

19. Mean and Median of ungrouped data

Points to Remember :

1. **Mean** ($\bar{x}$) = $\frac{\text{Sum of observations}}{\text{Number of observations}} = \frac{\sum x_i}{n}$

Where $\sum x_i$ is the sum of observations
and n is the number of observations

or Mean ($\bar{x}$) = $\frac{x_1 + x_2 + x_3 + \dots + x_n}{n} \Rightarrow x_1 + x_2 + x_3 + \dots + x_n = n \times \bar{x}$

2. **Mean for ungrouped data : (i) Direct method** : Let $x_1, x_2, x_3 \dots x_n$ be the n variates and $f_1, f_2, f_3 \dots f_n$ be their frequency respectively

Then mean ($\bar{x}$) = $\frac{f_1 x_1 + f_2 x_2 + f_3 x_3 + \dots + f_n x_n}{f_1 + f_2 + f_3 + \dots + f_n} = \frac{\sum f_i x_i}{\sum f_i}$

(ii) **Assumed Mean Method** : Mean = $A + \frac{\sum f_i d_i}{\sum f_i}$

Where A = assumed mean, f_i is the frequency and d_i is the $(x_i - A)$

(iii) **Step - Deviation Method** : Mean ($\bar{x}$) = $A + h + \frac{\sum f_i u_i}{\sum f_i}$

where A is assumed means $h = x_2 - x_1$ $u_i = \frac{x_i - A}{h}$

3. **Median : (i) Median for ungrouped data** : First of all, arrange the observations in descending or ascending order

Median = $\left(\frac{n+1}{2}\right)$ th term where n is odd observation = $\frac{1}{2} \left[\left(\frac{n}{2}\right)\text{th term} + \left(\frac{n}{2} + 1\right)\text{th term} \right]$

(ii) **Median of Discrete Series**

Method : First arrange the terms in an ascending order or a descending order. Now, prepare a cumulative frequency table.

Let the total frequency be n

(i) If n is odd then median = $\frac{n+1}{2}$ th term

If n is even then median = $\frac{1}{2} \left[\left(\frac{n}{2}\right)\text{th term} + \left(\frac{n}{2} + 1\right)\text{th term} \right]$

EXERCISE 19 (A)

1. The weights of 7 boys in a group are 52 kg, 57 kg, 55 kg, 60 kg, 54 kg, 59 kg and 55 kg. Find the mean weight of the group.

Sol. Here $n = 7$

$$\therefore \text{Sum of weights of 7 boys is} = 52 \text{ kg} + 57 \text{ kg} + 55 \text{ kg} + 60 \text{ kg} + 54 \text{ kg} + 59 \text{ kg} + 55 \text{ kg} \\ = 392 \text{ kg}$$

$$\therefore \text{Mean } (\bar{x}) = \frac{\sum x_i}{n} = \frac{392}{7} = 56 \text{ kg Ans.}$$

2. The marks obtained by 7 students in a group are 340, 180, 260, 164, 56, 275 and 307 respectively. Find the mean marks per student.

Sol. Here $n = 7$

$$\text{and sum of marks of 7 students} = 340 + 180 + 260 + 164 + 56 + 275 + 307 = 1582$$

$$\therefore \text{Mean } (\bar{x}) = \frac{\sum x_i}{n} = \frac{1582}{7} = 226 \text{ marks Ans.}$$

3. Find the mean of first six prime numbers.

Sol. First 6 prime numbers are 2, 3, 5, 7, 11, 13

$$\therefore \text{Mean } (\bar{x}) = \frac{\sum x_i}{n} = \frac{2+3+5+7+11+13}{6} = \frac{41}{6} = 6.83 \text{ Ans.}$$

4. Find the mean of first 10 odd numbers.

Sol. First 10 odd numbers are 1, 3, 5, 7, 9, 11, 13, 15, 17, 19

$$\therefore \text{Mean } (\bar{x}) = \frac{\sum x_i}{n}$$

$$= \frac{1+3+5+7+9+11+13+15+17+19}{10} = \frac{100}{10} = 10 \text{ Ans.}$$

5. Find the mean of all the factors of 20.

Sol. Factors of 20 are 1, 2, 4, 5, 10, 20

Here $n = 6$

$$\therefore \text{Mean } (\bar{x}) = \frac{1+2+4+5+10+20}{6} = \frac{42}{6} = 7 \text{ Ans.}$$

6. The daily minimum temperature recorded (in degree F), at a place during a week was as under.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
35.2	31.1	27.6	31.8	29.3	23.8

Find the mean temperature.

