LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SECOND SEMESTER – **APRIL 2024**

UST 2302 – MATHEMATICAL STATISTICS

Date: 06-04-2024 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

	SECTION A - K1 (CO1)
	Answer ALL the Questions - **(10 x 1 = 10)**
1.	**MCQ**
a)	If random variables X and Y are independent then E(XY) is a) E(X)+E(Y) b) E(X)-E(Y) c) E(X)E(Y) d) E(X)E(Y)+σ_{XY}
b)	A family of parametric distributions in which mean is always greater than its variance is: a) gamma distribution b) binomial distribution c) geometric distribution d) hyper geometric distribution.
c)	The range of t test statistic lies between a) -1 to 1 b) -∞ to ∞ c) 0 to ∞ d) 0 to 1
d)	Equality of several normal population means can be tested by: a) F - test b) Bartlett's test c) χ^2 - distribution d) t - test
e)	In a standard normal probability distribution, the area to the left portion of the mean is equal to a) -0.5 b) 0.5 c) any value between 0 and 1 d) 1
2.	**Fill in the blanks**
a)	The mean and variance of Poisson distribution is _____
b)	The standard deviation of sampling distribution is _____
c)	The geometric distribution otherwise said to be _____
d)	Central limit theorem is also known as _____
e)	The difference between a statistic and the parameter is called _____
	SECTION A - K2 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
3.	**True or False**
a)	The variable of t-distribution ranges from -∞ to + ∞
b)	The mean of the sampling distribution is called the standard error.
c)	Mean of the binomial distribution is npq.
d)	F-test is used to test for equality of variances from two normal populations.
e)	Correlation coefficient lies between 0 and 1
4.	**Definitions**
a)	Define F distribution
b)	Define Exponential distribution
c)	Define Uniform distribution
d)	State any two properties of mathematical expectation.

e)	Define the distribution function of a continuous random variable.

SECTION B - K3 (CO2)

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

5.	A continuous random variable X has a p.d.f $f(x) = 3x^2$, $0 \leq x \leq 1$. Find a and b such that (i) $P(X \leq a) = P(X > a)$ and (ii) P(X>b) = 0.05
6.	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 mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) the proportion of days on which some demand is refused.
7.	State and prove student's t distribution.
8.	Calculate coefficient of correlation for the following data.

X:	10	12	13	16	17	20	25
Y:	19	22	26	27	29	33	37

SECTION C – K4 (CO3)

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

9.	A project yields an average cash-flow of Rs. 500 lakhs with a standard deviation of Rs. 60 lakhs. Calculate the following probabilities: (i) cash flow will be more than Rs. 560 lakhs (ii) cash flow will be less than Rs. 420 lakhs (iii) cash flow will be between Rs. 460 and Rs. 540 lakhs.
10.	State and prove the mean and variance of Gamma distribution.
11.	A random variable X has the following probability function:

Values of X, x:	0	1	2	3	4	5	6	7
'p(x):	0	K	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

(i) Find k, (ii) Evaluate P(X<6), $P(X \geq 6)$, $and\ P(0 < X < 5)$

12.	State and prove Chebychev's inequality.

SECTION D – K5 (CO4)

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

13.	(a) A random variable X is distributed at random between the values 0 and 1 so that its probability density function is : $f(x) = kx^2(1 - x^3)$, where k is a constant. Find the value of k. Using this value of k, find its mean and variance. (b) A variable X is distributed at random between the values 0 and 4 and its probability density function is given by: $f(x) = kx^3(4 - x)^2$. Find the value of k, the mean and standard deviation of the distribution.
14.	Derive the pdf of χ^2 distribution.

SECTION E – K6 (CO5)

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

15.	Derive mean and variance of Binomial Distribution.
16.	State and prove central limit theorem.

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