LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

FIRST SEMESTER – **NOVEMBER 2022**

UST 1502 – PROBABILITY AND DISCRETE DISTRIBUTIONS

Date: 03-12-2022 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A			
Define the following.			
1.	**Answer the following definitions**	**(5 x 1 = 5)**	
a)	Axiomatic probability.	K1	CO1
b)	Multiplicative law of probability.	K1	CO1
c)	Joint probability mass function.	K1	CO1
d)	Covariance.	K1	CO1
e)	Binomial random variable.	K1	CO1
2.	**Answer the following MCQ**	**(5 x 1 = 5)**	
a)	If A and B are two events, the probability of occurrence of either A or B is given as ___________. a. P(A)+P(B) b. P(A U B) c. P(A ∩ C) d. P(A)P(B)	K1	CO1
b)	Given that P(A)=1/3, P(B)=3/4 and P(AUB)=11/12, P(B|A) is ___ a. $\frac{1}{6}$ b. $\frac{4}{9}$ c. $\frac{1}{2}$ d. None of the above	K1	CO1
c)	Which is false regarding the distribution function? a. $F(-\infty) = 1$ b. $F(-\infty) = 0$ c. $F(\infty) = 1$ d. $X < Y \Rightarrow F(x) < F(y)$	K1	CO1
d)	If X and Y are two random variables, then $\mathrm{Cov}[(\mathrm{aX} + \mathrm{b}), (\mathrm{cY} + \mathrm{d})]$ is a. $Cov(X,Y)$ b. $abcd\ Cov(X,Y)$ c. $ac\ Cov(X,Y)$ d. $bc\ Cov(X,Y)$	K1	CO1
e)	Name the distribution in which the mean is equal to the variance. a. Binomial b. Bernoulli c. Poisson d. Geometric	K1	CO1

3.	**Fill in the blanks.** **(5 x 1 = 5)**		
a)	An event consisting of only one outcome is________.	K2	CO1
b)	If two events A and B are disjoint, then $P\ (A\ U\ B) =$ _______.	K2	CO1
c)	The conditional probability mass function $P_{XY}(X = x/\ Y = y) =$_________.	K2	CO1
d)	If X and Y are two independent random variables, then $E(XY) =$ ________.	K2	CO1
e)	A discrete variable can take a _________ number of values within its range.	K2	CO1
4.	**Match the following** **(5 x 1 = 5)**		
a)	Mutually independent — $a^2V(X)$	K2	CO1
b)	Priori Probability — Probability mass function	K2	CO1
c)	Discrete Random Variable — Laplace	K2	CO1
d)	V(aX) — Binomial distribution	K2	CO1
e)	'n' trials — P(A∩B∩C)=P(A)P(B)P(C)	K2	CO1

SECTION B

Answer any TWO of the following questions **(2 x 10 = 20)**

5.	A problem in Statistics is given to 3 students X, Y and Z, whose chance of solving it are 1/2, 3/4 and 1/4 respectively. What is the probability that the problem will be solved if all of them try independently.	K3	CO2
6.	Define distribution function. What are the properties of a distribution function?	K3	CO2
7.	Define the expectation of a random variable and discuss its properties.	K3	CO2
8.	If a discrete random variable possesses the following probability distribution	K3	CO2

(X=x)	3	2	1	0	-1	-2	-3
P(X=x)	0.1	0.2	3k	k	2k	0	0.1

i) Calculate the value of k.

ii) Find E(X) and V(X).

SECTION C

Answer any TWO of the following questions. **(2 x 10 = 20)**

9.	(i) State and Prove the multiplication theorem on probability. (ii) If A, B and C are random events and if A, B and C are pairwise independent and A is independent of (BUC), then prove that A, B and C are mutually independent.	K4	CO3
10.	(i) Explain conditional probability.	K4	CO3

	(ii) One shot is fired from each of the 3 guns. G1, G2, G3 denote the event where the target is hit by the guns G1, G2, G3 respectively. If P(G1)=0.5, P(G2)=0.6, P(G3)=0.8. Find the probability that, i) exactly one hit is registered ii) at least two hits are registered.		
11.	Two dice are thrown. Let A be the event that the sum of the points on the faces is odd, and B be the event of at least one being face '1'. Find the probabilities of the events a) $(\bar{A}\, U\bar{B})$ b) $(\overline{A \cap B})$ c) $(\overline{AUB})$ d) $(\bar{A} \cap \bar{B})$	K4	CO3
12.	Derive the mean and variance of Bernoulli distribution.	K4	CO3

SECTION D

Answer any ONE of the following questions. **(1 x 20 = 20)**

13.	In a railway reservation office, 2 clerks are engaged in checking reservation forms. On an average, the first clerk checks 55% of the forms, while the second clerk checks the remaining. The first clerk has an error rate of 0.03 and that of the second clerk is 0.02. A reservation form is selected at random from the total number of forms checked during a day and is discovered to have an error. Find the probability that (i) it was checked by the first clerk (ii) it was checked by the second clerk.	K5	CO4
14.	For the following bivariate probability distribution of X and Y, find (i) $P(X \leq 1, Y = 2)$ (ii) $P(X \leq 1)$ (iii) $P(Y \leq 3)$ (iv) $P(X < 3, Y \leq 4)$.	K5	CO4

X	**Y**					
	1	**2**	**3**	**4**	**5**	**6**
0	0	0	$\frac{1}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{3}{32}$
1	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
2	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{64}$	0	$\frac{2}{64}$

SECTION E

Answer any ONE of the following questions. **(1 x 20 = 20)**

15.	Derive the Moment Generating Function of binomial distribution.	K6	CO5
16.	Define a Poisson random variable. Also, derive the mean and variance of the Poisson distribution.	K6	CO5

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