MATHS

BOOKS - ML KHANNA

MEASURES OF CENTRAL TENDENCY

Examples

1. A cyclist covers his first three miles at an average speed of 8 m.p.h., another two miles at 3 m.p.h and the last two miles at 3 m.p.h. Find his average speed for the entire journey.

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2. If in a distribution probability of a random variable X taking the particular value x is $\ ^{n}C_{x}p^{x}q^{n-x}$ where $p + q = 1$, and

$x = 1, 2, 3, \ldots, n,$ find the its mean.

3. If G is the GM of the product of r sets of observations with geometric means $G_1, G_2, \ldots, G_r$ respectively, then G is equal to

4. Show that for a set of positive values of the variate the arithmetic geometric and harmonic means are the special cases of the pth root of the mean of the pth powers of the variates.

5. A motor car when travelling from rest travels the first twentieth of a mile at 6 m.p.h. the next three twentieths of the mile at 8,12,24 m.p.h

respectively. But its average speed over the first one-fifth of a mile is not $12 \cdot 5$ m.p.h., but $9 \cdot 6$ m.p.h. Explain the aparent paradox.

6. Find out the avegare rate of motion in the case of a person who rides the first mile @10 m.p.h., the next mile @ 8 m.p.h and the third mile @ 6 m.p.h.

7. Find the average rate of increase in population which in the first decade has increased 20% , in the next 25% and in the third 44% .

8. A man motors from A to B. In motoring a distance uphill, he gets a mileage of only 10 miles per gallon of gasoline. On the return trip, he markes 15 miles per gallon. Find the harmonic mean of his mileage. Verify that this is the proper average to be used here, assuming that the distance from A to B is 60 miles.

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9. Compute the mean of the following data by using both direct and short - cut methods.

x = Height in inches :	73	72	71	70	69	68	67	66	65
No. of = Students :	2	4	6	10	11	7	5	4	1

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10. Compute the mean (M) from the frequency distribution

Monthly wages Rs.	Freq. (f)	Mid-Value (x)	xf	$\xi = (x - A)$	$f\xi$
12.5–17.5	2	15	30	– 15	– 30
17.5–22.5	22	20	440	– 10	– 220
22.5–27.5	19	25	475	– 5	– 95
27.5–32.5	14	30	420	0	0
32.5–37.5	3	35	105	+ 5	+ 15
37.5–42.5	4	40	160	+ 10	+ 40
42.5–47.5	6	45	270	+ 15	+ 90
47.5–52.5	1	50	50	+ 20	+ 20
	n = 71		Σxf = 1950	A = 30	$\Sigma f\xi$ = – 180

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11. The following table given the marks obtained by abatch of 25 students in a certain class test in Economics. Compute the median

from the following table :

Roll No. of the Students	Economics	Roll No. of the Students	Economics
1	29	14	47
2	65	15	60
3	33	16	30
4	45	17	32
5	51	18	52
6	72	19	54
7	48	20	56
8	33	21	58
9	42	22	49
10	25	23	39
11	28	24	40
12	35	25	46
13	46		

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12. Calculate the median of the following series of marks obtained by 10 candidates in an examination

22,26,14,30,18,11,35,41,12,32

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13. Calculate the median and mode of the following grouped distribution

Marks	Frequency	Marks	Frequency
10–25	6	50–70	26
25–40	20	70–85	3
40–55	44	85–100	1

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14. Calculate the modal size in the following series by the method of grouping.

Size of item :	2	3	4	5	6	7	8	9	10	11	12	13
Frequency :	3	8	10	12	16	14	10	8	17	5	4	1

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15. Calculate the Mean, Median and Mode of the following distribution :

Marks	Frequency	Marks	Frequency
10–25	6	50–70	26
25–40	20	70–85	3
40–55	44	85–100	1

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16. Find the mode of the following series by grouping

Height	Frequency	Height	Frequency
5'6''	1	5'11''	1
5'7''	2	6'0''	2
5'8''	4	6'1''	1
5'9''	3	6'2''	1
5'10''	2	6'3''	1

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17. Determine Mode and the Median from the following figures :

25,15,23,40,27,25,23,25,20

18. Calculate the values of (a) the mode (b) the from the following :

Wages in Rs.	No. of workers
20	8
21	10
22	11
23	16
24	20
25	25
26	15
27	9
28–29	6

