LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

U.G. DEGREE EXAMINATION – **ALLIED OPTIONAL**

FOURTH SEMESTER – **APRIL 2024**

UST 4401 – PROBABILTY AND DISTRIBUTIONS

Date: 13-04-2024 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Definitions**	
a)	Probability	
b)	Random Variable	
c)	Geometric distribution	
d)	Probability density function	
e)	Random Process	
2.	**Fill in the blanks**	
a)	If A and B are mutually exclusive events, then P(A∩B)=_____.	
b)	The first raw moment is called _____ of the distribution.	
c)	The Rectangular distribution is also called _____.	
d)	Mean and variance of Poisson distribution are _____.	
e)	A random process is conceptually an extension of a _____.	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Match the following**	
a)	Random experiment	State Space
b)	Continuous random variable	Probability mass function
c)	Discrete random variable	Probability density function
d)	Normal distribution	Tossing a coin
e)	Markov chain	Bell shaped curve
4.	**True or False**	
a)	Probability is the chance of happening of an event.	
b)	A Continuous random variable takes a finite number of possible values.	
c)	The mean of geometric distribution is $\frac{q}{p^2}$.	
d)	Gamma distribution mean and variance are different.	
e)	A discrete parameter Markov process is known as a Markov chain.	
	SECTION B - K3 (CO2)	
	Answer any TWO of the following	**(2 x 10 = 20)**
5.	In a bolt factory machine ABC manufactures respectively, 25%, 30% and 45% of total output. Their output has 5%, 4% and 2% are defective bolts. A bolt is drawn at random and is found to be defective. What is the probability that it was manufacturing by Machine A, B or C?	
6.	Let X be a random variable with following probability distribution X: -3, 6, 9 P(X=x): 1/6, 1/2, 1/3 Find E(X) and $E(3X^2+1)$.	
7.	Derive mean and variance of Gamma distribution	

8.	Explain the different classifications of the processes in stochastic process.
	SECTION C – K4 (CO3)
	Answer any TWO of the following **(2 x 10 = 20)**
9.	A random variable X has the following probability distribution: x: 0, 1, 2, 3, 4, 5, 6, 7, 8 $p(x)$: k, 3k, 5k, 7k, 9k, 11k, 13k, 15k, 17k Determine the value of k. and Find $p(X < 3)$ and $p(0 < X < 5)$
10.	If 3% of electric bulbs manufactured by a company are defective find the probability that in a sample of 100 bulbs, i) exactly 5 bulbs are defective. ii) more than 2 bulbs are defective
11.	Derive the mean and variance of exponential distribution.
12.	Explain Poisson process with an example.
	SECTION D – K5 (CO4)
	Answer any ONE of the following **(1 x 20 = 20)**
13.	a) State and prove Bayes Theorem. b) Let A and B be two independent events with P(A)=0.7, P(B)=0.2. Compute (i) P(A∩B) (ii) P(AUB) and (iii) P($\bar{A}U\bar{B}$).
14.	The joint probability distribution of 2 random variables X and Y is given by P(X=0,Y=1)=$\frac{1}{3}$, P(X=1,Y=-1)=$\frac{1}{3}$, P(X=1,Y=1)=$\frac{1}{3}$ Find i) Marginal distribution of X and Y ii) The conditional probability distribution of X given y=1. iii) E(x) iv) V(x))
	SECTION E – K6 (CO5)
	Answer any ONE of the following **(1 x 20 = 20)**
15.	a) For a binomial distribution with parameters n=5, p=0.3 find the probabilities of getting i) at least 3 success ii) at most 3 success iii) exactly 3 success b) Derive the mean and variance of Geometric distribution.
16.	In a test of 2000 electric bulbs it was found that the life of a particular bulb was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for a) More than 2150 hours b) Less than 1950 hours c) More than 1920 hours but less than 2160 hours. d) Exactly 2000 hours

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