Collection and Organisation
Ex 21A

Q1

Answer :

(i) Data: Information in the form of numerical figures is known as data.

(ii) Raw data: Data that is obtained in the original form is known as raw data.

(iii) Array: When the raw data is obtained in ascending or descending order of magnitude, it is known as array.

(iv) Tabulation of data: Arranging the data in a systematic way in the form of a table is known as the tabulation of the data.

(v) Observations: Each numerical figure in a data is known as an observation.

(vi) Frequency of an observation: Number of times an observation occurs in the data is known as the frequency of an observation.

(vii) Statistics: The subject that deals with the collection, presentation, analysis and interpretation of the numerical data is known as statistics.

Q2

Answer :

Data in the ascending order:

1, 1, 2, 2, 2, 2, 2, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 6, 6

Observation	Frequency
1	2
2	5
3	1
4	4
5	6
6	2

Q3

Answer :

Daily wages in the ascending order:

130, 130, 150, 150, 150, 150, 180, 180, 180, 180, 180, 180, 200, 200, 200

Frequency table:

Daily wages (in Rs.)	No. of workers
130	2
150	4
180	6
200	3

Q4

Answer :

Data in ascending order:

5, 5, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 9, 9, 10, 10

Frequency table:

Observation	Frequency
5	2
6	4
7	7
8	5
9	2
10	2

Q5

Answer :

(i) numerical
(ii) original
(iii) array
(iv) frequency
(v) tabulation

Q6

Answer :

First five natural numbers are 1, 2, 3, 4 and 5.

Mean of the first five natural numbers $= \dfrac{\text{Sum of the given observations}}{\text{Number of given observations}}$

$= \dfrac{1+2+3+4+5}{5} = \dfrac{15}{5} = 3$

Hence, mean of the first five natural numbers is 3.

Q7

Answer :

First six odd natural numbers are 1, 3, 5, 7, 9 and 11.

Mean of the first six natural numbers $= \dfrac{\text{Sum of the given observations}}{\text{Number of the given observations}}$

$= \dfrac{1+3+5+7+9+11}{6} = \dfrac{36}{6} = 6$

Mean of the first six odd natural numbers is 6.

Q8

Answer :

First seven even natural numbers are 2, 4, 6, 8, 10, 12 and 14.

Mean of the first seven even natural numbers $= \dfrac{\text{Sum of the given observations}}{\text{Number of the given observations}}$

$$= \dfrac{2+4+6+8+10+12+14}{7} = \dfrac{56}{7} = 8$$

Mean of the first seven even natural numbers is 8.

Q9

Answer :

First five prime numbers are 2, 3, 5, 7 and 11.

Mean of the first five prime numbers $= \dfrac{\text{Sum of the given observations}}{\text{Number of the given observations}}$

$$= \dfrac{2+3+5+7+11}{5} = \dfrac{28}{5} = 5.6$$

Mean of the first five prime numbers is 5.6.

Q10

Answer :

First six multiples of 5 are 5, 10, 15, 20, 25 and 30.

Mean of the first six multiples of 5 $= \dfrac{\text{Sum of the given observations}}{\text{Number of the given observations}}$

$$\dfrac{5+10+15+20+25+30}{6} = \dfrac{105}{6} = 17.5$$

Q11

Answer :

Weight (in kg) (x_i)	Number of workers (f_i)	$(f_i \times x_i)$
60	4	240
63	5	315
66	3	198
72	1	72
75	2	150
	$\sum f_i = 15$	$\sum(f_i \times x_i) = 975$

Mean weight $= \dfrac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \dfrac{975}{15} = 65$ kg

Q12

Answer :

Daily wages (in Rs.)	Number of workers (f_i)	$(f_i \times x_i)$
140	14	1960
150	16	2400
160	15	2400
180	7	1260
190	8	1520
	$\sum f_i = 60$	$\sum(f_i \times x_i) = 9540$

Mean daily wages $= \dfrac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \dfrac{9540}{60} = $ Rs 159

Q13

Answer :

Height (in cm) (x_i)	Number of plants (f_i)	$(f_i \times x_i)$
58	20	1160
60	25	1500
62	15	930
64	8	512
66	12	792
74	10	740
	$\sum f_i = 90$	$\sum (f_i \times x_i) = 5634$

Mean height $= \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{5634}{90} = 62.6$ cm

Q14

Answer :

Age (in years) (x_i)	Number of players (f_i)	$(f_i \times x_i)$
14	15	210
15	14	210
16	10	160
17	8	136
18	3	54
	$\sum f_i = 50$	$\sum (f_i \times x_i) = 770$

Mean age $= \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{770}{50} = 15.4$ years

Q15

Answer :

Height (in cm) (x_i)	Number of boys (f_i)	$(f_i \times x_i)$
165	9	1485
170	8	1360
175	11	1925
180	12	2160
	$\sum f_i = 40$	$\sum (f_i \times x_i) = 6930$

Mean height $= \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{6930}{40} = 173.25$ cm

Collection and Organisation
Ex 21B

Q1

Answer :

We have to find the median of the following data.

