Very Short Answer Type Questions

[1 Marks]

Que 1. Find the class mark of the class 10 – 25.

Sol. Class mark = $\frac{Upper\ limit + Lower\ limit}{2} = \frac{10+25}{2} = \frac{35}{2}$ 17.5

Que 2. Find the mean of the first five natural numbers.

Sol. Mean = $\frac{x_1+x_2+x_3+x_4+x_5}{5} = \frac{1+2++3+4+5}{5} = \frac{15}{5} = 3$

Que 3. A data has 13 observations arranged in descending order. Which observation represents the median of data?

Sol. Total no. of observations = 13, which is odd

∴ The median will be $\left(\frac{n+1}{2}\right)^{th}$ $term = \left(\frac{13+1}{2}\right)^{th} = \left(\frac{14}{2}\right)^{th} = 7th$

i.e., 7^{th} term will be the median.

Que 4. If the mode of a distribution is 8 and its mean is also 8, then find median.

Sol. Mode = 8; Mean = 8; Median =?

Relation among mean, median and mode is

3 median = mode + 2 mean

3 × median = 8 + 2 × 8

Median = $\frac{8+16}{3} = \frac{24}{3} = 8$

Que 5. In an arranged series of an even number of 2n terms which terms is median?

Sol. No. or terms = 2n which are even

∴ The median term will be $\frac{\left[\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}\right]}{2}$

Put n = 2n

$= \frac{\left[\left(\frac{2n}{2}\right)^{th} + \left(\frac{2n}{2}+1\right)^{th}\right]}{2} = \left[\frac{n^{th}+(n+1)^{th}}{2}\right]$

i.e., the mean of n^{th} and $(n + 1)^{th}$ term will be the median.

Que 6. What does the abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data represent?

Sol. The abscissa of the point of intersection of the less than type and of the more than type cumulative frequency curves of a grouped data gives its median.

Que 7. Name the graphical representation from which the mode of a frequency distribution is obtained.

Sol. The mode of frequency distribution is determined graphically from Histogram.

Que 8. A student draws a cumulative frequency curve for the marks obtained by 60 students of a class as shown below. Find the median marks obtained by the students of the class.

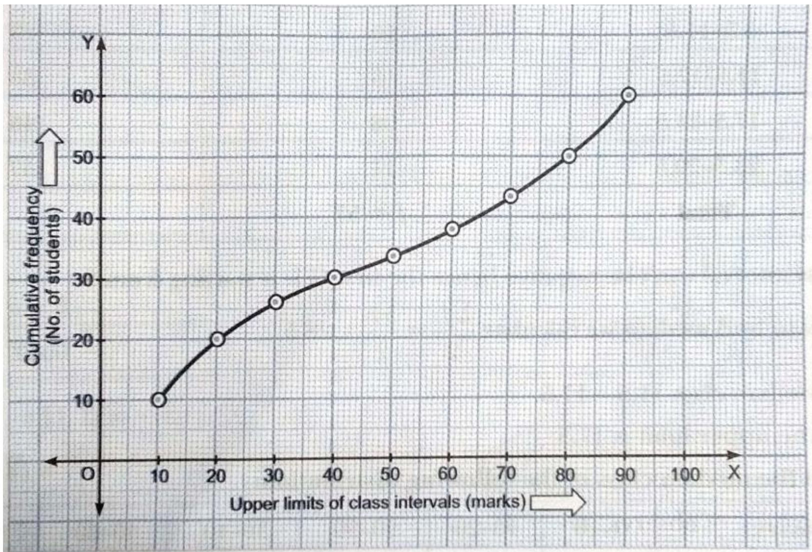

Fig. 14.2

Sol. Here n = 60 ∴ $\frac{n}{2} = 30$

Corresponding to 30 on y-axis, the marks on x-axis is 40.
∴ Median marks = 40.

Que 9. Write the modal class for the following frequency distribution:

Class Interval	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency	33	38	65	52	19	48

Sol. Maximum frequency, i.e., 65 corresponds to the class 30 – 40
∴ Modal class is 30 – 40.

Short Answer Type Questions – I

[2 marks]

Que 1. If x_i's are the mid-point of the class intervals of a grouped data. F_i's are the corresponding frequencies and $\overline{x}$ is the mean, then find $\Sigma f_i(x_i - \overline{x})$.

