

### 13. STATISTICS

1. **If Irregular class Intervals are given :**

Find the mean of the following distribution :

<b>Class Interval</b>	Below 20	Below 30	Below 40	Below 50	Below 60	Below 70	Below 80	Below 90	Below 100
<b>Frequency</b>	8	15	27	50	61	74	82	88	100

[ Sol : We first convert the given distribution into a ordinary frequency distribution :

<b>Class interval</b>	<b>Class mark (<math>x_i</math>)</b>	<b>Frequency (<math>f_i</math>)</b>	<b><math>f_i x_i</math></b>
10 - 20	15	8	120
20 - 30	25	7	175
30 - 40	35	12	420
40 - 50	45	23	1035
50 - 60	55	11	605
60 - 70	65	13	845
70 - 80	75	8	600
80 - 90	85	6	510
90 - 100	95	12	1140
<b>Total</b>		<b>100</b>	<b>5450</b>

$$\begin{aligned} \therefore \text{Mean} &= \frac{\sum_{i=1}^n f_i x_i}{\sum f_i} \\ &= \frac{5450}{100} = 54.50 \end{aligned}$$

2. Find the mean of the following distribution :

Marks	No. of Students
More than or equal to 50	50
More than or equal to 75	45
More than or equal to 100	39
More than or equal to 125	36
More than or equal to 150	32
More than or equal to 175	29
More than or equal to 200	22
More than or equal to 225	17
More than or equal to 250	13
More than or equal to 275	5

[Sol : We first convert the given distribution to ordinary frequency distribution as follows and then proceed as usual :

Marks (Class interval)	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	187.5	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
		$\sum f_i = 50$		$\sum f_i u_i = -12$

$$\text{So, mean} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 187.5 - \frac{12}{50} \times 25 = 187.5 - 6 = 181.6$$

3. The following data gives information on 150 policy holders :

Age (in years)	No. of policy holders
Above or equal to 18	150
Above or equal to 22	135
Above or equal to 26	113
Above or equal to 30	92
Above or equal to 34	68
Above or equal to 38	50
Above or equal to 42	36
Above or equal to 46	14

Determine the modal age of the policy holders.

[ Ans : We first convert the given distribution into an ordinary frequency distribution as follows:

Age (in years)	No. of policy holders
18 - 22	15
22 - 26	22
26 - 30	21
30 - 34	24
34 - 38	18
38 - 42	14
42 - 46	22
46 - 50	14

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

Here,  $l = 30$ ,  $f_1 = 24$ ,  $f_0 = 21$ ,  $f_2 = 18$  and  $h = 4$ .

$$\begin{aligned} \text{So, } \text{mode} &= 30 + \left( \frac{24 - 21}{2 \times 24 - 21 - 18} \right) \times 4 \\ &= 30 + \frac{3 \times 4}{9} \\ &= 30 + \frac{4}{3} = 30 + 1.33 = 31.33(\text{approx.}) \end{aligned}$$

Hence, the modal age is 31.33 years.

4. Calculate the mode of the following distribution table :

Marks	No. of students
25 or above 25	52
35 or above 35	47
45 or above 45	37
55 or above 55	17
65 or above 65	8
75 or above 75	2
85 or above 85	0

[Ans : We first convert the given cumulative distribution to an ordinary cumulative distribution as shown below :

Marks (Class)	Frequency
25 - 35	5
35 - 45	10
45 - 55	20
55 - 65	9
65 - 75	6
75 - 85	2

Here, modal class is 45 - 55.

So,  $f_1 = 20$ ,  $f_0 = 10$  and  $f_2 = 9$

$$\text{Hence, } \text{mode} = 45 + \frac{(20 - 10)}{2 \times 20 - 10 - 9} \times 10$$

$$= 45 + \frac{10 \times 10}{40 - 19} = 45 + \frac{100}{21}$$

$$= 45 + 4.7 = 49.7.$$

5. Given below is a cumulative frequency distribution. Corresponding to make an ordinary frequency distribution :

x	ef
Below 600	60
Below 500	58
Below 500	54
Below 500	35
Below 500	22
Below 500	10

