Exercise-1

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Mean, median & mode

A-1. **Sol.** $\frac{1+2+4.....2^n}{n+1} = \frac{(2^{n+1}-1)}{2-1} \cdot \frac{1}{n+1}$

A-2. **Sol.** $\frac{w_1+w_2+.....+w_9}{9} = x$ ...(1)

$\frac{(w_1+w_2+.....+w_9)+w_{10}}{10} = x + \frac{1}{20}x$ ....(2)

From equation (1) & (2)

$w_{10} = \frac{3}{2}x$

Now $\frac{(w_1+w_2+......+w_9)+w_{10}+w_{11}}{11} = x$ ....(3)

From equation (1), (2) and (3)

$w_{11} = \frac{x}{2}$

A-3. **Sol.** Mean $= \frac{\sum_{i=1}^{n} A+iB}{n} = \frac{A.n+B\frac{(n(n+1))}{2}}{n}$

Mean $= A + B\frac{(n+1)}{2}$

A-4. **Sol.** 6, 8, 9, 10, 11, 12, 14

median = 10

A-5. **Sol.** $\alpha - \frac{7}{2}$, $\alpha - 3$, $\alpha - \frac{5}{2}$, $\alpha - 2$, $\alpha - \frac{1}{2}$, $\alpha + \frac{1}{2}$, $\alpha + 4$, $\alpha + 5$ ($\alpha > 0$)

median $= \frac{\alpha-2+\alpha-\frac{1}{2}}{2} = \alpha - \frac{5}{4}$

A-6. **Sol.** Number 2 repeats maximum number of times

A-7. **Sol.** Obvious

A-8. **Sol.** Geometric mean

$\frac{M(x_1,x_2,x_3.....x_n)}{M(y_1,y_2,y_3.....y_n)} \equiv \frac{(x_1.x_2.x_3......x_n)^{1/n}}{(y_1.y_2.y_3......y_n)^{1/n}} = \left(\frac{x_1}{y_1}.\frac{x_2}{y_2}.....\frac{x_n}{y_n}\right)^{\frac{1}{n}} = M\left(\frac{x_1}{y_1},\frac{x_2}{y_2},\frac{x_3}{y_3},.....,\frac{x_n}{y_n}\right)$

⇒ While in case of 1 & 2 it is not true always

A-9. **Sol.** Frequency of f = ${}_{10}C_5$ which has maximum value

A-10. **Sol.** Mean of 21 observation $\bar{x}$ = 40, so
Sum of numbers = 21 × 40 = 840
⇒ As numbers greater then median increased by 21, so 10 observations will increase by 21.
Now sum of all observations = 840 + 10×(21) = 1050
⇒ So now new mean is = $\frac{1050}{21}$ = 50

A-11. **Sol.** $x_1 + x_2 \ldots\ldots x_n = n\,\bar{x}$
so $\sum_{i=1}^{n}(x_i + 2i) = \sum x_i + 2\sum i = n\bar{x} + \frac{2n\ (n+1)}{2}$ so Mean $= \bar{x} + (n + 1)$

A-12. **Sol.** Mean – Mode = 63
As mode = 3 median – 2 mean
⇒ mean – 63 = 3 median – 2 mean
⇒ mean – median = 21
⇒ – 63 = 3 – 2
⇒ – = 21

A-13. **Sol.** Mean of variate 1.2.3, 2.3.4, 3.4.5, ..., n.(n + 1).(n + 2)
For sum of series
$T_r = \frac{r(r+1)(r+2)}{4}$ [(r + 3) – (r – 1)] ⇒ $S = \sum_{r=1}^{n} T_r = \frac{n(n+1)(n+2)(n+3)}{4}$
Mean = $\frac{s}{n} = \frac{(n+1)(n+2)(n+3)}{4}$

Section (B) : Range, coefficient of range, mean deviation and coefficient of mean deviaiton.

