STATISTICS

★ INTRODUCTION

In class IX, we have studied about the presentation of given data in the form of ungrouped us well as grouped frequency distributions. We have also studied how to represent the statistical data in the form of various graphs such as bar graphs, histograms and frequency polygons. In addition, we have studied the measure of central tendencies such as mean, median and mode of ungrouped data.

In this chapter, we shall discuss about mean, median and mode of grouped data. We shall also discuss the concept of cumulative frequency, cumulative frequency distribution and cumulative frequency curve (ogive).

★ MEAN OF UNGROUPED DATA

We know that the mean of observations is the sum of the values of all the observations divided by the total number of observations i.e., if $x_1, x_2, x_3, \ldots\ldots, x_n$ are n observations, then

mean, $\bar{x} = \dfrac{x_1 + x_2 + x_3 + \ldots.. + x_n}{n}$ or $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$, where $\sum_{i=1}^{n} x_i$ denotes the sum $x_1 + x_2 \; x_3 + \ldots\ldots + x_n$.

- Direct method
- Short-cut method or Assumed-mean method
- Step-deviation method.

★ MEAN OF GROUPED DATA

• Direct method

If $x_1, x_2, x_3, \ldots\ldots, x_n$ are n observations with respective frequencies $f_1, f_2, f_3, \ldots\ldots\ldots, f_n$ then mean, $(\bar{x})$ defined by

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \ldots.. + f_nx_n}{f_1 + f_2 + f_3 + \ldots. + f_n} \text{ or } \bar{x} = \frac{\sum_{i=1}^{n} f_ix_i}{\sum_{i=1}^{n} f_i}, \text{ where } \sum_{i=1}^{n} f_i = f_1 + f_2 + f_3 + \ldots.. + f_n .$$

To find mean of grouped Data

The following steps should be followed in finding the arithmetic mean of grouped data by direct method.

STEP-1: Find the class mark (x_i) of each class using, $x_i = \dfrac{lower\,limit + Upper\,limit}{2}$

STEP-2: Calculate f_ix_i for each i

STEP-3: Use the formula : mean, $\bar{x} = \dfrac{\sum_{i=1}^{n} f_ix_i}{\sum_{i=1}^{n} f_i}$,

• SHORTCUT METHOD OR ASSUMED MEAN METHOD

In this case, to calculate the mean, we follow the following steps :

STEP-1: Find the class mark (x_i) of each class using

$$x_i = \frac{lower\,limit + Upper\,limit}{2}$$

STEP-2: Choose a suitable value of x_i in the middle as the assumed mean and denote it by 'a'.

STEP-3: Find $d_i = x_i - a$ for each i

STEP-4: Find $f_i \times d_i$ for each i

STEP-5: Find $n = \sum f_i$

STEP-6: Calculate the mean, $(\bar{x})$ by using the formula $\bar{x} = a + \frac{\sum f_i d_i}{N}$.

- **STEP-DEVIATION METHOD**

Sometimes, the values of x and f are so large that the calculation of mean by assumed mean method becomes quite inconvenient. In this case, we follow the following steps:

STEP-1: Find the class mark (x_i) of each class using, $x_i = \frac{lower\,limit + Upper\,limit}{2}$

STEP-2: Choose a suitable value of x_i in the middle as the assumed mean and denote it by 'a'.

STEP-3: Find h = (upper limit – lower limit) for each class.

STEP-4: Find $u_i = \frac{x_i - a}{h}$ for each class.

STEP-5: Find $f_i u_i$ for each i.

STEP-6: Calculate, the mean by using the formula $\bar{x} = a + \left\{\frac{\sum f_i \times u_i}{N}\right\} \times h$, where $N = \sum f_i$

Ex.1 Find the mean of the following data :

Class Interval	0-8	8-16	16-24	24-32	32-40
Frequency	6	7	10	8	9

Sol. We may prepare the table as given below :

Class Interval	**Frequency (f_i)**	**Class mark (x_i)**	**$f_i x_i$**
0-8	6	4	24
8-16	7	12	84
16-24	10	20	200
24-32	8	28	224
32-40	9	36	324
	$\sum f_i = 40$		$\sum f_i x_i = 856$

$\therefore$ Mean, $\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i} = \frac{856}{40} = 21.4$

Ex.2 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 children	7	6	9	13	f	5	4

Sol. We may prepare the table as given below :

Daily pocket allowance	**Number of Children (f_i)**	**Class mark (x_i)**	**f_ix_i**
11-13	7	12	84
13-15	6	14	84
15-17	9	16	144
17-19	13	18	234
19-21	f	20	20f
21-23	5	22	110
23-25	4	24	96
	$\sum f_i = 44 + f$		$\sum f_i x_i = 752 + 20f$

$$\therefore \quad \text{Mean, } \bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i} = \frac{752 + 20f}{44 + f}$$

Given, mean = 18

$$\therefore \quad 18 = \frac{752 + 20f}{44 + f} \Rightarrow 792 + 18f = 752 + 20f \Rightarrow f = 20$$

Ex.3 Find the missing frequencies f1 and f2 in the table given below, it is being given that the mean of the given frequency distribution is 50.

Class	0-20	20-40	40-60	60-80	80-100	Total
Frequency	17	f_1	32	f_2	19	120

Sol. We may prepare the table as given below :

Class	**Number of (f_i)**	**Class mark (x_i)**	**f_ix_i**
0-20	17	10	170
20-40	f_1	30	$30f_1$
40-60	32	50	1600
60-80	f_2	70	$70f_2$
80-100	19	90	1710

	$\sum f_i = 68 + f_1 + f_2$		$\sum f_i x_i = 3480 + 30f_1 + 70f_2$

$\therefore$ Mean, $\bar{x} = \dfrac{\sum_{i=1}^{n} f_i x_i}{\sum f_i} = \dfrac{3480 + 30f_1 + 70f_2}{68 + f_1 + f_2}$

Given, mean = 50

$\therefore \quad 50 = \dfrac{3480 + 30f_1 + 70f_2}{68 + f_1 + f_2} \Rightarrow 3400 + 50f_1 = 50f_2 = 3480 + 30f_1 + 70f_2$

$\Rightarrow \quad 20f_1 - 20f_2 = 80 \Rightarrow f_1 - f_2 = 4 \qquad \ldots(i)$

And $\sum f_i = 68 + f_1 + f_2$

$\therefore \quad 120 = 68 + f_1 + f_2 \qquad [\because \sum f_1 = 120]$

$\Rightarrow \quad f_1 + f_2 = 52 \qquad \ldots(ii)$

Adding (1) and (2), we get $2f_1 = 56 \Rightarrow f_1 = 28$

$\therefore \quad f_2 = 24$

Hence, following missing frequencies f1 and f2 are 28 and 24 respectively.

