33. MEASURES OF DISPERSION

1. The mean deviation of the following data about its mean is **[24TH APRIL 20 SHIFT-2]**

x_i	5	15	25	35	45
f_i	8	48	56	32	16

1. 12 2. 16
3. 25 4. 8

2. If the standard deviation of the numbers 2, 3, 2x and 11 is 3.5 .find the possible values of x. **[AP EAMCET 17-09-20_Shift-1]**

1. $2,\frac{7}{2}$ 2. $3,\frac{5}{3}$
3. $2,\frac{5}{2}$ 4. $3,\frac{7}{3}$

3. The mean deviation about the mean of the set of first 'n' natural numbers, when 'n' is an even numbers, is equal to **[AP EAMCET 17-09-20_Shift-2]**

1. n 2. $\frac{n}{2}$
3. $\frac{n}{3}$ 4. $\frac{n}{4}$

4 If the mean of 100 observations is 50 and their standard deviation is 5, then the sum of squares of all observations is _____ **[AP EAMCET 17-09-20_Shift-2]**

1. 50,000 2. 2,50,000
3. 2,52,500 4. 2,55,000

5 What is the value of x if the mean of 8,6,7,5,x And 4 is 7 ? **[AP EAMCET 18-09-20_Shift-2]**

1. 10 2. 12
3. 8 4. 6

6. What is the formula for finding co-efficient of variation, given σ =standard deviation and $\overline{x}$ = mean $\neq 0$? **[AP EAMCET 21-09-20_Shift-1]**

1. $\frac{x}{\sigma}\times 100$ 2. $\frac{x}{\sigma}$
3. $\frac{\sigma}{x}$ 4. $\frac{\sigma}{x}\times 100$

7. The average marks of boys in a class is 40 and that of girls is 45 . the average marks of both boys and girls combined is 42. Then the percentage of boys in the class is **[AP EAMCET 21-09-20_Shift-2]**

1. 60% 2. 30%
3. 40% 4. 50%

8. Find the least positive value of k, if the range of 15, 14, k, 25, 30, 35 is 23. **[AP EAMCET 23-09-20_Shift-1]**

1. 11 2. 13
3. 12 4. 14

9. If the mean of two samples of sizes 20 and 30 are 25 and 10 respectively, their variances are 9 and 16 respectively, their combined variance is

1. 67.9 2. 68.2
3. 68.1 4. 67.2

10 If the arithmetic mean of the following frequency table is 50,then f_1 *and* f_2 *values*

Class	Frequency
0-20	17
20-40	f_1
40-60	32
60-80	f_2
80-100	19
	120

1. $f_1=27$ $f_2=35$ 2. $f_1=30$ $f_2=22$
3. $f_1=28$ $f_2=24$ 4. $f_1=32$ $f_2=20$

11. The mean deviation about the mean for following data is

class interval	0 – 4	4 – 8	8 – 12	12 – 16
frequency	4	3	2	1

[TS EAMCET 09-09-20_Shift-1]

1. 6 2. 3.6
3. 3.2 4. 10

12. The mean of two groups of observations A and B are $\overline{x},\overline{y}$ respectively and their standard deviation are respectively 2 and 3.In order that the group A is to be more consistent than the group $B\,\frac{\overline{y}}{\overline{x}}>$ **[TS EAMCET 09-09-20_Shift-1]**

1. $\frac{3}{2}$ 2. $\frac{5}{1}$
3. $\frac{2}{3}$ 4. $\frac{6}{5}$

13. The mean deviation from the arithmetic mean of the discrete data 2,7,5,6,4,3,11,17,8 is

[TS EAMCET 09-09-20_Shift-2]

1. $\frac{17}{2}$
2. $\frac{10}{3}$
3. $\frac{37}{2}$
4. 9

14. The variance of the following frequency distribution is

Class interval	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30
frequency	10	8	6	4	2

[TS EAMCET 09-09-20_Shift-2]

1. 56
2. 30
3. 11
4. 20

15. For the following frequency distribution, the variance is approximately equal to

Class interval	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
frequency	4	1	10	3	2

[TS EAMCET 10-09-20_Shift-1]

1. 33.1
2. 30.55
3. 34.75
4. 37.50

16. If the mean of the discrete distribution 8, 9 , 6, 5, x, 4, 6, 5 is 6, then its standard deviation (nearest to two decimal places) is

[TS EAMCET 10-09-20_Shift-1]

1. 2.50
2. 1.58
3. 0.51
4. 1.14

17 Assertion(A):variance of $4x_1, 4x_2, ...4x_n$ is 16 times the variance of $x_1, x_2, x_3 .....x_n$

Reason(R):If y=ax+b, then variance of y is a (variance of x)+b

[TS EAMCET 10-09-20_Shift-2]

1. (A) is true,(R) is true and(R) is the correct explanation for (A)
2. (A) is true,(R) is true but (R)is not the correct explanation for (A)
3. (A) is true but (R) is false
4. (A)is false but (R)is true

18 If α, β are respectively the mean deviation about the mean and variance of the first five prime numbers, then the ordered pair $(\alpha, \beta) =$

[TS EAMCET 10-09-20_Shift-2]

1. $(2.27, 10.42)$
2. $(2.27, 10.24)$
3. $(2.72, 10.24)$
4. $(2.72, 10.42)$

19. The variance of the following frequency distribution is

classes	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
frequency	11	29	18	4	5	3

[TS EAMCET 11-09-20_Shift-1]

1. 165.3
2. 161.1
3. 282.1
4. 152.5

20. The mean deviation about the mean of the following data is nearly

size(x)	1	3	5	7	9	11	13	15
frequency	3	3	4	14	7	4	3	4

[TS EAMCET 11-09-20_Shift-1]

1. 3.45
2. 3.25
3. 2.75
4. 2.95

21. If S_1 and S_2 are the variances of the first 2k and k (k>1) natural numbers respectively, then (S_1/S_2) lies in the interval

