

MATHEMATICS
WORKSHEET_201124
CHAPTER 13 - STATISTICS (ANSWERS)

SUBJECT: MATHEMATICS

MAX. MARKS : 40

CLASS : XI

DURATION : 1½ hrs

General Instructions:

- (i). All questions are compulsory.
- (ii). This question paper contains 20 questions divided into five Sections A, B, C, D and E.
- (iii). **Section A** comprises of 10 MCQs of 1 mark each. **Section B** comprises of 4 questions of 2 marks each. **Section C** comprises of 3 questions of 3 marks each. **Section D** comprises of 1 question of 5 marks each and **Section E** comprises of 2 Case Study Based Questions of 4 marks each.
- (iv). There is no overall choice.
- (v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is
(a) 2 (b) 2.57 (c) 3 (d) 3.75

Ans. (b) 2.57

2. Variance of the data given below is

Size of items	3.5	4.5	5.5	6.5	7.5	8.5	9.5
Frequency	3	7	22	60	85	32	8

- (a) 1.29 (b) 2.19 (c) 1.32 (d) none of these

Ans. (c) 1.32

3. Following are marks obtained by 9 students in Mathematics test 50, 69, 20, 33, 53, 39, 40, 65, 59.
The mean deviation from the median is

- (a) 9 (b) 10.5 (c) 12.67 (d) 14.76

Ans. (c) 12.67

4. The mean and variance of a series containing 5 terms are 8 and 24 respectively. The variance of their combined series will be

- (a) 20 (b) 24 (c) 25 (d) 42

Ans. (b) 24

5. Find the mean deviation about the mean of the distribution is:

Size	20	21	22	23	24
Frequency	6	4	5	1	4

- (a) 1.25 (b) 1 (c) 1.50 (d) 2

Ans. (a) 1.25

6. The standard deviations of first 10 natural number is

- (a) 5.5 (b) 3.87 (c) 2.97 (d) 2.87

Ans. (d) 2.87

7. The mean of two groups of size 200 and 300 are 25 and 10 respectively. Their standard deviations are 3 and 4 respectively. The variance of combined sample of size 500 is

- (a) 64 (b) 65.2 (c) 67.2 (d) 64.2

Ans. (c) 67.2

8. If a, b, c, d and e be the observations with mean m and standard deviations S then the standard deviation of the observation a + K, b + K, c + K, d + K and e + K is
 (a) S (b) KS (c) S + K (d) S/K
 Ans. (a) S

For Q9 and Q10, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
 (c) (A) is true but (R) is false.
 (d) (A) is false but (R) is true.

9. **Assertion (A):** Mean deviation about the median of the observations 38, 70, 48, 34, 63, 42, 55, 44, 53, 47 is 8.4.

$$\text{Reason (R): MD (Median)} = \frac{\sum |x_i - \text{Median}|}{n}$$

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).

10. **Assertion (A):** The weights (in kg) of 5 students are as follows 31, 35, 27, 29, 32, 43, 37, 41, 34, 28, 36, 44, 45, 42, 30.

If the weight 44 kg is replaced by 46 kg and 27 kg is by 25 kg, then the new median is 35.

Reason (R): The mean deviation from the median of the weights (in kg) 54, 50, 40, 42, 51, 45, 45, 57 is 4.78.

Ans. (b) Both A and R are true but R is not the correct explanation of A.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Find the mean deviation about mean for the following data : 2, 4, 5, 7, 8, 10, 12, 17, 19, 26.

$$\text{Ans. } \bar{x} = \frac{2+4+5+7+8+10+12+17+19+26}{10} = \frac{110}{10} = 11$$

Table for mean deviation.

x	x – 11	x – 11
2	–9	9
4	–7	7
5	–6	6
7	–4	4
8	–3	3
10	–1	1
12	1	1
17	6	6
19	8	8
26	15	15
		60

$$\text{Mean Deviation} = \frac{\sum |x - \bar{x}|}{n} = \frac{60}{10} = 6$$

12. The mean of 200 items is 48 and their standard deviation is 3. Find the sum of items and sum of squares of all items.

Ans. It is given that N = 200, $\bar{x} = 48$ and $\sigma = 3$ and it is required to find the values of $\sum x$ and $\sum x^2$.

$$\text{Now, } \bar{x} = \frac{\sum x}{N} \Rightarrow \sum x = N\bar{x} = 200 \times 48 = 9600$$

$$\text{Also, } \sigma^2 = \frac{\sum x^2}{N} - \left(\frac{\sum x}{N} \right)^2$$

$$\text{Substituting the value, we get, } \sigma^2 = \frac{\sum x^2}{200} - \left(\frac{9600}{200} \right)^2 \Rightarrow \sum x^2 = 4,62,600$$

13. Find the standard deviation of 2, 4, 5, 6, 8, 17.

Ans. Table for standard deviation.

x	$x - 7$	$(x - 7)^2$
2	-5	25
4	-3	9
5	-2	4
6	-1	1
8	1	1
17	10	100
42		140

$$\bar{x} = \frac{42}{6} = 7$$

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{\frac{140}{6}} = \sqrt{23.33} = 4.83$$

14. For the distribution, $\sum(x - 5) = 3$ and $\sum(x - 5)^2 = 43$, whose total number of items is 18. Find the mean and the standard deviation.

