CHAPTER 14

STATISTICS

ONE MARK QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. The median and mode respectively of a frequency distribution are 26 and 29, Then its mean is

(a) 27.5 (b) 24.5

(c) 28.4 (d) 25.8

Ans : [Board 2020 Delhi Basic]

We have $M_o = 3M_d - 2M$

$29 = 3 \times 26 - 2M$

$2M = 78 - 29 = 49$

$M = \frac{49}{2} = 24.5$

Thus (b) is correct option.

2. The cumulative frequency table is useful in determining

(a) Mean (b) Median

(c) Mode (d) All of these

Ans : [Board 2020 OD Basic]

Cumulative frequency is defined as a running total of frequencies. It is helpful in finding the mean, median and mode.

Thus (d) is correct option.

3. In a frequency distribution, the mid value of a class is 10 and the width of the class is 6. The lower limit of the class is

(a) 6 (b) 7

(c) 8 (d) 12

Ans :

Let x be the upper limit and y be the lower limit.

Since the mid value of the class is 10.

Hence, $\frac{x+y}{2} = 10$

$x + y = 20$ ...(1)

Since width of the class is 6,

$x - y = 6$ ...(2)

Solving (1) and (2), we get $y = 7$

Hence, lower limit of the class is 7.

Thus (b) is correct option.

4. Consider the following frequency distribution of the heights of 60 students of a class

Height (in cm)	150-155	155-160	160-165	165-170	170-175	175-180
Number of students	15	13	10	8	9	5

The upper limit of the median class in the given data is

(a) 165 (b) 155

(c) 160 (d) 170

Ans : [Board 2020 SQP Standard]

We prepare the following cumulative table

Height x (in cm)	Number of Students (f)	cf
150-155	15	15
155-160	13	28
160-165	10	38
165-170	08	46
170-175	09	55
175-180	08	63
	$N = 63$	

We have, $N = 63; \frac{N}{2} = \frac{63}{2} = 31.5$

The cumulative frequency just greater than $\frac{N}{2}$ is 38 and the corresponding class is 160-165. Thus upper limit is 165.

Thus (a) is correct option.

5. For finding the popular size of readymade garments, which central tendency is used?

(a) Mean

(b) Median

(c) Mode

(d) Both Mean and Mode

Ans :

For finding the popular size of ready made garments, mode is the best measure of central tendency.

Thus (c) is correct option.

6. If the difference of mode and median of a data is 24, then the difference of median and mean is

(a) 12 (b) 24

(c) 08 (d) 36

Ans :

We have, $M_o - M_d = 24$

We know $M_o = 3M_d - 2M$

Now $M_o - M_d = 2M_d - 2M$

$24 = 2(M_d - M)$

$M_d - M = 12$

Thus (a) is correct option.

7. If the mean of the numbers $27+x$, $31+x$, $89+x$ $107+x, 156+x$ is 82, then the mean of $130+x$, $126+x$, $68+x$, $50+x$, and $1+x$ is

(a) 75 (b) 157

(c) 82 (d) 80

Ans :

Given,

$$82 = \frac{(27+x)+(31+x)+(89+x)+(107+x)+(156+x)}{5}$$

$$82 \times 5 = 410 + 5x$$

$$410 - 410 = 5x \Rightarrow x = 0$$

Required mean is,

$$\bar{x} = \frac{130+x+126+x+68+x+50+x+1+x}{5}$$

$$= \frac{375+5x}{5} = \frac{375+0}{5}$$

$$= \frac{375}{5} = 75$$

Thus (a) is correct option.

8. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observation of the set is increased by 2, then the median of the new set

(a) Is increased by 2

(b) Is decreased by 2

(c) Is two times the original median

(d) Remains the same as that of the original set

Ans :

Since, $n = 9$

then, median term $= \left(\frac{9+1}{2}\right)^{\text{th}} = 5^{\text{th}}$ item.

Now, last four observations are increased by 2, but median is 5^{th} observation, which is remaining unchanged. Hence there will be no change in median.

Thus (d) is correct option.

9. If the coordinates of the point of intersection of less than ogive and more than ogive is (13.5,20), then the value of median is

(a) 13.5 (b) 20

(c) 33.5 (d) 7.5

Ans :

The abscissa of point of intersection gives the median of the data. So, median is 13.5.

Thus (a) is correct option.

10. A set of numbers consists of three 4's, five 5's, six 6's, eight 8's and seven 10's. The mode of this set of numbers is

(a) 6 (b) 7

(c) 8 (d) 10

Ans :

Mode of the data is 8 as it is repeated maximum number of times.

Thus (c) is correct option.

11. If the mean of the observation $x, x+3, x+5, x+7$ and $x+10$ is 9, the mean of the last three observation is

(a) $10\frac{1}{3}$ (b) $10\frac{2}{3}$

(c) $11\frac{1}{3}$ (d) $11\frac{2}{3}$

Ans :

$$\text{Mean} = \frac{\text{Sum of all the observations}}{\text{Total no. of observation}}$$

$$9 = \frac{x+x+3+x+5+x+7+x+10}{5}$$

$$9 = \frac{5x+25}{5}$$

$$x = 4$$

So, mean of last three observation,

$$= \frac{x+5+x+7+x+10}{3} = \frac{5x+22}{3}$$

$$\frac{3x+22}{3} = \frac{3\times 4+22}{3}$$

$$= \frac{12+22}{3} = \frac{34}{3} = 11\frac{1}{3}$$

Thus (c) is correct option.

12. The mean weight of 9 students is 25 kg. If one more student is joined in the group the mean is unaltered, then the weight of the 10^{th} student is

(a) 25 kg (b) 24 kg

(c) 26 kg (d) 23 kg

Ans :

The sum of the weights of the 9 students $= 25 \times 9 = 225$. If one more student is joined in the group, then total number of students is 10 and mean is 25.

Hence, the sum of the weights of the 10^{th} students $= 25 \times 10 = 250$.

Hence, the weight of the 10^{th} student is $250 - 225 = 25$ kg.

However we can answer this question without any calculation. If mean is not altered on adding more data, then added data must be of mean value.

Thus (a) is correct option.

13. The mean and median of the data a, b and c are 50 and 35 respectively, where $a < b < c$. If $c - a = 55$, then $(b - a)$ is

(a) 8 (b) 7

(c) 3 (d) 5

Ans :

Since, a, b and c and are in ascending order, therefore median is b i.e $b = 35$.

Mean $\frac{a+b+c}{3} = 50$

$$a+b+c = 150$$

$$a+c = 150-35 = 115 \quad ...(1)$$

Also, it is given that $c - a = 55$ ...(2)

Subtracting equation (2) and (1), we get

$$a = 30$$

Hence, $b - a = 35 - 30 = 5$

Thus (d) is correct option.

14. Observations of some data are $\frac{x}{5}$, x, $\frac{x}{3}$, $\frac{2x}{3}$, $\frac{x}{4}$, $\frac{2x}{5}$ and $\frac{3x}{4}$ where $x > 0$. If the median of the data is 4, then the value of x is

(a) 5 (b) 15

(c) 9 (d) 10

Ans :

Given observations are $\frac{x}{5}$, x, $\frac{x}{3}$, $\frac{2x}{3}$, $\frac{x}{4}$, $\frac{2x}{5}$ and $\frac{3x}{4}$ where $x > 0$. On arranging the above observations in ascending order, we get

$$\frac{x}{5}, \frac{x}{4}, \frac{x}{3}, \frac{2x}{5}, \frac{2x}{3}, \frac{3x}{4}, x$$

Here, total number of observations are 7, which is odd.

$$\text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{ observation}$$

$$= \left(\frac{7+1}{2}\right)^{th} \text{ observation}$$

$$= 4^{th} \text{ observation} = \frac{2x}{5}$$

$$\text{Median} = \frac{2x}{5} = 4$$

$$x = \frac{4\times 5}{2} = 10$$

Thus (d) is correct option.

15. If the mean of the squares of first n natural numbers is 105, then the first n natural numbers is

(a) 8 (b) 9

(c) 10 (d) 11

Ans :

Sum of square, $\sum x^2 = \frac{n(n+1)(2n+1)}{6}$

Mean of squares of first n natural numbers,

$$105 = \frac{(n+1)(2n+1)}{6}$$

$$2n^2+3n+1 = 630$$

$$2n^2+3n-629 = 0$$

$$2n^2+37n-34n-629 = 0$$

$$n(2n+37)-17(2n+37) = 0$$

$$(2n+37)(n-17) = 0 \Rightarrow n = 17$$

Since, n is odd, therefore median is $= \left(\frac{17+1}{2}\right)^{\text{th}} = 9^{\text{th}}$ observation.

Thus (b) is correct option.

16. Mode of the following grouped frequency distribution is

Class	Frequency
3-6	2
6-9	5
9-12	10
12-15	23
15-18	21
18-21	12
21-24	03

(a) 13.6 (b) 15.6

(c) 14.6 (d) 16.6

Ans :

We observe that the class 12-15 has maximum frequency 23. Therefore, this is the modal class.

We have, $l = 12$, $h = 3$, $f_1 = 23$, $f_0 = 10$ and $f_2 = 21$

$$M_o = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$= 12 + \frac{23 - 10}{46 - 10 - 21} \times 3$$

$$= 12 + \frac{13}{15} \times 3$$

$$= 12 + \frac{13}{5} = 14.6$$

Thus (c) is correct option.

17. While computing the mean of grouped data, we assume that the frequencies are

(a) evenly distributed over all the classes

(b) centred at the class marks of the classes

(c) centred at the upper limits of the classes

(d) centred at the lower limits of the classes

Ans :

While computing mean of ground data, we assume that the frequencies distribution table.

Thus (b) is correct option.

18. If median is 137 and mean is 137.05, then the value of mode is

(a) 156.90 (b) 136.90

(c) 186.90 (d) 206.90

Ans :

$$M_o = 3M_d - 2M$$

$$= 3(137) - 2(137.05)$$

$$= 411 - 274.10 = 136.90$$

Thus (b) is correct option.

19. The following data gives the distribution of total household expenditure (in <) of manual workers in a city.

Expenditure (in <)	Frequency
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	30
3500-4000	22
4000-4500	16
4500-5000	07

Then, find the average expenditure which is done by the maximum number of manual workers.

(a) 1747.26 (b) 1847.26

(c) 1947.26 (d) 2047.26

Ans :

We observe that the class 1500-2000 has maximum frequency 40. Therefore, this is the modal class.

We have $l = 1500$, $h = 500$, $f_1 = 40$, $f_0 = 24$ and $f_2 = 23$

$$M_o = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$= 1500 + \frac{40 - 24}{80 - 24 - 33} \times 500$$

$$= 1500 + \frac{16}{23} \times 500$$

$$= 1847.26$$

Thus (b) is correct option.

20. For the following distribution

Marks	Number of Students	Marks	Number of students
Below 10	3	Below 40	57
Below 20	12	Below 50	75
Below 30	28	Below 60	80

The modal class is

(a) 0-20 (b) 20-30

(c) 30-40 (d) 50-60

Ans :

Let us first construct the following frequency distribution table.

Marks	Number of Students
0-10	3
10-20	9
20-30	16
30-40	29
40-50	18
50-60	5

Since, the maximum frequency is 29 and the class corresponding to this frequency is 30-40. So, the modal class is 30-40.

Thus (c) is correct option.

21. If X, M and Z are denoting mean, median and mode of a data and $X: M = 9:8$, then the ratio $M:Z$ is

(a) 3 : 4 (b) 4 : 9

(c) 4 : 3 (d) 2 : 5

Ans :

Since, $M_o = 3M_d - 2M$

$Z = 3M - 2X$ ...(1)

Now $X:M = 9:8$

$\frac{X}{M} = \frac{9}{8}$

$X = \frac{9M}{8}$

Substituting the value of X in equation (1), we get

$Z = 3M - 2 \times \frac{9M}{8} = 3M - \frac{9M}{4}$

$Z = \frac{3M}{4}$

$\frac{M}{Z} = \frac{4}{3}$

or $M:Z = 4:3$

Thus (c) is correct option.

22. A student noted the number of cars passing through a spot on a road for 100 periods each of 3 min and summarised in the table give below.

Number of cars	Frequency
0-10	7
10-20	14
20-30	13
30-40	12
40-50	20
50-60	11
60-70	15
70-80	08

Then, the mode of the data is

(a) 34.7 (b) 44.7

(c) 54.7 (d) 64.7

Ans :

Here, modal class is 40-50. Since, it has maximum frequency which is 20.

So, $l = 40$, $f_1 = 20$, $f_0 = 12$, $f_2 = 11$ and $h = 10$

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

$$= 40 + \left(\frac{20 - 12}{40 - 12 - 11}\right) \times 10$$

$$= 40 + \frac{80}{17}$$

$$= 40 + 4.7 = 44.7 \text{ cars}$$

Thus (b) is correct option.

23. If the mean of a, b, c is M and $ab + bc + ca = 0$, the mean of a^2, b^2 and c^2 is KM^2, then K is equal to

(a) 3 (b) 9

(c) 6 (d) 4

Ans :

We have $\frac{a+b+c}{3} = M$

$a + b + c = 3M$

and $\frac{a^2+b^2+c^2}{3} = KM^2$

Now, $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

$$(a+b+c)^2 = a^2+b^2+c^2 \quad [ab+bc+ca=0]$$
$$(3M)^2 = 3KM^2$$
$$9M^2 = 3KM^2 \Rightarrow K = 3$$

Thus (a) is correct option.

24. In the formula $\overline{x} = a + \dfrac{\sum f_i d_i}{\sum f_i}$, for finding the mean of grouped data d_i's are deviation from a of

(a) lower limits of the classes

(b) upper limits of the classes

(c) mid-points of the classes

(d) frequencies of the class marks

Ans :

Mid-point of the classes $= (x_i - a)$,

where, $x_i = \dfrac{\text{upper limit} + \text{lower limit}}{2}$

So, the option (c) is correct, which is the required answer.

Thus (c) is correct option.

25. While computing mean of grouped data, we assume that the frequencies are

(a) evenly distributed over all the classes

(b) centred at the class marks of the classes

(c) centred at the upper limits of the classes

(d) centred at the lower limits of the classes

Ans : (b) centred at the class marks of the classes

Frequencies are centred at the class-marks of the classes.

So, the option (b) is correct, which is the required answer.

Thus (b) is correct option.

26. If x_i's are the mid-points of the class intervals of grouped data, f_i's are the corresponding frequencies and $\overline{x}$ is the mean, then $\sum(f_i x_i - \overline{x})$ is equal to

(a) 0 (b) -1

(c) 1 (d) 2

Ans :

$$\sum(f_i x_i - \overline{x}) = \sum f_i x_i - \sum \overline{x} = \sum f_i x_i - n\overline{x}$$
$$= \sum f_i x_i - \sum f_i x_i = 0 \qquad \left(\overline{x} = \frac{\sum f_i x_i}{n}\right)$$

So, the option (a) is correct, which is the required answer.

27. In the formula $\overline{x} = a + h\left(\dfrac{\sum f_i u_i}{\sum f_i}\right)$, for finding the mean of grouped frequency distribution, u_i is equal to

(a) $\dfrac{x_i + a}{h}$ (b) $h(x_i - a$

(c) $\dfrac{x_i - a}{h}$ (d) $\dfrac{a - x_i}{h}$

Ans :

We know that, $u_i = \dfrac{x_i - a}{h}$

So, the option (c) is correct, which is the required answer.