B-1. **Sol.** Range of data = difference of extreme values = 18-1 = 17

B-2. **Sol.** Coefficient of range = $\frac{\text{difference of extreme values}}{\text{sum of extreme values}} = \frac{10-2}{10+2} = \frac{2}{3}$

B-3 **Sol.** 34, 38, 42, 44, 46, 48, 54, 55, 63, 70
median () = $\frac{46+48}{2}$ = 47
$\sum |x_i - M|$ = 13 + 9 + 5 + 3 + 1 + 1 + 7 + 8 + 16 + 23 = 86
so mean diviation about median = $\frac{86}{10}$ = 8.6

B-4. **Sol.** n = 88

Median = $\frac{44^{th}\text{ value} + 45^{th}\text{ value}}{2} = \frac{56+57}{2}$ = 56.5
= $\frac{44^{th}\text{ value} + 45^{th}\text{ value}}{2} = \frac{56+57}{2}$ = 56.5

M.D.(median) = $\frac{\sum_{i=1}^{88}|x_i - 56.5|}{88} = \frac{43.5 + 42.5 + . \ . \ . \ . \ + 0.5 + 0.5 + . \ . \ . \ . \ + 43.5}{88}$

= $\frac{1 + 3 + 5 + . \ . \ . \ . \ + 85 + 87}{88}$ = 22

B-5_ Sol. If $x_1 ..... x_n$ are the observations then the new observations are (1.02) x_1, (1.02)x_n

Therefore the new mean = (1.02) $\bar{x}$

New mean deviation = $\frac{1}{n}\sum|(1.02)x_i - (1.02)\bar{x}|$

= (1.02) $\frac{1}{n}\sum|x_i - \bar{x}|$

= (1.02) × 50 = 51

B-6_. Sol. If $x_1 ..... x_n$ are the observations then the new observations are (0.95) x_1, (0.95) x_n

Therefore the new mean , = (0.95) $\bar{x}$

New mean deviation = $\frac{1}{n}\sum|(0.95)x_i - (0.95)\bar{x}|$

= (0.95) $\frac{1}{n}\sum|x_i - \bar{x}|$

= (0.95) × 80 = 76

B-7._ Sol. $\bar{x} = \frac{1}{2n+1}$ [a + (a + d) + ... + (a + 2nd)]

= $\frac{1}{2n+1}$ [(2n + 1) a + d (1 + 2 + ... + 2n)]

= a + d $\frac{2n}{2}\frac{(1+2n)}{2n+1}$ = a + nd

M.D. from mean = $\frac{1}{2n+1}$ 2|d| (1 + 2 + ... + n) = $\frac{n(n+1)|d|}{(2n+1)}$

B-8._ Sol. Mean = $\frac{-1+0+4}{3} = 1$

Hence M.D. (about mean)

$\frac{|-1-1| + |0-1| + |4-1|}{3}$ = 2

B-9_. Sol. See properties of AM

B-10_. Sol. $\sum_{i=1}^{20}(x_i - 30) = 20 \Rightarrow \sum_{i=1}^{20} x_i - 20 \times 30 = 20$

$\sum_{i=1}^{20} x_i = 600 + 20 = 620$

Mean = $\frac{620}{20} = 31$ Ans.

Section (C) : Variance, Standard deviation and coefficient of variation.

C-1. **Sol.** $\bar{x} = \dfrac{\sum_{i=1}^{20} n}{20} = \dfrac{21}{2}$, $\dfrac{\sum_{i=1}^{20} n^2}{20} = \dfrac{287}{2}$

$\Rightarrow$ $\sigma^2 = \dfrac{\sum_{i=1}^{20} n^2}{20} - \left(\dfrac{\sum_{i=1}^{20} n}{20}\right)^2 = \dfrac{287}{2} - \left(\dfrac{21}{2}\right)^2 = \dfrac{133}{4}$