Sol. We know mean $(\overline{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$\therefore \quad \Sigma f_i x_i = \overline{x}\Sigma f_i \qquad \ldots$(i)

Now the value of $\Sigma f_i(x_i - \overline{x}) = \Sigma f_i x_i - \Sigma f_i \overline{x}$
$= \Sigma f_i \overline{x} - \Sigma f_i \overline{x} = 0.$ [Using (i)]

Que 2. Consider the following frequency distribution.

Class	0 – 5	6 – 11	12 – 17	18 – 23	24 – 29
Frequency	13	10	18	8	11

Find the upper limit of median class.

Sol. Classes are not continuous, hence make them continuous by adding 0.5 to the upper limits and subtracting 0.5 from the lower limits.

C.I.	**Frequency**	**Cumulative Frequency**
0 – 5.5	13	13
5.5 – 11.5	10	23
11.5 – 17.5	15	38
17.5 – 23.5	08	46
23.5 – 29.5	11	57
Total	**Σf = 57**	

Class interval can't be negative hence the first C.I. is starting from 0.

Now to find median we calculate $\frac{\Sigma f}{2} = \frac{57}{2} = 28.5$

$\therefore$ Median class 11.5 – 17.5
So, the upper limit is 17.5

Que 3. Find the median class of the following distribution:

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

Sol. First we find the cumulative frequency

Classes	**Frequency**	**Cumulative Frequency**
0 – 10	4	4
10 – 20	4	8
20 – 30	8	16
30 – 40	10	26
40 – 50	12	38
50 – 60	8	46
60 – 70	4	50
Total	50	

$Here, \frac{n}{2} = \frac{50}{2} = 25$

∴ Median class = 30 – 40.

Que 4. Find the class marks of classes 15.5 – 18.5 and 50 – 75.

Sol. Class marks = $\frac{upper\ limit + lower\ limit}{2}$

∴ Class marks of 15.5 – 18.5 = $\frac{18.5+15.5}{2} = \frac{34}{2} = 17$

Class marks of 50 – 75 = $\frac{75+50}{2} = \frac{125}{2} = 62.5$.

Short Answer Type Questions – II

[3 marks]

Que 1. If the mean of the following distribution is 6, find the value of p.

X	2	4	6	10	P + 5
f	3	2	3	1	2

Sol. Calculation of mean

x_i	f_i	$f_i x_i$
2	3	6
4	2	8
6	3	18
10	1	10
P + 5	2	2p + 10
Total	$\Sigma f_i = 11$	$\Sigma f_i x_i = 2p + 52$

We have, $\Sigma f_i = 11$, $\Sigma f_i x_i = 2p + 52$, $\overline{x} = 6$

$$\therefore \quad Mean\ (\overline{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}]$$

$$\Rightarrow \quad 6 = \frac{2p+52}{11} \quad \Rightarrow \quad 66 = 2p + 52$$

$$\Rightarrow \quad 2p = 14 \quad \Rightarrow \quad p = 7$$

Que 2. Find the mean of the following distribution:

x	4	6	9	10	15
f	5	10	10	7	8

Sol. Calculation of arithmetic mean

x_i	f_i	f_ix_i
4	5	20
6	10	60
9	10	90
10	7	70
15	8	120
Total	$\Sigma f_i = 40$	$\Sigma f_ix_i = 360$

$$\therefore \quad Mean\ (\overline{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{360}{40} = 9$$

Que 3. 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 maximum class frequency is 61 and the class corresponding to this frequency is 60 – 80. So, the modal class is 60 – 80.
Here, $l = 60$, $h = 20$, $f_1 = 61$, $f_0 = 52$, $f_2 = 38$

$$\therefore \quad Mode = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{61 - 52}{2 \times 61 - 52 - 38} \times 20 = 60 + \frac{9}{122 - 90} \times 20$$

$$= 60 + \frac{9}{32} \times 20 = 60 + \frac{45}{8} = 60 + 5.625 = 65.625$$

Hence, modal lifetime of the components is 65.625 hours.

