



CHAPTER 4

STATISTICS

CHAPTER EXERCISE

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Question # 1

Find the mean of the following data, using direct method.

Class	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75
Frequency	6	10	8	12	4

Solution:

Class	Frequency	Mid point (x)	$f \cdot x$
25 – 35	6	$\frac{25 + 35}{2} = 30$	$6 \times 30 = 180$
35 – 45	10	$\frac{35 + 45}{2} = 40$	$10 \times 40 = 400$
45 – 55	8	$\frac{45 + 55}{2} = 50$	$8 \times 50 = 400$
55 – 65	12	$\frac{55 + 65}{2} = 60$	$12 \times 60 = 720$
65 – 75	4	$\frac{65 + 75}{2} = 70$	$4 \times 70 = 280$
	$\sum f = 40$		$\sum f x = 1980$

$$\bar{X} = \frac{\sum f x}{\sum f}$$

$$\bar{X} = \frac{1980}{40} = 49.5$$



Question # 2

If the mean of the following frequency distribution is 24, find the value of p.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	3	4	P	3	2

Solution:

$$\sum f = 24$$

$$3 + 4 + p + 3 + 2 = 24$$

$$12 + p = 24$$

$$p = 24 - 12 = 12$$

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Question # 3

The daily expenditure of 100 families are given below.

Calculate f_1 and f_2 , if the mean of daily expenditure is \$188.

Expenditure in (\$)	140 – 160	160 – 180	180 – 200	200 – 220	220 – 240
Frequency	5	25	f_1	f_2	5

Solution:

$$\sum f = 100$$

$$5 + 25 + f_1 + f_2 + 5 = 100$$

$$35 + f_1 + f_2 = 100$$

$$f_1 + f_2 = 65 \text{ ---- (1)}$$

To find the value of f_1 & f_2 , we will find the $\bar{X}$

Classes	Frequency	Mid Point (X)	$f \cdot x$
140 – 160	5	150	$5 \times 150 = 750$
160 – 180	25	170	$25 \times 170 = 4250$
180 – 200	f_1	190	$f_1 \times 190 = 190f_1$
200 – 220	f_2	210	$f_2 \times 210 = 210f_2$
220 – 240	5	230	$5 \times 230 = 1150$
	$f_1 + f_2 + 35$		$190f_1 + 210f_2 + 6150$

$$\sum f x = 190f_1 + 210f_2 + 6150$$

$$\bar{X} = \frac{\sum f x}{\sum f}$$

$$188 = \frac{190f_1 + 210f_2 + 6150}{f_1 + f_2 + 35}$$

$$188(f_1 + f_2 + 35) = 190f_1 + 210f_2 + 6150$$

$$188f_1 + 188f_2 + 6580 = 190f_1 + 210f_2 + 6150$$

$$2f_1 + 22f_2 - 430 = 0$$

$$f_1 + 11f_2 - 215 = 0$$

$$f_1 + 11f_2 = 215 \text{ ---- (2)}$$

Solve Equation (1) & (2) simultaneously....

$$f_1 + f_2 = 65 \text{ --- (1)}$$

$$f_1 + 11f_2 = 215 \text{ --- (2)}$$

$$\begin{array}{r} \text{---} \\ -10f_2 = -150 \end{array}$$

$$f_2 = 15$$

Put into Equation (1), $f_1 = 50$



Question # 4

Calculate the missing frequency from the following distribution, given that the median of the distribution is 24.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	25	X	18	7

Solution:

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	25	X	18	7
C.F	5	30	30+X	48+X	55+X

$$l = 10; f = 25; cf = 5; \frac{N}{2} = \frac{55 + X}{2}$$

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

$$24 = 10 + \left\{ 10 \times \left(\frac{\frac{55 + X}{2} - 5}{25} \right) \right\}$$

$$24 - 10 = \left\{ 10 \times \left(\frac{\frac{55 + X}{2} - 5}{25} \right) \right\}$$

$$14 = \frac{10}{25} \left(\frac{55 + X}{2} - 5 \right)$$

$$\frac{14 \times 25}{10} = \frac{55 + X}{2} - 5$$

$$35 + 5 = \frac{55 + X}{2}$$

$$40 \times 2 = 55 + X$$

$$80 - 55 = X$$

$$X = 25$$

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Question # 5

If the median of the of the following frequency distribution is 32.5, calculate the value of f_1 and f_2 .

