R15

Code No: 123AN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, December – 2024/January -2025
PROBABILITY AND STATISTICS
(Common to ME, CSE, IT, AME, 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) A die is thrown 6 times, if getting an even number is success. Find the probabilities of at least one success? [2]

b) Determine the binomial distribution for which the mean is 4 and variance is 3. [3]

c) Given n =10, $\sigma_x = 5.4, \sigma_y = 6.2$ and the sum of the product of deviation from the mean of X and Y is 66. Find the correlation coefficient. [2]

d) If two regression co-efficient are $b_{yx} = \frac{5}{6}$; $b_{xy} = \frac{9}{20}$. What would be the value of r_{xy}. [3]

e) Write the types of hypotheses. [2]

f) What do you mean by Chi-square test of goodness of fit? [3]

g) Define Queue length and Waiting time. [2]

h) Define transient state, steady state and explosive state. [3]

i) Define Markov chain. [2]

j) Represent the following transition matrix as a digraph

$$\begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{bmatrix}$$ [3]

PART - B

(50 Marks)

2.a) A random variables X has the following probability function.

X = x	0	1	2	3	4	5	6	7
P(X= x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+1$

i) Find the value of k

ii) Mean of X.

b) Suppose there are 2 red, 4 blue and 5 black balls in a bag. Three balls are drawn from this bag randomly. Let X, denote the number of blue balls, out of the three drawn balls. Find variance of X. [5+5]

OR

3.a) For a normal distribution mean $\bar{x} = 50$ and standard deviation $\sigma = 9$, then find $(i) P(x > 60)$ $(ii) P(x < 40)$.

b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with a mean of 1.5, Calculate the proportion of days

(i) On which there is no demand

(ii) On which demand is refused. [5+5]

4. The joint density of two random variables X and Y is

$$f_{XY}(x,y) = \begin{cases} c(2x+y); & 0 \le x \le 1, 0 \le y \le 2 \\ 0; & elsewhere \end{cases}$$

Compute (a) The value of "c". (b) The marginal density functions of X and Y (c) are x and y independent. [3+3+4]

OR

5. Find the Regression line of X on Y given

X	78	77	85	88	87	82	81	77	76	83	97	93
Y	84	82	82	85	89	90	88	92	83	89	98	99

[10]

6. A population consists of 5, 10, 14, 18, 13, 24. Consider all possible samples of size two which can be drawn without replacement from the population. Find (a) mean of the population (b) Standard deviation of population (c) Mean of sampling distribution of means (d) Standard deviation of sampling distribution of means. [2+3+3+2]

OR

7.a) An ambulance service claims that it takes on the average less than 10 mins to reach its destination in emergency calls. A sample of 36 calls has a mean of 11 mins and the variance of 16 mins. Test the claim at 0.05 level of significance.

b) The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is greater than 64 inches? Test at 1% level of significance. [5+5]

8. Arrivals at a telephone both are considered to be Poisson at an average time of 8 min between our arrival and the next. The length of the phone call is distributed exponentially, with a mean of 4 min. Determine

(a) Expected fraction of the day that the phone will be in use.

(b) Expected number of units in the queue Expected waiting time in the queue.

(c) Expected number of units in the system.

(d) Expected waiting time in the system

(e) Expected number of units in queue that from time to time. [10]

OR

9. A tax consulting firm has 3 counters in its offices to receive the people who have problems concerning their income and the sales tax. On an average 48 persons arrive in 8hrs a day. Each tax advisor spends 15 min an on average for a arrival of the arrival time follows a Poisson distribution and the service time follows a E.D.
(a) Find the average number of customer in the system.
(b) Average waiting time of the customer in the system.
(c) Average number of customers waiting the queue for service.
(d) Average waiting time of the customers in the queue.
(e) How many hours each week a tax advisor spends performing his job. [10]

10. The school of international studies for population found out by its survey that the mobility of the population of a state to village town and city is the following percentage.

From / To	Village	Town	City
Village	30%	20%	50%
Town	30%	50%	20%
City	10%	40%	50%

What will the proportion of the population in village, town and city after two years? Present population has proportion of 0.4, 0.3 and 0.3 in village, town, and city respectively. Find the proportions in the long run. [10]

OR

11. A gambler has Rs. 2. He bets Rs.1 at a time and wins Rs.1 with probability ½. He stops playing if he loses Rs.2 or wins Rs. 4.
(a) What is the tpm of 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 lasts more than 7 plays? [4+3+3]

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