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

Que 4. The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Sol. Calculation of median

Weight (in kg)	Number of students (f_i)	Cumulative frequency (cf)
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	**$\Sigma f_i = 30$**	

We have, $\sum f_i = n = 30 \quad \Rightarrow \quad \frac{n}{2} = 15$

The cumulative frequency just greater that $\frac{n}{2} = 15$ is 19, and the corresponding class is 55 – 60.

$\therefore \quad 55 - 60 \; is \; the \; median \; class.$

Now, we have $\frac{n}{2} = 15, l = 55, cf = 13, f = 6, h = 5$

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

$$= 55 + \left(\frac{15-13}{6}\right) \times 5 = 55 + \frac{2}{6} \times 5 = 55 + 1.67 = 56.67$$

Hence, median weight is 56.67 kg.

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

Que 5. The length of 40 leaves of a plant are measured correctly to the nearest millimeter, and the data obtained is represented in the following table:

Find the median length of the leaves.

Sol. Here, the classes are not in inclusive form. So, we first convert them in inclusive form by subtracting $\frac{h}{2}$ from the lower limit and adding $\frac{h}{2}$ to the upper limit of each class, where h is the difference between the lower limit of a class and the upper limit of preceding class.
Now, we have

Class interval	Number of leaves	Cumulative frequency (cf)
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	$\Sigma f_i = 40$	

We have, n = 40 ⇒ $\frac{n}{2} = 20$

And, the cumulative frequency just greater than $\frac{n}{2}$ is 29 and corresponding class is 144. – 153.5. So median class is 144.5 – 153.5.

Here, we have $\frac{n}{2}$ = 20, l = 144.5, h = 9, f = 12, cf = 17

$$\therefore \; Median = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h = 144.5 + \left(\frac{20 - 17}{12}\right) \times 9$$

$$= 144.5 + \frac{3}{12} \times 9 = 144.5 + \frac{9}{4} = 144.5 + 2.25 = 146.75\, mm.$$

Hence, the median length of the leaves is 146.75 mm.

Long Answer Type Questions

[4 MARKS]

Que 1. 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
Number of cities	3	10	11	8	3

Sol. Here, we use step deviation method to find mean.

Let assumed mean A = 70 and class size h = 10

So, $u_i = \frac{x_i - 70}{10}$

Now, we have

Literacy rate (in %)	**Frequency (f_i)**	**Class mark (x_i)**	$u_i = \frac{x_i - 70}{10}$	$f_i u_i$
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
Total	$\Sigma f_i = 35$			$\Sigma f_i u_i = -2$

$$\therefore \quad Mean\ (\overline{x}) = A + h \times \frac{\Sigma f_i u_i}{\Sigma f_i} = 70 + 10 \times \frac{-2}{35} = 70 - 0.57 = 69.43\%$$

Que 2. The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is ₹18. Find the missing frequency f.

Daily pocket allowance (in ₹)	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. Let the assumed mean A = 16 and class size h = 2, here we apply step deviation method.

So, $u_i = \frac{x_i - A}{h} = \frac{x_i - 16}{2}$

Class interval	**Frequency (f_i)**	**Class mark (x_i)**	$u_i = \frac{x_i - 16}{2}$	$f_i u_i$
11 – 13	7	12	–2	–14
13 – 15	6	14	–1	–6

15 – 17	9	16	0	0
17 – 19	13	18	1	13
19 – 21	f	20	2	2f
21 – 23	5	22	3	15
23 – 25	4	24	4	16
Total	$\boldsymbol{\Sigma f_i = f + 44}$			$\boldsymbol{\Sigma f_i u_i = 2f + 24}$

Now, we have,

We have, Mean $(\overline{x}) = 18, A = 16\ and\ h = 2$

$\therefore \quad \overline{x} = A + h \times \frac{\Sigma f_i u_i}{\Sigma f_i}$

$18 = 16 + 2 \times \left(\frac{2f+24}{f+44}\right) \Rightarrow 2 = 2 \times \left(\frac{2f+24}{f+44}\right)$

$\Rightarrow \quad 1 = \frac{2f+24}{f+44} \qquad \Rightarrow f + 44 = 2f + 24$

$\Rightarrow \quad f = 44 - 24$

$\Rightarrow \quad f = 20$

Hence, the missing frequency is 20.

