



CHAPTER 13 STATISTICS

❖ Measures of Central Tendency

- 1) Mean 2) Median 3) Mode

❖ Types of Mean

- 1) Arithmetic Mean (A.M.)
2) Geometric Mean (G.M.)
3) Harmonic Mean (H.M.)

❖ Devices to determine the Arithmetic Mean of a grouped data

1) Direct Method

$$\bar{x} = \frac{1}{N} \sum_{i=1}^n f_i x_i$$

2) Assumed Mean Method (Change of Origin Method)

$$\bar{x} = a + \frac{1}{N} \sum f_i d_i, \text{ where } d_i = x_i - a$$

3) Step Deviation Method (Change of Origin & Scale Method)

$$\bar{x} = a + h\bar{u}$$

Derivation:

Let us consider a new variate value u_i such that $u_i = \frac{x_i - a}{h}$.

$$\text{Now, } u_i = \frac{x_i - a}{h}$$

$$\Rightarrow hu_i = x_i - a$$

$$\Rightarrow f_i hu_i = f_i x_i - a f_i$$

$$\Rightarrow \sum f_i hu_i = \sum f_i x_i - \sum a f_i$$

$$\Rightarrow h \sum f_i u_i = \sum f_i x_i - a \sum f_i$$

$$\Rightarrow \frac{1}{N} h \sum f_i u_i = \frac{1}{N} \sum f_i x_i - \frac{1}{N} a \sum f_i$$

$$\Rightarrow h \frac{1}{N} \sum f_i u_i = \bar{x} - \frac{a}{N} \times N$$

$$\Rightarrow h\bar{u} = \bar{x} - a$$

$$\therefore \bar{x} = a + h\bar{u}$$



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- **Preparation of table to find A.M. by Direct Method**

Class	Frequency (f_i)	Mid-Value(x_i)	$f_i \cdot x_i$
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- **Preparation of table to find A.M. by Assumed Mean Method**

Class	Mid-value (x_i)	$d_i = x_i - a$	Frequency (f_i)	$f_i \cdot d_i$
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- **Preparation of table to find A.M. by Step Deviation Method**

Class	Mid-value (x_i)	$u_i = \frac{x_i - a}{h}$	Frequency (f_i)	$f_i \cdot u_i$
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❖ **Geometric Mean:** $G = (\prod x_i^{f_i})^{\frac{1}{N}}$

❖ **Harmonic Mean:** $\frac{1}{H} = \frac{1}{N} \sum \frac{f_i}{x_i}$

❖ **Defect of Geometric Mean and Harmonic Mean**

The defect of geometric mean and harmonic mean are as follows:

- Inconveniences in calculating the numerical values.
- Lack of versatility.

Note:

Arithmetic Mean is taken in most cases to represent the mean of the data because GM and HM have the following disadvantages:

- Inconveniences in calculating the numerical values.
- Lack of versatility.

❖ **Median**

The median is the value of the variate such that half of the total number of variates have their values less than or equal to it and the other half have their values greater than or equal to it.

• **Formula:** $M = l + \frac{\frac{N}{2} - c}{f} \times h$ (for a grouped frequency distribution)

where, l = lower limit of the median class

N = size of the sample or population

c = cumulative frequency of the class just before the median class

f = frequency of the median class

h = width of the median class

- **Preparation of table to find Median of a grouped data**

Class	Frequency (f_i)	cumulative frequency
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❖ Mode

The mode of a data is the value of the variate for which there is maximum frequency.

- **Formula:** $\text{Mode} = l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$ (for a grouped frequency distribution)

where, l = lower limit of the modal class

f_m = frequency of the modal class (frequency having the maximum value)

f_1 = frequency of the class just before the modal class

f_2 = frequency of the class just after the modal class

h = width of the modal class

- **Preparation of table to find Mode of a grouped data**

Class	Frequency (f_i)
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❖ Relation among the three measures of Central Tendency

Karl Pearson's Empirical Formula:-

Mean – Mode = 3(Mean – Median)

i.e. Mode = 3Median – 2Mean

Note:

In an ideal case (Normal Distribution), the mean, median and mode of a distribution coincide at the same point.