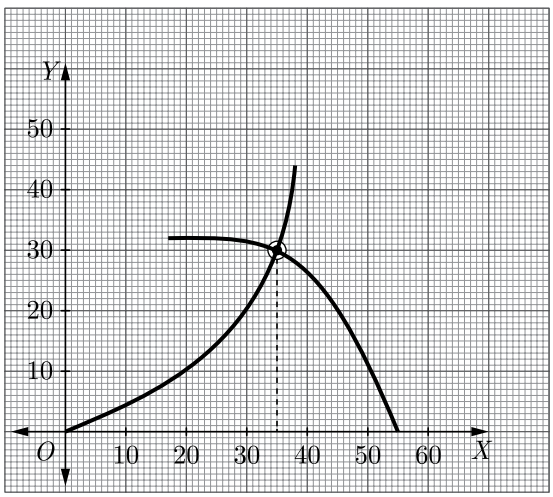
Thus (c) is correct option.

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

(a) mean (b) median

(c) mode (d) All of these

Ans :



It gives median of the grouped-data.

So, the option (b) is correct, which is the required answer.

Thus (b) is correct option.

29. For the following distribution.

Class	0-5	5-10	10-15	15-20	20-25
Frequency	10	15	12	20	9

the sum of lower limits of the median class and modal class is

(a) 15 (b) 25

(c) 30 (d) 35

Ans :

Here,

Class	Frequency	Cumulative frequency
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

Now, $\frac{N}{2} = \frac{33}{2} = 33$, which lies in the interval 10-15. Therefore, lower limit of the median class is 10.

The highest frequency is 20, which lies in the interval 15-20. Therefore, lower limit of modal class is 15. Hence, required sum is $10 + 15 = 25$.

Thus (b) is correct option.

30. Consider the following frequency distribution

Class	0-5	6-11	12-17	18-23	24-29
Frequency	13	10	15	8	11

The upper limit of the median class is

(a) 17 (b) 17.5

(c) 18 (d) 18.5

Ans :

Given, classes are not continuous, so we make continuous by subtracting 0.5 from lower limit and adding 0.5 to upper limit of each class.

Class	Frequency	Cumulative frequency
-0.5-5.5	13	13
5.5-11.5	10	23
11.5-17.5	15	38
17.5-23.5	8	46
23.5-29.5	11	57

Here, $\frac{N}{2} = \frac{57}{2} = 28.5$, which lies in the interval $11.5 - 17.5$. Hence, the upper limit is 17.5.

Thus (b) is correct option.

31. For the following distribution:

Marks	Number of students
Below 10	3
Below 20	12
Below 30	27
Below 40	57
Below 50	75
Below 60	80

The modal class is

n131

(a) 10-20 (b) 20-30

(c) 30-40 (d) 50-60

Ans :

Marks	Number of students
0-10	$3 - 0 = 3$
10-20	$12 - 3 = 9$
20-30	$27 - 12 = 15$
30-40	$57 - 27 = 30$
40-50	$75 - 57 = 18$
50-60	$80 - 75 = 5$

Class 30-40 has the maximum frequency 30, therefore this is model class.

Thus (c) is correct option.

32. Consider the data:

Class	65-85	85-105	105-125	125-145	145-165	165-185	185-205
Frequency	4	5	13	20	14	7	4

The difference of the upper limit of the median class and the lower limit of the modal class is

(a) 0 (b) 19

(c) 20 (d) 38

Ans :

Class	Frequency	Cumulative frequency
65-85	4	7
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	7	63
185-205	4	67

Here, $\frac{N}{2} = \frac{67}{2} = 33.5$, which lies in the interval $125 - 145$. Hence, upper limit of median class is 145.

Here, we see that the highest frequency is 20 which lies in 125-145. Hence, the lower limit of modal class is 125.

Required difference

= Upper limit of median class

− Lower limit of modal class

$= 145 - 125 = 20$

Thus (c) is correct option.

33. The times, in seconds, taken by 150 athletes to run a 110 m hurdle race are tabulated below

Class	Frequency
13.8-14	2
14-14.2	4
14.2-14.4	5
14.4-14.6	71
14.6-14.8	48
14.8-15	20

The number of athletes who completed the race in less than 14.6 second is :

(a) 11 (b) 71

(c) 82 (d) 130

Ans :

The number of athletes who completed the race in less than 14.6

$$= 2 + 4 + 5 + 71 = 82$$

Thus (c) is correct option.

34. Consider the following distribution :

Marks obtained	Number of students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

the frequency of the class 30-40 is :

(a) 3 (b) 4

(c) 48 (d) 51

Ans :

Marks obtained	Number of students
0-10	$(63 - 58) = 5$
10-20	$(58 - 55) = 3$
20-30	$(55 - 51) = 4$
30-40	$(51 - 48) = 3$
40-50	$(48 - 42) = 6$
50-60	$42 = 42$

Hence, frequency in the class interval 30-40 is 3.

Thus (a) is correct option.

35. **Assertion :** If the number of runs scored by 11 players of a cricket team of India are 5, 19, 42, 11, 50, 30, 21, 0, 52, 36, 27 then median is 30.

Reason : Median $= \left(\frac{n+1}{2}\right)^{\text{th}}$ value, if n is odd.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

Ans :

Arranging the terms in ascending order,

0, 5, 11, 19, 21, 27, 30, 36, 42, 50, 52

$$\text{Median value} = \left(\frac{11+1}{2}\right)^{\text{th}}$$

$$= 6^{\text{th}} \text{ value} = 27$$

Assertion (A) is false but reason (R) is true.

Thus (d) is correct option.

Fill in the Blank Questions

36. ..... is mid value of class interval.

Ans :

Class mark

37. ..... is the value of the observation having the maximum frequency.

Ans :

Mode

38. The mid-point of a class interval is called its .....

Ans :

class-mark

39. The ..... is the most frequently occurring observation.

Ans :

mode

40. Facts or figures, collected with a definite purpose, are called .....

Ans :

data

41. To find the mode of a grouped data, the size of the

classes is .....

Ans :

uniform

42. ..... is graphical representation of cumulative frequency distribution.

Ans :

Ogive

43. Median divides the total frequency into ..... equal parts.

Ans :

two

44. Average of a data is called .....

Ans :

Mean

45. On an ogive, point A (say), whose Co-ordinated is $\frac{n}{2}$ (half of the total observation), has its X-coordinate equal to ..... of the data.

Ans :

Median

46. Value of the middle-most observation (s) is called .....

Ans :

median

47. Two ogive, for the same data intersect at the point P. Then Y-coordinate of P represents .....

Ans :

cumulative

48. The algebraic sum of the deviations from arithmetic mean is always .....

Ans :

zero

VERY SHORT ANSWER QUESTIONS

49. Find the class-marks of the classes 10-25 and 35-66.

Ans : [Board 2020 OD Standard]

Class mark of $10-25$, $= \frac{10+25}{2} = \frac{35}{2} = 17.5$

and class mark of $35-55$, $= \frac{35+55}{2} = \frac{90}{2} = 45$

50. Find the class marks of the classes 15-35 and 45-60.

Ans : [Board 2020 OD Standard]

Class mark of $15-35 = \frac{15+35}{2} = \frac{50}{2} = 25$

and class mark of $45-60 = \frac{45+60}{2} = \frac{105}{2} = 52.5$

51. If the mean of the first n natural number is 15, then find n.

Ans : [Board 2020 Delhi Standard]

Given : 1, 2, 3, 4, ... to n terms.

The sum of first n natural numbers

$$S_n = \frac{n(n+1)}{2}$$

Mean, $$M = \frac{n(n+1)}{2 \times n}$$

$$15 = \frac{n(n+1)}{2 \times n}$$

$$15 = \frac{n+1}{2}$$

$$n+1 = 30 \Rightarrow n = 29$$

52. Find the class marks of the classes 20-50 and 35-60.

Ans : [Board 2020 OD Standard]

Class mark of $20-50 = \frac{20+50}{2} = \frac{70}{2} = 35$ and

Class mark of $35-60 = \frac{35+60}{2} = \frac{95}{2} = 47.5$.

53. If the median of a series exceeds the mean by 3, find by what number the mode exceeds its mean?

Ans : [Board Term-1, 2015]

We have $M_d = M+3$

Now $M_o = 3M_d - 2M$

$= 3(M+3) - 2$

$= 3M+9-2M = M+9$

Hence mode exceeds mean by 9.

54. From the following frequency distribution, find the median class :

Cost of living index	1400-1500	1550-1700	1700-1850	1850-2000
Number of weeks	8	15	21	8

Ans : [Board Term-1, 2015]

We prepare following cumulative frequency table to find median class.

Cost of living index	Number of weeks f	c.f.
1400-1500	8	8
1550-1700	15	23
1700-1850	21	44
1850-2000	8	52

We have $N = 52$; $\frac{N}{2} = 26$

Cumulative frequency just greater than $\frac{N}{2}$ is 44 and the corresponding class is 1700-1850.
Thus median class is 1700-1850.

55. In the following frequency distribution, find the median class.

Height (in cm)	104-145	145-150	150-155	155-160	160-165	165-170
Frequency	5	15	25	30	15	10

Ans : [Board Term-1 2015]

We prepare following cumulative frequency table to find median class.

Height	Frequency	c.f.
140-145	5	5
145-150	15	20
150-155	25	45
155-160	30	75
160-165	15	90
165-170	10	100
	$N = 100$	

We have $N = 100$; $\frac{N}{2} = 50$

Cumulative frequency just greater than $\frac{N}{2}$ is 75 and the corresponding class is 155-160.
Thus median class is 155-160.

56. Find median of the data, using an empirical relation when it is given that Mode = 12.4 and Mean = 10.5.

Ans : [Board Term-1, 2015]

Mode, $M_o = 12.4$

Mean, $M = 10.5$

Median, $M_d = \frac{1}{3}M + \frac{2}{3}M_o$

$= \frac{1}{3}(12.4) + \frac{2}{3}(10.5)$

$= \frac{12.4}{3} + \frac{21}{3}$

$= \frac{12.4 + 21}{3} = \frac{33.4}{3}$

$= \frac{33.4}{3} = 11.13$

57. Consider the following distribution :

Marks Obtained	0 or more	10 or more	20 or more	30 or more	40 or more	50 or more
Number of students	63	58	55	51	48	42

(i) Calculate the frequency of the class 30 - 40.
(ii) Calculate the class mark of the class 10 - 25.

Ans : [Board Term-1, 2014]

Class Interval	c.f.	f
0-10	63	5
10-20	58	3
20-30	55	4
30-40	51	3
40-50	48	6
50-60	42	42

(i) Frequency of the class 30 - 40 is 3.

(ii) Class mark of the class : $10 - 25 = \frac{10 + 25}{2}$

$= \frac{35}{2} = 17.5$

58. Which central tendency is obtained by the abscissa of point of intersection of less than type and more than type ogives ?

Ans :

Median.

59. What is abscissa of the point of intersection of the "Less than type" and of the "More than type" cumulative frequency curve of a grouped data ?

Ans :

The abscissa of the point of intersection of the "Less than type" and "More than type" cumulative frequency curve of a grouped data is median.

60. Find the mean of the data using an empirical formula when it is given that mode is 50.5 and median in 45.5.

Ans : [Board Term-1 2015]

Mode, $M = 50.5$

Median, $M_d = 45.5$

Now $3M_d = M_o + 2M$

$3 \times 45.5 = 50.5 + 2M$

Mean, $M = \frac{136.5 - 50.5}{2} = 43$

Hence mean is 43.

61. Find the mean of first odd multiples of 5.

Ans : [Board Term-1 2012]

The first five odd multiples of 5, according to the problem are : 5, 15, 25, 35, 45

Mean $= \frac{5 + 15 + 25 + 35 + 45}{5} = \frac{125}{5} = 25$

62. Median of a data is 52.5 and its mean is 54, use empirical relationship between three measure of central tendency to find its mode.

Ans : [Board Term-1 2012]

Median $M_d = 52.5$

and mean $M = 54$

Now $3M_d = M_o + 2M$

$3 \times 52.5 = M_o + 2 \times 54$

Mode $M_o = 157.5 - 108 = 49.5$

TWO MARKS QUESTIONS

63. Find the mean the following distribution :

Class	3-5	5-7	7-9	9-11	11-13
Frequency	5	10	10	7	8

Ans : [Board 2020 Delhi Standard]

Class	Frequency (f_i)	Mid-Value (x_i)	$f_i x_i$
3-5	5	4	20
5-7	10	6	60
7-9	10	8	80
9-11	7	10	70
11-13	8	12	96
	$\sum f_i = 40$		$\sum f_i x_i = 326$

Mean $M = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15$

64. Find the mode of the following data :

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

Ans : [Board 2020 Delhi Standard]

Class 60-80 has the maximum frequency 12, therefore this is model class.

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

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

$= 60 + \frac{12 - 10}{2 \times 12 - 10 - 6} \times 20$

$= 60 + \frac{2 \times 20}{24 - 16}$

$= 60 + \frac{40}{8} \quad = 60 + 5$

$= 65$

65. The mode of the following frequency distribution is 36. Find the missing frequency f.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	8	10	f	16	12	6	7

Ans : [Board 2020 OD Basic]

Mode is 36 which lies in class 30-40, therefore this is model class.

Here, $f_0 = f$, $f_2 = 16$, $f_2 = 12$, $l = 30$ and $h = 10$

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

$36 = 30 + \frac{16 - f}{2 \times 16 - f - 12} \times 10$

$$6 = \frac{16-f}{20-f} \times 10$$

$$120 - 6f = 160 - 10f$$

$$4f = 40 \Rightarrow f = 10$$

Thus (d) is correct option.

66. Find the median for the given frequency distribution :

Class	40-45	45-50	50-55	55-60	60-65	65-70	70-75
Frequency	2	3	8	6	6	3	2

Ans : [Board 2020 OD Basic]

Class	Frequency	*c.f.*
40-45	2	2
45-50	3	5
50-55	8	13
55-60	6	19
60-65	6	25
65-70	3	28
70-75	2	30
	$N = 30$	

We have $N = 30$; $\frac{N}{2} = 15$

Cumulative frequency just greater than $\frac{N}{2}$ is 19 and the corresponding class is 55-60. Thus median class is 55-60.

Now $l = 55,\ f = 6,\ F = 13,\ h = 5$

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right) \times h$

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

$$= 55 + \frac{5}{3} = 55 + 1.67$$

$$= 56.67$$

67. Find the mean of the following distribution :

Class	10-25	25-40	40-55	55-70	70-85	85-100
Frequency	2	3	7	6	6	6

Ans : [Board 2020 Delhi Basic]

Let $a = 62.5$ be assumed mean.

Class Interval	Frequency (f_i)	*c.f.*	x_i	$U_i = \frac{x-a}{h}$	$f_i u_i$
10-25	2	2	17.5	-3	-6
25-40	3	5	32.5	-2	-6
40-55	7	12	47.5	-1	-7
55-70	6	18	62.50= a	0	0
70-85	6	24	77.5	1	6
85-100	6	30	92.5	2	12
	$\sum f_i = 30$				$\sum f_i u_i = -1$

Mean, $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$$= 62.5 + \frac{-1}{30} \times 15$$

$$= 62.5 - \frac{1}{2} = 62.5 - 0.5 = 62$$

68. Find the mean of the following data :

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	20	35	52	44	38	31

Ans :

Let $a = 70$ be assumed mean.

C.I.	Frequency f	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
0-20	20	10	-3	-60
20-40	35	30	-2	-70
40-60	52	50	-1	-52
60-80	44	70	0	0
80-100	38	90	1	38
100-120	31	110	2	62
	$\sum f_i = 220$			$\sum f_i u_i = -82$

Mean, $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$$= 70 + \frac{(-82)}{220} \times 20$$

$$= 70 - \frac{82}{11} = 70 - 7.45 = 62.55$$

69. Find the mode of the following frequency distribution.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70

Frequency	8	10	10	16	12	6	7

Ans : [Board 2019 Delhi]

Class 30-40 has the maximum frequency 16, therefore this is model class.