19. Recast the following cumulative table in the from of an ordinary frequency distribution and determine the value of the mode by using

the formula : mode = 3 median -2 mean

No. of days absent	No. of students	No. of days absent	No. of students
Less than 5	29	Less than 30	644
Less than 10	·224	Less than 35	650
Less than 15	465	Less than 40	653
Less than 20	582	Less than 45	655
Less than 25	634		

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20. Calculate the mean deviation from the arithmatic mean of the following series of marks :

20,22,27,30,31,32,35,40,45,48

Serial No.	Marks x	Deviation from 33, $[d]$ (sign ignored)
1	20	13
2	22	11
3	27	6
4	30	3
5	31	2
6	32	1
7	35	2
8	40	7
9	45	12
10	48	15
$n = 10$	$\Sigma x = 330$	$\Sigma|d| = 72$

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21. Calculate the mean deviation from the median and from the mean for following distribution of the scores of 50 college students.

Scores	140–	150–	160–	170–	180–	190–200
Freq.	4	6	10	18	9	3

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22. Find the standard deviation for the following frequency distribution

Variable	2	3	4	5	9	10	12	13	15
Freq.	25	37	44	59	68	43	31	23	12

23. Calculate the standard deviation and the coeff. Of variation from

the following data :

Age	No. of members
20–30	3
30–40	61
40–50	132
50–60	153
60–70	140
70–80	51
80–90	2

24. Calculate the mean median and the coeff. of variation from the following freq. table :

25. Calculate the arithmetic average and the standard deviation of the following series :

Expenditure	No. of students
Below Rs. 5	6
Below Rs. 10	16
Below Rs. 15	28
Below Rs. 20	38
Below Rs. 25	46

26. Calculate the arithmetic average , mean deviation and the standard deviation from the data in the following series :

Size of item	Frequency
3–4	3
4–5	7
5–6	22
6–7	60
7–8	85
8–9	32
9–10	8

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27. Goals scored by two teams A and in a foot ball season were as follows :

No. of goals scored in a Match	No. of Matches	
	A	B
0	27	17
1	9	9
2	8	6
3	5	5
4	4	3

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28. Find the mean, mode and S.D. for the following :

Year under :	10	20	30	40	50	60
No. of persons :	15	32	51	78	97	109

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Problem Set 1 Measures Of Central Tendency

1. The algebraic sum of the deviations of $\dfrac{x_i}{f_i}$ from the mean is:

A. zero

B. maximum

C. least

D. none of these

Answer: A

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2. The sum of squares of deviations of a set of values about the mean is :

A. zero

B. maximum

C. least

D. none of these

Answer: C

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3. The mean marks of 100 students were found to be 40.Later on it was discovered that a score of 53 was misread as 83. The corrected mean corresponding to the corrected score is: (a) 37.5 (b) 35.6(c) 39.7 (d) 38.7

A. $37 \cdot 5$

B. $35 \cdot 6$

C. $39 \cdot 7$

D. $38 \cdot 7$

Answer: C

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4. The median of the following items

25,15,23,40,27,25,23,25 and 20 is

A. 27

B. 40

C. 25

D. 23

Answer: C

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5. The median of the variables

$$x + 4, x - 7/2, x - 5/2x - 3, x - 2, x + 1/2, x - 1/2, x + 5, (x > 0)$$

is

A. $x - 3$

B. $x - 2$

C. $x + 5/4$

D. $x - 5/4$

Answer: D

6. The algebraic sum of deviations of ten observations about 15 is 70. The mean is

    A. 22

    B. 25

    C. 20

    D. none of these

Answer: A

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7. A distribution has mean $= 8 \cdot 7$, median $= 8 \cdot 5$ and mode $= 7 \cdot 3$. The distribution is

    A. positively skewed

    B. negatively skewed

C. symmetrical

D. none of these

Answer: A

8. The average of daily wages for the workers of the two factories combined is

No. of wage earners	Factory A 250	Factory B 200
Average daily wages	Rs. 200	Rs. 250

A. $2 \cdot 22$

B. $3 \cdot 15$

C. 4.10

D. none of these

Answer: A

9. Marks obtained by four students are : 25, 35, 45, 55.

The average deriations from the mean is

A. 10

B. 9

C. 7

D. none of these

Answer: A

10. The quartile deviation of the income of a certain person given in rupees for 12 months in a year : 129, 150,151,151,157,158,160,161,162,162,173,175