❖ Measures of Location (Or Partition Values Or Quantiles)

Some of the important Partition Values are

- 1) Quartiles
- 2) Deciles
- 3) Percentiles

- **Quartiles:** The values of the variate which divide the total frequency distribution into four equal parts are called Quartiles.

There are three values of Quartiles. They are:

The first or Lower Quartile (Q_1): The value of the variate such that one fourth of all the values of the variate in the data have their values less than it while three fourth have their values greater than it is called the first or Lower Quartile. It is denoted by Q_1 .

The second Quartile (Q_2): It is same to the Median.

The third Quartile (Q_3): The value of the variate such that three fourth of all the values of the variate in the data have their values less than it while one fourth have their values greater than it is called the third or Upper Quartile. It is denoted by Q_3 .



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Combined Formula for Quartiles:

$$Q_i = l + \frac{\frac{iN}{4} - c}{f} \times h \quad (i = 1, 2, 3)$$

where, l = lower limit of the quartile class

N = sum of all the frequencies

c = cumulative frequency of the class just before the quartile class

f = frequency of the quartile class

h = width of the quartile class

- **Deciles:** The values of the variate which divide the total frequency distribution into ten equal parts are called Deciles.

There are nine values of Quartiles.

Combined Formula for Deciles:

$$D_i = l + \frac{\frac{iN}{10} - c}{f} \times h \quad (i = 1, 2, 3, \dots, 9)$$

where, l = lower limit of the decile class

N = sum of all the frequencies

c = cumulative frequency of the class just before the decile class

f = frequency of the decile class

h = width of the decile class

- **Percentiles:** The values of the variate which divide the total frequency distribution into one hundred equal parts are called Percentiles.

There are ninety nine values of Percentiles.

Combined Formula for Percentiles:

$$P_i = l + \frac{\frac{iN}{100} - c}{f} \times h \quad (i = 1, 2, 3, \dots, 99)$$

where, l = lower limit of the percentile class

N = sum of all the frequencies

c = cumulative frequency of the class just before the percentile class

f = frequency of the percentile class

h = width of the percentile class

Note: Median = $Q_2 = D_5 = P_{50}$



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SOLUTIONS

EXERCISE 13.1

1. The following are the numbers of children in a locality of 30 families.

7, 4, 0, 4, 2, 1, 2, 5, 3, 1, 4, 6, 2, 1, 4,
3, 2, 0, 1, 2, 5, 4, 2, 3, 2, 2, 1, 2, 1, 3.

Find the average number of children per family.

Solution:

$$\begin{aligned}\text{The average number of children per family} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\ &= \frac{\text{Total no. of children in the locality}}{\text{No. of families}} \\ &= \frac{79}{30} = 2.63\end{aligned}$$

2. A shop dealing in electronic goods makes the following record of T.V. sets sold during a particular year –

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No. of T.V. sets sold	14	17	16	12	7	6	8	9	6	14	15	18

Find the average number of T.V. sets sold per month.

Solution:

$$\begin{aligned}\text{The average number of T.V. sets sold per month} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\ &= \frac{\text{Total no. of T.V. sold during the year}}{\text{No. of months}} \\ &= \frac{142}{12} = 11.83\end{aligned}$$

3. The following is the record of weight of children at the time of their birth as maintained in a maternity ward during a particular year –

Weight of children in kg.	2.5	3.0	3.5	3.8	4.0	4.2
No. of Children	12	175	156	42	15	5

Find the average (mean) weight of a child at the time of birth.

Solution:

$$\begin{aligned}\text{The average (mean) weight of a child at the time of birth} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\ &= \frac{2.5 \times 12 + 3.0 \times 175 + 3.5 \times 156 + 3.8 \times 42 + 4.0 \times 15 + 4.2 \times 5}{12 + 175 + 156 + 42 + 15 + 5} \text{ kg} \\ &= \frac{30 + 525 + 546 + 159.6 + 60 + 21}{405} \text{ kg} \\ &= \frac{1341.6}{405} \text{ kg} \\ &= 3.31 \text{ kg}\end{aligned}$$



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4. Five coins were simultaneously tossed 1000 times, and at each toss the number of heads was observed. The number of tosses during which 0, 1, 2, 3, 4, 5 heads were obtained are shown in the table below. Find the mean number of heads per toss.