We have $l = 30, f_0 = 10, f_1 = 16, f_2 = 12, h = 10$

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

$$= 30 + \left(\frac{16 - 10}{2 \times 16 - 10 - 12}\right) \times 10$$

$$= 30 + \left(\frac{6}{32 - 22}\right.$$

$$= 30 + \left(\frac{6}{10}\right) \times 10$$

$$= 30 + 6 = 36$$

70. The data regarding marks obtained by 48 students of a class in a class test is given below. Calculate the modal marks of students.

Marks obtained	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
Number of students	1	0	2	0	0	10	25	7	2	1

Ans : [Board Term-1, 2015]

Class 30-35 has the maximum frequency 25, therefore this is model class.

Now $l = 30,\ f_1 = 25\ \ f_0 = 10\ ,\ f_2 = 7,\ h = 5$

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

$$= 30 + \frac{25 - 10}{50 - 10 - 7} \times 5$$

$$= 30 + 2.27 \text{ or } 32.27 \text{ approx.}$$

71. Find the value of λ, if the mode of the following data is 20 :

15, 20, 25, 18, 13, 15, 25, 15, 18, 17, 20, 25, 20, λ, 18.

Ans : [Board Term-1, 2015]

First we prepare the following table as discrete frequency distribution.

x_i	f_i
13	1
15	3
17	1
18	3
20	3
λ	1
25	3

Frequency of 20 must be highest to be mode of the frequency distribution, $\lambda = 20$.

72. The mean and median of 100 observation are 50 and 52 respectively. The value of the largest observation is 100. It was later found that it is 110. Find the true mean and median.

Ans : [Board Term-1 2016]

Mean, $$M = \frac{\sum fx}{\sum f}$$

$$50 = \frac{\sum fx}{100}$$

$$\sum fx = 5000$$

Correct, $$\sum fx' = 5000 - 100 + 110$$

$$= 5010$$

Correct Mean $$= \frac{5010}{100}$$

$$= 50.1$$

Median will remain same i.e median is 52.

73. Find the arithmetic mean of the following frequency distribution :

x_i	3	4	5	7	10
f_i	3	4	8	5	10

Ans : [Board Term-1, 2015]

We prepare the following table to fine mean.

x_i	f_i	$f_i x_i$
3	3	9
4	4	16
5	8	40
7	5	35
10	10	100
Total	$\sum f_i = 30$	$\sum f_i x_i = 200$

Mean, $$M = \frac{\sum f_i x_i}{\sum f_i} = \frac{200}{30} = 6.67$$

74. Given below is the distribution of weekly pocket money received by students of a class. Calculate the

pocket money that is received by most of the students.

Pocket Money (in Rs.)	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Number of students.	2	2	3	12	18	5	2

Ans : [Board Term-1 2015]

Class Interval	Frequency
0-20	2
20-40	2
40-60	3
60-80	12
80-100	18
100-120	5
120-140	2
Total	44

Class 80-100 has the maximum frequency 18, therefore this is model class.

We have $l = 80,\ f_1 = 18,\ f_2 = 5,\ f_0 = 12\ ,\ h = 20$

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

$$= 80 + \left(\frac{18 - 12}{36 - 12 - 5}\right) \times 20$$

$$= 80 + \frac{6}{19} \times 20$$

$$= 80 + 6.31$$

$$= 86.31$$

75. Find the mean of the following distribution :

Class interval	0-6	6-12	12-18	18-24	24-30
Frequency	5	4	1	6	4

Ans : [Board Term-1 2015]

x_i	f_i	$f_i x_i$
3	5	15
9	4	36
15	1	15
21	6	126
27	4	108
Total	$\sum f_i = 20$	$\sum f_i x_i = 300$

Mean $$M = \frac{\sum f_i x_i}{\sum f_i} = \frac{300}{20} = 15$$

76. The following table gives the life time in days of 100 bulbs :

Life time in days	Less than 50	Less than 100	Less than 150	Less than 200	Less than 250	Less than 300
Number of Bulbs	8	23	55	81	93	100

Change the above distribution as frequency distribution.

Ans : [Board Term-1 2012]

Life time in days (Class Interval)	Number of Bulbs (Frequency)
0-50	8
50-100	15
100-150	32
150-200	26
150-200	12
150-200	7
Total	100

77. 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

Ans : [Board Term-1 2016]

We have $$x_1 = 5 + 7 = 12$$

$$x_2 = 18 - x_1 = 18 - 12 = 6$$

$$x_3 = 18 + 5 = 23$$

and $x_4 = 30 - x_3 = 30 - 23 = 7$

78. Calculate the median from the following data :

Marks	0-10	10-20	20-30	30-40	40-50
Number of Students	5	15	30	8	2

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table to find median class.

Marks	No. of students	c.f.
0-10	5	5
10-20	15	20
20-30	30	50
30-40	8	58
40-50	2	60
	$N = 60$	

We have $N = 60$; $\frac{N}{2} = 30$

Cumulative frequency just greater than $\frac{N}{2}$ is 50 and the corresponding class is 20-30. Thus median class is 20-20.

Now $l = 20,\ f = 30,\ F = 20,\ h = 10$

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right) \times h$

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

$= 20 + \frac{100}{30} = 20 + \frac{10}{3}$

$= 20 + 3.33$

Thus $Md = 23.33$

79. Find the sum of the lower limit of the median class and the upper limit of the modal class :

Classes	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	1	3	5	9	7	3

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table to find median class.

Class	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	1	3	5	9	7	3
Cumulative Frequency	1	4	9	18	25	28

We have $N = 28$; $\frac{N}{2} = \frac{28}{2} = 14$

Cumulative frequency just greater than $\frac{N}{2}$ is 18 and the corresponding class is 40 - 50. Thus median class is 40-50.

Lower limit is 40 and upper limit is 5. Their sum is $= 40 + 50 = 90$

80. Write the relationship connecting three measures of central tendencies. Hence find the median of the give data if mode is 24.5 and mean is 29.75.

Ans : [Board Term-1 2012]

Mode, $M_o = 24.5$

and mean, $M = 29.75$

The relationship connecting measures of central tendencies is,

$3M_d = M_o + 2M$

Thus $3M_d = 24.5 + 2 \times 59\ 50$

$= 24.5 + 59.50 = 84.0$

Median $M_d = \frac{84}{3} = 28$

81. The following distribution shows the marks scored by 140 students in an examination. Calculate the mode of the distribution :

Marks	0-10	10-20	20-30	30-40	40-50
Number of students	20	24	40	36	20

Ans : [Board Term-1 2012]

Class 20-30 has the maximum frequency 40, therefore this is model class.

Here, $l = 20, f_1 = 40, f_0 = 24, f_2 = 36, h = 10$

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

$= 20 + \frac{(40 - 24)}{80 - 24 - 36} \times 10$

$= 20 + \frac{16 \times 10}{20} = 28$

82. Find the unknown entries a, b, c, d in the following

distribution of heights of students in a class :

Height (in cm)	Frequency	Cumulative Frequency
150-155	12	12
155-160	a	25
160-165	10	b
165-170	c	43
170-175	5	48
175-180	2	d

Ans : [Board Term-1 2012]

From the table,

$$12 + a = 25 \Rightarrow a = 25 - 12 = 13$$

$$25 + 10 = b \Rightarrow b = 35,$$

$$b + c = 43 \Rightarrow c = 43 - b = 13 - 35 = 8$$

and $48 + 2 = d \Rightarrow d = 50$

83. Find the mode of the following distribution :

Classes	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	25	34	50	42	38	14

Ans :

Class 35-40 has the maximum frequency 50, therefore this is model class.

Now $l = 35,\ f_1 = 50,\ f_2 = 42,\ f_0 = 34,\ h = 5$

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

$$= 35 + \frac{50 - 34}{100 - 34 - 42} \times 5$$

$$= 35 + \frac{16 \times 5}{24} = 38.33$$

84. Find x and y from the following cumulative frequency distribution :

Classes	Frequency	c.f.
0-8	15	15
8-16	x	28
16-24	15	43
24-32	18	y
32-40	09	70

Ans : [Board Term-1 2012]

From the cumulative frequency distribution,

$$15 + x = 28 \Rightarrow x = 28 - 15 = 13$$

and $$43 + 18 = y \Rightarrow y = 61$$

Hence, $$x = 13 \text{ and } y = 61$$

85. The frequency distribution of agricultural holdings in a village below :

Area of land (in hectare)	1-3	3-5	5-7	7-9	9-11	11-13
Number of families	20	45	80	55	40	12

Find the modal agricultural holding of the village.

Ans : [Board Term-1 2012]

Class 5-7 has the maximum frequency 80, therefore this is model class.

Here $l = 5, f_1 = 80, f_0 = 45,\ h = 2,\ f_2 = 55$

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

$$= 5 + \frac{80 - 45}{160 - 45 - 55} \times 2 = 5 + \frac{35 \times 2}{60}$$

$$= 6.17$$

86. Write the median class of the following distribution :

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

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table to find median class.

Classes	Frequency	Less than 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
	$N = 50$	

We have $N = 50$; $\frac{N}{2} = 25$

Cumulative frequency just greater than $\frac{N}{2}$ is 26 and the corresponding class is 30-40. Thus median class is 20-20.

87. The following are the ages of 300 patients getting medical treatment in a hospital on a particular day :

Age (in years)	10-20	20-30	30-40	40-50	50-60	60-70
Number of students	60	42	55	70	53	20

Form the "less than type" cumulative frequency distribution table.

Ans : [Board Term-1 2012]

Age	Number of Patients
Less then 20	60
Less then 30	102
Less then 40	157
Less then 50	227
Less then 60	280
Less then 70	300

88. Find the mean of the following data :

Class	Frequency
0.5-5.5	13
5.5-10.5	16
10.5-15.5	22
15.5-20.5	18
20.5-25.5	11

Ans : [Board Term-1 2012]

We prepare following table to find mean.

Class	$x_i = \frac{l_1 + l_2}{2}$	f_i	$f_i x_i$
0.5-5.5	3	13	39
5.5-10.5	8	16	128
10.5-15.5	13	22	286
15.5-20.5	18	18	324
20.5-25.5	23	11	253
	Total	$\sum f_i = 80$	1,030

Mean $\overline{x} = \frac{\sum x_i f_i}{\sum f_i} = \frac{1,030}{80} = 12.9$

89. Find the mean number of plants per house from the following data :

Number of plants	0-2	2-4	4-6	6-8	8-10	10-12	12-14
Number of houses	1	2	1	5	6	2	3

Ans : [Board Term-1 2012]

We prepare following table to find mean.

Class	$x_i = \frac{l_1 + l_2}{2}$	f_i	$f_i x_i$
0-2	1	1	1
2-4	3	2	6
4-6	5	1	5
6-8	7	5	35
8-10	9	6	54
10-12	11	2	22
12-14	13	3	39
	Total	20	162

Mean $M = \frac{\sum f_i x_i}{\sum f_i} = \frac{162}{20} = 8.1$ n189

Mean number of plants per house = 8.1.

90. Given below is a frequency distribution showing the marks by 50 students of a class :

Marks	Number of students
Below 20	17
Below 40	22
Below 60	29
Below 80	37
Below 100	50

Form the distribution table for the above data.

Ans : [Board Term-1 2012]

Class	Frequency
0-20	17
20-40	5
40-60	7
60-80	8
80-100	13
Total	50

91. Find the mode of the following frequency distribution :

Classes	0-6	6-12	12-18	18-24	24-30
Frequency	7	5	10	12	6

Ans : [Board Term-1 2012]

Class 18-24 has the maximum frequency 12, therefore this is model class.

Now $l = 18,\ f_1 = 12,\ f_0 = 10,\ f_2 = 6,\ h = 6$

Mode, $M_o = l + \left(\dfrac{f_1 - f_0}{2f_1 - f_0 - f_2}\right.$

$= 18 + \dfrac{12 - 10}{24 - 10 - 6} \times 6$

$= 18 + 1.5 = 19.5$

92. Find the mean of the following frequency distribution :

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

Ans : [Board Term-1 2012]

We prepare following table to find mean.

Classes	x_i	f_i	$f_i x_i$
0-6	3	7	21
6-12	9	5	45
12-18	15	10	150
18-24	21	12	252
24-30	27	6	162
		$\sum f_i = 40$	$\sum f_i x_i = 630$

Mean $M = \dfrac{\sum f_i x_i}{\sum f_i} = \dfrac{630}{40} = 15.75$

93. The mean of the following frequency distribution is 25. Find the value of p.

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	4	6	10	6	p

Ans : [Board Term-1 2015]

We prepare following table to find mean.

Class-Interval	Mid-Point x_i	f_i	$f_i x_i$
0-10	5	4	20
10-20	15	6	90
20-30	25	10	250
30-40	35	6	210
40-50	45	p	45 p
		$26 + p$	$570 + 45p$

We have $M = \dfrac{\sum f_i x_i}{\sum f_i}$

$25 = \dfrac{570 + 45p}{26 + p}$

$650 + 25p = 570 + 45p$

$650 - 570 = 45p - 25p$

Thus $p = 4$

94. The data regarding the height of 50 girls of class X of a school is given below :

Height (in cm)	120-130	130-140	140-150	150-160	160-170	Total

Number of girls	2	8	12	20	8	50

Change the above distribution to 'more than type' distribution.

Ans : [Board Term-1 2012]

Heights	No. of girls
more than 120	50
more than 130	48
more than 140	40
more than 150	28
more than 160	6

95. Convert the following distribution to more than type, cumulative frequency distribution :

Class	50-60	60-70	70-80	80-90	90-100
Frequency	12	18	10	15	5

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table.

Class	Cumulative Frequency
More than 50	60
More than 60	48
More than 70	30
More than 80	20
More than 90	5

96. Convert the following cumulative distribution to a frequency distribution :

Height (in cm)	less than 140	less than 145	less than 150	less than 155	less than 160	less than 165
Number of students	4	11	29	40	46	51

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table.

Class	Frequency	Cumulative Frequency
135-140	4	4
140-145	7	11
145-150	18	29
150-155	11	40
155-160	6	46
160-165	5	51

97. Prepare a cumulative frequency distribution of 'more than type' for the following data :

Marks	0-10	10-20	20-30	30-40	40-50
Number of students	3	8	15	7	5

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table.

Marks	Cumulative Frequency
More than 0	38
More than 10	35
More than 20	27
More than 30	12
More than 40	5

98. Change the following distribution to 'more than type' of distribution :

Daily income (in Rs.)	100-120	120-140	140-160	160-180	180-200
Number of students	12	14	8	6	10

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table.

Daily income	No. of workers
More than 100	50
More than 120	38
More than 140	24
More than 160	16
More than 180	10

99. Convert the following data into 'more than type'

distribution :

Class	50-55	55-60	60-65	65-70	70-75	75-80
Frequency	2	8	12	24	38	16

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table.

Class	Frequency
More than 50	100
More than 55	98
More than 60	90
More than 65	78
More than 70	54
More than 75	16

100. Given below is a frequency distribution table showing daily income of 100 workers of a factory :

Daily income of workers (in Rs.)	200-300	300-400	400-500	500-600	600-700
Number of workers	12	18	35	20	15

Convert this table to a cumulative frequency distribution table of 'more than type'.

Ans : [Board Term-1 2016]

Cumulative frequency distribution table (more than type)

Daily income of workers (in Rs.)	Number of workers
More than 200	100
More than 300	88
More than 400	70
More than 500	35
More than 600	15
More than 700	0

101. The given distribution shows the number of runs scored by the batsmen in inter-school cricket matches :

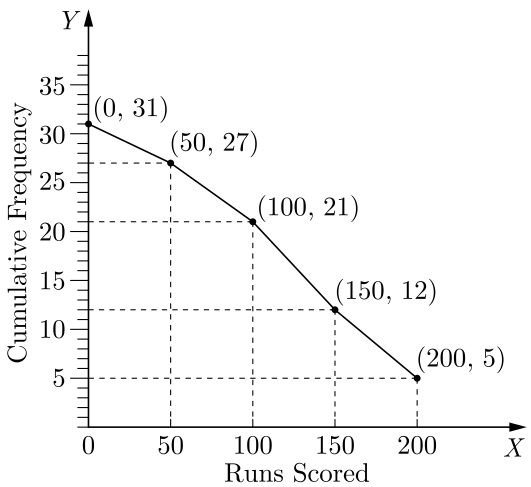
Runs scored	0-50	50-100	100-150	150-200	200-250
Number of batsmen	4	6	9	7	5

Draw a 'more than type' ogive for the above data .