[TS EAMCET 11-09-20_Shift-2]

1. $[4, \infty)$
2. $(1, 4]$
3. $(4, 5]$
4. $[7, \infty)$

22 The standard deviations of two sets of observations $X = \{x_i\}$ and $Y = \{y_i\}$ (i=1, 2,....,100) are respectively 5 and 6. If $\bar{x}, \bar{y}$ are their means and $\sum_{i=1}^{100}(x_i - \bar{x})(y_i - \bar{y}) = 600$, then the standard deviation of $Z = \{z_i / z_i = x_i - y_i\}$ is

[TS EAMCET 11-09-20_Shift-2]

1. 12
2. 6
3. 7
4. 10

23 In a discrete data $\frac{1}{4}^{th}$ of the observations are equal to a, another $\frac{1}{4}^{th}$ of the observations are equal to $-a$. Out of the remaining, half of them are equal to b and the rest are equal to $-b$. If the variance of all the observations is $a.b$, then

[TS EAMCET 14-09-20_Shift-2]

1. $a^2 = 4b^2$
2. $a = -2b$
3. $a = b$
4. $a = -3b$

24. For the following distribution, the mean deviation about the median is

x_i	6	12	18	24	30	36	42
f_i	4	7	9	18	15	10	5

[TS EAMCET 14-09-20_Shift-2]

1. 8.0
2. 7.5
3. 7.2
4. 7.0

25. The range of the observation 20, 28, 40, 12, 30, 15, 50 is ___ **[AP EAMCET 23-09-20_Shift-1]**

1. 18
2. 38
3. 28
4. 16

26. The variance of the variates112,116,120,125, 132 about their A.M. is **[AP EAMCET 19-08-2021_Shift-1]**

1. 58.8
2. 60
3. 48.8
4. 61.8

27. which of the following set of data has least standard deviation? **[AP EAMCET 19-08-2021_Shift-1]**

1. 10,20,30,40
2. 2,4,6,8
3. 3,6,9,12
4. 1,2,3,4

28 The mean and variance of 'n' observations $x_1, x_2, ..., x_n$ are 5 and 0 respectively. If $\sum_{i=1}^{n} x_i^2 = 400$. Then the value of '$n$' is equal to **[AP EAMCET 19-08-2021_Shift-2]**

1. 80
2. 25
3. 20
4. 16

29. Mean of the values $\sin^2 10^0, \sin^2 20^0, \sin^2 30^0, ..., \sin^2 90^0$ is **[AP EAMCET 19-08-2021_Shift-2]**

1. $\frac{5}{9}$
2. $\frac{2}{3}$
3. $\frac{7}{9}$
4. $\frac{1}{9}$

30 The mean deviation from the mean of the set of observations $-1, 0, 4$ is **[AP EAMCET 20-08-2021_Shift-1]**

1. 3
2. 1
3. -2
4. 2

31. Let an angle of a triangle is 60^0. If the variance of the angles of the triangles is 1014^0, then the other two angles are **[AP EAMCET 20-08-2021_Shift-1]**

1. 23^0 and 97^0
2. 22^0 and 98^0
3. 21^0 and 99^0
4. 20^0 and 100^0

32. If the mean of a data $\bar{x}$ is 10 and if all the observations are multiplied by 2, then the mean of new data is **[AP EAMCET 20-08-2021_Shift-2]**

1. 30
2. 15
3. 50
4. 20

33. Which of the following data has minimum variance? **[AP EAMCET 23-08-2021_Shift-1]**

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

34. For the set $A = \{x_1, x_2, x_3, x_4, x_5\}$ the variance is 4 and the mean is 2. For the set $B = \{y_1, y_2, y_3, y_4, y_5\}$ the variance is 5 and the mean is 4. Then the variance of $A \cup B$ is **[AP EAMCET 23-08-2021_Shift-1]**

1. 6
2. 6.5
3. 5.5
4. 5

35. The mean of the numbers $a, b, 8, 5, 10$ is 6 and the variance is 6.80, then the possible values of a and b are **[AP EAMCET 23-08-2021_Shift-2]**

1. $a = 2, b = 3$
2. $a = 4, b = 5$
3. $a = 1, b = 3$
4. $a = 3, b = 4$

36. In a distribution of 10 observation, the sum of the observations is 60 and sum of their squares is 1000, then the variance is **[AP EAMCET 23-08-2021_Shift-2]**

1. 8
2. 64
3. 32
4. 40

37. The mean of set 'n' numbers when each in divided by 5 is $\frac{X}{5}$, then mean of the 'n' number is **[AP EAMCET 24-08-2021_Shift-1]**

1. $5\bar{X}$
2. X
3. $25X$
4. $\frac{X}{25}$

38. The mean of the squares of first 'n' natural numbers is **[AP EAMCET 24-08-2021_Shift-1]**

1. $\left[\frac{n(n+1)}{2}\right]^2$
2. $\frac{2n^2 - 3n + 1}{6}$

3. $\frac{2n^2+3n+1}{6}$ 4. $\frac{n(n+1)(2n+1)}{6}$

39. The arithmetic mean of the following discrete data 12, 14, 20, 23, 25, 32 is given by

[AP EAMCET 24-08-2021_Shift-2]

1. 22 2. 21.75
3. 21 4. 20.5

40. The mean marks of 25 boys in a class is 61 and the mean marks of 35 girls in the same class is 58. Then the mean of all 60 students is _____

[AP EAMCET 25-08-2021_Shift-1]

1. 56.25 2. 59.25
3. 57.25 4. 63.25

41. The arithmetic mean of five natural numbers is 40. The largest exceeds the smallest number by 10. If α is the maximum possible value for the largest of these 5 numbers, then the number of positive integral divisors of α is _____

[AP EAMCET 25-08-2021_Shift-1]

1. 12 2. 10
3. 9 4. 5

42. If for a distribution,

$\sum(x-5)=3, \sum(x-5)^2=43$ and total no.of observations is 18, then the variance of the distribution is

