CHAPTER – 14
STATISTICS

MEAN OF GROUPED DATA

Direct method

Mean, $\bar{x} = \dfrac{\sum f_i x_i}{\sum f_i}$

Assume mean method or Short-cut method

Mean, $\bar{x} = A + \dfrac{\sum f_i d_i}{\sum f_i}$ where $d_i = x_i - A$

Step Deviation method *(This method deleted but student can use this method also)*

Mean, $\bar{x} = A + \dfrac{\sum f_i u_i}{\sum f_i} \times h$ where $u = \dfrac{x_i - A}{h}$

IMPORTANT QUESTIONS

The following table gives the literacy rate (in percentage) of 35 cities. Find the mean literacy rate.

Literacy rate (in %)	45 – 55	55 – 65	65 – 75	75 – 85	85 – 95
Number of cities	3	10	11	8	3

Solution:

Literacy rate (in %)	**Number of Cities 'f'**	**Class mark 'x'**	$u = \dfrac{x - A}{h}$	**fu**
45 – 55	3	50	–2	–6
55 – 65	10	60	–1	–10
65 – 75	11	70	0	0
75 – 85	8	80	1	8
85 – 95	3	90	2	6
Total	35			–2

Here, $\sum fu = -2, \sum f = 35$, A = 70, h = 10

Mean, $\bar{x} = A + \dfrac{\sum fu}{\sum f} \times h \Rightarrow \bar{x} = 70 + \dfrac{-2}{35} \times 10 = 70 - \dfrac{20}{35} = 70 - \dfrac{4}{7} = 70 - 0.57 \Rightarrow \bar{x} = 69.43$

Questions for Practice

1. Find the mean of the following data:

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

2. Find the mean percentage of female teachers of the following data:

Percentage of female teachers	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
Number of States/U.T	6	11	7	4	4	2	1

3. A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house.

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

4. Find the mean daily wages of the workers of the factory by using an appropriate method for the following data:

Daily wages (in Rs)	100 – 120	120 – 140	140 – 160	160 – 180	180 – 200
Number of workers	12	14	8	6	10

5. Find the mean number of mangoes kept in a packing box for the following data:

Number of mangoes	50 – 52	53 – 55	56 – 58	59 – 61	62 – 64
Number of boxes	15	110	135	115	25

6. Find the mean daily expenditure on food for the following data:

Daily expenditure (in Rs.)	100 – 150	150 – 200	200 – 250	250 – 300	300 – 350
Number of households	4	5	12	2	2

MODE OF GROUPED DATA

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

where l = lower limit of the modal class,
h = size of the class interval (assuming all class sizes to be equal),
f_1 = frequency of the modal class,
f_0 = frequency of the class preceding the modal class,
f_2 = frequency of the class succeeding the modal class.

IMPORTANT QUESTIONS

Find the mean, mode and median for the following frequency distribution.

Class	0-10	10-20	20-30	30-40	40-50	Total
Frequency	8	16	36	34	6	100

Solution:

Here, highest frequency is 36 which belongs to class 20 – 30. So, modal class is 20 – 30,
$l = 20$, $f_0 = 16$, $f_1 = 36$, $f_2 = 34$, $h = 10$

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

$$\Rightarrow Mode = 20 + \frac{36 - 16}{2(36) - 16 - 34} \times 10$$

$$\Rightarrow Mode = 20 + \frac{20}{72 - 50} \times 10 = 20 + \frac{200}{22} = 20 + 9.09 = 29.09$$

Questions for Practice

1. The frequency distribution table of agriculture holdings in a village is given below:

Area of land(in ha)	1-3	3-5	5-7	79	9-11	11-13
No. of families	20	45	80	55	40	12

Find the modal agriculture holdings of the village.

2. Find the mode age of the patients from the following distribution :

Age(in years)	6-15	16-25	26-35	36-45	46-55	56-65
No. of patients	6	11	21	23	14	5

3. Find the mode of the following frequency distribution:

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

4. Find the modal height of maximum number of students from the following distribution:

Height(in cm)	160-162	163-165	166-168	169-171	172-174
No. of students	15	118	142	127	18

5. A survey regarding the heights (in cms) of 50 girls of a class was conducted and the following data was obtained.

Height(in cm)	120-130	130-140	140-150	150-160	160-170	**Total**
No. of girls	2	8	12	20	8	**50**

Find the mode of the above data.

- **Cumulative Frequency:** The cumulative frequency of a class is the frequency obtained by adding the frequencies of all the classes preceeding the given class.

