14}{14} \right) \times 2$$

$$= 46 + \frac{3.5}{7}$$

$$= 46.5$$

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

Production yield (in kh/ha)	50 – 55	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80
Number of farms	2	8	12	24	38	16

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

Solution: The frequency distribution table of more than type graph is as follows:

Production yield (lower class limits)	Cumulative frequency
More than or equal to 50	100
More than or equal to 55	98
More than or equal to 60	90
More than or equal to 65	78
More than or equal to 70	54
More than or equal to 75	16

Now,

Taking lower limit on x-axis,

Cumulative Frequencies on y- axis,

Its ogive can be drawn as:

