

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.

| | | | | | |
|------------------|--------------|-----------------------|--------------|--------------|--------------|
| Class | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 |
| Frequency | 5 | x | 15 | 12 | 7 |

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

$$N = 40$$

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

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

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

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

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]

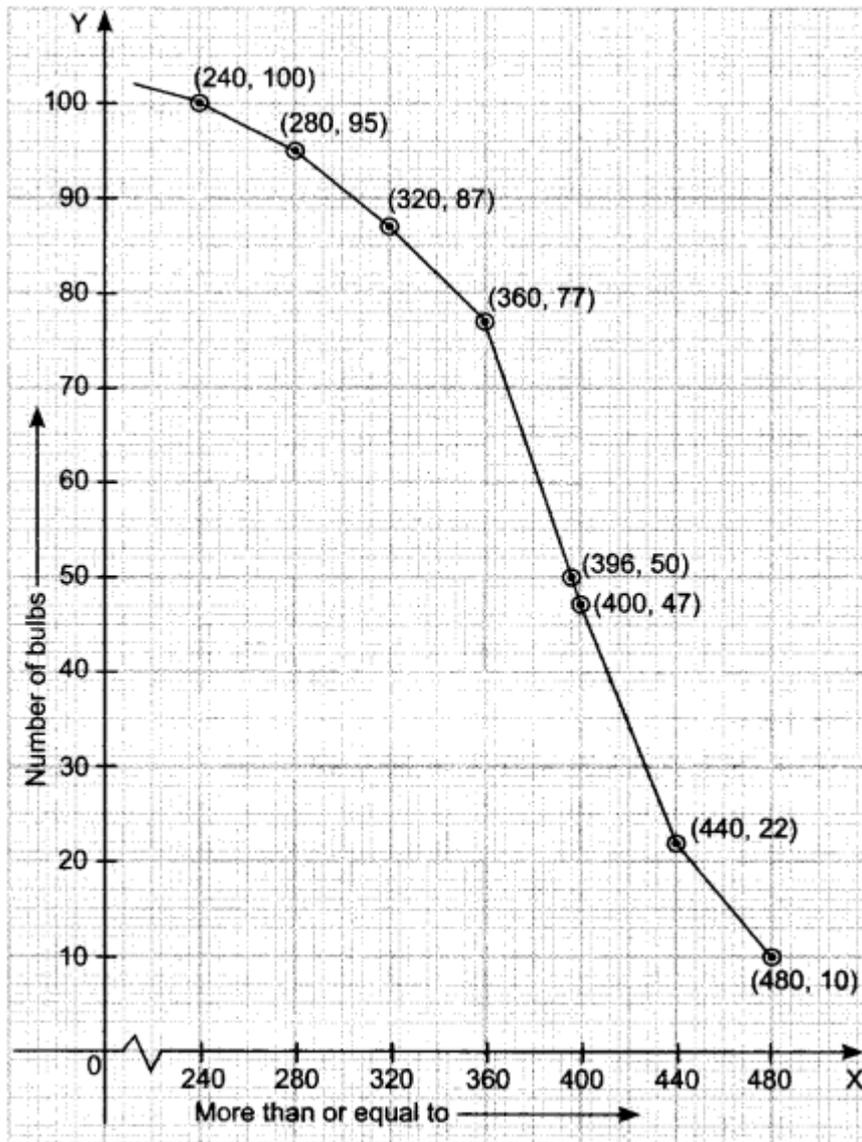
Question 8.

| 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.

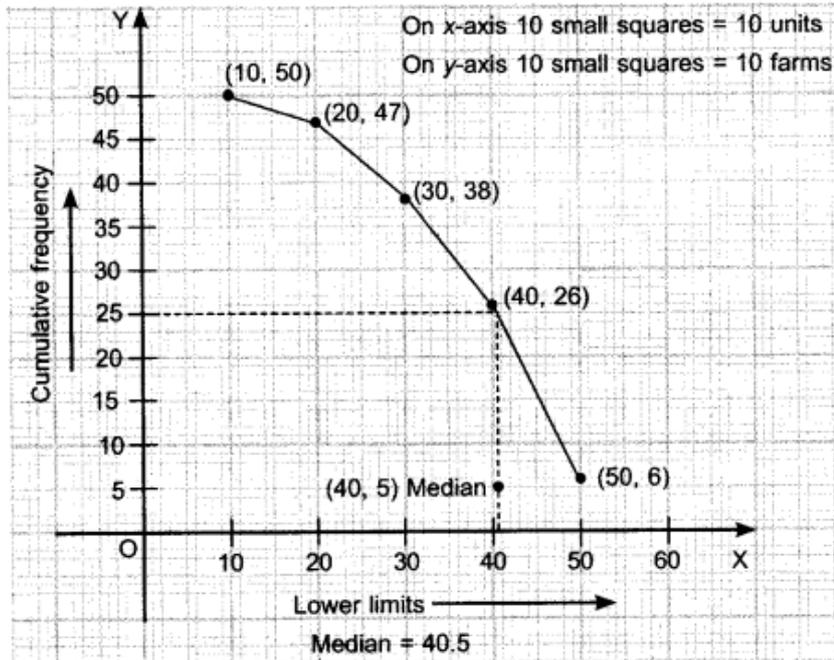
The following table gives production yield of rice per hectare in some farms of a village:

| 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.

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

Solution:

| Class Interval | 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 :

| | | | | | |
|------------------|-------------|--------------|--------------|--------------|-----------------------|
| Class | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| Frequency | 16 | 14 | 24 | 26 | x |

Solution:

| Class Interval | 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 | $90x$ |
| Total | | $80 + x$ | $3600 + 90x$ |

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

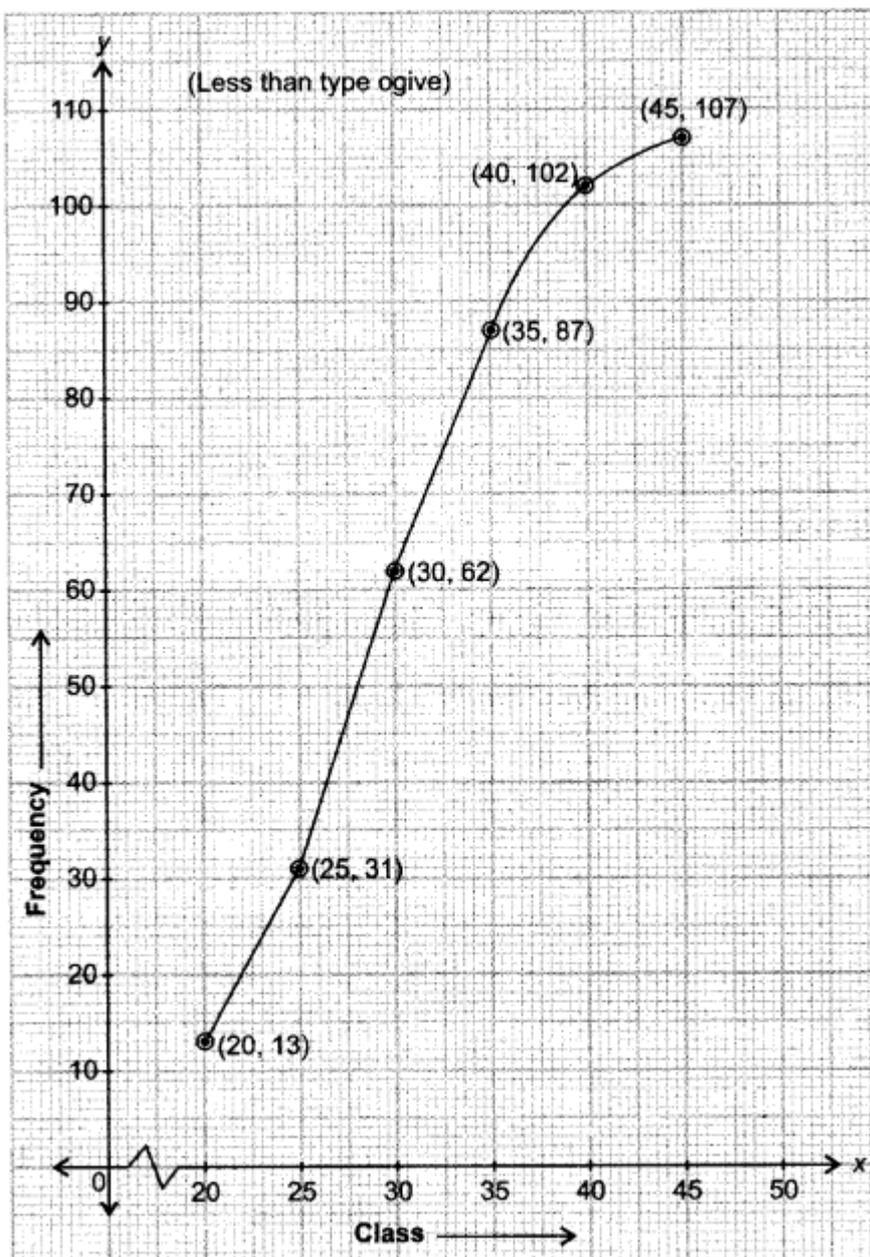
Question 14.

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

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

Find the mean length of the leaves.

Solution:

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

| Class Interval | 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 |
| Total | | $\Sigma f_i = 50$ | | $\Sigma f_i u_i = -15$ |

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

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

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 (Σf_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

| | | | | | | | |
|-----------------------------|------------|------------|------------|------------|------------|------------|------------|
| Width (in mm) | ≥20 | ≥30 | ≥40 | ≥50 | ≥60 | ≥70 | ≥80 |
| Cumulative frequency | 50 | 44 | 28 | 20 | 15 | 7 | 0 |

Solution:

Frequency distribution table is as follows:

| | | | | | | |
|-----------------------|-------|-------|-------|-------|-------|-------|
| Class Interval | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
| Frequency | 6 | 16 | 8 | 5 | 8 | 7 |

Question 19.

Find the mode of the following frequency distribution:

| | | | | | |
|------------------|------------|-------------|--------------|--------------|--------------|
| Class | 0-6 | 6-12 | 12-18 | 18-24 | 24-30 |
| Frequency | 7 | 5 | 10 | 12 | 6 |

Solution:

| Class | Frequency |
|--------------|------------------|
| 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:

| | | | | | |
|---------------------------|------------|------------|-------------|--------------|--------------|
| Money saved (in ₹) | 5-7 | 7-9 | 9-11 | 11-13 | 13-15 |
| No. of students | 6 | 3 | 9 | 5 | 7 |

Find mean and median of this data.

Solution:

| Class Interval | x_i | f_i | fx_i | $cf.$ |
|----------------|-------|-------------------|---------------------|-------|
| 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.

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

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

∴ Mean = 10.26 and median = 10.33

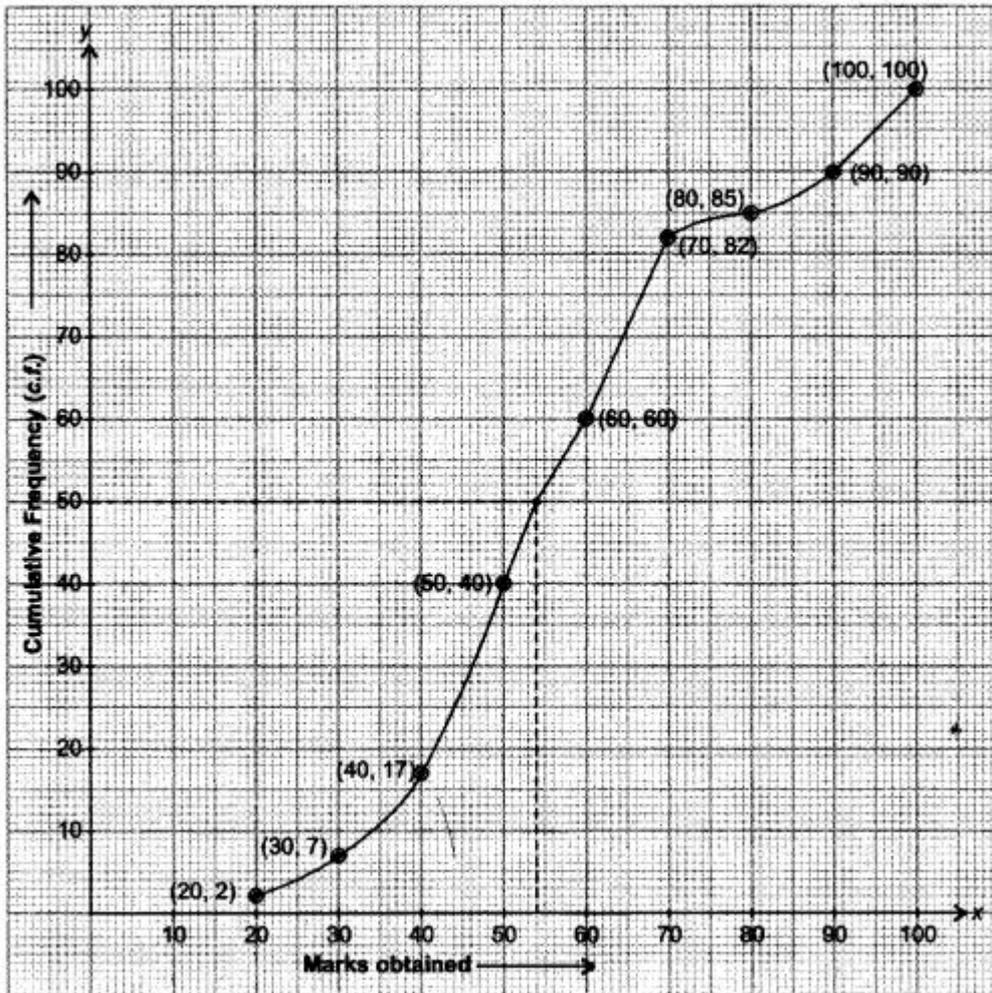
Question 21.

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.

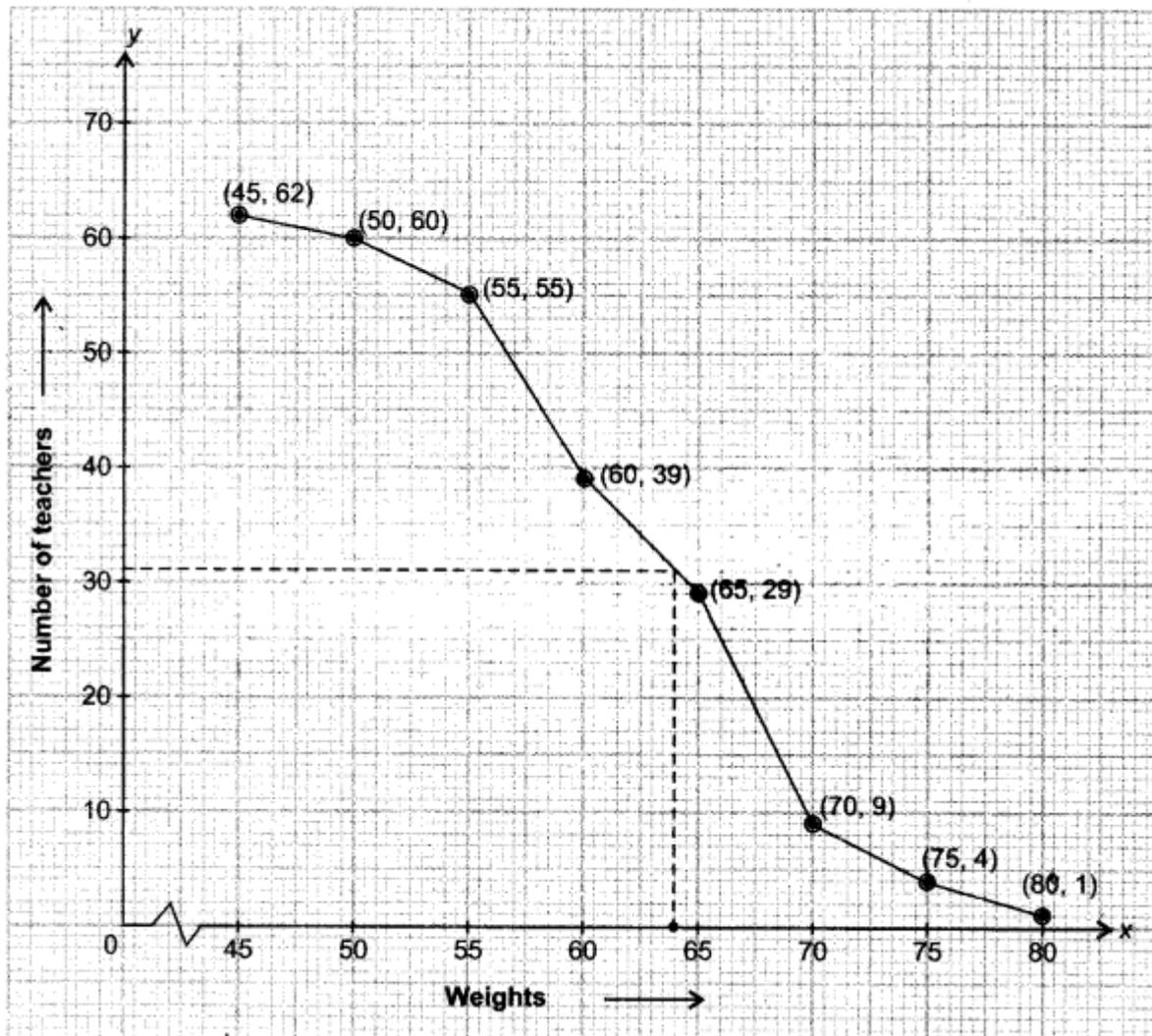
In a school, weights of 62 teachers was recorded as follows:

| Weight (in kg) | ≥ 45 | ≥ 50 | ≥ 55 | ≥ 60 | ≥ 65 | ≥ 70 | ≥ 75 | ≥ 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,

