STATISTICS

MEASURES OF CENTRAL TENDENCY AND DISPERSION

CONCEPTUAL QUESTIONS

1. Which one of the following measures is the most suitable one of central location for computing intelligence of students?

a. Mode b. A.M. c. G.M. d. Median

Ans. d

2. Which of the following is not a measure of central tendency.

a. Mean b. Median c. Range d. Mode

Ans. c

3. Which of the following is not a measure of dispersion?

a. Variance b. Mean Deviation c. Mode d. Standard Deviation

Ans. c

4. Classification is the process of arranging data in

a. different columns

b. different rows

c. different columns and rows

d. grouping of related facts in different classes

Ans: d

5. The diagram used to estimate mode graphically is

a. Histogram b. Frequency curve

c. Ogive d. Bar diagram

Ans. Ogive

6. Which of the following would you regard as discrete variable

a. height b. weight

c. time d. number of persons in family

Ans. d

7. Diagram and graphs are tools of

a. collection of data b. analysis

c. presentation d. summarization

Ans. b

8. Each term of data is divided by non-zero number *a*. In order to obtain the mean of the new data, the original mean is to be___

a. diminished by *a* b. increased by *a*

c. multiplied by *a* d. divided by *a*

Ans. d

9. Adding 'a' to every term of a series, the arithmetic mean of the series

a. does not change b. is increased by 'a'

c. is diminished by 'a' d. none of these

Ans. a

10. Median can be graphically determined from

a. Ogive b. Histogram

c. Frequency curve d. Frequency Polygon

Ans c

11. If we draw a perpendicular on the x-axis from the point where both less than and more than curves meet, we get,

a. median b. mode

c. arithmetic mean d. quartiles

Ans . a

12. In a histogram with equal class intervals, heights of bars are proportional to_____

a. Mid-value of the classes b. Frequencies of respective classes

c. Cumulative frequencies of the classes d. Class interval of the classes

Ans. b

13. If a variate x is expressed as a linear function of two variates v and v in the form x=au+bv, then mean $\bar{x}$ of x is

a. $a\bar{u}+b\bar{v}$ b. $\bar{u}+\bar{v}$ c. $b\bar{v}+a\bar{u}$ d. u + v

Ans. a

14. In any discrete series (when all the values 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.

Ans. b

15. Sum of absolute deviations about median is

a. least b. greatest c. zero d. equal to median

Ans. a

16. In a symmetrical distribution with a central peak-

a. mean is smaller than median

b. median is smaller than mean

c. mean and median are the same

d. mode is 1

Ans. c

17. If we draw a perpendicular on the x-axis from the point where both less than and more than curves meet, we get,

a. median b. mode c. arithmetic mean d. quartiles

Ans. a

18. If a set of data has zero as an observation, then which one of the following is NOT an appropriate measure of central tendency ?

a. arithmetic mean b. geometric mean

c. median d. mode

Ans. b

19. The standard deviation is not affected by the change of

a. origin b. scale

c. origin and scale d. x-axis

Ans. a

20. Quartile deviation is based on

a. Highest 25% of items b. Lowest 25% of the items

c. The highest 25% of items d. Middle 50% of the items

Ans. d

21. The sum of squares of deviations of a set of values is minimum when taken about

a. A.M. b. Median c. Mode d. H.M.

Ans. a

22. The mean deviation from the median is

a. greater than that measured from any other value

b. less than that measured from any other value

c. equal to that measured from any other value

d. maximum if all observations are positive

Ans.b

23. The arithmetic mean of the squares of the first n natural numbers is

a. $\frac{(n+1)}{6}$ b. $\frac{(n+1)(2n+1)}{6}$

c. $\frac{(n^2-1)}{6}$ d. $\frac{n(n+1)(2n+1)}{6}$

Ans. d

$$\frac{n(n+1)(2n+1)}{6n}=\frac{(n+1)(2n+1)}{6}$$

24. A car completes the first half of its journey with a velocity v_1 and the rest half with velocity v_2. Then, the average velocity of the car for the whole journey is

a. $\frac{v_1+v_2}{2}$ b. $\sqrt{v_1v_2}$ c. $\frac{2v_1v_2}{v_1+v_2}$ d. $\frac{v_1\times v_2}{2}$