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	Total
Frequency	f_1	5	9	12	f_2	3	2	40

Solution:

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	Total
Frequency	f_1	5	9	12	f_2	3	2	40
CF	f_1	$5+f_1$	$14+f_1$	$26+f_1$	$26+f_1+f_2$	$29+f_1+f_2$	$31+f_1+f_2$	

$$31 + f_1 + f_2 = 40$$

$$f_1 + f_2 = 40 - 31 = 9$$

$$f_1 + f_2 = 9 \text{ ----- (1)}$$

$$l = 30; f = 12; cf = 14 + f_1; \frac{N}{2} = \frac{31 + f_1 + f_2}{2}$$

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

$$32.5 = 30 + \left\{ 10 \times \left(\frac{\frac{31 + f_1 + f_2}{2} - (14 + f_1)}{12} \right) \right\}$$

$$32.5 - 30 = \left\{ 10 \times \left(\frac{\frac{31 + f_1 + f_2}{2} - (14 + f_1)}{12} \right) \right\}$$

$$2.5 = \frac{10}{12} \left(\frac{31 + f_1 + f_2}{2} - (14 + f_1) \right)$$

$$\frac{2.5 \times 12}{10} = \frac{31 + f_1 + f_2}{2} - \frac{2(14 + f_1)}{2}$$

$$\frac{30}{10} = \frac{31 + f_1 + f_2 - 28 - 2f_1}{2}$$

$$3 \times 2 = 3 - f_1 + f_2$$

$$6 - 3 = -f_1 + f_2$$

$$-f_1 + f_2 = 3$$

$$f_1 - f_2 = -3 \text{ ---- (2)}$$

Solve Equation (1) & (2) simultaneously....

$$f_1 + f_2 = 9 \text{ --- (1)}$$

$$f_1 - f_2 = -3 \text{ --- (2)}$$

add both equation

$$2f_1 = 6$$

$$f_1 = 3$$

Put $f_1 = 3$ into equation (1)

$$3 + f_2 = 9$$

$$f_2 = 9 - 3 = 6$$

$$f_2 = 6$$



Question # 6

The heights of the students of Class X are given in the following frequency distribution below.

Find the model height.

Height in cm	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175
No. of students	15	8	20	12	5

Solution:

Height in cm	150 – 155	155 – 160	160 – 165	165 – 170	170 – 175
No. of students	15	8	20	12	5

Model class can be selected where Highest frequency is given

$$f_k = 20 ; f_{k-1} = 8 ; f_{k+1} = 12 ; x_h = 160 ; h = 5$$

Mode

$$M_o = x_k + h \left\{ \frac{f_k - f_{k-1}}{2(f_k) - f_{k-1} - f_{k+1}} \right\}$$

$$M_o = x_k + h \left\{ \frac{20 - 8}{2(20) - 8 - 12} \right\}$$

$$M_o = 160 + 5 \left\{ \frac{12}{40 - 20} \right\}$$

$$M_o = 160 + \left\{ \frac{60}{20} \right\}$$

$$M_o = 160 + 3 = 163$$

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Question # 7

The table below shows the mathematics grades obtained by 100 students in a school.

Grade	1	2	3	4	5	6
Frequency	18	32	20	13	10	7

Find the mean and the standard deviation of the grades.

