

## Chapter 14: Statistics

2016

### Very Short Answer Type Questions [1 Mark]

**Question 1.**

Find mode, using an empirical relation, when it is given that mean and median are 10.5 and 9.6 respectively.

**Solution:**

Mean = 10.5 and median = 9.6

Empirical relation:  $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

$$3(9.6) = \text{Mode} + 2(10.5)$$

$$28.8 = \text{Mode} + 21$$

$$\text{Mode} = 28.8 - 21 = 7.8$$

**Question 2.**

In a frequency distribution, if  $a =$  assumed mean  $= 55, \sum f_i = 100, h = 10$  and  $\sum f_i u_i = -30$ , then find the mean of the distribution

**Solution:**

$$\begin{aligned} \text{Mean} &= a + \left( \frac{\sum f_i u_i}{\sum f_i} \right) \times h \\ &= 55 + \left( \frac{-30}{100} \right) \times 10 \\ &= 55 - 3 = 52 \end{aligned}$$

### Short Answer Type Questions I [2 Marks]

**Question 3.**

**Find the unknown values in the following table:**

Class interval	frequency	Cumulative frequency
0 – 10	5	5
10 – 20	7	$x_1$
20 – 30	$x_2$	18
30 – 40	5	$x_3$
40 – 50	$x_4$	30

**Solution:**

Class interval	frequency	Cumulative frequency
0 - 10	5	5
10 - 20	7	$x_1$
20 - 30	$x_2$	18
30 - 40	5	$x_3$
40 - 50	$x_4$	30

From table:

$$x_1 = 7 + 5 = 12$$

$$18 = x_1 + x_2 = 12 + x_2 \Rightarrow x_2 = 18 - 12 = 6$$

$$x_3 = 18 + 5 = 23$$

$$30 = x_3 + x_4 \Rightarrow x_4 = 30 - x_3 = 30 - 23 = 7.$$

**Question 4.**

**Determine the missing frequency  $x$ , from the following data, when Mode is 67.**

<b>Class</b>	<b>40-50</b>	<b>50-60</b>	<b>60-70</b>	<b>70-80</b>	<b>80-90</b>
<b>Frequency</b>	<b>5</b>	<b><math>x</math></b>	<b>15</b>	<b>12</b>	<b>7</b>

**Solution:**

Class interval	Frequency
40 – 50	5
50 – 60	$x \rightarrow f_0$
60 – 70	$15 \rightarrow f_1$ ← Modal class
70 – 80	$12 \rightarrow f_2$
80 – 90	7

Mode = 67 (given)

∴ Modal class is 60 – 70

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

$$= 60 + \left( \frac{15 - x}{30 - x - 12} \right) \times 10$$

$$= 60 + \left( \frac{15 - x}{18 - x} \right) \times 10$$

$$67 = 60 + \frac{150 - 10x}{18 - x}$$

$$7 = \frac{150 - 10x}{18 - x}$$

$$126 - 7x = 150 - 10x$$

$$10x - 7x = 150 - 126$$

$$3x = 24$$

$$x = 8$$

### Short Answer Type Questions II [3 Marks]

#### Question 5.

The following data gives the information on the observed life times (in hours) of 150 electrical components

Life time (in hours)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency	15	10	35	50	40

**Find the mode of the distribution.**

**Solution:**

Life time (in hours)	Frequency
0 - 20	15
20 - 40	10
40 - 60	35
60 - 80	50
80 - 100	40

—————→ Modal class

Modal class is 60 - 80

$$\therefore l = 60, f_0 = 35, f_1 = 50, f_2 = 40, h = 20$$

$$\begin{aligned} \text{Mode} &= l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h = 60 + \left[ \frac{50 - 35}{(2 \times 50) - 35 - 40} \right] \times 20 \\ &= 60 + \left[ \frac{15}{100 - 75} \right] \times 20 = 60 + \left[ \frac{300}{25} \right] = 60 + 12 = 72 \end{aligned}$$

**Question 6.**

The average score of boys in the examination of a school is 71 and that of the girls is 73. The average score of the school in the examination is 71.8. Find the ratio of the number of boys to the number of girls who appeared in the examination.

**Solution:**

Let number of boys in the school be  $x$

Average score of boys = 71

Total score of boys in the examination of the school =  $71x = 71x$

Let number of girls in the school be  $y$

Average score of girls = 73

Total score of girls in the examination of the school =  $73y = 73y$

Now,

average score of the school in examination = 71.8

$$\therefore \frac{\text{Total score of boys} + \text{Total score of girls}}{\text{Total number of boys and girls}} = 71.8$$

$$\frac{71x + 73y}{x + y} = 71.8$$

$$71x + 73y = 71.8x + 71.8y$$

$$73y - 71.8y = 71.8x - 71x$$

$$1.2y = 0.8x$$

$$\frac{1.2}{0.8} = \frac{x}{y}$$

$$\frac{12}{8} = \frac{x}{y} \Rightarrow x : y = 3 : 2$$

**Question 7.**

**Some students of Class X donated for the welfare of old age persons. Their contributions are shown in the following frequency distribution:**

Amount (in ₹)	0-20	20-40	40-60	60-80	80-100
No. of students	5	8	12	11	4

Find median and mode for their contribution.

Solution:

Amount in (₹) (Class interval)	Numbers of students ( $f_i$ )	$c.f.$
0-20	5	5
20-40	8	13
40-60	12	25 $f_1$
60-80	11	36
80-100	4	40
$N = \sum f_i = 40$		

Median class

$$N = 40$$

$$\frac{N}{2} = 20; \therefore \text{Median class} = 40 - 60$$

$$l = 40, f = 12, \text{ and } c.f. = 13, h = 60 - 40 = 20$$

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

$$= 40 + \left( \frac{20 - 13}{12} \right) \times 20 = 40 + \frac{7}{12} \times 20 = 40 + \frac{70}{6} = 40 + 11.66 = 51.66$$

For mode, modal class 40 - 60

$$f_0 = 8, f_1 = 12, f_2 = 11, h = 60 - 40 = 20$$

$$\text{Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 40 + \left( \frac{12 - 8}{24 - 8 - 11} \right) \times 20 = 40 + \frac{80}{5} = 40 + 16 = 56$$

### Long Answer Type Questions [4 Marks]

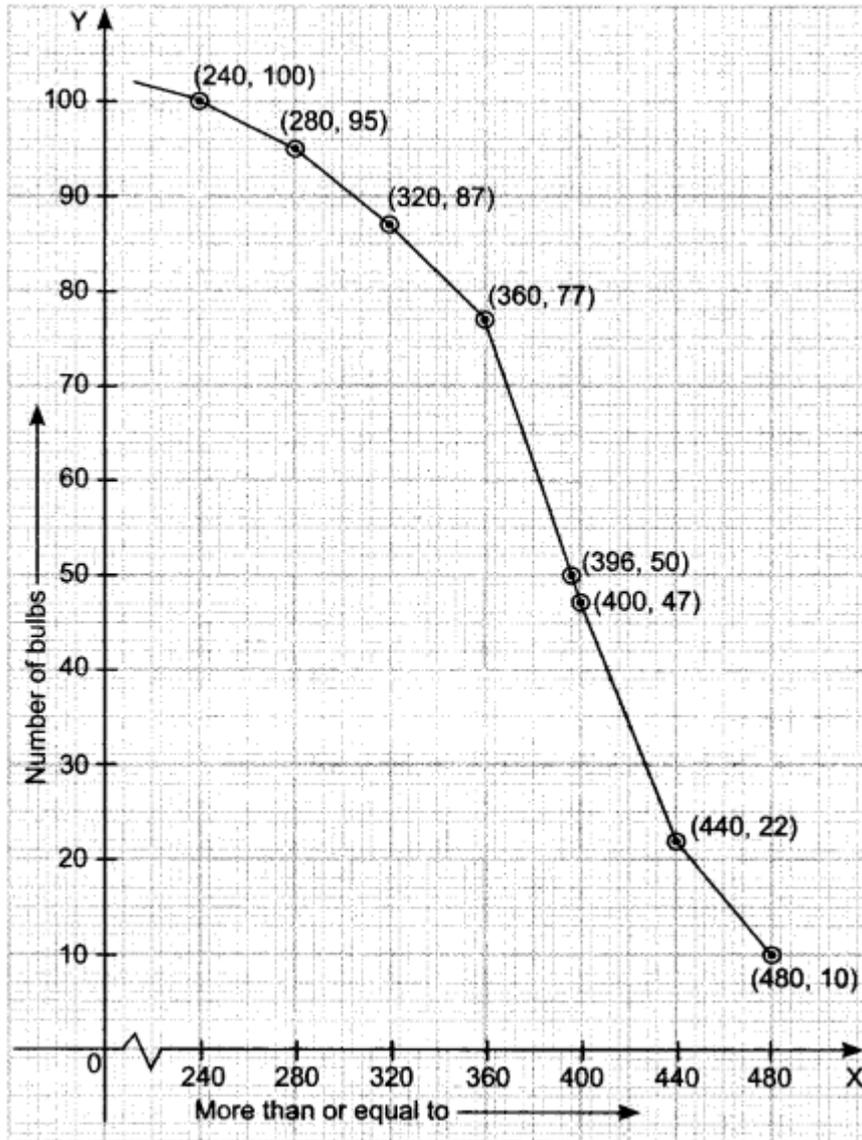
Question 8.

Life time (in hours)	More than or equal to 240	More than or equal to 280	More than or equal to 320	More than or equal to 360	More than or equal to 400	More than or equal to 440	More than or equal to 480
Number of bulbs	100	95	87	77	47	22	10

Draw a 'more than type' ogive and from it, find median. Verify it by actual calculations.

Solution:

More than or equal to	Number of bulbs
240	100
280	95
320	87
360	77
400	47
440	22
480	10



Median from curve is 396.

