2025

STATISTICS — MINOR

Paper : MN-2

(Descriptive Statistics - II and Probability - II)

Full Marks : 75

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer ***any five*** questions : 2×5

(a) Define correlation coefficient.

(b) Verify that the following is a valid probability density function (p.d.f) of a continuous random variable X :

$$f_X(x) = 6x^2(1-x^3) \qquad 0 \le x \le 1$$
$$0 \qquad \text{otherwise.}$$

(c) Define a continuous random variable with an example.

(d) In a contingency table, define independence of two attributes.

(e) If two regression lines are $3x + 2y = 5$ and $4x + 9y = 3$, find the correlation coefficient between x and y.

(f) Let X be a random variable with p.d.f.

$$f_X(x) = 3x^2 \qquad 0 < x < 1$$
$$0 \qquad \text{otherwise.}$$

Find the distribution function of X.

(g) If X follows Binomial $(4, P)$ with

$4P[X = 2] = P[X = 3]$

Find $V(X)$.

(h) What do you mean by perfect negative correlation?

2. Answer ***any four*** questions : 5×4

(a) Define correlation ratio in the context of bivariate data. Write the properties of correlation ratio.

(b) Find the angle between the two regression lines.

(c) A box contains 'm' white and 'n' black balls, 'p' balls are drawn at random. Find the expected value of the number of white balls drawn.

(d) A continuous random variable X has a p.d.f.

$$f_X(x) = 6x(1-x) \qquad 0 \le x \le 1$$
$$0 \qquad \text{otherwise.}$$

(i) Check that the above is a p.d.f.

(ii) Compute $P\left(X \le \frac{1}{2} \Big/ \frac{1}{3} \le X \le \frac{2}{3}\right)$.

(e) The probability of a man hitting a target is ¼. How many times must he fire so that the probability of his hitting the target at least once is greater than $\frac{2}{3}$?

(f) Let X be a continuous r.v. with p.d.f $f_X(x)$, where

$$f_X(x) = e^{-x} \qquad x > 0$$
$$0 \qquad \text{otherwise.}$$

Find mean and median of X.

3. Answer ***any three*** questions :

(a) (i) Define c.d.f. Let X be a r.v. with c.d.f $F_X(x)$. Mention the properties of c.d.f.

(ii) If $f(x) = \frac{x}{15}$; x = 1, 2, 3, 4, 5

0 otherwise.

Find $P[X = 1 \text{ or } 2]$ and $P\left[\frac{1}{2} < X < \frac{5}{2} \Big/ X > 1\right]$

(iii) Let X be a continuous r.v. with p.d.f. given by

$$f_X(x) = \begin{cases} Kx & 0 \le x \le 1 \\ K & 1 < x \le 2 \\ -Kx + 3K & 2 < x \le 3 \\ 0 & \text{otherwise.} \end{cases}$$

Find the constant K. Determine the c.d.f $F_X(x)$. 4+4+(2+5)

(b) (i) Find the mean and variance of a Poisson distribution with parameter $\lambda(> 0)$.

(ii) Show that the Poisson distribution can be obtained as a limiting form of a binomial distribution. 10+5

(c) (i) Find the mode of a binomial (n, p) distribution.

(ii) Find the mean deviation about mean of a normal distribution with mean μ and variance σ^2.

(iii) What are Bernoulli trials? Give an example. 7+5+(2+1)

(d) (i) What is rank correlation? State its uses. Derive Spearman's rank correlation coefficient formula when there are no ties.

(ii) What are the regression coefficient in bivariate data? Why do we get two regression equations? When do they coincide? (2+2+5)+(2+2+2)

(e) (i) Prove that the correlation coefficient lies between –1 and +1.

(ii) In the centext of contingency tables, suggest a measure of association between two attributes.

(iii) Describe how you would fit an exponential curve using the method of least squares. 5+5+5