Sol. Here $n = 6$

$$\therefore \text{Mean of temperature } (\bar{x}) = \frac{\sum x_i}{n} = \frac{35.2 + 31.1 + 27.6 + 31.8 + 29.3 + 23.8}{6}$$

$$= \frac{178.8}{6} = 29.8 \text{ F Ans.}$$

7. If the mean of 6, 8, 9, x , 13 is 10, find the value of x .

Sol. Mean = 10

Here $n = 5$

$$\therefore \text{Mean } (\bar{x}) = \frac{\sum x_i}{n} = \frac{6 + 8 + 9 + x + 13}{5}$$

$$\Rightarrow 10 = \frac{36 + x}{5} \Rightarrow 36 + x = 50 \Rightarrow x = 50 - 36 = 14 \text{ Ans.}$$

8. The mean of the heights of 6 girls is 148 cm. If the individual heights of five of them are 142 cm, 154 cm, 146 cm, 145 cm and 150 cm, find the height of the sixth girl.

Sol. Mean of height of 6 girls = 148 cm

$$\therefore \text{Total height} = 148 \times 6 = 888 \text{ cm}$$

$$\text{Total heights of 5 girls among them} = (142 + 154 + 146 + 145 + 150) \text{ cm} = 737 \text{ cm}$$

$$\therefore \text{Height of the sixth girls} = 888 - 737 = 151 \text{ cm Ans.}$$

9. The following table shows the weights (in kg) of 15 workers in a factory :

Weight (in kg)	60	63	66	72	75
Number of workers	4	5	3	1	2

Calculate the mean weight.

Sol. Total number of workers = 15

Weight (in kg) (x)	Number of workers (f)	$f \times x$
60	4	240
63	5	315
66	3	198
72	1	72
75	2	150
Total	15	975

$$\therefore \text{Mean} = \frac{\sum fx}{\sum f} = \frac{975}{15} = 65 \text{ kg Ans.}$$

10. Find the mean of daily wages of 60 workers in a factory as per data given below :

Daily wages (in Rs)	90	110	120	130	150
No. of workers	12	14	13	11	10
Sol. Daily wages (in Rs.) (x)	Number of worker (f)		$f \times x$		
90	12		1080		
110	14		1540		
120	13		1560		
130	11		1430		
150	10		1500		
Total	60		7110		

$$\therefore \text{Mean wages} = \frac{\Sigma fx}{\Sigma f} = \frac{7110}{60}$$

$$= \frac{711}{6} = \text{Rs. } 118.50 \text{ Ans.}$$

11. The heights (in cm) of 90 plants in a garden are given below :

Sol. Height (in cm)	58	60	62	64	66	74
Number of plants	20	25	15	8	12	10
Height (in cm) x	Number of plants f		$f \times x$			
58	20		1160			
60	25		1500			
62	15		930			
64	8		512			
66	12		792			
74	10		740			
Total	90		5634			

$$\text{Mean } (\bar{x}) = \frac{\Sigma fx}{\Sigma f_i} = \frac{5634}{90}$$

$$= 62.6 \text{ cm Ans.}$$

12. The mean of the following data is 21.6. Find the value of P.

x_1	6	12	18	24	30	36
f_i	5	4	p	6	4	6

Sol. Mean = 21.6

x_i	f_i	$f_i \times x_i$
6	5	30
12	4	48
18	p	$18p$
24	6	144
30	4	120
36	6	216
Total	$25 + p$	$558 + 18p$

$$\text{Mean } (\bar{x}) = \frac{\sum f_i \times x_i}{\sum f_i}$$

$$\Rightarrow 21.6 = \frac{558 + 18p}{25 + p}$$

$$\Rightarrow 21.6p - 18p = 558 - 540$$

$$\Rightarrow p = \frac{18}{3.6} = 5$$

$$\Rightarrow 540 + 21.6p = 558 + 18p$$

$$\Rightarrow 3.6p = 18$$

$$\Rightarrow p = 5 \text{ Ans.}$$

13. If the mean of the following data is 18.75, find the value of p :

x_i	10	15	p	25	30
f_i	5	10	7	8	2

Sol. Mean = 18.75

x_i	f_i	$x_i + f_i$
10	5	50
15	10	150
p	7	$7p$
25	8	200
30	2	60
Total	32	$460 + 7p$

