

1557

8

(b) Two random variables have the regression equations $3X + 2Y - 26 = 0$ and $6X + Y - 31 = 0$. Find the mean values and the coefficient of correlation between X and Y. If the variance of $X = 25$, find the standard deviation of Y.

(8,7)

(500)

17

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1557

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Unique Paper Code : 2372011101

Name of the Paper : Descriptive Statistics

Name of the Course : B.Sc. (Hons.) 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** questions from each section.
5. Use of non-programmable calculator is allowed.

P.T.O.

1. (a) Fill in the blanks :

- (i) The system of grades in the military service is an example of a _____ scale.
- (ii) In a frequency polygon, the frequencies of different class intervals are plotted against the _____ of the respective intervals.
- (iii) The relationship between the A.M., G.M., and H.M. is _____.
- (iv) The geometric mean becomes zero when _____.
- (v) The algebraic sum of deviations of a set of n values from their arithmetic mean is _____.
- (vi) The magnitude of the correlation coefficient is invariant under changes of _____ and _____.
- (vii) If both the regression coefficients are negative, the correlation coefficient would be _____.

7. (a) Define the 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) The variables X and Y have variances σ_X^2 and σ_Y^2 respectively and coefficient of correlation 'r' between them. If U and V are defined by: $U = X \cos \alpha + Y \sin \alpha$, $V = Y \cos \alpha - X \sin \alpha$. Then, show that U and V will be uncorrelated if

$$\tan \alpha = \frac{2r\sigma_X\sigma_Y}{\sigma_X^2 - \sigma_Y^2} \quad (8,7)$$

8. (a) Define Spearman's rank correlation coefficient. The coefficient of rank correlation between the 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 correct coefficient of rank correlation.

Section - B

5. (a) Define Yule's coefficient of association (Q) between two attributes A and B. Prove that $-1 \leq Q \leq 1$. When are the limits +1 and -1 attained? Interpret them.
- (b) In a group of 400 students, the number of married is 160. Out of 120 students who failed, 48 belonged to the married group. Is there any association between marriage and Failure? Justify your answer. (8,7)
6. (a) Show that for n attributes $A_1, A_2, A_3, \dots, A_n$,
- $$(A_1 A_2 A_3 \dots A_n) \geq (A_1) + (A_2) + (A_3) + \dots + (A_n) - (n-1)N$$
- where N is the total number of observations.
- (b) Define lines of regression. If θ is the acute angle between the two regression lines with correlation coefficient r, show that

$$\sin\theta \leq 1 - r^2 \quad (7,8)$$

- (viii) When the correlation coefficient $r = \pm 1$, then the two regression lines are _____.
- (ix) In case of n attributes, the total number of ultimate class frequencies is _____ and number of positive class frequencies is _____.
- (b) The mean marks of 60 students in section A is 40 and mean marks of 40 students in section B is 45. Find the combined mean of the 100 students in both sections.
- (c) The coefficient of correlation between two variates X and Y is 0.8 and their covariance is 20. If variance of X series is 16, find the standard deviation of Y series.
- (d) Examine the consistency of the following data :
- $N = 400$, $(A) = 300$, $(B) = 20$ and $(AB) = 70$, the symbols having their usual meaning.
- (9×1,3×2)

Section - A

2. (a) Distinguish between 'discrete' and 'continuous' variables by giving suitable examples.
- (b) Show that the sum of squares of deviations of a set of 'n' values is minimum when taken about the mean.
- (c) 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 incorrect and should be replaced by x'_1 . Show that the adjustment to the variance to correct this error is

$$\frac{1}{n}(x'_1 + x_1) \left(x'_1 + x_1 - \frac{x'_1 - x_1 + 2T}{n} \right)$$

where T is the total of the original results.

(4,4,7)

3. (a) What do you understand by skewness? How is it measured? Distinguish clearly, between positive and negative skewness graphically. Also, show the relative positions of mean, median, and mode in the graphs.

- (b) The mean and standard deviation of a variable X are M and σ respectively. In a discrete series, if deviations are small compared with mean, so that $(x/M)^3$ and higher power of (x/M) are neglected, show that

$$(i) G = M \left(1 - \frac{\sigma^2}{2M^2} \right), \text{ and } (ii) M^2 - G^2 = \sigma^2$$

where G is the geometric mean. (8,7)

4. (a) Define r^{th} moment about origin and r^{th} moment about mean of a frequency distribution. Establish the relationship between moments about mean in terms of moments about origin for first four moments.
- (b) Let X be a variable which takes the values 0, 1, 2, ..., n with frequencies proportional to the binomial coefficients $\binom{n}{0}, \binom{n}{1}, \binom{n}{2}, \dots, \binom{n}{n}$, respectively. Find (i) mean, (ii) second moment about origin, and (iii) variance. (8,7)