Ans : [Board Term-1 2015]

Units on $x-$ axis 1 cm $= 50$, y-axis 1cm $= 5$

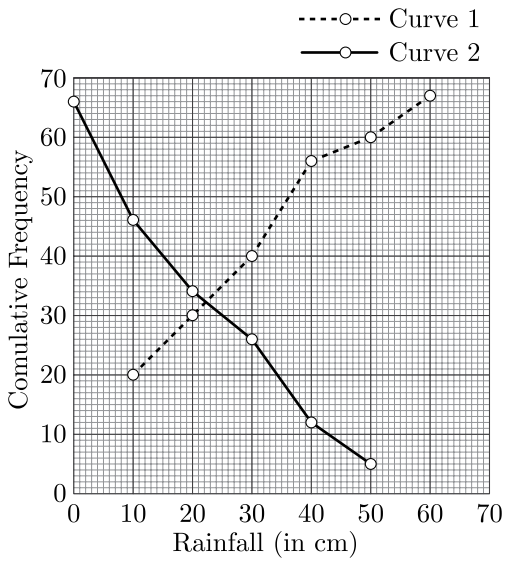
More than	*c.f.*
0	31
50	27
100	21
150	12
200	5



THREE MARKS QUESTIONS

102. A TV reporter was given a task to prepare a report on the rainfall of the city Dispur of Indian in a particular year. After collecting the data, he analysed the data and prepared a report on the rainfall of the city, Using this report, he drew the following graph of a particular

time period of 66 days



Based on the above graph, answer the following questions :

(i) Identify less than type ogive and more than type ogive from the given graph.

(ii) Find the median rainfall of Dispur.

(iii) Obtain the Mode of the data if mean rainfall is 23.4 cm

Ans : [Board 2020 SQP Standard]

(i) Curve-1 shows less than ogive and curve-2 shows more than ogive.

(ii) The abscissa of intersecting point of less than and more than ogive give the median. Thus median is 21 cm.

(iii) Mode of data,

$$M_o = 3M_d - 2M$$
$$= 3 \times 21 - 2 \times 23.4$$
$$= 63 - 46.8 = 16.2 \text{ cm}$$

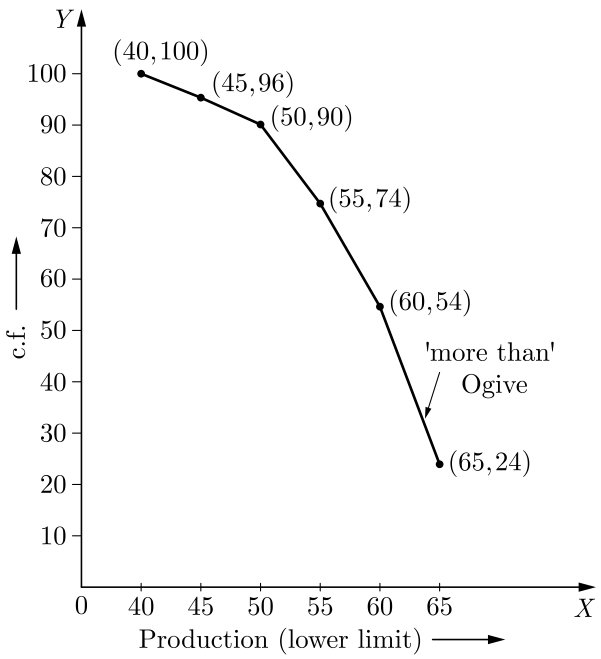
103. The following table gives production yield per hectare (in quintal) of wheat of 100 farms of a village :

Production yield/hect.	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

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

Ans : [Board 2020 Delhi STD, OD STD]

Production yield/hectare	*c.f.*
more than 40	100
more than 45	96
more than 50	90
more than 55	74
more than 60	54
more than 65	24



104. Compute the mode for the following frequency distribution:

Size of items (in cm)	0-4	4-8	8-12	12-16	16-20	20-24	24-28
Frequency	5	7	9	17	12	10	6

Ans : [Board 2020 OD Standard]

Class 12-16 has the maximum frequency 17, therefore this is model class.

We have $l = 12$, $f_1 = 17$, $f_0 = 9$, $f_2 = 12$ and $h = 4$

$$\text{Mode} \quad M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$
$$= 12 + \left(\frac{17 - 9}{2 \times 17 - 9 - 12} \times 4\right.$$
$$= 12 + \frac{8 \times 4}{13}$$
$$= 12 + 2.46 = 14.46$$

105. The mean of the following frequency distribution is 18. The frequency f in the class interval 19-21 is

missing. Determine f.

Class interval	11-13	13-15	15-17	17-19	19-21	21-23	23-25
Frequency	3	6	9	13	f	5	4

Ans : [Board 2020 OD Standard]

Class	Class Mark	Frequency	f_ix_i
11-13	12	3	36
13-15	14	6	84
15-17	16	9	144
17-19	18	13	234
19-21	20	f	$20f$
21-23	22	5	110
23-25	24	4	96
	Total	$40+f$	$704+20f$

We have $\sum f_i = 40+f$

$\sum f_ix_i = 704+20f$

Mean, $M = \frac{\sum f_ix_i}{\sum f_i}$

$18 = \frac{704\times 20f}{40+f}$

$720+18f = 704+20f$

$f = 8$

106. Find the mode of the following frequency distribution :

Class	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	3	8	9	10	3	2

Ans : [Board 2020 OD Standard]

Class 30-35 has the maximum frequency 10, therefore this is model class.

Now $l = 30,\ f_0 = 9,\ f_1 = 10,\ f_2 = 3$ and $h = 5$

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

$= 30+\left(\frac{10-9}{2\times 10-9-3}\right)\times 5$

$= 30+\frac{5}{8}$

$= 30+0.625 = 30.625$

107. The marks obtained by 110 students in an examination are given below

Marks	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Number of Students	14	16	28	23	18	8	3

Find the mean marks of the students.

Ans : [Board 2019 OD Standard]

Marks	f	x_i	$u_i=\frac{x_i-a}{h}$	f_iu_i
30-35	14	32.5	-3	-42
35-40	16	37.5	-2	-32
40-45	28	42.5	-1	-28
45-50	23	47.5	0	0
50-55	18	52.5	1	18
55-60	8	57.5	2	16
60-65	3	62.5	3	9
	$\sum f_i = 110$			$\sum f_iu_i = -59$

Let a be assumed mean,

$a = 47.5$

Mean $M = a+\frac{\sum f_iu_i}{N}\times h$

n207

$= 47.5+\frac{(-59)}{110}\times 5$

$= 47.5-2.682 = 44.818$

108. The table below shows the daily expenditure on food of 25 households in a locality. Find the mean daily expenditure on food.

Daily expenditure (in ₹)	100-150	150-200	200-250	250-300	300-350
Number of households	4	5	12	2	2

Ans : [Board 2019 Delhi]

Let $a = 225$ be assumed mean,

Daily Expenditure (in ₹)	No. of household (f_i)	(x_i)	$u_i=\frac{x_i-a}{h}$	f_iu_i
100-150	4	125	-2	-8
150-200	5	175	-1	-5

200-250	12	225	0	0
250-300	2	275	1	2
300-350	2	325	2	4
	$\sum f_i = 25$			$\sum f_i u_i = -7$

Mean, $M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$= 225 + \frac{(-7)}{25} \times 50$

$= 225 - 14 = 211$

Hence, mean of daily expenditure on food is ₹211.

109. The mean of the following distribution is 48 and sum of all the frequency is 50. Find the missing frequencies x and y.

Class	20-30	30-40	40-50	50-60	60-70
Frequency	8	6	x	11	y

Ans : [Board Term-1 2015, 2016]

We prepare following table to find mean.

C.I.	f_i	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
20-30	8	25	-2	-16
30-40	6	35	-1	-6
40-50	x	$45 = a$	0	0
50-60	11	55	1	11
60-70	y	65	2	$2y$
Total	$\sum f_i = 25 + x + y$			$\sum f_i u_i = 2y - 11$

Mean, $M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$48 = 45 + \frac{2y - 11}{50} \times 10$

$48 - 45 = \frac{2y - 11}{5}$

$3 \times 5 = 2y - 11$

$15 = 2y - 11 \Rightarrow y = 13$

Also $\sum f_i = 25 + x + y = 50$

$x + y = 25$

$x = 25 - 13 = 12$

Thus $x = 12$ and $y = 13$

110. Find the mean of the following distribution :

Height (in cm)	Less than 75	Less than 100	Less than 125	Less than 150	Less than 175	Less than 200
No. of students	5	11	14	18	21	28
Height (in cm)	Less than 225	Less than 250	Less than 275	Less than 300		
No. of students	33	37	45	50		

Ans : [Board Term-1 2016]

We prepare following table to find mean.

Class Interval Height (in cm)	Frequency f_i	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
50-75	5	62.5	-5	-25
75-100	6	87.5	-4	-24
100-125	3	112.5	-3	-9
125-150	4	137.5	-2	-8
150-175	3	162.5	-1	-3
175-200	7		0	0
200-225	5	212.5	1	5
225-250	4	237.5	2	8
250-275	8	262.5	3	24
275-300	5	287.5	4	20
	$\sum f_i = 50$			$\sum f_i y_i = -12$

Here, $\sum f_i u_i = -12$; $\sum f_i = 50$, $h = 25$

Mean $M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

$= 187.5 + \frac{-12}{50} \times 25$

$= 187.5 - 6 = 181.5$

111. Following frequency distribution shows the expenditure on milk of 30 households in a locality :

Daily expenditure on milk (Rs.)	0-30	30-60	60-90	90-120	120-150
Number of households	5	6	9	6	4

Find the mode for the above data.

Ans : [Board Term-1 2016]

Class 60-90 has the maximum frequency 9, therefore this is model class.

Here, $l_1 = 60$, $f_1 = 9$, $f_0 = 6$, $f_2 = 6$ and $h = 30$.

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

$$= 60 + \left(\frac{9-6}{2\times 9 - 6 - 6}\right) \times 30$$

$$= 60 + \frac{30 \times 3}{6} = 60 + 15 = 75$$

112. The weekly expenditure of 500 families is tabulated below :

Weekly Expenditure(Rs.)	Number of families
0-1000	150
1000-2000	200
2000-3000	75
3000-4000	60
4000-5000	15

Find the median expenditure.

Ans : [Board Term-1 2015]

We prepare following cumulative frequency table to find median class.

Expenditure	f (families)	c.f.
0-1000	150	150
1000-2000	200	350
2000-3000	75	425
3000-4000	60	485
4000-5000	15	500
	$\sum f = 500$	

We have $N = 500$; $\frac{N}{2} = 250$

Cumulative frequency just greater than $\frac{N}{2}$ is 350 and the corresponding class is 1000-2000. Thus median class is 1000-2000.

Median, $$M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

$$= 1000 + \frac{250 - 150}{200} \times 1000$$

$$= 1000 + 500 = 1{,}500$$

Thus median expenditure is Rs. 1500 per week.

113. Find the median of the following data :

Height (in cm)	Less than 120	Less than 140	Less than 160	Less than 180	Less than 200
Number of students	12	26	34	40	50

Ans : [Board Term-1 2015]

We prepare following cumulative frequency table to find median class.

Height	Frequency	$c.f.$
100-120	12	12
120-140	14	26
140-160	8	34
160-180	6	40
180-200	10	50
Total	$N = 50$	

We have $N = 50$; $\frac{N}{2} = 25$

Cumulative frequency just greater than $\frac{N}{2}$ is 26 and the corresponding class is 120-140. Thus median class is 120-140.

Median, $$M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

$$= 120 + \left(\frac{25 - 12}{14}\right) \times 20$$

$$= 120 + \frac{260}{14}$$

$$= 120 + 18.57$$

$$= 138.57$$

114. The mean of the following distribution is 314. Determine the missing frequency x.

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	5	x	10	12	7	8

Ans : [Board Term-1 2016]

We prepare following table to find mean.

C.I.	x	f	$u_i = \frac{x-f}{h}$	$f_i u_i$
1-10	5	5	-3	-15
10-20	15	x	-2	$-2x$
20-30	25	10	-1	-10
30-40	35	12	0	0
40-50	45	7	1	7
50-60	55	8	2	16
Total		$42+x$		$-2x$-2

Let mid point of class 30-40 be assumed mean a.

$$a = 35$$

$$\text{Mean} \quad M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$$

$$31.4 = 35 + \frac{-2x-2}{42+x} \times 10$$

$$(2x+2)10 = (42+x)(3.6)$$

$$20x + 20 = 151.2 + 3.6x$$

$$16.4x = 131.2 \Rightarrow x = 8$$

115. Calculate the mean of the following frequency distribution :

Class	10-30	30-50	50-70	70-90	90-110
Frequency	15	18	25	10	2

Ans :

We prepare following table to find mean.

C.I.	f_i	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
10-30	15	20	-2	-30
30-50	18	40	-1	-18
50-70	25	$60 = a$	0	0
70-90	10	80	1	10
90-110	2	100	2	4
Total	$\sum f = 70$			$\sum f_i u_i = -34$

Let mid point of class 50-60 be assumed mean a.

$$a = 60$$

$$\text{Mean} \quad M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$$

$$= 60 + \frac{-34}{70} \times 20$$

$$= 60 - 9.71 = 50.29$$

116. Heights of students of class X are given in the following distribution :

Heights (in cm)	150-155	155-160	160-165	165-170	170-175
Number of students	15	8	20	12	5

Find the modal height.

Ans : [Board Term-1 2015]

Class 160-165 has the maximum frequency 20, therefore this is model class.

Now $l = 160,\ f_1 = 20,\ f_0 = 8,\ f_2 = 12,\ h = 5$

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

$$= 160 + \left(\frac{20-8}{40-8-12}\right) \times 5$$

$$= 160 + \left(\frac{12}{20}\right) \times 5$$

$$= 163$$

Thus modal height is 163 cm.

117. A school conducted a test (of 100 marks) in English for students of Class X. The marks obtained by students are shown in the following table :

Marks obtained	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Number of students	1	2	4	15	15	25	15	10	2	1

Find the modal marks.

Ans : [Board Term-1 2015]

Class 50-60 has the maximum frequency 25, therefore this is model class.

Here $l = 50,\ f_1 = 25,\ f_0 = 15,\ f_2 = 15,\ h = 10$

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

$$= 50 + \frac{25-15}{50-15-15} \times 10$$

$$= 50 + \frac{10}{20} \times 10$$

$$= 50 + 10 \ = 55$$

118. The following frequency distribution shows the number of runs scored by some batsman of India in one-day cricket matches :

Run scored	2000-4000	4000-6000	6000-8000	8000-10000	10000-12000
Number of batsmen	9	8	10	2	1

Find the mode for the above data.

Ans : [Board Term-1 2015]

Class 6000-8000 has the maximum frequency 10, therefore this is model class.

Here $f_0 = 8,\ f_1 = 10,\ f_2 = 2,\ h = 2000$, and $l = 6000$

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

$$= 6000 + \left(\frac{10 - 8}{20 - 8 - 2}\right) \times 2000$$

$$= 6000 + \frac{2}{10} \times 2000$$

$$= 6000 + 400$$

$$= 6400$$

119. A group of students conducted a survey of their locality to collect the data regarding number of plants and recorded it in the following table :

Number of plants	0-3	3-6	6-9	9-12	12-15
Number of houses	2	4	5	1	2

Find the mode for the above data.