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

$$\Rightarrow 18.75 = \frac{460 + 7p}{32}$$

$$\Rightarrow 460 + 7p = 600$$

$$\Rightarrow 460 + 7p = 32 \times 18.75$$

$$\Rightarrow 7p = 600 - 460 = 140$$

$$\Rightarrow p = \frac{140}{7} = 20$$

$\therefore p = 20$ Ans.

14. The mean age of a group of 40 students is 17.45 years. Find the missing frequencies.

Age (in years)	15	16	17	18	19	20
Number of students	3	?	9	11	?	3

Sol. Let missing frequencies are x and y

Mean = 17.45 years.

Age (in years) (x)	Number of students (f)	$f_i \times x_i$
15	3	45
16	x	$16x$
17	9	153
18	11	198
19	y	$19y$
20	3	60
Total	$40(26 + x + y)$	$456 + 16x + 19y$

$$26 + x + y = 40$$

$$\Rightarrow x + y = 40 - 26$$

$$\Rightarrow x + y = 14$$

....(i)

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

$$\Rightarrow 17.45 = \frac{456 + 16x + 19y}{40}$$

$$\Rightarrow 698 = 456 + 16x + 19y$$

$$16x + 19y = 698 - 456 = 242$$

$$\Rightarrow 16x + 19y = 242$$

....(ii)

From (i) $x = 14 - y$

$\therefore$ Substituting the value of x in (ii)

$$16(14 - y) + 19y = 242$$

$$224 - 16y + 19y = 242$$

$$\Rightarrow 3y = 242 - 224 = 18 \Rightarrow y = \frac{18}{3} = 6$$

$$\therefore x = 14 - y = 14 - 6 = 8$$

Hence $x = 8, y = 6$

15. Using the assumed mean method, calculate the mean weekly wage from the following frequency distribution :

Weekly wages (in Rs.)	950	1000	1050	1100	1250	1500	1600
Number of workers	24	18	13	15	20	11	9

Sol. Let assumed mean = $A = 11000$

Weekly wages (in Rs.) (x)	Numbers of workers (f)	$d =$ ($x - A$)	$f_i d_i$
950	24	-150	-3600
1000	18	-100	-1800
1050	13	-50	-650
1100 = A	15	0	0
1250	20	150	3000
1500	11	400	4400
1600	9	500	4500
Total	110		5850

$$\therefore \text{Mean} = A + \frac{\sum f_i d_i}{\sum f_i}$$

$$= 1100 + \frac{5850}{110}$$

$$= 1100 + 53.18$$

$$= 1153.18 \text{ Ans.}$$

16. Using the step-deviation method, find the mean from the following data.

x_i	18	19	20	21	22	23	24
f_i	170	320	530	700	230	140	110

Sol. Let Assumed mean = 21

$$\therefore d_i = x_i - A$$

$$x_i = \frac{x_1 - A}{1}$$

x_i	f_i	$u_i = \frac{x_i - 21}{1}$	$f_i \times u_i$
18	170	$\frac{-3}{1} = -3$	-510
19	320	-2	-640
20	530	-1	-530
21 = A	700	0	0
22	230	1	230
23	140	2	280
24	110	3	330
Total	2200		-840

$$\text{Mean} = A + \frac{f_i \times u_i}{1}$$

$$= 21 + \left(\frac{-840}{2200} \right) = 21 - 0.38 = 20.62 \text{ Ans.}$$

EXERCISE 19 (B)

1. Find the median of :

- (i) 15, 6, 16, 8, 22, 21, 9, 18, 25
 (ii) 10, 75, 3, 15, 9, 47, 12, 48, 4, 81, 17, 27
 (iii) 55, 60, 35, 51, 29, 63, 72, 91, 85, 82

Sol. (i) Arranging the given data in descending order,

6, 8, 9, 15, 16, 18, 21, 22, 25

Here $n = 9$ which is odd

$$\therefore \text{Median} = \frac{x+1}{2} \text{th term} = \frac{9+1}{2} \text{th or 5th term}$$

which is 16

$\therefore$ Median = 16 Ans.

