SOLVED EXAMPLES

Ex. 1 If the mean of the series $x_1, x_2, \ldots, x_n$ is $\bar{x}$, then find the mean of the series $x_i + 2i$, $i = 1, 2, \ldots, n$.

Sol. As given $\bar{x} = \dfrac{x_1 + x_2 + \ldots + x_n}{n}$ ....(1)

If the mean of the series $x_i + 2i$, $i = 1, 2, \ldots, n$ be $\bar{X}$, then

$$\bar{X} = \frac{(x_1 + 2.1) + (x_2 + 2.2) + (x_3 + 2.3) + \ldots + (x_n + 2.n)}{n}$$

$$= \frac{x_1 + x_2 + \ldots + x_n}{n} + \frac{2(1 + 2 + 3 + \ldots + n)}{n}$$

$$= \bar{x} + \frac{2n(n+1)}{2n} \qquad \text{from (i)}$$

$$= \bar{x} + n + 1$$

Ex. 2 Find the mean of the following distribution :

x	4	6	9	10	15
f	5	10	10	7	8

Sol. Calculation of Arithmetic Mean

x_i	f_i	$f_i x_i$
4	5	20
6	10	60
9	10	90
10	7	70
15	8	120
	$N = \Sigma f_i = 40$	$\Sigma f_i x_i = 360$

$\therefore$ Mean $= \bar{X} = \dfrac{\sum f_i x_i}{\sum f_i} = \dfrac{360}{40} = 9$

Ex. 3 The following table shows marks secured by 140 students in an examination :

Marks	0-10	10-20	20-30	30-40	40-50
Number of Students	20	24	40	36	20

Calculate mean marks by using all the three methods, i.e., direct method, assumed mean method and step-deviation method.

Sol. Direct method

Marks	Number of Students (f_i)	Mid Point (x_i)	$f_i x_i$
0-10	20	5	100
10-20	24	15	360
20-30	40	25	1000
30-40	36	35	1260
40-50	20	45	900
Total	140		3620

Hence, mean $\bar{x} = \dfrac{1}{n}\sum_{i=1}^{5} f_i x_i = \dfrac{3620}{140} = 25.86$ marks

Assumed Mean Method

Marks	Number of Students (fi)	Mid-Point (xi)	Deviation $d_i = x_i - 25$	$f_i d_i$
0-10	20	5	–20	–400
10-20	24	15	–10	–240
20-30	40	a = 25	0	0
30-40	36	35	10	360
40-50	20	45	20	400
Total	140			120

Hence, mean $\bar{x} = a + \frac{1}{n}\sum_{i=1}^{5} f_i d_i = 25 + \frac{120}{140} = 25.86$ marks

Step-Deviation Method

Marks	Number of Students (fi)	Mid-Point (xi)	Deviation $u_i = (x_i - 25)/10$	$f_i u_i$
0-10	20	5	–2	–40
10-20	24	15	–1	–24
20-30	40	a = 25	0	0
30-40	36	35	1	36
40-50	20	45	2	40
Total	140			12

Hence, $\bar{x} = a + h \times \frac{1}{n}\sum_{i=1}^{5} f_i u_i$ [where h = 10]

$$= 25 + 10 \times \frac{12}{140} = 25.86 \text{ marks}$$

Ex. 4 If a variable takes the value 0, 1, 2......n with frequencies proportional to the binomial coefficients ${}^nC_0, {}^nC_1, \ldots, {}^nC_n$ then find the mean of the distribution.

Sol. $N = \sum f_i = k\,[{}^nC_0 + {}^nC_1 + \ldots + {}^nC_n] = k2^n$

$$\sum f_i x_i = k\,[1.{}^nC_1 + 2.{}^nC_2 + \ldots + n\,{}^nC_n] = k\sum_{r=1}^{n} r\,{}^nC_r = kn\sum_{r=1}^{n} {}^{n-1}C_{r-1} = kn2^{n-1}$$

Thus $\bar{x} = \frac{1}{2^n}(n\,2^{n-1}) = \frac{n}{2}$.

Ex. 5 Find the mean age in years from the frequency distribution given below :

Class Interval of Age in Years	Frequency f_i
25-29	4
30-34	14
35-39	22
40-44	16
45-49	6
50-54	5
55-59	3
Total	70

Sol.

Class Interval of Age in Years	Frequency f_i	Mid-Point (x_i)	Deviation $u_i = (x_i - 42)/5$	$f_i u_i$
25-29	4	27	–3	–12
30-34	14	32	–2	–28
35-39	22	37	–1	–22
40-44	16	a = 42	0	0
45-49	6	47	1	6
50-54	5	52	2	10
55-59	3	57	3	9
Total	70			–37

Hence, mean $\bar{x} = a + h\left(\frac{1}{n}\sum_{i=1}^{7} f_i u_i\right)$ [where h = 5] $= 42 + 5 \times \frac{-37}{70} = 39.36$ years

Ex. 6 Find the mean wage from the following data :

Wage (in Rs)	800	820	860	900	920	980	1000
No. of workers	7	14	19	25	20	10	5

Sol. Let the assumed mean be A = 900 and h = 20.

Calculation of Mean

Wage (in Rs) x_i	No. of workers f_i	$d_i = x_i - A = x_i - 900$	$u_i = \frac{x_i - 900}{20}$	$f_i u_i$
800	7	–100	–5	–35
820	14	–80	–4	–56
860	19	–40	–2	–38
900	25	0	0	0
920	20	20	1	20
980	10	80	4	40
1000	5	100	5	25
	$N = \sum f_i = 100$			$\sum f_i u_i = -44$

We have,

$$N = 100,\ \sum f_i u_i = -44,\ A = 900 \text{ and } h = 20$$

$$\therefore \quad \text{Mean} = \overline{X} = A + h\left(\frac{1}{N}\sum f_i u_i\right)$$

$$\Rightarrow \quad \overline{X} = 900 + 20 \times \frac{-44}{100} = 900 - 8.8 = 891.2$$

Hence, mean wage = Rs. 891.2

Ex. 7 Find the mean marks from the following data :

Marks	Number of Students
Below 10	5
Below 20	9
Below 30	17
Below 40	29
Below 50	45
Below 60	60
Below 70	70
Below 80	78
Below 90	83
Below 100	85

Sol.

Marks	Number of Students f_i	Mid-Point (x_i)	Deviation $u_i = (x_i - 55)/10$	f_iu_i
0-10	5	5	5	25
10-20	9 5 – 4	15	4	16
20-30	17 9 – 8	25	3	24
30-40	29 17 – 12	35	2	24
40-50	45 29 – 16	45	1	16
50-60	60 45 – 15	a – 55	0	0
60-70	70 60 – 10	65	1	10
70-80	78 70 – 8	75	2	16
80-90	83 78 = 5	85	3	15
90-100	85 83 = 2	95	4	8
Total	85			– 56

Hence, $\overline{X} = a + h \times \frac{1}{n}\sum_{i=1}^{10} f_i u_i$ [where h = 10]

$$= 55 + 10 \times \frac{-56}{85} = 48.41 \text{ marks}$$

Ex. 8 Find the mean deviation about mean from the following data

x_i	3	9	17	23	27
f_i	8	10	12	9	5

Sol.

x_i	f_i	f_ix_i	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
3	8	24	12	96
9	10	90	6	60
17	12	204	2	24
23	9	207	8	72
27	5	135	12	60
	N = 44	$\sum f_ix_i = 660$		$\sum f_i \lvert x_i - \bar{x} \rvert = 312$

$$\text{Mean } (\bar{x}) = \frac{\Sigma f_i x_i}{N} = \frac{660}{44} = 15$$

$$\text{Mean deviation} = \frac{\Sigma f_i \lvert x_i - \bar{x} \rvert}{N} = \frac{312}{44} = 7.09$$

Ex. 9 Find the mean age of 100 residents of a colony from the following data

Age in years (Greater than or equal to)	Number of Persons
0	100
10	90
20	75
30	50
40	25
50	15
60	5
70	0

Sol.