Ans.

$$\text{Mean} = A + \frac{\sum d}{n} = 5 + \frac{3}{18} = 5 + 0.16 = 5.16$$

$$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n} \right)^2} = \sqrt{\frac{43}{18} - \left(\frac{3}{18} \right)^2} = \sqrt{2.38 - 0.02} = \sqrt{2.36} = 1.53$$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. The mean and standard deviation of 100 observations were calculated as 40 and 5.1 respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct mean and standard deviation ?

Ans.

$$\text{Given } n = 100, \bar{x} = 40, \sigma = 5.1, \bar{x} = \frac{\sum x}{n} \Rightarrow 40 = \frac{\sum x}{100} \Rightarrow \sum x = 4000$$

$$\text{Corrected } \sum x = 4000 - 50 + 40 = 3990 \quad \therefore \text{Corrected } \bar{x} = \frac{\text{Corrected } \sum x}{n} = \frac{3990}{100} = 39.9$$

$$\text{Also } \sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n} \right)^2} \Rightarrow 5.1 = \sqrt{\frac{\sum x^2}{100} - (40)^2} \Rightarrow (5.1)^2 = \frac{\sum x^2}{100} - 1600 \Rightarrow 26.01 + 1600 = \frac{\sum x^2}{100}$$

$$\Rightarrow \sum x^2 = 162601$$

$$\text{Corrected } \sum x^2 = 162601 - (50)^2 + (40)^2 = 161701$$

$$\therefore \text{Corrected } \sigma = \sqrt{\frac{\text{Corrected } \sum x^2}{n} - (\text{Corrected } \bar{x})^2} = \sqrt{\frac{161701}{100} - (39.9)^2} \\ = \sqrt{1617.01 - 1592.01} = \sqrt{25} = 5$$

16. The mean of 5 observations is 4.4 and variance is 8.24. If three observations are 1, 2 and 6, find the other two observations.

Ans. Let two other observations be x_1 and x_2

$$1 + 2 + 6 + x_1 + x_2 = n\bar{x} = 5 \times 4.4 \Rightarrow x_1 + x_2 = 13 \quad \dots (i)$$

$$\text{Also } \sigma^2 = \frac{\sum x^2}{n} - (\bar{x})^2 \Rightarrow 8.24 = \frac{\sum x^2}{5} - (4.4)^2 \Rightarrow \sum x^2 = 138$$

$$\Rightarrow 1 + 4 + 36 + x_1^2 + x_2^2 = 138 \Rightarrow x_1^2 + x_2^2 = 97$$

Solve (i) and (ii) to get $x_1 = 9$, $x_2 = 4$ etc.

17. Calculate the standard deviation for the following:

Age in years	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Number of persons	3	61	132	153	140	51	2

Ans. Table for the calculation of Standard deviation; $A = 55$; $h = 10$

C.I.	x_i	f_i	$d_i = \frac{x_i - 55}{10}$	$f_i d_i$	$f_i d_i^2$
20-30	25	3	-3	-9	27
30-40	35	61	-2	-122	244
40-50	45	132	-1	-132	132
50-60	55	153	0	0	0
60-70	65	140	1	140	140
70-80	75	51	2	102	204
80-90	85	2	3	6	18
Total		$\sum f_i = 542$		$\sum f_i d_i = -15$	$\sum f_i d_i^2 = 765$

$$\text{Standard deviation } (\sigma) = h \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N} \right)^2}$$

$$= 10 \sqrt{\frac{765}{542} - \left(\frac{-15}{542} \right)^2} = 10 \sqrt{1.4114 - 0.0008} = 10 \sqrt{1.41060} = 10 \times 1.1877 = 11.877$$

SECTION – D

Questions 18 carry 5 marks.

18. The diameter of circles (in mm) drawn in a design are given below :

Diameter (in mm)	33 – 36	37 – 40	41 – 44	45 – 48	49 – 52
No. of circles	15	17	21	22	25

Calculate the standard deviation and mean diameter of the circles.

Ans.

Class interval	Mid Value (x_i)	Frequencies (f_i)	$u_i = \frac{x_i - 42.5}{4}$	$f_i u_i$	u_i^2	$f_i u_i^2$
33 – 36	34.5	15	-2	-30	4	60
37 – 40	38.5	17	-1	-17	1	17
41 – 44	42.5	21	0	0	0	0
45 – 48	46.5	22	1	22	1	22
49 – 52	50.5	25	2	50	4	100
Total		$\sum f_i = 100$		$\sum f_i u_i = 25$		$\sum f_i u_i^2 = 199$

Here, we have taken

$$u_i = \frac{x_i - a}{h} = \frac{x_i - 42.5}{4}$$

Where, assumed mean is 42.5 and $h = 4$.

