

R13

Code No: 114DK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, September/October - 2023

PROBABILITY AND STATISTICS

(Civil Engineering)

Time: 3 Hours

Max. Marks: 75

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

- 1.a) A fair coin is tossed until a head or five tails occurs. Find discrete probability distribution [2]
- b) Ten coins are tossed simultaneously. Find the probability that of getting at least eight heads. [3]
- c) Write the formula to find the Rank correlation, coefficient when few ranks are repeated. [2]
- d) The joint probability mass function of (X, Y) is given by $p(x, y) = K(3x + 5y)$, $x = 1, 2, 3, y = 0, 1, 2$. Find the marginal distributions. [3]
- e) Write the properties of Z-distribution. [2]
- f) Construct sampling distribution of means for the population 3, 7, 11, 15 by drawing samples of size two without replacement. Determine mean and standard deviation of the population. [3]
- g) Define the terms busy period and Traffic intensity. [2]
- h) Discuss different states of the queuing system. [3]
- i) Define stationary and non-stationary random processes. [2]
- j) Discuss the classification of random process. [3]

PART - B

(50 Marks)

- 2.a) A manufacturer of pins knows that 2% of his product is defective. If he sells pins in boxes of 100 and guarantees that not more than 4 pins will be defective. What is the probability that a box will fail to meet the guaranteed quality.
- b) Find the probability of getting 1 or 4 or 5 or 6 in throwing a die 5 to 7 times among 9 trials using normal distribution. [5+5]
- OR**
- 3.a) Prove that Poisson distribution is the limiting case of Binomial distribution.
- b) Let $f(x) = 3x^2$, when $0 \leq x \leq 1$ be the probability density function of a continuous random variable X. Determine a such that $P(X \leq a) = P(X > a)$. [5+5]

4. Fit a regression line of Y on X for the following data and hence predict Y if X = 67.5 [10]

X	65	66	67	67	68	69	71	73
Y	67	68	64	68	72	70	69	70

OR

5. The joint probability density function of the continuous random variables X and Y is given by $f(x, y) = \begin{cases} 2xe^{-y}, & 0 < x < 1, y > 0 \\ 0, & \text{elsewhere} \end{cases}$. Find the distribution of X + Y. [10]

- 6.a) The mean of certain normal population is equal to the standard error of the distribution of means of a sample of 64 items. Find the probability that the mean of the sample will be negative.

- b) The mean voltage of a battery is 15 and standard deviation 0.2. Find the probability that four such batteries connected in series will have a combined voltage of 60.8 or more volts. [5+5]

OR

7. The owner of a machine shop must decide which of two snack vending machines to install in his shop. If each is tested 250 times, the first machine fails to work 13 times and the second machine fails to work 7 times. Test at the 0.05 level of significance whether the difference between the corresponding sample proportions is significant. [10]

8. A PC repairman finds that the time spend on jobs has an exponential distribution with mean 30 minutes. If the sets are repaired in the order, in which they come in, and if the arrival of sets is approximately Poisson with an average of 10 per 8 hours day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? [10]

OR

9. In a colour T.V. manufacturing plant, a loading unit takes exactly 10 minutes to load two T.V. sets into a wagon and again comes back to the position to another set of T.V. If the arrival rate is 2 T.V. sets per 20 minutes. Calculate the average time of T.V. sets in a stationary state. [10]

- 10.a) A fair die is tossed repeatedly. If X_n denotes the maximum of the number occurring in the first n tosses, find the transition probability matrix P of the Markov chain $\{X_n\}$. Find also P^2 and $P(X_2 = 6)$.

- b) The transition probability matrix of a Markov chain is given by $\begin{bmatrix} 0.3 & 0.7 & 0 \\ 0.1 & 0.4 & 0.5 \\ 0 & 0.2 & 0.8 \end{bmatrix}$. Is this matrix irreducible? [5+5]

OR

11. A gambler has Rs.2. He bets Rs.1 at a time and wins Rs.1 with probability 1/3. He stops playing if he loses Rs.2 or wins Rs.4.

- a) What is the transition probability matrix of the related Markov chain?
 b) What is the probability that he has lost his money at the end of 5 plays?
 c) What is the probability that the game last more than 7 plays? [10]