Age	Number of Persons f_i	Mid-Point (x_i)	Deviation $u = (x_i - 35)/10$	f_iu_i
0-10	100 – 90 = 10	5	–3	–30
10-20	90 – 75 = 15	15	–2	–30
20-30	75 – 50 = 25	25	–1	–25
30-40	50 – 25 = 25	a = 35	0	0
40-50	25 – 15 = 10	45	1	10
50-60	15 – 5 = 10	55	2	20
60-70	5 – 0 = 5	65	3	15
Total	100			– 40

Hence, $\bar{X} = a + h \times \frac{1}{n}\sum_{i=1}^{7} f_iu_i$ [where h = 10]

$$= 35 + 10 \times \frac{-40}{100} = 31 \text{ years}$$

Ex. 10 Find the mean of the following frequency distribution :

Class-interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
No. of workers f	7	10	15	8	10

Sol. Calculation of Mean

Class-interval	Mid-values (x_i)	Frequency f_i	$d_i = x_i - 25$	$u_i = \frac{x_i - 25}{10}$	f_iu_i
0 – 10	5	7	−20	−2	−14
10 – 20	15	10	−10	−1	−10
20 – 30	25	15	0	0	0
30 – 40	35	8	10	1	8
40 – 50	45	10	20	2	20
		$N = \sum f_i = 50$			$\sum f_iu_i = 4$

We have,

$A = 25,\ h = 10,\ N = 50$ and $\sum f_iu_i = 4$.

$\therefore$ Mean $= A + h\left\{\frac{1}{N}\sum f_iu_i\right\}$

$\Rightarrow$ mean $= 25 + 10 \times \frac{4}{50} = 25.8$

Ex. 11 If the mean of the following data is 21.5, find the value of k

x_i	5	15	25	35	45
f_i	6	4	3	k	2

Sol.

x_i	f_i	x_if_i
5	6	30
15	4	60
25	3	75
35	k	35 k
45	2	90
Total	15 + k	255 + 35 k

Mean $= \frac{\sum x_if_i}{\sum f_i}$

$\frac{255 + 35k}{15 + k} = 21.5$

$21.5(15 + k) = 255 + 35k$

$21.5 \times 15 + 21.5k = 255 + 35k$

$35k - 21.5k = 322.5 - 255 \quad \Rightarrow \quad 13.5k = 67.5$

$\therefore \quad k = \frac{67.5}{13.5} = 5$

Ex. 12 Find the coefficient of variation of first n natural numbers.

Sol. For first n natural numbers,

$$\text{Mean}\,(\bar{x}) = \frac{n+1}{2},\ \text{S.D.}\,(\sigma) = \sqrt{\frac{n^2-1}{12}}$$

$$\therefore \quad \text{coefficient of variance} = \frac{\sigma}{\bar{x}} \times 100 = \sqrt{\frac{n^2-1}{12}} \times \frac{1}{\left(\frac{n+1}{2}\right)} \times 100 = \sqrt{\frac{(n-1)}{3(n+1)}} \times 100$$

Ex. 13 Calculate the median from the following distribution :

Class	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45
Frequency	5	6	15	10	5	4	2	2

Sol.

Class	Frequency	Cumulative Frequency
5 - 10	5	5
10 - 15	6	11
15 - 20	15	26
20 - 25	10	36
25 - 30	5	41
30 - 35	4	45
35 - 40	2	47
40 - 45	2	49
	N = 49	

We have, N = 49

$$\therefore \quad \frac{N}{2} = \frac{49}{2} = 24.5$$

The cumulative frequency just greater than $\frac{N}{2}$ is 26 and the corresponding class is 15-20.

Thus 15-20 is the median class such that $\ell = 15$, $f = 15$, $F = 11$ and $h = 5$

$$\therefore \quad \text{Median} = \ell + \frac{\frac{N}{2} - F}{f} \times h = 15 + \frac{24.5 - 11}{15} \times 5 = 15 + \frac{13.5}{3} = 19.5$$

Ex. 14 Find the values of f_1 and f_2 of the frequency, if the mean of the following frequency distribution is 2[illegible].4 and the total frequency is 40.

Class-interval	Frequency
0-8	6
8-16	f_1
16-24	10
24-32	f_2
32-40	9

Sol. Take $a = 20$ and $h = 8$

Class-interval	Mid-Point x_i	f_i	$f_i x_i$
0-8	4	6	24
8-16	12	f_1	$12\ f_1$
16-24	20	10	200
24-32	28	f_2	$28\ f_2$
32-40	36	9	324
		$25 + f_1 + f_2 = 40$	$548 + 12f_1 + 28f_2$

$f_1 + f_2 = 15$ .....(i)

$\therefore \quad \bar{x} = \dfrac{548 + 12f_1 + 28f_2}{40}$

$21.4 = \dfrac{548 + 12f_1 + 28f_2}{40}$

$856 - 548 = 12f_1 + 28f_2$

$3f_1 + 7f_2 = 77$ .....(ii)

(ii) $-(3) \times$ eq (i) $\Rightarrow$

$3f_1 + 7f_2 = 77$

$3f_1 + 3f_2 = 45$

$4f_2 = 32$

$f_2 = 8 \quad \therefore \quad f_1 = 15 - 8 = 7$

Ex. 15 The mean square deviation of a set of n observations $x_1, x_2, \ldots, x_n$ about a point c is defined as $\dfrac{1}{n}\sum_{i=1}^{n}(x_i - c)^2$. The mean square deviation about -2 and 2 are 18 and 10 respectively, then find standard deviation of this set of observations.

Sol. $\dfrac{1}{n}\Sigma(x_i + 2)^2 = 18$ and $\dfrac{1}{n}\Sigma(x_i - 2)^2 = 10$

$\Rightarrow \quad \Sigma(x_i + 2)^2 = 18n$ and $\Sigma(x_i - 2)^2 = 10n$

$\Rightarrow \quad \Sigma(x_i + 2)^2 + \Sigma(x_i - 2)^2 = 28\ n$ and $\Sigma(x_i + 2)^2 - \Sigma(x_i - 2)^2 = 8\ n$

$\Rightarrow \quad 2\Sigma x_i^2 + 8n = 28\ n$ and $8\Sigma x_i = 8n$

$\Rightarrow \quad \Sigma x_i^2 = 10\ n$ and $\Sigma x_i = n \quad \Rightarrow \quad \dfrac{\Sigma x^2}{n} = 10$ and $\dfrac{\Sigma x_i}{n} = 1$

$\therefore \quad \sigma = \sqrt{\dfrac{\Sigma x_i^2}{n} - \left(\dfrac{\Sigma x_i}{n}\right)^2} = \sqrt{10 - (1)^2} = 3$

Ex.16 Compute the mode for the following frequency distribution :

Size of Items	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24	24 - 28	28 - 32	32 - 36	36 - 40
Frequency	5	7	9	17	12	10	6	3	1	0

Sol. Here, the maximum frequency is 17 and the corresponding class is 12-16 So 12-16 is the modal class.