$$\text{Now, mean, } \bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 42.5 + 4 \times \frac{25}{100} = 42.5 + 1 = 43.5$$

$$\begin{aligned} \text{Variance, } \sigma_2 &= h^2 \left[\frac{\sum f_i u_i^2}{N} - \left(\frac{\sum f_i u_i}{N} \right)^2 \right] = 4^2 \left[\frac{199}{100} - \left(\frac{25}{100} \right)^2 \right] \\ &= 4^2 \left[1.99 - \frac{1}{16} \right] = 30.84 \end{aligned}$$

$$\text{Standard deviation} = \sqrt{\text{Variance}}$$

$$\Rightarrow \text{Standard deviation} = \sqrt{30.84} = 5.55$$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

- 19.** A Mathematics teacher conducted a test with 10 students in Class XI to assess their understanding of the chapter "Real Statistics." The test was scored out of a maximum of 20 marks. The teacher aims to analyze the performance of the students to identify areas of improvement, design targeted interventions, and motivate students to excel in future tests.



Marks Obtained by Students:

- 12, 18, 15, 10, 20, 14, 16, 9, 11, 17

- (i) Find the mean marks. (1)
- (ii) Find the mean of square of their marks. (1)
- (iii) Find the variance. (1)
- (iv) Find the standard deviation. (1)

Ans. (i)

$$\begin{aligned} \text{Mean marks} &= \frac{\sum x_i}{10} \\ &= \frac{17 + 7 + 13 + 16 + 12 + 15 + 10 + 18 + 12 + 20}{10} \\ &= \frac{140}{10} = 14 \end{aligned}$$

(ii)

$$\begin{aligned} \text{Mean of square of marks} &= \frac{\sum x_i^2}{10} \\ &= \frac{289 + 49 + 169 + 256 + 144 + 225}{10} \\ &= \frac{+100 + 324 + 144 + 400}{10} \\ &= \frac{2100}{10} = 210 \end{aligned}$$

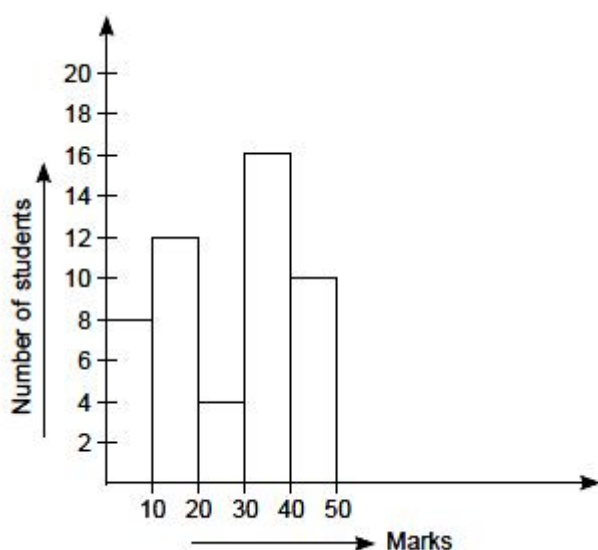
(iii)

$$\begin{aligned}\text{Variance} &= \frac{\sum x_i^2}{10} - \left(\frac{\sum x_i}{10} \right)^2 \\ &= 210 - 14^2 \\ &= 210 - 196 = 14\end{aligned}$$

(iv)

$$\text{Standard deviation} = \sqrt{\text{variance}} = \sqrt{14} = 3.74$$

20. A teacher wants to analyze the performance of 50 students in a Mathematics test to identify patterns and trends in their marks distribution. The teacher collects the marks of all 50 students, organizes them into class intervals such as 0-10, 10-20, 20-30, and so on, and counts the number of students whose marks fall within each interval. Using this data, the teacher creates a histogram to represent the frequency distribution.



(i) Find the mean deviation about median. (2)

(ii) Find the mean deviation about mean. (2)

Ans.

Marks	x_i	No. of student (f_i)	cf	$f_i x_i$
0 - 10	5	8	8	40
10 - 20	15	12	20	180
20 - 30	25	4	24	100
30 - 40	35	16	40	560
40 - 50	45	10	50	450
		$\sum f_i = 50$	$\frac{n}{2} = 25$	$\sum f_i x_i = 1330$

$$\frac{N}{2} = 25 \text{ Median class } 30-40$$

$$\begin{aligned}\text{Median} &= l + \frac{\left(\frac{n}{2} - cf \right) h}{f} \\ &= 30 + \frac{(25 - 24) \times 10}{16} \\ &= 30 + 0.625 = 30.625\end{aligned}$$

$$\text{Mean} = \frac{1330}{50} = 26.6$$

x_i	f_i	Deviation from median $d_i = x_i - \text{median} $	Deviation from mean $(d_i') = x_i - \bar{X} $	$f_i d_i$	$f_i d_i'$
5	8	25.625	21.6	205.00	172.8
15	12	15.625	11.6	187.50	139.2
25	4	5.625	1.6	22.50	6.4
35	16	4.375	8.4	70.00	134.4
45	10	14.375	18.4	143.75	184.0
				$\Sigma f_i d_i = 628.75$	$\Sigma f_i d_i' = 636.8$

(i) Median deviation about median

$$= \frac{628.75}{50} = 12.575$$

(ii) Mean deviation about mean

$$= \frac{636.8}{50} = 12.74$$