Class interval	Frequency	Cumulative frequency	
240 – 280	5	5	
280 – 320	8	13	
320 – 360	10	23	
360 – 400	30	53	Median class
-----			
400 – 440	25	78	
440 – 480	12	90	
480 – 520	10	100	
	100		

$$N = 100$$

$$\frac{N}{2} = \frac{100}{2} = 50$$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - cf}{f} \right) \times h = 360 + \left( \frac{50 - 23}{30} \right) \times 40 = 360 + \left( \frac{27}{30} \right) \times 40$$

$$= 360 + 36 = 396$$

**Question 9.**

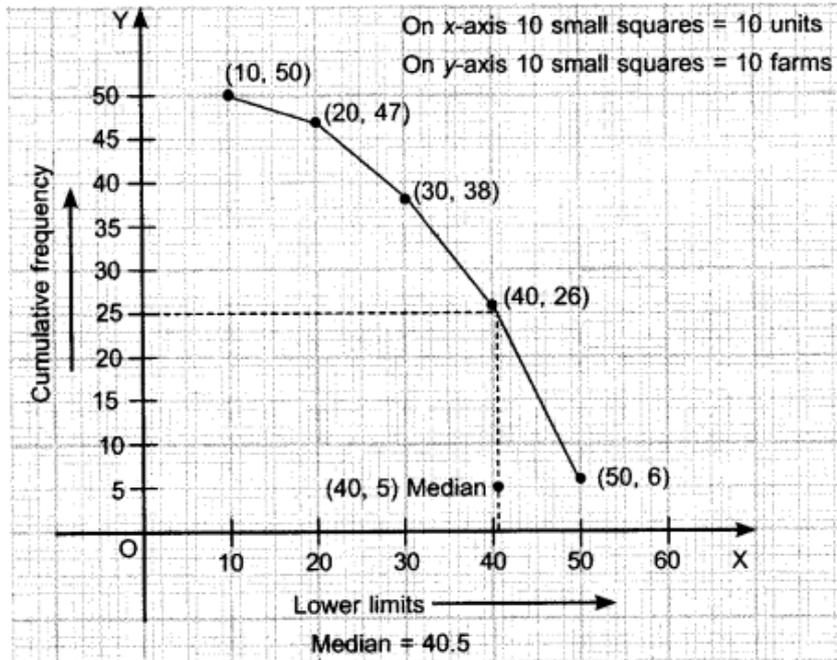
The following table gives production yield of rice per hectare in some farms of a village:

Production yield (in kg/hectare)	10–20	20–30	30–40	40–50	50–60
No. of farms	3	9	12	20	6

Draw a 'more than type' ogive. Also, find median from the curve.

**Solution:**

Production yield (in kg/ hectare) Class interval	Frequency	Production yield more than or equal to	<i>c.f</i>
10 – 20	3	10	50
20 – 30	9	20	47
30 – 40	12	30	38
40 – 50	20	40	26
50 – 60	6	50	6



**Question 10.**

**In a retail market, fruit vendor were selling mangoes in packing boxes. These boxes contained varying number of mangoes. The following was the distribution:**

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

**Find the mean and median number of mangoes kept in a packing box.**

**Solution:**

Class interval	Mid value ( $x_i$ )	$d_i = \frac{x_i - a}{h}$ (where $a = 57$ )	$f_i$	$f_i d_i$	$cf$
49.5 – 52.5	51	-2	15	-30	15
52.5 – 55.5	54	-1	110	-110	125
55.5 – 58.5	$57 = a$	0	135	0	260
58.5 – 61.5	60	1	115	115	375
61.5 – 64.5	63	2	25	50	400
			$\Sigma f_i = 400$	$\Sigma f_i d_i = 25$	

$$\text{Mean} = a + \left( \frac{\Sigma f_i d_i}{\Sigma f_i} \right) h = 57 + \frac{25}{400} \times 3 = 57 + \frac{3}{16} = 57 + 0.1875 = 57.18$$

$$\text{For median: Median} = l + \left[ \frac{\frac{N}{2} - cf}{f} \right] \times h$$

Here  $N = 400$  (Even)

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

Median class is 55.5 – 58.5

$l = 55.5, f = 135, cf = 125, h = 3$

$$\begin{aligned} \text{Median} &= 55.5 + \left( \frac{200 - 125}{135} \right) \times 3 = 55.5 + \frac{75}{135} \times 3 = 55.5 + \frac{225}{135} \\ &= 55.5 + 1.666 = 57.16 \end{aligned}$$

2015

**Very Short Answer Type Question [1 Mark]**

**Question 11.**

Given below is a cumulative frequency distribution of “less than type”.

Marks obtained	Less than 20	Less than 30	Less than 40	Less than 50
No. of students cumulative frequency	8	13	19	24

Change the above data into a continuous grouped frequency distribution

**Solution:**

Class Interval	Number of students ( $f_i$ )
10 – 20	8
20 – 30	5
30 – 40	6
40 – 50	5

### Short Answer Type Question I [2 Mark]

**Question 12.**

The following table shows the distribution of weights of 100 candidates appearing for a competition. Determine the modal weight.

<b>Weight (in kg)</b>	<b>50-55</b>	<b>55-60</b>	<b>60-65</b>	<b>65-70</b>	<b>70-75</b>	<b>75-80</b>
<b>No. of candidates</b>	<b>13</b>	<b>18</b>	<b>45</b>	<b>16</b>	<b>6</b>	<b>2</b>

**Solution:**

<b>Class Interval</b>	$f_i$
50 - 55	13
55 - 60	18
60 - 65	45
65 - 70	16
70 - 75	6
75 - 80	2

→ Modal class interval

Here,  $l = 60, f_1 = 45, f_0 = 18, f_2 = 16, h = 5$

$$\text{Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 60 + \left( \frac{45 - 18}{2 \times 45 - 18 - 16} \right) \times 5 = 60 + \frac{135}{56} = 60 + 2.41 = 62.41$$

Hence, mode = 62.41

### Short Answer Type Question II [3 Marks]

**Question 13.**

If the mean of the following distribution is 54, find the missing frequency  $x$ :

<b>Class</b>	<b>0-20</b>	<b>20-40</b>	<b>40-60</b>	<b>60-80</b>	<b>80-100</b>
<b>Frequency</b>	<b>16</b>	<b>14</b>	<b>24</b>	<b>26</b>	<b><math>x</math></b>

**Solution:**

<b>Class Interval</b>	$x_i$	$f_i$	$f_i x_i$
0 - 20	10	16	160
20 - 40	30	14	420
40 - 60	50	24	1200
60 - 80	70	26	1820
80 - 100	90	$x$	$90x$
<b>Total</b>		$80 + x$	$3600 + 90x$

$$\begin{aligned} \text{Mean} &= \frac{\sum f_i x_i}{\sum f_i} \Rightarrow 54 = \frac{3600 + 90x}{80 + x} \\ \Rightarrow 4320 + 54x &= 3600 + 90x \Rightarrow 36x = 720 \Rightarrow \boxed{x=20} \end{aligned}$$

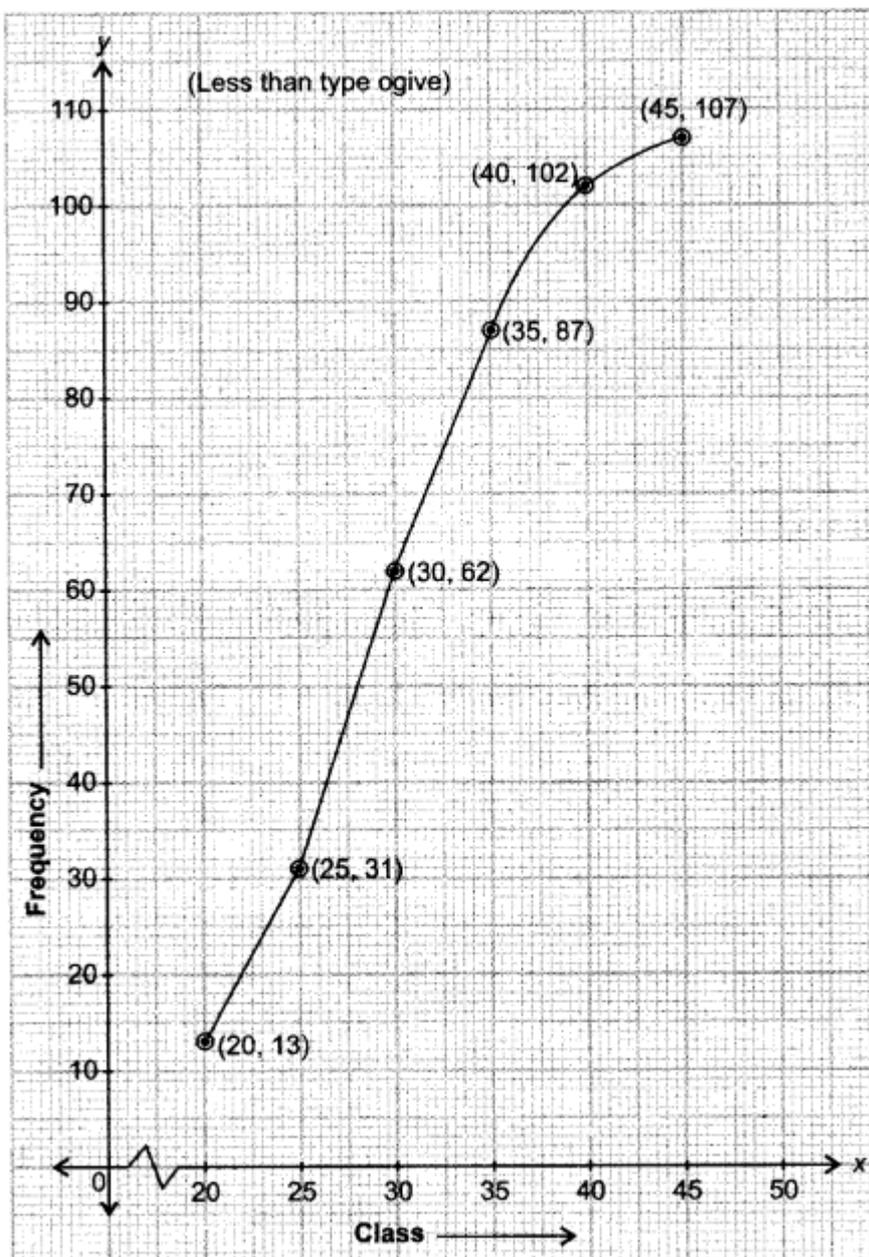
**Question 14.**

Draw a 'less than type' ogive for the following frequency distribution.

Class	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45
Frequency	13	18	31	25	15	5

Solution:

Class	Frequency
Less than 20	13
Less than 25	$13 + 18 = 31$
Less than 30	$31 + 31 = 62$
Less than 35	$62 + 25 = 87$
Less than 40	$87 + 15 = 102$
Less than 45	$102 + 5 = 107$



**Long Answer Type Question [4 Mark]**

**Question 15.**

The lengths of 50 leaves of a plant are measured correct to the nearest millimetre and the data obtained is represented in the following table

<b>Length (in mm)</b>	<b>109–117</b>	<b>118–126</b>	<b>127–135</b>	<b>136–144</b>	<b>145–153</b>	<b>154–162</b>	<b>163–171</b>
<b>No. of leaves</b>	<b>4</b>	<b>6</b>	<b>14</b>	<b>13</b>	<b>6</b>	<b>4</b>	<b>3</b>

Find the mean length of the leaves.

