Measures of Central Tendency-24.1

1.

Sol:

It is given that,

The heights of 5 persons are $-140cm, 150cm, 152cm, 158cm \; and \; 161cm.$

$\therefore$ Mean height $= \dfrac{Sum \; of \; heights}{Total \; No.of \; persons}$

$= \dfrac{140+150+152+158+161}{5}$

$= \dfrac{761}{5}$

$= 152 \cdot 2.$

2.

Sol:

Given numbers are $-994, 996, 998, 1000 \; and \; 1002.$

$\therefore Mean = \dfrac{Sum \; of \; Numbers}{Total \; Numbers}$

$= \dfrac{994+996+998+1000+1002}{5}$

$= \dfrac{4990}{5}$

$= 998.$

3.

Sol:

Given that,

The first five natural numbers are $1, 2, 3, 4, 5$

$\therefore Mean = \dfrac{Sum \; of \; Numbers}{Total \; Numbers}$

$= \dfrac{1+2+3+4+5}{5}$

$= \dfrac{15}{5}$

$\boxed{Mean = 3}$

4.

Sol:

All factors of 10 are $-1, 2, 5, 10$

$$\therefore Mean = \frac{Sum\ of\ \ factors}{Total\ \ factors}$$

$$= \frac{1+2+5+10}{4}$$

$$= \frac{18}{4}$$

$$= \frac{9}{2}$$

$$= 4 \cdot 5$$

$$\boxed{\therefore Mean = 4 \cdot 5}$$

5.

Sol:

Given that,

The first 10 natural numbers be $-2, 4, 6, 8, 10, 12, 14, 16, 18, 20$

$$\therefore Mean = \frac{Sum\ of\ all\ Numbers}{Total\ \ Numbers}$$

$$= \frac{2+4+6+8+10+12+14+16+18+20}{10} = \frac{110}{10}$$

$$= \frac{110}{10} = 11$$

$$\boxed{Mean = 11}$$

6.

Sol:

Numbers be $x, x+2, x+y, x+6\ and\ x+8$

$$\therefore Mean = \frac{Sum\ of\ \ Numbers}{Total\ \ Numbers}$$

$$= \frac{x+x+2+x+4+x+6+x+8}{5}$$

$$= \frac{5x+20}{5}$$

$$= \frac{5(x+4)}{5}$$

$$= x+4$$

7.

Sol:

First five multiple of 3: $3, 6, 9, 12, 15$

$$\therefore Mean = \frac{Sum\ of\ Numbers}{Total\ \ Numbers}$$

$$= \frac{3+6+9+12+15}{5}$$

$$= \frac{45}{5} = 9.$$

8.

Sol:

The weight (in kg) of 10 new born babies

$= 3\cdot4, 3\cdot6, 4\cdot2, 4\cdot5, 3\cdot9, 4\cdot1, 3\cdot8, 4\cdot5, 4\cdot4, 3\cdot6$

$$\therefore Mean\left(\overline{x}\right) = \frac{Sum\ of\ weights}{Total\ babies}$$

$= 3\cdot4 + 3\cdot6 + 4\cdot2 + 4\cdot5 + 3\cdot9 + 4\cdot1 + 3\cdot8 + 4\cdot5 + 4\cdot4 + 3\cdot6$

$= 10$

$$= \frac{40}{10} 4kg.$$

9.

Sol:

The percentage marks obtained by students are

$= 64, 36, 47, 23, 0, 19, 81, 93, 72, 35, 3, 1.$

$$\therefore \text{Mean marks } = \frac{64+36+47+23+0+19+81+93+72+35+3+1}{12}$$

$$= \frac{474}{12} = 39\cdot5$$

$\therefore$ Mean marks $= 39\cdot5$

10.

Sol:

The number of children in 10 families is

$\Rightarrow 2, 4, 3, 4, 2, 3, 5, 1, 1, 5.$

$\therefore$ Mean number of children per family

$$= \frac{Total\ no.\ of\ children}{Total\ \ families}$$

$$= \frac{2+4+3+4+2+3+5+1+1+5}{10}$$

$$= \frac{30}{10}$$

$$= 3.$$

11.