[AP EAMCET 25-08-2021_Shift-2]

1. 2.16 2. 3.16
3. 2.36 4. 3.36

43. The possible values of x if S.D of the numbers 2, 3, $2x$ and 11 is 3.5 is equal to

[AP EAMCET 25-08-2021_Shift-2]

1. $4, \frac{5}{3}$ 2. $5, \frac{7}{3}$
3. $3, \frac{7}{3}$ 4. $2, \frac{5}{3}$

44. If 65 is the range of the ungrouped data 50, 70, 60, B, 20, 40, then the absolute difference of the possible values of B is

[TS EAMCET 04-08-2021_Shift-2]

1. 90 2. 20
3. 80 4. 65

45 If 10 the mean of the data 2,3, 5,18, 17,15, 13, x, 9 and 7, then the mean deviation of this data about its mean is

[TS EAMCET 04-08-2021_Shift-1]

1. 4.7 2. 4.8
3. 4.9 4. 5.0

46 Let O be the mean deviation of the first five odd natural numbers about their mean and P be the mean deviation of the first five prime numbers about their mean. Then $P-O=$

[TS EAMCET 05-08-2021_Shift-1]

1. 0.3 2. 0.32
3. 0.23 4. 0.2

47 If M_1 *and* M_2 are the mean deviations from mean and median of the first 15 even integers then $M_1+M_2=$

[TS EAMCET 05-08-2021_Shift-2]

1. $\frac{112}{15}$ 2. $\frac{224}{15}$
3. $\frac{56}{15}$ 4. $\frac{28}{15}$

48 The mean deviation about the median of the discrete data 12,15,7,4,4,15,23,14 is

[TS EAMCET 06-08-2021_Shift-1]

1. 5 2. 8
3. 13 4. 10

49 The mean deviation about the mean for the following data: 5,6,7,8,6,9,13,12,15 is

[AP EAMCET 04-07-2022_Shift-1]

1. 1.55 2. 2.88
3. 3.89 4. 5

50. If the mean of the data p,6,6,7,8,11,15,16,is 3 times p,then the mean deviation of the data from its mean is

[AP EAMCET 04-07-2022_Shift-2]

1. 2.25 2. 3.75
3. 4.4 4. 2.5

51. If the mean deviation of the data 1, 1+d, 1+2d, ... , 1+100d, (d>0) from their mean is 255, then 'd' is equal to

[AP EAMCET 05-07-2022_Shift-1]

1. 10.1 2. 10.2
3. 10.3 4. 10.4

52. The mean deviation about the mean for the following data:

Marks	0–20	20–40	40–60	60–80	80–

obtained					100
Number of students	10	8	12	9	11

[AP EAMCET 05-07-2022_Shift-2]

1. 14.33
2. 15.66
3. 18
4. 22.08

53 If the total number of observations is 20, $\sum x_i = 1000$ *and* $\sum x_i^2 = 84000$, then the variance of the distribution is

[AP EAMCET 06-07-2022_Shift-1]

1. 1500
2. 1600
3. 1700
4. 1800

54. If the variance of four numbers w,x,y and z is 9, then the variance of 5w,5x,5y and 5z is

[AP EAMCET 06-07-2022_Shift-2]

1. 225
2. 5/9
3. 45
4. 54

55. The range of the data 35,12,21,24,15,7,16,12,30,32,13,17

[AP EAMCET 07-07-2022_Shift-1]

1. 28
2. 42
3. 17
4. 21

56 The standard deviation of first 10 multiples of 4 is

[AP EAMCET 07-07-2022_Shift-2]

1. 7
2. 8
3. 11.5
4. 14

57. The mean deviation about the median for the following data 6, 3, 4, 9, 2, 7 and 11 is

[AP EAMCET 08-07-2022_Shift-1]

1. 1.89
2. 2.57
3. 3.14
4. 6.23

58. The mean deviation from the median for the following data is

x	10	11	12	13
f	6	12	18	12

[AP EAMCET 08-07-2022_Shift-2]

1. 0.75
2. 7.5
3. 0.65
4. 0.40

59. If $\bar{x}$ is the mean of n observations $x_1, x_2, \ldots x_n$ then the mean of the absolute deviations of these observations from $\bar{x}$ is

[TS EAMCET 18-07-2022_Shift-1]

1. the variance of the data
2. the mean proportion of the data
3. the standard deviation of the data
4. the mean deviation of the data

60 The mean deviation from the mean of the discrete data 1, 3, 4, 7, 11, 18, 29, 47, 78 is

[TS EAMCET 18-07-2022_Shift-2]

1. 22
2. 24
3. $\frac{176}{9}$
4. $\frac{182}{9}$

61 There are n observations and all of them are negative numbers. The ascending order of these observations is $x_1, x_2 \ldots, x_n$. If the signs of the first term and last term in that order are changed, then the range of the data is

[TS EAMCET 19-07-2022_Shift-2]

1. $|x_1| - |x_n|$
2. $|x_n - x_1|$
3. $|x_1| - x_2$
4. $|x_1| - |x_2|$

62. If 10 is the mean deviation of 'n' observations $x_1, x_2, x_3, \ldots\ldots, x_n$ then the mean deviation of the observations $\frac{2x_1+5}{3}, \frac{2x_2+5}{3}, \frac{2x_3+5}{3}, \ldots\ldots, \frac{2x_n+5}{3}$ is

[TS EAMCET 20-07-2022_Shift-1]

1. $\frac{25}{3}$
2. $\frac{40}{9}$
3. $\frac{20}{3}$
4. 15

63. Statement (I) : The range of the ungrouped data does not change even if certain intermediate observations are removed.
Statement (II) : The value of the mean deviation of an ungrouped data about the median is always less than or equal to the value of mean deviation computed about any other measure of central tendency.
Statement (III) : For a grouped data, range is approximated as the difference between the

lower limit of the largest class and the upper limit of the smallest class.