We have, ● = 12, h = 4, $f = 17$, $f_1 = 9$ and $f_2 = 12$

$\therefore$ $$\text{Mode} = ● + \frac{f - f_1}{2f - f_1 - f_2} \times h$$

$\Rightarrow$ $$\text{Mode} = 12 + \frac{17 - 9}{34 - 9 - 12} \times 4$$

$\Rightarrow$ $$\text{Mode} = 12 + \frac{8}{13} \times 4 = 12 + \frac{32}{13} = 12 + 10.66 = 32.66$$

Ex. 17 Find the mean deviation from the mean for the following data :

Classes	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
Frequencies	2	3	8	14	8	3	2

Sol. We prepare the table as follows :

Computation of mean deviation from mean

Classes	Mid - values (x_i)	frequencies f_i	f_ix_i	$\lvert x_i - \overline{X}\rvert = \lvert x_i - 45\rvert$	$f_i\lvert x_i - \overline{X}\rvert$
10 - 20	15	2	30	30	60
20 - 30	25	3	75	20	60
30 - 40	35	8	280	10	80
40 - 50	45	14	630	0	0
50 - 60	55	8	440	10	80
60 - 70	65	3	195	20	60
70 - 80	75	2	150	30	60
		$N = \sum f_i = 40$	$\sum f_ix_i = 1800$		$\sum f_i\lvert x_i - \overline{X}\rvert = 400$

We have, $N = 40$ and $\sum f_i x_i = 1800$

$\therefore$ $$\overline{X} = \frac{\sum f_i x_i}{N} = \frac{1800}{40} = 45$$

Now $\sum f_i\lvert x_i - \overline{X}\rvert = 400$ and $N = \sum f_i = 40$

$\therefore$ $$\text{M.D.} = \frac{1}{N}\sum f_i\lvert x_i - \overline{X}\rvert = \frac{400}{40} = 10$$

Ex. 18 Calculate the mean and standard deviation for the following data :

Wages upto (in Rs.)	15	30	45	60	75	90	105	120
No. of workers	12	30	65	107	157	202	222	230

Sol. We are given the cumulative frequency distribution. So first we will prepare the frequency distribution as given below :

Class Interval	Cumulative frequency	Mid-values	Frequency	$u_i = \frac{x_i - 67.5}{15}$	$f_i u_i$	$f_i u_i^2$
0 - 15	12	7.5	12	−4	−48	192
15 - 30	30	22.5	18	−3	−54	162
30 - 45	65	37.5	35	−2	−70	140
45 - 60	107	52.5	42	−1	−42	42
60 - 75	157	67.5	50	0	0	0
75 - 90	202	82.5	45	1	45	45
90 - 105	222	97.5	20	2	40	80
105 - 120	230	112.5	8	3	24	72
			$\sum f_i = 230$		$\sum f_i u_i = -105$	$\sum f_i u_i^2 = 733$

Here $A = 67.5$, $h = 15$, $N = 230$, $\sum f_i u_i = -105$ and $\sum f_i u_i^2 = 733$

$$\therefore \quad \text{Mean} = A + h\left(\frac{1}{N}\sum f_i u_i\right) = 67.5 + 15\left(\frac{-105}{230}\right) = 67.5 - 6.85 = 60.65$$

and $$\text{Var}(X) = h^2\left[\frac{1}{N}\sum f_i u_i^2 - \left(\frac{1}{N}\sum f_i u_i\right)^2\right]$$

$$\Rightarrow \quad \text{Var}(X) = 225\left[\frac{733}{230} - \left(\frac{-105}{230}\right)^2\right] = 225[3.18 - 0.2025] = 669.9375$$

$$\therefore \quad \text{S.D.} = \sqrt{\text{Var}(X)} = \sqrt{669.9375} = 25.883$$

Ex. 19 The median of the observations 11, 12, 14, 18, x + 2, x + 4, 30, 32, 35, 41 arranged in ascending order is 24. Find the value of x.

Sol. The number of observations = n = 10. Since n is even,

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th}\text{observation} + \left(\frac{n}{2}+1\right)^{th}\text{observation}}{2}$$

$$\Rightarrow \quad 24 = \frac{(5^{th})\text{observation} + (6^{th})\text{observation}}{2} = \frac{(x+2)+(x+4)}{2} = \frac{2x+6}{2}$$

$$\Rightarrow \quad x = 21$$

Ex. 20 Find the median of the following 19, 25, 59, 48, 35, 31, 30, 32, 51. If 25 is replaced by 52 and 19 by 29, what will be the new median ?

Sol. Arranging the data in ascending order : 19, 25, 30, 31, 32, 35, 48, 51, 59.

The number of observations n = 9 (odd)

$\therefore \quad \text{Median} = \left(\frac{9+1}{2}\right)\text{observation} = 5\text{th observation} = 32.$

Hence median = 32.

If 25 is replaced by 52 and 19 by 29, the new observations in ascending order are :

29, 30, 31, 32, 35, 48, 51, 59

$\therefore \quad \text{New median} = 5^{\text{th}} \text{ observation} = 35.$

Ex. 21 Find the value of p, if the mean of the following distribution is 20.

x	15	17	19	20 + p	23
f	2	3	4	5p	6

Sol.

x_i	f_i	x_if_i
15	2	30
17	3	51
19	4	76
20 + p	5p	$100p + 5p^2$
23	6	138
Total	15 + 5p	$5p^2 + 100p + 295$

$\text{Mean} = \bar{x} = \frac{1}{n}\left(\sum x_i\right)$

$20 = \frac{5p^2 + 100p + 295}{15 + 5p}$

$5p^2 + 100p + 295 = 300 + 100p$

$5p^2 - 5 = 0$

$5(p^2 - 1) = 0$

$(p + 1)(p - 1) = 0$

$p = 1 \text{ or } p = -1$

Ex. 22 Suppose that samples of polyethylene bags from two manufactures, A and B are tested by a prospective buyer for bursting pressure, with the following results :

Bursting pressure in kg	Number of bags manufactured by manufacturer A	B
5 - 10	2	9
10 - 15	9	11
15 - 20	29	18
20 - 25	54	32
25 - 30	11	27
30 - 35	5	13

Which set of the bag has the highest average bursting pressure ? Which has more uniform pressure ?

Sol. For determining the set of bags having higher average bursting pressure we compute mean and for finding out set of bags having more uniform pressure we compute coefficient of variation.

Manufacturer A

Computation of mean and standard deviation

Bursting pressure	Mid - values x_i	f_i	$u_i = \frac{x_i - 17.5}{5}$	$f_i u_i$	$f_i u_i^2$
5 - 10	7.5	2	-2	-4	8
10 - 15	12.5	9	-1	-9	9
15 - 20	17.5	29	0	0	0
20 - 25	22.5	54	1	54	54
25 - 30	27.5	11	2	22	44
30 - 35	32.5	5	3	15	45
		$N = \sum f_i = 110$	$\sum u_i = 3$	$\sum f_i u_i = 78$	$\sum f_i u_i^2 = 160$

$$\bar{X}_A = a + h\left(\frac{\sum f_i u_i}{N}\right)$$

$$\Rightarrow \quad \bar{X}_A = 17.5 + 5 \times \frac{78}{110} \qquad [\because h = 5, a = 17.5]$$

$$\Rightarrow \quad \bar{X}_A = 17.5 + 3.5 = 21$$

$$\sigma_A^2 = h^2\left[\frac{1}{N}\sum f_i u_i^2 - \left(\frac{1}{N}\sum f_i u_i\right)^2\right]$$

$$\Rightarrow \quad \sigma_A^2 = 25\left[\frac{160}{110} - \left(\frac{78}{110}\right)^2\right] \qquad \Rightarrow \quad \sigma_A^2 = 25\left(\frac{17600 - 6084}{110 \times 110}\right) = 23.79$$

$$\Rightarrow \quad \sigma_A = \sqrt{23.79} = 4.87$$

$$\therefore \quad \text{Coefficient of variation} = \frac{\sigma_A}{\bar{X}_A} \times 100 = \frac{4.87}{21} \times 100 = 23.19$$

