Reg. No.												

Question Paper Code	12305

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

First Semester

M.E. - Computer Science Engineering

(Common to Computer Science and Engineering (Specialization in Networking)

20PCSMA104 - APPLIED PROBABILITY AND STATISTICS

(Use of Statistical Table is Permitted)

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

Marks, K-Level, CO

1. A discrete R.V X has moment generating function $M_X(t) = \left(\frac{1}{4} + \frac{3}{4}e^t\right)^5$. Find $E(X)$. *2,K2,CO1*
2. State memory less property for exponential distribution. *2,K1,CO1*
3. The joint pdf of the random variable (X, Y) is $f(x, y) = \begin{cases} c\,x\,y & , 0 < x < 2 ; 0 < y < 2 \\ 0 & , otherwise \end{cases}$. Find the value of *c*. *2,K2,CO2*
4. The coefficient of correlation between two variables *X* and *Y* is 0.48. The covariance is 36. The variance of *X* is 16. Find the standard deviation of *Y*. *2,K2,CO2*
5. State any two properties of Regression coefficient. *2,K1,CO3*
6. What is meant by maximum likelihood estimator? *2,K1,CO3*
7. State the difference between parameter and statistic. *2,K1,CO4*
8. Define level of significance. *2,K1,CO4*
9. Define multivariate analysis. *2,K1,CO5*
10. Define covariance matrix. *2,K1,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) A discrete random variable *X* has the probability function, *8,K3,CO1*

x	1	2	3	4	5	6	7	8
p(x)	*2a*	*4a*	*6a*	*8a*	*10a*	*12a*	*14a*	*4a*

a) Find the value of *a*.
b) Find$P(X \geq 3), P(X < 3)$.
c) Find the distribution function.

(ii) Find Moment Generating function of Binomial distribution. Hence find mean and variance. *8,K2,CO1*

OR

b) (i) The mileage which car owners get with certain kind of radial tyre is a random variable having an exponential distribution with mean 4000 km. Find the probabilities that one of these tyres will last (1) at least 2000 km (2) at most 3000km. *8,K3,CO1*

(ii) A certain type of storage battery lasts on the average 3.0 years with standard deviation of 0.5 year. Assuming that the battery lives are normally distributed, find the probability that a given battery will last less than 2.3 years. *8,K3,CO1*

12. a) (i) The joint probability mass function of (X , Y) is given by $P(x, y) = k(2x + 3y)$, $x = 0, 1, 2, y = 1, 2, 3$. Find the marginal probability distributions and $P(X/Y = 1)$ *8,K3,CO2*

(ii) Find the correlation co-efficient for the following data *8,K3,CO2*

X	10	14	18	22	26	30
Y	18	12	24	6	30	36

OR

b) If $f(x, y) = \begin{cases} 2 - x - y , & 0 \le x \le 1, \ 0 \le y \le 1 \\ 0 & ; elsewhere \end{cases}$ is the joint pdf of the random variables X and Y, find the correlation co-efficient of X and Y. *16,K3,CO2*

13. a) (i) The lines of regression of a bivariate population are: *8,K3,CO3*

(a) $8x - 10y + 66 = 0$ and $40x - 18y = 214$ and Variance of $X = 9$.Find i) the mean values of X and Y.

(b) the correlation coefficient between X and Y.0

(c) the standard deviation of Y.

(ii) Fit a straight line $y = a + bx$ to the following data by the principle of least squares. *8,K3,CO3*

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

Also find the value of y when$X = 1.5$.

OR

b) A random sample $(X_1, X_2, X_3, X_4, X_5)$of size 5 is drawn from a normal population with unknown mean μ. Consider the following estimators to estimate μ *16,K3,CO3*

(i) $t_1 = \frac{X_1+X_2+X_3+X_4+X_5}{5}$ (ii) $t_2 = \frac{X_1+X_2}{2} + X_3$ (iii) $t_1 = \frac{2X_1+X_2+\lambda X_3}{3}$

Where λ is such that t_3 is an unbiased estimator of μ. Find λ. Are t_1 and $t_2$unbiased? State giving reasons, the estimator which the best among t_1, t_2 *and* t_3.

14. a) (i) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same at 5% level. *8,K3,CO4*

(ii) Two independent samples of eight and seven items respectively had the following values of the variable. 8,K3,CO4

Sample I	9	11	13	11	15	9	12	14
Sample II	10	12	10	14	9	8	10	

Do the two estimates of population variance differ significantly?

OR

b) (i) Before an increase in excise duty on tea, 800 people out of a sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after the increase in duty. 8,K3,CO4

(ii) 1000 students at college level were graded according to their I.Q and their economic conditions. What conclusion can you draw from the following data: 8,K3,CO4

Economic Conditions	I.Q Level	
	High	Low
Rich	460	140
Poor	240	160

15. a) The covariance matrix of a 3-dimensional vector $X = (X_1, X_2, X_3)$ is given by $\Sigma = \begin{pmatrix} 25 & -2 & 4 \\ -2 & 4 & 1 \\ 4 & 1 & 9 \end{pmatrix}$. Determine the correlation matrix and correlation between X_1 and $\frac{X_2}{2} + \frac{X_3}{2}$. 16,K3,CO5

OR

b) Find the mean matrix, covariance matrix, standard deviation matrix and correlation coefficient matrix for two random variables $X_1$and X_2 whose joint mass function is given by 16,K3,CO5

$x_1 \backslash x_2$	0	1
-1	0.24	0.06
0	0.16	0.14
1	0.4	0.0