Ans : [Board Term-1 2015]

Class 6-9 has the maximum frequency 5, therefore this is model class.

Now $l_1 = 6,\ f_1 = 5,\ f_0 = 4,\ f_2 = 1,\ h = 3$

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

$$= 6 + \frac{5 - 4}{10 - 4 - 1} \times 3$$

$$= 6 + \frac{1}{5} \times 3$$

$$= 6 + 0.6 \ = 6.6$$

120. If the median for the following frequency distribution is 28.5, find the value of x and y :

Class	Frequencies
0-10	5
10-20	x
20-30	20
30-40	15
40-50	y
50-60	5
Total	60

Ans : [Board Term-1 2013]

We prepare following cumulative frequency table to find median class.

C.I.	f	$c.f.$
0-10	5	5
10-20	x	$x+5$
20-30	20	$x+25$
30-40	15	$x+40$
40-50	y	$x+y+40$
50-60	5	$x+y+45$
	$\sum f = 60$	

Since, median is 28.5 which lies between 20-30. Thus model class is 20-30.

From table $$N = x + y + 45$$

$$60 = x + y + 45$$

$$x + y = 60 - 45 = 15 \qquad ...(1)$$

Median, $$M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

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

$$8.5 = \frac{25 - x}{2}$$

$$25 - x = 17 \Rightarrow x = 25 - 17 = 8$$

From (1), $$y = 15 - 8 = 7$$

Hence, $x = 8$ and $y = 7$

121. If the mean of the following data is 14.7, find the

values of p and q.

Class	0-6	6-12	12-18	18-24	24-30	30-36	36-42	Total
Frequency	10	p	4	7	q	4	1	40

Ans : [Board Term-1 2013]

Class	x_i	f_i	$f_i x_i$
0-6	3	10	30
6-12	9	p	$9p$
12-18	15	4	60
18-24	21	7	147
24-30	27	q	$27q$
30-36	33	4	132
36-42	39	1	39
	Total	$\sum f_i =$ $26+p+q=40$	$\sum f_i x_i =$ $408+9p+27q$

We have $\sum f_i = 40,$

$$26+p+q = 40$$

$$p+q = 14 \quad ...(1)$$

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

$$14.7 = \frac{408+9p+27q}{40}$$

$$588 = 408+9p+27q$$

$$180 = 9p+27q$$

$$p+3q = 20 \quad ...(2)$$

Subtracting equation (1) from (2) we have,

$$2q = 6 \Rightarrow q = 3$$

Substituting this value of q in equation (2) we get

$$p = 14-q = 14-3 = 11$$

Hence, $p = 11,\ q = 3$

122. Find the mean and mode of the following frequency distribution :

Classes	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	3	8	10	15	7	4	3

Ans : [Board Term-1 2013]

We prepare following table to find mean.

Classes	x_i	f_i	$f_i x_i$
0-10	5	3	15
10-20	15	8	120
20-30	25	10	250
30-40	35	15	525
40-50	45	7	315
50-60	55	4	220
60-70	65	3	195
		$\sum f_i = 50$	$\sum f_i x_i = 1640$

Mean $$M = \frac{\sum f_i x_i}{\sum f_i} = \frac{1640}{50} = 32.8$$

Class 30-40 has the maximum frequency 35, therefore this is model class.

Here $l = 30,\ f_1 = 15,\ f_2 = 7,\ f_0 = 10,\ h = 10$

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

$$= 30 + \frac{15-10}{30-10-7} \times 10$$

$$= 30 + \frac{5}{13} \times 10$$

$$= 30 + \frac{50}{13}$$

$$= 30 + 3.85 = 33\ 85$$

123. Find the mean and median for the following data :

Class	0-10	10-20	20-30	30-40	40-50
Frequency	8	16	36	34	6

Ans : [Board Term-1 2011]

We prepare following cumulative frequency table to find median class.

Class	x_i (class marks)	f_i	$f_i x_i$	$c.f.$
0-10	5	8	40	8
10-20	15	16	240	24
20-30	25	36	900	60
30-40	35	34	1190	94
40-50	45	6	270	100
		$\sum f_i = 100$	$\sum f_i x_i = 2640$	

Mean $$M = \frac{\sum f_i x_i}{\sum f_i} = \frac{2640}{100} = 26.4$$

We have $N = 100 \; ; \; \frac{N}{2} = 50$

Cumulative frequency just greater than $\frac{N}{2}$ is 60 and the corresponding class is 20-30. Thus median class is 20-30.

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$

$= 20 + \frac{50 - 24}{36} \times 10$

$= 20 + 7.22 = 27.22$

124. If the median of the following data is 240, then find the value of f :

Classes	0-100	100-200	200-300	300-400	400-500	500-600	600-700
Frequency	15	17	f	12	9	5	2

Ans : [Board Term-1 2011]

We prepare following cumulative frequency table to find median class.

Classes	f_i	*c.f.*
0-100	15	15
100-200	17	32
200-300	f	32+f
300-400	12	44+f
400-500	9	53+f
500-600	5	58+f
600-700	2	60+f

From table, $N = 60 + f \Rightarrow \frac{N}{2} = \frac{60 + f}{2}$

Since median is 240 which lies between class 200-300. Thus median class is 200-300.

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$

$240 = 200 + \left[\frac{\frac{60+f}{2} - 32}{f}\right] \times 100$

$40 = \left[\frac{60 + f - 64}{2f}\right. \times 100$

$8f = 10f - 40$

$2f = 40 \Rightarrow f = 20$

125. The following table shows the weights (in gms) of a sample of 100 apples, taken from a large consignment :

Weight (in gms)	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
No. of Apples	8	10	12	16	18	14	12	10

Find the median weight of apples.

Ans : [Board Term-1 2011]

C.I.	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
f	8	10	12	16	18	14	12	10
c.f.	8	18	30	46	64	78	90	100

We have $N = 100 \; ; \; \frac{N}{2} = 50$

Cumulative frequency just greater than $\frac{N}{2}$ is 64 and the corresponding class is 90-100. Thus median class is 90-100.

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$

$= 90 + \left(\frac{50 - 46}{18}\right.$

$= 90 + \frac{40}{18} = 92.2$

$= 92.2$ gm.

Thus median weight is 92.2.

126. Weekly income of 600 families is given below :

Income (in Rs.)	0-1000	1000-2000	2000-3000	3000-4000	4000-5000	5000-6000
No. of Families	250	190	100	40	15	5

Find the median.

Ans :

We prepare following cumulative frequency table to find median class.

Income	No. of Families	*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
	$N = 600$	

We have $N = 600$; $\frac{N}{2} = 300$

Cumulative frequency just greater than $\frac{N}{2}$ is 440 and the corresponding class is 1000-2000. Thus median class is 1000-2000.

$$\text{Median}, \quad M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

$$\text{Median} = 1000 + \left(\frac{300 - 250}{190}\right) \times 1000$$

$$= 1000 + \frac{50}{190} \times 1000$$

$$= 1000 + \frac{5000}{19}$$

$$= 1000 + 263.16$$

$$= 1263.16$$

$$\text{Median} = \text{Rs. } 1263.16$$

127. Find the mean of the following distribution by step deviation method :

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	5	13	20	15	7	5

Ans : [Board Term-1 2011]

Class	x_i (Class Marks)	$u_i = \frac{x_i - a}{h}$	f_i	$f_i u_i$
0-10	5	-3	5	-15
10-20	15	-2	13	-26
20-30	25	-1	20	-20
30-40	35	0	15	0
40-50	45	1	7	7
50-60	55	2	5	10
	Total		$\sum f_i = 65$	$\sum f_i u_i = -44$

Let assumed mean, $a = 35$ and given $h = 10$.

$$\text{Mean}, \quad M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$$

$$= 35 + \frac{-44}{65} \times 10$$

$$= 35 - 6.76 = 28.24$$

128. The mean of the following distribution is 53. Find the missing frequency p :

Class	0-20	20-40	40-60	60-80	80-100
Frequency	12	15	32	p	13

Ans : [Board Term-1 2011]

Class	x_i (Class marks)	f_i	$f_i x_i$
0-20	10	12	120
20-40	30	15	450
40-60	50	32	1600
60-80	70	p	$70p$
80-100	90	13	1170
	Total	$\sum f_i = 72 + p$	$\sum f_i x_i = 3340 + 70p$

$$\text{Mean}, \quad \overline{x} = \frac{\sum f_i x_i}{\sum f_i}$$

$$53 = \frac{3340 + 70p}{72 + p}$$

$$3340 + 70p = 53(72 + p)$$

$$3340 + 70p = 3816 + 53p$$

$$70p - 53p = 3816 - 3340$$

$$17p = 476$$

$$p = \frac{476}{17} = 28$$

129. Find the mean for the following data :

Class	24.5-29.5	29.5-34.5	34.5-39.5	39.5-44.5	44.5-49.5	49.5-54.5	54.5-59.5
Frequency	4	14	22	16	6	5	3

Ans : [Board Term-1 2011]

We prepare following table to find mean.

Class	Class marks (x_i)	f_i	$f_i x_i$
24.5-29.5	27	4	108
29.5-34.5	32	14	448
34.5-39.5	37	22	814
39.5-44.5	42	16	672
44.5-49.5	47	6	282
49.5-54.5	52	5	260

54.5-59.5	57	3	171
		$\sum f_i = 70$	$\sum f_i x_i = 2,755$

Mean $M = \dfrac{\sum f_i x_i}{\sum f_i} = \dfrac{2755}{70} = 39.36$

130. Find the mode of following data :

Marks	Below 10	Below 20	Below 30	Below 40	Below 50
Number of students	8	20	45	58	70

Ans :

Class-Interval	Frequency
0-10	8
10-20	12
20-30	25
30-40	13
40-50	12
Total	70

Class 20-30 has the maximum frequency, therefore this is model class.

Now $l = 20,\ f_1 = 25,\ f_2 = 13,\ f_0 = 12,\ h = 10$

Mode, $M_o = l + \left(\dfrac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)h$

$= 20 + \left(\dfrac{25 - 12}{50 - 12 - 13}\right) \times 10$

$= 20 + \dfrac{13}{25} \times 10$

$= 20 + 5.2 = 25.2$

131. Find the mean of the following data :

Class	Less than 20	Less than 40	Less than 60	Less than 80	Less than 100
Frequency	15	37	74	99	120

Ans : [Board Term-1 2011]

We prepare following table to find mean.

C.I.	f_i	x_i	$x_i f_i$
0-20	15	10	150
20-40	22	30	660
40-60	37	50	1850
60-80	25	70	1750
80-100	21	90	1890
	$\sum f_i = 120$		$\sum x_i f_i = 6,300$

Mean $M = \dfrac{\sum f_i x_i}{\sum f_i} = \dfrac{6300}{120} = 52.5$

132. Find the mean of the following data :

Classes	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	6	8	10	12	8	6

Ans : [Board Term-1, 2011, Set-66]

We prepare following table to find mean.

Classes	Frequency	Mid points	$f_i x_i$
0-20	6	10	60
20-40	8	30	240
40-60	10	50	500
60-80	12	70	840
80-100	8	90	720
100-120	6	110	660
	$\sum f_i = 50$		$\sum f_i x_i = 3020$

Mean, $M = \dfrac{\sum x_i f_i}{\sum f_i} = \dfrac{3020}{50} = 60.4$

133. The sum of deviations of a set of values x_1, x_2, x_3, ..., x_n, measured from 50 is -10 and the sum of deviations of the values from 46 is 70. Find the value of n and the mean.

Ans :

We have,

$$\sum_{i=1}^{n}(x_i - 50) = -10 \text{ and } \sum_{i=1}^{n}(x_i - 46) = 70$$

$$\sum_{i=1}^{n} x_i - 50n = -10 \quad \ldots(1)$$

and $$\sum_{i=1}^{n} x_i - 46n = 70 \quad \ldots(2)$$

Subtracting (2) from (1) we get,

$$-4n = -80 \Rightarrow n = 20$$

Substituting this value of n in equation (1) we have

$$\sum_{i=1}^{n} x_i - 50 \times 20 = -10$$

$$\sum_{i=1}^{n} x_i = 990$$

Mean $$M = \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right) = \frac{990}{20} = 49.5$$

Hence, $$n = 20 \text{ and mean } = 49.5$$

134. Prove that $\sum(x_i - \overline{x}) = 0$

Ans :

We have $$\overline{x} = \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)$$

$$n\overline{x} = \sum_{i=1}^{n} x_i$$

Now, $$\sum_{i=1}^{n}(x_i - \overline{x}) = (x_1 - \overline{x}) + (x_2 - \overline{x}) + \ldots + (x_n - \overline{x})$$

$$\sum_{i=1}^{n}(x_i - \overline{x}) = (x_1 + x_2 + \ldots + x_n) - n\overline{x}$$

$$\sum_{i=1}^{n}(x_i - \overline{x}) = \sum_{i=1}^{n} x_i - n\overline{x} = \sum_{i=1}^{n}(x_i - \overline{x})$$

Hence, $$\sum_{i=1}^{n}(x_i - \overline{x}) = 0$$

135. Compute the median from the following data :

Mid-values	115	125	135	145	155	165	175	185	195
Frequency	6	25	48	72	116	60	38	22	3

Ans :

Here, the mid-values are given So, we should first find the upper and lower limits of the various classes. The difference between two consecutive values is $h = 125 - 115 = 10$

$$\text{Lower limit of a class} = \text{Mid-value} - \frac{h}{2}$$

$$\text{Upper limit} = \text{Mid- value} + \frac{h}{2}$$

Mid-value	Class Groups	Frequency	Cumulative Frequency
115	110-120	6	6
125	120-130	25	31
135	130-140	48	79
145	140-150	72	151
155	150-160	116	267
165	106-170	60	327
175	170-180	38	365
185	180-190	22	387
195	190-200	3	390

Now $$N = 390\,;\ \tfrac{N}{2} = 195$$

Cumulative frequency just greater than $\frac{N}{2}$ is 36 and the corresponding class is 150-160. Thus median class is 150-160.

Here, $$l = 150,\ f = 116,\ h = 10,\ F = 151$$

Median, $$M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

$$= 150 + \frac{195 - 151}{116} \times 10$$

$$= 153.8$$

136. The mean of n observations is $\overline{x}$, if the first term is increased by 1, second by 2 and so on. What will be the new mean ?

Ans :

I term $+1$
II term $+2$
III term $+3$
n terms $+n$

The mean of the new numbers is

$$\overline{x} + \frac{\frac{n(n+1)}{2}}{n} = \overline{x} = \frac{(n+1)}{2}$$

137. The mode of a distribution is 55 and the modal class is 45-60 and the frequency preceding the modal class is 5 and the frequency after the modal class is 10. Find the frequency of the modal class.

Ans :

Mode, $$M_o = 55$$

$$\text{Modal class} = 45 - 60$$

Frequency of the class preceding,

$$f_1 = 5$$

Frequency of the class succeeding the modal class,

$$f_2 = 10$$

Let the frequency of modal class be f.

Mode $$M_o = l + \frac{f - f_1}{2f - f_1 - f_2} \times h$$

$$55 = 45 + \frac{f-5}{2f-5-10} \times 15$$

$$10 = \left(\frac{f-5}{2f-15}\right) \times 15$$

$$\frac{10}{15} = \frac{f-5}{2f-15}$$

$$\frac{2}{3} = \frac{f-15}{2f-15}$$

$$4f - 30 = 3f - 15$$

$$4f - 3f = -15 + 30 \Rightarrow f = 15$$

FOUR MARKS QUESTIONS

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

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

Ans : [Board 2020 Delhi OD STD]

We prepare cumulative frequency table as given below.