C-2. **Sol.** Let two observations are x and y

then $\dfrac{x+y+2+4+10+12+14}{7} = 8$

$x + y + 42 = 56 \Rightarrow x + y = 14$ ...(A)

and $\dfrac{x^2+y^2+4+16+100+144+196}{7} - \dfrac{(x+y+42)^2}{49} = 16$

$\Rightarrow \dfrac{x^2+y^2+460}{7} = 16 + 64 = 80$

$\Rightarrow x^2 + y^2 = 560 - 460 = 100$ ...(B)

$\therefore$ on solving (A) & (B) we get x = 6, y = 8

C-3. **Sol.** $\sigma^2 = \dfrac{\Sigma x^2}{n} - (\bar{x})^2$

$\sigma^2 = \dfrac{1560}{10} - \left(\sqrt{12}\right)^2 = 144$ $\Rightarrow$ S.D. = $\sqrt{\sigma^2}$ = 12

C-4. **Sol.** Coefficient of variation = 0.58 = $\dfrac{\sigma}{\bar{x}}$

σ(S.D.) = .58 × 4 = 2.32

C-5. **Sol.** $\sum_{i=1}^{10}(x_i - 50)^2 = 250$

$\sigma = \sqrt{\dfrac{\sum_{i=1}^{10}(x_i-50)^2}{10}} = 5$

coeff. of variation = $\dfrac{\sigma}{\bar{x}} \times 100 = 10\%$

C-6. **Sol.** Obvious

C-7 **Sol.** 28, 29, 30, 31, 32

Mean = 30

$\Rightarrow$ variance = $\sigma^2 = \dfrac{(30-28)^2+(30-29)^2+(30-30)^2+(30-31)^2+(30-32)^2}{5}$

$\sigma^2 = 2$ $\Rightarrow$ S.D. = + $\sqrt{\sigma^2} = \sqrt{2}$

C-8._ **Sol.** We known that if $d_1 = \dfrac{x_i + 3/2}{-1/2}$ so , h = $-\dfrac{1}{2}$.Thus $\sigma_d = \dfrac{1}{|h|}\sigma_x = 2\times3.5 = 7$

C-9._ **Sol.** We known that $y_i = \frac{3}{2}x_i$ so $h = \frac{3}{2}$ Thus $\sigma_y = |h|\ \sigma_x = 1.5 \times 9 = 13.5$

Exercise-2

Marked Questions may have for Revision Questions.

PART - I : OBJECTIVE QUESTIONS

1. **Sol.** $\frac{{}^{2n+1}C_0 + \ldots\ldots {}^{2n+1}C_n}{n+1} = \frac{2^{2n}}{n+1}$

2. **Sol.** $\bar{x} = \frac{0.{}^nC_0 + 1\ .{}^nC_1 + 2{}^nC_2 + \ldots\ldots + n{}^nC_n}{{}^nC_0 + {}^nC_1 + {}^nC_2 + \ldots\ldots + {}^nC_n} = \frac{n.2^{n-1}}{2^n} = \frac{n}{2}$

3. **Sol.**

x_i	f_i	$f_i x_i$	$f_i x_i^2$
0	1	0	0
1	9	9	9
2	7	14	28
3	5	15	45
4	3	12	48
	$\sum f_i = 25$	$\sum f_i x_i = 50$	$\sum f_i x_i^2 = 130$

$\sigma_2 = \left[\frac{\sum f_i\ x_i^2}{\sum f_i} - \left(\frac{\sum f_i\ x_i}{\sum f_i}\right)^2\right]$

$= \left[\frac{130}{25} - \left(\frac{50}{25}\right)^2\right] = 1.2$

so variance of A = 1.2 < 1.25 = variance of B

so more consistent team = A

4. **Sol.** $\frac{\Sigma x_i}{200} = 25$, $\frac{\Sigma y_i}{300} = 10$

⇒ $\Sigma x_i = 5000$, $\Sigma y_i = 3000$

$\sigma_x = 3$ and $\sigma_y = 4$

⇒ $\frac{\Sigma x_i^2}{200} - (25)_2 = 9$ and $\frac{\Sigma y_i^2}{300} - (10)_2 = 16$