MEDIAN OF GROUPED DATA

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

where l = lower limit of median class,
n = number of observations,
cf = cumulative frequency of class preceding the median class,
f = frequency of median class,
h = class size (assuming class size to be equal).

EMPIRICAL FORMULA

3Median = Mode + 2 Mean

IMPORTANT QUESTIONS

Find the median of the following frequency distribution:

Class	75-84	85-94	95-104	105-114	115-124	125-134	135-144
Frequency	8	11	26	31	18	4	2

Solution:

Class	**True Class limits**	**Frequency**	**cf**
75-84	74.5 – 84.5	8	8
85-94	84.5 – 94.5	11	19
95-104	94.5 – 104.5	26	45
105-114	104.5 – 114.5	31	76
115-124	114.5 – 124.5	18	94
125-134	124.5 – 134.5	4	98
135-144	134.5 – 144.5	2	100
Total		**100**	

Here, n = 100 $\Rightarrow \frac{n}{2} = 50$ which belongs to 104.5 – 114.5

So, l = 104.5, cf = 45, f = 31, h = 10

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

$\Rightarrow Median = 104.5 + \frac{50 - 45}{31} \times 10 \Rightarrow Median = 104.5 + \frac{50}{31} = 104.5 + 1.61 = 106.11$

Questions for Practice

1. The percentage of marks obtained by 100 students in an examination are given below:

Marks	30-35	35-40	40-45	45-50	50-55	55-60	60-65
No. of Students	14	16	18	23	18	8	3

Determine the median percentage of marks.

2. Weekly income of 600 families is as under:

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

Compute the median income.

3. Find the median of the following frequency distribution:

Marks	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40
Number of students	8	12	20	12	18	13	10	7

4. The following table gives the distribution of the life time of 500 neon lamps:

Life time (in hrs)	1500 – 2000	2000 – 2500	2500 – 3000	3000 – 3500	3500 – 4000	4000 – 4500	4500 – 5000
Number of Lamps	24	86	90	115	95	72	18

Find the median life time of a lamp.

5. Find the median marks for the following distribution:

Marks	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60
No. of Students	6	15	29	41	60	70

6. Find the median wages for the following frequency distribution:

Wages per day	61-70	71-80	81-90	91-100	101-110	111-120
No. of workers	5	15	20	30	10	8

7. Find the median marks for the following distribution:

Marks	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
No. of Students	2	3	6	7	14	12	4	2

MCQ QUESTIONS (1 mark)

1. In the following distribution :

Monthly income range (in Rs)	**Number of families**
Income more than Rs 10000	100
Income more than Rs 13000	85
Income more than Rs 16000	69
Income more than Rs 19000	50
Income more than Rs 22000	33
Income more than Rs 25000	15

the number of families having income range (in Rs) 16000 – 19000 is
(a) 15 (b) 16 (c) 17 (d) 19

2. While computing mean of grouped data, we assume that the frequencies are
(a) evenly distributed over all the classes (b) centred at the classmarks of the classes
(c) centred at the upper limits of the classes (d) centred at the lower limits of the classes

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

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

The sum of the lower limit of the modal class and upper limit of the median class is
(a) 310 (b) 315 (c) 320 (d) 330

4. In the formula $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$, for finding the mean of grouped data d_i's are deviations 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

5. For the following distribution :

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

the sum of lower limits of the median class and modal class is
(a) 15 (b) 25 (c) 30 (d) 35

6. Consider the following frequency distribution :

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

The upper limit of the median class is
(a) 17 (b) 17.5 (c) 18 (d) 18.5

7. 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
(a) 10-20 (b) 20-30 (c) 30-40 (d) 50-60

8. Consider the data :

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

9. The times, in seconds, taken by 150 atheletes 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 atheletes who completed the race in less then 14.6 seconds is :
(a) 11 (b) 71 (c) 82 (d) 130

10. 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

11. If x_i's are the mid points of the class intervals of grouped data, f_i's are the corresponding frequencies and $\bar{x}$ is the mean, then $\sum(f_i x_i - \bar{x})$ is equal to
(a) 0 (b) –1 (c) 1 (d) 2

12. In the formula $\bar{x} = a + h\left(\frac{\sum f_i u_i}{\sum f_i}\right)$, for finding the mean of grouped frequency distribution, u_i =

(a) $\frac{x_i + a}{h}$ (b) $h(x_i - a)$ (c) $\frac{x_i - a}{h}$ (d) $\frac{a - x_i}{h}$