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

From table we have

$$76 + x + y = 100$$

$$x + y = 100 - 76 = 24 \quad ...(1)$$

Here median is 525 which lies between class $500 - 600$. Thus median class is 500-600.

Median, $$M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$$

$$525 = 500 + \left[\frac{\frac{100}{2} - (36 + x)}{20}\right] \times 100$$

$$25 = (50 - 36 - x)5$$

$$14 - x = \frac{25}{5} = 5$$

$$x = 14 - 5 = 9$$

Substituting the value of x is equation (1), we get

$$y = 24 - 9 = 15$$

Hence, $x = 9$ and $y = 15$

139. If the median of the following frequency distribution

is 32.5. Find the values of f_1 and f_2.

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

Ans : [Board 2019 Delhi]

Class	Frequency (f)	Cumulative Frequency (cf)
0-10	f_1	f_1
10-20	5	f_1+5
20-30	9	f_1+14
30-40	12	f_1+26
40-50	f_2	f_1+f_2+26
50-60	3	f_1+f_2+29
60-70	2	f_1+f_2+31
	$N=\sum f=40$	

Now, $f_1+f_2+31 = 40$

$$f_1+f_2 = 9$$

$$f_2 = 9-f_1 \quad ...(1)$$

Since median is 32.5, which lies in 30-40, median class is 30-40.

Here $l=30, \frac{N}{2}=\frac{40}{2}=20, f=12$ and $F=14+f_1$

Now, median $= 3.25$

$$l+\left(\frac{\frac{N}{2}-cf}{f}\right)\times h = 32.5$$

$$30+\left(\frac{20-(14+f_1)}{12}\right)\times 10 = 32.5$$

$$\left(\frac{6-f_1}{12}\right)\times 10 = 2.5$$

$$\frac{60-10f_1}{12} = 2.5$$

$$60-10f_1 = 30$$

$$10f_1 = 30 \Rightarrow f_1 = 3$$

From equation (1), we get $f_2 = 9-3 = 6$

Hence, $f_1 = 3$ and $f_2 = 6$

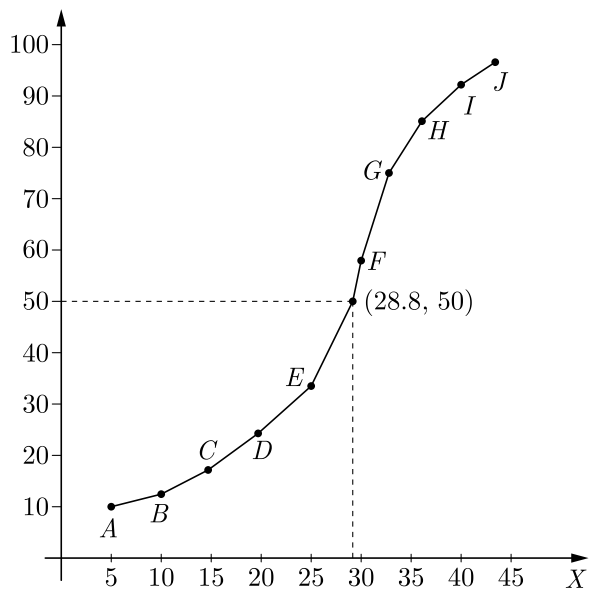
140. The marks obtained by 100 students of a class is an examination are given below:

Marks	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of Students	2	5	6	8	10	25	20	18	4	2

Draw 'a less than' type cumulative frequency curves (ogive). Hence find median.

Ans : [Board 2019 Delhi]

Marks	No of students	cf
Less than 5	2	2
Less than 10	5	7
Less than 15	6	13
Less than 20	8	21
Less than 25	10	31
Less than 30	25	56
Less than 35	20	76
Less than 40	18	94
Less than 45	4	98
Less than 50	2	100



From graph, $\frac{N}{2} = \frac{100}{2} = 50$

Now, locate the point on the ogive where ordinate is 50. The x-coordinate corresponding to this ordinate is 28.8. Therefore, the required median on the graph is 28.8.

141. The arithmetic mean of the following frequency distribution is 53. Find the value of k.

Class	0-20	20-40	40-60	60-80	80-100
Frequency	12	15	32	k	13

Ans : [Board 2019 Delhi]

Class Interval	Class Marks (x_i)	Frequency (f_i)	f_ix_i
0-20	10	12	120
20-40	30	15	450
40-60	50	32	1600
60-80	70	k	$70k$
80-100	90	13	1170
	Total	$72+k$	$3340+70k$

Mean, $M = \frac{\sum f_ix_i}{\sum f_i}$

$$53 = \frac{3340+70k}{72+k}$$

$$53(72+k) = 3340+70k$$

$$3816+53k = 3340+70k$$

$$70k-53k = 3816-3340$$

$$17k = 476 \Rightarrow k = 28$$

Hence, value of k is 28.

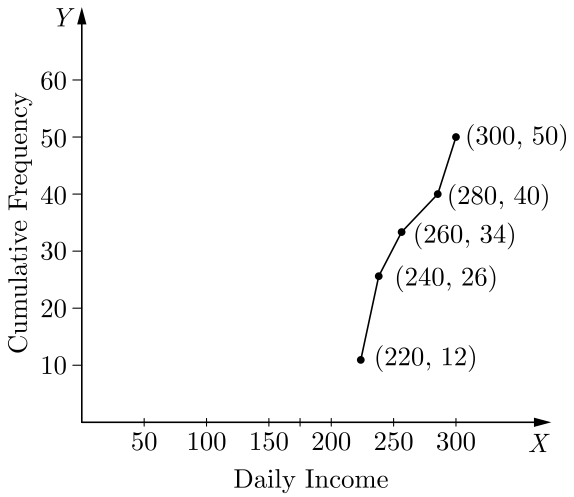
142. The following distribution gives the daily income of 50 workers of a factory:

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

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

Ans : [Board 2019 Delhi]

Daily Income (in ₹)	Cumulative Frequency
Less than 220	12
Less than 240	26
Less than 260	34
Less than 280	40
Less than 300	50



143. Find the mode of the following frequency distribution

Class Interval	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	25	34	50	42	38	14

Ans : [Board 2019 OD Standard]

25-30	25
30-35	34
35-40	50
40-45	42
45-50	38
50-55	14

Class 35-40 has the maximum frequency 50, therefore this is model class.

Now, $l = 35$ $f_1 = 50$, $f_0 = 34$, $f_2 = 42$, $h = 5$

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

$$= 35 + \left(\frac{50-34}{2\times 50 - 34 - 42}\right) \times 5$$

$$= 35 + \frac{16\times 5}{24} = 35 + \frac{10}{3}$$

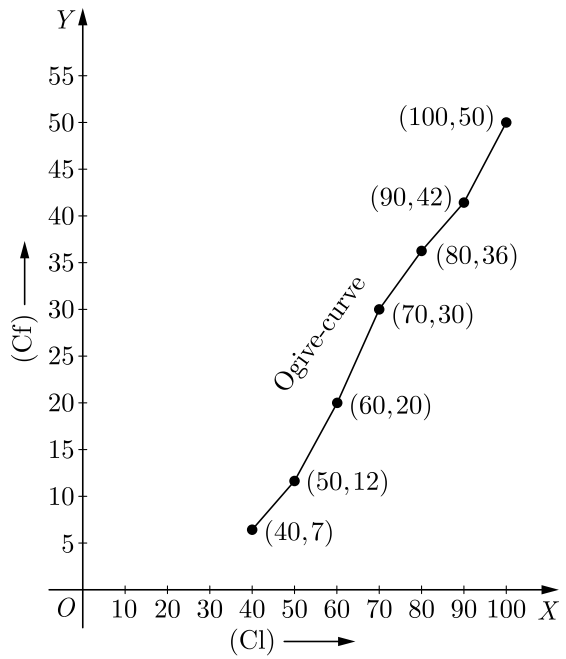
$$= \frac{105+10}{3} = \frac{115}{3} = 38.33$$

144. Change the following data into 'less than type' distribution and draw its ogive:

Class Interval	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	7	5	8	10	6	6	8

Ans : [Board 2019 OD Standard]

Classes	Cumulative frequency
less than 40	7
less than 50	$7+5=12$
less than 60	$12+8=20$
less than 70	$20+10=30$
less than 80	$30+6=36$
less than 90	$36+6=42$
less than 100	$42+8=50$



Scale : at x-axis,1 small division $= 10$ units

at y-axis, 1 small division $= 5$ units

145. The table below show the salaries of 280 persons:

Salary (In thousand ₹)	No. of Persons
5-10	49
10-15	133
15-20	63
20-25	15
25-30	6
30-35	7
35-40	4
40-45	2
45-50	1

Calculate the median salary of the data.

Ans : [Board 2018]

Salary (In thousand ₹)	No. of Persons (f)	c.f.
5-10	49	49
10-15	133	182
15-20	63	245
20-25	15	260
25-30	6	266
30-35	7	273
35-40	4	277
40-45	2	279
45-50	1	280

We have $\frac{N}{2} = \frac{280}{2} = 140$

Commutative frequency greater than just greater than $\frac{N}{2} = 140$ is 182 and the corresponding class is 10-15. Thus median class is 10-15.

Median $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$

$= 10 + \frac{(140-49}{133} \times 5$

$= 10 + \frac{91 \times 5}{133} = 13.42$

Median salary is ₹ 13.42 thousand or ₹ 13420 (approx)

146. The mean of the following distribution is 18. Find the frequency of the class 19-21.

Class	11-13	13-15	15-17	17-19	19-21	21-23	23-25
Frequency	3	6	9	13	f	5	4

Ans : [Board 2018]

Class	Class mark	Frequency (f)	fx_i
11-13	12	3	36
13-15	14	6	84
15-17	16	9	144
17-19	18	13	234
19-21	20	f	$20f$
21-23	22	5	110
23-25	24	4	96
		$40+f$	$704+20f$

Mean, $M = \frac{\Sigma f x_i}{\Sigma f}$

$$18 = \frac{704 + 20f}{40 + f}$$

$$720 + 18f = 704 + 20f \Rightarrow f = 8$$

147. The following distribution gives the daily income of 50 workers of a factory:

Daily Income (in ₹)	100-120	120-140	140-160	160-180	180-200
Number of workers	12	14	8	6	10

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

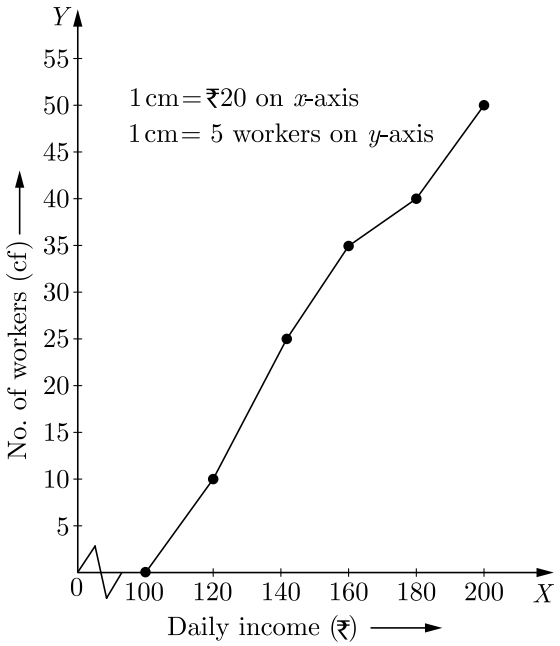
Ans : [Board 2018]

Cumulative frequency distribution table is given below.

Daily Income (in ₹)	Number of Workers (f)	Cumulative Frequency ($c.f.$)
100-120	12	12
120-140	14	26
140-160	8	34
160-180	6	40
180-200	10	50

Cumulative frequency distribution table less than type is

Less than Daily income in (₹)	Number of Workers (f)
100	0
120	12
140	26
160	34
180	40
200	50



148. Literacy rates of 40 cities are given in the following table. It is given that mean literacy rate is 63.5, then find the missing frequencies x and y.

Literacy rate (in %)	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90
Number of cities	1	2	3	x	y	6	8	4	2	3	2

Ans : [Board Term-1 2016]

We prepare following table to find mean.

C.I.	x_i	u_i	f_i	$f_i u_i$
35-40	37.5	-5	1	-5
40-45	42.5	-4	2	-8
45-50	75.5	-3	3	-9
50-55	52.5	-2	x	$-2x$
55-60	57.5	-1	y	$-y$
60-65	$62.5 = a$	0	6	0
65-70	67.5	1	8	8
70-75	72.5	2	4	8
75-80	77.5	3	2	6
80-85	82.5	4	3	12
85-90	87.5	5	2	10
Total			$\sum f_i = 31 + x + y$	$\sum f_i u_i = 22 - 2x - y$

Here, $\sum f_i = 31 + x + y = 40$

$x + y = 9$ ...(1)

$\sum f_i u_i = 22 - 2x - y$

Mean $M = a + \frac{\sum f_i u_i}{\sum f_i} \times h$

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

$2x + y = 14$ ...(2)

Solving equation (1) and (2) we have $x = 5$ and $y = 4$

149. Find the mode of the following frequency distribution :

Class-Interval	f
25-35	7
35-45	31
45-55	33
55-65	17
65-75	11
75-85	1

Ans : [Board Term-1 2015]

Class 44-45 has the maximum frequency 33, therefore this is model class.

Now $l_1 = 45,\ f_0 = 31,\ f_1 = 33\ f_2 = 17,\ h = 10$

Mode, $M_o = l + h\left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right.$

$= 45 + \frac{33 - 31}{66 - 31 - 17} \times 10$

$= 45 + \frac{2}{18} \times 10 = 46.1$

150. On the sports day of a school, 300 students participated. Their ages are given in the following distribution :

Age (in years)	5-7	7-9	9-11	11-13	13-15	15-17	17-19
Number of students	67	33	41	95	36	13	15

Find the mean and mode of the data.

Ans : [Board Term-1 2015]

We prepare following table to find mean.

Age	x_i	f_i	$f_i x_i$
5-7	6	67	402
7-9	8	33	264
9-11	10	41	410
11-13	12	95	1140
13-15	14	36	504
15-17	16	13	208
17-19	18	15	270
		$\sum f_i = 300$	$\sum f_i x_i = 3,198$

Mean, $M = \frac{\sum f_i x_i}{\sum f_i} = \frac{3,198}{300} = 10.66$

Class 11-13 has the maximum frequency 95, therefore this is model class.

Now $l = 11,\ f_1 = 95,\ f_0 = 41,\ f_2 = 36,\ h = 2$

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

$= 11 + \frac{95 - 41}{190 - 41 - 36} \times 2$

$= 11 + \frac{54}{113} \times 2$

$= 11 + 0.95 = 11\ 95$

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

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

Ans : [Board Term-1 2013]

We prepare following cumulative frequency table to find median class.

Class Interval	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7

200-300	x	$7+x$
300-400	12	$19+x$
400-500	17	$36+x$
500-600	20	$56+x$
600-700	y	$56+x+y$
700-800	9	$65+x+y$
800-900	7	$72+x+y$
900-1000	4	$76+x+y$
	$N=100$	

Here median is 525, which lies between class 500-600. Thus median class is 500-600.

Now, $76+x+y = 100$

$$x+y = 100-76 = 24 \quad ...(1)$$

Median, $M_d = l+\left(\frac{\frac{N}{2}-F}{f}\right)h$

$$525 = 500+\left[\frac{\frac{100}{2}-(36+x)}{20}\right]\times 100$$

$$25 = (50-36-x\ 5$$

$$(14-x) = \frac{25}{5}=5$$

$$x = 14-5=9$$

Substituting the value of x in equation (1),

$$y = 24-9=15$$

Hence, $x = 9$ and $y=15$

152. Monthly expenditures on milk in 100 families of a housing society are given in the following frequency distribution :

Monthly expenditure (in Rs.)	0-175	175-350	350-525	525-700	700-875	875-1050	1050-1125
Number of families	10	14	15	21	28	7	5

Find the mode and median for the distribution.