No. of heads per toss	0	1	2	3	4	5
No. of tosses	38	144	342	287	164	25

Solution:

$$\begin{aligned}
 \text{The mean number of heads per toss} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\
 &= \frac{0 \times 38 + 1 \times 144 + 2 \times 342 + 3 \times 287 + 4 \times 164 + 5 \times 25}{1000} \\
 &= \frac{0 + 144 + 684 + 861 + 656 + 125}{1000} \\
 &= \frac{2470}{1000} \\
 &= 2.47
 \end{aligned}$$

5. A class master maintains the following record of absence of students in his class.

No. of students absent	0	1	2	3	4	5	6	7	8	9
No. of days	2	7	6	8	30	25	7	12	8	5

Total no. of days = 110

Find the mean number of students absent per day.

Solution:

$$\begin{aligned}
 \text{The mean number of students absent per day} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\
 &= \frac{0 \times 2 + 1 \times 7 + 2 \times 6 + 3 \times 8 + 4 \times 30 + 5 \times 25 + 6 \times 7 + 7 \times 12 + 8 \times 8 + 9 \times 5}{110} \\
 &= \frac{0 + 7 + 12 + 24 + 120 + 125 + 42 + 84 + 64 + 45}{110} \\
 &= \frac{523}{110} \\
 &= 4.75
 \end{aligned}$$

6. The following is the frequency distribution of the number of teachers in Higher Secondary Schools in 1978 in India. Find the average number of teacher per Higher Secondary Schools in India for 1978.

No. of Teachers	6 – 10	11 – 15	16 – 20	21 – 25	26 – 30	31 – 35	36 – 40	41 – 45	46 – 50
No. of Hr. Sec. Schools	955	1067	1663	1492	1220	1129	745	637	442

Also, find the median number of teachers.



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Solution:

Class	Frequency (f_i)	Cumulative frequency	Mid- value (x_i)	$u_i = \frac{x_i - a}{h}$ $a = 28$	$f_i \cdot u_i$
5.5 – 10.5	955	955	8	–4	–3820
10.5 – 15.5	1067	2022	13	–3	–3201
15.5 – 20.5	1663	3685	18	–2	–3326
20.5 – 25.5	1492	5177	23	–1	–1492
25.5 – 30.5	1220	6397	28	0	0
30.5 – 35.5	1129	7526	33	1	1129
35.5 – 40.5	745	8271	38	2	1490
40.5 – 45.5	637	8908	43	3	1911
45.5 – 50.5	442	9350	48	4	1768
Total	N = 9350				–5541

Calculation of Mean

$$\begin{aligned}
 \bar{x} &= a + h\bar{u} \\
 &= a + h \frac{1}{N} \sum f_i u_i \\
 &= 28 + 5 \times \frac{-5541}{9350} \\
 &= 28 - \frac{5541}{1870} \\
 &= 28 - 2.96 \\
 &= 25.04
 \end{aligned}$$

Calculation of Median

$$\begin{aligned}
 \frac{N}{2} &= \frac{9350}{2} = 4675 \\
 \text{Median class} &= 20.5 - 25.5
 \end{aligned}$$

$$\begin{aligned}
 M &= l + \frac{\frac{N}{2} - c}{f} \times h \\
 &= 20.5 + \frac{4675 - 3685}{1492} \times 5 \\
 &= 20.5 + \frac{990}{1492} \times 5 \\
 &= 20.5 + \frac{495}{746} \times 5 \\
 &= 20.5 + \frac{2475}{746} \\
 &= 20.5 + 3.32 \\
 &= 23.82
 \end{aligned}$$

$\therefore$ the required average no. of teacher per Higher Secondary Schools is 25.04 and the median no. of teachers is 23.82.



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7. The expenditure for the consumption of water per month by 100 families is given below.

Expenditure on water (in Rs.)	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100	100 – 110	110 – 120
No. of families	12	18	20	15	12	11	6	4	2

Find the mean monthly expenditure of the families on water.

Also, determine the quartiles of the expenditure.