Que 3. The mean of the following frequency distribution is 62.8. Find the missing frequency x.

Classes	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 20
Frequency	5	8	x	12	7	8

Sol. We have

Class interval	**Frequency**	**Class mark** $(\boldsymbol{x_i})$	$\boldsymbol{f_i x_i}$
0 – 20	5	10	50
20 – 40	8	30	240
40 – 60	x	50	50x
60 – 80	12	70	840
80 – 100	7	90	630
100 – 120	8	110	880
Total	$\boldsymbol{\Sigma f_i = 40 + x}$		$\boldsymbol{\Sigma f_i x_i = 2640 + 50x}$

Here, $\Sigma f_i x_i = 2640 + 50x, \Sigma f_i = 40 + x, \overline{x} = 62.8$

$\therefore \quad Mean(\overline{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$\Rightarrow \quad 62.8 = \frac{2640 + 50x}{40 + x}$

$\Rightarrow \quad 2512 + 62.8x = 2640 + 50x$

$\Rightarrow \quad 62.8x - 50x = 2640 - 2512$

$\Rightarrow \quad 12.8x = 128$

$\therefore \qquad x = \frac{128}{12.8} = 10$

Hence, the missing frequency is 10.

Que 4. The distribution below gives the marks of 100 students of a class.

Marks	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40
Number of students	4	6	10	10	25	22	18	5

Draw a less than type and a more than type ogive from the gives data. Hence, obtain the median marks from the graph.

Sol.

Marks	**Cumulative Frequency**	**Marks**	**Cumulative Frequency**
Less than 5	4	More than 0	100
Less than 10	10	More than 5	96
Less than 15	20	More than 10	90
Less than 20	30	More than 15	80
Less than 25	55	More than 20	70
Less than 30	77	More than 25	45
Less than 35	95	More than 30	23
Less than 40	100	More than 35	5

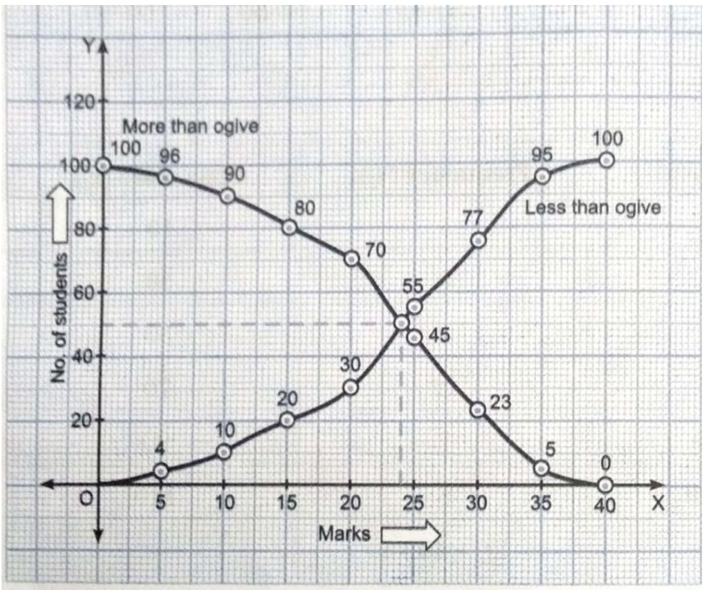

Fig. 14.3

Hence, median marks = 24

Que 5. During the medical check-up of 35 students of a class, their weight were recorded as follows:

Weight	Number of students	Weight (in kg)	Number of students
Less than 38	0	Less than 46	14
Less than 40	3	Less than 48	28
Less than 42	5	Less than 50	32
Less than 44	9	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.

Sol. To represent the data in the table graphically, we mark the upper limits of the class interval on x-axis and their corresponding cumulative frequency on y-axis choosing a convenient scale.

Now, let us plot the points corresponding to the ordered pair given by (38,0), (40,3), (42,5), (44,9), (46,14), (48,28), (50,32) and (52,35) on a graph paper and join them by a freehand smooth curve.

Thus, the curve obtained is the less than type ogive.