Ans : [Board Term-1 2016]

We prepare following cumulative frequency table to find median class.

C.I.	f	$c.f.$
0-175	10	10
157-350	14	24
350-525	15	39
525-700	21	60
700-875	28	88
875-1050	7	95
1050-1225	5	100
	$N=100$	

We have $N=100$; $\frac{N}{2}=50$

Cumulative frequency just greater than $\frac{N}{2}$ is 60 and the corresponding class is 525-700. Thus median class is 525-700.

Median, $M_d = l+\left(\frac{\frac{N}{2}-F}{f}\right)h$

$$= 525+\frac{50-39}{21}\times 175$$

$$= 525+\frac{11}{21}\times 175$$

$$= 525+91.6$$

$$= 616.6$$

Class 700-875 has the maximum frequency 28, therefore this is model class.

Here $l = 700$, $f_0 = 21$, $f_1 = 28$ $f_2 = 7$, $h = 175$

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

$$= 700+\left(\frac{28-21}{2\times 28-21-7}\right)\times 175$$

$$= 700+\frac{7}{28}\times 175$$

$$= 700+43.75$$

$$= 743.75$$

153. Calculate the average daily income (in Rs.) of the following data about men working in a company :

Daily income (Rs.)	<100	<200	<300	<400	<500
Number of men	12	28	34	41	50

Ans : [Board Term-1 2012]

We prepare following table to find mean.

Class	x_i (class mark)	f_i	$f_i x_i$
0-100	50	12	600
100-200	150	16	2400
20-300	250	6	1500
300-400	350	7	2450
400-500	450	9	4050
		$\sum f_i = 50$	$\sum f_i x_i = 11{,}000$

Mean $M = \frac{\sum x_i f_i}{\sum f_i} = \frac{11000}{50}$

$= 200$

Average daily income is Rs. 220.

154. If the mean of the following frequency distribution is 91, and sum of frequency is 150, find the missing frequency x and y :

Class	0- 30	30-60	60-90	90-120	120-150	150-180
Frequency	12	21	x	52	y	11

Ans : [Board Term-1 2012]

We prepare following table to find mean.

Class	x_i (Class marks)	f_i	$f_i x_i$
0-30	15	12	180
30-60	45	21	945
60-90	75	x	$75x$
90-120	105	52	5460
120-150	135	y	$135y$
150-180	165	11	1815
	Total	$\sum f = x + y + 96 = 150$	$\sum f x_i = 8400 + 75x + 135y$

$96 + x + y = 150$

$x + y = 54$ ...(1)

$\overline{x} = \frac{\sum f_i x_i}{\sum f_i}$

$91 = \frac{8400 + 75x + 135}{150}$

$13650 = 8{,}400 + 75x + 135y$

$75x + 135y = 5250$

$5x + 9y = 350$ ...(2)

Solving equation (1) and (2) we get $x = 34$ and $y = 20$

155. Find the median of the following data :

Profit (in lakh of rupee)	Number of shops
More than of equal to 5	30
More than of equal to 10	28
More than of equal to 15	16
More than of equal to 20	14
More than of equal to 25	10
More than of equal to 30	7
More than of equal to 35	3

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table to find median class.

Class	f	$c.f.$
5-10	2	2
10-15	12	14
15-20	2	16
20-25	4	20
25-30	3	23
30-35	4	27
35-40	3	30
Total	$\sum f = 30 = N$	

We have $N = 30$; $\frac{N}{2} = 15$

Cumulative frequency just greater than $\frac{N}{2}$ is 16 and the corresponding class is 15-20. Thus median class is 15-20.

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right) h$

Now, $l = 15$, $N = 30$, $F = 14$, $f = 2$ $h = 5$

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right) h$

$= 15 + \left(\frac{15 - 14}{2}\right) \times 5$

$= 15 + 2.5 = 17.5$

156. Find the value of x and y, if the median for the

following data is 31.

Classes	0-10	10-20	20-30	30-40	40-50	50-60	Total
Frequency	5	x	6	y	6	5	40

Ans : [Board Term-1 2012]

We prepare following cumulative frequency table to find median class.

C.I.	f	$c.f.$
0-10	5	5
10-20	x	$5+x$
20-30	6	$11+x$
30-40	y	$11+x+y$
40-50	6	$17+x+y$
50-60	5	$22+x+y$
	Total 40	

Since median is 31, which lies between 30-40. Thus median class is 30-40.

Here from table, $N = 22+x+y$

$$40 = 22+x+y$$

$$x+y = 18 \quad \ldots(1)$$

Median, $M_d = l+\left(\frac{\frac{N}{2}-F}{f}\right)h$

$$31 = 30+\left[\frac{20-(11+x)}{y}\right]\times 10$$

$$1 = \frac{(9-x)\times 10}{y}$$

$$y = 90-10x$$

$$10x+y = 90 \quad \ldots(2)$$

Solving equation (1) and (2) we get $x = 8$ and $y = 10$

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

Daily income (in Rs.)	100-120	120-140	140-160	160-180	180-200
Number of Workers	12	14	8	6	10

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

Ans : [Board Term-1 2009]

We prepare following table to find mean.

C.I.	f_i	$c.f.$	x_i	$u_i = \frac{x_i-a}{h}$	f_iu_i
100-120	12	12	110	-2	-24
120-140	14	26	130	-1	-14
140-160	8	34	150	0	0
160-180	6	40	170	1	6
180-200	10	50	190	2	20
	$\sum f = 50$				$\sum f_iu_i = -12$

Let a be assumed mean be $a = 150$

Mean $M = a+\frac{\sum f_iu_i}{\sum f_i}\times h$

$$= 150+\frac{-12}{50}\times 20$$

$$= 150-4.8 = 145.2$$

Now $N = 50$; $\frac{N}{2} = 25$

Cumulative frequency just greater than $\frac{N}{2}$ is 26 and the corresponding class is 120-140. Thus median class is 120-140.

Now $l = 120$, $f = 14$, $F = 12$ and $h = 20$

Median, $M_d = l+\left(\frac{\frac{N}{2}-F}{f}\right)h$

$$= 120+\left(\frac{25-12}{14}\right)\times 20$$

$$= 120+18.57\times 138.57$$

$$\text{Mode} = 3\ \text{Median} - 2\ \text{Mean}$$

$$= 3\times 138.57 - 2\times 145.2$$

$$= 415.71 - 290.4 = 125.31$$

Hence, mean is 145.2, median is 138.57 and mode is 125.31.

158. Find the mode of the following distribution of marks

obtained by the students in an examination :

Marks obtained	0-20	20-40	40-60	60-80	80-100
Number of students	15	18	21	29	17

Given the mean of the above distribution is 53, using empirical relationship estimate the value of its median.

Ans : [Board Term-1 SQP 2017]

Class 60-80 has the maximum frequency 29, therefore this is model class.

Here, $l = 60,\ f_1 = 29,\ f_0 = 21,\ f_2 = 17$ and $h = 20$

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

$$= 60 + \frac{8}{58 - 38} \times 20$$

$$= 60 + 8 = 68$$

Now $$3M_d = M_o + 2M$$

$$= 68 + 2 \times 53$$

$$M_d = \frac{174}{3} = 58$$

Hence median is 58.

159. On the annual day of school, age-wise participation of students is given in the following frequency distribution table :

Age (in years)	Number of students
Less than 6	2
Less than 8	6
Less than 10	12
Less than 12	22
Less than 14	42
Less than 16	67
Less than 18	76

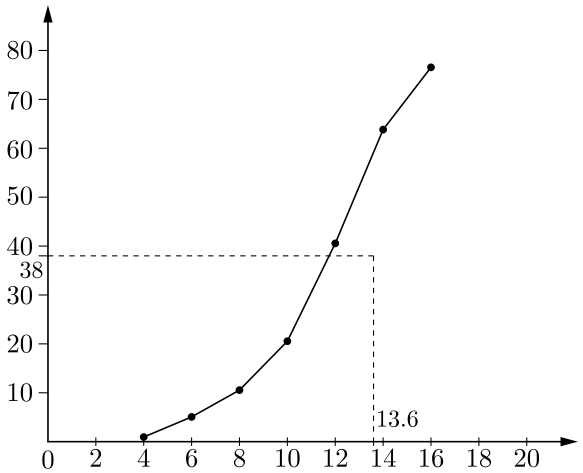
Find the median of the students and how can get the median graphically ?

Ans : [Board Term-1 2016]

Age of students	C.I.	*c.f.*	*f*
Less than 6	4-6	2	2
Less than 8	6-8	6	4
Less than 10	8-10	12	6
Less than 12	10-12	22	10
Less than 14	12-14	42	20
Less than 16	14-16	67	25
Less than18	16-18	76	9

Now $N = 76\ ;\ \frac{N}{2} = 38$

Cumulative frequency just greater than $\frac{N}{2}$ is 42 and the corresponding class is 12-14. Thus median class is 12-14.



160. Find the median of the following data :

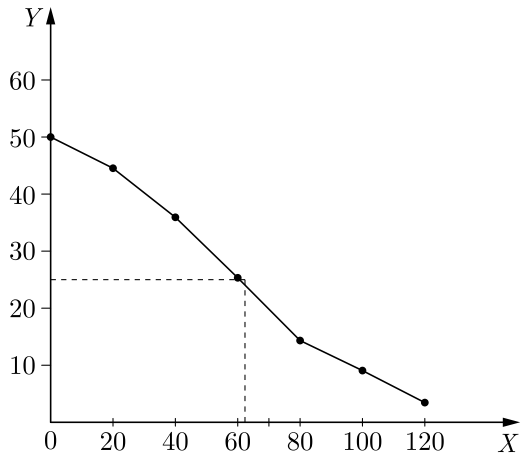
Class Interval	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

How can we find the median graphically ?

Ans : [Board Term-1 2015]

Classes	*c.f.*
More than 0	50
More than 20	44
More than 40	36
More than 60	26
More than 80	14
More than 100	8
More than 120	3

To draw an ogive we take the indices : (0, 50), (20, 44), (40, 36), (60, 26), (80, 14), (100, 8) and (120, 3).



From graph, $\frac{N}{2} = \frac{50}{2} = 25$

Median, $M_d = 61.6$

By Formula Method :

Classes	f	$c.f.$	
0-20	6	6	
20-40	8	14	
40-60	10	24	
60-80	12	36	Median Class
80-100	6	42	
100-120	5	47	
120-140	3	50	

Now $N = 50\,;\ \frac{N}{2} = 25$

Cumulative frequency just greater than $\frac{N}{2}$ is 36 and the corresponding class is 60-80. Thus median class is 60-80.

Now $l = 60,\ f = 12,\ F = 24,\ h = 20$

Median, $M_d = l + \left(\frac{\frac{N}{2} - F}{f}\right)h$

$= 60 + \frac{(25 - 24)}{12} \times 20$

$= 60 + \frac{1}{12} \times 20 = 60 + \frac{5}{3}$

$= \frac{185}{3}$

$= 61.67$

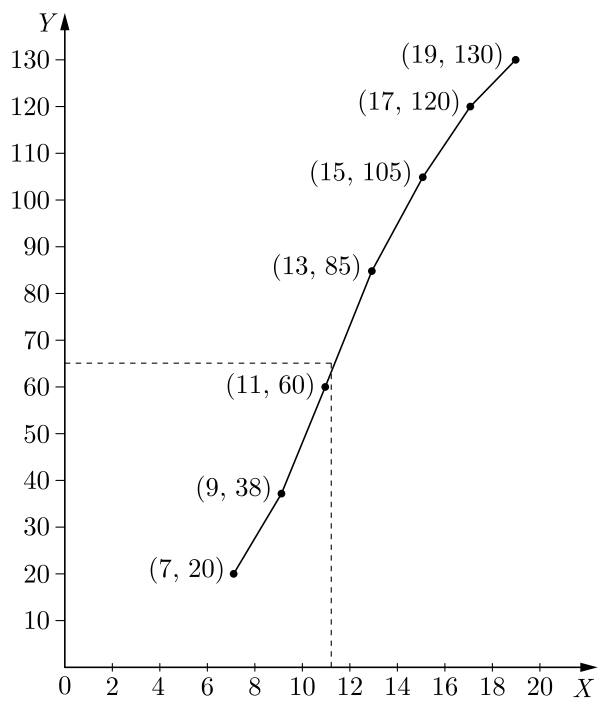
161. In annual day of a school, age-wise participation of students is shown in the following frequency distribution :

Age of students (in years)	5- 7	7- 9	9- 11	11- 13	13- 15	15- 17	17- 19
Number of students	20	18	22	25	20	15	10

Draw a 'less than type' ogive for the above data and from it find the median age.

Ans : [Board Term-1 2015]

Students	$c.f.$
Less than 7	20
Less than 9	38
Less than 11	60
Less than 13	85
Less than 15	105
Less than 17	120
Less than 19	130



This curve is the required cumulative frequency curve or an ogive of the less than type.

Here, $N = 130,$

So, $\frac{N}{2} = \frac{130}{2} = 65$

Now, we locate the point on the ogive whose ordinate is 65. The x co-ordinate corresponding to this

ordinate is 11.4. Hence. the required median on the graph is 11.4.

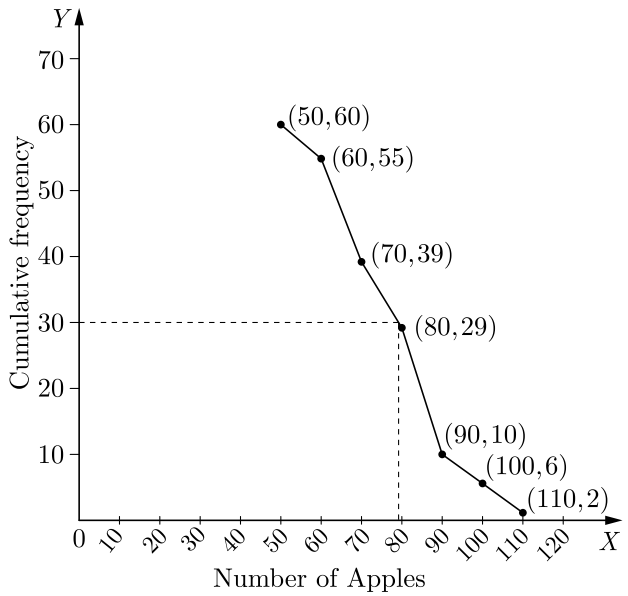
162. In an orchard, the number of apples on trees are below :

Number of apples	more than of equal to 50	more than of equal to 60	more than of equal to 70	more than of equal to 80	more than of equal to 90	more than of equal to 100	more than of equal to 110
Number of trees	60	55	39	29	10	6	2

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

Ans : [Board Term-1 2015]

Apples	*c.f.*
More than 50	60
More than 60	55
More than 70	39
More than 80	29
More than 90	10
More than 100	6
More than 110	2



This curve shows cumulative frequency on an ogive of the 'more than type'.

Here $N = 60,$

So $\frac{N}{2} = \frac{60}{2} = 30$

Now, we locate the point on the ogive whose ordinate is 30. The x-co-ordinate corresponding to this ordinate is 79. Hence, the required median on the graph is 79.