**Solution:**

Given frequency distribution is not continuous. So first we have to make it continuous.

<b>Class Interval</b>	$x_i$	$f_i$	$u_i = \frac{x_i - 140}{9}$	$f_i u_i$
108.5 – 117.5	113	4	-3	-12
117.5 – 126.5	122	6	-2	-12
126.5 – 135.5	131	14	-1	-14
135.5 – 144.5	140	13	0	0
144.5 – 153.5	149	6	1	6
153.5 – 162.5	158	4	2	8
162.5 – 171.5	167	3	3	9
<b>Total</b>		$\Sigma f_i = 50$		$\Sigma f_i u_i = -15$

Here, assumed mean ( $a$ ) = 140; class size = 9

Now,

$$\begin{aligned} \text{mean } (\bar{x}) &= a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h \\ &= 140 + 9 \left( \frac{-15}{50} \right) \\ &= 140 - \frac{27}{10} = 140 - 2.7 = 137.30 \end{aligned}$$

Hence, mean length of the leaves = 137.30 mm.

**Question 16.**

In a hospital, during the month of October 2013, number of patients admitted for dengue and their ages are as follows

<b>Age (in years)</b>	<b>0–8</b>	<b>8–16</b>	<b>16–24</b>	<b>24–32</b>	<b>32–40</b>	<b>40–48</b>	<b>48–56</b>	<b>56–64</b>	<b>64–72</b>
<b>No. of patients</b>	<b>10</b>	<b>12</b>	<b>8</b>	<b>25</b>	<b>15</b>	<b>11</b>	<b>21</b>	<b>30</b>	<b>22</b>

Find the mean and median age of patients.

**Solution:**

Class Interval	$x_i$	$f_i$	$c.f.$	$u_i = \frac{x_i - 36}{8}$	$f_i u_i$
0 - 8	4	10	10	-4	-40
8 - 16	12	12	22	-3	-36
16 - 24	20	8	30	-2	-16
24 - 32	28	25	55	-1	-25
32 - 40	36	15	70	0	0
40 - 48	44	11	81	1	11
48 - 56	52	21	102	2	42
56 - 64	60	30	132	3	90
64 - 72	68	22	154	4	88
Total		$\Sigma f_i = 154$			$\Sigma f_i u_i = 114$

→Median C.I.

Here, assumed mean ( $a$ ) = 36; class size ( $h$ ) = 8, Total frequency ( $\Sigma f_i$ ) = 154

Now, mean,  $(\bar{x}) = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 36 + 8 \times \frac{114}{154} = 36 + 5.92 = 41.92$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 40 + \left( \frac{77 - 70}{11} \right) \times 8 = 40 + \frac{56}{11} = 45.09$$

Hence, Mean = 41.92 and Median = 45.09.

2014

**Short Answer Type Question I [2 Mark]**

**Question 17.**

Ramesh is a cricket player. He played 50 matches in a year. His data regarding runs scored is given below. Calculate his average score.

Score (runs)	0-20	20-40	40-60	60-80	80-100	100-120
Number of matches	5	11	13	7	8	6

**Solution:**

Class Interval	$x_i$	$f_i$	$f_i x_i$
0 - 20	10	5	50
20 - 40	30	11	330
40 - 60	50	13	650
60 - 80	70	7	490
80 - 100	90	8	720
100 - 120	110	6	660
Total		$\Sigma f_i = 50$	$\Sigma f_i x_i = 2900$

$$\text{Mean } (\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{2900}{50} = 58 \quad \therefore \text{Average score of Ramesh} = 58.$$

**Question 18.**

The width of 50 leaves of a plant were measured in mm and their cumulative frequency distribution is shown in the following table. Make frequency distribution table for this

<b>Width (in mm)</b>	<b>≥20</b>	<b>≥30</b>	<b>≥40</b>	<b>≥50</b>	<b>≥60</b>	<b>≥70</b>	<b>≥80</b>
<b>Cumulative frequency</b>	<b>50</b>	<b>44</b>	<b>28</b>	<b>20</b>	<b>15</b>	<b>7</b>	<b>0</b>

**Solution:**

Frequency distribution table is as follows:

<b>Class Interval</b>	20-30	30-40	40-50	50-60	60-70	70-80
<b>Frequency</b>	6	16	8	5	8	7

**Question 19.**

Find the mode of the following frequency distribution:

<b>Class</b>	<b>0-6</b>	<b>6-12</b>	<b>12-18</b>	<b>18-24</b>	<b>24-30</b>
<b>Frequency</b>	<b>7</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>6</b>

**Solution:**

<b>Class</b>	<b>Frequency</b>
0 - 6	7
6 - 12	5
12 - 18	10
18 - 24	12
24 - 30	6

→Modal C.I.

∴ Maximum frequency = 12, so, modal class = 18 - 24

$$\text{Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 18 + \left( \frac{12 - 10}{2 \times 12 - 10 - 6} \right) \times 6 = 18 + \frac{3}{2} = 19.5$$

∴ Mode = 19.5

**Short Answer Type Questions II [3 Marks]****Question 20.**

For helping poor girls of their class, students saved pocket money as shown in the following table:

<b>Money saved (in ₹)</b>	<b>5-7</b>	<b>7-9</b>	<b>9-11</b>	<b>11-13</b>	<b>13-15</b>
<b>No. of students</b>	<b>6</b>	<b>3</b>	<b>9</b>	<b>5</b>	<b>7</b>

Find mean and median of this data.

**Solution:**

Class Interval	$x_i$	$f_i$	$fx_i$	$c.f.$
5 - 7	6	6	36	6
7 - 9	8	3	24	9
9 - 11	10	9	90	18
11 - 13	12	5	60	23
13 - 15	14	7	98	30
Total		$\Sigma f_i = 30$	$\Sigma fx_i = 308$	

→Median C.I.

$$\text{Mean } (\bar{x}) = \frac{\Sigma fx_i}{\Sigma f_i} = \frac{308}{30} = \frac{154}{15} = 10.26$$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 9 + \left( \frac{15 - 9}{9} \right) \times 2 = 9 + \frac{4}{3} = 10.33$$

∴ Mean = 10.26 and median = 10.33

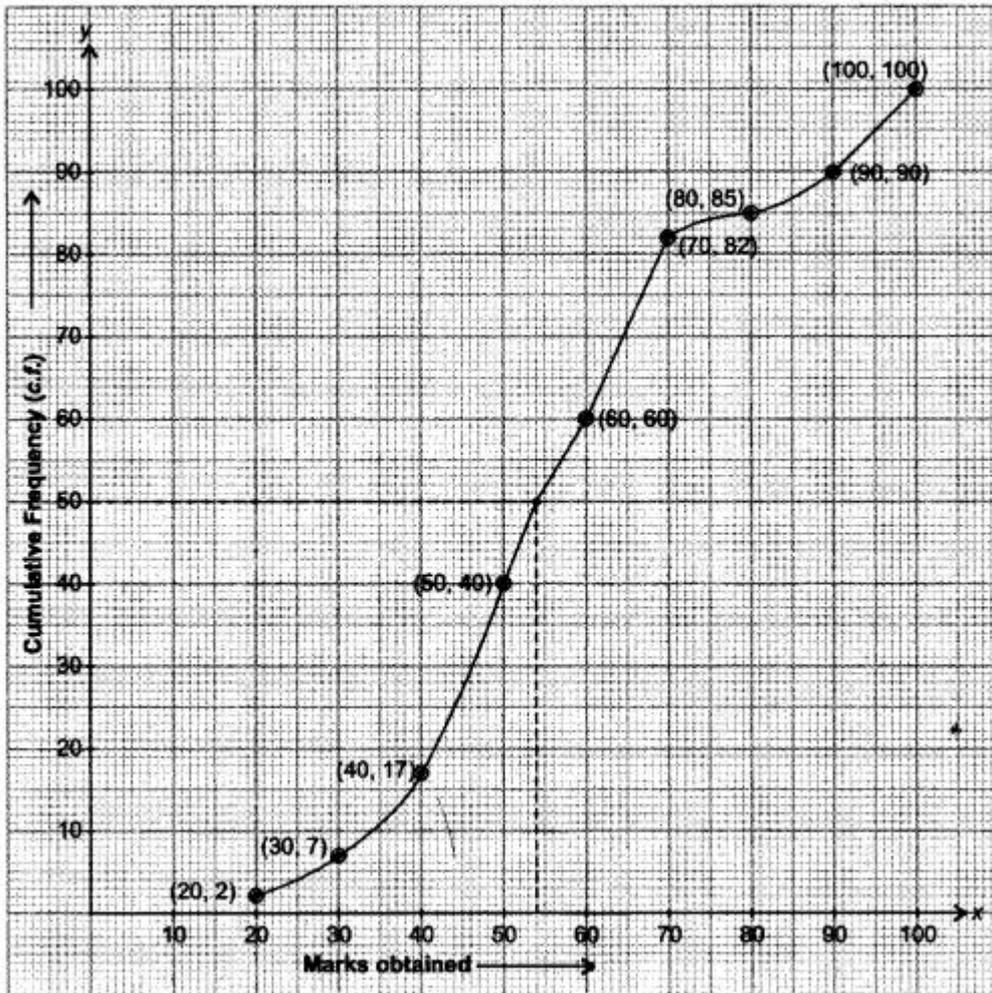
### Question 21.

For the following distribution, draw a 'less than type' ogive and from the curve, find median.

Marks obtained	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60	Less than 70	Less than 80	Less than 90	Less than 100
No. of students	2	7	17	40	60	82	85	90	100

Solution:

Marks obtained	No. of students
Less than 20	2
Less than 30	7
Less than 40	17
Less than 50	40
Less than 60	60
Less than 70	82
Less than 80	85
Less than 90	90
Less than 100	100



From graph, median = 54.