Ex.4 The following table gives the marks scored by 100 students in a class test :

Mark	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	12	28	27	20	17	6

Sol. We may prepare the table with assumed mean, a = 35 as given below :

Mrks	**No.of students (f_i)**	**Class mark (x_i)**	**$d_i = x_i - a = xi - 35$**	**$f_i d_i$**
0-10	12	5	– 30	– 360
10-20	18	15	– 20	– 360
20-30	27	25	– 10	– 270
30-40	20	30 = a	0	0
40-50	17	45	10	170
50-60	6	55	20	120
	N = 100			$\sum f_i d_i = -700$

$\therefore$ Mean, $\bar{x} = a + \dfrac{\sum f_i d_i}{N} = 35 + \dfrac{(-700)}{100} = 35 - 7 = 28$

Ex.5 Thirty women were examined in a hospital by a doctor and the number of heart beats per minute, were recorded and summarized as follows. Find the mean heart beats per minute for these women, by using assumed.

No. of heart beats per minute	65-68	68-71	71-74	74-77	77-80	80-83	83-86
Frequency	2	4	3	8	7	4	2

Sol. We may prepare the table with assumed mean, a = 35 as given below :

No. of heart beats per minute	**No.of women (f_i)**	**Class mark (x_i)**	**$d_i = x_i - a$ = xi – 75.5**	**$f_i d_i$**
65-68	2	66.5	– 9	– 18
68-71	4	69.5	– 6	– 24
71-74	3	72.5	**– 3**	– 9
74-77	8	75.5 = a	0	21
77-80	7	78.5	3	24
80-83	4	81.5	6	18
83-86	2	84.5	9	
	N = 30			$\sum f_i d_i = 12$

$\therefore$ Mean, $\bar{x} = a + \frac{\sum f_i d_i}{N} = 75.5 + \frac{12}{30} = 75.5 + \frac{2}{5} = 75.9$

Ex.6 Find the mean of the following distribution by step-deviation method :

Class	50-70	70-90	90-110	110-130	130-150	150-170
Frequency	18	12	13	27	8	22

Sol. We may prepare the table with assumed mean a = 120 as given below :

Class	**Frequency (f_i)**	**Class mark (x_i)**	$u_i = \frac{x_i - a}{h} = \frac{x_i - 120}{20}$	$f_i u_i$
50-70	18	60	– 3	– 54
70-90	12	80	– 2	– 24
90-110	13	100	– 1	– 13
110-130	27	120 = a	0	0
130-150	8	140	1	8
150-170	22	160	2	44
	N = 100			$\sum f_i u_i = -39$

$\therefore$ Mean, $\bar{x} = a + \frac{\sum f_i u_i}{N} \times h = 120 + \frac{(-39) \times 20}{100} = 20 - \frac{39}{5} = \frac{561}{5} = 112.2$

Ex.7 Find the mean marks from the following data :

Marks	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60	Below 70	Below 80	Below 90	Below 100
No. of Students	5	9	17	29	45	60	70	78	83	z85

Sol. We may prepare the table as given below :

Marks	**No. of students**	**Class Interval**	f_i	**Class mark** (x_i)	$f_i x_i$
Below 10	5	0-10	5	5	25
Below 20	9	10-20	4	15	60
Below 30	17	20-30	9	25	225
Below 40	29	30-40	12	35	420
Below 50	45	40-50	16	45	720
Below 60	60	50-60	15	55	825
Below 70	70	60-70	10	65	650
Below 80	78	70-80	8	75	600
Below 90	83	80-90	5	85	425
Below 100	85	90-100	2	95	190
			N = 85		$\sum f_i x_i = 4140$

$\therefore$ Mean, $\bar{x} = \dfrac{\sum f_i x_i}{N} = \dfrac{4140}{85} = 48.41$

Ex.8 Find the mean marks of students from the adjoining frequency distribution table.

Marks	**No. of Students**
Above 0	80
Above 10	77
Above 20	72
Above 30	65
Above 40	55
Above 50	43
Above 60	23
Above 70	16
Above 80	10
Above 90	8
Above 100	0

Sol. We may prepare the table as given below :

Marks	No. of students	Class Interval	f_i	Class mark (x_i)	f_ix_i
Above 0	80	0-10	3	5	15
Above 10	77	10-20	5	15	75
Above 20	72	20-30	7	25	175
Above 30	65	30-40	10	35	350
Above 40	55	40-50	12	45	540
Above 50	43	50-60	20	55	1100
Above 60	23	60-70	7	65	455
Above 70	16	70-80	6	75	450
Above 80	10	80-90	2	85	170
Above 90	8	90-100	8	95	760
Above 100	0	100-110	0	105	0
			N = 80		$\sum f_ix_i = 4090$

$\therefore$ Mean, $\bar{x} = \frac{\sum f_ix_i}{N} = \frac{4090}{80} = 51.125 = 51.1\,(\text{approx})$

Ex.9 Find the arithmetic mean of the following frequency distribution.

Class	25-29	30-24	35-39	40-44	45-49	50-54	55-59
Frequency	14	22	16	6	5	3	4

Sol. The given series is in inclusive form. We may prepare the table in exclusive form with assumed mean a = 42 as given below :

Class	Frequency (f_i)	Class mark (x_i)	$d_i = x_i - a = x_i - 75.5$	f_iu_i
24.5-29.5	14	27	– 15	– 210
29.5-34.5	22	32	– 10	– 220
34.5-39.5	16	37	– 5	– 80
39.5-44.5	6	42 = a	0	0
44.5-49.5	5	47	5	25
49.5-54.5	3	52	10	30
54.5-59.5	4	57	15	60
	N = 70			$\sum f_id_i = -395$

$\therefore$ Mean, $\bar{x} = a\frac{\sum f_i d_i}{N} = 42 + \frac{(-395)}{70} = \frac{2940-395}{70} = \frac{2545}{70} 36.36$ (approx)

★ MEDIAN OF A GROUPED DATA

MEDIAN : It is a measure of central tendency which gives the value of the middle most observation in the data. In a grouped data, it is not possible to find the middle observation by looking at the cumulative frequencies as the middle observation will be some value in a class interval. It is, therefore, necessary to find the value inside a class that divides the whole distribution into two halves.

MEDIAN CLASS : The class whose cumulative frequency is greater than $\frac{N}{2}$ is called the median class.

To calculate the median of a grouped data, we follow the following steps :

STEP-1: Prepare the cumulative frequency table corresponding to the given frequency distribution and obtain $N = \sum f_i$.