Manufacturer B

Bursting pressure	Mid - values x_i	f_i	$u_i = \frac{x_i - 17.5}{5}$	$f_i u_i$	$f_i u_i^2$
5 - 10	7.5	9	-2	-18	36
10 - 15	12.5	11	-1	-11	11
15 - 20	17.5	18	0	0	0
20 - 25	22.5	32	1	32	32
25 - 30	27.5	27	2	54	108
30 - 35	32.5	13	3	39	117
		$N = \sum f_i = 110$	$\sum u_i = 3$	$\sum f_i u_i = 96$	$\sum f_i u_i^2 = 304$

$$\bar{X}_B = a + h\left(\frac{\sum f_i u_i}{N}\right)$$

$\Rightarrow$ $$\bar{X}_B = 17.5 + 5 \times \frac{96}{110} = 17.5 + 4.36 = 21.81$$

$$\sigma_B = h^2\left[\frac{1}{N}\left(\sum f_i u_i^2\right) - \left(\frac{1}{N}\sum f_i u_i\right)^2\right]$$

$\Rightarrow$ $$\sigma_B^2 = 25\left[\frac{304}{110} - \left(\frac{96}{110}\right)^2\right] \qquad \Rightarrow \sigma_B^2 = 25\left(\frac{33440 - 9216}{110 \times 110}\right) = 50.04$$

$$\sigma_B = 7.07$$

$\therefore$ Coefficient of variation $= \frac{\sigma_B}{\bar{X}_B} \times 100 = \frac{7.07}{21.81} \times 100 = 32.41$

We observe that the average bursting pressure is higher for manufacturer B. So, bags manufactured by B have higher bursting pressure.

The coefficient of variation is less for manufacturer A. So bags manufactured by A have more uniform pressure.

Exercise # 1 [Single Correct Choice Type Questions]

1. The median of the numbers 6, 14, 12, 8, 10, 9, 11, is :-

(A) 8 (B) 10 (C) 10.5 (D) 11

2. If the mean of n observations $1^2, 2^2, 3^2, \ldots\ldots, n^2$ is $\frac{46n}{11}$, then n is equal to-

(A) 11 (B) 12 (C) 23 (D) 22

3. An additional observation 15 is included in a series of 11 observations and its mean remains unaffected. The mean of the series was

(A) 1 (B) 15 (C) 165 (D) 4

4. The geometric mean of the first n terms of the series $a, ar, ar^2, \ldots$, is-

(A) $ar^{n/2}$ (B) ar^n (C) $ar^{(n-1)/2}$ (D) ar^{n-1}

5. If standard deviation of variate x_i is 10, then variance of the variate $(50 + 5x_i)$ will be-

(A) 50 (B) 250 (C) 500 (D) 2500

6. Median is independent of change of :-

(A) only Origin (B) only Scale

(C) Origin and scale both (D) Neither origin nor scale

7. In a batch of 15 students, 4 have failed. The marks of successful candidates are 41, 57, 38, 61, 36, 55, 71, 50 and 40. The median marks are

(A) 40 (B) 50 (C) [illegible] (D) cannot be determined

8. Mean of the first n terms of the A.P. a, (a + d), (a + 2d), ... is -

(A) $a + \frac{nd}{2}$ (B) $a + \frac{(n-1)d}{2}$ (C) $a + (n - 1)d$ (D) $a + nd$

9. The median and standard deviation (S.D.) of a distribution will be, If each term is increased by 2 -

(A) median and S.D. will increased by 2

(B) median will increased by 2 but S.D. will remain same

(C) median will remain same but S.D. will increased by 2

(D) median and S.D. will remain same

10. If values a, b, c......, j, k occurs with frequencies $^{10}C_0, {}^{10}C_1, {}^{10}C_2, \ldots, {}^{10}C_{10}$ then mode is

(A) a (B) e (C) f (D) k

11. The mode of the following freq. dist is :-

Class	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50
f_i	5	7	8	6	4

(A) 24 (B) 23.83 (C) 27.16 (D) None of these

12. Median of $^{2n}C_0, ^{2n}C_1, ^{2n}C_2, ..., ^{2n}C_n$ (when n is even) is -

(A) $^{2n}C_{\frac{n}{2}}$ (B) $^{2n}C_{\frac{n}{2}}$ (C) $^{2n}C_{\frac{n-1}{2}}$ (D) None of these

13. The mean deviation about median of variates 13, 14, 15, ..., 99, 100 is

(A) 1936 (B) 21.5 (C) 23.5 (D) 22

14. The S.D. of the first n natural numbers is -

(A) $\sqrt{\frac{n^2-1}{2}}$ (B) $\sqrt{\frac{n^2-1}{3}}$ (C) $\sqrt{\frac{n^2-1}{4}}$ (D) $\sqrt{\frac{n^2-1}{12}}$

15. A series which have numbers three 4's, four 5's, five 6's, eight 7's, seven 8's and six 9's then the mode of numbers is :-

(A) 9 (B) 8 (C) 7 (D) 6

16. The A.M. of first n terms of the series 1.3.5, 3.5.7, 5.7.9, ..., is-

(A) $3n^3 - 6n^2 - 7n - 2$ (B) $n^3 + 8n^2 - 7n - 1$ (C) $2n^3 - 8n^2 - 7n - 2$ (D) $2n^3 - 8n^2 - 7n - 2$

17. The sum of squares of deviations for 10 observations taken from mean 50 is 250. The co-efficient of variation is

(A) 50% (B) 10% (C) 40% (D) None of these

18. The A.M. of $^nC_0, ^nC_1, ^nC_2, ..., ^nC_n$ is -

(A) $\frac{2^n}{n}$ (B) $\frac{2^{n-1}}{n}$ (C) $\frac{2^n}{n+1}$ (D) $\frac{2^n}{n-1}$

19. If the mean and S.D. of n observations $x_1, x_2, ..., x_n$ are $\bar{x}$ and σ resp, then the sum of squares of observations is :-

(A) $n(\sigma^2 + \bar{x}^2)$ (B) $n(\sigma^2 - \bar{x}^2)$ (C) $n(\bar{x}^2 - \sigma^2)$ (D) None of these

20. The Harmonic mean of 3, 7, 8, 10, 14 is-

(A) $\frac{3+7+8+10+14}{5}$ (B) $\frac{5}{3+7+8+10+14}$

(C) $\frac{\frac{1}{3}+\frac{1}{7}+\frac{1}{8}+\frac{1}{10}+\frac{1}{14}}{5}$ (D) $\frac{5}{\frac{1}{3}+\frac{1}{7}+\frac{1}{8}+\frac{1}{10}+\frac{1}{14}}$

21. The S.D. of the following freq. dist. :-

Class	0 - 10	10 - 20	20 - 30	30 - 40
f_i	1	3	4	2

(A) 7.8 (B) 9 (C) 8.1 (D) 0.9

22. For a normal dist :-

(A) mean = median (B) median = mode (C) mean = mode (D) mean = median = mode

23. Mean deviation of the observations 70, 42, 63, 34, 44, 54, 55, 46, 38, 48 from median is :-

(A) 7.8 (B) 8.6 (C) 7.6 (D) 8.8

24. If $\bar{X}_1$ and $\bar{X}_2$ are the means of two series such that $\bar{X}_1 < \bar{X}_2$ and $\bar{X}$ is the mean of the combined series, then-

(A) $\bar{X} < \bar{X}_1$ (B) $\bar{X} > \bar{X}_2$ (C) $\bar{X}_1 < \bar{X} < \bar{X}_2$ (D) $\bar{X} = \dfrac{\bar{X}_1 + \bar{X}_2}{2}$

25. If the mean of numbers 27, 31, 89, 107, 156 is 82, then the mean of numbers 130, 126, 68, 50, 1 will be-

(A) 80 (B) 82 (C) 75 (D) 157

26. The coefficient of mean deviation from median of observations 40, 62, 54, 90, 68, 76 is :-

(A) 2.16 (B) 0.2 (C) 5 (D) None of these

27. If the mode of a data is 18 and the mean is 24, then median is

(A) 21 (B) 24 (C) 22 (D) 18

28. The weighted mean of first n natural numbers when their weights are equal to corresponding natural number, is :-

(A) $\dfrac{n+1}{2}$ (B) $\dfrac{2n+1}{3}$ (C) $\dfrac{(n+1)(2n+1)}{6}$ (D) None of these