(i) 3, 11, 7, 2, 5, 9, 9, 2 and 10

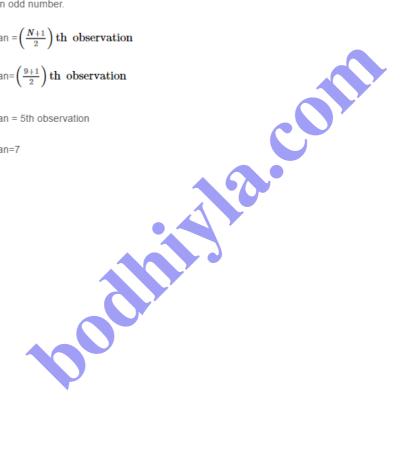Arranging them in ascending order:

 2, 2, 3, 5, 7, 9, 9, 10, 11

Number of terms, N= 9
It is an odd number.

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

Median= $\left(\frac{9+1}{2}\right)$ th observation

Median = 5th observation

Median=7

(ii) 9, 25, 18, 15, 6, 16, 8, 22, 21

Arranging them in ascending order,

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

Number of terms, $N=9$
It is an odd number.

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

Median $= \left(\frac{9+1}{2}\right)$ th observation

Median = 5th observation

Median=16

(iii) 21, 15, 6, 25, 18, 13, 20, 9, 16, 8, 22

Arranging them in ascending order:

6, 8, 9, 13, 15, 16, 18, 20, 21, 22, 25

Number of terms, $N = 11$
It is an odd number.

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

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

Median = 6th observation

Median=16

Q2

Answer :

We have to find the median of the following data.

(i) 10, 32, 17, 19, 21, 22, 9, 35

Arranging them in ascending order:

9, 10, 17, 19, 21, 22, 32, 35

Number of terms, $N = 8$

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

Median $= \frac{1}{2}(4\text{th observation} + 5\text{th observation})$

Median $= \frac{1}{2}(19+21) = 20$

∴ Median= 20

(ii) 55, 60, 35, 51, 29, 63, 72, 91, 85, 82

Arranging them in ascending order:

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

Number of terms, $N = 10$

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

$\text{Median} = \frac{1}{2} (5 \text{th observation} + 6 \text{th observation})$

$\text{Median} = \frac{1}{2} (60 + 63)$

$\therefore \text{Median} = 61.5$

Q3

Answer:

First 15 odd numbers are 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27 and 29.

Number of terms, $N = 15$
It is an odd number.

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

$\text{Median} = \left(\frac{15+1}{2} \right) \text{th observation}$

$\text{Median} = 15$

Q4

Answer:

First 10 even numbers are 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20.

Number of terms, $N = 10$

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

$\text{Median} = \frac{1}{2} (5 \text{th observation} + 6 \text{th observation})$

$\text{Median} = \frac{1}{2} (10 + 12) = 11$

Q5

Answer:

First 50 whole numbers are 0, 1, 2, 3, 4 ... and 49.

Number of terms, $N = 50$
It is an even number.

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

$= \frac{1}{2} \{ 25 \text{th observation} + 26 \text{th observation} \}$

$= \frac{1}{2} \{ 24 + 25 \}$

$= 24.5$

Q6

Answer :

Marks of the students (out of 50) in an examination are given below:

20, 22, 26, 31, 40, 19, 17, 19, 25, 29, 23, 17, 24, 21, 35

Arranging the marks in ascending order:

17, 17, 19, 19, 20, 21, 22, 23, 24, 25, 26, 29, 31, 35, 40

Number of terms, $N=15$
This is an odd number.

$$\text{Median} = \left(\frac{N+1}{2}\right) \text{th observation}$$
$$\text{Median} = \left(\frac{15+1}{2}\right) \text{th observation}$$
$$\text{Median} = 8 \text{th observation}$$
$$\text{Median} = 23$$

Hence, the median marks are 23.

Q7

Answer :

Ages (in years) of 10 teachers in a school are given below:

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

Arranging them in ascending order:

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

Number of terms, $N=10$
It is an even number.

$$\text{Median} = \tfrac{1}{2}\left\{ \left(\frac{N}{2}\right) \text{th observation} + \left(\frac{N}{2}+1\right) \text{th observation}\right\}$$
$$\text{Median} = \tfrac{1}{2}\{5 \text{th observation} + 6 \text{th observation}\}$$
$$\text{Median} = \tfrac{1}{2}\{40+43\}$$
$$\text{Median} = 41.5$$

Hence, the median age is 41.5 years.

Q8

Answer :

Cumulative frequency table:

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

Number of terms, $N = 41$
It is an odd number.

$$\text{Median} = \left\{ \left(\frac{N+1}{2}\right) \text{th observation}\right\}$$
$$= \left\{ \left(\frac{41+1}{2}\right) \text{th observation}\right\}$$
$$= \{21 \text{th observation}\}$$
$$= 50 \ \text{kg}$$

Hence, the median weight is 50 kg.