[Sol : The ordinary frequency distribution is as follows :

x	Frequency (f)
500 - 600	60 - 58 = 2
400 - 500	58 - 54 = 4
300 - 400	54 - 35 = 19
200 - 300	35 - 22 = 13
100 - 200	22 - 10 = 12
0 - 100	10

, i.e.,

x	f
0 - 100	10
100 - 200	12
200 - 300	13
300 - 400	19
400 - 500	4
500 - 600	2

6. Find the mean marks of students from the following cumulative frequency distribution :

Marks	Number of students	Marks	Number of students
0 and above	80	60 and above	28
10 and above	77	70 and above	16
20 and above	72	80 and above	10
30 and above	65	90 and above	8
40 and above	55	100 and above	0
50 and above	43		

[Ans :

Marks	Mid - valus	Frequency	$u_i = \frac{x_i - 55}{10}$	$f_i u_i$
0 - 10	5	3	-5	-15
10 - 20	15	5	-4	-20
20 - 30	25	7	-3	-21
30 - 40	35	10	-2	-20
40 - 50	45	12	-1	-12
50 - 60	55	15	0	0
60 - 70	65	12	1	12
70 - 80	75	6	2	12
80 - 90	85	2	3	6
90 - 100	95	8	4	32
<b>Total</b>		$\Sigma f_i = 80$		$\Sigma f_i u_i = -26$

We have,

$$N = \Sigma f_i = 80, \quad \Sigma f_i u_i = -26, \quad A = 55 \text{ and } h = 10$$

$$\therefore \bar{X} = A + h \left\{ \frac{1}{N} \Sigma f_i u_i \right\}$$

$$\Rightarrow \bar{X} = 55 + 10 \times \frac{-26}{80} = 55 - 3.25 = 51.75 \text{ Marks.}$$

**To calculate the unknown ter****ms :**

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

<b>Class</b>	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
<b>Frequency</b>	8	6	$x$	11	$y$

**[Ans:  $x = 12, y = 13$ ]**

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

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

**[Ans :  $x = 20$ ]**

9. The mean of the following frequency distribution is 62.8 and the sum of all frequencies is 50. Compute the missing frequencies  $f_1$  and  $f_2$ .

<b>Class</b>	<b>Frequency</b>
0 - 20	5
20 - 40	$f_1$
40 - 60	10
60 - 80	$f_2$
80 - 100	7
100 - 120	8
	50

**[Ans :  $f_1 = 8, f_2 = 12$ ]**

10. Monthly consumptions of electricity of some consumers are given below as a distribution. Find the missing frequency ( $x$ ), if mode of distribution is given to be 200 units.

<b>Monthly consumption (in units)</b>	90 - 120	120 - 150	150 - 180	180 - 210	210 - 240
<b>Number of consumers</b>	20	15	$x$	75	50

**[Ans :  $x = 25$ ]**

11. In a class test, marks obtained by the students (out of 90) are as follows: If mode of the data is 63, find the missing frequencies  $x$  and  $y$ , when it is given that sum of all the frequencies is 125.

<b>Marks</b>	0 - 15	15 - 30	30 - 45	45 - 60	60 - 75	75 - 90
<b>Number of students</b>	5	12	28	$x$	35	$y$

**[Ans :  $x = 30, y = 15$ ]**

12. If empirical relationship between mean, median and mode is expressed as mean =  $k$  (3 median - mode), then find the value of  $k$ .

**[Sol :  $k = \frac{1}{2}$ ]**

13. The following frequency distribution gives the monthly consumptions of electricity in a locality of 80 families. If the median is 206, find the missing frequencies  $x$  and  $y$ .