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

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

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

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

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

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

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

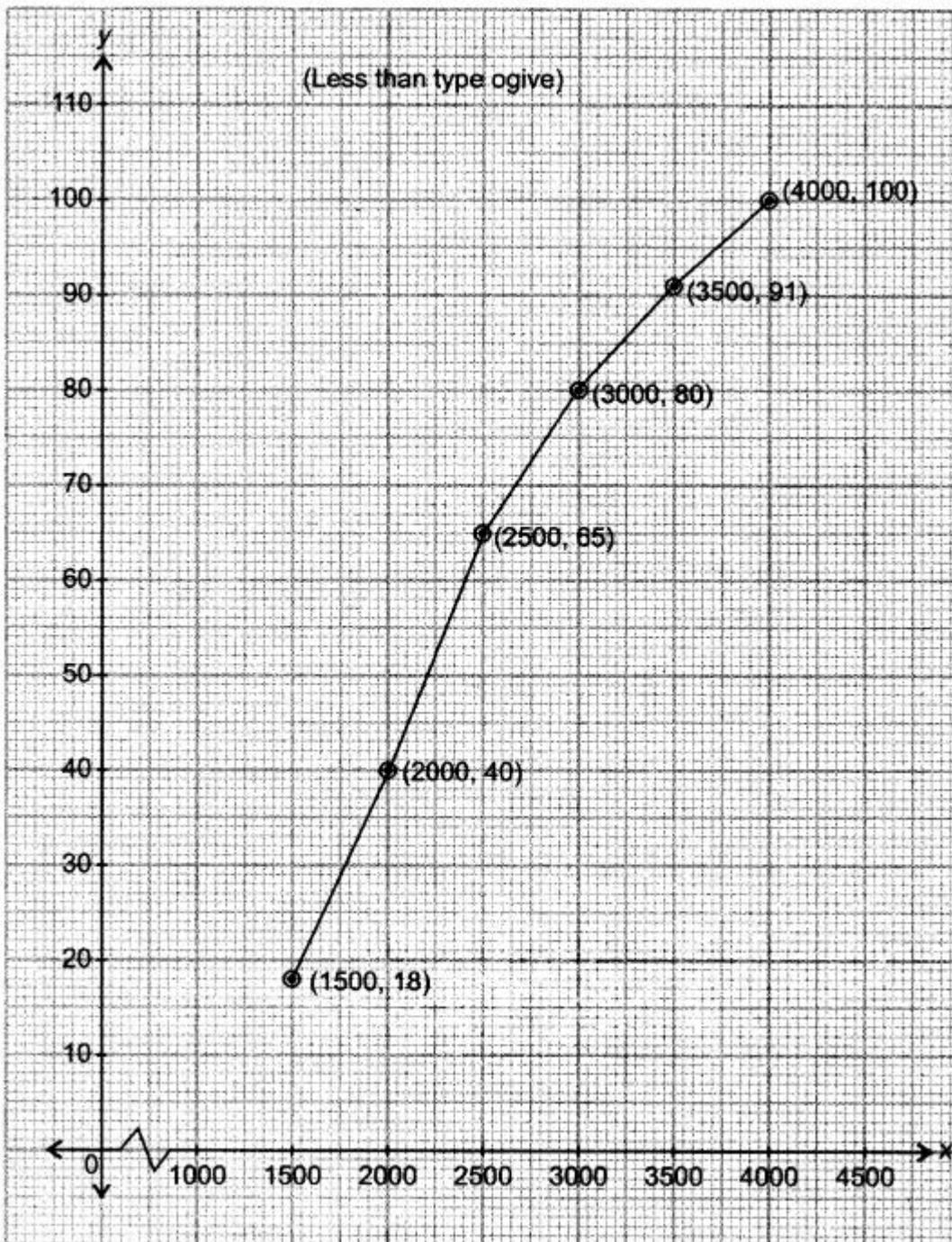
Question 26.

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:

| | | | | | | | |
|-----------------------|-------------|--------------|--------------|--------------|---------------|----------------|----------------|
| Class Interval | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 | 120-140 |
| Frequency | 6 | 8 | 10 | 12 | 6 | 5 | 3 |

Solution:

| Class Interval | 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 |
| Total | | $\Sigma f_i = 50$ | $\Sigma f_i x_i = 3120$ | * |

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

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

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

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.

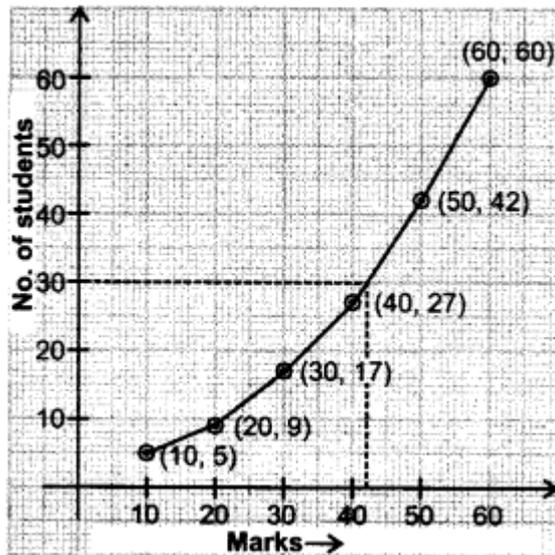
Draw a less than type ogive of the following distribution:

| 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.

