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S. No. of Question Paper : 11

Unique Paper Code : 237162

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Name of the Paper : Descriptive Statistics and Probability (STP-101)

Name of the Course : B.Sc. (Mathematical Sciences)

Semester : I

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any six questions.

All questions carry equal marks.

1. (a) Describe how you can represent a frequency distribution graphically using cumulative frequencies. Which measure of central tendency can be obtained from this graph ? Explain it.
- (b) Define the terms :
 - (i) Standard deviation
 - (ii) Root mean square deviation and establish the relationship between the two. (6, 6½)
2. (a) Define skewness. Explain it with the help of graph. Give various measures of skewness and find the limits for Bowley's coefficient of skewness.
- (b) If the letters of the word 'REGULATIONS' be arranged at random, then what is the chance that there will be exactly 4 letters between R and E ? (6, 6½)

P.T.O.

3. (a) A letter is known to have come either from TATANAGAR or from CALCUTTA. On the envelop just two consecutive letters TA are visible. What is the probability that letters came from TATANAGAR ?

- (b) Let A and B be two events such that :

$$P(A) = \frac{3}{4} \text{ and } P(B) = \frac{5}{8}.$$

Show that :

(i) $P(A \cup B) \geq \frac{3}{4}$ and

(ii) $\frac{3}{8} \leq P(A \cap B) \leq \frac{5}{8}.$

(6, 3, 3½)

4. (a) A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers from the purchase department, 2 officers of the sales department and one chartered accountant. Find the probability of forming the committee in the following manner :

- (i) There must be one from each category,
- (ii) It should have at least one from the purchase department,
- (iii) The chartered accountant must be in the committee.

- (b) An urn contains four tickets marked with numbers 112, 121, 211, 222 and one ticket is drawn at random. Let A_i , ($i = 1, 2, 3, \dots$) be the event that i th digit of the number of the ticket drawn is 1. Discuss the independence of the events A_1 , A_2 and A_3 . (6, 6½)

5. (a) Using the Principle of Least Squares fit the curve of the form $y = ae^{bx}$.
(b) In a partially destroyed laboratory record of an analysis of correlations data, the following results only are legible :

Variance of X : 9. Regression equations : $8X - 10Y + 66 = 0$, $40X - 18Y = 214$.

What are :

(i) The mean values X and Y .

(ii) The correlation coefficient between X and Y ? (6, 6½)

6. (a) Prove that correlation coefficient is independent of change of origin and scale.
(b) Can $Y = 5 + 1.4X$ and $X = 3 + 0.5Y$ be the estimated regression equation of Y on X and X on Y respectively ? Explain your answer with suitable arguments. Hence find regression coefficients b_{XY} and b_{YX} . Also compute the correlation coefficients between X and Y . (6, 6½)

7. (a) What is the effect of change of origin and scale on correlation coefficient ? Given $r(X, Y) = 0.2$, find :
(i) $r(2X + 3, -3Y - 3)$ and
(ii) $r(5X, 4Y)$.

- (b) Explain the concepts of multiple and partial correlation coefficients. Explain the following notations :

(i) $R_{1.23}$

(ii) $r_{12.3}$

(iii) r_{12}

Prove that :

$$1 - R_{1.23}^2 = (1 - r_{12}^2)(1 - r_{13.2}^2). \quad (6, 6\frac{1}{2})$$

8. (a) Show that :

(i) Sum of deviations about arithmetic mean is zero.

(ii) Sum of the squares of deviations about arithmetic mean is least.

- (b) State and prove multiplication theorem of probability for two independent events

A and B.

(6, 6½)