STEP-2: Find $\frac{N}{2}$

STEP-3: Look at the cumulative frequency just greater than $\frac{N}{2}$ and find the corresponding class (Median class).

STEP-4: Use the formula Median, $M = \ell + \left\{\frac{\frac{N}{2} - C}{f}\right\} \times h$

Where ℓ = Lower limit of median class.
F = Frequency of the median class.
C = Cumulative frequency of the class preceding the median class.
h = Size of the median class.
$N = \sum f_i$

Ex.10. Find the median of the following frequency distribution :

Marks	0-10	10-20	20-30	30-40	40-50	Total
No. of Students	8	20	36	24	12	100

Sol. At first we prepare a cumulative frequency distribution table as given below :

Marks	**Number of students (f_i)**	**Cumulative frequency**
0-10	8	8
10-20	20	28
20-30	36	64
30-40	24	88
40-50	12	100
	N = 100	

Here, N = 100

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

The cumulative frequency just greater than 50 is 64 and the corresponding class is 20-30.
So, the median class is 20-30.

$\therefore$ $\ell = 20$, N = 100, C = 28, f = 36 and h = 10

Therefore, median $= \ell + \left\{\dfrac{\frac{N}{2} - C}{f}\right\} \times h$

$$= 20 + \left(\frac{50-28}{36}\right) \times 10 = 20 + \frac{22 \times 10}{36} = 20 + \frac{55}{9} = \frac{180+55}{9} = \frac{235}{9} = 36.1$$

Ex.11 A life insurance agent found the following data for distribution of ages of 100 policy holders. Calculate the median age, if policies are given only to persons having age 18 years onwards but less than 60 years.

Age (in years)	Below 20	Below 25	Below 30	Below 35	Below 40	Below 45	Below 50	Below 55	Below 60
No. of policy holders	2	6	24	45	78	89	92	98	100

Sol. From the given table we can find the frequency and cumulative frequency as given below :

Age (in years)	**Number of students (f_i)**	**Cumulative frequency**
15-20	2	2
20-25	4	6
25-30	18	24
30-35	21	45
35-40	33	78
40-45	11	89
45-50	3	92
50-55	6	98
55-60	2	100
	N = 100	

Here, N = 100

$\therefore \quad \dfrac{N}{2} = 50$

The cumulative frequency just greater than 50 is 78 and the corresponding class is 35-40.
So, the median class is 65-40.

$\therefore \quad \ell = 20$, N = 100, C = 45, f = 33 and h = 5

Therefore, median $= \ell + \left\{\dfrac{\frac{N}{2} - C}{f}\right\} \times h$

$$= 35 + \left(\frac{50-45}{33}\right) \times 5 = 35 + \frac{5 \times 5}{33} = \frac{1155+25}{33} = \frac{1180}{33} = 35.76$$

Hence, the median age is 35.76 years.

Ex.12 The length of 40 leaves of a plant are measured correct to the nearest millimeter, and the data obtained is represented in the following table. Find the median length of the leaves.

Length (in mm)	118-126	127-135	136-144	145-153	154-162	163-171	172-180
No. of leaves	3	5	9	12	5	4	2

Sol. The given series is in inclusive form. We may prepare the table in exclusive form and prepare the cumulative frequency table as given below :

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
	N = 40	

Here, N = 40

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

The cumulative frequency just greater than 20 is 29 and the corresponding class is 144.5-153.5
So, the median class is 144.5-153.5

$\therefore \quad \ell = 144.5$, N = 40, C = 17, f = 12 and h = 9

Therefore, median $= \ell + \left\{\frac{\frac{N}{2} - C}{f}\right\} \times h$

$$= 144.5 + \frac{(20-17)}{12} \times 9 = 144.5 + \frac{3 \times 9}{12} = 144.5 + 2.25 = 146.75$$

Hence, median length of leaves is 146.75 mm.

Ex.13 Calculate the missing frequency 'a' from the following distribution, it is being given that the median of the distribution is 24.

Age (in mm)	0-10	10-20	20-30	30-40	40-50
No. of persons	5	25	a	18	7

Sol. At first we prepare a cumulative frequency distribution table as given below :

Age (in years)	0-10	10-20	20-30	30-40	40-50	Total
No. of persons (f_i)	5	25	a	18	7	55+a
Cumulative frequency	5	30	30+a	48+a	55+a	

Since the median is 24, therefore, the median class will be 20-30.

Hence, $\ell = 20$, N = 55+a, C = 30, f = a and h = 10

Therefore, median $= \ell + \left\{\dfrac{\frac{N}{2} - C}{f}\right\} \times h$

$$\Rightarrow \quad 24 = 20 + \left(\frac{\frac{55+a}{2} - 30}{a}\right) \times 10$$

$$\Rightarrow \quad 24 = 20 + \frac{(a-5)}{2a} \times 10$$

$$\Rightarrow \quad 4 = \frac{(a-5)}{2a} \times 5$$

$$\Rightarrow \quad 4a = 5a - 25 \Rightarrow a = 25$$

Hence, the value of missing frequency a is 25.

Ex.14 The median of the following data is 525. Find the values of x and y, if the total frequency is 100.

Class Interval	Frequency (f_i)
0-100	2
100-200	5
200-300	x
300-400	12
400-500	17
500-600	20
600-700	y
700-800	9
800-900	7
900-1000	4
	N = 100

Sol. At first we prepare a cumulative frequency distribution table as given below :

Class Interval	frequency (f_i)	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	7+x
300-400	12	19+x
400-500	17	36+x
500-600	20	56+x
600-700	y	56+x+y
700-800	9	65+x+y
800-900	7	72+x+y
900-1000	4	76+x+y
	N = 100	

We have N = 100

$\therefore 76 + x + y = 100 \Rightarrow x + y = 24$ ...(i)

Since the median is 525, so, the median class is 500 – 600

$\therefore \ell = 500$, N = 100, C = 36 + x, f = 20 and h = 100

Therefore, median $= \ell + \left\{\frac{\frac{N}{2} - C}{f}\right\} \times h$

$\Rightarrow \quad 525 = 500 + \left(\frac{50 - 36 - x}{20}\right) \times 100 \Rightarrow 25 = (14 - x) \times 5$

$\Rightarrow \quad 5 = 14 - x \Rightarrow x = 9$

Also, putting x = 9 in (1), we get 9 + y = 24 $\Rightarrow$ y = 15

Hence, the values of x and y are 9 and 15 respectively.

★ MODE OF A GROUPED DATA

MODE : Mode is that value among the observations which occurs most often i.e., the value of the observation having the maximum frequency.

In a grouped frequency distribution, it is not possible to determine the mode by looking at the frequency.