Ans. c

25. The mean weight of 9 items is 15. If one more item is added to the series the mean becomes 16. The value of 10th item is

a. 35 b. 30 c. 25 d. 20

Ans. c

$$\frac{9.15+x}{10}=16\Rightarrow 135+x=160\Rightarrow x=25$$

26. The mean of a set of observation is $\bar{x}$. If each observation is divided by a, $a\neq 0$ and then is increased by 10, then mean of the new set is

a. $\frac{\bar{x}}{a}$ b. $\frac{\bar{x}+10}{a}$ c. $\frac{\bar{x}+10a}{a}$ d. $a\bar{x}+b$

Ans. c

$$\frac{\bar{x}}{a}+10=\frac{\bar{x}+10a}{a}$$

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

a. $\bar{x}+n+1$ b. $\bar{x}+2n$ c. $\bar{x}+2$ d. $\bar{x}+n$

Ans. a

$$\frac{x_1+2+x_2+4x_3+6+.....+x_n+2n}{n},$$

$$=\frac{\Sigma x_i}{n}+\frac{2+4+6+.....2n}{n}=\bar{x}+(n+1)$$

28. If a variable takes the values 0, 1, 2, ... n with frequencies proportional to the binomial coefficients ${}^nC_0, {}^nC_1, ... {}^nC_n$ then the mean of the distribution is

a. $\frac{n(n+1)}{4}$ b. $\frac{n}{2}$

c. $\frac{n(n-1)}{2}$ d. $\frac{n(n+1)}{2}$

Ans. b

$$=\frac{0.n_{co}+1.n_{c1}+2.n_{c2}+3.n_{c3}+.....+n.n_{cn}}{2^n}=\frac{n.2^{n-1}}{2^n}=\frac{n}{2}$$

= n/2

29. The arithmetic mean of the series ${}^nC_0, {}^nC_1, {}^nC_2, ... {}^nC_n$ is

a. $\frac{2^n}{(n+1)}$ b. $\frac{2^n}{n}$ c. $\frac{2^{n-1}}{(n+1)}$ d. $\frac{2^n}{(n-1)}$

Ans. b $\frac{n_{c_0}+n_{c_1}+n_{c_2}+.....+n_{c_n}}{n}=\frac{2^n}{n}$

30. If a variable takes values 0, 1, 2, ..., n with frequencies proportional to $q^n, {}^nC_1 pq^{n-1}, {}^nC_2 p^2q^{n-2}, ...p^n$ where p+q=1 then the mean is

a. np b. nq c. npq d. np^2

Ans. b

31. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is.

a. 48 b. $82\frac{1}{2}$ c. 80 d. 50

Ans. d

$$\frac{4900-40-20-50+60+70+80}{100}=\frac{5000}{100}=50$$

32. If the arithmetic and harmonic means of two numbers are 4.5 and 4 respectively, then one of the number is

a. 5 b. 6 c. 7 d. 4

Ans. b

$\frac{a+b}{2}=4.5, \frac{2ab}{a+b}=4, \ a+b=9$, ab = 18 $\Rightarrow$ a = 6

33. If the median of 21 observations is 40 and if the observations greater than the median are increased by 6 then the median of the new data will be

a. 40 b. 46 c. 46 + $\frac{40}{21}$ d. 46 - $\frac{40}{21}$

Ans. a. (no change)

34. In a moderately asymmetrical series, the values of arithmetic mean and mode are at 20.6 and 34.1 respectively. The value of the median is

a. 25.1 b. 28.0 c. 23.4 d. 35.3

Ans. a

Mode = 3 median - 2mean,

34.1 = 3 median -2 (20.6)

