Undergraduate Examination, 2018
Semester-I (CBCS)
Statistics
Generic Elective Course (GEC-1)
Statistical Methods

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer question No. 1 and any three from the rest.

1. Choose the correct alternative(Answer any **ten**) 10X1=10

i) The Standard Deviation(SD) of first n natural numbers is

(a) $\sqrt{\frac{n^2+1}{12}}$ (b) $\sqrt{\frac{n+1}{12}}$ (c) $\sqrt{\frac{n^2-1}{12}}$ (d) $\sqrt{\frac{2n^2-1}{8}}$

ii) The value of the coefficient of Kurtosis β_2 can be

(a) Less than 3 (b) Greater than 3 (c) Equal to 3 (d) Any of the above

iii) The Mean Deviation (MD) from 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

iv) If the relationship between U and V are given by 2U+V+7=0 and if the arithmetic mean of U is 10 then arithmetic mean of V is

(a) 17 (b) -17 (c) 27 (d) -27

v) If mean =5, Standard Deviation(SD)= 2.6, median=5, Quartile Deviation(QD)=1.5, then the coefficient of QD equals

(a) 35 (b) 39 (c) 30 (d) 32

vi) If two lines of regression are perpendicular, the relation between the two regression coefficients is

(a) $b_{yx}= b_{xy}$ (b) $b_{yx}.b_{xy}= 1$ (c) $b_{yx} \leq b_{xy}$ (d) $b_{yx} = -b_{xy}$

vii) Histogram is useful to determine graphically the value of

(a) Mean (b) Median (c) Mode (d) All of them

P.T.O.

viii) Extreme values has no effect on

(a) Average (b) Median (c) Geometric Mean(GM) (d) Harmonic Mean(HM)

ix) Mean annual salaries paid to 200 employees of the company is Rs. 500. The mean annual salaries paid to male and female employees were Rs. 520 and Rs. 420 respectively. The number of Males and Females employed by the company are

(a) (160,40) (b) (150,50), (c) (140,60) (d) (130,70)

x) If each value of a series is multiplied by 10 the coefficient of variation will be increased by

(a) 5% (b) 10% (c) 15% (d) 0%

xi) There are 25 teachers in a school whose mean age was 30 years. A teacher retired at the age of 60 years and a new teacher was appointed in his place. The mean age of teachers in the school was reduced by one year. The age of the new teacher was

(a) 25 years (b) 30 years (c) 35 years (d) 40 years

xii) Harmonic mean is better than other means if the data are for

(a) Speeds or Rates (b) Heights or Weights (c) Binary values like 0 or 1.
(d) Ratio or Proportions

2. (a) Show that if $S=f_k+(f_k+f_{k-1})+(f_k+f_{k-1}+f_{k-2})+.....+(f_k+f_{k-1}+f_{k-2}+.....+f_2)$ where $f_1,f_2,.....f_k$ are the class frequencies, then Arithmetic Mean(AM) = $x_1+\frac{hS}{N}$ where x_1= midpoint of the first class, h=class interval, N= total frequency. 5

(b) Prove that for a given set of observations the sum of squares of deviations is the minimum, when deviations are taken from the arithmetic mean. 5

3. (a) Prove that the arithmetic mean is greater than or equal to the geometric mean and state the case when the two averages are equal. 4

(b) Show that the Mean Deviation (MD) is minimum when measured about median. 6

4. (a) if $n_1, \sigma_1, \bar{x}_1$ be the number of observations, Standard Deviation(SD) and mean of a set of observations and $n_2, \sigma_2, \bar{x}_2$ be those for a second set of observations, prove that the SD(σ) of combined set of (n_1+n_2) observations is given by

$$(n_1+n_2)\,\sigma^2 = n_1\sigma_1^2 + n_2\sigma_2^2 + n_1d_1^2 + n_2d_2^2$$

where $d=x_1-\bar{m}$, $d=x_2-\bar{m}$, $\bar{m} = (n_1\bar{x}_1+n_2\bar{x}_2)/(n_1+n_2)$ 6

(b) Prove that the Standard Deviation(SD) calculated from two values x_1 and x_2 of a variable x is equal to half their difference i.e. SD= $\frac{1}{2}|x_1-x_2|$ 4

5. (a) if $\bar{X}$ is the mean of X_1, X_2, X_3 and x_1, x_2 and x_3 are the deviations of X_1, X_2, X_3 from $\bar{X}$ respectively, then prove that $x_1^2 + x_2^2 + x_3^2 = X_1^2 + X_2^2 + X_3^2 - 3\bar{X}^2$ 5

(b) For two observations only, prove $\frac{AM}{GM} = \frac{GM}{HM}$ 5

6. (a) i) Define correlation. 2

ii) What is scatter diagram? 2

(b) What is Spearman's rank correlation? Deduce Spearman's rank correlation formula for correlation coefficient. 2+4

7. (a) Explain the method of least squares for fitting a straight line y=mx + c to a given set of n pairs of observations $(x_1, y_1), (x_2, y_2), \ldots\ldots(x_n, y_n)$. 5

(b) Prove that the correlation coefficient does not depend on change of origin and scale of observations. 5