Sol:

Let m be the mean of x_1, x_2, x_3, x_4, x_5 *and* x_6

Then $M = \frac{x_1 + x_2 + x_3 + x_4 + x_5 + x_6}{6}$

$\Rightarrow x_1 + x_2 + x_3 + x_4 + x_5 + x_6 = 6M$

To prove: $(x_1 - M) + (x_2 - M) + (x_3 - M) + (x_4 - M) + (x_5 - M) + (x_6 - M)$

$= (x_1 + x_2 + x_3 + x_4 + x_5 + x_6) - (M + M + M + M + M + M)$

$= 6M - 6M$

$= 0$

$= RHS$

12.

Sol:

Duration of sunshine (in hours) for 10 days are

$= 9\cdot6, 5\cdot2, 3\cdot5, 1\cdot5, 1\cdot6, 2\cdot4, 2\cdot6, 8\cdot4, 10\cdot3, 10\cdot9$

(i) $Mean\ \bar{x} = \frac{Sum\ of\ all\ numbers}{Total\ \ numbers}$

$$= \frac{9\cdot6+5\cdot2+3\cdot5+1\cdot5+1\cdot6+2\cdot4+2\cdot6+8\cdot4+10\cdot3+10\cdot9}{10}$$

$$= \frac{56}{10} = 5\cdot6$$

(ii) LHS $= \sum_{i=1}^{10} (x_i - \bar{x})$

$= (x_1 - \bar{x}) + (x_2 - \bar{x}) + (x_3 - \bar{x}) + \ldots\ldots\ldots\ldots + (x_{10} - \bar{x})$

$= (9\cdot6-5\cdot6)+(5\cdot2-5\cdot6)+(3\cdot5-5\cdot6)+(1\cdot5-5\cdot6)+(1\cdot6-5\cdot6)+(2\cdot4-5\cdot6)$

$= (4)+(-0\cdot4)+(-2\cdot1)-4\cdot1-4-3\cdot2-3+2\cdot8+4\cdot7+5\cdot3$

$= 16\cdot8-16\cdot8$

$= 0.$

13.

Sol:

Let us say numbers are be $3,4,5$

$\therefore Mean = \dfrac{Sum\ of\ \ number}{Total\ \ number}$

$= \dfrac{3+4+5}{3}$

$= \dfrac{12}{3}$

$= 4$

(i) Adding constant term $k = 2$ in each term

New numbers are $= 5,6,7.$

$\therefore$ New mean $= \dfrac{5+6+7}{3}$

$= \dfrac{18}{3} = 6 = 4+2$

$\therefore$ New mean will be 2 more than the original mean.

(ii) Subtracting constant term $k = 2$ in each term New number are $= 1,2,3.$

$\therefore$ New mean $= \dfrac{1+2+3}{3} = \dfrac{6}{3} = 2 = 4-2.$

$\therefore$ New mean will be 2 less than the original mean

(iii) Multiplying by constant term $k = 2$ in each term

New numbers are $= \dfrac{6+8+10}{3}$

$= \dfrac{24}{3}$

$= 8$

$= 4\times2$

$\therefore$ New mean will be 2 times of the original mean.

(iv) Divide by constant term $k = 2$ in each term

New number sale $= 1\cdot5, 2, 2\cdot5$

$\therefore$ New mean $= \dfrac{1\cdot5+2+2\cdot5}{3}$

$= \frac{6}{3} = 2 = \frac{4}{2}$

$\therefore$ New mean will be half of the original mean.

14.

Sol:

Mean marks of 100 students = 40

$\Rightarrow$ Sum of marks of 100 students $= 100 \times 40 = 4000$

Correct value $= 53.$

Incorrect value $= 83.$

Correct sum $= 4000 - 83 + 53$

$= 3970$

$\therefore$ Correct mean $= \frac{3970}{100}$

$= 39 \cdot 7.$

15.