$\Rightarrow 34.1=3$ median -41.2,

Median $=\frac{75.3}{3}=25.1$

35. The range of the following set of observations 2, 3, 5, 9, 8, 7, 6, 5, 7, 4, 3 is

a. 11 b. 7 c. 5.5 d. 6

Ans. b

36. In an arranged series of an even number n of terms, the median is

a. $\left(\frac{n}{2}\right)$th term b. $\left(\frac{n}{2}+1\right)$th term

c. the mean of $\left(\frac{n}{2}\right)$th and $\left(\frac{n}{2}+1\right)$th term d. $\left(\frac{n}{2}+2\right)$th term

Ans. c

37. The median of the set of observations 1,3,5,7,11,13,17 is

a. 1 b. 7 c. 9 d. 17

Ans. b

1, 3, 5, 7, 11, 13, 17

Median = 4^{th} variant in the array ie 7

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

a. M.D. = S.D. b. M.D. $\geq$ S.D. c. M.D. < S.D. d. M.D. $\leq$ S.D.

Ans. d

39. The mode of the data 3, 2, 5, 1, 3, 2, 2, 7, 1, 5, 4, 5, 6, 5, 9, 5, 3, 5 is

a. 5 b. 3 c. 7 d. 9

Ans. a

3, 3, 3, 2, 2, 2, 5, 5, 5, 5, 5, 5, 1, 1, 7, 4, 6, 9, mode = 5

40. The standard deviation of the data given by

Variate (x)	**0**	**1**	**2**	**3**	**....**	**n**
Frequency (f)	$^nC_0$	$^nC_1$	$^nC_2$	$^nC_3$	....	^nC_n

a. $\sqrt{\frac{(n+1)}{2}}$ b. $\sqrt{\frac{n}{2}}$

c. $\frac{2^n}{n}$ d. $\frac{\sqrt{n}}{2}$

Ans. d

Mean = $np = \frac{n}{2}$

$\frac{n_{c1} + 2.n_{c2} + 3.n_{c3} + ... + n.n_{cn}}{2^n}$,

Variance = $\frac{n}{4}$, S.D. = $\frac{\sqrt{n}}{2}$

41. If each observation of a raw data whose variance is σ^2, is increased by λ, then the variance of the new set is

a. σ^2 b. $\sigma^2 + \lambda^2$ c. $\sigma^2\lambda^2$ d. $\sigma^3\lambda^3$

Ans. a

42. If each observation of a raw data, whose variance is σ^2, is multiplied by λ, then the variance of the new set is

a. σ^2 b. $\sigma^2\lambda^2$ c. $\sigma^2+\lambda$ d. $\sigma^2+\lambda^2$

Ans.b

43. If $\bar{x}$ is the mean of a distribution, then $\sum f_i(x_i-\bar{x})=$

a. 0 b. M.D. c. S.D. d. A.M.

Ans.a

44. Variance of the data 2, 4, 6, 8, 10 is

a. 6 b. 7 c. 8 d. 9

Ans. c

$$\sigma^2=\frac{\Sigma xi^2}{n}-\left(\frac{\Sigma xi}{n}\right)^2=\frac{4+16+36+64+100}{5}-\left(\frac{30}{2}\right)^2=\frac{44}{5}-36=8$$

45. If the standard deviation of 0,1,2,3…..9 is K, then the standard deviation of 10,11,12,13…. 19 is

a. K + 10 b. K c. $\sqrt{10}+K$ d. 10 K

Ans.b

46. If the mean of a set of observations

$x_1, x_2, \ldots\ldots, x_{10}$ is 20 then the mean of

$x_1+4, x_2+8, x_3+12, \ldots\ldots, x_{10}+40$ is

a. 34 b. 42 c. 38 d. 40

Ans. b

$$\frac{\sum_{i=1}^{10} x_i}{10}=20$$

$$\frac{x_1+4+x_2+8+x_3+12+\ldots\ldots+x_{10}+40}{10}$$

$$=\sum_{\frac{i=1}{10}}^{10} xi+\frac{4+8+12\ldots\ldots\ldots\ldots+40}{10}$$

$$=20+\frac{4(1+2+3+\ldots\ldots\ldots\ldots+10)}{10} \quad =20+\frac{4(10)(11)}{2.10}=42$$

47. When 10 is subtracted from all the observations, the mean is reduced to 60% of its value. If 5 is added to all the observations, then the mean will be

a. 25 b. 30 c. 60 d. 65

Ans. b

$\left(\bar{x}-10\right)=\frac{3}{5}\bar{x}\Rightarrow\bar{x}=25$.

