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Sr. No. of Question Paper : 281

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Roll No.....

Unique Paper Code : 237162

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

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

Semester : I

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any six questions.
3. All questions carry equal marks.

1. (a) What is an ogive ? Explain graphically how the ogive can be used to find the median and first quartile.

(b) Prove that the mean deviation about the mean \bar{x} of the variable x , the frequency of whose i^{th} size x_i is f_i is given by :

$$\frac{2}{N} \left(\bar{x} \sum_{x_i < \bar{x}} f_i - \sum_{x_i < \bar{x}} f_i x_i \right), \quad N = \sum_i f_i \quad (6, 6\frac{1}{2})$$

2. (a) Define kurtosis. Explain it with the help of figure. Show that for a discrete distribution $\beta_2 > 1$.

(b) A frequency distribution gave the following results :

- (i) C.V = 5, (ii) Karl Pearson's coefficient of Skewness = 0.5 and
(iii) $\sigma = 2$. Find the mean and mode of the distribution, (6, 6½)

P.T.O.

3. (a) Define conditional probability. Show that if A and B are two mutually exclusive events then $P(A|\bar{B}) = P(A)/(1 - P(B))$.

- (b) The sum of two non-negative quantities is equal to $2n$. Find the chance that their product is not less than $\frac{3}{4}$ times their greatest product. (6,6½)

4. (a) State and prove Bayes Theorem.

- (b) An urn contains four tickets marked with numbers 112, 121, 211, 222 and one ticket is drawn at random. Let A_i , ($i = 1, 2, 3$) 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) (i) What are the limits for Spearman's rank correlation coefficient and when are these limits attained?

- (ii) Show that if X' , Y' are the deviations of the random variables X and Y

from their respective means, then
$$r = 1 - \frac{1}{2N} \sum_i \left(\frac{X'_i}{\sigma_X} - \frac{Y'_i}{\sigma_Y} \right)^2$$

- (b) 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) $r(5X, 4Y)$.

(3,3,6½)

6. (a) Using the Principle of Least Squares, fit the curve of the form $y = ae^{bx}$.

- (b) (i) 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 : 1) The mean values X and Y.,

2) The correlation coefficient between X and Y.

(ii) Show that the correlation coefficient is the geometric mean between the regression coefficients. (6,4,2½)

7. (a) Give the concepts of multiple and partial correlation coefficients. Explain the following notations :

(i) $R_{1.23}$

(ii) $r_{12.3}$

(iii) $X_{1.23}$

Write the limits of $R_{1.23}$ and $r_{12.3}$.

(b) Sixty percent of the employees of the XYZ Corporation are college graduates. Of these, ten percent are in sales. Of the employees who did not graduate from college, eighty percent are in sales. What is the probability that :

(i) an employee selected at random is in sales ?

(ii) an employee selected at random is neither in sales nor a college graduate ? (6,6½)

8. (a) From a vessel containing 3 white and 5 black balls, 4 balls are transferred in to an empty vessel. From this vessel a ball is drawn and is found to be white. What is the probability that out of 4 balls transferred 3 are white and 1 is black ?

(b) Prove that two independent variables are uncorrelated. Is the converse true ? Justify. (6,6½)