1. Statement I and II are true but statement III is false
2. Statements II and III are true but statement I is false
3. Statement III and I are true but statement II is false
4. Statements I, II and III are true

64. The variance of 20 observations is 5. If each one of the observations is multiplied by 2, then the variance of the resulting observations is

[15th May 2023 Shift 1]

1. 40
2. 80
3. 20
4. 10

65. The mean of 5 observation is 4.4 and their variance is 8.24 . If three of those observations are 1, 2 and 6, then the other two observations are **[15th May 2023 Shift 2]**

1. 9, 4
2. 9,5
3. 9,2
4. 9,13

66 If the sum of squares of the deviations from the mean of the data $x_i\left(i=1,2,.....n\right) is\, n\left(\bar{x}\right)^2$ where $\bar{x}$ is the mean of $x_i's$, then the sum of squares of $x_i's$ is

[16th May 2023 Shift 1]

1. $4n\bar{x}^2$
2. $3n\bar{x}^2$
3. $12\, n\bar{x}^2$
4. $2n\bar{x}^2$

67 If $x_1, x_2, ...x_n$ are 'n' observations and $\bar{\times}$ is their mean. If $\sum_{i=1}^{n}(x_i-\bar{x})^2$ is almost zero, then a true statement among the following is

[16th May 2023 Shift 2]

1.It indicates a higher degree of dispersion of the observations from the mean $\bar{x}$

2.It indicates that there is no dispersion

3. $\sum_{i=1}^{n}(x_i-\bar{x})^2$ is the arithmetic mean of the data

4. It indicates that each observation x_i is very close to the mean $\bar{x}$ and hence degree of dispersion is low.

68 If each of the observations $x_1, x_2, ...x_n$ is increased or decreased by k, where k is a positive number, then the variance of the data thus obtained **[17th May 2023 Shift 1]**

1. Increases by k
2. Do not change
3. Is equal to k^2
4. Is equal to 2k

69. An analysis of monthly wages paid to the workers of two jute mills A and B gives the following data: **[17th May 2023 Shift 2]**

	Mill–A	Mill–B
No. of workers	500	600
Average daily wage (in rupees)	186	175
Variance of distribution of wages	81	100

Then

1. Wage bill of mill A is twice that of mill B
2. Mills A and B both have same wage bills.
3. Wage bill of mill A is greater than that of mill B
4. Wage bill of mill B is greater that that of mill A

70 Which one of the following is false?

1. Mean deviation from the mean and the Mean deviation from the Median must always be equal
2. The measure of variability which is a number independent of units, is called the coefficient of variation
3. The coefficient of variation is a relative measure of variation
4. Among two given data, the one having greater coefficient of variation is said to have more variability then the other. **[18th May2023 shift -1]**

71 Students of two sections A and B of a class show the following results in a test conducted for 100 marks.

	Section A	*Section B*
Number of students	50	60
Average marks in the test	45	45
Variance of distribution of marks	64	81

[18th May 2023 Shift 2]

1. Variability of section B> variability of section A
2. Variability of section A> variability of section B
3. Variability of section A = variability of section B
4. The data is not sufficient to compare the Variability of the sections

72 The mean deviation from the mean for the data Data 6,7,10,12,13,4,12,16 is [**19th May 2023 Shift 1**]

1. 3.25
2. 3.52
3. 3.33
4. 2.35

73 Assertion (A): The variance of the first n odd natural numbers is $\frac{n^2-1}{3}$.

Reason (R): The sum of the first n odd natural numbers is n^2 and the sum of the squares of the first n odd natural numbers is $\frac{n\left(4n^2-1\right)}{3}$.

[12TH MAY 2023 SHIFT -2]

1. (A) and (R) are true. (R) is correct explanation of (A)
2. (A) and (R) are true, but (R) is not correct explanation of (A)
3. (A) is true, but (R) is false
4. (A) is false, but (R) is true

74. If the variance of the data 2,3,5,8,12 is σ^2 and the mean deviation from the median for this data is M, then $\sigma^2 - M =$

[13TH MAY 2023 SHIFT-1]

1. 10.2
2. 5.8
3. 10.6
4. 8.2

75 The variance of 50 observations is 7. Suppose that each observation in this data is multiplied by 6 and then 5 is subtracted from it. Then the variance of that new data is [**EAPCET 14-05-23 SHIFT-1**]

1. 37
2. 42
3. 247
4. 252

76 If M and σ^2 represent respectively the mean deviation from the mean and the variance for the data 1,3,5,7,11,13,17,19,23 then $3\left(\sigma^2 - M\right) =$

[EAPCET 13-05-23 SHIFT-2]

1. 232
2. 112
3. 224
4. 136

KEY

1)	1	2)	4	3)	4	4)	3	5)	2
6)	4	7)	1	8)	3	9)	4	10)	3
11)	3	12)	3	13)	2	14)	1	15)	3
16)	2	17)	3	18)	3	19)	2	20)	4
21)	2	22)	3	23)	3	24)	2	25)	2
26)	3	27)	4	28)	4	29)	1	30)	4
31)	3	32)	4	33)	1	34)	3	35)	4
36)	2	37)	2	38)	3	39)	3	40)	2
41)	2	42)	3	43)	3	44)	3	45)	2
46)	2	47)	2	48)	1	49)	2	50)	2
51)	1	52)	4	53)	3	54)	1	55)	1
56)	3	57)	2	58)	1	59)	4	60)	3
61)	3	62)	3	63)	1	64)	3	65)	1
66)	4	67)	4	68)	2	69)	4	70)	1
71)	1	72)	1	73)	1	74)	1	75)	4
76)	4								

SOLUTIONS

1. W.K.T $M.D = \frac{1}{n}\sum_{i=1}^{n}\left|x_i - \bar{x}\right|$

x_i	f_i	$f_i x_i$	$\left\|x_i - \bar{x}\right\|$
5	8	40	20
15	48	720	10
25	56	1400	0