**Question 22.**

The Median of the following distribution is 35. Find the value of x:

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	2	3	x	6	5	3	2

**Solution:**

Class Interval	$f_i$	$c.f.$
0 - 10	2	2
10 - 20	3	5
20 - 30	$x$	$5+x$
30 - 40	6	$11+x$
40 - 50	5	$16+x$
50 - 60	3	$19+x$
60 - 70	2	$21+x$

Median C.I. as median  
= 35(given)

$$\text{Median} = l + \frac{\left(\frac{N}{2} - c.f.\right)}{f} \times h \Rightarrow 35 = 30 + \frac{\left\{\frac{21+x}{2} - (5+x)\right\}}{6} \times 10$$

$$\Rightarrow 35 = 30 + \frac{(21+x-10-2x)}{12} \times 10 \Rightarrow 35 = 30 + \left(\frac{11-x}{12}\right) \times 10$$

$$\Rightarrow 5 = \frac{5(11-x)}{6} \Rightarrow 6 = 11-x \Rightarrow x = 5$$

Hence,  $x = 5$

**Question 23.**

Find the median of the following data

Class Interval	5-15	15-25	25-35	35-45	45-55	55-65	65-75
Frequency	6	10	16	15	24	8	7

**Solution:**

Class Interval	$f$	$c.f.$
5 - 15	6	6
15 - 25	10	16
25 - 35	16	32
35 - 45	15	47
45 - 55	24	71
55 - 65	8	79
65 - 75	7	86
Total	86	

→Median C.I.

Here,  $N = 86$ ,  $\frac{N}{2} = 43$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h = 35 + \left(\frac{43 - 32}{15}\right) \times 10 = 35 + \frac{22}{3} = 42.33$$

Hence, median = 42.33.

**Question 24.**

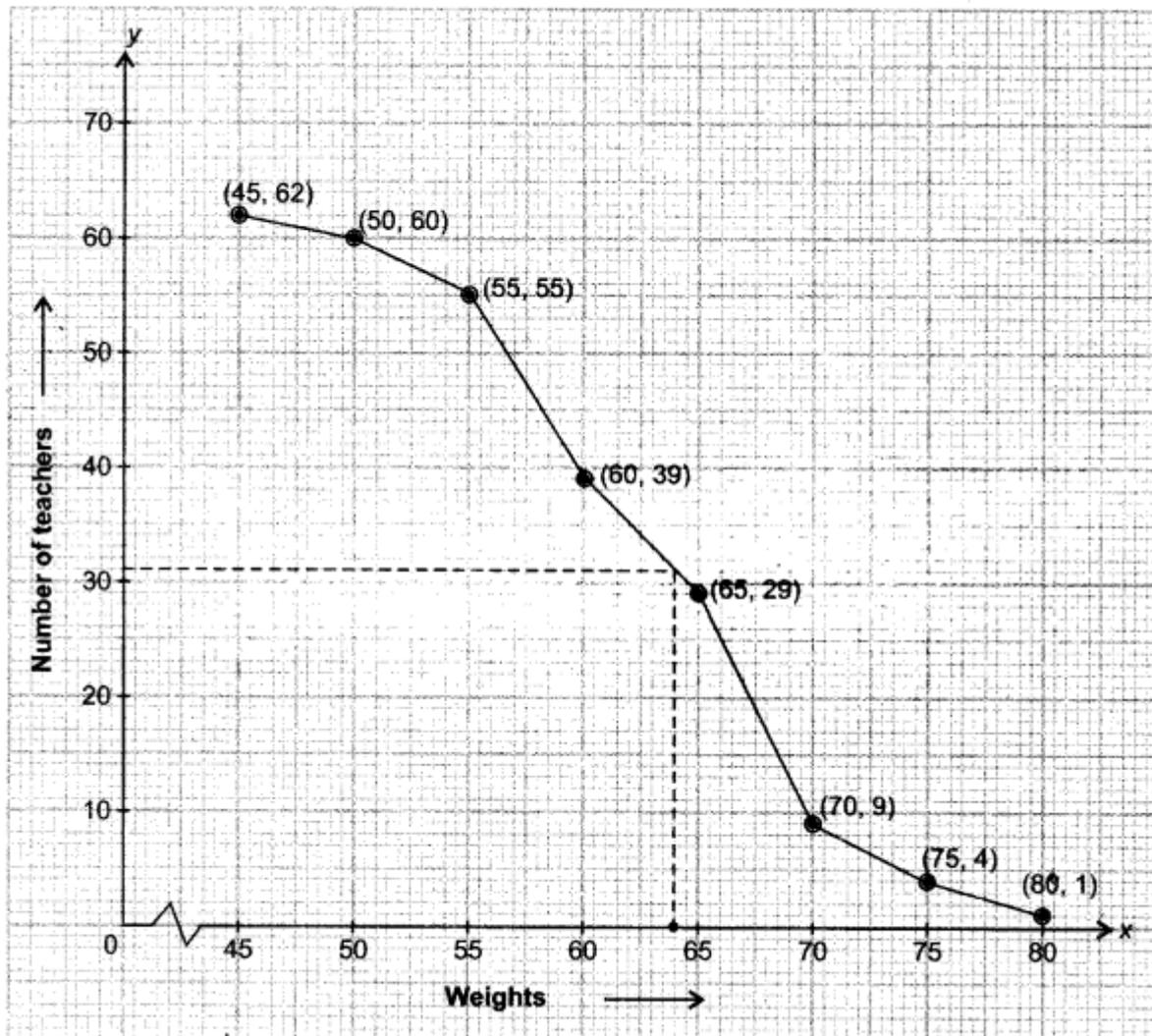
In a school, weights of 62 teachers was recorded as follows:

Weight (in kg)	$\geq 45$	$\geq 50$	$\geq 55$	$\geq 60$	$\geq 65$	$\geq 70$	$\geq 75$	$\geq 80$
Number of teachers	62	60	55	39	29	9	4	1

Draw a 'more than type' ogive for this distribution and hence obtain median from the curve.

**Solution:**

Weight (in kg)	No. of teachers
More than or equal to 45	62
More than or equal to 50	60
More than or equal to 55	55
More than or equal to 60	39
More than or equal to 65	29
More than or equal to 70	9
More than or equal to 75	4
More than or equal to 80	1



From graph median = 64.

### Long Answer Type Questions [4 Marks]

#### Question 25.

Find the missing frequencies ( $f_1$ ,  $f_2$  and  $f_3$ ) in the following frequency distribution when it is given that  $f_2 : f_3 = 4 : 3$  and mean = 50.

Class Interval	0–20	20–40	40–60	60–80	80–100	Total
Frequency	17	$f_1$	$f_2$	$f_3$	19	120

Solution:

Class Interval	$x_i$	$f_i$	$f_i x_i$
0 – 20	10	17	170
20 – 40	30	$f_1$	$30f_1$
40 – 60	50	$f_2$	$50f_2$
60 – 80	70	$f_3$	$70f_3$
80 – 100	90	19	1710
Total		120	$1880 + 30f_1 + 50f_2 + 70f_3$

A.T.Q.

$$17 + f_1 + f_2 + f_3 + 19 = 120$$

$$\Rightarrow f_1 + f_2 + f_3 = 84 \quad \dots(i)$$

Now,

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$50 = \frac{1880 + 30f_1 + 50f_2 + 70f_3}{120}$$

$$\Rightarrow 30f_1 + 50f_2 + 70f_3 = 4120 \quad \dots(ii)$$

Also, 
$$\frac{f_2}{f_3} = \frac{4}{3}$$

$$\Rightarrow 3f_2 - 4f_3 = 0 \quad \dots(iii)$$

On solving above equations (i), (ii) and (iii), we get

$$f_1 = 28; f_2 = 32 \text{ and } f_3 = 24$$

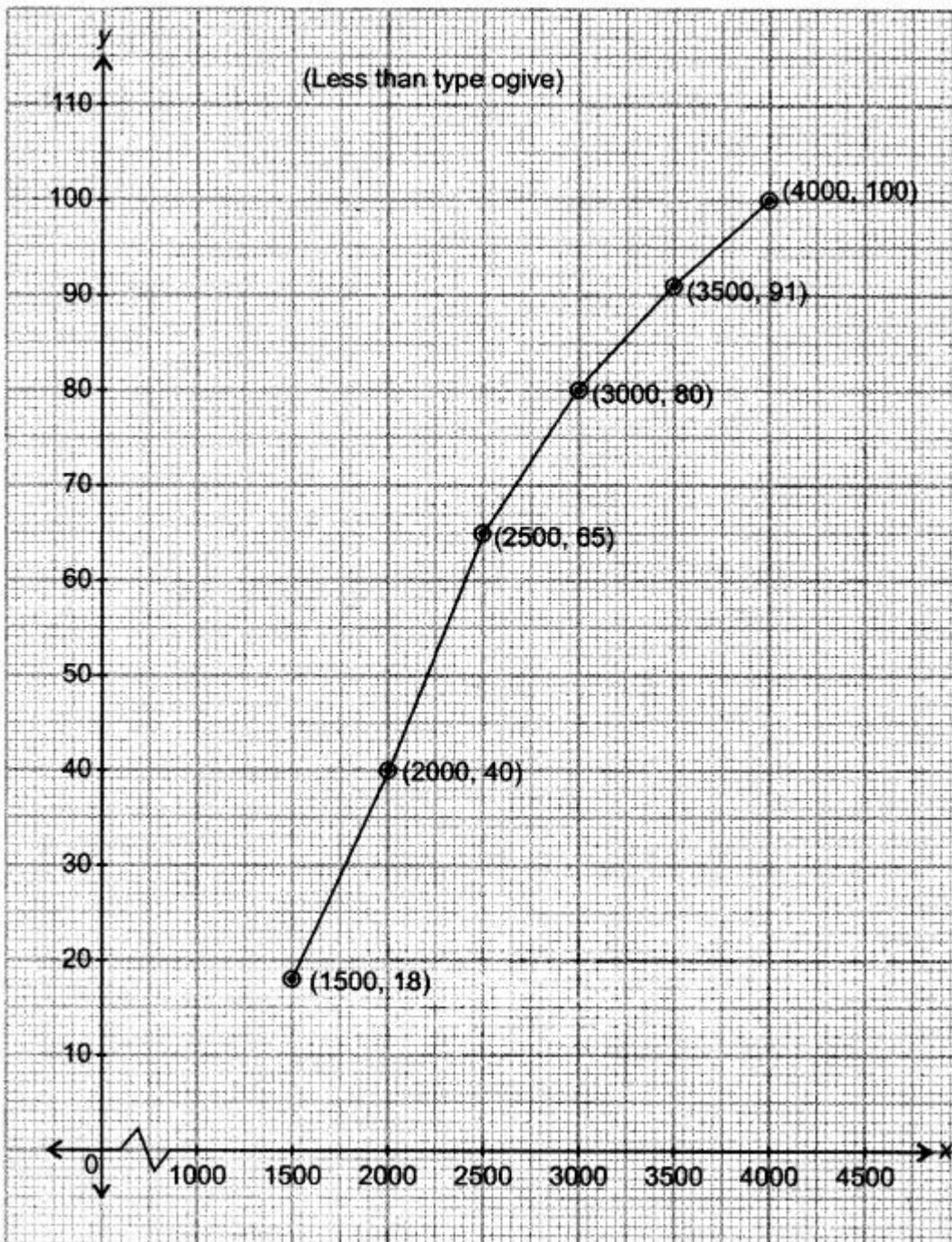
#### Question 26.