MODAL CLASS : The class of a frequency distribution having maximum frequency is called modal class of a frequency distribution .

The mode is a value inside the modal class and is calculated by using the formula.

Mode $= \ell + \left\{\frac{f_1 f_0}{2f_1 - f_0 - f_2}\right\} \times h$

Where ℓ = Lower limit of the modal class.
h = Size of class interval.
f_1 = Frequency of modal class.
f_0 = Frequency of the class preceding the modal class
f_2 = Frequency of the class succeeding the modal class

Ex15 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
Frequency	10	35	52	61	38	29

Determine the modal lifetimes of the components.

Sol. Here the class 60-80 has maximum frequency, so it is the modal class.

$\therefore \quad \ell = 60, h = 20, f_1 = 61, f_0 = 52$ and $f_2 = 38$

Therefore, mode $= \ell + \left\{\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right\} \times h$

$$= 60 + \left(\frac{61-52}{2\times 61 - 52 - 38}\right) \times 20 = 60 + \frac{9}{20} \times 20 = 60 + 5.625 = 65.625$$

Hence, the modal lifetimes of the components is 65.625 hours.

Ex.16 Given below is the frequency distribution of the heights of players in a school.

Heights (in cm)	160-162	136-165	166-168	169-171	172-174
No. of students	15	118	142	127	18

Find the average height of maximum number of students.

Sol. The given series is in inclusive form. We prepare the table in exculsive form, as given below :

Heights (in cm)	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

We have to find the mode of the data.

Here, the class 165.5-168.5 has maximum frequency, so it is the modal class.

Ex.17 The mode of the following series is 36. Find the missing frequency f in it.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-71
Frequency	8	10	f	16	12	6	7

Sol. Since the mode is 36, so the modal class will be 30-40

$\therefore \quad \ell = 30, h = 10, f_1 = 16, f_0 = f$ and $f_2 = 12$

Therefore, mode $= \ell + \left\{\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right\} \times h$

$$\Rightarrow \quad 66 = 30 + \left(\frac{61-f}{2\times 16 - f - 12}\right) \times 10 \Rightarrow 6 = \frac{(16-f)}{(20-f)} \times 10$$

$$\Rightarrow \quad 120 - 6f = 160 - 10f \Rightarrow 4f = 40 \Rightarrow f = 10$$

Hence, the value of the missing frequency f is 10.

★ GRAPHICAL. REPRESENTATION OF CUMULATIVE FREQUENCY DISTRIBUTION

- **CUMULATIVE FREQUENCY POLYGON CURVE (OGIVE)**

Cumulative frequency is of two types and corresponding to these, the ogive is also of two types.

- **LESS THAN SERIES**
- **MORE THAN SERIES**

- **LESS THAN SERIES** To construct a cumulative frequency polygon and an ogive, we follow these steps :

STEP-1 : Mark the upper class limit along x-axis and the corresponding cumulative frequencies along y-axis.

STEP-2 : Plot these points cuccessively by line segments. We get a polygon, called cumulative frequency polygon.

STEP-3 : Plot these points cuccessively by smooth curves, we get a curve called cumulative frequency or an ogive.

★ APPLICATION OF AN OGIVE

Ogive can be used to find the median of a frequency distribution. To find the median, we follow these steps.

METHOD –I

STEP-1 : Draw anyone of the two types of frequencies curves on the graph paper.

STEP-2 : Compute $\frac{N}{2}(N = \sum f_i)$ and mark the corresponding points on the y-axis.

STEP-3 : Draw a line parallel to x-axis from the point marked in step 2, cutting the cumulative frequency curve at a point P.

METHOD –II

STEP-1 : Draw less than type and more than type cumulative frequency curves on the graph paper.
STEP-2 : Mark the point of intersecting (P) of the two curves draw2n in step 1.
STEP-3 : Draw perpendicular PM from P on the x-axis. The x-coordinate of point M gives the median .

Ex.18 The following distribution gives the daily income of 50 workers of a factory.

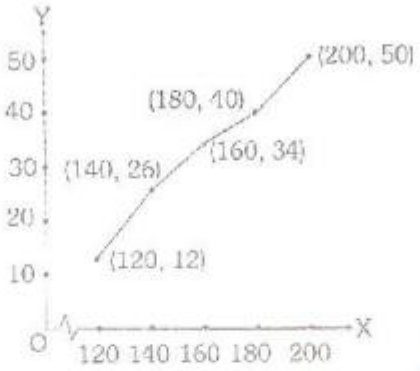
Daily income (in Rs.)	100-120	120-140	140-160	160-180	180-200
No. of workers	12	14	8	6	10

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

Sol. From the given table, we prepare a less than type cumulative frequency distribution table, as given below :

Income less than (in Rs)	120	140	160	180	200
Cumulative frequency	12	26	34	40	50

Join these points by a freehand curve to get an ogive of 'less than' type.



Ex.19 The following table gives production yield per hectare of wheat of 100 farms of a village.

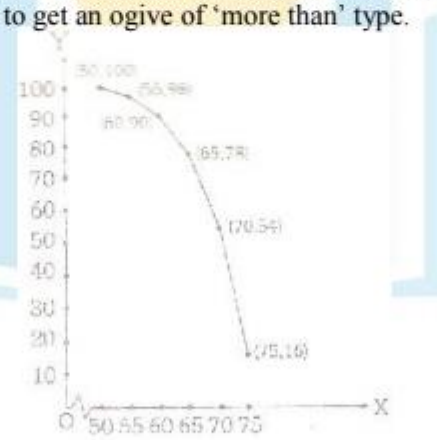
Production yield (in kg/ha)	50-55	55-60	60-65	65-70	70-75	75-80
No. of farms	2	8	12	24	38	16

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

Sol. From the given table, we may prepare more than type cumulative frequency distribution table, as given below :

Production more than (in kg/ha)	50	55	60	65	70	75
Cumulative frequency	100	98	90	78	54	16

Now, plot the points (50, 100), (55,98), (60,90), (65,78), (70,54) and (75,16)
Join these points by a freehand curve to get an ogive of 'more than' type.



Ex.20 The annual profits earned by 30 shops of a shopping complex in a locality gives rise to the following distribution

Profit (in lakhs Rs.)	No. of shops (frequency)
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Draw both ogives for the data above. Hence, obtain the median profit.