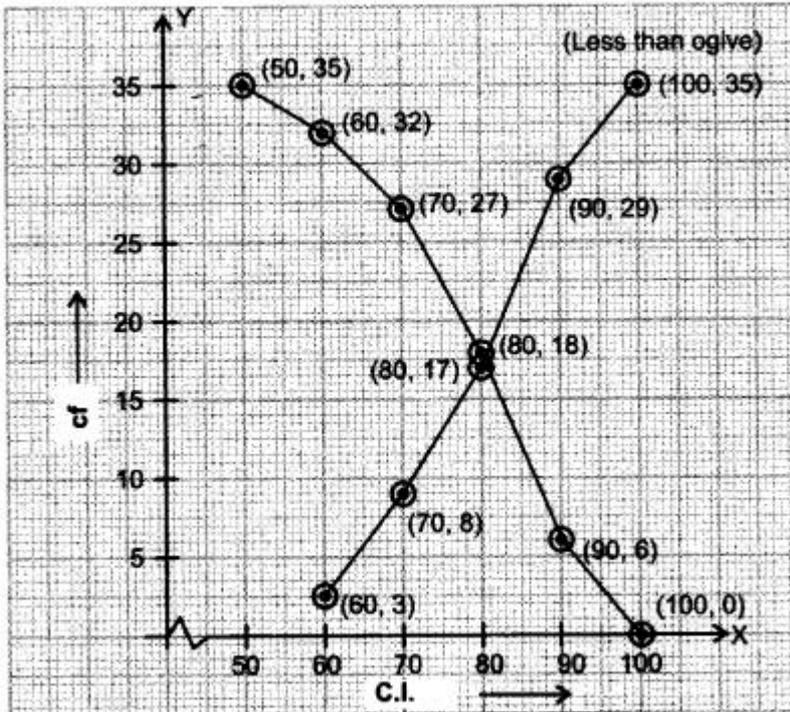
Find the median by drawing both types of gives.

| 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. | c.f. |
|---------------------------|------|
| 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.

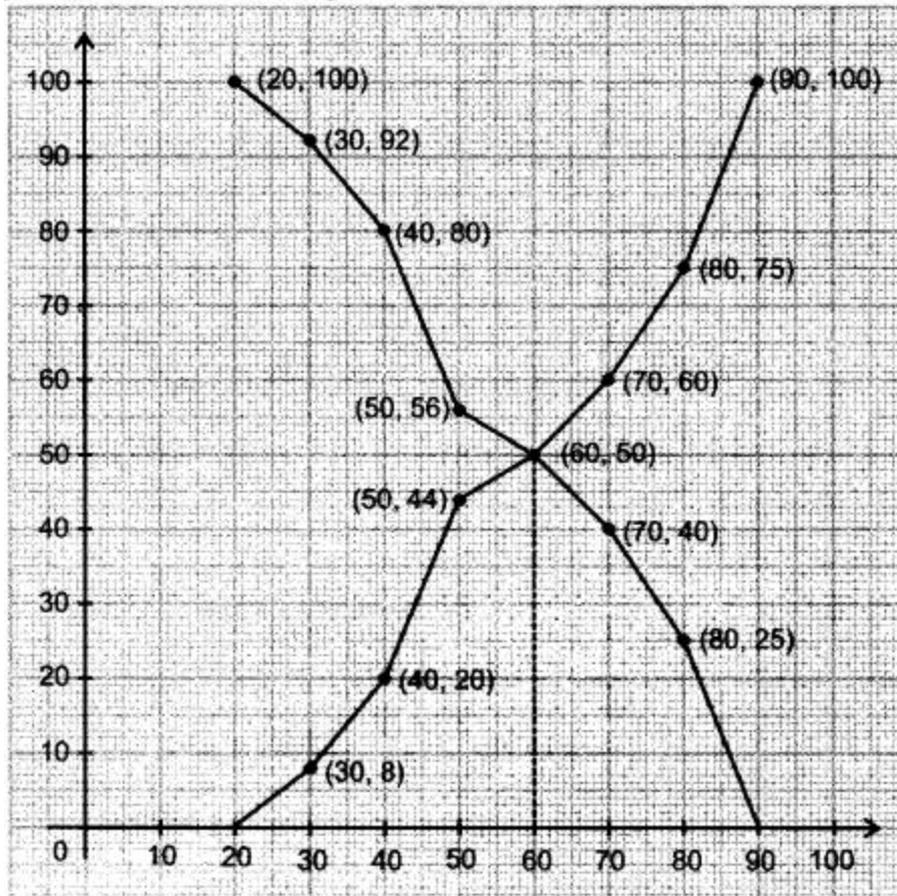
Draw 'less than ogive' and 'more than ogive' for the following distribution and hence find its median

| 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.