Solution:

Grade (x)	No. of students (f)	$f \times x$	x^2	$f \times x^2$
1	18	18	1	18
2	32	64	4	128
3	20	60	9	180
4	13	52	16	208
5	10	50	25	250
6	7	42	36	252
	$\sum f$ = 100	$\sum f x = 286$		$\sum f x^2$ = 1286

$$\text{Mean} = \bar{X} = \frac{\sum f x}{\sum f} = \frac{286}{100} = 2.86$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum f x^2}{\sum f} - \left(\frac{\sum f x}{\sum f}\right)^2}$$

$$\text{Standard Deviation} = \sqrt{\frac{1286}{100} - (2.86)^2}$$

$$\text{Standard Deviation} = \sqrt{12.86 - (2.86)^2}$$

$$\text{Standard Deviation} = \sqrt{4.6804} = 2.16$$



Question # 8

In an expenditure five dices are thrown 50 times. For each throw the number of times the number 6 appears is recorded.

The result is given in the table below.

Number of times 6 appears	0	1	2	3	4	5
Frequency	21	19	9	1	0	0

Calculate the mean and the standard deviation of this distribution.

Solution:

Grade (x)	No. of students (f)	$f \times x$	x^2	$f \times x^2$
0	21	0	0	0
1	19	19	1	19
2	9	18	4	36
3	1	3	9	9
4	0	0	16	0
5	0	0	25	0
	$\sum f = 50$	$\sum f x = 40$		$\sum f x^2 = 64$

$$\text{Mean} = \bar{X} = \frac{\sum f x}{\sum f} = \frac{40}{50} = 0.8$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum f x^2}{\sum f} - \left(\frac{\sum f x}{\sum f}\right)^2}$$

$$\text{Standard Deviation} = \sqrt{\frac{64}{50} - (0.8)^2}$$

$$\text{Standard Deviation} = \sqrt{1.28 - 0.64}$$

$$\text{Standard Deviation} = \sqrt{0.64} = 0.8$$



Question # 9

A troop of scouts were asked to estimate the heights of a coconut tree. The results are shown in the table below.

Height (mm)	No. of students
$4 < m \leq 4.5$	1
$4.5 < m \leq 5$	3
$5 < m \leq 5.5$	11
$5.5 < m \leq 6$	7
$6 < m \leq 6.5$	3

Calculate an estimate of the mean and standard deviation of the heights.

Solution:

Height (mm)	No. of students (f)	Mid Point (x)	$f \times x$	x^2	$f \times x^2$
$4 < m \leq 4.5$	1	4.25	4.25	18.0625	18.0625
$4.5 < m \leq 5$	3	4.75	14.25	22.5625	67.6875
$5 < m \leq 5.5$	11	5.25	57.75	27.5625	303.1875
$5.5 < m \leq 6$	7	5.75	40.25	33.0625	231.4375
$6 < m \leq 6.5$	3	6.25	18.75	39.0625	117.1875
	$\sum f = 25$		$\sum f x = 135.25$		$\sum f x^2 = 737.5625$

$$\text{Mean} = \bar{X} = \frac{\sum f x}{\sum f} = \frac{135.25}{25} = 5.41$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum f x^2}{\sum f} - \left(\frac{\sum f x}{\sum f}\right)^2}$$

$$\text{Standard Deviation} = \sqrt{\frac{737.56}{25} - \left(\frac{135.25}{25}\right)^2}$$

$$\text{Standard Deviation} = \sqrt{29.5024 - (5.41)^2} = \sqrt{0.2343}$$

$$\text{Standard Deviation} = 0.4840$$



Question # 10

Here are the points scored by the final 15 competitors in a talent contest:

74, 75, 77, 82, 80, 77, 79, 79, 81, 82, 82, 82, 79, 80, 78.

Construct a stem and leaf diagram to summarize these points.

Solution:

Key: 7|9 means 79

S	Leaf	(f)
7	4 5 7 7 8 9 9 9	(8)
8	0 0 1 2 2 2 2	(7)