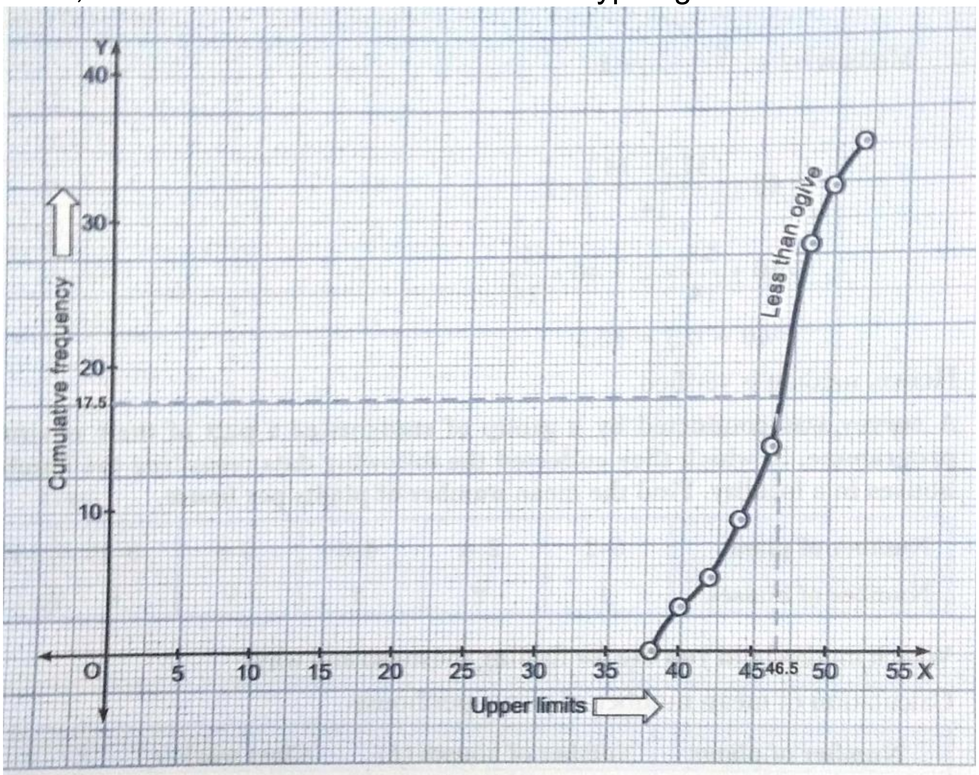

Fig. 14.4

Now, locate $\frac{n}{2} = \frac{35}{2= 17.5}$ on the y-axis,

We draw a line from this point parallel to x-axis cutting the curve at a point. From this point, draw a perpendicular line to the x-axis. The point of intersection of this perpendicular with the x-axis gives the median of the data. Here it is 46.5.
Let us make the following table in order to find median by using formula.

Weight (in kg)	**No. of students (frequency)**	**Cumulative frequency (cf)**
36 – 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
Total	$\Sigma f_i = 35$	

Here, n =$35, \frac{n}{2} = \frac{35}{2} = 17.5$, cumulative frequency greater than $\frac{n}{2} = 17.5$ is 28 and corresponding class is 46 – 48. So median class is 46 – 48.

Now, we have $l = 46, \frac{n}{2} = 17.5, cf = 14, f = 14, h = 2$

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

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

$$= 46 + \frac{3.5}{14} \times 2 = 46 + \frac{7}{14}$$

$$= 46 + 0.5 \ = 46.5$$

Hence, median is verified.

Que 6. 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?

Sol. Calculation of mean number of plants per house.

Number of plants	**Number of houses (f_i)**	**Class mark (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	$\Sigma f_i = 20$		$\Sigma f_i x_i = 162$

Hence, Mean$(\overline{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{162}{20} = 8.1$

Here, we used direct method to find mean because numerical values of x_i and f_i are small.

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

Que 7. 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.

Sol. We are given the cumulative frequency distribution. So, we first construct a frequency table from the given cumulative frequency distribution and then we will make necessary computations to compute median.

Class interval	**Frequency (f_i)**	**Cumulative frequency (cf)**
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
Total	$\Sigma f_i = 100$	

Here, n = 100

$\Rightarrow \quad \frac{n}{2} = 50$

And, cumulative frequency just greater than $\frac{n}{2} = 50$ is 78 and the corresponding class is 35 – 40. So 35 – 40 is the median class.