Solution:

Class	Frequency (f_i)	Cumulative frequency	Mid-value (x_i)	$u_i = \frac{x_i - a}{h}$ $a = 75$	$f_i \cdot u_i$
30 – 40	12	12	35	-4	-48
40 – 50	18	30	45	-3	-54
50 – 60	20	50	55	-2	-40
60 – 70	15	65	65	-1	-15
70 – 80	12	77	75	0	0
80 – 90	11	88	85	1	11
90 – 100	6	94	95	2	12
100 – 110	4	98	105	3	12
110 – 120	2	100	115	4	8
Total	N = 100				-114

Calculation of Mean

$$\begin{aligned}\bar{x} &= a + h\bar{u} \\ &= a + h \frac{1}{N} \sum f_i u_i \\ &= 75 + 10 \times \frac{-114}{100} \\ &= 75 - 11.4 \\ &= 63.60\end{aligned}$$

Calculation of Q_1

$$\begin{aligned}\frac{N}{4} &= \frac{100}{4} = 25 \\ Q_1 \text{ class} &= 40 - 50 \\ Q_1 &= l + \frac{\frac{N}{4} - c}{f} \times h \\ &= 40 + \frac{25 - 12}{18} \times 10 \\ &= 40 + \frac{13}{9} \times 5 \\ &= 40 + \frac{65}{9} \\ &= 40 + 7.22 \\ &= 47.22\end{aligned}$$

Calculation of Q_3

$$\begin{aligned}\frac{3N}{4} &= \frac{3 \times 100}{4} = 75 \\ Q_3 \text{ class} &= 70 - 80 \\ Q_3 &= l + \frac{\frac{3N}{4} - c}{f} \times h \\ &= 70 + \frac{75 - 65}{12} \times 10 \\ &= 70 + \frac{10}{6} \times 5 \\ &= 70 + \frac{5}{3} \times 5 \\ &= 70 + \frac{25}{3} \\ &= 70 + 8.33 \\ &= 78.33\end{aligned}$$

$\therefore$ the mean monthly expenditure of the families on water is Rs. 63.60.

Quartiles of the expenditure are Rs. 47.22 and Rs. 78.33.



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8. Find the median, lower and upper quartiles, 4th decile and 56th percentile of the following distribution of marks:

Marks	0 – 4	4 – 8	8 – 12	12 – 14	14 – 18	18 – 20	20 – 25	25 & above
No. of students	10	12	18	7	5	8	4	6

Solution:

Marks (Classes)	No. of Students (Frequency)	Cumulative Frequency
0 – 4	10	10
4 – 8	12	22
8 – 12	18	40
12 – 14	7	47
14 – 18	5	52
18 – 20	8	60
20 – 25	4	64
25 & above	6	70

Total $N = 70$

Calculation of Median

$$\begin{aligned}\frac{N}{2} &= \frac{70}{2} = 35 \\ \text{Median class} &= 8 - 12 \\ M &= l + \frac{\frac{N}{2} - c}{f} \times h \\ &= 8 + \frac{35 - 22}{18} \times 4 \\ &= 8 + \frac{13}{9} \times 2 \\ &= 8 + \frac{26}{9} = 8 + 2.89 \\ &= 10.89\end{aligned}$$

Calculation of Q_1

$$\begin{aligned}\frac{N}{4} &= \frac{70}{4} = 17.5 \\ Q_1 \text{ class} &= 4 - 8 \\ Q_1 &= l + \frac{\frac{N}{4} - c}{f} \times h \\ &= 4 + \frac{17.5 - 10}{12} \times 4 \\ &= 4 + \frac{7.5}{3} \\ &= 4 + 2.5 \\ &= 6.5\end{aligned}$$

Calculation of Q_3

$$\begin{aligned}\frac{3N}{4} &= \frac{3 \times 70}{4} = 52.5 \\ Q_3 \text{ class} &= 18 - 20 \\ Q_3 &= l + \frac{\frac{3N}{4} - c}{f} \times h \\ &= 18 + \frac{52.5 - 52}{8} \times 2 \\ &= 18 + \frac{0.5}{4} \\ &= 18 + 0.125 \\ &= 18.13\end{aligned}$$

Calculation of D_4

$$\begin{aligned}\frac{4N}{10} &= \frac{4 \times 70}{10} = 28 \\ D_4 \text{ class} &= 8 - 12 \\ D_4 &= l + \frac{\frac{4N}{10} - c}{f} \times h \\ &= 8 + \frac{28 - 22}{18} \times 4 \\ &= 8 + \frac{6 \times 4}{18} = 8 + \frac{4}{3} \\ &= 8 + 1.33 = 9.33\end{aligned}$$