⇒ $\Sigma x_{i2} = 126800$ and $\Sigma y_{i2} = 34800$

$\therefore \quad \sigma = \frac{\Sigma z_i^2}{n} - \left(\frac{\Sigma z_i}{n}\right)^2 = \frac{\Sigma(x_i^2 + y_i^2)}{500} - \left(\frac{\Sigma x_i + \Sigma y_i}{500}\right)^2 = \frac{161600}{500} - \left(\frac{8000}{500}\right)^2 = 67.2$

5. **Sol.** $\sigma_x = 3 \Rightarrow \frac{\sum x_i^2}{100} - (\bar{x})^2 = 9 \Rightarrow \sum x_i^2 = 23400$

$\sum z_i = 250 \times 15.6 = 3900$

$\therefore \sum y_i = \sum z_i - \sum x_i = 3900 - 1500 = 2400$

$\sigma_z^2 = 13.44 \Rightarrow \frac{\sum x_i^2 + \sum y_i^2}{250} - (15.6)^2 = 13.44 \Rightarrow \sum y_i^2 = 40800$

$\Rightarrow \sigma_y = \sqrt{\frac{\sum y_i^2}{150} - \left(\frac{\sum y_i}{150}\right)^2} = \sqrt{\frac{40800}{150} - \left(\frac{2400}{150}\right)^2} = 4$

6. **Sol.** $(\bar{x}) = 60$, $(\bar{y}) = 40$

$(\sigma_{x^2}) = 16$, $(\sigma_{y^2}) = 36$

$\sigma_{x^2} = \frac{\Sigma x_1^2}{10} -, (\bar{x})^2$ $\sigma_{y^2} = \frac{\Sigma y^2}{10} - (\bar{y})^2$

$\Sigma x_1^2 = 160 + (60)^2 - 10$ $\Sigma y_1^2 = 360 + (40)^2.10$

$\sigma^2(\text{overall}) = \frac{\Sigma x_1^2 + \Sigma y_1^2}{20} - \left(\frac{10\bar{x} + 10\bar{y}}{20}\right)^2 = \frac{520 + 52000}{20} - (50)^2$

$\sigma^2 = 2626 - 2500 = 126$

S.D. $= +\sqrt{\sigma^2} = 11.2$

7. **Sol.** Mean $(\bar{x}) = 4$, variance = 5.2

$a_1, a_2, a_3 = 1, 2, 3.$

Let x_1, x_2 are remaining values

Mean $(\bar{x}) = \frac{a_1 + a_2 + a_3 + x_1 + x_2}{5} \Rightarrow x_1 + x_2 = 11$ ....(1)

variance $\sigma^2 = 5.2 = \frac{a_1^2 + a_2^2 + a_3^2 + x_1^2 + x_2^2}{5} - (\bar{x})^2 \Rightarrow x_1^2 + x_2^2 = 65$ ....(2)

$\Rightarrow |x_1 - x_2| = 3$

$\Rightarrow$ So $\lambda = 11 \Rightarrow 10 - x^2 - 2x = \lambda \Rightarrow (x + 1)^2 = 0$ one solution

8. **Sol.** Let x_n misread value $(x_n) = 10$ $(x_n)_{actual} = 12$

$\sigma^2 = 3.3$ $\bar{x} = 11.3 \Rightarrow \sum_{i=1}^{n-1} x_i = 113 - 10 = 103 = 10.(\bar{x}) - 10$

$\sigma^2 = \frac{\sum_{i=1}^{n-1} x_i^2 + x_n^2}{10} - (\bar{x})^2$

$\sum_{i=1}^{n-1} x_i^2 = -67 + 10(\bar{x})^2$ ...(1)

$\Rightarrow (\sigma^2)_{actual} = \frac{\sum_{i=1}^{n} x_1^2 + (x_n)^2_{actual}}{10} - (\bar{x})_{actual}$