The mean required = 25 + 5 = 30

48. The following table given, the average score of the students is

Marks(x)	**No. of students (f)**
20	**8**
30	**12**
40	**20**
50	**10**
60	**6**
70	**4**

a. 41 b. 42 c. 40 d. 39

Ans.a

49. In the frequency distribution of discrete data given below, the frequency x against value 0 is missing.

Variable *x* :	**0**	**1**	**2**	**3**	**4**	**5**
Frequency *f* :	***x***	**20**	**40**	**40**	**20**	**4**

If the mean is 2.5, then the missing frequency x will be____

a. 0 b. 1 c. 3 d. 4

Ans. d

50. Let G_1, G_2 be the geometric means of two series x_1, x_2, ..., x_n; y_1, y_2, ..., y_n. If G is the geometric mean of $\frac{x_i}{y_i}$, i = 1, 2, ... n, then G is equal to

a. $G_1 - G_2$ b. $\frac{\log G_1}{\log G_2}$ c. $\frac{G_1}{G_2}$ d. $G_1 + G_2$

Ans. c

51. The mean of two samples of sizes 200 and 300 were found to be 25, 10 respectively. Their standard deviations were 3 and 4 respectively. The variance of combined sample of size 500 is

a. 64 b. 65.2 c. 67.2 d. 64.2

Ans. c

52. If the s.d. of n observations x_1, x_2, ..., x_n is 4 and another set of n observations y_1, y_2, ..., y_n is 3 the s.d. of n observations x_1-y_1, x_2-y_2, ..., x_n- y_n is

a. 1 b. $2/\sqrt{3}$ c. 5 d. 7

Ans.d

$$\sigma 1 = 4,\ \sigma_2 = 3,\ \frac{\Sigma x_i^2}{n} - \frac{\Sigma x_i}{n} = 16,\quad \frac{\Sigma y_i^2}{n} - \frac{\Sigma y_i}{n} = 9,\quad (x_1 - y_1)^2 + (x_2 - y_2)^2$$

53. If M_{gx} is the G.M. Nx's and M_{gy} is the G.M. of Ny's then G.M. of 2N values is given by

a. $M_{gx}\ M_{gy}$ b. $\sqrt{M_{gx} M_{gy}}$

c. $M_{gx} + M_{gy}$ d. $M_{gx} - M_{gy}$

Ans.b

$$\sqrt[n]{x_1 x_2 x_3 \ldots\ldots\ldots x_n} = M_{gx},\ \sqrt[n]{y_1 y_2 y_3 \ldots\ldots\ldots y_n} = M_{gy}$$

$$\sqrt[2n]{x_1 x_2 x_3 \ldots\ldots\ldots x_n, y_1 y_2 y_3 \ldots\ldots y_n} = \left(M_{gx} M_{gy}\right)^{1/2} = \sqrt{M_{gx} M_{gy}}$$

54. The mean of five observations is 4 and their variance is 5.2. If three of these observations are 1, 2, and 6. Then the other two are

a. 2 and 9 b. 3 and 8 c. 4 and 7 d. 5 and 6

Ans.c

$$x + y = 11,\ \frac{\Sigma x_i^2}{5} - 16 = 5.2,\ \Sigma x_i^2 = 106,\ x^2 + y^2 = 65,$$

$$x + y = 11, x^2 + y^2 = 65 \Rightarrow xy = 28,\ \therefore x = 7, y = 4$$

55. Mean deviation of numbers 3, 4, 5, 6, 7 is

a. 0 b. 1.2 c. 5 d. 25

Ans. b

56. The mean and S.D. of 1, 2, 3, 4, 5, 6 is

a. 3, 3 b. $\frac{7}{2}, \sqrt{\frac{35}{12}}$ c. $\frac{7}{2}, \sqrt{3}$ d. $\frac{35}{12}$