Sol. We have a more than type cumulative frequency distribution table. We may also prepare a less than type cumulative frequency distribution table from the given data, as given below :

'More than' type

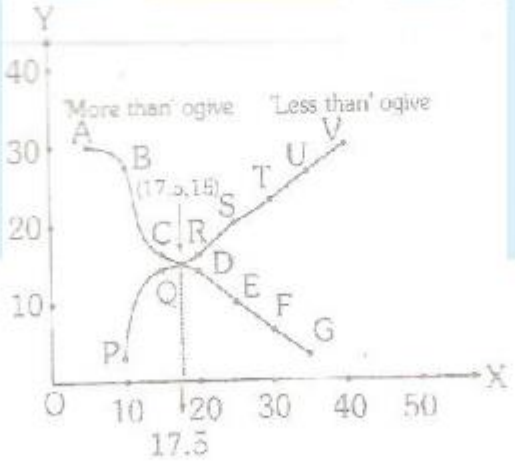
Profit more than (Rs. in lakhs)	No. of shops
5	30
10	28
15	16
20	14
25	10
30	7
35	3

'Less than' type

Profit less than (Rs. in lakhs)	No. of shops
10	2
15	14
20	11
25	20
30	23
35	27
40	30

Now, plot the points A(5,30), B(10,28), C(15,16), D(20,14), E(25,10), F(30,7) and G(35,3) for the more than type cumulative frequency and the points P(10,2), Q(15,14), R(20,16), S(25,20), T(30,23), U(35,27) and V(40,30) for the less then type cumulative frequency table.

Join these points by a freehand to get ogives for 'more than' type and 'less than' type.



The tow ogives intersect each other at point (17.5, 15).

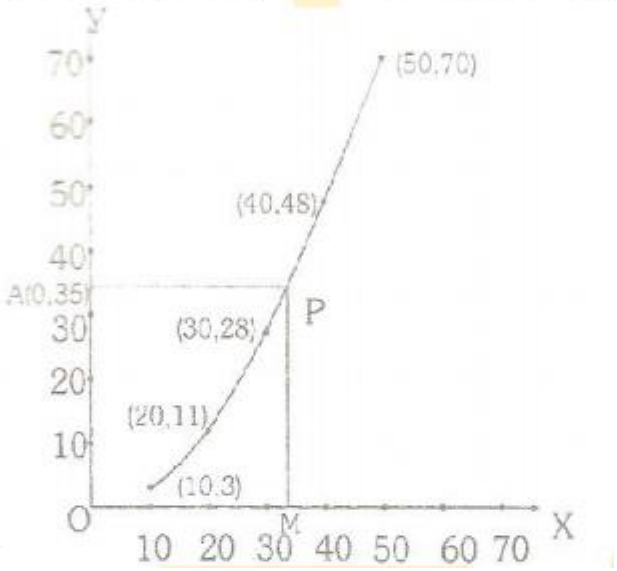
Hence, the median profit is Rs. 17.5 lakhs.

Ex.21 The following data gives the information on marks of 70 students in a periodical test :

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50
No. of students	3	11	28	48	70

Draw a cumulative frequency curve for the above data and find the median.

Sol. We have a less than cumulative frequency table. We mark the upper class limits along the x-axis and the corresponding cumulative frequency (no. of students) along the y-axis. Now, plot the points (10,3), (20,11), (30,28), (40,48) and (50,70). Join these points by a freehand curve to get an ogive of 'less than' type.



Here, N = 70

$$\therefore \frac{N}{2} = 35$$

Take a point A(0,35) on the y-axis and draw AP $\parallel$ x-axis, meeting the curve at P.

Draw PM $\perp$ x-axis, intersecting the x-axis, at M.

Then, OM = 33.

Hence, the median marks is 33.

EXERCISE – 1 (FOR SCHOOL/BOARD EXAMS)

OBJECTIVE TYPE QUESTIONS

CHOOSE THE CORRECT ONE

1. Which of the following is a measure of central tendency ?

(A) Frequency (B) Cumulative frequency

(C) Mean (D) Class limit

2. Class mark of a class is obtained by using –

(A) Class mark (B) $\frac{1}{2}$[upper limit – lower limit]

(C) $\frac{1}{2}$[upper limit + lower limit] (D) $\frac{1}{2}$[upper limit + lower limit] – 1

3. The value of $\sum_{i=1}^{n} x_i$ is –

(A) $\frac{\bar{x}}{2}$ (B) 2 $\bar{x}$ (C) n $\bar{x}$ (D) $\frac{\bar{x}}{n}$

4. The mean of the following data $1^2, 2^2, 3^2, \ldots\ldots n^2$ is –

(A) $\frac{(n+1)(2n+1)}{6}$ (B) $\frac{n(n-1)(2n+1)}{6}$ (C) $\frac{n(n+1)(2n-1)}{6}$ (D) $\frac{n(n-1)(2n-1)}{6}$

5. The mean of following distribution is –

x_i	10	12	15	25
f_i	2	3	7	8

(A) 18.50 (B) 18.50 (C) 18.15 (D) 18.25

6. The mean of following data is 18.75 then the value of p is –

x_i	10	15	p	25	30
f_i	5	10	7	8	2

(A) 21 (B) 20.6 (C) 20 (D) 22

7. To find mean, we use the formula.

(A) $\sum_{i=1}^{n} f_i x_i$ (B) $N\sum_{i=1}^{n} f_i x_i$ (C) $\frac{1}{N}\sum_{i=1}^{n} f_i x_i$ (D) $\sum_{i=1}^{n}\left(\frac{f_i x_i}{N}\right)$

8. Which of the following can not be determined graphically –

(A) Mean (B) Median (C) Mode (D) Standard deviation

9. If the median of the following data is 40 then the value of p is –

Class	0- 10	10-30	30-60	60-80	80-90
Frequency	5	15	30	p	2

(A) 7 (B) 8 (C) 9 (D) 7.6

10. Which of the following is true?

(A) Mode = 2median – Mean (B) Mode = 3median + 2Mean

(C) Mode = 3median – 2Mean (D) None of these

11. Mode is –

(A) Most frequent value (B) Least frequent value

(C) Middle most value (D) None of these

12. Which of the following is true –

(A) Mode = 2median + Mean (B) Median = Mode + $\frac{3}{2}$[Mean – Median]

(C) Mean = Mode + $\frac{3}{2}$[Median – Mode] (D) Median = Mode + $\frac{3}{2}$[Mean +Median]

13. In the formula for mode of a grouped data, mode = $\ell + \left\{\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right\} \times h$, where symbols have their usual meaning f_0 represents :

(A) Frequency of modal class

(B) Frequency of median class

(C) Frequency of the class preceding the modal class

(D) Frequency of class succeeding the modal class

14. Median of a given frequency distribution is found with the help of a –

(A) Bar graph (B) Ogive (C) Histogram (D) None of these

15. The measure of central tendency which is given by the x-coordinate of the point of intersection of the 'more than' ogive and 'less than' ogive is –