A. $4 \cdot 5$

B. $5 \cdot 5$

C. $6 \cdot 2$

D. none of these

Answer: B

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11. The weighted mean of first n natural numbers whose weights are equal to the corresponding number is equal to

A. $\dfrac{1}{3}(2n + 1)$

B. $\dfrac{1}{2}(n + 4)$

C. $\dfrac{1}{5}(2n + 3)$

D. none of these

Answer: A

12. The arithmetic mean of n numbers of a series is $\bar{x}$. The sum of the first (n-1) numbers is k. The nth number is

A. $\dfrac{n}{2}\bar{x} - k$

B. $n\bar{x} - k$

C. $\dfrac{1}{n}\bar{x} - k$

D. none of these

Answer: B

13. If a variate takes values $a, ar, ar^2, .. ar^{n-1}$ which of the relation between means hold

A. $AH = G^2$

B. $\dfrac{A+H}{2} = G$

C. $A > G > H$

D. $A = G = H$

Answer: A

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14. A population of values is symmetrically distributed about the constant k. Test which statements are correct

A. the mean is k

B. the mean coincides with the mode

C. the distribution cannot be bimodal

D. $\dfrac{1}{2}$ (upper quartile + lower quartile) is equal to k

Answer: A::D

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15. The geometric mean of the series $1, 2, 4, 8, 16, \ldots, 2^n$ is

A. $2^{n/2}$

B. $2^{n/4}$

C. 2^{2n}

D. none of these

Answer: A

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16. An aeroplane flies round a square, the sides of which measure 100 miles each. The aeroplane covers at a speed of 100 m. p.h. the first side, at 200 m.p.h. the m.p.h. the fourth side. The average speed of the aeroplane around the square is

    A. 190

    B. 195

    C. 192

    D. 200

Answer: C

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17. A group of 10 items has arithmetic mean 6. If the arithmetic mean of 4 of these items is 7.5, then the mean of the remaining items is

    A. $6 \cdot 5$

B. $5 \cdot 5$

C. 5

D. $4 \cdot 5$

Answer: C

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18. If the mean of a variate x is m, the mean of $\dfrac{ax+b}{c}$ where a,b,c are constants is

A. $\dfrac{am+b}{c}$

B. $\left(\dfrac{2b+a}{c}\right)m$

C. $\dfrac{a+b}{mc}$

D. none of these

Answer: A

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19. The numbers 3,5,7,4 have frequencies $x, x + 4, x - 3, x + 8$. If their arithmetic mean is 4, the value of x is

A. $\dfrac{5}{3}$

B. $\dfrac{7}{4}$

C. $\dfrac{2}{3}$

D. none of these

Answer: A

20. If the mean of a set of observations $x_1, x_2, \ldots, x_n$ is $\overline{X}$, then the mean of the observations $x_i + 2i, i = 1, 2, \ldots, n$ is

A. $\bar{x} + 2$

B. $\bar{x} + n$

C. $\bar{x} + 2n$

D. $\bar{x} + n + 1$

Answer: D

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21. If the mode and mean of a moderately asymmetrical series are 16 inches and $15 \cdot 6$ inches respectively, then most probable median is

A. $15 \cdot 73$

B. $14 \cdot 60$

C. $16 \cdot 02$

D. none of these

Answer: A

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22. The results of two colleges are as follows :

		M.A.	M.Sc.	B.A.	B.Sc.	Total
A	Appeared	100	60	120	200	480
	Passed	90	45	75	150	360
B	Appeared	240	200	160	200	800
	Passed	200	160	100	140	600

then

A. A is better than B

B. none is better than the other

C. A is inderior to B

D. cannot say

Answer: B

23. If g_1 and g_2 be the geometric means of two series of n_1 and n_2 items. Then the G.M. of the series obtained on combining them is

A. $\left[\left(g_1\right)^{n_1} \cdot \left(g_2\right)^{n_2}\right]^{\frac{1}{n_1 + n_2}}$

B. $\left(g_1 g_2\right)^{\frac{n_1}{n_1 + n_2}}$

C. $\left(g_1 g_2\right)^{\frac{n_2}{n_1 + n_2}}$

D. $\left(g_1 g_2\right)^{\frac{\cdot n_1 n_2}{n_1 + n_2}}$

Answer: A

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24. For a symmetrical distribution lower quartile is 20 and upper quartile is 40. The value of 50th percentile is