Ans.b

57. Mean deviation of the series a, a+d, a + 2d, a + 2 nd from its mean is

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

c. $\frac{(2n+1)d}{n(n+1)}$ d. $\frac{n(n+1)d}{2n+1}$

Ans.d

Mean $\bar{x} = a + nd$ $M.D. = \frac{1}{(2n+1)}\left|x_i - \bar{x}\right| = \frac{n(n+1)}{(2n+1)}d$

58. The A.M. of the observations

1.3.5, 3.5.7, 5.7.9, ..., (2n-1)(2n+1)(2n+3) is

a. $2n^3 + 6n^2 + 7n - 2$ b. $n^3 + 8n^2 + 7n - 2$

c. $2n^3 + 5n^2 + 6n - 1$ d. $2n^3 + 8n^2 + 7n - 2$

Ans. d

$$\frac{\Sigma(2n-1)(2n+1)(2n+3)}{n} = \frac{\Sigma(4n^2-1)(2n+3)}{n} = \frac{\Sigma(8n^3+12n^2-2n-3)}{n} = 2n^3+8n^2+7n-2$$

59. The value of the mode given below is

Mark	**F**
0 – 10	**5**
10 – 20	**15**
20 – 30	**20**
30 – 40	**20**
40 – 50	**32**
50 – 60	**14**
60 – 70	**14**

a. 43 b. 42 c. 41 d. 44

Ans. d

Mode = $l + \frac{(f_0 - f_1)}{2f_0 - (f_1 + f_2)} \times C$, $l = 40, f_0 = 32, f_1 = 20, f_2 = 14, c = 10$,

Mode = 44

60. The mean of following frequency table is 50.

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

The missing frequencies are

a. 28, 24 b. 24, 36 c. 36, 28 d. 28, 34

Ans. a

$f_1 + f_2 = 52$, use $\bar{x} = \frac{\Sigma f_i x_i}{N}$, $3f_1 + 7f_2 = 252$, $N = \Sigma f_i$, $f_1 = 28, f_2 = 24$

61. The median wage of the worker in the following table is

Wages/ Week (Rs.)	No. of workers F	c.f
50 - 59	15	15
60 - 69	40	55
70 - 79	50	105
80 - 89	60	165
90 - 99	45	210
100 - 109	40	250
110 - 119	15	265

a. Rs. 80.08 b. Rs 82.08

c. 84.08 d. 81.04

Ans. c

Median $= l + \left(\frac{\frac{N}{2} - m}{f}\right) \times C$, $l = 79.5, N = 265, m = 105, f = 60, c = 10$, Median = 84.08

62. If x_1, x_2, x_3 are three non zero real numbers such that then the G.M. of x_1, x_2, x_3 is

a. x_1 b. x_2 c. x_3 d. $x_1 x_3$

Ans. d

$\left(x_1^2 + x_2^2\right)\left(x_2^2 + x_3^2\right) \le \left(x_1 x_2 + x_2 x_3\right)^2$ on expanding $\left(x_1 x_3 - x_2^2\right)^2 \le 0$, $\Rightarrow x_2^2 = x_1 x_3$

63. The mean square deviation of n observations x_1, x_2, ..., x_n about -2 and 2are 18 and 10 respectively. Then S.D. of the given set is

a. 1 b. 2 c. 3 d. 4

Ans. c

$\frac{1}{n}\Sigma(x_i+2)^2=18$ ——(1), $\frac{1}{n}\Sigma(x_i-2)^2=10$ ———(2)

adding equation 1 & 2, $\frac{1}{2}\Sigma x_i^2=10$, subtracting 2 from 1, $\frac{1}{n}\Sigma x_i=1$,

$\therefore$ S.D. = $\sigma=3$