Sol:

The speed of 10 motorists are $47, 53, 49, 60, 39, 42, 55, 57, 52, 48$

Later on it was discovered that the instrument recorded 5km/hr less than in each case

$\therefore$ Correct values are $= \frac{52 + 58 + 54 + 65 + 44 + 47 + 60 + 62 + 57 + 53}{10}$

$= \frac{552}{10}$

$= 55 \cdot 2 \ \ km / hr$

16.

Sol:

The mean of the numbers 27

The, sum of five numbers $= 5 \times 27$

$= 135.$

If one number is excluded, then the new mean us 25

$\therefore$ Sum of numbers $= 4 \times 25 = 100$

$\therefore$ Excluded number $= 135 - 100$

$= 35$

17.

Sol:

The mean weight per student in a group of 7 students

Weight of 6 students (in kg) $= 52, 54, 55, 53, 56$ and 54.

Let weight of 7^{th} student = x kg

$\therefore$ Mean $= \frac{Sum\ of\ all\ weights}{Total\ students}$

$\Rightarrow 55 = \frac{52+54+55+53+56+54+x}{7}$

$\Rightarrow 385 = 324 + x$

$\Rightarrow x = 385 = 324$

$\Rightarrow x = 61\ kg$

$\therefore$ Weight of 7^{th} student = 61kg

18.

Sol:

We have,

The mean weight of 8 numbers is 15

Then, The sum of 8 numbers $= 8 \times 15 = 120$.

If each number is multiplied by 2

Then, new mean $= 120 \times 2$

$= 240$

$\therefore$ New mean $= \frac{240}{8} = 30$.

19.

Sol:

The mean of 5 numbers is 18

Then, the sum of 5 numbers $= 5 \times 18$

$= 90$

If the one number is excluded

Then, the mean of 4 numbers = 16.

$\therefore$ Sum of 4 numbers $= 4 \times 16$

$= 64$

Excluded number $= 90 - 64$

$= 26$.

20.

Sol:

The mean of 200 items = 50

Then the sum of 200 items $= 200 \times 50$

$= 10,000$

Correct values $=192 \text{ and } 88$

Incorrect values $=92=8$

$\therefore$ Correct sum $=10000-92-8+192+88$

$=10180$

$\therefore$ Correct mean $=\frac{10180}{200}=50\cdot 9$

$=\frac{101\cdot 8}{2}=50\cdot 9.$

21.

(i)

Sol:

(i) Given $\sum_{i=1}^{n}(x_i-12)=-10$

$\Rightarrow (x_1-12)+(x_2-12)+.......+(x_n-12)=-10$

$\Rightarrow (x_1+x_2+x_3+x_4+x_5+..........+x_n)=(12+12+12+......+12)=-10$

$\Rightarrow \sum x-12n=-10$ ....(1)

And $\sum_{i=1}^{n}(x_i-3)=62$

$\Rightarrow (x_1-3)+(x_2-x_3)+(x_3-3)+.......+(x_n-3)=62.$

$\Rightarrow (x_1+x_2+.........+x_n)-(3+3+3+3+......+37)=62$

$\Rightarrow \Sigma x-3n=62$ ....(2)

By subtracting equation (1) from equation (2)

We get

$\Sigma x-3n-\Sigma x+12n=62+10$

$\Rightarrow 9n=72$

$\Rightarrow n=\frac{72}{9}=8.$

Put value of n in equation (1)