A. 20

B. 40

C. 30

D. none of these

Answer: C

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25. For a symmetrical distribution P_{25} and P_{75} are 30 and 70 respectively. The value of median is

A. 50

B. 30

C. 40

D. none of these

Answer: A

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1. If in a series which is not highly skewed the mean deviation is $7 \cdot 8$, the approximate value of its standard deviation is

  A. $9 \cdot 75$

  B. $8 \cdot 37$

  C. $10 \cdot 2$

  D. none of these

Answer: A

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2. If mean of a series is 40 and variance $148 \cdot 6$, then coefficient of variation is

  A. $30 \cdot 5$

B. $29 \cdot 6$

C. $28 \cdot 7$

D. none of these

Answer: A

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3. In a final examination in Statistics the mean marks of a group of 150 students were 78 and the s.d. was $8 \cdot 0$. In Economics, however, the mean marks were 73 and the s.d. was $7 \cdot 6$. The variability in the two subjects respectively is

A. $10 \cdot 3 \%$, $10 \cdot 4 \%$

B. $9 \cdot 5 \%$, $7 \cdot 9 \%$

C. $11 \cdot 2 \%$, $10 \cdot 1 \%$

D. none of these

Answer: A

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4. If the variable takes values 0,1,2,3, . . .,n with frequencies proportional to $nc_0, nc_1, nc_2, \ldots, nc_n$ respectively, the variance is

A. $n/4$

B. $n/3$

C. $2n/5$

D. none of these

Answer: A

5. The sum of squares of deviations of 10 items about mean 50 is 250.

The coefficient of variation is

A. 10 %

B. 50 %

C. 30 %

D. none of these

Answer: A

6. If s.d. of X is σ then s.d. of the variable $U = \dfrac{aX + b}{c}$ where a,b,c are constants is

A. $\left|\dfrac{c}{a}\right|\sigma$

B. $\left|\dfrac{a}{c}\right|\sigma$

C. $\left|\dfrac{b}{c}\right|\sigma$

D. $\dfrac{c^2}{a^2}\sigma$

Answer: B

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7. The mean of five observations is 44 and and the variance is $8\cdot24$. Three of the five observations are 1,2 and 6. The remaining two are

A. 9,4

B. 7,6

C. 6,5

D. 10,3

Answer: A

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8. Mean deviations of the series $a, a + d, a + 2d, \ldots, a + 2nd$ from its mean is

A. $\dfrac{n(n + 1)d}{(2n + 1)}$

B. $\dfrac{nd}{2n + 1}$

C. $\dfrac{(n + 1)d}{2n + 1}$

D. $\dfrac{(2n + 1)d}{n(n + 1)}$

Answer: A

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9. A sample of 35 observations has the means 80 and SD. As 4. A second sample of 65 observations from the same population has mean 70 and S.D.3. The S.D. of the combined sample is -

A. $5 \cdot 85$

B. $37 \cdot 2$

C. $5 \cdot 58$

D. none of these

Answer: A

10. The first of the two samples have 100 items with mean 15 and S.D.3. If the whole group has 250 items with mean 15.6 and $S.D. = \sqrt{13.44}$ then S.D. of the second group is

A. 5

B. 4

C. 6

D. $3 \cdot 52$

Answer: B

11. The mean and s.d. of 63 children on an arithmetic test are repectively $27 \cdot 6$ and $7 \cdot 1$ To them are added a new group of 26 who had less training and whose mean is $19 \cdot 2$ and s.d. $6 \cdot 2$ The values of the combined group differ from the original as to (i) the mean and (ii) the s.d.