35	32	1120	10
45	16	720	20
total	$\sum f_i = 160$	4000	60

$$\text{Mean} = \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1400}{160} = 25$$

$$M.D = \frac{1}{5}|60| = 12$$

2 $S.D = \frac{7}{2}$

$$(S.D)^2 = \frac{49}{4}$$

$$\frac{\sum x_i^2}{n} - (\bar{x})^2 = \frac{49}{4}$$

$$\frac{134 + 4x^2}{4} - \frac{(8+x)^2}{4} = \frac{49}{4}$$

$$\Rightarrow x = 3, \frac{7}{3}$$

3 By verification:

Let n=4,take 1,2,3,4

$$\bar{x} = \frac{10}{4} = \frac{5}{2}$$

$$M.D = \frac{\sum |x_i - \bar{x}|}{n} = \frac{\left|\frac{-3}{2}\right| + \left|\frac{-1}{2}\right| + \frac{1}{2} + \frac{3}{2}}{4} = 1$$

4. $\bar{x} = \frac{\sum x_i}{100} = 50, \quad n = 100, \sigma = 5$

$$\sum x_i = 2500$$

$$\sigma^2 = \frac{\sum x_i^2}{n} - (\bar{x})^2$$

$$25 = \frac{\sum x_i^2}{100} - 2500$$

$$\sum x_1^2 = 2,52,500$$

5. $\frac{8+6+7+5+x+4}{6} = 7$

$$\Rightarrow x = 12$$

6. $\frac{\sigma}{\bar{x}} \times 100$

7. Let there are x boys and y girls then according to the given condition

$$40x + 45y = 42(x + y)$$

$$2x = 3y$$

$$\frac{x}{y} = \frac{3}{2}$$

$\therefore$ *The percentage of boys in the class is 60%*

8. $35 - k = 23 \Rightarrow k = 12$

9. $n_1 = 20, \bar{x}_1 = 25, \sigma_1^2 = 9$

$$n_2 = 30, \bar{x}_2 = 10, \sigma_2^2 = 16$$

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = 16$$

$$d_1 = \bar{x}_1 - \bar{x} = 25 - 16 = 9$$

$$d_2 = \bar{x}_2 - \bar{x} = 10 - 16 = -6$$

$$\sigma^2 = \frac{n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)}{n_1 + n_2} = 67.2$$

10

C.I	f_i	x_i	$x_i . f_i$
0-20	17	10	170
20-40	f_1	30	$30f_1$
40-60	32	50	1600
60-80	f_2	70	$70f_2$
80-100	19	90	1710
	120		$3480 + 30f_1 + 70f_2$

Given mean=50

$$50 = \frac{\sum f_i x_i}{\sum f_i} = \frac{3480 + 30f_1 + 70f_2}{120}$$

We get, $252 = 3f_1 + 7f_2 \ldots\ldots(1)$

Also $120 = 68 + f_1 + f_2$

$\Rightarrow 52 = f_1 + f_2 \ldots\ldots(2)$

From (1) & (2),

$f_1 = 28, \quad f_2 = 24$

11 M.D about mean $= \frac{1}{N}\sum f_i |x_i - \bar{x}|$

Where $N = \sum f_i \quad \bar{x} = \frac{\sum f_i x_i}{N}$

12. Conceptual

13. Mean deviation $= \frac{\sum |x_i - \bar{x}|}{n}, \ \bar{x} = \frac{\sum x_i}{n}$

14. Variance $= \frac{\sum f_i x_i^2}{n} - (\bar{x})^2$

15.

C-I	0-5	5-10	10-15	15-20	20-25
f_i	4	1	10	3	2
x_i	2.5	7.5	12.5	17.5	22.5
$f_i x_i$	10	7.5	125	52.5	45
$f_i x_i^2$	25	56.25	156.25	918.75	1012.5

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{240}{20} = 12$$

$$\text{var}iance = \frac{\sum f_i x_i^2}{N} - \mu^2 = \frac{3575}{20} - 144$$

$$= 34.75$$

16. Given $\frac{8+9+6+5+x+4+6+5}{8} = 6$

$$x = 5$$

$$\text{var}iance = \frac{8^2+9^2+6^2+5^2+5^2+4^2+6^2+5^2}{8} - 36$$

$$= 2.375$$

$$S.D = \sqrt{Variance} = 1.54$$

17. A:W.K.T. $V(ax) = a^2 V(x)$

$\therefore$ variance of $4x_1, 4x_2, \ldots\ldots 4x_n$ is

$16\text{vari}(x_1, x_2, \ldots\ldots x_n)$

R: vari(y)=vari(ax+b)

$= a^2$ vari(x)

$\therefore$ A is true, R is false

18. Let the numbers be 2,3,5,7,11

$$\text{Mean} = \frac{28}{5}$$

$$\text{M.D} = \frac{\left|\frac{28}{5}-2\right| + \left|\frac{28}{5}-3\right| + \left|\frac{28}{5}-5\right| + \left|\frac{28}{5}-7\right| + \left|\frac{28}{5}-11\right|}{5}$$

$$= 2.72$$

$$\text{Variance} = \frac{\frac{324}{25} + \frac{169}{25} + \frac{9}{25} + \frac{49}{25} + \frac{729}{25}}{5}$$

$$= \frac{1280}{125} = 10.24$$

19

C.I	f_i	x_i	$f_i x_i$	$f_i x_i^2$
0-10	11	5	55	275
10-20	29	15	435	6525
20-30	18	25	450	11250
30-40	4	35	140	4900
40-50	5	45	225	10125
50-60	3	55	165	9075
	N=70		$\sum f_i x_i = 1470$	$\sum f_i x_i^2 = 42150$

$$\text{Now } \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1470}{70} = 21$$

$$\text{Variance, } \sigma^2 = \frac{1}{n}\sum f_i x_i^2 - \bar{x}_i^2 = 161.14$$

20.