29. The S.D. of a variate x is σ. The S.D. of the variate where $\dfrac{ax+b}{c}$ a, b, c are constants, is

(A) $\left(\dfrac{a}{c}\right)\sigma$ (B) $\left|\dfrac{a}{c}\right|\sigma$ (C) $\left(\dfrac{a^2}{c^2}\right)\sigma$ (D) None of these

30. The mean deviation from median is

(A) greater than the mean deviation from any other central value

(B) less than the mean deviation from any other central value

(C) equal to the mean deviation from any other central value

(D) maximum if all values are positive

31. The first of the two samples has 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) 3.52

32. In a group of students, the mean weight of boys is 65 kg. and mean weight of girls is 55 kg. If the mean weight of all students of group is 61 kg, then the ratio of the number of boys and girls in the group is :-

(A) 2 : 3 (B) 3 : 1 (C) 3 : 2 (D) 4 : 3

33. If the mean of the set of numbers $x_1, x_2, \ldots\ldots, x_n$ is $\bar{x}$, then the mean of the numbers $x_i + 2i$, $1 \le i \le n$ is

(A) $\bar{x} + 2n$ (B) $\bar{x} + n + 1$ (C) $\bar{x} + 2$ (D) $\bar{x} + n$

34. If each observation of a dist., whose variance is σ^2, is multiplied by λ, then the S.D. of the new new observations is-

(A) σ (B) $\lambda\sigma$ (C) $|\lambda|\sigma$ (D) $\lambda^2\sigma$

35. If $\sum_{i=1}^{n}(x_i - 15) = 12$ and $\sum_{i=1}^{n}(x_i - 15)^2 = 18$ then the S.D. of observations $x_1, x_2, \ldots\ldots, x_n$ is :-

(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{4}{5}$ (D) None of these

36. The best statistical measure used for comparing the two series is

(A) Mean deviation (B) Range

(C) Coefficient of variation (D) Coefficient of range

37. The mean of a set of numbers is $\bar{x}$. If each number is decreased by λ, the mean of the new set is-

(A) $\bar{x}$ (B) $\bar{x} + \lambda$ (C) $\lambda - \bar{x}$ (D) $\bar{x} - \lambda$

38. The H.M. of the reciprocal of first n natural numbers is :-

(A) $\frac{n+1}{2}$ (B) $\frac{n}{\left(1+\frac{1}{2}+\frac{1}{3}+\ldots+\frac{1}{n}\right)}$ (C) $\frac{2}{n+1}$ (D) None of these

39. Mode of the following frequency distribution

x	4	5	6	7	8
f	6	7	10	8	3

(A) 5 (B) 6 (C) 8 (D) 10

40. If mean = (3 median – mode) x, then the value of x is-

(A) 1 (B) 2 (C) 1/2 (D) 3/2

41. Variance is independent of change of-

(A) only origin (B) only scale (C) origin and scale both (D) none of these

42. If the difference between mean and mode is 63, the difference between mean and median is

(A) 189 (B) 21 (C) 31.5 (D) 48.5

43. The observations 29, 32, 48, 50, x, x + 2, 72, 78, 84, 95 are arranged in ascending order and their median is 63 then the value of x is :-

(A) 61 (B) 62 (C) 62.5 (D) 63

44. The H.M. of following freq. dist. is :-

x_i	3	6	9	12
f_i	1	2	3	4

(A) 9 (B) 3 (C) 7.5 (D) None of these

45. If the mean of a set of observations $x_1, x_2, \ldots\ldots, x_{10}$ is 20, then the mean of $x_1 + 4$, $x_2 + 8$, $x_3 + 12$, ..., $x_{10} + 40$ is-

(A) 34 (B) 42 (C) 38 (D) 40

46. The sum of squares of deviation of variates from their A.M. is always :-

(A) Zero **(B)** Minimum **(C)** Maximum **(D)** Nothing can be said

47. If a , b, c are any three positive numbers, then the least value of $(a + b + c)\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$ is-

(A) 3 **(B)** 6 **(C)** 9 **(D)** None of these

48. The average of n numbers $x_1, x_2, x_3, \ldots\ldots\ldots\ldots\ldots, x_n$ is M. If x_n is replaced by x', then the new average is

(A) $\frac{M - x_n + x'}{n}$ **(B)** $\frac{(n-1)M + x'}{n}$ **(C)** $\frac{nM - x_n + x'}{n}$ **(D)** $M - x_n + x'$

49. The mean of values 0, 1, 2, ..., n when their weights are $1, {}^nC_1, {}^nC_2, \ldots, {}^nC_n$, resp., is

(A) $\frac{2^n}{n+1}$ **(B)** $\frac{n+1}{2}$ **(C)** $\frac{2^{n+1}}{n(n+1)}$ **(D)** $\frac{n}{2}$

50. The G.M. of n positive terms $x_1, x_2, \ldots\ldots x_n$ is :-

(A) $(x_1 \times x_2 \times \ldots\ldots \times x_n)^n$ **(B)** $\frac{1}{n}(x_1 \times x_2 \times \ldots \times x_n)$

(C) $(x_1 \times x_2 \times \ldots \times x_n)^{1/n}$ **(D)** None of these

51. For the values $x_1, x_2 \ldots\ldots x_{101}$ of a distribution $x_1 < x_2 < x_3 < \ldots\ldots < x_{100} < x_{101}$. The mean deviation of this distribution with respect to a number k will be minimum when k is equal to-

(A) x_1 **(B)** x_{51} **(C)** x_{50} **(D)** $\frac{x_1 + x_2 + \ldots\ldots + x_{101}}{101}$

52. For finding average speed of a vehicle covering equal distances in different time intervals, we prefer to use

(A) A.M. **(B)** G.M. **(C)** H.M. **(D)** Median

53. The mean deviation of a frequency dist. is equal to :-

(A) $\frac{\Sigma d_i}{\Sigma f_i}$ **(B)** $\frac{\Sigma |d_i|}{\Sigma f_i}$ **(C)** $\frac{\Sigma f_i d_i}{\Sigma f_i}$ **(D)** $\frac{\Sigma f_i |d_i|}{\Sigma f_i}$

54. If a variable takes the discrete values $\alpha + 4, \alpha - \frac{7}{2}, \alpha - \frac{5}{2}, \alpha - 3, \alpha - 2, \alpha + \frac{1}{2}, \alpha - \frac{1}{2}, \alpha + 5$ $(\alpha > 0)$, then the median of these values-

(A) $\alpha - \frac{5}{4}$ **(B)** $\alpha - \frac{1}{2}$ **(C)** $\alpha - 2$ **(D)** $\alpha + \frac{5}{4}$

55. The weighted mean (W.M.) is computed by the formula ?

(A) $W.M. = \frac{\Sigma x_i}{\Sigma w_i}$ **(B)** $W.M. = \frac{\Sigma w_i}{\Sigma x_i}$ **(C)** $W.M. = \frac{\Sigma w_i x_i}{\Sigma x_i}$ **(D)** $W.M. = \frac{\Sigma w_i x_i}{\Sigma w_i}$

56. The S.D. of first n odd natural numbers is :-

(A) $\sqrt{\frac{n^2 - 1}{2}}$ **(B)** $\sqrt{\frac{n^2 - 1}{3}}$ **(C)** $\sqrt{\frac{n^2 - 1}{6}}$ **(D)** $\sqrt{\frac{n^2 - 1}{12}}$

57. The median of an arranged series of n even observations, will be :-

(A) $\left(\frac{n+1}{2}\right)$ th term **(B)** $\left(\frac{n}{2}\right)$ th term

(C) $\left(\frac{n}{2}+1\right)$ th term **(D)** Mean of $\left(\frac{n}{2}\right)$ th and $\left(\frac{n}{2}+1\right)$ th terms

58. The value of π upto 25 decimal places is 3.1415926535897932384626433. If we make a frequency distribution of the digits from 0 to 9 after the decimal point then mode of the distribution is

(A) 3 **(B)** 4 **(C)** 5 **(D)** 8

59. In any discrete series (when all the value are not same) the relationship between M.D. about mean and S.D. is-

(A) M.D. = S.D. **(B)** M.D. > S.D. **(C)** M.D. < S.D. **(D)** M.D. $\leq$ S.D.

