

June : 2026

STATISTICS

Paper: STS-C-201

**DESCRIPTIVE STATISTICS II AND PROBABILITY
DISTRIBUTIONS**

Time: 2 Hours

Total Mark: 45

(The figures in the right margin indicate full marks of the questions)

1. Select the correct alternative from the following: 1×5=5
- a) If the correlation coefficient, r between two variables is -0.95 , what does this indicate?
- (i) A weak positive linear relationship.
 - (ii) A strong positive linear relationship.
 - (iii) A weak negative linear relationship.
 - (iv) A strong negative linear relationship.
- b) Two random variables X and Y are said to be statistically independent if and only if:
- (i) $f(x, y) = f(x) + f(y)$ (ii) $f(x, y) = f(x) / f(y)$
 - (iii) $f(x, y) = f(x) \cdot f(y)$ (iv) $f(x, y) = f(x) - f(y)$
- c) For a constant c , what is the mgf of the random variable c ?
- (i) 1 (ii) e^c (iii) e^{ct} (iv) 0
- d) If the probability of success $p = 0.2$ and number of trials $n = 10$, what is the mean of binomial distribution?
- (i) 2 (ii) 5 (iii) 8 (iv) 10
- e) For a standard normal probability distribution, the mean (μ) and standard deviation (σ) are:
- (i) $\mu = 0, \sigma = 1$ (ii) $\mu = 16, \sigma = 4$
 - (iii) $\mu = 25, \sigma = 5$ (iv) $\mu = 100, \sigma = 10$

2. Answer the following questions in brief:

2×4=8

- If $b_{yx} > 1$, then show that $b_{xy} < 1$.
- What are the conditions for a function to be a probability density function?
- The range of a random variable X is $\{1, 2, 3, 4, 5, 6\}$ such that

$$P(X = x) = \frac{1}{6}, \text{ find } E(3X).$$

- Explain why the geometric distribution is also called the memoryless or lack of memory distribution?
- What is the rank correlation? Derive the formula for determining rank correlation. When is it used? 2+4+1=7

Or

- Explain the concept of multiple and partial correlation coefficients. Show that in the usual notations the multiple correlation coefficient $R_{1.23}^2$ is given by $R_{1.23}^2 = 1 - \frac{\omega}{\omega_{11}}$ 4+3=7
- Define marginal probability distribution?
Let X and Y be two random variables having the joint probability

$$\text{mass function } p(x, y) = \frac{1}{27}(x + 2y)$$

where x and y can assume only the integer values 0, 1 and 2, find the conditional distribution of Y for $X = x$. 2+5=7

Or

- Let (X, Y) be a two dimensional non-negative continuous random variables having the joint density function

$$f(x, y) = \begin{cases} 4xy e^{-(x^2+y^2)}; & x \geq 0 \text{ and } y \geq 0 \\ 0 & , \text{ otherwise} \end{cases}$$

Prove that the density function of

$$U = \sqrt{x^2 + y^2} \text{ is}$$

$$f(x, y) = \begin{cases} 2u^2 e^{-u^2}; & 0 \leq u \leq \infty \\ 0 & , \text{ otherwise} \end{cases}$$

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- The pdf of a continuous random variable X is

$$f(x) = \begin{cases} 6(x-1)(2-x); & 1 \leq x \leq 2 \\ = 0 & ; \text{ otherwise} \end{cases}$$

Find (i) The distribution function of X

$$(ii) P\left(\frac{5}{4} \leq X \leq \frac{3}{2}\right)$$

4+3=7

Or

- Define moment generating function (*mgf*) of a random variable X . If $M_X(t)$ is the *mgf* of a random variable X about origin,

$$\text{show that the moment, } \mu'_r \text{ is given by } \mu'_r = \left[\frac{d^r M_X(t)}{dt^r} \right]_{t=0}$$

2+5=7

- Derive the Poisson distribution as a limiting form of a binomial distribution? Give some situations in which the Poisson distribution possesses. 4+2=6

Or

- Define the hypergeometric distribution. Derive the recurrence relation for the probabilities of the hypergeometric distribution.

3+3=6

- Mention the chief characteristics of normal distribution and the normal probability curve. 5

Or

- Obtain the *mgf* of exponential distribution and hence find its mean and variance 2+1+2=5