Q9

Answer :

Arranging the terms in ascending order, we have:

Marks	15	17	20	22	25	30
Number of students	3	5	9	4	6	10

Cumulative frequency table:

Marks (x_i)	Number of students (f_i)	Cumulative frequency
15	3	3
17	5	8
20	9	17
22	4	21
25	6	27
30	10	37

Number of terms, N = 37

$$\text{Median} = \left\{\left(\frac{N+1}{2}\right)\text{th observation}\right\}$$
$$= \left\{\left(\frac{37+1}{2}\right)\text{th observation}\right\}$$
$$= 19\text{ th observation}$$
$$= 22$$

Hence, the median is 22.

Q10

Answer :

Arranging the terms in ascending order:

Height (in cm)	151	152	153	154	155	156	157
Number of students	6	3	12	4	10	8	7

Cumulative frequency table:

Height (in cm) (x_i)	Number of students (f_i)	Cumulative frequency
151	6	6
152	3	9
153	12	21
154	4	25
155	10	35
156	8	43
157	7	50

Number of terms, N = 50

$$\text{Median} = \frac{1}{2}\left\{\left(\frac{N}{2}\right)\text{th observation} + \left(\frac{N}{2}+1\right)\text{th observation}\right\}$$
$$= \frac{1}{2}\left\{25\text{ th observation} + 26\text{ th observation}\right\}$$
$$= \frac{1}{2}\left\{154 + 155\right\}$$

Median =154.5

Q1

Answer :

We have to find the mode of the given data.

Mode - It is that value of the variables that occurs most frequently.

(i) 10, 8, 4, 7, 8, 11, 15, 8, 6, 8

Here, 8 occurs most frequently. Hence, the mode of the data is 8.

(ii) 27, 23, 39, 18, 27, 21, 27, 27, 40, 36, 27

Here, 27 occurs most frequently. Hence, the mode of the data is 27.

Q2

Answer :

Following are the ages (in years) of 11 cricket players:

28, 34, 32, 41, 36, 32, 32, 38, 32, 40, 31

Mode is the value of the variable that occurs most frequently.

Here, 32 occurs maximum number of times.

Hence, 32 is the mode of the ages.

Q3

Answer :

Daily wages (in Rs.) (x_i)	Number of workers (f_i)	Cumulative frequency	$(f_i \times x_i)$
100	6	6	600
125	8	14	1000
150	9	23	1350
175	12	35	2100
200	10	45	2000
	$N = \sum f_i = 45$		$\sum (f_i \times x_i) = 7050$

Here, N is 45, which is odd.

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

$$= \left\{ \frac{45+1}{2} \right\} \text{observation}$$

$$= 23 \text{ th observation}$$

$$\text{Median} = 150$$

$$\text{Mean} = \frac{\sum (f_i \times x_i)}{\sum f_i} = \frac{7050}{45} = 156.67$$

$$\text{Mode} = 3 \left(\text{Median} \right) - 2 \left(\text{Mean} \right)$$

$$= 3(150) - 2 \left(156.67 \right)$$

$$= 450 - 313.34$$

$$= 136.6$$

Hence, the median is 150, the mean is 156.67 and the mode is 136.6.

Q4

Answer:

Marks obtained (x_i)	Number of students (f_i)	Cumulative frequency	$(f_i \times x_i)$
15	2	2	30
17	5	7	85
20	10	17	200
22	12	29	264
25	8	37	200
30	4	41	120
	$N=\sum f_i = 41$		$\sum (f_i \times x_i) = 899$

Number of terms $\left(N\right)$ is 41, which is odd.

$$\text{Median} = \left\{ \left(\frac{N+1}{2}\right) \text{th observation} \right\}$$
$$= \{21 \text{th observation}\}$$
$$= 22$$

$\text{Median} = 22$

$$\text{Mean} = \frac{\sum(f_i \times x_i)}{\sum f_i}$$
$$= \frac{899}{41}$$

$\text{Mean} = 21.92$

Using empirical formula :

$$\text{Mode} = 3\left(\text{Median}\right) - 2\left(\text{Mean}\right)$$
$$= 66 - 43.84$$

$\text{Mode} = 22.16$

Hence, the median is 22, the mean is 21.92 and the mode is 22.16.

Q5

Answer:

We will prepare the table given below:

Weight (in kg) (x_i)	Number of players (f_i)	Cumulative frequency	$(f_i \times x_i)$
48	4	4	192
50	3	7	150
52	2	9	104
54	2	11	108
58	1	12	58
	$N=\sum f_i = 12$		$\sum (f_i \times x_i) = 612$

Number of terms $\left(N\right)$ is 12, which is an even number.

$$\text{Median} = \frac{1}{2}\left\{ \left(\frac{N}{2}\right) \text{th observation} + \left(\frac{N}{2}+1\right) \text{th observation} \right\}$$
$$= \{6 \text{th observation} + 7 \text{th observation}\}$$
$$= \frac{1}{2}\{50 + 50\}$$

$\text{Median} = 50$

$$\text{Mean} = \frac{\sum(f_i \times x_i)}{\sum f_i}$$
$$= \frac{612}{12}$$

$\text{Mean} = 51$

Using empirical formula :

$$\text{Mode} = 3\left(\text{Median}\right) - 2\left(\text{Mean}\right)$$
$$= 150 - 102$$

$\text{Mode} = 48$