$\Sigma x-12\times 8=-10$

$\Rightarrow \Sigma x-96=-10$

$\Rightarrow \Sigma x=-10+96=86$

$\therefore \overline{x}=\frac{\Sigma x}{x}=\frac{86}{8}=10\cdot 75$

(ii) Given $\sum_{i=1}^{n}(x_i-10)=30$

$$\Rightarrow (x_1 - 10) + (x_2 - 10) + ... + (x_n - 10) = 30$$

$$\Rightarrow (x_1 + x_2 + x_3 + ... + x_n) - (10 + 10 + 10 + ... + 10) = 30$$

$$\Rightarrow \sum x - 10n = 30 \qquad ....(1)$$

And $\sum_{i=1}^{n} (x_i - 6) = 150.$

$$\Rightarrow (x_1 - 6) + (x_2 - 6) + ... + (x_n - 6) = 150.$$

$$\Rightarrow (x_1 + x_2 + x_3 + ... + x_n) - (6 + 6 + 6 + ... + 6) = 150$$

$$\Rightarrow \Sigma x - 6n = 150 \qquad ....(2)$$

By subtracting equation (1) from equation (2)

$$\Sigma x - 6n - \Sigma x + 10n = 150 - 30$$

$$\Rightarrow \Sigma x - \Sigma x + 4n = 120$$

$$\Rightarrow n = \frac{120}{4}$$

$$\Rightarrow n = 30$$

Put value of n in equation (1)

$$\Sigma x - 10 \times 30 = 30$$

$$\Rightarrow \Sigma x - 300 = 30$$

$$\Rightarrow \Sigma x = 30 + 300 = 330$$

$$\therefore \overline{x} = \frac{\Sigma x}{x} = \frac{330}{30} = 11.$$

22.

Sol:

(i) Given $\sum_{i=1}^{n} (x_i + 5) = -90$

$$\Rightarrow (x_1 - 15) + (x_2 - 15) + ... + (x_n - 15) = -90$$

$$\Rightarrow (x_1 + x_2 + ... + x_n) - (15 + 15 + ... + 15) = -90$$

$$\Rightarrow \sum x - 15n = -90 \qquad ....(1)$$

And $\sum_{i=1}^{n} (x_i + 3) = 54$

$$\Rightarrow (x_1 - 3) + (x_2 - 3) + ... + (x_n + 3) = 54.$$

$$\Rightarrow (x_1 + x_2 + x_3 + ... + x_n) + (3 + 3 + 3 + ... + 37) = 54$$

$$\Rightarrow \Sigma x + 3n = 54 \qquad ....(2)$$

By subtracting equation (1) from equation (2)

$$\Sigma x - 30 - \Sigma x + 15n = 54 + 90$$

$$\Rightarrow 18n = 144$$

$$\Rightarrow n = \frac{144}{18} = 8.$$

Put value of n in equation (1)

$$\Sigma x - 15 \times 8 = -90$$

$$\Rightarrow \Sigma x - 120 = -90$$

$$\Rightarrow \Sigma x = -90 + 120 = 30$$

$$\therefore Mean = \frac{\Sigma x}{n} = \frac{30}{8} = \frac{15}{4}.$$

23.

Values are $3, 4, 6, 7, 8, 14.$

$$\therefore Mean = \frac{Sum\ of\ \ numbers}{Total\ \ number}$$

$$= \frac{3 + 4 + 6 + 7 + 8 + 14}{6}$$

$$= \frac{14}{6}$$

$$= 7.$$

$\therefore$ Sum of deviation of values from their mean

$$\Rightarrow (3 - 7) + (4 - 7) + (6 - 7) + (7 - 7) + (8 - 7) + (14 - 7)$$

$$\Rightarrow (-4) + (-3) + (-1) + (0) + (1) + (7)$$

$$\Rightarrow -8 + 8$$

$$= 0.$$

24.

Sol:

We have, $\overline{x} = \dfrac{x_1 + x_2 + ... + x_{10}}{10}$

$$\Rightarrow x_1 + x_2 + ... + x_{10} = 10\overline{x} \qquad ......(i)$$

Now, $(x_1 - \overline{x}) + (x_2 - \overline{x}) + ... + (x_{10} - \overline{x})$

$= \left(x_1 + x_2 + \ldots\ldots\ldots + x_{10}\right) - (\overline{x} + \overline{x} + \ldots\ldots\ldots$ up to 10 terms)

$\Rightarrow 10\overline{x} - 10\overline{x}$ [By equation (i)]

$= 0$

$\therefore \left(x_1 - \overline{x}\right) + \left(x_2 - \overline{x}\right) + \ldots\ldots\ldots + \left(x_{10} - \overline{x}\right) = 0$ Hence proved.