Draw a less than type give for the following distribution

Class Interval	1000–1500	1500–2000	2000–2500	2500–3000	3000–3500	3500–4000
Frequency	18	22	25	15	11	9

Solution:

Class Interval	<i>c.f.</i>
Less than 1500	18
Less than 2000	40
Less than 2500	65
Less than 3000	80
Less than 3500	91
Less than 4000	100



**Question 27.**

Literacy rates of 40 cities is given in the following table. If it is given that mean

literacy rate is 63.5, then find the missing frequencies  $x$  and  $y$ .

Literacy rate	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90
No. of cities	1	2	3	$x$	$y$	6	8	4	2	3	2

**Solution:**

Class Interval	$x_i$	$f_i$	$u_i = \frac{x_i - 62.5}{5}$	$f_i u_i$
35 - 40	37.5	1	-5	-5
40 - 45	42.5	2	-4	-8
45 - 50	47.5	3	-3	-9
50 - 55	52.5	$x$	-2	$-2x$
55 - 60	57.5	$y$	-1	$-y$
60 - 65	62.5	6	0	0
65 - 70	67.5	8	1	8
70 - 75	72.5	4	2	8
75 - 80	77.5	2	3	6
80 - 85	82.5	3	4	12
85 - 90	87.5	2	5	10
Total		$31 + x + y$		$-2x - y + 22$

A.T.Q.

$$31 + x + y = 40 \Rightarrow x + y = 9 \quad \dots(i)$$

Also, 
$$\text{Mean} = A + \frac{\sum f_i u_i}{\sum f_i} \times h$$

$$63.5 = 62.5 + \frac{(22 - 2x - y)}{40} \times 5 \Rightarrow \frac{22 - 22x - y}{8} = 1$$

$$\Rightarrow 2x + y = 14 \quad \dots(ii)$$

On solving equations (i) and (ii), we get

$$x = 5 \text{ and } y = 4$$

**Question 28.**

If median height of 50 students of a class in the following frequency distribution is 144 cm, find the missing frequencies  $x$  and  $y$

Height (in cm)	125-130	130-135	135-140	140-145	145-150	150-155	155-160
No. of students	2	4	$x$	$y$	8	9	5

**Solution:**

Class Interval	$f_i$	c.f.
125 – 130	2	2
130 – 135	4	6
135 – 140	$x$	$6+x$
140 – 145	$y$	$6+x+y$
145 – 150	8	$14+x+y$
150 – 155	9	$23+x+y$
155 – 160	5	$28+x+y$

A.T.Q.

$$28 + x + y = 50 \Rightarrow x + y = 22 \quad \dots(i)$$

Also,

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h$$

$$144 = 140 + \left( \frac{25 - 6 - x}{y} \right) \times 5$$

$$4 = \left( \frac{19 - x}{y} \right) \times 5 \Rightarrow 5x + 4y = 95 \quad \dots(ii)$$

On solving equations (i) and (ii), we get  
 $x = 7$  and  $y = 15$

2013

### Short Answer Type Questions I [2 Marks]

#### Question 29.

The following distribution given below gives the daily income of 50 workers in a factory

Daily wages (in ₹)	200 – 220	220 – 240	240 – 260	260 – 280	280 – 300
Number of workers	14	12	8	6	10

Convert the above distribution to a less than type cumulative frequency distribution

**Solution:**

Daily wages (in ₹)	Number of workers
Less than 220	14
Less than 240	26
Less than 260	34
Less than 280	40
Less than 300	50

**Question 30.**

Make a frequency distribution table for the given table:

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	85

Solution:

Class Interval	Frequency
0 – 10	5
10 – 20	4
20 – 30	8
30 – 40	12
40 – 50	16
50 – 60	15
60 – 70	10
70 – 80	8
80 – 90	5
90 – 100	2

**Short Answer Type Questions II [3 Marks]****Question 31.**

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

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

**Solution:**

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

$$\text{Now, Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 62.8 = \frac{2640 + 50x}{40 + x}$$

$$\Rightarrow \frac{628}{10} = \frac{2640 + 50x}{40 + x}$$

$$\Rightarrow 628x + 25120 = 26400 + 500x$$

$$\Rightarrow 128x = 1280 \Rightarrow x = 10$$

**Question 32.**

The weights of tea in 70 packets are shown in the following table.

Weight (in gm)	200–201	201–202	202–203	203–204	204–205	205–206
No. of packets	13	27	18	10	1	1

**Find the mean weight of packets using step deviation method.**

**Solution:**

Class Interval	$x_i$	$f_i$	$u_i = \frac{x_i - 202.5}{1}$	$f_i u_i$
200 – 201	200.5	13	-2	-26
201 – 202	201.5	27	-1	-27
202 – 203	202.5	18	0	0
203 – 204	203.5	10	1	10
204 – 205	204.5	1	2	2
205 – 206	205.5	1	3	3
Total		$\Sigma f_i = 70$		$\Sigma f_i u_i = -38$

$$\text{Now, } \bar{u} = \frac{\Sigma f_i u_i}{\Sigma f_i} = \frac{-38}{70}$$

$$\therefore \bar{x} = A + h\bar{u}$$

$$= 202.5 + 1\left(\frac{-38}{70}\right) = 202.5 - \frac{38}{70} = \frac{14175 - 38}{70} = \frac{14137}{70} = 201.96$$

**Question 33.**

Find the mode of the following data

Class Interval	5-15	15-25	25-35	35-45	45-55	55-65
Frequency	6	11	21	23	14	5

**Solution:**

Class Interval	$f$
5 - 15	6
15 - 25	11
25 - 35	21
35 - 45	23
45 - 55	14
55 - 65	5

→ Modal class

$$\text{Mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 35 + \left( \frac{23 - 21}{2 \times 23 - 21 - 14} \right) \times 10 = 35 + \frac{20}{11} = 36.81$$

**Question 34.**If the mode of the following distribution is 57.5, find the value of  $x$ 

Class	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	6	10	16	$x$	10	5	2

**Solution:**

Class Interval	Frequency
30 - 40	6
40 - 50	10
50 - 60	16
60 - 70	$x$
70 - 80	10
80 - 90	5
90 - 100	2

Modal class interval as Mode = 57.5 (given)

$$\begin{aligned} \therefore \quad \text{Mode} &= l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \Rightarrow 57.5 = 50 + \left( \frac{16 - 10}{2 \times 16 - 10 - x} \right) \times 10 \\ \Rightarrow \quad 57.5 &= 50 + \frac{60}{22 - x} \Rightarrow 7.5 = \frac{60}{22 - x} \Rightarrow \frac{75}{10} = \frac{60}{22 - x} \\ \Rightarrow \quad 1650 - 75x &= 600 \\ \Rightarrow \quad 75x &= 1050 \Rightarrow x = 14 \end{aligned}$$

### Long Answer Type Questions [4 Marks]

**Question 35.**

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

<b>Class Interval</b>	<b>0-20</b>	<b>20-40</b>	<b>40-60</b>	<b>60-80</b>	<b>80-100</b>	<b>100-120</b>	<b>120-140</b>
<b>Frequency</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>6</b>	<b>5</b>	<b>3</b>

**Solution:**

<b>Class Interval</b>	$x_i$	$f_i$	$f_i x_i$	<i>c.f.</i>
0 - 20	10	6	60	6
20 - 40	30	8	240	14
40 - 60	50	10	500	24
60 - 80	70	12	840	36
80 - 100	90	6	540	42
100 - 120	110	5	550	47
120 - 140	130	3	390	50
<b>Total</b>		$\Sigma f_i = 50$	$\Sigma f_i x_i = 3120$	*

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{3120}{50} = 62.4$$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 60 + \left( \frac{25 - 24}{12} \right) \times 20 = 61.66$$

$$\begin{aligned} \text{Mode} &= l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 60 + \left( \frac{12 - 10}{2 \times 12 - 10 - 6} \right) \times 20 = 60 + 5 = 65 \end{aligned}$$

2012

### Short Answer Type Question I [2 Marks]

**Question 36.**

Convert the following frequency distribution to a more than type cumulative frequency distribution

Marks Obtained	Number of students
0 – 20	5
20 – 40	9
40 – 60	12
60 – 80	8
80 – 100	6

**Solution:**

Marks obtained	Number of students
More than or equal to 0	40
More than or equal to 20	35
More than or equal to 40	26
More than or equal to 60	14
More than or equal to 80	6
More than or equal to 100	0

**Short Answer Type Question II [3 Marks]**

**Question 37.**

Weekly income of 600 families is given below

Income (in ₹)	Frequency
0–1000	250
1000–2000	190
2000–3000	100
3000–4000	40
4000–5000	15
5000–6000	5

**Find the median.**

**Solution:**

Income (in ₹)	Number of families ( $f$ )	$c.f.$
0 – 1000	250	250
1000 – 2000	190	440
2000 – 3000	100	540
3000 – 4000	40	580
4000 – 5000	15	595
5000 – 6000	5	600

$$N = 600 \Rightarrow \frac{N}{2} = 300$$

$\therefore$  Median class = 1000 – 2000

$$l = 1000, c.f. = 250, f = 190, h = 1000$$

$$\begin{aligned} \text{Median} &= l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 1000 + \left( \frac{300 - 250}{190} \right) \times 1000 = 1000 + \frac{5000}{19} \\ &= 1263.158 \end{aligned}$$

### Long Answer Type Questions [4 Marks]

**Question 38.**

Find the value of  $fx$  from the following data, if its mode is 65.

Class	Frequency
0 – 20	6
20 – 40	8
40 – 60	$f_1$
60 – 80	12
80 – 100	6
100 – 120	5

where frequency 6, 8,  $f_1$ , and 12 are in ascending order

**Solution:**

Class	Frequency
0 – 20	6
20 – 40	8
40 – 60	$f_1$
60 – 80	12
80 – 100	6
100 – 120	5

mode=65

modal class=60-80 as its frequency is 12

$$l=60, f=12, f_0=f_1, f_2=6, h=20$$

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

$$65 = 60 + \frac{12 - f_1}{2 \times 12 - f_1 - 6} \times 20$$

$$5 = \left( \frac{12 - f_1}{18 - f_1} \right) \times 20$$

$$90 - 5f_1 = 240 - 20f_1$$

$$15f_1 = 150 \Rightarrow f_1 = 10.$$

2011

### Short Answer Type Questions I [2 Marks]

#### Question 39.

Convert the following data to a less than type distribution.