$\therefore \quad \frac{n}{2} = 50, l = 35, cf = 45, f = 33, h = 5$

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

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

$$= 35 + \frac{25}{33} = 35 + 0.76 = 35.76$$

Hence, the median age is 35.76 years.

Que 8. The following distribution gives the daily income of 50 workers of a factory.

Daily income (in ₹)	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.

Sol. Converting gives distribution to a less than type cumulative frequency distribution, we have,

Daily income (in ₹)	**Cumulative frequency**
Less than 120	12
Less than 140	12 + 14 = 26
Less than 160	26 + 8 = 34
Less than 180	34 + 6 = 40
Less than 200	40 + 10 = 50

Now, let us plot the points corresponding to the ordered pairs (120, 12), (140, 26), (160, 34), (180, 40), (200, 50) on a graph paper and join them by a freehand smooth curve.

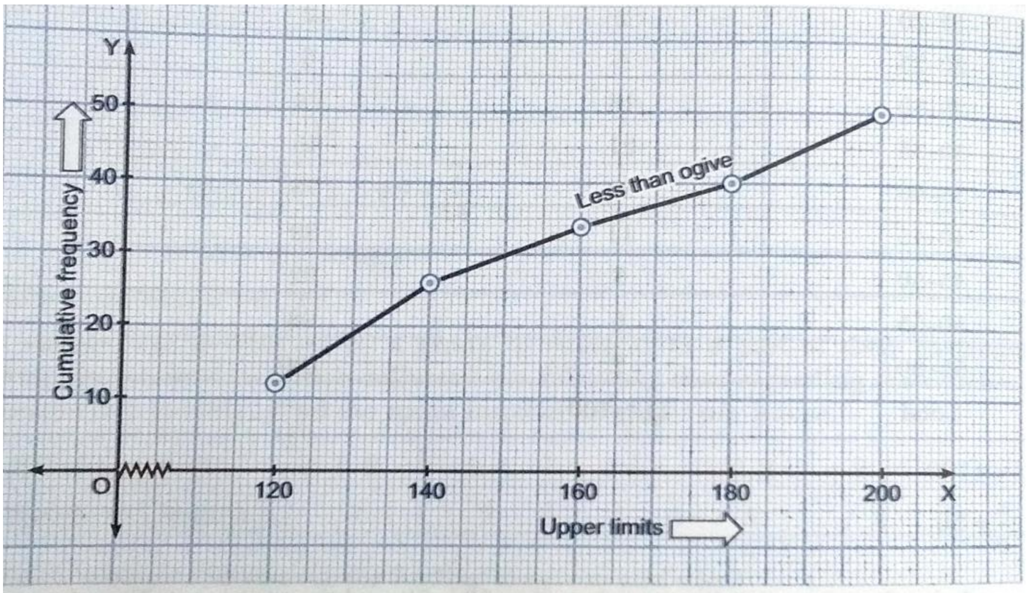

Fig. 14.5

Thus, obtained curve is called the less than type ogive.

Que 9. Find the mean of the following frequency distribution:

Class interval	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of workers	15	18	21	29	17

Sol. Calculation of mean

We have, $A = 50, h = 20, \Sigma f_i = 100\ and\ \Sigma f_i u_i = 15$.

Class interval	**Class mark** (x_i)	**Frequency** (f_i)	$u_i = \frac{x_i - A}{20} = \frac{x_i - 50}{20}$	$f_i u_i$
0 – 20	10	15	– 2	–30
20 – 40	30	18	–1	–18
40 – 60	50	21	0	0
60 – 80	70	29	1	29
80 – 100	90	17	2	34
Total		$\Sigma f_i = 100$		$\Sigma f_i u_i = 15$

$$\therefore \quad Mean\ (\overline{x}) = A + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right)$$

$$= 50 + 20 \times \frac{15}{100}$$

$$= 50 + 3 = 53.$$

HOTS (Higher Order Thinking Skills)

Que 1. The mean of the following frequency table is 50. But the frequencies $f_1 and f_2$ in class 20 – 40 and 60 – 80 respectively are missing. Find the missing frequencies.