$\Rightarrow (\sigma^2)_{actual} = \frac{\sum_{i=1}^{n} x_1^2 + (x_n)^2_{actual}}{10} - (\bar{x})_{actual}$

$= \dfrac{-67+10(\bar{x})^2+144}{10} - \left(\dfrac{10(\bar{x})-10+12}{10}\right)$

$= (\sigma_{2actual}) = 3.14$

9. **Sol.** 1, 2, 3, 4, 5, 6, 7,

$Q_1 = \left(1.\left(\dfrac{7+1}{4}\right)\right)^{nd}$ = 2_{nd} term = 2

$Q_3 = \left(3.\left(\dfrac{7+1}{4}\right)\right)^{th}$ = 6_{th} term = 6

10. **Sol.** 6, 8, 9, 10, 11, 12, 14
$Q_1 = 2_{nd}$ term = 8
$Q_3 = 6_{th}$ term = 12

Quartile deviation $= \dfrac{1}{2}(Q_3 - Q_1) = \dfrac{1}{2}(12-8) = 2$

11. **Sol.** Coefficient of quartile deviation is $= \dfrac{Q_3 - Q_1}{Q_3 + Q_1}$
6, 8, 9, 10, 11, 12, 14

$Q_1 = 8$ ⇒ coefficient $= \dfrac{12-8}{12+8} = \dfrac{4}{20} = \dfrac{1}{5}$
$Q_3 = 12$

12. **Sol.** As data has outliners at 90,000 and 95,000 we should use median in place of mode

& Median $= \dfrac{10^{th}\text{ value} + 11^{th}\text{ value}}{2}$ = 12000

13. **Sol.** For a normally distributed data, we many use either mean or median. However, mean is preferred as it include all the values in the data set for its calculation and any change in any of the scores will affect the value of the mean which is not the case with median or mode.

14. **Sol.** Obviously

PART - II : MISCELLANEOUS QUESTIONS

A-1. **Ans. (1)**

Sol. S.D.(x_i) = S.D. (x_i – 8) = $\sqrt{\dfrac{\sum (x_i-8)^2}{n} - \left(\dfrac{\sum (x_i-8)}{n}\right)^2} = \sqrt{\dfrac{45}{9}-1} = 2$

A-2_. **Ans.** **(1)**
Sol. Obviously

Section (B) : MATCH THE COLUMN

B-1 **Ans.** (A) → (q, r) ; (B) → (p, q, r, s) ; (C) → (s) ; (D) → (s)

Sol. (A) Due to low value 1, mean is not preferred
(B) Mean, Median, Mode and S.D. are dependent on change of scale.
(C) S.D. is independent of change of origin.
(D) Range is always greater than or equal to S.D.

B-2_ **Sol.** A → r ; B → r ; C → p ; D → p
(A) = 2 {S.D. of 2, 4, 6, ..., 2n
= 2 {S.D. of 1,2,3, ...n}
$= \sqrt{\frac{n^2-1}{12}} = \sqrt{\frac{n^2-1}{3}}$
(B) S.D. of 1,3,5, ..., 2n – 1
= S.D. of 2,4,6, ..., 2n
$= \sqrt{\frac{n^2-1}{3}}$ [from part (A)]
(C) Mean of 1,3,5, ... 2n – 1
$= \frac{1+3+5....+(2n-1)}{n}$
$= \frac{n^2}{n} = n$
(D) When n is odd, then
median = $\frac{n+1}{2}$ th odd natural number
$= 2\left(\frac{n+1}{2}\right) - 1 = n$
When n is even, then
median = $\left(\left(\frac{n}{2}+1\right)\text{th odd number}\right)$
$= \frac{1}{2}\left\{2\left(\frac{n}{2}\right)-1+2\left(\frac{n}{2}+2\right)-1\right\}$
$= \frac{1}{2}$ (n – 1 + n + 1) = n
Note kth odd number = 2k – 1