C.I.	Frequency
50 - 55	2
55 - 60	8
60 - 65	12
65 - 70	24
70 - 75	38
75 - 80	16

Solution:

Less than	50	55	60	65	70	75	80
Frequency	0	2	10	22	46	84	100

#### Question 40.

Write the frequency distribution table for the following data:

Marks	No. of students
Below 10	0
Below 20	15
Below 30	20
Below 40	30
Below 50	35
Below 60	40

**Solution:**

Class Interval	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of Students	15	5	10	5	5

**Question 41.**

Calculate mode of the following data

Marks Obtained	No. of students
0 – 20	8
20 – 40	10
40 – 60	12
60 – 80	6
80 – 100	3

**Solution:**

Marks obtained	No. of students
0 – 20	8
20 – 40	10
40 – 60	12
60 – 80	6
80 – 100	3

$\therefore$  Maximum frequency = 12

$\therefore$  Modal class = 40 – 60

Now,  $l = 40, f_0 = 10, f_1 = 12, f_2 = 6, h = 20$

$$\begin{aligned}\text{Mode} &= l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 40 + \left( \frac{12 - 10}{2 \times 12 - 10 - 6} \right) \times 20 \\ &= 40 + \frac{2}{8} \times 20 = 45\end{aligned}$$

**Short Answer Type Questions II [3 Marks]**

**Question 42.**

Find 'p' if the mean of the given data is 15.45.

Class	Frequency
0 – 6	6
6 – 12	8
12 – 18	$p$
18 – 24	9
24 – 30	7

**Solution:**

Class	$x_i$	$f_i$	$f_i x_i$
0 - 6	3	6	18
6 - 12	9	8	72
12 - 18	15	$p$	$15p$
18 - 24	21	9	189
24 - 30	27	7	189
		$\Sigma f_i = 30 + p$	$\Sigma f_i x_i = 468 + 15p$

$$\text{Mean} = \frac{468 + 15p}{30 + p} \Rightarrow \frac{468 + 15p}{30 + p} = 15.45$$

$$468 + 15p = 463.5 + 15.45p \Rightarrow 468 - 463.5 = 15.45p - 15p$$

$$4.5 = 0.45p$$

$$p = \frac{4.5}{0.45} \Rightarrow p = 10$$

**Question 43.**

The median of the distribution given below is 14.4. Find the values of the x, y, if the sum of frequency is 20.

Class Interval	Frequency
0 - 6	4
6 - 12	$x$
12 - 18	5
18 - 24	$y$
24 - 30	1

**Solution:**

Class Interval	$f$	$cf$
0 - 6	4	4
6 - 12	$x$	$4 + x$
12 - 18	5	$9 + x$
18 - 24	$y$	$9 + x + y$
24 - 30	1	$10 + x + y$
	$10 + x + y$	

$$N = 20 \Rightarrow \frac{N}{2} = 10$$

$$\text{Median} = 14.4$$

$$\text{Median class} = 12 - 18$$

$$l = 12, c.f. = 4 + x, f = 5, h = 6$$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h$$

$$14.4 = 12 + \left[ \frac{10 - (4 + x)}{5} \right] \times 6$$

$$2.4 = \left( \frac{6 - x}{5} \right) \times 6 \Rightarrow \frac{2.4 \times 5}{6} = 6 - x \Rightarrow x = 4$$

$$\text{Now, } 10 + x + y = 20 \Rightarrow y = 6$$

$$\therefore x = 4, y = 6$$

### Long Answer Type Questions [4 Marks]

#### Question 44.

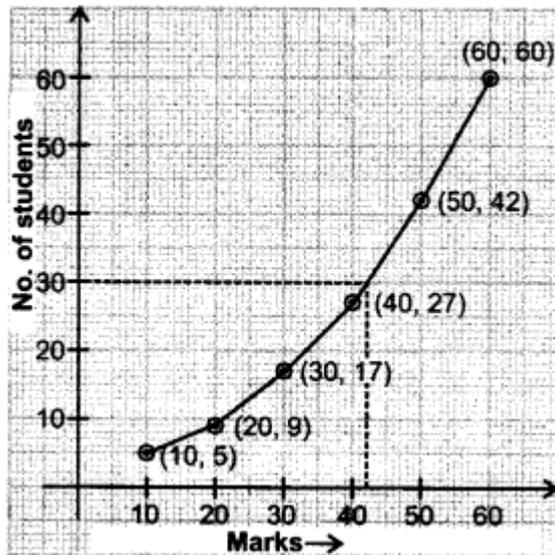
Draw a less than type ogive of the following distribution:

Marks	No. of students
0 - 10	5
10 - 20	4
20 - 30	8
30 - 40	10
40 - 50	15
50 - 60	18

**Find median from graph.**

**Solution:**

Class Interval	$f$ (No. of students)	Marks	$c.f.$
0 – 10	5	Less than 10	5
10 – 20	4	Less than 20	9
20 – 30	8	Less than 30	17
30 – 40	10	Less than 40	27
40 – 50	15	Less than 50	42
50 – 60	18	Less than 60	60



median=42

#### Question 45.

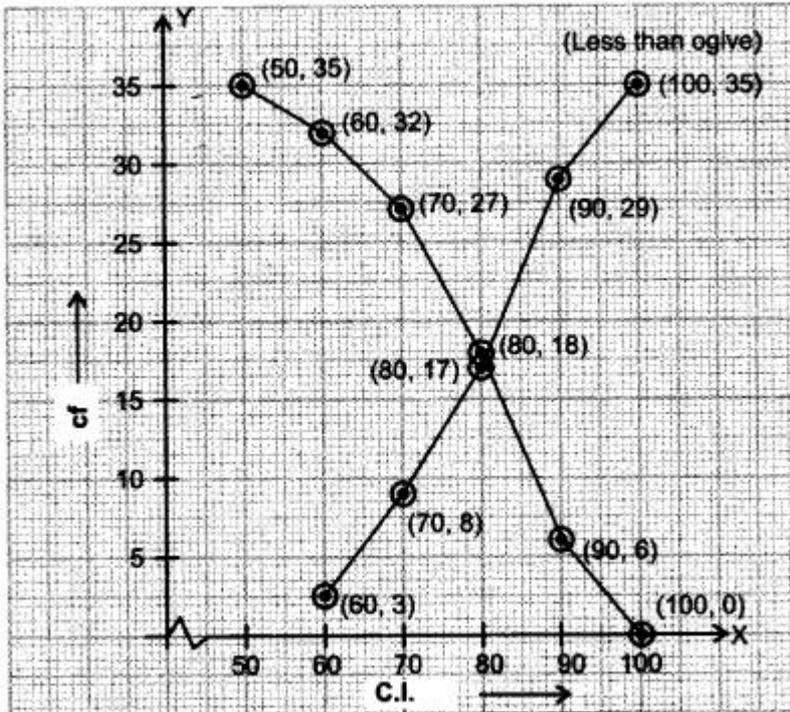
Find the median by drawing both types of graphs.

Class Interval	Frequency
50 – 60	3
60 – 70	5
70 – 80	9
80 – 90	12
90 – 100	6

Solution:

C.I.	$c.f.$
Less than 60	3
Less than 70	8
Less than 80	17
Less than 90	29
Less than 100	35

C.I.	cf.
More than or equal to 50	35
More than or equal to 60	32
More than or equal to 70	27
More than or equal to 80	18
More than or equal to 90	6
More than or equal to 100	0



curves intersect at  $(80.4, 17.5)$   
 median = 80.4.

2010

### Long Answer Type Questions [4 Marks]

#### Question 46.

Find the mean, mode and median of the following frequency distribution:

Class	Frequency
0 – 10	4
10 – 20	4
20 – 30	7
30 – 40	10
40 – 50	12
50 – 60	8
60 – 70	5

**Solution:**

Table for mean, median and mode;  $a = 35; h = 10$

C.I	$x$	$f$	$d = \frac{x - 35}{10}$	$fd$	$cf$
0 - 10	5	4	-3	-12	4
10 - 20	15	4	-2	-8	8
20 - 30	25	7	-1	-7	15
30 - 40	35	10	0	0	25
40 - 50	45	12	1	12	37
50 - 60	55	8	2	16	45
60 - 70	65	5	3	15	50
		$\Sigma f = 50$		$\Sigma fd = 16$	

← Median class

← Modal class

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma fd}{\Sigma f} \times h \\ &= 35 + \frac{16}{50} \times 10 = 35 + 3.2 = 38.2 \end{aligned}$$

For Median:  $N = 50, \frac{N}{2} = 25$

Median class is 30 - 40

∴  $l = 30, f = 10, c.f. = 15, h = 10$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 30 + \frac{25 - 15}{10} \times 10 = 30 + 10 = 40$$

For Mode: Maximum frequency = 12

∴ Modal class is 40 - 50

$l = 40, f_0 = 10, f_2 = 8, f_1 = 12, h = 10$

$$\begin{aligned} \text{Mode} &= l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 40 + \left( \frac{12 - 10}{24 - 10 - 8} \right) \times 10 = 43.3 \end{aligned}$$

