RV University

School of Computer Science and Engineering

B.Tech (Hons.) Degree Examination-December 2024

Semester : III

Course Code : CS2801

Course Title : Probability, Statistics and Numerical Methods

Duration : 2 Hours

Max. Marks: 30

Instructions to students:

Part-A (10 Marks): Consists of 2 Questions. Both questions are of 5 marks each. All questions are compulsory.

Part-B (20 Marks): Consists of 2 Questions. Both questions are of 10 marks each. All questions are compulsory.

The question paper includes a table of integral values for a standardized normal distribution and a table of integral values for the Chi-square distribution at the end. Please write your answers in a clean and organized manner. Answers that are not legible will not be graded.

Sl. No.	PART A – Max Marks (10)	Marks	L1-L6	CO
1.	**a.** We roll two two-sided dice, each with faces numbered 3 and 4, simultaneously and independently. We win if both dice show the same number; otherwise, we lose. Let the events be defined as follows: **A: The first die shows a four.** **B: The second die shows a four.** **C : We win.** If both dice are equally biased towards showing a four, determine whether the event of winning is dependent on the other events. **(3 Marks)**	5	L3	CO1
	b. Suppose a six-sided fair die is rolled 5 times. The die has 6 possible outcomes, each with a probability of $\frac{1}{6}$. Compute the probability of getting 1 two times, 2 one time, 3 one time, 4 zero times, five zero times, and six one time? **(2 Marks)**			CO2

2.	**a.** The joint density of X and Y is given by $$f(x,y) = \begin{cases} cxe^{-(x+2y)} & \text{for } x > 0 \text{ and } y > 0, \\ 0 & \text{otherwise.} \end{cases}$$ (i) Calculate the value of c. (**1 Marks**) (ii) Determine the marginal density function of X and Y. (**2 Marks**) **b.** In a random sample of 100 packages shipped by air flight, 13 had some damage. Construct the 95% confidence interval for the true proportion of the damage package. (**2 Marks**)	5	L3	CO2 CO4

Sl. No.	**PART B – Max Marks (20)**	Marks	L1-L6	CO
1.	**a.** Two researchers used different sampling techniques to investigate a group of 300 students and determine how many students fell into various intelligence levels. The results are as follows:			CO4

Researchers	Below Average	Average	Above Average	Genius
X	86	60	44	10
Y	40	33	25	2

	Analyse and compare whether the sampling techniques adopted by the two researchers are significantly different? (Use 5% of Chi-square.) (**4 Marks**) Yes **b.** Compute the real root of $xe^x - 2 = 0$, correct to three places of decimals, using the Newton-Raphson method with an initial guess of $x_0 = 1$. (**3 Marks**) 0.853 **c.** Evaluate $\int_4^5 2\log(x)\,dx$ by using Simpson's $1/3^{rd}$ rule for n = 6. 7.8267 (**3 Marks**)	10	L4	CO5 CO5
2.	**a.** A company claims that its bulbs are superior to those of its main competitor. If a study showed that a sample of 40 of its bulbs has a mean lifetime of 647 hrs of continuous use with a standard deviation of 27 hours. While another sample of 40 bulbs made by its main competitor had a mean life time of 638 hrs of continuous use with a standard deviation of 31 hrs. Test the significance between the difference of two means at 5% level. (**3 Marks**) No			CO4

b. Frequency distribution of two random variables X and Y denoting the average time spent in minutes on "reddit" and "twitter" by 22 young adults.

Calculate the correlation coefficient between time spent on reddit and twitter for the following bivariate frequency distribution:

X→ Y ↓	10-20	20-30	30-40	40-50
10-20	4	1	2	3
20-30	3	2	2	-
30-40	-	2	2	1

0.0826

(4 Marks)

CO3

10   L4

c. The following table shows the data on the number of people (in thousands) who went to watch the movies "Avatar" and "Black Panther: Wakanda Forever" on a given day for Delhi and Chennai. Calculate the Spearman correlation coefficient between the two cities for the "Avatar-Panther" movie enthusiasts.

X	64	75	50	64	80	75	40	55	64
Y	58	68	45	81	60	68	48	50	70

0.5917   **(3 Marks)**

CO3

Course Outcomes

1. Understand and demonstrate the essential concepts of probability theory and the principles of conditional probability.
2. Apply probability distribution functions to solve real world problems.
3. Apply the method of least squares to fit a data set, and interpret the results in the context of the problem at hand.
4. Perform hypothesis testing using methods like critical value, p-value and chi-square tests for goodness of fit and independence of attributes.
5. Implement various numerical methods to solve problems in engineering applications.

Marks Distribution

L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
-	-	10	20	-	-	3	5	7	9	6