Measures of Central Tendency-24.2

1.

Sol:

x	f	Fx
5	4	20
6	8	48
7	14	98
8	11	88
9	3	27
	N = 40	$\Sigma fx = 281.$

$\therefore$ Mean $\bar{x} = \frac{\Sigma fx}{N}$

$= \frac{281}{40}$

$= 7 \cdot 025$

2.

Sol:

x	f	fx
19	13	247
21	15	315
23	16	368
25	18	450
27	16	432
29	15	435
31	13	403
	N = 106	$\Sigma fx = 2650$

$\therefore$ Mean $\bar{x} = \frac{\Sigma fx}{N} = \frac{2650}{106} = 25.$

3.

Sol:

x	f	Fx
10	3	30
15	10	150
P	25	25p
25	7	175
35	5	175
	N = 50	$\Sigma fx = 25P + 530$

It is given that

Mean $= 20 \cdot 6$

$\Rightarrow \frac{\Sigma fx}{N} = 20 \cdot 6$

$\Rightarrow \frac{25p + 530}{50} = 20 \cdot 6$

$\Rightarrow 25p + 530 = 20 \cdot 6(50) = 1030$

$\Rightarrow 25p = 1030 - 530$

$\Rightarrow 25p = 500$

$\Rightarrow p = \frac{500}{25} = 20$

$\Rightarrow p = 20$

$\boxed{\therefore P = 20}$

4.

Sol:

x	f	Fx
5	6	30
10	P	10p
15	6	90
20	10	200
25	5	125
	N = P + 27	$\Sigma fx = 10P + 445$

Given mean = 15

$\Rightarrow \frac{\Sigma xf}{N} = 15$

$\Rightarrow \frac{10p + 445}{p + 27} = 15$

$\Rightarrow 10p + 445 = 15p + 405$

$\Rightarrow 15p - 10p = 445 - 405$

$\Rightarrow 5p = 40$

$\Rightarrow p = \frac{40}{5}$

$\therefore p = 8.$

5.

Sol:

x	f	fx

8	12	96
12	16	192
15	20	300
P	24	24p
20	16	320
25	8	200
30	4	120
	N = 100	$\Sigma fx = 24P + 1228$

Given mean $= 16 \cdot 6$

$\Rightarrow \frac{\Sigma fx}{N} = 16 \cdot 6$

$\Rightarrow \frac{24p + 1228}{100} = 16 \cdot 6$

$\Rightarrow 24p = 1660 - 1228$

$\Rightarrow 24p = 432$

$\Rightarrow p = \frac{432}{24} = 18$

6.

Sol:

x	f	fx
5	2	10
8	5	40
10	8	80
12	22	264
P	7	7p
20	4	80
25	2	50
	N = 50	$\Sigma fx = 7P + 524.$

Given mean $= 12 \cdot 58$

$\Rightarrow \frac{\Sigma fx}{N} = 12 \cdot 58$

$\Rightarrow \frac{7p + 524}{50} = 12 \cdot 58$

$\Rightarrow 7p = 524 = 629$

$\Rightarrow 7p = 629 - 524$

$\Rightarrow 7p = 105$

$\Rightarrow p = \frac{105}{7} = 15$

7.

Sol:

x	f	Fx
3	6	18
5	8	40
7	15	105
9	P	9p
11	8	88
13	4	52
	N = P + 41	$\Sigma fx = 9P + 303.$

Given mean $= 7\cdot 68$

$\Rightarrow \frac{\Sigma fx}{N} = 7\cdot 68$

$\Rightarrow \frac{9p+303}{p+41} = 7\cdot 68$

$\Rightarrow 9p + 303 = 7\cdot 68p + 314\cdot 88$

$\Rightarrow 9p - 7\cdot 68p = 314\cdot 88 - 303$

$\Rightarrow 1\cdot 32p = 11\cdot 88$

$\Rightarrow p = \frac{11\cdot 88}{1\cdot 32}$

$\Rightarrow p = 9.$

8.