Monthly consumption of electricity (in units)	Number of families
170 - 180	4
180 - 190	$x$
190 - 200	12
200 - 210	15
210 - 220	13
220 - 230	$y$
230 - 240	14
240 - 250	6

[Ans :  $x = 15$ ,  $y = 1$ ]

14. Find the unknown entries  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$  and  $f$  in the following distribution of heights of students in a class :

Height (in cm)	Frequency	Less than type c.f.
150 - 155	12	$a$
155 - 160	$b$	25
160 - 165	10	$c$
165 - 170	$d$	43
170 - 175	$e$	48
175 - 180	2	$f$
	<b>Total = 50</b>	

[Ans :  $a = 12$ ,  $b = 13$ ,  $c = 35$ ,  $d = 8$ ,  $e = 5$ ,  $f = 50$ ]

15. In a check up of heart beats rate of 50 females, it was found that median heart beats is 78. Find the missing frequencies  $f_1$  and  $f_2$  in the following frequency distribution :

Number of heart beats per minute	64 - 68	68 - 72	72 - 76	76 - 80	80 - 84	84 - 88	88 - 92
Number of females	4	5	$f_1$	$f_2$	9	7	1

[Ans:  $f_1 = 8$ ,  $f_2 = 16$ ]

16. A school organised a Diwali mela. Ages of persons, who visited the mela, are given by the following frequency distribution:

Age (in years)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Number of persons	50	400	108	53	47	10	5

Find the mean and median age of the distribution.

[Ans : Mean = 20.59 years, Median = 17.16 years]

17. Monthly expenditure of milk of 100 families in a housing society are given in the following frequency distribution:

Monthly (in ₹)	0 - 175	175 - 350	350 - 525	525 - 700	700 - 875	875 - 1050	1050 - 1225
Number of families	10	14	15	21	28	7	5

Find the mode and the median for this distribution.

[Ans : Mode = ₹743.75, Median = ₹616.67]

18. The mean temperature of a certain city for 31 consecutive days was found to be  $35.7^{\circ}\text{C}$ . Further, the mean temperature of the first 8 days was  $28.4^{\circ}\text{C}$ . The mean temperature of the next 12 days was  $36.4^{\circ}\text{C}$ .

Find the mean temperature of the rest of the days. Show your work.

(Note : Round the numbers to one decimal point.)

[Sol. : The number of days remaining as  $31 - 8 - 12 = 11$ .

The sum of the temperatures of all the 31 days as  $35.7^{\circ}\text{C} \times 31 = 1106.7^{\circ}\text{C}$ .

The sum of the temperatures of first 8 days as  $28.4^{\circ}\text{C} \times 8 = 227.2^{\circ}\text{C}$ .

The sum of the temperatures of next 12 days as  $36.4^{\circ}\text{C} \times 12 = 436.8^{\circ}\text{C}$

The sum of the temperatures of last 11 days as  $1106.7^{\circ}\text{C} - 227.2^{\circ}\text{C} - 436.8^{\circ}\text{C} = 442.7^{\circ}\text{C}$

The mean temperature of the last 11 days =  $\frac{442.7}{11} = 40.2^{\circ}\text{C}$  ]

19. Bowling strike rate for a bowler is defined as the average number of balls bowled per wicket taken. A bowler has taken 148 wickets so far with a strike rate of 27. In his next match, he bowls 48 balls and takes 2 wickets.

What is his new strike rate? Show your work.

[Sol. : The total number of balls bowled by the bowler so far as  $148 \times 27 = 3996$ .

The total number of balls bowled after the latest match as  $3996 + 48 = 4044$ .

The total number of wickets taken after the latest match =  $148 + 2 = 150$ .

The new strike rate of the bowler as (total number of balls bowled)/(total number of wickets taken) =  $\frac{4044}{150} = 26.96$  ]

Rainfall (in mm)	Number of days
0 - 20	7
20 - 40	$x$
40 - 60	10
60 - 80	4

Unfortunately, due to manual errors, the information on the 20 - 40 mm range got deleted from the data.

If the mean daily rainfall for the period was 35 mm, find the number of days when the rainfall ranged between 20 - 40 mm. Show your work.

[Sol : Completes the frequency distribution table as :

Rainfall (in mm)	Number of days/ Frequency ( $f_i$ )	Class - mark ( $X_i$ )	( $f_i x_i$ )
0 - 20 mm	7	10	70
20 - 40 mm	$x$	30	$30x$
40 - 60 mm	10	50	500
60 - 80 mm	4	70	280
<b>Total</b>	$21 + x$		$850 + 30x$

The equation for mean as :  $\frac{850 + 30x}{21 + x} = 35$

The equation in step 2 to find the value of  $x$  as 23.