60. If the coefficient of variation and standard deviation of a distribution are 50% and 20 respectively, then its mean is-

(A) 40 **(B)** 30 **(C)** 20 **(D)** None of these

61. Product of n positive numbers is unit. The sum of these numbers can not be less than-

(A) 1 **(B)** n **(C)** n^2 **(D)** none of these

62. Which of the following are dimensionless ?

(A) Standard deviation **(B)** Mean deviation **(C)** variance **(D)** coefficient of variation

63. The variate x and u are related by $u = \frac{x-a}{h}$ then correct relation between σ_x and σ_u is :-

(A) $\sigma_x = h\sigma_u$ **(B)** $\sigma_x = h + \sigma_u$ **(C)** $\sigma_u = h\sigma_x$ **(D)** $\sigma_u = h + \sigma_x$

64. The mean of n values of a distribution is $\bar{x}$. If its first value is increased by 1, second by 2, ... then the mean of new values will be-

(A) $\bar{x}+n$ **(B)** $\bar{x}+n/2$ **(C)** $\bar{x}+\left(\frac{n+1}{2}\right)$ **(D)** None of these

65. The algebraic sum of deviations of 10 observations measured from 15 is 7. The mean is

(A) 105 **(B)** 70 **(C)** 15.7 **(D)** none of these

66. The standard deviation of variate x_i is σ. Then standard deviation of the variate $\frac{ax_i+b}{c}$, where a , b, c are constants is-

(A) $\left(\frac{a}{c}\right)\sigma$ **(B)** $\left|\frac{a}{c}\right|\sigma$ **(C)** $\left(\frac{a^2}{c^2}\right)\sigma$ **(D)** None of these

67. In a frequency dist. , if d_i is deviation of variates from a number ● and mean = ● + $\frac{\Sigma f_i d_i}{\Sigma f_i}$, then ● is :-

(A) Lower limit **(B)** Assumed mean

(C) Number of observation **(D)** Class interval

68. The M.D. of the variates 40, 62, 68, 76, 54 from A.M. is

(A) 9.4 **(B)** 10 **(C)** 10.4 **(D)** 11

69. If each observation of a dist. whose S.D. is σ, is increased by λ, then the variance of the new observations is -

(A) σ **(B)** $\sigma+\lambda$ **(C)** σ^2 **(D)** $\sigma^2+\lambda$

70. The mean deviation from the mean of the increasing A.P. a, a + d, a + 2d,.............., a + 2nd is

(A) n(n+1)d **(B)** $\frac{n(n+1)d}{2n+1}$ **(C)** $\frac{n(n+1)d}{2n}$ **(D)** $\frac{n(n-1)d}{2n+1}$

Exercise # 2

Part # I [Matrix Match Type Questions]

Following question contains statements given in two columns, which have to be matched. The statements in Column-I are labelled as A, B, C and D while the statements in Column-II are labelled as p, q, r and s. Any given statement in Column-I can have correct matching with one or more statement(s) in Column-II.

1.

	Column - I		Column - II
(A)	Better measure of central tendency for data 1, 7, 8, 9, 9 is	(p)	Mean
(B)	Which is not independent of change of scale ?	(q)	Median
(C)	Which is not dependent on change of origin ?	(r)	Mode
(D)	The value of range of data is always greater than or equal to	(s)	S.D.

Part # II [Comprehension Types Questions]

Comprehension # 1

Given values $x_1, x_2, \ldots\ldots, x_{12}$ such that $\sum_{i=1}^{12} x_i = 120$, $\sum_{i=1}^{12} x_i^2 = 1530$ then

1. A.M. of $x_1, x_2, \ldots\ldots, x_{12}$ is

(A) 12 (B) 10 (C) 13 (D) 12

2. Variance of $x_1, x_2, \ldots\ldots, x_{12}$ is

(A) 2 (B) 3 (C) 9 (D) 16

3. Coefficient of variation is

(A) 36% (B) 41% (C) 25% (D) none of these

Comprehension # 2

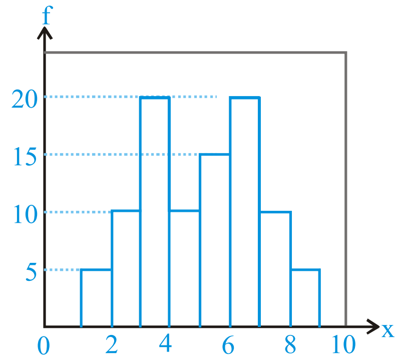
To analyze data using mean, median and mode, we need to use the most appropriate measure of central tendency. The mean is useful for predicting future results when there are no extreme values in the data set. The median may be more useful than the mean when there are extreme values in the data set as it is not affected by the extreme values. The median is most commonly quoted figure used to measure property prices as mean property price is affected by a few expensive properties that are not representative of the general property market. The mode is useful when the most common item or characteristic of a data set is required. The mode has applications in printing. It is important to print more of the most popular books.

1. For the data shown, the value of appropriate measure of central tendency is

Staff	1	2	4	5	6	2
salary (In rupees)	15000	10000	7000	12000	90000	95000

(A) 95000 (B) 18350 (C) 90000 (D) 12000

2. For a normally distributed sample as shown, then most appropriate representative of data is



(A) Mean
(B) Mode
(C) Median
(D) any one of mean or median

3. Based upon collection of data of numbers of days it snows, rains or it is sunny in a month for three month December, January and February of last year, the weather forecast points that snow is likely to be in January. Which measure is used for this forecast ?

(A) Mean **(B)** Mode **(C)** Median **(D)** Range

Exercise # 3 Part # I [Previous Year Questions] [AIEEE/JEE-MAIN]

1. The mean of Mathematics marks of 100 students of a class is 72. If the number of boys is 70 and the mean of their marks is 75. Then the mean of the marks of girls in the class will be- **[AIEEE-2002]**

(1) 60 **(2)** 62 **(3)** 65 **(4)** 68

2. In an experiment with 15 observations of x, the following results were available $\sum x^2 = 2830$, $\sum x = 170$. One observation that was 20 was found to be wrong and it was replaced by it's correct value 30. Then the corrected variance is- **[AIEEE-2003]**

(1) 8.33 **(2)** 78 **(3)** 188.66 **(4)** 177.33

3. The mean and variance of a random variable X having a binomial distribution are 4 and 2 respectively. Then P(X = 1) is- **[AIEEE-2003]**

(1) $\frac{1}{4}$ **(2)** $\frac{1}{32}$ **(3)** $\frac{1}{16}$ **(4)** $\frac{1}{8}$

4. The median of a set of 9 distinct observations is 20.5. If each of the largest four observations of the set is increased by 2, then the median of the new set- **[AIEEE-2003]**

(1) remains the same as that of the original set **(2)** is increased by 2

(3) is decreased by 2 **(4)** is two times the original median

5. Consider the following statements- **[AIEEE-2004]**

(A) Mode can be computed from histogram

(B) median is not independent of change of scale

(C) variance is independent of change of origin and scale

which of these are correct-

(1) only (A) and (B) **(2)** only (B) **(3)** only **(A)** **(4)** (A), (B) and (C)