Sol:

x	f	Fx
10	3	30
12	10	120
20	15	300
25	7	175
35	5	175
	N = 40	$\Sigma fx = 800$

$\therefore Mean(\overline{x}) = \frac{\Sigma fx}{N}$

$= \frac{800}{40} = 20$

$\overline{x} = 20.$

9.

Sol:

Let no. of candidates appeared from school $III = x$.

School	No. of candidates	Average score
I	60	75
II	48	80
III	x	55
IV	40	50

Given, average score of all school = 66.

$$\Rightarrow \frac{N_1\bar{x}_1 + N_2\bar{x}_2 + N_3\bar{x}_3 + N_4\bar{x}_4}{N_1 + N_2 + N_3 + N_4} = 66$$

$$\Rightarrow \frac{60 + 75 + 48 + 80 + x \times 55 + 40 \times 50}{60 + 48 + x + 40} = 66$$

$$\Rightarrow \frac{4500 + 3840 + 55x + 2000}{148 + x} = 66$$

$$\Rightarrow \frac{10340 + 55x}{148 + x} = 66$$

$$\Rightarrow 10340 + 55x = 66x + 9768$$

$$\Rightarrow 10340 - 9768 = 66x - 55x$$

$$\Rightarrow 11x = 572$$

$$\Rightarrow x = \frac{572}{11} = 52.$$

$\therefore$ No. of candidates appeared from school (3) – 52.

10.

Sol:

No. of heads per toss (x)	No. of tosses (f)	fx
0	38	0
1	144	144
2	342	684
3	287	861
4	164	656
5	25	125
	N = 100	$\Sigma fx = 2470$

$\therefore$ Mean number of heads per toss $= \dfrac{\Sigma fx}{N}$

$= \frac{2470}{1000}$
$= 2 \cdot 47.$

11.

Sol:

x	f	fx
10	17	170
30	f_1	$30\ f_1$
50	32	1600
70	f_2	$70\ f_2$
90	19	1710
	N = 120	$\Sigma fx = 3480 + 30 f_1 + 70 f_2$

It is give that

Mean = 50

$\Rightarrow \frac{\Sigma fx}{N} = 50$

$\Rightarrow \frac{3480 + 30 f_1 + 70 f_2}{N} = 50$

$\Rightarrow 3480 + 30 f_1 + 70 f_2 = 50(120)$

$\Rightarrow 30 f_1 + 70 f_2 = 6000 - 3480$

$\Rightarrow 10(3 f_1 + 7 f_2) = 10(252)$

$\Rightarrow 3 f_1 + 7 f_2 = 252 \quad .....(1)$ [$\because$ Divide by 10]

And $N = 120$

$\Rightarrow 17 + f_1 + 32 + f_2 + 19 = 120$

$\Rightarrow 68 + f_1 + f_2 = 120$

$\Rightarrow f_1 + f_2 = 120 - 68$

$\Rightarrow f_1 + f_2 = 52$

Multiply with ‘3’ on both sides

$\Rightarrow 3 f_1 + 3 f_2 = 156 \quad .....(2)$

Subtracting equation (2) from equation (1)

$3 f_1 + 7 f_2 - 3 f_1 - 3 f_2 = 252 - 156$

$\Rightarrow 4 f_2 = 96$

$\Rightarrow f_2 = \frac{96}{4}$

$\Rightarrow f_2 = 24$

Put value of f_2 in equation (1)

$$\Rightarrow 3f_1 + 7 \times 24 = 250$$

$$\Rightarrow 3f_1 = 252 - 168 - 84$$

$$\Rightarrow f_1 = \frac{84}{3} = 28.$$

Measures of Central Tendency – 24.3

Find the median of the following data (1-8)

1.