(A) Mean (B) Median (C) Mode (D) None of these

OBJECTIVE **ANSWER KEY** EXERCISE

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	C	C	A	B	C	C	A	B	C
Que.	**11**	**12**	**13**	**14**	**15**					
Ans.	A	C	C	B	B					

EXERCISE – 2 (FOR SCHOOL/BOARD EXAMS)

SUBJECTIVE TYPE QUESTIONS

(A) MEAN OF A GROUPED DATA

1. Find the mean of the following data :

(a)

Class Interval	0-6	6-12	12-18	18-24	24-30
Frequency	6	8	10	9	7

(b)

Number of Plant	0-2	2-4	4-6	6-8	8-10	10-12	12-14
Number of house	1	2	1	5	6	2	3

2. Find the mean of the following distribution :

(a)

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	9	5	3

(b) (i)

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	12	16	6	7	9

(ii)

Class Interval	100-120	120-140	140-160	160-180	180-200
Frequency	12	14	8	6	10

(iii)

Class Interval	0-100	100-200	200-300	300-400	400-500
Frequency	6	9	15	12	8

3. (a) The arithmetic mean of the following frequency distribution is 25.25. Determine the value of p :

Class	0-10	10-20	20-30	30-40	40-50
Frequency	7	8	p	15	4

(b) The arithmetic mean of the following frequency distribution is 47. Determine the value of p :

Class Interval	0-20	20-40	40-60	60-80	80-100
Frequency	8	15	20	p	5

4. Find the value of f, the missing frequency, if the mean of the following distribution is 67.

Class Interval	25-35	35-45	45-55	55-65	65-75	75-85	85-98
Frequency	10	6	4	f	4	12	26

5. (a) Find the missing frequencies f_1 and f_2 if the frequency distribution is 62.8 and the sum of all frequency is 50

Class	0-20	20-40	40-60	60-80	80-100	100-120	Total
Frequency	5	f_1	10	f_2	7	8	50

(b) Find the missing frequencies f_1 and f_2 in the following data if the mean is $166\frac{9}{26}$ and the sum of the observation

Class	140-150	150-160	160-170	170-180	180-190	190-200

Frequency	7	f_1	20	f_2	7	8

(c) The mean of following frequency table is 53. But the frequency f_1 and f_2 in the classes 20-40 and 60-80 are missing. Find the missing frequency

Age (in years)	0-20	20-40	40-60	60-80	80-100	Total
No. of people	15	f_1	21	f_2	17	100

6. (a) Find the mean of the following data, by using the assumed mean method.

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	7	8	12	13	10

(b)

Marks	0-100	100-200	200-300	300-400	400-500	500-600
No. of students	2	8	12	20	5	3

7. 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.

No. of days	0-6	6-10	10-14	14-20	20-28	28-38	38-40
No. of students	11	10	7	4	4	3	1

8. (a) Find the arithmetic mean of the following frequency distribution by using step deviation method :

Class	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36
No. of students	2	12	15	25	18	12	13	3

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

Literacy rate (in %)	45-55	55-65	65-75	75-85	85-95
No. of cities	3	10	11	8	3

(c) The distribution show the number of wickets taken by bowlers in one day cricket matches. Find the mean number

No. of wickets	20-60	60-100	100-150	150-250	250-350	350-450
No. of bowlers	7	5	16	12	2	3

9. (a) The following table gives the distribution of expenditures of different families on education. Find the mean expenditure on education of a family.

Expenditure (in Rs.)	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000
No. of families	24	10	33	28	30	22	16	7

(b) (i) To find the concentration of SO_2 in the air (in per million), 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	0.16-0.020	0.20-0.24
Frequency	4	9	9	2	4	2

Find the mean concentration of SO_2 in the air.

(ii) The following table shows that the daily expenditure on food of 25 house holds in a localities. Find the mean daily expenditure on food by a suitable method.

Daily expenditure (in Rs.)	100-150	150-200	200-250	250-300	300-350
No. of house holds	4	5	12	2	2

10. (a) Find the mean marks from the following data :

Marks	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60
No. of students	4	10	18	28	40	70

(b) Compute the mean for the following data :

Marks	Less than 10	Less than 30	Less than 50	Less than 70	Less than 90	Less than 110	Less than 130	Less than 150
No. of students	0	10	25	43	65	87	96	100

11. (a) Find the average marks of student from the following data :

Marks	No. of Students
Above 0	80
Above 10	77
Above 20	72
Above 30	65
Above 40	55
Above 50	43
Above 60	23
Above 70	16
Above 80	10
Above 90	8
Above 100	0

(b) Find the mean wage of the following data :

Wages (in Rs.)	No. of Workers

0 and above	120
20 and above	108
40 and above	90
60 and above	75
80 and above	50
100 and above	24
120 and above	9
140 and above	0

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

No. of mangoes	50-52	53-55	56-58	59-61	62-64
No. of boxes	15	110	135	115	25

Find the mean number of mangoes kept in a pocket box.

(b) The following data shows that the age distribution of patients of malaria in a village during a particular month. Find the average age of the patients.

Age (in years)	5-14	15-24	25-34	35-44	45-54	55-64
No. of cases	6	11	21	23	14	5

(B) MEDIAN OF A GROUPED DATA

1. Find the median for the following frequency distribution :

(a)

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	6	9	14	2	19	10

(b) (i)

Class Interval	25-35	35-45	45-55	55-65	65-75
Frequency	20	25	5	7	4

(ii)

Class Interval	0-8	8-16	16-24	24-32	32-40	40-48
Frequency	8	10	16	24	15	7

(c) 100 surnames were randomly picket up from a local telephone directly 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

Find the median number of letters in the surnames. Find the mean number of letters in the surnames.

2. (a) Find the median from the following data :

Class groups	110-120	120-130	130-140	140-150	150-160	160-170	170-180	180-190	190-200
Frequency	6	25	48	72	116	60	38	22	3

(b) (i) The following distribution gives the weights of 30 students of a class. Find the median weight of the student

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

(ii) Find the median of the following frequency distribution :

Marks	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency	2	5	9	12	17	20	15	9	7	4

(c) The following table gives the distribution of the life time of 400 neon lamps :

Life Time (in hours)	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000
No. of lamps	14	56	60	86	74	62	48

Find the median life time of a lamp.

3. (a) 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.

Age in years	Below 20	Below 25	Below 30	Below 35	Below 40	Below 45	Below 50	Below 55	Below 60
No. of policy holders	2	6	24	45	78	89	92	98	100

(b) A survey regarding the heights (in cm) of 51 girls of class X of a school was conducted and the data obtained follows :

Heights (in cm)	Less than 140	Less than 145	Less than 150	Less than 155	Less than 160	Less than 165
No. of girls	4	11	29	40	46	51

Find the median height.