A. $2 \cdot 5, 0 \cdot 7$

B. $2 \cdot 3, 0 \cdot 8$

C. $1 \cdot 5, 0 \cdot 9$

D. none of these

Answer: A

12. Coefficient of skewness for the values

$$\text{Median} = 18 \cdot 8''$$
$$Q_1 = 14 \cdot 6'' \quad \text{is}$$
$$Q_3 = 25 \cdot 2''$$

A. $0 \cdot 2$

B. $0 \cdot 5$

C. $0 \cdot 7$

D. none of these

Answer: A

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13. For a series the value of men deviation is 15. The most likely value of its quartile deviation is -

A. $12 \cdot 5$

B. $11 \cdot 6$

C. 13

D. $9 \cdot 7$

Answer: A

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14. Karl Pearson's coefficient of skewness of a distribution is $0 \cdot 32$. Its s.d. is $6 \cdot 5$ and mean is $29 \cdot 6$. The mode and median of the distribution are

A. $27 \cdot 52, 28.91$

B. $26 \cdot 91, 27 \cdot 23$

C. $25 \cdot 67, 26 \cdot 34$

D. none of these

Answer: A

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15. Which of the following are dimensionless

    A. S.D.

    B. M.D.

    C. variance

    D. coefficient of variation

Answer: D

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16. The variance of the first n natural numbers is

A. $\dfrac{n^2 + 1}{12}$

B. $\dfrac{n^2 - 1}{12}$

C. $\dfrac{n(n + 1)(2n + 1)}{6}$

D. none of these

Answer: B

17. An incomplete frequency distribution is given below

Variate	Frequency
10–20	12
20–30	30
30–40	?
40–50	65
50–60	45
60–70	25
70–80	18
Total	229

Median value is 46, the missing frequency is

A. 33

B. 35

C. 34

D. 26

Answer: C

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18. Mean deviation about the mean $\bar{x}$ of the variate x is

$$\frac{2}{N}\left[\bar{x}\sum_{x_i<\bar{x}} f_i - \sum_{x_i<\bar{x}} f_i x_i\right] \qquad \text{True/False}$$

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19. If r be the range and $S = \left\{\dfrac{1}{n-1}\Sigma_i(x_i - \bar{x})^2\right\}^{1/2}$ be the s.d. of a

set of observations $x_1, x_2, \ldots, x_n$ then $S \le r\left(\dfrac{n}{n-1}\right)^{1/2}$

True/False

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20. The score of two golfers for 10 rounds each are

A : 58,59,60,54,65,66,52,75,69,52

B : 84,56,92,65,86,78,44,54,78,68

B is a more consistent player than A. True/False

21. If the variable takes the values 0,1,2, . . .,n with frequencies proportional to $q^n, {}^nC_1q^{n-1}p, {}^nC_2q^{n-2}p^2, \ldots, p^n$ where $p+q=1$ then mean square deviation is $n^2p^2 + npq$ and variance is npq, True/False

22. A student obtained the mean and s.d. of the observations as 40 and $5 \cdot 1$ respectively. It was later on discovered that he had wrongly copied

down an observation as 50 instead of 40. The correct mean and s.d. is

$39 \cdot 9$ and 5 respectively. True/False

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23. The S.D. is not less than the mean deviation. True/False

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Self Assessment Test

1. If the mean deviation about the median of the numbers a, 2a ,...., 50 a

is 50 then |a| equals

A. 2

B. 3

C. 4

D. 5

Answer: C

2. For two data sets each of size 5, then variances are given to be 4 and 5 and the corresponding means are given to be 2 and 4 respectively the variance of the combined data set is

A. $\dfrac{5}{2}$

B. $\dfrac{11}{2}$

C. 6

D. $\dfrac{13}{2}$

Answer: B

3. If the mean deviation of the number 1,1+d,1+2d ,.., 1 + 100 d from their mean is 255 then d is equal to

A. 10.0

B. 20.0

C. 10.1

D. 20.2

Answer: C

4. If the average of the numberd ,1,2,3 ..... 98,99 x is 100 x then the value of x is

A. $\dfrac{51}{100}$

B. $\dfrac{50}{99}$

C. $\dfrac{50}{101}$

D. $\dfrac{51}{99}$

Answer: C

5. All the student of a class performed poorly in mathematics the teacher decied to give gracs marks of 10 to each student which of the following statistical measures will not change even after the grace marks were given

A. mean

B. median

C. mode

D. variance

Answer: D

Assertion Reason

1. Let $x_1, x_2, \ldots, x_n$ be n observation and let $\bar{x}$ be their arithmetic mean and σ^2 be the variance

statement -1 Variance of $2x_1, 2x_2, \ldots, 2X_n$ is $4\sigma^2$

Statement -2 arithmatic mean of $2x_1, 2x_2, \ldots, 2X_n$ is $4\bar{x}$