6. In a series of 2n observations, half of them equal a and remaining half equal –a. If the standard deviation of the observations is 2, then |a| equals- **[AIEEE-2004]**

(1) 2 **(2)** $\sqrt{2}$ **(3)** $\frac{1}{n}$ **(4)** $\frac{\sqrt{2}}{n}$

7. The mean and the variance of a binomial distribution are 4 and 2 respectively. Then the probability of 2 success is-

(1) $\frac{128}{256}$ **(2)** $\frac{219}{256}$ **(3)** $\frac{37}{256}$ **(4)** $\frac{28}{256}$ **[AIEEE-2004]**

8. If in a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately-

(1) 24.0 **(2)** 25.5 **(3)** 20.5 **(4)** 22.0 **[AIEEE-2005]**

9. Let $x_1, x_2, \ldots\ldots, x_n$ be n observations such that $\sum x_i^2 = 400$ and $\sum x_i = 80$. Then a possible value of n among the following is- **[AIEEE-2005]**

(1) 12 **(2)** 9 **(3)** 18 **(4)** 15

10. Suppose a population A has 100 observations 101, 102, ... 200 and other population B has 100 observations 151, 152, ... 250. If V_A and V_B represent the variance of two population respectively then $\frac{V_A}{V_B}$ is- **[AIEEE-2006]**

(1) 9/4 **(2)** 4/9 **(3)** 2/3 **(4)** 1

11. The average marks of boys in a class 52 and that of girls is 42. The average marks of boys and girls combined is 50 then the percentage of boys in the class is- **[AIEEE-2007]**

(1) 20 **(2)** 80 **(3)** 60 **(4)** 40

12. The mean of the numbers a, b, 8, 5, 10 is 6 and the variance is 6.80 then which one of the following gives possible values of a and b ? **[AIEEE-2008]**

(1) a = 0, b = 7 **(2)** a = 5, b = 2 **(3)** a = 1, b = 6 **(4)** a = 3, b = 4

13. **Statement–I :**

The variance of first n even natural numbers is $\frac{n^2-1}{4}$.

Statement–II :

The sum of first n natural numbers is $\frac{n(n+1)}{2}$ and the sum of squares of first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. **[AIEEE-2009]**

(1) Statement–1 is true, Statement–2 is false.
(2) Statement–1 is false, Statement–2 is true.
(3) Statement–1 is true, Statement–2 is true ; Statement–2 is a correct explanation for Statement–1.
(4) Statement–1 is true, Statement–2 is true ; Statement–2 is not a correct explanation for statement–1.

14. If the mean deviation of the numbers 1, 1 + d, 1 + 2d, ..., 1 + 100d from their mean is 255, then that d is equal to

(1) 10.1 **(2)** 20.2 **(3)** 10.0 **(4)** 20.0 **[AIEEE-2009]**

15. For two data sets each of size is 5, the variances are given to be 4 and 5 and the corresponding means are given to be 2 and 4 respectively, then the variance of the combined data set is :- **[AIEEE-2010]**

(1) $\frac{5}{2}$ **(2)** $\frac{11}{2}$ **(3)** 6 **(4)** $\frac{13}{2}$

16. If the mean deviation about the median of the numbers a, 2a, ..., 50a is 50, then |a| equals:- **[AIEEE-2011]**

(1) 4 **(2)** 5 **(3)** 2 **(4)** 3

17. A scientist is weighing each of 30 fishes. Their mean weight worked out is 30 gm and a standard deviation of 2 gm. Later, it was found that the measuring scale was misaligned and always under reported every fish weight by 2 gm. The correct mean and standard deviation (in gm) of fishes are respectively : **[AIEEE-2011]**

(1) 28, 4 **(2)** 32, 2 **(3)** 32, 4 **(4)** 28, 2

18. Let $x_1, x_2, \ldots, x_n$ be n observations, and let $\overline{x}$ be their arithmetic mean and σ^2 be their variance.

Statement–I : Variance of $2x_1, 2x_2, \ldots, 2x_n$ is $4\sigma^2$.

Statement–II : Arithmetic mean of $2x_1, 2x_2, \ldots, 2x_n$ is $4\overline{x}$. **[AIEEE-2012]**

(1) Statement–I is true, Statement–II is false.

(2) Statement–I is false, Statement–II is true.

(3) Statement–I is true, Statement–II is true ; Statement–II is a correct explanation for Statement–1.

(4) Statement–I is true, Statement–II is true ; Statement–II is not a correct explanation for Statement–1.

19. The variance of first 50 even natural numbers is : **[JEE Main 2014]**

(1) $\frac{833}{4}$ **(2)** 833 **(3)** 437 **(4)** $\frac{437}{4}$

20. The negative of $: s \vee (: r \wedge s)$ is equivalent to : **[JEE Main 2015]**

(1) $s \vee (r \vee : s)$ **(2)** $s \wedge r$ **(3)** $s \wedge : r$ **(4)** $s \wedge (r \wedge : s)$

21. If the standard deviation of the numbers 2, 3, a and 11 is 3.5, then which of the following is true ? **[JEE Main 2016]**

(1) $3a^2 - 32a + 84 = 0$ **(2)** $3a^2 - 34a + 91 = 0$

(3) $3a^2 - 23a + 44 = 0$ **(4)** $3a^2 - 26a + 55 = 0$

MOCK TEST

1. Converse of the statement: If a number n is even, then n^2 is even , is :
(A) If a number n^2 is even , then n is even **(B)** If n is not even, then n^2 is not even
(C) Neither n nor n^2 is even **(D)** none of these

2. Which of the following statement is not equivalent to $p \leftrightarrow q$?
(A) p if and only if q **(B)** q if and only if p
(C) p is necessary and sufficient for q **(D)** none of these

3. Negation of the statement p: for every real number, either $x > 1$ or $x < 1$ is
(A) There exist a real number x such that neither $x > 1$ nor $x < 1$
(B) There exist a real number x such that $0 < x < 1$
(C) There exist a real number x such that neither $x \geq 1$ nor $x \leq 1$
(D) none of these

4. The statement $p \rightarrow (q \rightarrow p)$ is equivalent to
(A) $p \rightarrow (p \rightarrow q)$ **(B)** $p \rightarrow (p \vee q)$ **(C)** $p \rightarrow (p \wedge q)$ **(D)** $p \rightarrow (p \leftrightarrow q)$

5. The statement $p \rightarrow (q \vee r)$ is not equivalent to
(A) $(p \rightarrow q) \vee (p \rightarrow r)$ **(B)** $p \wedge (\sim q) \rightarrow r$ **(C)** $p \wedge (\sim r) \rightarrow q$ **(D)** $p \wedge q \rightarrow (p \wedge r) \vee (q \wedge r)$

6. Negation of $p \rightarrow q$ is
(A) $p \wedge (\sim q)$ **(B)** $\sim p \vee q$ **(C)** $\sim q \rightarrow \sim p$ **(D)** $p \vee (\sim q)$

7. The negation of the statement
"If I become a teacher, then I will open a school", is :
(A) I will become a teacher and and I will not open a school.
(B) Either I will not become a teacher or I will not open a school.
(C) Neither I will become a teacher nor I will open a school.
(D) I will not become a teacher or I will open a school.