4. (a) The following table gives the marks obtained by 50 students in a class test :

Marks	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
No. of Students	2	3	6	7	14	12	4	2

Find the median.

(b) The following table gives the population of males in different age groups :

Age group (in years)	5-14	15-24	25-34	35-44	45-54	55-64	65-74
No. of males	447	307	279	220	157	91	39

Find their median age.

5. (a) The following table gives the distribution of IQ of 100 students. Find the median IQ.

IQ	75-84	85-94	95-104	105-114	115-124	125-134	135-144
Frequency	8	11	26	31	18	4	2

(b) The length of 70 leaves of a plant are measured correct to the nearest millimeter and the data obtained is represented in the following table :

Variable	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	12	30	f_1	65	f_2	25	18

Find the median length of the leaves.

Class interval	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	7	10	x	13	y	10	14	9

6. Calculate the missing frequency f from the following distribution, it being given that the median of the distribution is 24.

Class	0-10	10-20	20-30	30-40	40-50
Frequency	5	25	f	18	7

7. (a) If the median of the following frequency distribution is 28.5, find the missing frequencies.

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	Total
Frequency	5	f_1	20	15	f_2	5	60

(b) If the median of the following frequency distribution is 32.5, find the values of f_1 and f_2.

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Total
Frequency	f_1	5	9	12	f_2	3	2	40

(c) (i) An incomplete distribution is given below :

Length (in mm)	118-126	127-135	136-144	145-153	154-162	163-171	172-180
No. of leave	10	8	13	22	7	6	4

If median value is 46 and the total number of items is 230.

(α) Find the missing frequencies f_1 and f_2.

(β) Find the arithmetic mean (AM) of the completed distribution.

(ii) The median of the following data is 20.75 Find the missing frequencies x and y, if the total frequency is 100

(C) MEDIAN OF A GROUPED DATA

1. (a) Calculate the mode for the following frequency distribution.

Class	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

(b) A student noted the number of cars passing through spot on a road for 100 periods each of 3 minutes and summarized it in the table given below. Find the mode of the data .

No. of cars	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	14	13	12	20	11	15	8

2. (a) The given distribution shows the number of runs scored by some top batsmen of the world in one day international cricket matches :

Runs Scored	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000-9000	9000-10000	10000-11000
No. of batsman	4	18	9	7	6	3	1	1

Find the mode of the data.

(b) (i) The following tables gives 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
No. of patients	6	11	21	23	14	5

Find the mode and the mean of the data

(ii) The following data gives the distribution of total monthly house hold expenditure of 200 families of a village. Find the modal monthly expenditure of the families. Also, find the mean monthly expenditure

Expenditure (in Rs.)	1000-1500	1500-2000	2000-2500	2500-3000	3000-3500	3500-4000	4000-4500	4500-5000
No. of families	24	40	33	28	30	22	16	7

(c) (i) 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 two measures.

No. of students per teacher	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55
No. of state/U.T.	3	8	9	10	3	0	0	2

(ii) The following table shows the marks obtained by 100 students of Class X in school during a particular academic session. Find the mode of this distribution

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60	Less than 70	Less than 80
No. of students	7	21	34	46	66	77	92	100

3. (a) Compute the mode of the following data :

Class Interval	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Frequency	3	8	13	18	28	20	13	8	6	4

(b) Compute the mode of the following data :

Score	80-90	90-100	100-110	110-120	120-130	130-140	140-150
No. of pupil	18	27	48	39	12	6	16

4. Calculate the mode of the following data :

Wages (In Rs.)	51-56	57-62	63-68	69-74	75-80	81-86	87-92
No. of workers	12	24	40	30	18	8	20

5. The mode of the following data is 85.7 Find the missing frequency in it.

Size	45-55	55-65	650-75	75-85	85-95	95-105	105-115
Frequency	7	12	17	f	32	6	10

(C) GRAPHICA REPRESENTATION OF CUMULATIVE FREQUENCY DISTRIBUTION

1. The following distribution gives the mark obtained by 102 students of class X.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	9	10	25	50	5	3

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

2. The following table gives the distribution of IQ of 60 pupils of class X in a school.

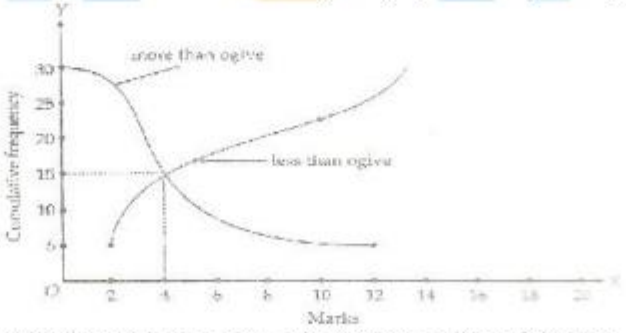
IQ	60-70	70-80	80-90	90-100	1005-110	110-120	120-130
No. of pupils	2	3	5	16	14	13	7

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

3. (a) The following table gives the height of trees :

Height	Less than 140	Less than 145	Less than 150	Less than 155	Less than 160	Less than 165
No. of trees	4	11	29	40	46	50

(b) What is the value of the median of the data using the graph in the given figure, of less than ogive and more than ogive?

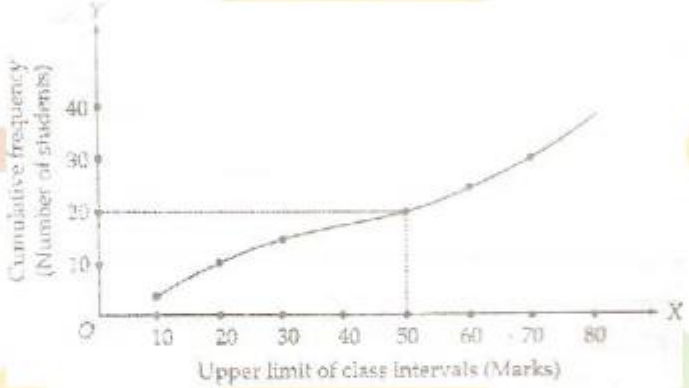


Draw both ogives for the data above. Hence, obtain the median of the data.

4. (a) Following is the age distribution of a group of students. Draw a cumulative frequency curve for the data and find the median.

Age in years	No. of students
Less than 5	36
Less than 6	78
Less than 7	136
Less than 8	190
Less than 9	258
Less than 10	342
Less than 11	438
Less than 12	520
Less than 13	586
Less than 14	634
Less than 15	684
Less than 16	700

(b) A student draws a cumulative frequency curve for the marks obtained by 40 students of a class as shown below. Find the median marks obtained by the students of the class.