Calculation of P_{56}

$$\begin{aligned}\frac{56N}{100} &= \frac{56 \times 70}{100} = 39.2 \\ P_{56} \text{ class} &= 8 - 12 \\ P_{56} &= l + \frac{\frac{56N}{100} - c}{f} \times h \\ &= 8 + \frac{39.2 - 22}{18} \times 4 \\ &= 8 + \frac{34.4}{9} = 8 + 3.82 \\ &= 11.82\end{aligned}$$



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9. A school has 4 sections in class X having 45, 50, 42 and 30 students respectively. A test in Mathematics was conducted in all the sections and the mean marks of these sections are 62, 55, 58 and 49 respectively. Find the overall average mark of the class.

Solution:

$$\begin{aligned}\text{The overall average mark of the class} &= \frac{1}{N} \sum_{i=1}^n f_i x_i \\ &= \frac{45 \times 62 + 50 \times 55 + 42 \times 58 + 30 \times 49}{45 + 50 + 42 + 30} \\ &= \frac{2790 + 2750 + 2436 + 1470}{167} = \frac{9446}{167} = 56.56\end{aligned}$$

10. In the following distribution, the frequencies of two classes were missing. However, the mean of the data is given to be 50 and sum of the frequencies is 120. Find the missing frequencies.

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency	17		32		19

Solution:

Let x and y represent the missing frequencies of the classes 20 – 40 and 60 – 80.

Then,

Class	Mid-value (x_i)	$u_i = \frac{x_i - a}{h}$ $a = 50$	Frequency (f_i)	$f_i \cdot u_i$
0 – 20	10	-2	17	-34
20 – 40	30	-1	x	$-x$
40 – 60	50	0	32	0
60 – 80	70	1	y	y
80 – 100	90	2	19	38
Total			$N = x + y + 68$	$-x + y + 4$

We have, $N = 120$ (given)

$$\Rightarrow x + y + 68 = 120$$

$$\Rightarrow x + y = 52 \text{ ----- (1)}$$

And

Mean = 50

$$\Rightarrow a + h\bar{u} = 50$$

$$\Rightarrow a + h \frac{1}{N} \sum f_i u_i = 50$$

$$\Rightarrow 50 + 20 \times \frac{1}{120} \times (-x + y + 4) = 50$$

$$\Rightarrow 20 \times \frac{1}{120} \times (-x + y + 4) = 0$$

$$\Rightarrow -x + y + 4 = 0$$

$$\Rightarrow -x + y = -4 \text{ ----- (2)}$$

Adding equations (1) & (2), we get

$$2y = 48$$

$$\Rightarrow y = 24$$

Substituting $y = 24$ in equation (1), we get

$$x + 24 = 52$$

$$\Rightarrow x = 52 - 24$$

$$\Rightarrow x = 28$$

$\therefore$ the missing frequencies of the classes 20 – 40 and 60 – 80 are 28 and 24 respectively.



11. Find the median, the two quartiles and the mode of the following distribution.

Marks below	10	20	30	40	50	60	70	80
No. of Students	15	35	60	84	96	127	198	250

By drawing the less than ogive, indicating the positions of the quartiles.

Solution:

Class	Cumulative Frequency	Frequency
0 – 10	15	15
10 – 20	35	20 (= 35 – 15)
20 – 30	60	25 (= 60 – 35)
30 – 40	84	24 (= 84 – 60)
40 – 50	96	12 (= 96 – 84)
50 – 60	127	31 (= 127 – 96)
60 – 70	198	71 (= 198 – 127)
70 – 80	250	52 (= 250 – 198)
Total		N = 250

Calculation of Median

Calculation of Q_1

$$\frac{N}{2} = \frac{250}{2} = 125$$

$$\frac{N}{4} = \frac{250}{4} = 62.5$$

Median class = 50 – 60

Q_1 class = 30 – 40

$$M = l + \frac{\frac{N}{2} - c}{f} \times h$$

$$Q_1 = l + \frac{\frac{N}{4} - c}{f} \times h$$

$$= 50 + \frac{125 - 96}{31} \times 10$$

$$= 30 + \frac{62.5 - 60}{24} \times 10$$

$$= 50 + \frac{290}{31} = 50 + 9.35$$

$$= 30 + \frac{25}{24} = 30 + 1.04$$

$$= 59.35$$

$$= 31.04$$



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The points (10, 15), (20, 35), (30, 60), (40, 84), (50, 96), (60, 127), (70, 198) and (80, 250) are plotted. A free hand curve is drawn by joining these points which is the required less than ogive of the given data.

