Code No: 113AN **R13**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech II Year I Semester Examinations, February - 2024**
**PROBABILITY AND STATISTICS**
**(Common to ME, CSE, IT, MCT, MIE)**

**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) Define a random variable and discuss the various types of random variables with examples in each case. [2]
b) Discuss the area property of normal distribution in detail. [3]
c) Define the joint probability density function. [2]
d) Discuss various types of correlation. [3]
e) Define Type-I error and type-II error. [2]
f) Define the point estimation and interval estimation. [3]
g) Describe the probability distribution of queue length. [2]
h) Explain the basic probabilistic queuing models. [3]
i) What is a transition diagram? [2]
j) Find the unique fixed probability vector of the matrix $A = \begin{bmatrix} 0.3 & 0.7 \\ 0.5 & 0.5 \end{bmatrix}$. [3]

**PART - B**
**(50 Marks)**

2. Let X denotes the minimum of the two numbers that appear when a pair of dice is thrown once. Determine the
(a) Discrete probability distribution
(b) Expectation and
(c) Variance. [4+3+3]

**OR**

3. Define normal distribution and hence find its mean and variance. [10]

4. The probabilities of random variables X and Y are given below. Find (a) the value of K and (b) the joint distribution function and marginal distribution functions and plot these. [10]

| X \ Y | -1 | 0 | 1 |
|---|---|---|---|
| 0 | $\frac{3}{18}$ | $\frac{2}{18}$ | $\frac{3}{18}$ |
| 1 | $\frac{1}{18}$ | $\frac{K}{18}$ | $\frac{1}{18}$ |
| 2 | $\frac{2}{18}$ | $\frac{1}{18}$ | $\frac{2}{18}$ |

**OR**

5. Find the regression lines of y on x and x on y to the following data: [10]

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| x | 65 | 63 | 67 | 64 | 68 | 62 | 70 | 66 | 68 | 67 | 69 | 71 |
| y | 68 | 66 | 68 | 65 | 69 | 66 | 68 | 65 | 71 | 67 | 68 | 70 |

6. Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results. Test whether the two horses have the same running capacity? [10]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Horse A | 28 | 30 | 32 | 33 | 33 | 29 | 34 |
| Horse B | 29 | 30 | 30 | 24 | 27 | 29 | -- |

**OR**

7. Fit a Poisson distribution to the following data and test for goodness of fit at 0.05 level of significance. [10]

| | | | | | |
|---|---|---|---|---|---|
| x: | 0 | 1 | 2 | 3 | 4 |
| f: | 419 | 352 | 154 | 56 | 19 |

8.a) Describe the customer's behavior in a queuing system.
b) Establish the probability distribution formula for pure death process. [5+5]

**OR**

9. The arrival rate of customers at a railway ticket window follows Poisson distribution with a mean of 50 per hour. The service rate of a window clerk also follows Poisson distribution with a mean of 70 per hour. Find
(a) The probability of having zero customers in the system
(b) Average number of waiting customers in the system
(c) Average number of waiting customers in the queue
(d) Average waiting time of customer in the system
(e) Average waiting time of customer in the queue. [10]

10.a) Describe the states of Markov process.
b) Show that the non-zero vector $e = [2, 5, 0, 1]$ is the probability vector. [5+5]

**OR**

11. A student tries to take admission in only three colleges A, B and C. First day he goes to A, second day to B and third day to C. He never goes to some college in two continuous days, but if he goes either B or C, then the next day he is twice as likely to go to college A. Find out how often, in the long run he tries to go to each college? [10]

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