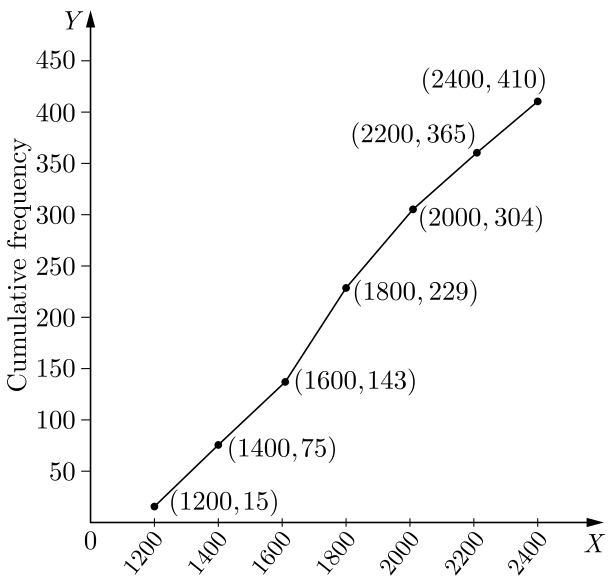
163. The following distribution gives the distribution of life times of washing machines of a certain company :

Life time (in hours)	1000-1200	1200-1400	1400-1600	1600-1800	1800-2000	2000-2200	2200-2400
Number of washing machines	15	60	68	86	75	61	45

Convert the above distribution into 'less than type' and draw its ogive.

Ans : [Board Term-1 2015]

Life time	c.f.
Less than 1200	15
Less than 1400	75
Less than 1600	143
Less than 1800	229
Less than 2000	304
Less than 2200	365
Less than 2400	410



164. Following distribution shows the marks obtained by a class of 100 students :

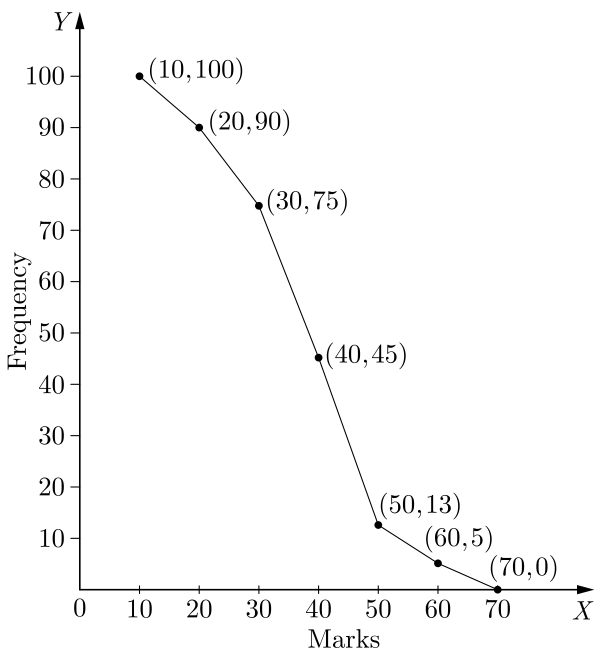
Marks	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	10	15	30	32	8	5

Draw a 'more than' ogive for the above data

Ans : [Board Term-1, 2012, Set-48]

Marks	Frequency
More than 10	100
More than 20	90
More than 30	75
More than 40	45
More than 50	13
More than 60	5
More than 70	0

'More than' ogive is shown below :

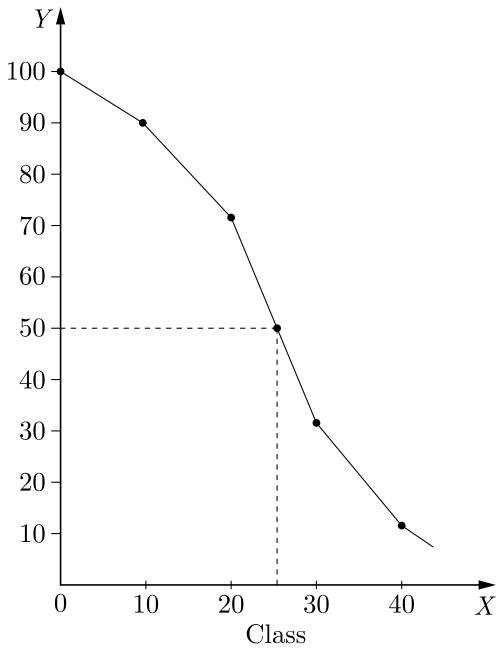


165. Draw more than ogive for the following distribution. Find the median from the curve.

Classes	0-10	10-20	20-30	30-40	40-50
Frequency	10	18	40	20	12

Ans : [Board Term-1, 2012, Set-48]

More than	c.f.
0	100
10	90
20	72
30	32
40	12



From graph, $\frac{N}{2} = \frac{100}{2} = 50$

Hence, Median $= 25$

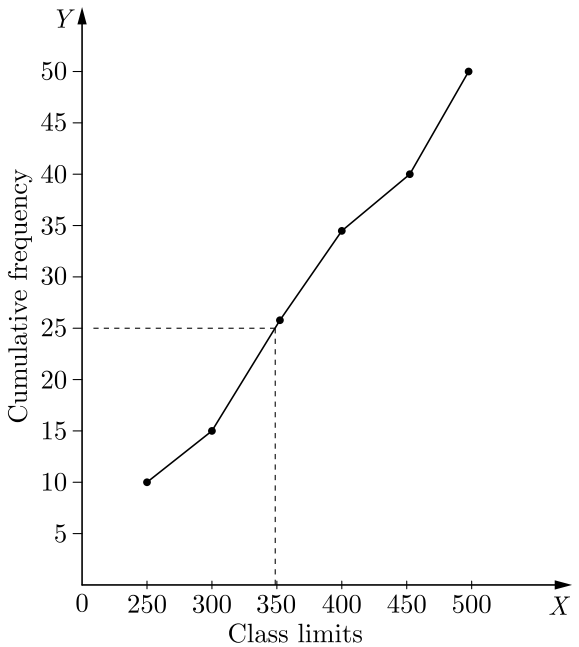
166. The following distribution gives the daily income of 50 workers of a factory :

Daily income(In Rs.)	200-250	250-300	300-350	350-400	400-450	450-500
Number of workers	10	5	11	8	6	10

Convert the distribution to a 'less than type' cumulative frequency distribution and draw its ogive. Hence obtain the median of daily income.

Ans : [Board Term-2, 2012, Set-55]

Daily income (Classes)	No. of workers (*c.f.*)
Less than 250	10
Less than 300	15
Less than 350	26
Less than 400	34
Less than 450	40
Less than 500	50



From graph. $\frac{N}{2} = \frac{50}{2} = 25$

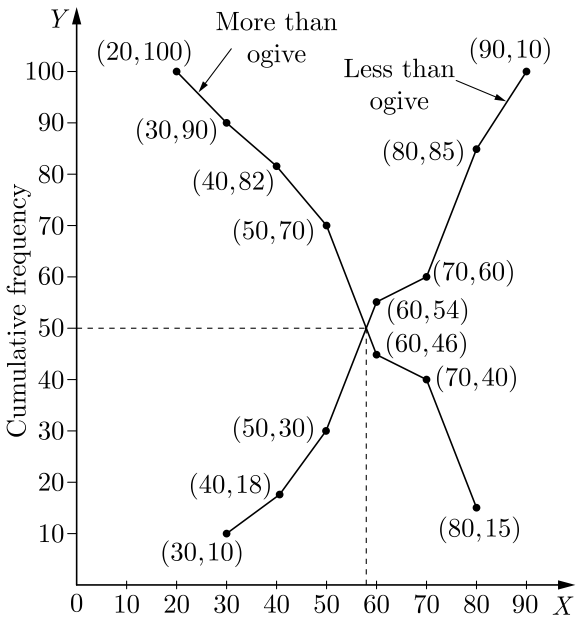
Hence, Median daily income = Rs. 345.

167. Draw "less than ogive" and more than ogive" for the following distribution and hence find its median :

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

Ans : [Board Term-1, 2012, Set-39, 48, 50]

Less than	*c.f.*	More than	*c.f.*
30	10	20	100
40	18	30	90
50	30	40	82
60	54	50	70
70	60	60	46
80	85	70	40
90	100	80	15



168. The following table gives the weight of 120 articles :

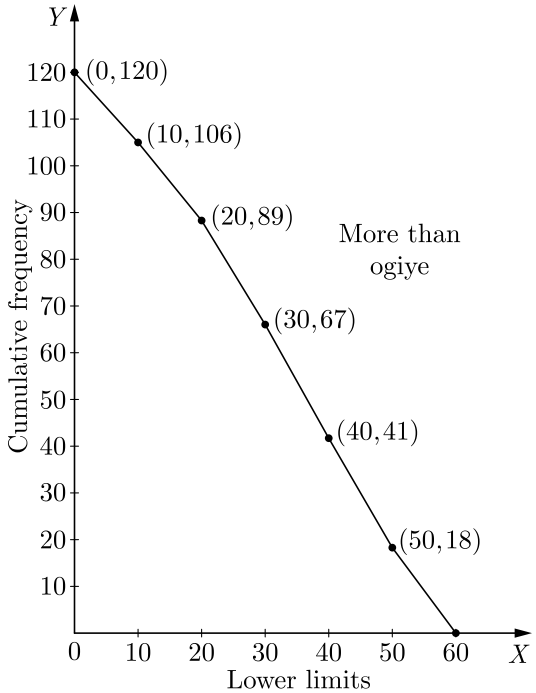
Weight (in kg)	0-10	10-20	20-30	30-40	40-50	50-60
Number of students	14	17	22	26	23	18

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

Ans : [Board Term-1, 2012, Set-48]

Weight (in kg) 0	Cumulative Frequency
More than to 10	120
More than to 20	106
More than to 30	89
More than to 40	67
More than to 40	41
More than to 50	18
More than to 60	0

Plotting the points :

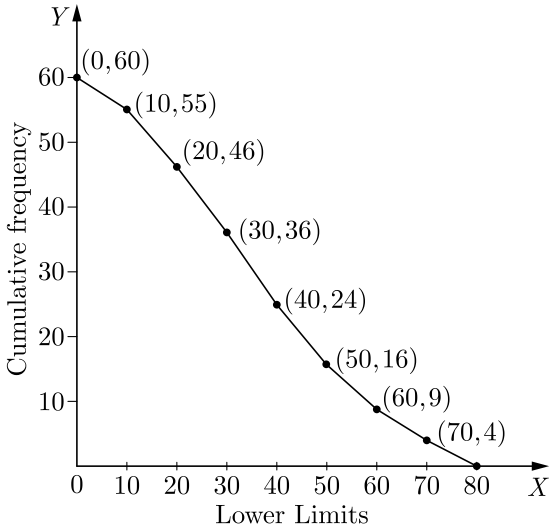


169. Draw a 'more than ogive' for the following data :

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	9	10	12	8	7	5	4

Ans : [Board Term-1, 2012, Set-48]

More than	c.f.
0	60
10	55
20	46
30	36
40	24
50	16
60	9
70	4
80	0



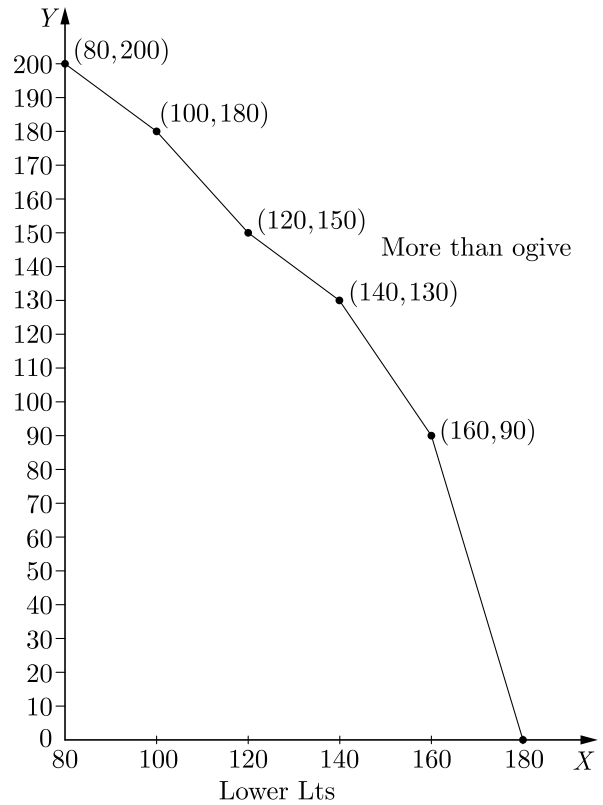
170. The distribution of monthly wages of 200 workers of a certain factory is as given below :

Monthly wages (in Rs.)	80-100	100-120	120-140	140-160	160-180
Number of workers	20	30	20	40	90

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

Ans : [Board Term-1, 2012, Set-60]

Wages	*c.f.*
More than 80	200
More than 100	180
More than 120	150
More than 140	130
More than 160	90
More than 180	0



171. The following are the ages of 200 patients getting medical treatment in a hospital on a particular day :

Age (In years)	10-20	20-30	30-40	40-50	50-60	60-70
Number of Patients	40	22	35	50	23	30

Write the above distribution as 'less than type' cumulative frequency distribution and also draw an ogive to find the median.

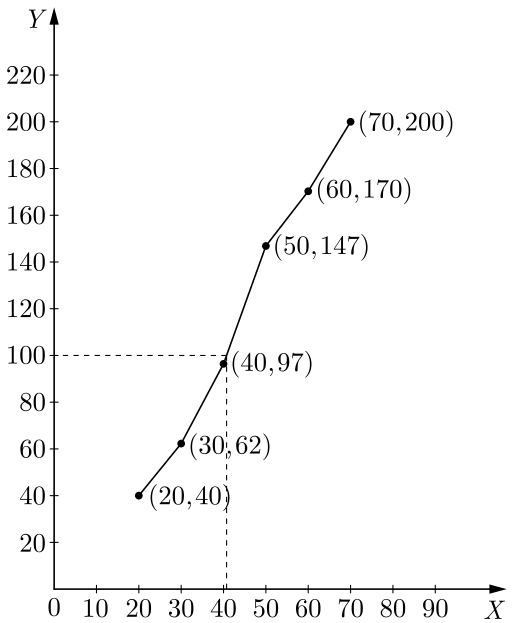
Ans : [Board Term-1 2015]

Less than	*c.f.*
10	0
20	40
30	62
40	97
50	147
60	170
70	200

We have $N = 200$

So, $\frac{N}{2} = 100$

Plotting the obtained coordinates (20,40), (30, 62), (40, 97), (50, 147), (60, 170) and (70, 200) and draw 'less than type' curve.



Median = 40.6

172. The following frequency distribution shows the distance (in meters) thrown by 68 students in a Javelin throw competition.

Distance (in m)	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Number of students	4	5	13	20	14	8	4

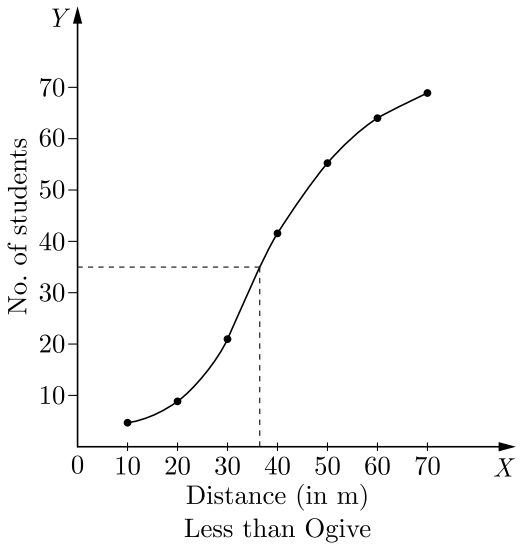
Draw a less than Ogive for the given data and find the median distance through using this curve.

Ans :

Distance (in m)	Number of Students	Less than distance (in m)	*c.f.*
0-10	4	Less than 0	0
10-20	5	Less than 10	4
20-30	13	Less than 20	9
30-40	20	Less than 30	22
40-50	14	Less than 40	42
50-60	8	Less than 50	56
60-70	4	Less than 60	64
		Less than 70	68

The co-ordinates for drawing an ogive are (0, 0), (10,

4), (20, 9), (30, 22), (40, 42), (50, 56), (60, 64), (70, 68).



Less than Ogive