5. The table given below shows the frequency distribution of the scores obtained by 200 candidates in a MCA entrance examination.

Score	200-250	250-300	300-350	350-400	400-450	450-500	500-550	550-600
No. of students	30	15	45	20	25	40	10	15

Draw cumulative curve of more than type and hence find median.

(A) MEAN OF A GROUPED DATA :

1. (a) 15.45, (b) 8.1 **2.** (a) 25, (b) (i) 22 (ii) 145.20 (iii) 264 **3.** (a) 6, (b) 12 **4.** 23.71
5. (a) 8, 12, (b) $f_1 = 7$, $f_2 = 10$, (c) $f_1 = 18$, $f_2 = 29$, **6.** (a) 27.2 (b) 304 **7.** 12.48 days
8. (a) 19.92 (b) 69.43%, (c) On an average the number of wickets taken by bowers in one day cricket is 152.89.

9. (a) 2823.53 (b) (i) 0.099 ppm (ii) Rs.211 **10.** (a) $40\frac{5}{7}$ marks (b) 74.80

11. (a) 51.1 (b) (i) 69.34 **12.** (a) 57.19 (b) 34.87 years

(B) MEDIAN OF A GROUPED DATA :

1. (a) 35 (b) (i) 39.2 (ii) 26 (c) Median = 8.05, Mean = 8.32
2. (a) 153.8 (b) (i) 56.67 kg (ii) 532.5 (c) 3406.98 hours
3. (a) 35.76 years (b) 149.03 cm **4.** (a) 33 (b) 25.07 years
5. (a) 106.1 (b) 146.14 m **6.** 25
7. (a) 8, 7 (b) 3, 6 (c) (i) (α) 34 & 46 (β) 45.87 (ii) x = 17, y = 20

(C) MODE OF A GROUPED DATA :

1. (a) 46.67 (b) 44.7 cars
2. (a) 4608.7 runs
(b) (i) mode = 36.8, mean = 35.37 years, (ii) Rs. 1847.83, Rs. 2662.5
(c) (i) mode = 30.6, mean = 29.2 Most states U. T., have a student teacher ratio of 30.6 and on an average, this ratio is 29.2
(ii) 44.7
3. (a) 23.28 (b) 107 4. 66.2 5. 30 (approx.)

(D) GRAPHICAL REPRESENTATION OF CUMULATIVE FREQUENCY DISTRIBUTION :

3. (a) Median = 148.9 (b) Median = 4
4. (a) Median = 10 (b) Median marks = 50
5. Median = 375

EXERCISE – 3 (FOR SCHOOL/BOARD EXAMS)

PREVIOUS YEARS BOARD QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Which measure of central tendency is given by the x-coordinate of the point of intersection of the "more than ogive" and "less than ogive"? **Delhi-2008**
2. Find the median class of the following data : **Al-2008**

Marks Obtained	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	8	10	12	22	30	18

3. Find the class marks of classes 10-25 and 35-55 : **Foreing-2008**
4. Write the median class of the following distribution : **Delhi-2009**

Classes	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	4	8	10	12	8	4

5. What is the lower limit of the modal class of the following frequency distribution? **Foreing-2009**

Age (in years)	0-10	10-20	20-30	30-40	40-50	50-60
Number of patients	16	13	6	11	27	18

SHORT ANSWER TYPE QUESTIONS

1. The mean of the following frequency distribution is 57.6 and the sum of observations is 50. Find the missing frequencies f_1 and f_2 : **Al-2004**

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	7	f_1	12	f_2	8	5

2. The following table gives the distribution of expenditure of different families on education. Find the mean expenditure on education of a family : **Delhi-2004C**

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

3. Find the mean of the following distribution : **Delhi-2005**

Class	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36
Number of students	2	12	15	25	18	12	13	3

4. If the mean of the following data is 18.75 find the value of p : **Al-2005**

x_i	10	15	p	25	30
f_i	5	10	7	8	2

5. The Arithmetic Mean of the following frequency distribution is 50. Find the value of p : **Delhi-2006**

Class	0-20	20-40	40-60	60-80	80-100
Frequency	17	p	32	24	19

6. If the mean of the following is 50, find the value of f_1 : **Delhi-2006**

Class	0-20	20-40	40-60	60-80	80-100
Frequency	17	28	32	f_1	19

7. The mean of the following frequency distribution is 62.8. Find the missing frequency x. **Delhi-2007**

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	8	x	12	7	8

LONG ANSWER TYPE QUESTIONS

1. A survery regarding the heights (in cm) of 50 girls of class x of a school was conducted and the following data was obtained : **Delhi-2008**

Height in cm	120-130	130-140	140-150	150-160	160-170	Total
Number of girls	2	8	12	20	8	50

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

2. Find the mean, mode and median of the following data. **Al-2008**

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	5	10	18	30	20	12	5

3. Find the mean, median and mode of the following data. **Foreign-2008**

Class	Frequency
0-50	2
50-100	3
100-150	5
150-200	6
200-250	5
250-300	3
300-350	1

4. The following table gives the daily income of 50 workers of a factory : **Delhi-2009**

Daily income (in Rs.)	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.

5. During the medical check-up of 35 students of a class their weights were recorded as follows : **Al-2009**

Weight (in kg)	Number of students
38-40	3
40-42	2
42-44	4
44-46	5
46-48	14
48-50	4
50-52	3

Draw a less than type and a more than type ogive from the given data. Hence obtain the median weight from the graph.

6. Find the mode, median and mean for the following data : **Foreign-2009**

Marks obtained	Number of students
25-35	7
35-45	31
45-50	33
50-55	17
55-65	11
65-75	1

VERY SHORT ANSWER TYPE QUESTION

1. Median **2.** 30-40 **3.** 17.5 and 45 **4.** 30-40 5. 40

SHORT ANSWER TYPE QUESTION

1. $f_1 = 8, f_2 = 10$ **2.** Rs. 2662.5 **3.** 19.92 **4.** $p = 20$ **5.** $p = 28$ **6.** $f_1 = 24$ **7.** 10

LONG ANSWER TYPE QUESTION

1. mean = 150.25 ; Median = 151.5 ; Mode = 154. **2.** mean = 35.76 ; Median = 35.66 ; Mode = 35.44
3. mean = 59.9 ; Median = 61.6 ; Mode = 65. **4.** mean = 145.20 ; Median = 138.57 ; Mode = 125
5. 42.2 kg **6.** mean = 49.7 ; Median = 48.5 ; Mode = 46.1