Along the y – axis, the points corresponding to the ordinates $\frac{N}{2} = 125$, $\frac{N}{4} = 62.5$ and $\frac{3N}{4} = 187.5$ are located. Through these points, lines are drawn parallel to the x – axis meeting the ogive at A, B and C respectively. Now, A, B and C are the positions of the Median (Q_2), the first quartile (Q_1) and the third quartile (Q_3).

12. Find the median, lower & upper quartiles, 8th decile, 56th percentile and the mode of the following distribution of 245 workers.

Daily savings (in Rs.)	1 – 2.99	3 – 4.99	5 – 6.99	7 – 8.99	9 – 10.99	11 – 12.99	13 – 14.99	15 – 16.99
No. of workers	6	53	85	56	21	16	4	4

Solution:

Class	Frequency	Cumulative Frequency
1 – 3	6	6
3 – 5	53	59
5 – 7	85	144
7 – 9	56	200
9 – 11	21	221
11 – 13	16	237
13 – 15	4	241
15 – 17	4	245

Total

N = 245



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Calculation of Median

$$\frac{N}{2} = \frac{245}{2} = 122.5$$

Median class = 5 – 7

$$M = l + \frac{\frac{N}{2} - c}{f} \times h$$

$$= 5 + \frac{122.5 - 59}{85} \times 2$$

$$= 5 + \frac{127}{85}$$

$$= 5 + 1.49$$

$$= 6.49 \text{ (in Rs.)}$$

Calculation of Q_1

$$\frac{N}{4} = \frac{245}{4} = 61.25$$

Q_1 class = 5 – 7

$$Q_1 = l + \frac{\frac{N}{4} - c}{f} \times h$$

$$= 5 + \frac{61.25 - 59}{85} \times 2$$

$$= 5 + \frac{4.5}{85}$$

$$= 5 + 0.05$$

$$= 5.05 \text{ (in Rs.)}$$

Calculation of Q_3

$$\frac{3N}{4} = \frac{3 \times 245}{4} = 183.75$$

Q_3 class = 7 – 9

$$Q_3 = l + \frac{\frac{3N}{4} - c}{f} \times h$$

$$= 7 + \frac{183.75 - 144}{56} \times 2$$

$$= 7 + \frac{79.5}{56}$$

$$= 7 + 1.41$$

$$= 8.41 \text{ (in Rs.)}$$

Calculation of D_8

$$\frac{8N}{10} = \frac{8 \times 245}{10} = 196$$

D_8 class = 7 – 9

$$D_8 = l + \frac{\frac{8N}{10} - c}{f} \times h$$

$$= 7 + \frac{196 - 144}{56} \times 2$$

$$= 7 + \frac{52}{28}$$

$$= 7 + 1.85$$

$$= 8.85 \text{ (in Rs.)}$$

Calculation of P_{56}

$$\frac{56N}{100} = \frac{56 \times 245}{100} = 137.2$$

P_{56} class = 5 – 7

$$P_{56} = l + \frac{\frac{56N}{100} - c}{f} \times h$$

$$= 5 + \frac{137.2 - 59}{85} \times 2$$

$$= 5 + \frac{156.4}{85}$$

$$= 5 + 1.84$$

$$= 6.84 \text{ (in Rs.)}$$

Calculation of Mode

$$f_m = 85$$

$\therefore$ Modal Class = 5 – 7

$$\therefore \text{Mode} = l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$$

$$= 5 + \frac{85 - 53}{2 \times 85 - 53 - 56} \times 2$$

$$= 5 + \frac{64}{61}$$

$$= 5 + 1.04$$

$$= 6.04 \text{ (in Rs.)}$$



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