**Question 47.**

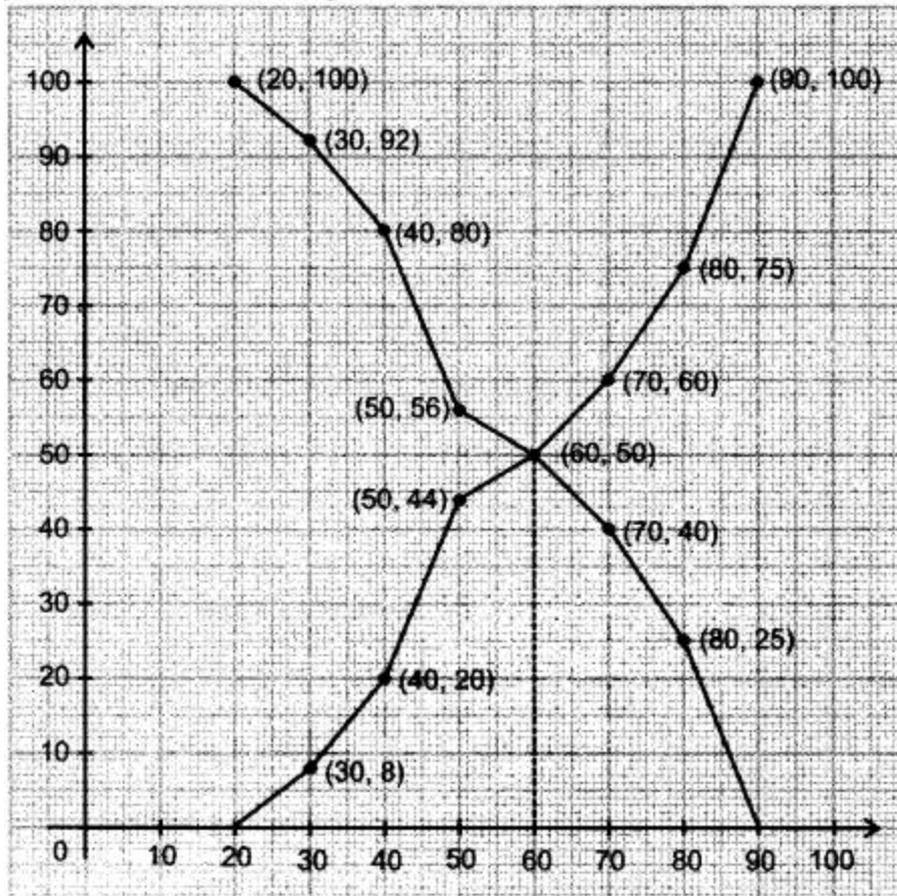
Draw 'less than ogive' and 'more than ogive' for the following distribution and hence find its median

Class	Frequency
20 - 30	8
30 - 40	12
40 - 50	24
50 - 60	6
60 - 70	10
70 - 80	15
80 - 90	25

Solution:

C.I.	For 'less than' Ogive				For 'more than' Ogive		
	$f$	C.I. (less than)	$cf$	Point	C.I. (more than)	$cf$	Point
20 - 30	8	30	8	(30, 8)	20	100	(20, 100)
30 - 40	12	40	20	(40, 20)	30	92	(30, 92)
40 - 50	24	50	44	(50, 44)	40	80	(40, 80)
50 - 60	6	60	50	(60, 50)	50	56	(50, 56)
60 - 70	10	70	60	(70, 60)	60	40	(60, 40)
70 - 80	15	80	75	(80, 75)	70	25	(70, 25)
80 - 90	25	90	100	(90, 100)	80	0	(80, 0)

'Less than' Ogive and 'more than' Ogive curves



we notice both curves intersect at (60,50)  
 median =60

**Question 48.**

Draw 'less than ogive' and 'more than ogive' for the following distribution and hence find its median.

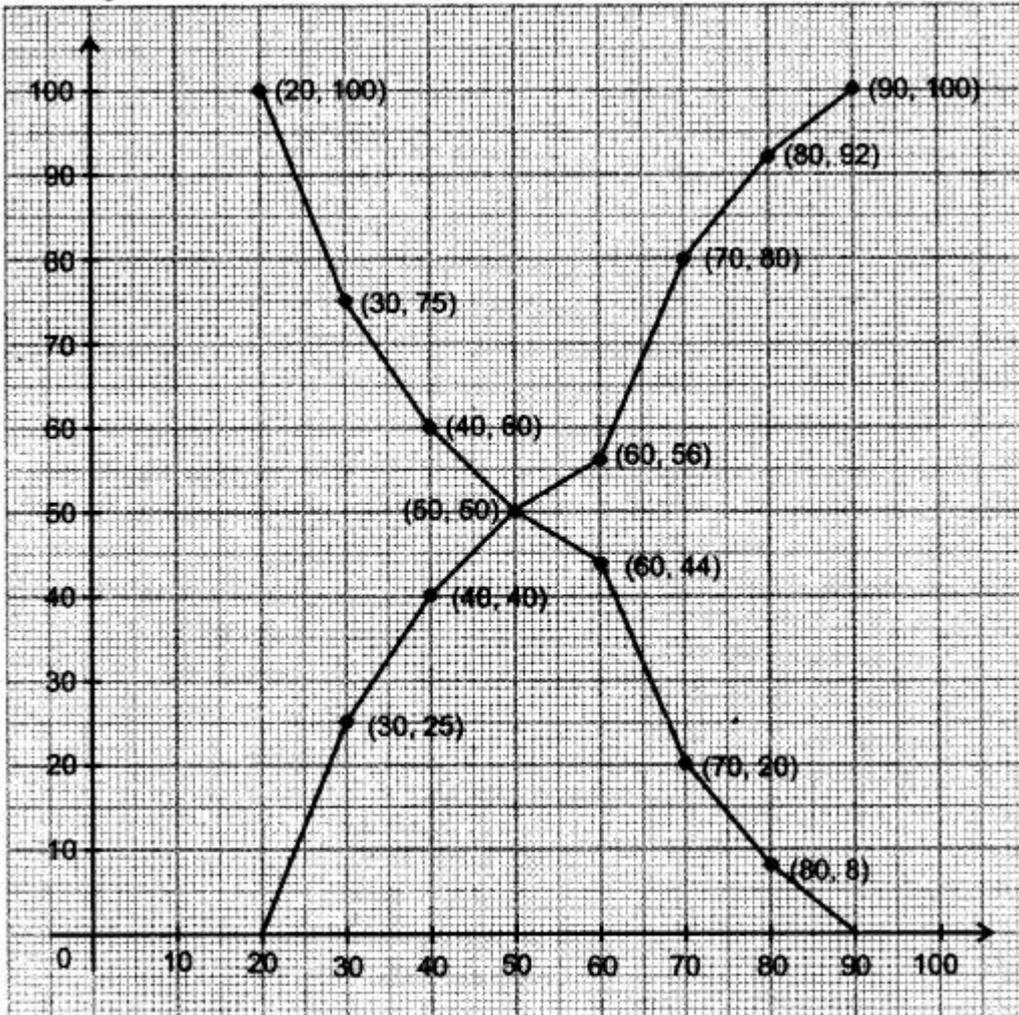
<b>Class</b>	<b>20 – 30</b>	<b>30 – 40</b>	<b>40 – 50</b>	<b>50 – 60</b>	<b>60 – 70</b>	<b>70 – 80</b>	<b>80 – 90</b>
<b>Frequency</b>	<b>25</b>	<b>15</b>	<b>10</b>	<b>6</b>	<b>24</b>	<b>12</b>	<b>8</b>

**Solution:**

table for "less than ogive" and "more than ogive"

C.I.	For 'less than' Ogive				For 'more than' Ogive		
	<i>f</i>	C.I. (less than)	<i>cf</i>	Point	C.I. (more than)	<i>cf</i>	Point
20 – 30	25	30	25	(30, 25)	20	100	(20, 100)
30 – 40	15	40	40	(40, 40)	30	75	(30, 75)
40 – 50	10	50	50	(50, 50)	40	60	(40, 60)
50 – 60	6	60	56	(60, 56)	50	50	(50, 50)
60 – 70	24	70	80	(70, 80)	60	44	(60, 44)
70 – 80	12	80	92	(80, 92)	70	20	(70, 20)
80 – 90	8	90	100	(90, 100)	80	8	(80, 8)

'Less than' Ogive and 'more than' Ogive.



we notice curves intersect at (50,50)  
median=50.

**Question 49.**

Draw 'less than ogive' and 'more than ogive' for the following distribution and hence find its median

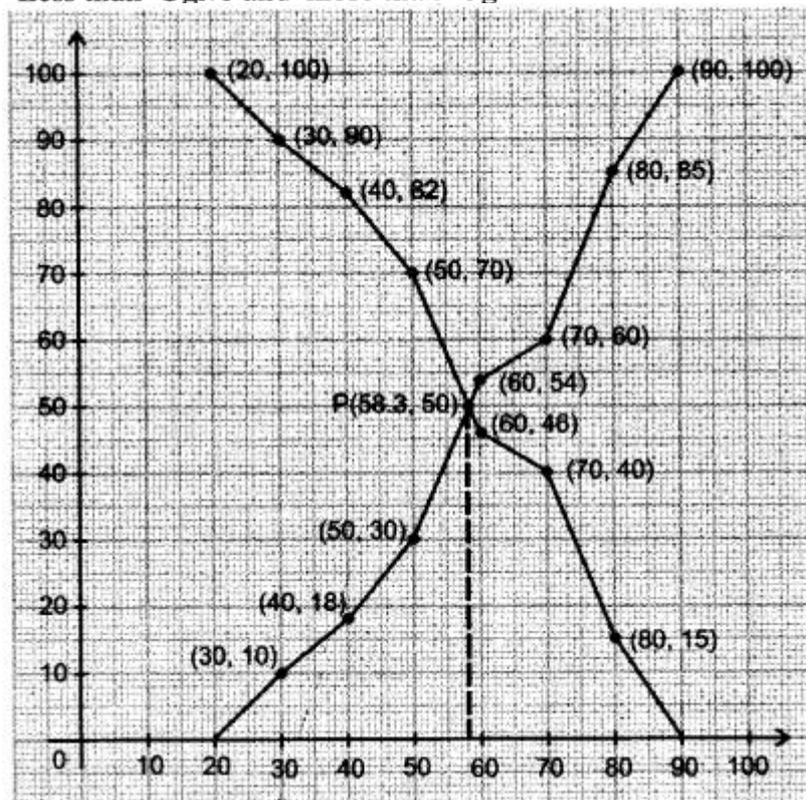
Class	Frequency
20 - 30	10
30 - 40	8
40 - 50	12
50 - 60	24
60 - 70	6
70 - 80	25
80 - 90	15

**Solution:**

table for less than ogive' and 'more than ogive'

C.I.	For 'less than' Ogive				For 'more than' Ogive		
	$f$	C.I. (less than)	$cf$	Point	C.I. (more than)	$cf$	Point
20 - 30	10	30	10	(30, 10)	20	100	(20, 100)
30 - 40	8	40	18	(40, 18)	30	90	(30, 90)
40 - 50	12	50	30	(50, 30)	40	82	(40, 82)
50 - 60	24	60	54	(60, 54)	50	70	(50, 70)
60 - 70	6	70	60	(70, 60)	60	46	(60, 46)
70 - 80	25	80	85	(80, 85)	70	40	(70, 40)
80 - 90	15	90	100	(90, 100)	80	15	(80, 15)

'Less than' Ogive and 'more than' Ogive.



we notice curves intersect at (58.3, 50)  
median = 58.30

### Question 50.

If the mean of the following frequency distribution is 65.6, find the missing

Class	Frequency
10 - 30	5
30 - 50	8
50 - 70	$f_1$
70 - 90	20
90 - 110	$f_2$
110 - 130	2
<b>Total</b>	<b>50</b>