x_i	f_i	$(x_i - \bar{x})$	$\lvert f_i(x_i - \bar{x})\rvert$
1	3	-7	21
3	3	-5	15
5	4	-3	12
7	14	-1	14
9	7	1	7
11	4	3	12
13	3	5	15
15	4	7	28
	$N = 42$		$\sum\lvert f_i(x_i - \bar{x})\rvert = 124$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{336}{42} = 8$$

$$M.D \text{ about } mean = \frac{1}{n}\sum\left|f_i(x_i - \bar{x})\right| = \frac{124}{42} = 2.95$$

21. Variance of first 'n' natural numbers $= \frac{n^2-1}{12}$

$$S_1 = \frac{4k^2-1}{12}, \quad S_2 = \frac{k^2-1}{12}$$

$$\frac{S_1}{S_2} = \frac{4k^2-1}{k^2-1} = y(say) \Rightarrow 4k^2 - 1 = k^2 y - y$$

$$\Rightarrow k^2(4-y) = 1-y$$

$$\Rightarrow k^2 = \frac{1-y}{4-y} = \frac{y-1}{y-4}$$

22. $\sigma_{x_i} = 5 \Rightarrow \sigma^2_{x_i} = 25 \Rightarrow \frac{\sum(x_i - \bar{x})^2}{100} = 25$

$$\sigma_{y_i} = 6 \Rightarrow \sigma^2_{y_i} = 36 \Rightarrow \frac{\sum(y_i - \bar{y})^2}{100} = 36$$

$$\sum_{i=1}^{100}(x - x_i)(y - y_i) = 600 \Rightarrow \sum_{r=1}^{100}\frac{(x-x_i)(y-y_i)}{100} = 6$$

Let $z_i = x_i - y_i$

$$\sigma_z = \sqrt{\sum \frac{(x_i - \bar{x})^2}{100}} = \sqrt{\sum \frac{\left[(x_i - \bar{x}) - (y_i - y)\right]^2}{100}}$$

$$\sigma_z = \sqrt{\sum \frac{(x_i - \bar{x})^2}{100} + \sum \frac{(y_i - \bar{y})^2}{100} - 2.\sum \frac{(x_i - \bar{x})(y_i - \bar{y})}{100}}$$

$$= \sqrt{25 + 36 - 12} = \sqrt{49} = 7$$

23 No . of observations =n

Mean $(\bar{x}) = 0$

Variance $= ab$

$$\frac{\sum x_i^2}{n} - \bar{x}^2 = ab$$

$$\frac{\frac{n}{2}(a^2 + b^2)}{n} - 0^2 = ab$$

$$(a-b)^2 = 0 \Rightarrow a = b$$

24

x_i	6	12	18	24	30	36	42
d_i	4	7	9	18	15	10	5
l.c.f	4	11	20	38	53	63	68
$\lvert x_i - m \rvert$	18	12	6	0	6	12	18
$f_i \lvert x_i - m \rvert$	72	84	54	0	90	120	90

$$m = \frac{\sum f_i}{2}^{th} \; observation = 24$$

Mean deviation about median=

$$\frac{\sum f_i |x_i - m|}{\sum f_i} = \frac{510}{68} = 7.5$$

25 Range = maximum value – minimum value
=50-12=38

26 $mean(\bar{x}) = \frac{sum\ of\ the\ observations}{number\ of\ observations} = \frac{605}{5} = 121$

$$variance = \frac{\sum (x_i - \bar{x})^2}{n}$$

$$= \frac{9^2 + 5^2 + 1^2 + 4^2 + 11^2}{5} = \frac{244}{5} = 48.8$$

27 *S.D of* 1,2,3,4 *is* $\sqrt{\frac{n^2 - 1}{12}} = \sqrt{\frac{4^2 - 1}{12}} = \frac{\sqrt{5}}{2}$

S.D of $3,6,9,12$ *is* $= 3\left(\frac{\sqrt{5}}{2}\right)$

S.D of $2,4,6,8 = 2\left(\frac{\sqrt{5}}{2}\right) = \sqrt{5}$

S.D of $10,20,30,40 = 10\left(\frac{\sqrt{5}}{2}\right) = 5\sqrt{5}$

28 $\bar{x} = 5$

$$\frac{\sum x_i^2}{n} - x^2 = 0 \Rightarrow \frac{400}{n} - 5^2 = 0$$

$$\Rightarrow n = 16$$

29 $\bar{x}$

$$= \frac{\sin^2 10 + \sin^2 20 + ... + \sin^2 70 + \sin^2 80^0 + \sin^2 90^0}{9}$$