Sol:

Given numbers are

83, 37, 70, 29, 45, 63, 41, 70, 34, 54

Arrange the numbers is ascending order

29, 34, 37, 41, 45, 54, 63, 70, 70, 83

n = 10 (even)

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

$$= \frac{\frac{10}{2}^{th} \ value + \left(\frac{10}{2}+1\right)^{th} \ value}{2}$$

$$= \frac{5^{th} \ value + 6^{th} value}{2}$$

$$= \frac{45+54}{2} = \frac{99}{2} = 49\cdot 5$$

2.

Sol:

Given numbers are 133, 73, 89, 108, 94, 104, 94, 85, 100, 120

Arrange in ascending order

73, 85, 89, 94, 94, 100, 104, 105, 120, 133

$n = 10$ (even)

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

$$= \frac{\frac{10}{2}^{th} \ value + \left(\frac{10}{2}+1\right)^{th} \ value}{2}$$

$$= \frac{5^{th} value + 6^{th} value}{2}$$

$$= \frac{90+104}{2} = 97$$

3.

Sol:

Given numbers are 31, 38, 27, 28, 36, 35, 40

Arranging in increasing order

25, 27, 28, 31, 35, 36, 38, 40

$n = 8$ (even)

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

$$= \frac{\frac{8}{2}^{th} \ value + \left(\frac{8}{2}+1\right)^{th} \ value}{2}$$

$$= \frac{4^{th} value + 5^{th} value}{2} = \frac{31+35}{2}$$

$$= \frac{66}{2} = 33$$

4.

Sol:

Given numbers are 15, 6, 16, 8, 222, 21, 9, 18, 25

Arrange in increasing order

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

$n = 9$ (odd)

$$\therefore Median = \left(\frac{n+1}{2}\right)^{th} \ value = \left(\frac{9+1}{2}\right)^{th} \ value$$

$$= 5^{th} value$$

$$= 16$$

5.

Sol:

Given numbers are 41, 43, 127, 99, 71, 92, 71, 58, 57

Arrange in increasing order

41, 43, 57, 58, 71, 71, 92, 99, 127

$n = 9$ (odd)

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

$$= \left(\frac{9+1}{2}\right)^{th} value$$
$$= 5^{th} value$$
$$= 71$$

6.

Sol:

Given number are 25, 34, 31, 23, 22, 26, 35, 29, 20, 32

Arranging in increasing order

20, 22, 23, 25, 26, 29, 31, 32, 34, 35

$n = 10$ (even)

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

$$= \frac{\frac{10}{2}^{th} value + \left(\frac{10}{2}+1\right)^{th} value}{2}$$

$$= \frac{5^{th} value + 6^{th} value}{2}$$

$$= \frac{26+29}{2} = \frac{55}{2}.$$

7.

Sol:

Given numbers are 12, 17, 3, 14, 5, 8, 7, 15

Arranging in increasing order 3, 5, 7, 8, 12, 14, 15, 17

$n = 8$ (even)

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

$$= \frac{\frac{8}{2}^{th} value + \left(\frac{8}{2}+1\right)^{th} value}{2}$$

$$= \frac{4^{th} value + 5^{th} value}{2}$$

$$= \frac{8+12}{2} = \frac{20}{2}$$

$\therefore$ Median = 10

8.

Sol:

Given number are

92, 35, 67, 85, 72, 81, 56, 51, 42, 69

Arranging in increasing order

35, 42, 51, 56, 67, 69, 72, 81, 85, 92

$n = 10$ (even)

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

$$= \frac{5^{th}\ value + 6^{th}\ value}{2}$$

$$= \frac{67+69}{2} = 68.$$

9.

Sol:

Given number of observation, $n = 8$

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

$$= \frac{2x+10+2x-8}{2}$$

$= 2x+1$

Given median $= 25$

$\therefore 2x+1 = 25$

$\Rightarrow 2x = 24$

$\Rightarrow x = 12$

10.