(ii) Arranging the given data in descending order:

3, 4, 9, 10, 12, 15, 17, 27, 47, 48, 75, 81

Here $n = 12$, which is even

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

$$= \frac{1}{2} \left\{ \frac{12}{2} \text{th term} + \left(\frac{12}{2} + 1 \right) \text{th term} \right\}$$

$$= \frac{1}{2} \{ 6\text{th} + 7\text{th term} \} = \frac{1}{2} \{ 15 + 17 \}$$

$$= \frac{1}{2} \times 32 = 16$$

$\therefore$ Median = 16 Ans.

(iii) Arranging the given data in descending order :

29, 35, 51, 55, 60, 63, 72, 82, 85, 91

Here $n = 10$, which is even

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

$$= \frac{1}{2} \left\{ \frac{10}{2} \text{th term} + \left(\frac{10}{2} + 1 \right) \text{th term} \right\}$$

$$= \frac{1}{2} \{ 5\text{th term} + 6\text{th term} \}$$

$$= \frac{1}{2} \{60 + 63\} = \frac{1}{2} \times 123 = 61.5 \text{ Ans.}$$

2. The runs scored by 11 members of a cricket team are :

26, 38, 53, 18, 66, 72, 0, 47, 32, 7, 35

Find the median score.

Sol. Arranging the given data in descending order ;

0, 7, 18, 26, 32, 35, 38, 47, 53, 66, 72

Here $n = 11$ which is odd

$$\therefore \text{Median} = \frac{n+1}{2} \text{th term} = \frac{11+1}{2} \text{th term} = 6\text{th term}$$

which is 35

Hence median scores = 35 **Ans.**

3. The heights (in cm) of 9 girls are :

144.2, 148.5, 152.1, 143.7, 145, 149.6, 150, 146.5, 147.3

Find the median height.

Sol. Arranging the given data in descending order:

143.7, 144.2, 145, 146.5, 147.3, 148.5, 149.6, 150, 152.1

Here $n = 9$, which is odd

$$\therefore \text{Median} = \frac{n+1}{2} \text{th term} = \frac{9+1}{2} \text{th term} = 5\text{th term}$$

which is 147.3 cm

Hence median height = 147.3 cm **Ans.**

4. The ages (in years) of 10 teachers in a school are :

34, 37, 53, 46, 52, 43, 31, 36, 40, 50

Find the median age :

Sol. Arranging the given data in descending order:

31, 34, 36, 37, 40, 43, 46, 50, 52, 53

Here $n = 10$ which is even

$$\therefore \text{Median} = \frac{1}{2} \left\{ \frac{n}{2} \text{th term} + \left(\frac{n}{2} + 1 \right) \text{th term} \right\} = \frac{1}{2} \left\{ \frac{10}{2} \text{th term} + \left(\frac{10}{2} + 1 \right) \text{th term} \right\}$$

$$= \frac{1}{2} \{5\text{th term} + 6\text{th term}\} = \frac{1}{2} \{40 + 43\} = \frac{83}{2} = 41.5$$

Hence median age = 41.5 years **Ans.**

5. The weights (in kg) of 8 children are 13.4, 10.6, 12.7, 17.2, 14.3, 15, 16.5, 9.8

Find the median weight

Sol. Arranging the given data in descending order :

9.8, 10.6, 12.7, 13.4, 14.3, 15, 16.5, 17.2

Here $n = 8$, which is even

$$\begin{aligned}\therefore \text{Median} &= \frac{1}{2} \left\{ \frac{n}{2} \text{th term} + \left(\frac{n}{2} + 1 \right) \text{th term} \right\} = \frac{1}{2} \left\{ \frac{8}{2} \text{th term} + \left(\frac{8}{2} + 1 \right) \text{th term} \right\} \\ &= \frac{1}{2} \{ 4\text{th term} + 5\text{th term} \} = \frac{1}{2} \{ 13.4 + 14.3 \} = \frac{1}{2} \times 27.7 = 13.85\end{aligned}$$