Solution:

$A = 60, h = 20$

C.I.	$x$	$f$	$d = \frac{x - 60}{20}$	$fd$
10 - 30	20	5	-2	-10
30 - 50	40	8	-1	-8
50 - 70	60	$f_1$	0	0
70 - 90	80	20	1	20
90 - 110	100	$f_2$	2	$2f_2$
110 - 130	120	2	3	6
		$\Sigma f = 50$		$\Sigma fd = 2f_2 + 8$

$$\text{Mean} = A + \frac{\Sigma fd}{\Sigma f} \times h \Rightarrow 65.6 = 60 + \left(\frac{2f_2 + 8}{50}\right) \times 20 \Rightarrow 5.6 = \frac{(2f_2 + 8)2}{5}$$

$$\Rightarrow 28 = 4f_2 + 16 \Rightarrow 12 = 4f_2 \Rightarrow f_2 = 3$$

Also  $35 + f_1 + f_2 = 50$

$$\Rightarrow 35 + f_1 + 3 = 50 \Rightarrow f_1 = 12$$

$$\therefore f_1 = 12, f_2 = 3.$$

**Question 51.**

If the mean of the following frequency distribution is 91, find the missing frequencies ( $f_1, f_2$ ):

Class	Frequency
0 - 30	12
30 - 60	21
60 - 90	$f_1$
90 - 120	52
120 - 150	$f_2$
150 - 180	11
<b>Total</b>	<b>150</b>

**Solution:**

$$A = 75, h = 30.$$

C.I.	$x$	$f$	$d = \frac{x-75}{30}$	$fd$
0 - 30	15	12	-2	-24
30 - 60	45	21	-1	-21
60 - 90	75	$f_1$	0	0
90 - 120	105	52	1	52
120 - 150	135	$f_2$	2	$2f_2$
150 - 180	165	11	3	33
		$\Sigma f = 150$		$\Sigma fd = 2f_2 + 40$

$$\text{Mean} = A + \frac{\Sigma fd}{\Sigma f} \times h$$

$$91 = 75 + \left( \frac{2f_2 + 40}{150} \right) \times 30$$

$$\Rightarrow 16 = \frac{2f_2 + 40}{5} \Rightarrow 80 = 2f_2 + 40$$

$$\Rightarrow 2f_2 = 40 \Rightarrow f_2 = 20.$$

$$\text{Also } 12 + 21 + f_1 + 52 + f_2 + 11 = 150$$

$$\Rightarrow 96 + f_1 + f_2 = 150$$

$$\Rightarrow 96 + f_1 + 20 = 150$$

$$\Rightarrow f_1 = 150 - 116 = 34$$

$$\therefore f_1 = 34, f_2 = 20$$

**Question 52.**

If the mean of the following frequency distribution is 145, find the missing frequencies ( $f_1, f_2$ ):

Class	Frequency
0 - 50	8
50 - 100	12
100 - 150	$f_1$
150 - 200	25
200 - 250	$f_2$
250 - 300	5
<b>Total</b>	<b>80</b>

**Solution:**

$$a = 125, h = 50.$$

C.I.	$x$	$f$	$d = \frac{x - 125}{50}$	$fd$
0 - 50	25	8	-2	-16
50 - 100	75	12	-1	-12
100 - 150	125	$f_1$	0	0
150 - 200	175	25	1	25
200 - 250	225	$f_2$	2	$2f_2$
250 - 300	275	5	3	15
		$\Sigma f = 80$		$\Sigma fd = 2f_2 + 12$

$$\text{Mean} = a + \frac{\Sigma fd}{\Sigma f} \times h$$

$$\Rightarrow 145 = 125 + \left( \frac{2f_2 + 12}{80} \right) \times 50$$

$$\Rightarrow 20 = \frac{5f_2 + 30}{4}$$

$$\Rightarrow 80 = 5f_2 + 30 \Rightarrow f_2 = 10.$$

$$\text{Also, } 8 + 12 + f_1 + 25 + f_2 + 5 = 80$$

$$\Rightarrow f_1 + f_2 = 30$$

$$\Rightarrow f_1 + 10 = 30$$

$$\Rightarrow f_1 = 20$$

$$\therefore f_1 = 20, f_2 = 10.$$

2009

**Very Short Answer Type Questions [1 Mark]**

**Question 53.**

Write the median class of the following distribution :

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

**Solution:**

<b>Classes</b>	<b>Frequency</b>	<b>c.f.</b>
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

$N=50$

$N/2=25$

Median Class=30-40

**Question 54.**

What is the lower limit of the modal class of the following distribution

<b>Age in years</b>	<b>Number of patients</b>
0 – 10	16
10 – 20	13
20 – 30	6
30 – 40	11
40 – 50	27
50 – 60	18

**Solution:**

Modal class =40-50

lower limit=40

### Long Answer Type Questions [4 Marks]

**Question 55.**

The following table gives the daily income of 50 workers of a factory:

<b>Daily income (in ₹)</b>	<b>Number of workers</b>
100 – 120	12
120 – 140	14
140 – 160	8
160 – 180	6
180 – 200	10

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

**Solution:**

Daily wages	No. of workers $f_i$	Class marks $x_i$	$u_i = \frac{x_i - a}{h}$	$f_i u_i$	c.f.
100 – 120	12	110	-2	-24	12
120 – 140	14	130	-1	-14	26
140 – 160	8	150	0	0	34
160 – 180	6	170	1	6	40
180 – 200	10	190	2	20	50
	$\Sigma f_i = 50$			$\Sigma f_i u_i = -12$	

Let assumed mean be  $a = 150$

$$h = 120 - 100 = 20$$

$$\text{Mean } (\bar{x}) = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 150 + 20 \times \left( \frac{-12}{50} \right) = 150 - \frac{24}{5} = 145.20$$

$$\frac{N}{2} = 25 [N = 50], \text{ so, median class} = 120 - 140$$

$$\text{Median} = l + \left( \frac{\frac{N}{2} - c.f.}{f} \right) \times h = 120 + \left[ \frac{25 - 12}{14} \right] \times 20 = 120 + 18.57 = 138.57$$

$$\text{Mode} = l + \left[ \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right] \times h = 120 + \left[ \frac{14 - 12}{28 - 12 - 8} \right] \times 20$$

$$[f_1 = 14, f_0 = 12, f_2 = 8]$$

$$= 120 + \left[ \frac{40}{8} \right] = 120 + 5 = 125$$

**Question 56.**

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

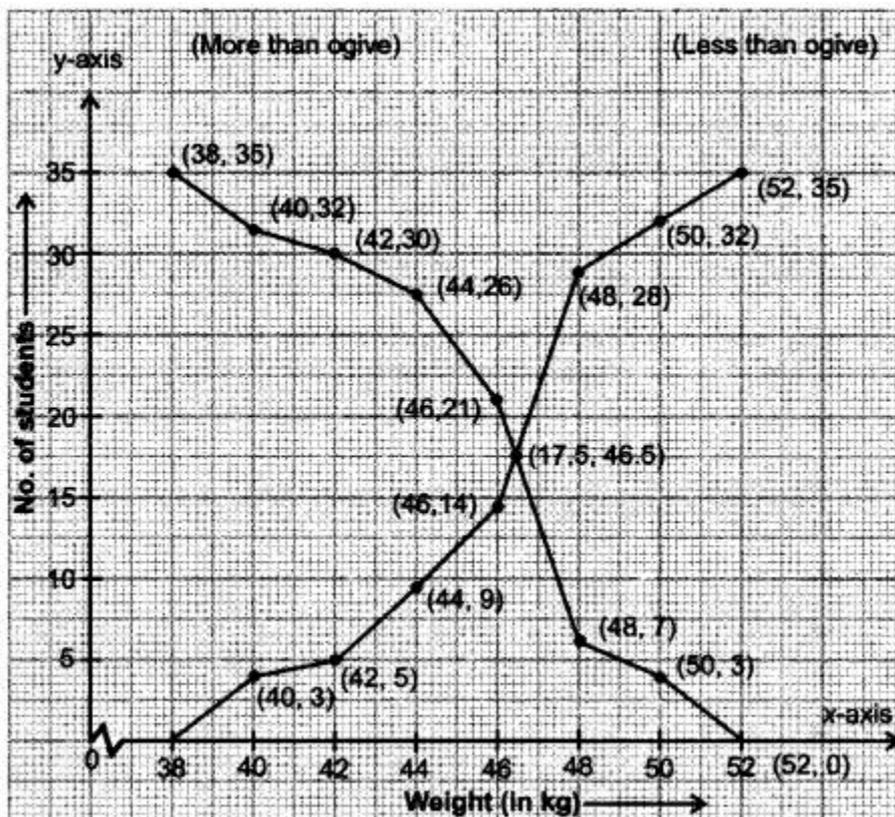
Weight (in kg)	Number of students
38 – 40	3
40 – 42	2
42 – 44	4
44 – 46	5
46 – 48	14
48 – 50	4
50 – 52	3

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

**Solution:**

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

Weight (in kg)	No. of students
More than or equal to 38	35
More than or equal to 40	32
More than or equal to 42	30
More than or equal to 44	26
More than or equal to 46	21
More than or equal to 48	7
More than or equal to 50	3
More than or equal to 52	0



we notice both the curves intersect at (46.5, 17.5)  
 Median weight = 46.5 kg

**Question 57.**

Find the mode, median and mean of the following data

Marks obtained	Number of students
25 – 35	7
35 – 45	31
45 – 55	33
55 – 65	17
65 – 75	11
75 – 85	1

**Solution:**

Marks obtained	$x_i$	Frequency $f_i$	$d_i = x_i - 60$	$cf.$	$f_i d_i$
25 – 35	30	7	-30	7	-210
35 – 45	40	31	-20	38	-620
45 – 55	50	33	-10	71	-330
55 – 65	60	17	0	88	0
65 – 75	70	11	10	99	110
75 – 85	80	1	20	100	20
		$\Sigma f_i = 100$			$\Sigma f_i d_i = -1030$

Let  $a$  be 60

$$\begin{aligned} \text{Mean} &= a + \frac{\Sigma f_i d_i}{\Sigma f_i} \\ &= 60 + \left( \frac{-1030}{100} \right) = 60 - 10.3 = 49.7 \end{aligned}$$

Modal class = 45 – 55

$$l = 45$$

$$\text{Mode} = 45 + \left( \frac{33 - 31}{66 - 48} \right) \times 10 = 46.11$$

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

$$= 45 + \left( \frac{50 - 38}{33} \right) \times 10 = 48.64$$