$$= \sin^2 10^0 + \sin^2 20^0 + \sin^2 30^0 + \sin^2 40^0 +$$

$$\frac{\cos^2 40^0 + \cos^2 30^0 + \cos^2 20^0 + \cos^2 10^0 + 1}{9}$$

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

30 $\bar{x} = \frac{-1 + 0 + 4}{3} = 1$

M.D from mean $= \frac{\sum |x_i - \bar{x}|}{n}$

$$= \frac{2 + 1 + 3}{3} = 2$$

31 $A + B + C = 180^0$

$A = 60^0 \Rightarrow B + C = 120^0; \bar{x} = \frac{180}{3} = 60^0$

$$\frac{\sum (x_i - \bar{x})^2}{n} = 1014$$

$$\Rightarrow \frac{(60-60)^2 + (B-60)^2 + (C-60)^2}{3} = 1014$$

$$0 + (B-60)^2 + (120 - B - 60)^2 = 3 \times 1014$$

$$2(B-60)^2 = 3 \times 1014$$

$$B - 60 = 39$$

$$B = 99^0$$

$$\Rightarrow C = 21^0$$

32. *Mean of the given data* $= 2\bar{x} = 2 \times 10 = 20$

33. $variance = \dfrac{\sum x_i^2}{n} - \bar{x}^2$

34. $A = \{x_1, x_2, x_3, x_4, x_5\}$

$$\frac{\sum x_i}{5} = 2 \Rightarrow \sum x_i = 10$$

$$\frac{\sum x_i^2}{5} - 2^2 = 4 \Rightarrow \sum x_i^2 = 40$$

$$B = \{y_1, y_2, y_3, y_4, y_5\}$$

$$\frac{\sum y_i}{5} = 4 \Rightarrow \sum y_i = 20$$

$$\frac{\sum y_i^2}{5} - 4^2 = 5 \Rightarrow \sum y_i^2 = 105$$

$$A \cup B = \{x_1, x_2 \ldots x_5, y_1, y_2 \ldots y_5\}$$

Mean of $A \cup B = \dfrac{\sum x_i + \sum y_i}{10} = 3$

Variance $= \dfrac{\sum x_i^2 + \sum y_i^2}{10} - x^{-2}$

$$= \frac{105+40}{10} - 9 = 5.5$$

35. $\dfrac{a+b+23}{5} = 6 \Rightarrow a+b = 7$

$$\frac{a^2+b^2+64+25+100}{5} - 36 = 6.80$$

$$\Rightarrow a^2 + b^2 = 25$$

By solving we get $a = 3, b = 4$

36 $\sum_{i=0}^{10} x_i = 60; \sum_{i=0}^{10} x_i^2 = 1000$

$$variance = \frac{\sum x_i^2}{n} - x^{-2}$$

$$= \frac{1000}{10} - \left(\frac{60}{10}\right)^2$$

$$= 64$$

37. Conceptual

38 $\bar{x} = \dfrac{\dfrac{n(n+1)(2n+1)}{6}}{n} = \dfrac{2n^2+3n+1}{6}$

39 Arithmetic mean

$$(\bar{x}) = \frac{Sum\ of\ the\ observations}{No\ of\ observations}$$

$$= \frac{126}{6} = 21$$

40 $n_1 = 25 \quad \bar{x}_1 = 61$

$n_2 = 35 \quad \bar{x}_2 = 58$

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = \frac{1525+2030}{60} = 59.25$$

41 Let the smallest be x and largest be x+10 in order to maximize x+10,we should minimize the others thus make them equal to the smallest integer x,

$$\frac{x+x+x+x+x+10}{5} = 40$$

$$5x = 190$$

$$x = 38$$

$\alpha = x + 10 = 48 = 2^4 \times 3^1$

No of positive integral divisors=

$= (4+1)(1+1) = 10$

42 $\sum (x-5) = 3 \qquad \sum (x-5)^2 = 43$

$\sum x - \sum 5 = 3 \qquad \sum (x^2 - 10x + 25) = 43$

$\sum x - 5 \times 18 = 3 \qquad \Rightarrow \sum x^2 = 523$

$\Rightarrow \sum x = 93$

$$Variance = \frac{\sum x^2}{18} - (\bar{x})^2$$

$$= \frac{523}{18} - \left(\frac{93}{18}\right)^2$$

$$= 2.36$$

43. $\bar{x} = 4 + \dfrac{x}{2}$

$$\frac{\left(2+\frac{x}{2}\right)^2 + \left(1+\frac{x}{2}\right)^2 + \left(4-\frac{3x}{2}\right)^2 + \left(-7+\frac{x}{2}\right)^2}{4} = 12.25$$

$$\Rightarrow 3x^2 - 16x + 21 = 0$$

$$x = 3, \frac{7}{3}$$

44. Conceptual

45 $10 = \dfrac{2+3+5+18+17+15+13+x+9+7}{10}$

$89 + x = 100 \Rightarrow x = 11$

Now mean deviation about the mean is

$8,7,5,8,7,5,6,11,3$

$\therefore \dfrac{8+7+5+8+7+5+3+11+3}{10} = 4.8$

46. Mean $= \dfrac{\sum x_i}{n}$

$\bar{x}_0 = \dfrac{1+3+5+7+9}{5} = 5$

M.D $= \dfrac{\sum |x_i - \bar{x}_0|}{n}$

$O = \dfrac{|4+2+0+2+4|}{5} = \dfrac{12}{5} = 2.4$

2,3,5,7,11 are five primes

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

$(M.D)_p = \dfrac{\sum |x_i - \bar{x}_p|}{n}$

$= \dfrac{3.6+2.6+0.6+1.4+5.4}{5} = \dfrac{13.6}{5} = 2.72$

$P = 2.72, O = 2.4$

$\boxed{P - O = 0.32}$

47 2,4,6,….30

n = 15

$\bar{x}$ = mean = median =16

Mean deviation is $\dfrac{\sum |x_i - \bar{x}|}{n}$

Clearly $m_1 = m_2$

$\therefore m_1 + m_2 = 2m_1$

$= 2\left[\dfrac{14+12+10+\ldots+2+0+2+4+\ldots.14}{15}\right]$

$= 2\left[\dfrac{2(0+2+4+\ldots 14)}{15}\right]$

$= 2\left[2\left(\dfrac{56}{15}\right)\right] = \dfrac{224}{15}$

48 Given data ascending order

4,4,7,12,14,14,15,15,23

$M = \dfrac{13+14}{2} = 13$

$|x_i - M| = 9,9,6,1,1,2,2,10$

Now $M.D = \dfrac{40}{8} = 5$.

