

[This question paper contains 8 printed pages.]

**Your Roll No.....**

**Sr. No. of Question Paper : 1367**

**I**

Unique Paper Code : 2372011101

Name of the Paper : Descriptive Statistics

Name of the Course : **B.Sc. (H) Statistics (NEP-UGCF)**

Semester : I

Duration : 3 Hours

Maximum Marks : 90

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. Question no. **1** is compulsory.
4. Attempt **five** more questions selecting at least **two** from each section.
5. Use of a non-programmable scientific calculator is allowed.

P.T.O.

1. (a) Fill in the blanks :

- (i) The harmonic mean of the two numbers  $x$  and  $y$  is 5. If  $x = 5$  then  $y$  is \_\_\_\_\_ .
- (ii) In case of leptokurtic curve, the relation between  $\mu_4$  and  $\mu_2$  is \_\_\_\_\_ .
- (iii) If the attributes  $A$  and  $B$  are independent, the frequency  $(AB)$  is equal to \_\_\_\_\_ .
- (iv) If the regression coefficients of  $X$  on  $Y$  and  $Y$  on  $X$  are 0.4 and 0.9 respectively, then the correlation coefficient between  $X$  and  $Y$  is \_\_\_\_\_ .
- (v) The mean of 20 observations is 7. If each observation is multiplied by 3 and then 5 is added to it, then the mean of the new data set is \_\_\_\_\_ .
- (vi) Rank correlation coefficient lies between \_\_\_\_\_ .
- (vii) If skewness is negative, the mean is \_\_\_\_\_ mode.

(viii) For a frequency distribution, C.V. = 5 and  $\sigma = 2$ . Mean of the distribution will be \_\_\_\_\_ .

(ix) The signs of coefficient of association Q and coefficient of colligation Y are always \_\_\_\_\_ .

(b) If mean and standard deviation of 8 observations in a sample are 9 and 4 respectively and that of second sample of size 4 are 15 and 3 respectively, find the combined variance of the two samples.

(c) Comment on the nature of association of the following data:

$$(A\beta) = 10, (\alpha B) = 50, (AB) = 20 \text{ and } (\alpha\beta) = 15$$

(d) If  $r(x, y) = 0.8$ ,  $\text{cov}(x, y) = 20$ ,  $v(x) = 16$ , find standard deviation of  $y$ . (1×9,2,2,2)

### Section A

2. (a) Write short note on :

(i) Primary and Secondary data

## (ii) Cumulative frequency curves

- (b) From a sample of  $n$  observations, the arithmetic mean and variance are calculated. It is then found that one of the values  $x_1$  is in error and should be replaced by  $x'_1$ . Show that the adjustment to the variance to correct this error is :

$$\frac{1}{n}(x'_1 - x_1) \left( x'_1 + x_1 - \frac{x'_1 - x_1 + 2T}{n} \right), \text{ where } T \text{ is the}$$

total of the original results. (7,8)

3. (a) Define standard deviation and root mean square deviation. Obtain the relation between them. If the mean and standard deviation of a variable  $x$  are  $m$  and  $\sigma$  respectively, obtain the mean and

standard deviation of the variable  $u = \frac{(ax+b)}{c}$ ,

where  $a$ ,  $b$  and  $c$  are constants.

- (b) What do you mean by skewness and kurtosis of a distribution. Give their different measures. Represent the different types of skewness and kurtosis graphically. (7,8)
4. (a) Define moments. The first three moments of a distribution about the value 2 are 1, 16 and - 40 respectively. Find the mean, variance and third central moment of the distribution. Also, obtain the first three moments about origin.
- (b) Show that if the variable takes the value 0, 1, 2, ....., n with frequencies proportional to the binomial coefficients  ${}^nC_0, {}^nC_1, {}^nC_2, \dots, {}^nC_n$  respectively, then the mean of the distribution is  $(n/2)$  and variance is  $(n/4)$ . (7,8)

### Section B

5. (a) Explain the following (i) Order of a class (ii) Ultimate classes and (iii) Dichotomy. Find the total number of class frequencies of all orders for n attributes.

- (b) If  $\delta = (AB) - (AB)_0$ , then with usual notations, prove that

$$(i) [(A) - (\alpha)][(B) - (\beta)] + 2N\delta = (AB)^2 + (\alpha\beta)^2 - (A\beta)^2 - (\alpha B)^2$$

$$(ii) \delta = \frac{(B)(\beta)}{N} \left\{ \frac{(AB)}{(B)} - \frac{(A\beta)}{(\beta)} \right\} = \frac{(A)(\alpha)}{N} \left\{ \frac{(AB)}{(A)} - \frac{(\alpha B)}{(\alpha)} \right\} \quad (7,8)$$

6. (a) Define principle of least squares. Fit a curve of the form  $y = ae^{bx}$  for a given set of  $n$  points  $\{(x_i, y_i); i = 1, 2, \dots, n\}$ .

- (b) Define Yule's coefficient of association (Q) and coefficient of colligation (Y). In a group of 400 students, the number of married is 160. Out of 120 students who failed, 48 belongs to the married group. Find out whether the attributes of marriage and failure are independent. (7,8)

7. (a) What is Spearman's Rank Correlation Coefficient? What measures are required in case of repeated ranks? The coefficient of rank correlation between marks obtained by 10 students in Mathematics and Statistics was found to be 0.5. It was later

discovered that the difference in ranks in two subjects obtained by one of the students was wrongly taken as 3 instead of 7. Find the revised coefficient of rank correlation.

- (b) If  $X$  and  $Y$  are independent random variables, show that

$$r(X + Y, X - Y) = r^2(X, X + Y) - r^2(Y, X + Y)$$

where  $r(X + Y, X - Y)$  denotes the coefficient of correlation between  $(X + Y)$  and  $(X - Y)$ .

(7,8)

8. (a) If the lines of regression of  $Y$  on  $X$  and  $X$  on  $Y$  are  $a_1X + b_1Y + c_1 = 0$  and  $a_2X + b_2Y + c_2 = 0$  respectively, then prove that  $a_1b_2 \leq a_2b_1$ .

- (b) The following data pertain to the marks in subject A and B in a certain examination :

Mean marks in A = 39.5

Mean marks in B = 47.5

Standard Deviation of marks in A = 10.8

Standard Deviation of marks in B = 16.8

Coefficient of correlation between marks in A and marks in B = 0.42

- (i) Draw the two lines of regression and explain why there are two regression equations.
- (ii) Give the estimate of marks in B for candidates who secured 50 marks in A.

(7,8)