Sol:

Given numbers are

46, 64, 87, 41, 58, 77, 35, 90, 55, 92, 33

Arrange in increasing order

33, 35, 41, 46, 55, 58, 64, 77, 87, 90, 92

$n = 1$ (odd)

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

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

$= 6^{th}$ *value* $= 58$

If 92 is replaced by 99 and 41 by 43

Then, the new values are

33, 35, 43, 46, 55, 58, 64, 77, 87, 90, 99

$\therefore n = 11$ (odd)

New median $= \left(\frac{n+1}{2}\right)^{th}$ *value*

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

$= 6^{th}$ *value*

$= 58.$

11.

Sol:

Given numbers are

41, 43, 127, 99, 61, 92, 71, 58 and 57

Arrange in ascending order

41, 43, 57, 58, 61, 71, 92, 99, 127

$n = 9$ (odd)

$\therefore$ Median $= \left(\frac{n+1}{2}\right)^{th}$ *value*

$= \left(\frac{9+1}{2}\right)^{th}$ *value*

$= 5^{th}$ *value*

$= 61$

If 58 is replaced by 85

Then new values be in order are

41, 43, 57, 61, 71, 85, 92, 99, 27

$n = 9$ (odd)

$\therefore$ Median $= \left(\frac{n+1}{2}\right)^{th}$ *value*

$= \left(\frac{9+1}{2}\right)^{th}$ *value*

$= 5^{th} value$

$= 71$

12.

Sol:

Given numbers are

31, 35, 27, 29, 32, 43, 37, 41, 34, 28, 36, 47, 45, 42, 30

Arranging increasing order

27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 41, 42, 43, 44, 45

$n = 15$ (oddd)

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

$= \left(\frac{15+1}{2}\right)^{th} value$

$= 8^{th} value$

$= 35kg$

If the weight 44kg is replaced by 46 kg and 27 kg is replaced by 25 kg

Then, new values in order be

25, 28, 29, 30, 31, 32, 34, 35, 36, 37, 41, 42, 43, 45, 46

$n = 15$ (odd)

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

$= \left(\frac{15+1}{2}\right)^{th} value$

$= 8^{th} value$

$= 35kg$

13.

Sol:

Total number of observation in the given data is 10 (even number). So median of this data will be mean of $\frac{10}{2}$ i.e., 5^{th} *and* $\frac{10}{2}+1$ i.e., 6^{th} observations.

So, median of data $= \frac{5^{th} observation + 6^{th} observation}{2}$

$\Rightarrow 63 = \frac{x + x + 2}{2}$

$$\Rightarrow 63 = \frac{2x+2}{2}$$

$$\Rightarrow 63 = x+1$$

$$\Rightarrow x = 62$$

Measures of Central Tendency – 24.4

1.

Sol:

Marks	4	5	6	7	8	9	10
No. of students	2	2	2	4	2	2	1

Since, the maximum frequency corresponds to the value 7 then mode = 7 marks.

2.

Sol:

Values	125	175	225	325	375
Frequency	4	2	3	1	1

Since, maximum frequency 4 corresponds value 125 then mode = 125

3.

Sol:

Values	$7\cdot2$	$7\cdot3$	$7\cdot4$	$7\cdot5$	$7\cdot6$	$7\cdot7$
Frequency	4	2	1	2	1	2

Since, maximum frequency 4 corresponds to value $7\cdot2$ then mode $= 7\cdot2$

4.

Sol:

(i) Arranging the data in an ascending order
14, 14, 14, 14, 17, 18, 18, 18, 22, 23, 25, 28
Here observation 14 is having the highest frequency
i.e., 4 in given data, so mode of given data is 14.

(ii)

Size	38	39	40	41	42	43	44	Total
No. of persons	26	39	20	15	13	7	5	125

Since, maximum frequency 5 corresponds to value 7 then the mode = 7

5.

Sol:

Size	38	39	40	41	42	43	44	Total
No. of persons	26	39	20	15	13	7	5	125

Since, maximum frequency 39 corresponds to value – 39 then mode size = 39.