49 Mean $= \dfrac{\text{sum of observations}}{\text{no of observations}} = \dfrac{81}{9} = 9$

$M.D = \dfrac{\sum |x_i - \bar{x}|}{n} = \dfrac{4+3+2+1+3+0+4+3+6}{9} = \dfrac{26}{9}$

=2.88

50. $\dfrac{p+69}{8} = 3p \Rightarrow \boxed{p = 3}$

$Mean = 3p = 9$

$M.D = \dfrac{6+3+3+2+1+2+6+7}{8} = \dfrac{30}{8} = 3.75$

51 Mean $= \dfrac{1+1+d+1+2d+\ldots\ldots+1+100d}{101}$

$= \dfrac{101+d(1+2\ldots+100)}{101}$

$= \dfrac{101+d\left(\dfrac{100\times 101}{2}\right)}{101}$

$= 1+50d$

$M.D = \dfrac{50d+49d+48d+\ldots\ldots = d+d+2d+\ldots\ldots+50d}{101} = 255$

$\dfrac{2\times\dfrac{50\times 51}{2}d}{101} = 225$

$d = 10.1$

52 $M.D = \dfrac{\sum fi|x_i - \bar{x}|}{\sum fi}$

53. $\sum x_i = 1000$

$\sum x_1^2 = 84000$

$$\sigma^2 = \frac{\sum x_1^2}{n} - \left(\bar{x}\right)^2$$

$$= \frac{84000}{20} - \left(\frac{1000}{20}\right)^2$$

$$= 4200 - 2500$$

$$= 1700$$

54. Variance $= 5^2 \times 9 = 225$

55. Range = Max value –min value

=35–7

=28

56. 4,8,12,16……40

$$\sigma = 4\sqrt{\frac{n^2-1}{12}} = 4\sqrt{\frac{100-1}{12}} = 11.49$$

57. Median=6

M.D about median $= \dfrac{\sum |x_i - M|}{n} = \dfrac{18}{7} = 2.57$

58

xi	fi	$c.f$	$\lvert x_i - m\rvert$	$f_i \lvert x_i - m\rvert$
10	6	6	2	12
11	12	18	1	12
12	18	36	0	0
13	12/48	48	1	12/36

Median m =12

M.D about median $= \dfrac{\sum fi|x_i - m|}{\sum fi} = \dfrac{36}{48} = 0.75$

59 CONCEPTUAL

60. Mean$= \dfrac{\text{sum of observations}}{\text{No. of observations}} = \dfrac{198}{9} = 22$

M.D about mean $= \dfrac{\sum |x_i - \bar{x}|}{9} = \dfrac{176}{9}$

61. Given observations $x_1, x_2, \ldots.. x_n$

Here $x_1 < x_n$

$-x_1 > -x_n$

$\therefore$ $-x_1$ is the maximum observation

Min value = x_2

$\therefore$ Range $= |x_1| - x_2$

62. $\dfrac{|x_i - \bar{x}|}{n} = 10$

M.D of $\dfrac{2x_1+5}{3}, \dfrac{2x_2+5}{3}, \ldots\ldots \dfrac{2x_n+5}{3}$

$$= \frac{\left|\dfrac{2x_i + \cancel{5}}{3} - \dfrac{2\bar{x} + \cancel{5}}{3}\right|}{n}$$

$$= \frac{2}{3}\frac{|x_i - \bar{x}|}{n} = \frac{2}{3} \times 10$$

$$= \frac{20}{3}$$

63. Conceptual

64 $v(ax+b) = a^2 v(x)$

$2^2 \times 5 = 20$

65 $x + y + 1 + 2 + 6 = 22 \rightarrow (1)$

$x + y = 13$

$$\frac{1+4+36+x^2+y^2}{5} - (4.4)^2 = 8.24$$

$$\frac{41+x^2+y^2}{5} = 8.24 + 19.36$$

$\Rightarrow x^2 + y^2 = 97 \rightarrow (2)$

solve in (1) & (2)

x = 9, y = 4

66 $\sum (x_i - \bar{x})^2 = n(\bar{x})^2$

$\sum x_i^2 + \sum (\bar{x})^2 - \sum 2x_i (\bar{x}) = n(\bar{x})^2$

$\dfrac{\sum x_i^2}{n} + (\bar{x})^2 \times \dfrac{n}{n} - 2(\bar{x})^2 = (\bar{x})^2$

$\sum x_i^2 = 2n(\bar{x})^2$

67. Conceptual

68 Variance do not change

69 $n_A = 500$ *and* $\overline{x_A} = 186$

$$\Rightarrow \frac{\Sigma x_A}{500} = 186$$

$$\Rightarrow \Sigma x_A = 186(500) = 93,000.$$

$\therefore$ *Sum of wage bill of mill* $\Lambda = 93,000$

Also $n_B = 600$ *and* $\overline{x_B} = 175$

$$\Rightarrow \frac{\Sigma x_B}{600} = 175$$

$$\Rightarrow \Sigma x_B = 175(600) = 1,05,000$$

$\therefore$ *wage bill of mill B > wage billl of mill A.*

70 Mean deviation from the mean and mean deviation from the median must always be equal

it is false

71 Since $\bar{x}_A = \bar{x}_B$

Given $\sigma_A < \sigma_B$

$\therefore$ Variability of section B > variability of section A.

72. $\bar{x} = \frac{\sum xi}{x} = \frac{80}{8} \Rightarrow 10$

$$M.D = \frac{\sum |xi - \bar{x}|}{N} = \frac{4+3+0+2+3+6+2+6}{8}$$

$$= \frac{26}{8} \Rightarrow 3.25$$

73 Conceptual

74 $\text{Mean} = \frac{\text{sum of observations}}{\text{No. of observations}} = \frac{30}{5} = 6$

$(x_i - \bar{x})^2 = 16, 9, 1, 4, 36$

$$\sigma^2 = \frac{16+9+1+4+36}{5} = \frac{66}{5} = 13.2$$

$$\therefore M = \frac{n+1}{2} = \frac{5+1}{2} = 3$$

$\sigma^2 - M = 13.2 - 3 = 10.2$

75 Given variance $= \sigma^2 = 7$

New Data is $6x - 5$

New variance of $6x - 5 = (6)^2 \sigma^2$

$= 36 \times 7 = 252$

76 $\bar{x} = 11$ *and* $M.D = (M) = \frac{56}{9}$

$$\sigma^2 = \frac{1}{N}\sum\left(x - \bar{x}\right)^2 = \frac{1}{9}[464]$$

$$3\left(\sigma^2 - M\right) = 3.\frac{1}{9}[464 - 56] = 136$$