$\therefore$ Median weight = 13.85 kg **Ans.**

6. Find the median weight for the following data:

Weight (in kg)	45	46	48	50	52	54	55
Number of boys	8	5	6	9	7	4	2

Sol. Writing in cumulative frequency table :

Weight (in kg)	Number of boys (f)	Cumulative Frequency (cf)
45	8	8
46	5	13
48	6	19
50	9	28
52	7	35
54	4	39
55	2	41

Here $n = 41$, which is odd

$$\therefore \text{Median} = \frac{n+1}{2} \text{th term} = \frac{41+1}{2} = \frac{42}{2} \text{th term}$$

21st term

$\therefore$ Weight of 21st boy = 50 kg

$\therefore$ Median = 50 kg **Ans.**

7. Calculate the median for the following frequency distribution :

Variate	3	6	10	12	7	15
Frequency	3	4	2	8	13	10

Sol. Arranging the variates in order are there writing on cumulative frequency table :

Variate	Frequency (f)	Cumulative frequency (cf)
3	3	3
6	4	7
7	13	20
10	2	22
12	8	30
15	10	40

Here, number of frequency is 40, which is even :

$$\begin{aligned}
 \therefore \text{Median} &= \frac{1}{2} \left\{ \frac{n}{2} \text{th term} + \left(\frac{n}{2} + 1 \right) \text{th term} \right\} \\
 &= \frac{1}{2} \left\{ \frac{40}{2} \text{th term} + \left(\frac{40}{2} + 1 \right) \text{th term} \right\} = \frac{1}{2} \{20\text{th} + 21\text{st}\} \text{ term} \\
 &= \frac{1}{2} \{7 + 10\} = \frac{17}{2} = 8.5
 \end{aligned}$$

$\therefore$ Median = 8.5 Ans.

8. The hearts of 60 patients were examined through X-ray and the observations obtained are given below :

Diameter of heart (in mm)	120	121	122	122	124	125
Number patients	7	9	15	12	6	11

Find the median :

Sol. Writing in cumulative frequency table :

Diameter of heart in (mm)	Number of patients (f)	Cumulative Frequency $c.f.$
120	7	7
121	9	16
122	15	31
123	12	43
124	6	49
125	11	60

Here number of patients = 60, which is even

$$\begin{aligned}
 \therefore \text{Median} &= \frac{1}{2} \left\{ \frac{n}{2} \text{th term} + \left(\frac{n}{2} + 1 \right) \text{th term} \right\} \\
 &= \frac{1}{2} \left\{ \frac{60}{2} \text{th term} + \left(\frac{60}{2} + 1 \right) \text{th term} \right\} = \frac{1}{2} \{30\text{th} + 31\text{st term}\} \\
 &= \frac{1}{2} \{122 + 122\} = \frac{1}{2} \times 244 = \frac{244}{2} = 122.0
 \end{aligned}$$

$\therefore$ Median = 122mm Ans.

9. Find the median for the following data :

Variate	23	26	20	30	28	25	18	16
Frequency	4	6	13	5	11	4	8	9

Sol. Writing in cumulative frequency table after arranging in order :

Variate	Frequency (f)	Cumulative frequency (c.f.)
16	9	9
18	8	17
20	13	30
23	4	38
25	4	34
26	6	44
28	11	55
30	5	60

Here number of total frequencies is 60 which is even.

$$\begin{aligned}
 \therefore \text{Median} &= \frac{1}{2} \left\{ \frac{n}{2} \text{th term} + \left(\frac{n}{2} + 1 \right) \text{th term} \right\} \\
 &= \frac{1}{2} \left\{ \frac{60}{2} \text{th term} + \left(\frac{60}{2} + 1 \right) \text{th term} \right\} \\
 &= \frac{1}{2} \{30\text{th term} + 31\text{st term}\} = \frac{1}{2} (20 + 23) = \frac{43}{2} = 21.5 \\
 \therefore \text{Median} &= 21.5 \text{ Ans.}
 \end{aligned}$$