Reg. No.												

Question Paper Code	12371

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

First Semester

M.E - Big Data Analytics

20PBDMA101 - APPLIED PROBABILITY AND STATISTICS

(Regulation 2020)

Duration: 3 Hours | Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

Marks, K-Level, CO

1. A random variable X has the density function, $f(x) = kx$, for $2 \le x \le 5$, Find the distribution F(x) and the $P(1 < x < 4)$. *2,K2,CO1*
2. The mean and S.D of a binomial distribution are 5 and 2. Determine the distribution. *2,K2,CO1*
3. If X and Y are independent random variables with variance 2 and 3, then find the variance of 3X+4Y. *2,K2,CO2*
4. The lines of regression in a bivariate distribution are $X + 9Y = 7$ and $Y + 4X = \frac{49}{3}$. Find the coefficient of correlation. *2,K2,CO2*
5. Define the unbiasedness of an estimator. *2,K2,CO3*
6. Write the normal equations for fitting a straight line by the method of least squares. *2,K1,CO3*
7. Explain Null hypothesis and alternative hypothesis. *2,K2,CO4*
8. State any two applications of chi square distribution. *2,K2,CO4*
9. Suppose $\Sigma = \begin{bmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{bmatrix}$. Obtain $V^{\frac{1}{2}}$ and ρ. *2,K2,CO5*
10. State any two properties of multivariate normal distribution. *2,K2, CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) The members of a consulting firm rent cars from rental agencies. A, B and C as 60%, 30% and 10% respectively. If 9%, 20% and 6% of cars from A, B and C agencies need tune up. (a) If a rental car delivered to the firm does not need tune up, what is the probability that it came from B agency? (b) If a rental car delivered to the firm need tune up what is the probability that came from B agency? *8,K3,CO1*

(ii) State and Prove memory less property of Exponential distribution. 8,K3,CO1

OR

b) (i) Suppose that we are investigating the safety of a dangerous intersection. Past police records indicate a mean of five accidents per month at this intersection. The number of accidents is distributed according to Poisson distribution, (i) what is the probability that more than 3 accidents per month, (ii) what is the probability that no accidents per month. 8,K3,CO1

(ii) Find the MGF, mean, variance of Geometric distribution. 8,K3,CO1

12. a) 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 all the marginal and conditional probability distributions. Also find the probability distribution of $(X+Y)$ and $P[X+Y>3]$. 16 K3,CO2

OR

b) If the joint probability density function of a two dimensional random variable (X,Y) is given by $f(x, y) = \begin{cases} x^2 + \frac{xy}{3}, 0 \le x \le 1, 0 \le y \le 2 \\ 0 \quad , \textit{otherwise} \end{cases}$, find (i) P(X > 1/2) (ii) P(Y < 1/2 / X< 1/2). 16,K3,CO2

13. a) Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample of size n. Also find its variance. Show that the sample mean $\bar{x}$ is sufficient for estimating the parameter λ of the Poisson distribution. 16,K3,CO3

OR

b) Fit a straight line $y = a + bx$ for the following data by the principle of least squares 16,K4,CO3

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

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

14. a) (i) In a sample of 1000 people Karnataka 540 are rice eaters and the rest are wheat eaters. Can we assume that both rice and wheat are equally popular in this state at 5% level of significance? 8,K3,CO4

(ii) The following table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly over a week. 8,K3,CO4

Days:	Mon	Tue	Wed	Thu	Fri	Sat
No.of accidents:	14	18	12	11	15	14

OR

b) (i) The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the sample population of S,D. 2.5 inches? *8,K3,CO4*

(ii) In an experiment on immunization of cattle from tuberculosis the following results were obtained. *8,K3,CO4*

	Affected	Not affected
Inoculated	12	26
Not Inoculated	16	6

Calculate the chi square and discuss the effect of vaccine in controlling susceptibility to tuberculosis.

15. a) (i) Let $X_{a\,x1}$ be $N_3(\mu, \Sigma)$ with $\Sigma = \begin{bmatrix} 4 & 1 & 0 \\ 1 & 3 & 0 \\ 0 & 0 & 2 \end{bmatrix}$. Are X_1 and X_2 independent? What about (X_1, X_2) and X_3? *8,K3,CO5*

(ii) Consider the random vector $X' = \{X_1, X_2\}$. The discrete random variable X_1 have the following probability function: *8,K3,CO5*

X_1	-1	0	1
$P_1(X_1)$	0.3	0.3	0.4

and X_2 have the following probability function:

X_2	0	1
$P_2(X_2)$	0.8	0.2

OR

b) (i) Let the variables X_1, X_2 and X_3 have the covariance matrix $\Sigma = \begin{bmatrix} 1 & -1 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$. Determine the principle components Y_1, Y_2 and Y_3. *10,K3,CO5*

(ii) Explain principal component population. *6,K3,CO5*