Classes	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	Total
Frequency	17	f_1	32	f_2	19	120

Sol. Let the assumed mean A = 50 and h = 20.

Calculation of mean

Class interval	**Mid-values (x_i)**	**Frequency (f_i)**	$u_i = \frac{x_i - 50}{20}$	$f_i u_i$
0 – 20	10	17	– 2	– 34
20 – 40	30	f_1	– 1	$-f_1$
40 – 60	50	32	0	0
60 – 80	70	f_2	1	f_2
80 – 100	90	19	2	38
Total		$\Sigma f_i = 68 + f_1 + f_2$		$\Sigma f_i u_i = 4 - f_1 + f_2$

We have, $\Sigma f_i = 120$ [Given]

$\Rightarrow \quad 68 + f_1 + f_2 = 120$

$\Rightarrow \quad f_1 + f_2 = 52$ …(i)

Now, Mean = 50

$$\Rightarrow \quad \overline{x} = A + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) \;\Rightarrow\; 50 = 50 + 20 \times \left\{\frac{4 - f_1 + f_2}{120}\right\}$$

$$\Rightarrow \quad 50 = 50 + \frac{4 - f_1 + f_2}{6} \;\Rightarrow\; 0 = \frac{4 - f_1 + f_2}{6}$$

$$\Rightarrow \quad f_1 - f_2 = 4$$

From equation (i) and (ii), we get

$$f_1 + f_2 = 52$$

$$\underline{f_1 - f_2 = 4}$$

$$2f_1 = 56$$

$\Rightarrow \quad f_1 = 28$

Putting the value of f_1 in equation (i), we get

$$28 + f_2 = 52 \quad \Rightarrow \quad f_2 = 24$$

Hence, the missing frequencies f_1 is 28 and f_2 is 24.

Que 2. If the median of the distribution given below is 28.5, 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

Sol. Here, median = 28.5 and n = 60

Now, we have

Class interval	**Frequency** (f_i)	**Cumulative frequency** (cf)
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	$\Sigma f_i = 60$	

Since the median is given to be 28.5, thus the median is 20 – 30.

$\therefore \quad \frac{n}{2} = 30, I = 20, h = 10, cf = 5 + x \text{ and } f = 20$

$\therefore \quad Median = I + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h \quad \Rightarrow \quad 28.5 = 20 + \left[\frac{30-(5+x)}{20}\right] \times 10$

$\Rightarrow \quad 28.5 = 20 + \frac{25-x}{20} \times 10$

$\Rightarrow \quad 28.5 = 20 + \frac{25-x}{2} \quad \Rightarrow \quad 57 = 40 + 25 - x$

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

Also, $n = \Sigma f_i = 60$

$\Rightarrow \quad 45 + x + y = 60$

$\Rightarrow \quad 45 + 8 + y = 60 \quad [\because x = 8]$

$\therefore \quad y = 60 - 53 \quad \Rightarrow \quad y = 7$

Hence, x = 8 and y = 7.

Value Based Questions

Que 1. The amount donated by some households in their religious organisation are as

follows:

Amount (in ₹)	Number of households
Less than 100	14
Less than 200	22
Less than 300	37
Less than 400	58
Less than 500	67
Less than 600	75

Calculate the arithmetic mean for the above data.
What values do these households possess?

Sol.

Amount (in ₹)	cf	f_i	x_i	$ui = \frac{xi - 250}{100}$	$f_i u_i$
0 – 100	14	14	50	– 2	– 28
100 – 200	22	8	150	– 1	– 8
200 – 300	37	15	**250**	0	0
300 – 400	58	21	350	1	21
400 – 500	67	9	450	2	18
500 – 600	75	8	550	3	24
Total		$\Sigma f_i = 75$			27

By step deviation method

Arithmetic mean = $A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 250 + \frac{27}{75} \times 100 = 286$

Religion values, Helpfulness.

Que 2. Some people of a society decorated their area with flags and tricolour ribbons on Republic Days. The following data shows the number of person in different age group who participated in the decoration:

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 of the above data. What values do there persons possess?

Sol. $h = 10,\ f_1 = 23,\ f_0 = 21,\ f_2 = 14,\ l = 35$

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

Mode = $35 + \frac{23-21}{46-35} \times 10 = 35 + \frac{20}{11} = 35 + 1.8 = 36.8$

National integrity, Unity, Beauty.

