



ST. JOSEPH'S UNIVERSITY, BENGALURU -27
M.Sc. (BIG DATA ANALYTICS) – I SEMESTER
SEMESTER EXAMINATION: OCTOBER 2023
(Examination Conducted in November/December 2023)
BDA 1221 – PROBABILITY & STOCHASTIC PROCESSES
(For current batch students only)

Time: 2 Hours

This paper contains TWO printed pages and THREE parts
Part A

Max Marks: 50

Answer All the questions**2 X 5 = 10**

- 1 The probability of passing a test is $\frac{1}{4}$. Suppose 3 students take this test. What is the probability that at least one will pass?
- 2 If X has the Binomial distribution with $n=12$ and $p = 1/12$. What is the expectation and standard deviation of X ?
- 3 A die is rolled thrice. What is the probability that the sum on the three faces is 4
- 4 Write down the expansion of $P(A \cup B \cup C)$
- 5 Sketch a picture to explain the two types of errors in hypothesis testing

PART B**Answer any FIVE questions****5 X 4 = 20**

- 6 If two students in a class share the same birthday, we call it a 'match'. If a class has 20 students, is the probability of a match greater than or less than $\frac{1}{2}$? What will be this probability if the class has 30 students?
- 7 Discuss how the Standard Normal, Chi Square and F tests are related? Which test do we use in ANOVA and why?
- 8 How is the Central Limit Theorem useful in testing of hypotheses?
- 9 Bag 1 contains 4 white and 6 black balls; Bag 2 contains 4 white and 3 black balls. One ball is drawn at random from one of the bags and it is found to be black. Find the probability that it was drawn from Bag 1.
- 10 Distinguish between parametric and non-parametric tests. Which one would you choose, and when?
- 11 What is the 'Markovian property'? How is this property useful in modelling stochastic processes?
- 12 Imagine that every day in Bangalore is either 'sunny', 'cloudy' and 'rainy'. Sketch a Markov chain showing any typical transition between these states.

PART C**Answer Any TWO questions****2 X 10 = 20**

- 13(a) Distinguish between finite, countably infinite and uncountable sets. 6
- (b) Connect this discussion to probability distributions, by comparing the binomial and the normal distributions 4
- 14(a) Explain the idea of a one-step and two-step probability transition matrix. 3

- (b) If $P(1)$ and $P(2)$ are, respectively, the one-step and two-step probability transition matrices of a 3-state Markov chain, then show that $P(1) \cdot P(1) = P(2)$ [4] 4
- (c) Explain the idea of a steady state Markov process 3
- 15(a) Discuss, with illustrations, the rationale of testing a statistical hypothesis. How do we choose the null and alternate hypotheses? Distinguish between one-sided and two-sided tests. 4
- 15(b) How do we compute the testing hypothesis, what is the p-value, and what is its role in accepting or rejecting the hypothesis? 6