Section (C) : ONE OR MORE THAN ONE OPTIONS CORRECT

C-1._ **Sol.** $\text{Mean} = \frac{\text{Sum of the observation}}{\text{number of observation}}$
For median , arrange the items in increasing order as 3, 5,7, 9, 11, 15, 16, 17, 28, 28, 31, 43.
Here , number of items is 12 (even number)
Median= $\frac{1}{2}\left(\left(\frac{12}{2}\right)\text{th item} + \left(\frac{12}{2}+1\right)\text{th item}\right) = \frac{1}{2}$ (6th item + 7 th item)
$= \frac{1}{2}$ (15+16) = 15.5

C-2_ **Sol.** Here, n_1 = 25, n_2 = 35.
$\bar{x}_1 = 40, \bar{x}_2 = 45,$
$\sigma_1 = 5$ and $\sigma_2 = 2$
Let $\bar{x}$ be the mean and σ , the standard deviation of the two samples taken together, then
$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1+n_2} = \frac{25\times 40 + 35\times 45}{25+35} = \frac{2575}{60} = 42.917$

Also, $\sigma^2 = \frac{1}{n_1+n_2}\left[n_1\sigma_1^2 + n_2\sigma_2^2 + \frac{n_1n_2}{n_1+n_2}(\bar{x}_1 - \bar{x}_2)^2\right]$

$= \frac{1}{25+35}\left[25\times(5)^2 + 35\times(2)^2 + \frac{25\times35}{25+35}(40-45)^2\right] = \frac{1}{60}[625+140+364.58]$

$= \frac{1129.58}{60}$ 18.83 nearly

$\Rightarrow \sigma = 4.34$ nearly

C-3. **Sol.** (1) $\sum d_i = \sum(x_i - \bar{x}) = n\bar{x} - n\bar{x} = 0$

(2) If S.D. of x_i(i = 1, 2, 3, ... n) is σ then S.D. of hx_i is |h|σ

(3) x_i(i = 1, 2, 3, ... n)

Exercise-3

*** Marked Questions may have more than one correct option.**

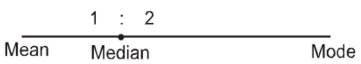
PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

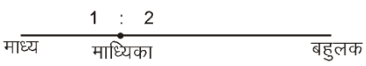
1. **Sol.** If we change scale by using x + h then median increases by h. so median is not independent of change of scale. From histogram we can see highest frequency so mode.

2. **Sol.** $\bar{x} = 0$

$\frac{|x_i - \bar{x}|^2}{2n}$ = a_2 ⇒ S.D. = |a| = 2

3. **Sol.**





so median = 22 = $\frac{1\times\text{mode} + 2\times21}{3}$, mode = 24

= 22 = $\frac{1\times\text{mode} + 2\times21}{3}$, = 24

4. **Sol.** $\sigma_2 \geq 0$

$\Rightarrow \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2 \geq 0 \Rightarrow \frac{400}{n} - \frac{6400}{n^2} \geq 0 \Rightarrow n \geq 16$

5. **Sol.** Variances remain uneffected by adding some constant to all observations

so $V_A = V_B$

so $V_A/V_B = 1$

6. **Sol.** Let no. of student = 100 number of boys = n,

$\frac{n\times52 + (100-n)\times42}{100} = 50 \Rightarrow n = 80$

so 80%

7. **Sol.** $\frac{a+b+8+5+10}{5} = 6 \Rightarrow a + b = 7$ ...(1)

$\frac{(a-6)^2+(b-6)^2+2^2+1^2+4^2}{5} = 6.80 \Rightarrow (a-6)^2 + (b-6)^2 = 13$

solve $a = 3, b = 4$

8. **Sol.** **Statement-1 :** $\frac{\sum n^2}{n} - \frac{\sum n}{n} = \frac{(n+1)\ \ (2n+1)}{6} - \frac{n+1}{2}$