Que 3. The table below gives the distribution of villages under different height from sea level in a certain region.

Height in metres	200	600	1000	1400	1800	2200
No. of villages	142	265	560	271	89	16

(i) Compute the mean height of the region.
(ii) Which mathematical concept is used in this problem?
(iii) What is the value of village in modern times?

Sol. (i) Let the assumed mean A = 1400 and h = 400

Height $(\boldsymbol{x_i}$ ***in metres***$)$	**No. of villages** $\boldsymbol{f_i}$	$\boldsymbol{u_i = \frac{x_i - 1400}{400}}$	$\boldsymbol{f_i u_i}$
200	142	– 3	– 426
600	265	– 2	– 530
1000	560	– 1	– 560
1400	271	0	0
1800	89	1	89
2200	16	2	32
Total	$N = \Sigma f_i = 1343$		$\Sigma f_i u_i = -1395$

Mean = $A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$

= $1400 + 400 \times \frac{-1395}{1343} = 1400 - 415.49 = 984.51$

(ii) Mean by step deviation method.
(iii) Villages are important to keep a balance between the ecological problems.

Que 4. (i) Find the mean of children per family from data given below:

No. of children	0	1	2	3	4	5
No. of families	5	11	25	12	5	2

(ii) Which mathematical concept is used in this problem?
(iii) Which value is discussed here?

Sol. (i)

No. of children x_i	No. of families f_i	$f_i x_i$
0	5	0
1	11	11
2	25	50
3	12	36
4	5	20
5	2	10
Total	$\Sigma f_i = 60$	$\Sigma f_i x_i = 127$

Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{127}{60} = \ 2.12\ (approx.)$

(ii) Mean of ungrouped data.
(iii) For progress, we should reduce the population growth.

Que 5. In a survey it was found that 40% people use petrol, 35% use diesel and remaining use CNG for their vehicles. Find the probability that a person chosen at random uses CNG.
Which fuel out of the above three is appropriate for the welfare of the society?

Sol. Percentage of people using CNG = 100 – (40 + 35) = 25%

P (Person using CNG) = $\frac{25}{100} = \frac{1}{4}$

CNG is useful as it does not leave unburnt carbon particles and also does not release other harmful gases which causes pollution in air.

Que 6. In a survey it was found that 30% of the population is using non-biodegradable products while the remaining is using biodegradable products. What is the probability that a person chosen at random uses non-biodegradable products?

Which type of products should be used in a society for its proper development – biodegradable or non-biodegradable? Justify your answer.

Sol. P (Person using non-biodegradable products) = (100 – 30) %

$$= \frac{70}{100} = \frac{7}{10}$$

Biodegradable products are reusable and cause less pollution, so such products should be used.

Que 7. A school gives awards to the students of each class-5 for bravery, 3 for punctuality, 3 for full attendance, 4 for social service and 5 for self-confidence. An awarded student is selected at random. What is the probability that he/she is being awarded for (i) punctuality (i) self-confidence.

Which value out of the above five is most important for the development of society? Justify your answer.

Sol. Total awards given to each class = 5 + 3 + 3 + 4 + 5 = 20

(i) P (punctual students) = $\frac{3}{20}$

(ii) P (Self-confident students) = $\frac{5}{20} = \frac{1}{4}$

Any value with justification is correct. (Do yourself)

Que 8. Arushi, Mahi and Saina were fighting to get first chance in a game. Arushi says, "Let us toss two coins. If both heads appear, Mahi will take first chance, if both tails appear, Saina will get it and if one head and one tail appears, I will get the chance."
(i) What is the probability of Arushi getting the first chance?
(ii) Is her decision fair?
(iii) What quality of her character is being depicted here?

Sol. The sample space of the experiment of tossing two coins in {HT, TH, HH, TT}. Outcomes favourable to Arushi are HT and HT.

(i) P (Arushi getting first chance) = $\frac{2}{4} = \frac{1}{2}$

(ii) No, the number of cases favourable to each one of them is not equal.
(iii) Dishonesty, as she kept two cases favourable to her and one each for the other two friends.