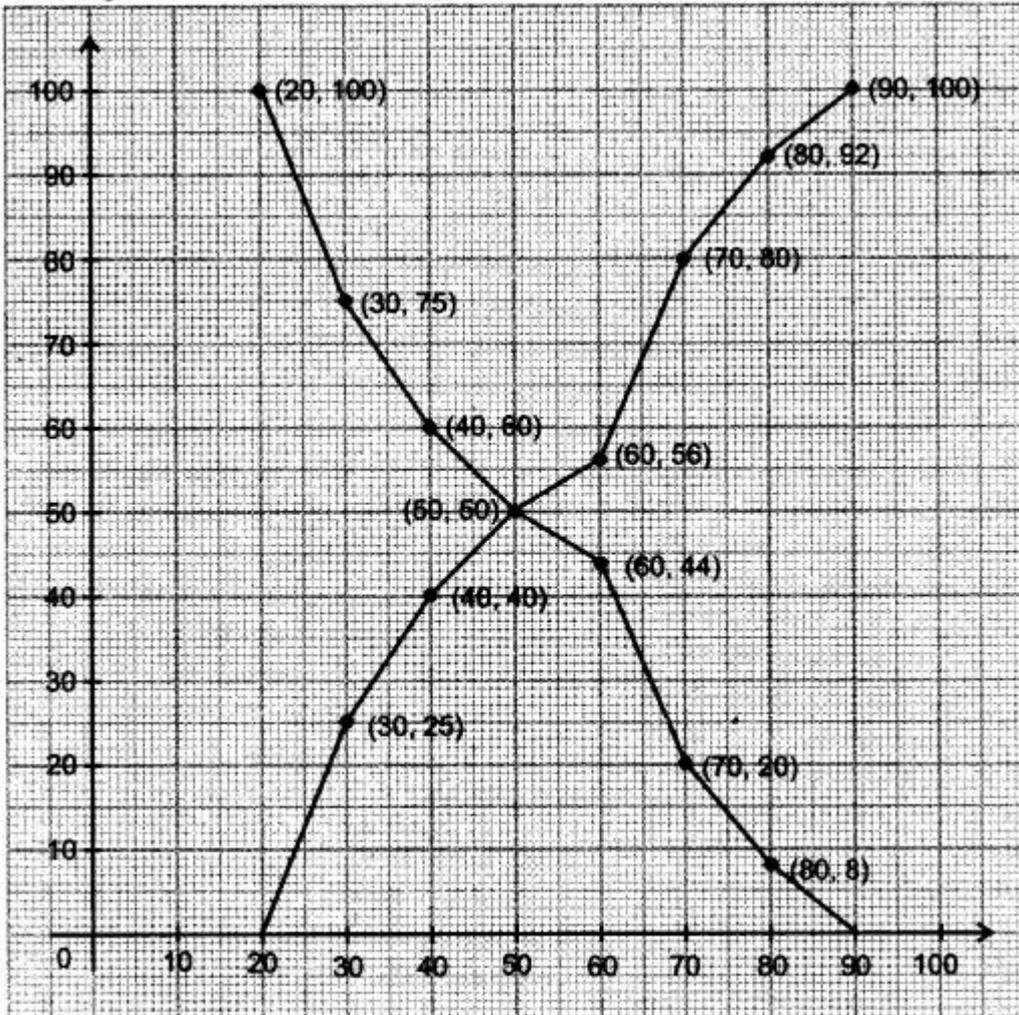
| | | | | | | | |
|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Class | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 | 80 – 90 |
| Frequency | 25 | 15 | 10 | 6 | 24 | 12 | 8 |