$= \left(\frac{n+1}{6}\right)(2n + 1 - 3)$

Statement-2 : Obvious

9. **Sol.** $\bar{x} = \frac{1+(1+d)+(1+2d)+(1+100d)}{101} = 1 + 50d$

Mean deviation $= \frac{\sum_{i=0}^{100} |x_i - \bar{x}|}{101} = \sum \frac{|(1+id)-(1+50d|}{101}$

$= \sum_{i=0}^{100} \frac{|(i-50)\ \ d|}{101} = 225 \Rightarrow \frac{(50+49+1+0+1+50)d}{101} = 225$

$\Rightarrow \frac{50 \times 51}{101}.d = 225 \Rightarrow d = 10.1$

10. (4)

Sol. $\sigma_x^2 = 4 \Rightarrow \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2 = 4$

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

similarly $\sum y_i^2 = 105$

$\therefore\ \sigma^2 = \frac{\sum x_i^2 + \sum y_i^2}{10} - \left(\frac{\sum x_i + \sum y_i}{10}\right)^2 = \frac{145}{10} - \left(\frac{10+20}{10}\right)^2 = 5.5$

11. **Sol.** Median = 25.5 a

Mean deviation about median = 50

= 25.5 a

ds lkis{k = 50

$\Rightarrow \frac{\Sigma\ |\ x_i - 25.5a\ |}{50} = 50$

$\Rightarrow$ 24.5 a + 23.5a + ... + 0.5a + 0.5a + ... + 24.5a = 2500

$\Rightarrow$ a + 3a + 5a + ... + 49a = 2500

$\Rightarrow \frac{25}{2}(50a) = 2500 \Rightarrow a = 4$

12. **Sol.** Correct mean = observed mean + 2

30 + 2 = 32

Correct S.D. = observed S.D. = 2

13. **Sol.** A.M. of $2x_1, 2x_2$ ..... $2x_n$ is $\frac{2x_1 + 2x_2 + ... + 2x_n}{n}$

$= 2\left(\frac{x_1 + x_2 + ... + x_n}{n}\right) = 2\bar{x}$

So statement-2 is false

variance $(2x_i) = 2^2$ variance $(x_i) = 4\sigma^2$

so statement-1 is true.

14. **Sol.** **(4)**

If initially all marks were x_i then $\sigma_1^2 = \frac{\sum (x_i - \bar{x})^2}{N}$

Now each is increased by 10

$\sigma_2^2 = \frac{\sum [(x_i + 10) \ -(\bar{x} + 10)]^2}{N} = \sigma_1^2$

So variance will not change whereas mean, median and mode will increase by 10.

15. **Sol.** First 50 even natural numbers

Mean $= \frac{\sum_{i=1}^{50} 2n}{50}$ + = $\frac{2 + 4 + 6 + ... + 100}{50} = 2\left(\frac{50 \times 51}{2 \times 50}\right) = 51$

variance $= \frac{\sum_{i=1}^{50} (2n)^2}{50}$ – = 42 = 4 $\frac{2^2 + 4^2 + ... + 100^2}{50}$ – 2601 = 833

16. **Sol.** $\frac{x_1 + x_2........x_{16}}{16} = 16$

If $x_1 = 16$

$\frac{x_1 + x_2........x_{10} - 16 + 3 + 4 + 5}{18}$

$= \frac{16 \times 10 - 16 + 12}{18} = \frac{240 + 12}{18} = \frac{252}{18} = 14$

17. **Ans.** **(1)**

Sol. Standard deviation of numbers 2, 3, a and 11 is 3.5

$\therefore \quad (3.5)^2 = \frac{\sum x_i^2}{4} - (\bar{x})^2$

$\Rightarrow \quad (3.5)^2 = \frac{4 + 9 + a^2 + 121}{4} - \left(\frac{2 + 3 + a + 11}{4}\right)^2$

on solving, we get

$3a^2 - 32a + 84 = 0$