8. Contrapositive of $p \rightarrow (q - r)$ is logically equivalent to
(A) $p \rightarrow (q \sim r)$ **(B)** $(p \rightarrow r) \rightarrow \sim p$ **(C)** $p \vee q \rightarrow r$ **(D)** $(q \rightarrow r) \rightarrow p$

9. Let p, q and r be the statements.
p : X is a rectangle
q : X is a square
$r : p \rightarrow q$
Statement - I: $p \rightarrow r$ is a tautology.
Statement - II: A tautology is equivalent to T.
(A) Statement - I is true, Statement - II is true, Statement - II is a correct explanation for Statement - 1
(B) Statement - I is true, Statement - II is true, Statement - II is **not** a correct explanation for Statement - 1
(C) Statement - I is true, Statement - II is False
(D) Statement - I is False, Statement - II is True

10. The propositions $(p \Rightarrow \sim p) \wedge (\sim p \Rightarrow p)$ is a
(A) Tautology and contradiction **(B)** Neither tautology nor contradiction
(C) Contradiction **(D)** Tautology

11. A die is tossed 5 times. Getting an odd number is considered a success. Then the variance of distribution of success is
(A) 8/3 **(B)** 3/8 **(C)** 4/5 **(D)** 5/4

12. In an experiment with 15 observations on x, then following results were available : $\sum x^2 = 2830$, $\sum x = 170$
One observation that was 20 was found to be wrong and was replaced by the correct value 30.
Then the corrected variance is
(A) 78.00 **(B)** 188.66 **(C)** 177.33 **(D)** 8.33

13. The mean and variance of a random variable having a binomial distribution are 4 and 2 respectively, then $P(X = 1)$ is

(A) $\frac{1}{32}$ **(B)** $\frac{1}{16}$ **(C)** $\frac{1}{8}$ **(D)** $\frac{1}{4}$

14. In a series of 2n observations, half of them equal a and remaining half equal –a. If the standard deviation of the observations is 2, then |a| equals

(A) $\frac{1}{n}$ **(B)** $\sqrt{2}$ **(C)** 2 **(D)** $\frac{\sqrt{2}}{n}$

15. If in a frequently distribution, the mean and median are 21 and 22 respectively, then its mode is approximately.

(A) 22.0 **(B)** 20.5 **(C)** 25.5 **(D)** 24.0

16. Suppose a population A has 100 observations 101, 102, ..., 200, and another population B has 100 observations 151, 152, ... 250. If V_A and V_B represent of the two populations, respectively, then $\frac{V_A}{V_B}$ is

(A) 1 **(B)** 9/4 **(C)** 4/9 **(D)** 2/3

17. The mean of the numbers a, b, 8, 5, 10 is 6 and the variance is 6.80. Then which one of the following gives possible values of a and b ?
(A) a = 0, b = 7 **(B)** a = 5, b = 2 **(C)** a = 1, b = 6 **(D)** a = 3, b = 4

18. Statement-I: The variance of first n even natural numbers is $\frac{n^2-1}{4}$

Statement-II: The sum of first n Natural numbers is $\frac{n(n+1)}{2}$ and the sum of squares of first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$

(A) Statement-I is true, Statement-II is true; Statement-II is a correct explanation for statement-I
(B) Statement-I is true, Statement-II is true; Statement-II is not correct explanation for statement-I
(C) Statement-I is true, Statement-II is false
(D) Statement-I is false, Statement-II is true

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

(A) 10.0 **(B)** 20.0 **(C)** 10.1 **(D)** 20.2

20. For two data sets, each of size 5, the 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) $\frac{11}{2}$ **(B)** 6 **(C)** $\frac{13}{2}$ **(D)** $\frac{5}{2}$

21. If $a_n = \sqrt{7+\sqrt{7+\sqrt{7+........}}}$ having n radical signs then by methods of mathematical inducation which is true.

(A) $a_n > 7 \; \forall n \geq 1$ (B) $a_n < 7 \; \forall n \geq 1$ (C) $a_n < 4 \; \forall n \geq 1$ (D) $a_n < 3 \; \forall n \geq 1$

22. Let $S(K) = 1 + 3 + 5 + ... + (2K - 1) = 3 + K^2$ Then which of the following is true ?
(A) S(1) is correct
(B) Principle of mathematical induction can be used to prove the formula
(C) $S(K) \not\Rightarrow S(K+1)$
(D) $S(K) \Rightarrow S(K+1)$

23. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then which one of the following holds for all $n \geq 1$, by the principle of mathematical induction.
(A) $A^n = nA - (n - 1)I$ (B) $A^n = 2^{n-1} A - (n - 1)I$
(C) $A^n = nA + (n - 1)I$ (D) $A^n = 2^{n-1} A + (n - 1)I$

24. Statement - I : For every natural number $n \geq 2$, $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + ... + \frac{1}{\sqrt{n}} > \sqrt{n}$

Statement - II : For every natural number $n \geq 2$, $\sqrt{n(n+1)} < n+1$
(A) Statement - I is false, Statement - II is true.
(B) Statement - I is true, Statement - II is true.
Statement - II is a correct explanation for Statement - I
(C) Statement - I is false, Statement - II is true.
Statement - II is **not** a correct explanation for statement - I
(D) Statement - I is true, Statement - II is false.

25. Statement - I : The sum of the series $1 + (1 + 2 + 4) + (4 + 6 + 9) + (9 + 12 + 16) + ... + (361 + 380 + 400)$ is 8000

Statement - II : $\sum_{k=1}^{n}(k^3 - (k-1)^3) = n^3$, for any natural number n.
(A) Statement - I is false, Statement - II is true.
(B) Statement - I is true, Statement - II is true.
Statement - II is a correct explanation for Statement - I
(C) Statement - I is true, Statement - II is true.
Statement - II is **not** a correct explanation for statement - I
(D) Statement - I is true, Statement - II is false.

26. If $a_n = 2^{2^n} + 1$, then for $n > 1$, $n \in N$, last digit of a_n is ....
(A) 3 (B) 5 (C) 8 (D) 7

27. By principle of mathematical induction
$\forall n \subset N$, $\cos\theta \cos2\theta \cos4\theta ....\cos[(2^{n-1})\theta] -$ ....
(A) $\sin2^n \theta / 2^n \sin\theta$ (B) $\cos2^n \theta / 2^n \sin\theta$
(C) $\sin2^n \theta / 2^{n-1} \sin\theta$ (D) None of these

28. By principle of mathematical induction, $\forall\, n \in N$, $1/(1.2.3) + 1/(2.3.4) + ... + 1/\{n(n+1)(n+2)\} =$ ....

(A) $n(n+1)/4(n+2)(n+3)$ **(B)** $n(n+3)/4(n+1)(n+2)$
(C) $n(n+2)/4(n+1)(n+3)$ **(D)** None of these

29. For all $n \in N$, $a^n - b^n$ is always divisible by .... (a and b are distinct rational numbers)

(A) $2a - b$ **(B)** $a + b$
(C) $a - b$ **(D)** $a - 2b$

30. let p (n) : $n^2 + n + 1$ is an odd integer. If it is assumed that P (k) is true $\Rightarrow$ P (k + 1) is true. Therefore, P (n) is true ....

(A) for $n > 1$ **(B)** for all $n \in N$
(C) for $n > 2$ **(D)** none of these

ANSWER KEY

EXERCISE - 1

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

EXERCISE - 2 : PART # I

1. $A \to q,r$ $B \to p,q,r,s$ $C \to s$ $D \to s$

PART # II

Comprehension # 1 : 1. A **2.** C **3.** C

Comprehension # 2 : 1. D **2.** A **3.** B

EXERCISE - 3 : PART # I

1. 3	**2.** 2	**3.** 2	**4.** 1	**5.** 1	**6.** 1	**7.** 4	**8.** 1	**9.** 3	**10.** 4	**11.** 2	**12.** 4	**13.** 2
14. 1	**15.** 2	**16.** 1	**17.** 2	**18.** 1	**19.** 2	**20.** 2	**21.** 1					

MOCK TEST

1. A	**2.** D	**3.** A	**4.** B	**5.** D	**6.** A	**7.** A	**8.** D	**9.** D	**10.** C	**11.** D	**12.** A	**13.** A
14. C	**15.** D	**16.** A	**17.** D	**18.** D	**19.** C	**20.** A	**21.** B	**22.** D	**23.** A	**24.** C	**25.** B	**26.** D
27. A	**28.** B	**29.** C	**30.** B									