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

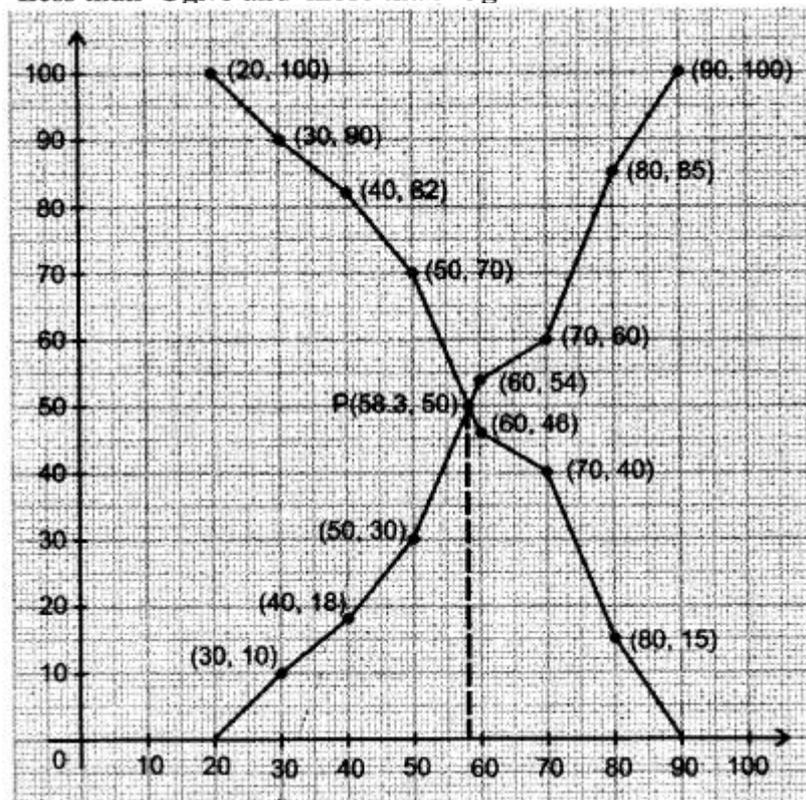
| Class | Frequency |
|---------|-----------|
| 20 – 30 | 10 |
| 30 – 40 | 8 |
| 40 – 50 | 12 |
| 50 – 60 | 24 |
| 60 – 70 | 6 |
| 70 – 80 | 25 |
| 80 – 90 | 15 |

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 |
| Total | 50 |

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 |
| Total | 150 |

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 |
| Total | 80 |

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:

| Classes | Frequency | c.f. |
|----------------|------------------|-------------|
| 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

| Age in years | Number of patients |
|---------------------|---------------------------|
| 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:

| Daily income (in ₹) | Number of workers |
|----------------------------|--------------------------|
| 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:

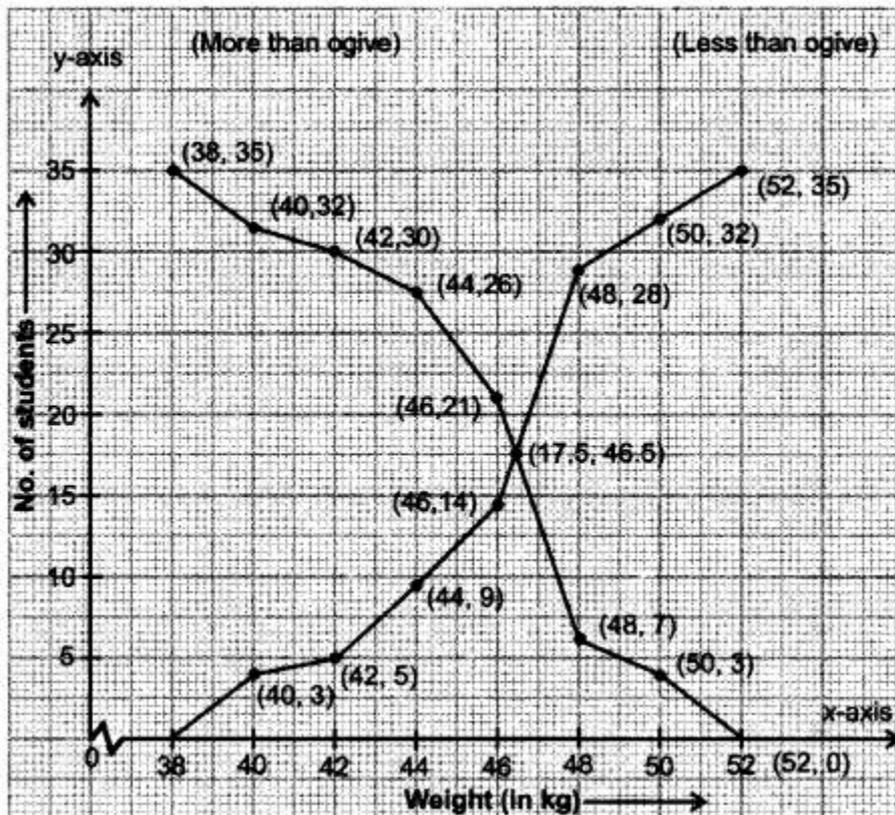
| Weight (in kg) | Number of students |
|----------------|--------------------|
| 38 – 40 | 3 |
| 40 – 42 | 2 |
| 42 – 44 | 4 |
| 44 – 46 | 5 |
| 46 – 48 | 14 |
| 48 – 50 | 4 |
| 50 – 52 | 3 |

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

$$l = 45$$

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

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

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