A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code:R1M03

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

First Semester

Computer Science and Business System

R21UMA103- PROBABILITY AND INFERENTIAL STATISTICAL TECHNIQUES

(Regulations R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Probability of an impossible event is _____. CO6 - U

   (a) 1 (b) 2 (c) 0 (d) 10

2. The probability of getting a head, when an unbiased coin is tossed: CO1 - App

   (a) 0 (b) ½ (c) 1 (d) 2

3. The probability of binomial variate is B (5, ½). Then Mean is CO2-App

   (a) 11/2 (b) 9/2 (c) 5/2 (d) None of the above

4. Which of the following discrete distribution has equal mean and variance? CO6 - U

   (a) Binomial (b)Geometric (c) Poisson (d) Uniform

5. If X and Y are independent RVs with variances 8 and 5. Calculate the variance of 3X + 4Y CO3 - App

   (a) 145 (b) 152 (c) 162 (d) 170

6. If X and Y are independent, then Cov (X, Y) = CO6 - U

   (a) 1 (b) 0 (c) 2 (d) 3

7. If the arithmetic mean of x, x + 3, x + 6, x + 9 and x + 12 is 10, then x = ? CO4 - App

   (a) 1 (b) 2 (c) 6 (d) 4

8. Probability sampling and random sampling are CO6 - U

   (a) Anonymous (a) Different terms (c) Synonymous (d) None of these

9. The degrees of freedom for chi square tests to fitting a binomial distribution — CO6 - U

(a) n – 1 (b) n – 2 (c) n – 3 (d) n – 4

10. Small sample size is _____ — CO6 - U

(a) 30 (b)> 30 (c)< 30 (d) None of these

PART – B (5 x 2= 10Marks)

11. In the probability density function $f(x) = kx^4 e^{-x}, x > 0$, Find K — CO1 - App

12. If X is uniformly distributed over the interval [0, 8]. Compute P (2 < X < 5). — CO2- App

13. If X and Y are independent random variables with variance 2 and 3, find the variance — CO3 -App

of 3X + 4Y

14. The median and mode of a distribution are 21.2 and 21.4 respectively, find its mean. — CO4 - App

15. What are null and alternative hypothesis? — CO5 -App

PART – C (5 x 16= 80Marks)

16. (a) (i) A R.V. X has the following distribution — CO1 - App (8)

x	0	1	2	3	4	5	6
P(X)	a	2a	2a	3a	3a	6a	8a

i) Find $P(X \geq 2)$ and $E(X)$, (ii) Find $Var(X)$

(ii) Three persons A, B and C have applied for a job in a private company. The chance of their selections is in the ratio 1 : 2 : 4. The probabilities that A, B and C can introduce changes to improve the profits of the company are 0.8, 0.5 and 0.3, respectively. If the change does not take place, find the probability that it is due to the appointment of C. — CO1 - App (8)

Or

(b) (i) If the density function of a continuous r.v X is given by — CO1 - App (8)

$$f(x) = \begin{cases} ax & 0 \leq x \leq 1 \\ a & 1 \leq x \leq 2 \\ 3a - ax & 2 \leq x \leq 3 \\ 0 & otherwise \end{cases}$$

(i) find the value of "a" (ii) Find the c.d.f of X

(ii) If p(x)= $\begin{cases} Kx, & x = 1,2,3,4,5 \\ 0 & otherwise \end{cases}$ represents p.m.f CO1 - App (8)

i) Find the value of 'K'

ii) Find $P\left(\frac{1}{2} < x < \frac{5}{2} \;/\; x > 1\right)$

iii) Find the distribution function.

17. (a) (i) Explain Moment generating function, Mean and Variance of Poisson distribution. CO2 -App (8)

(ii) The number of typing mistakes that a typist makes on a given page has a Poisson distribution with a mean of 3 mistakes. What is the probability that she makes (i) Exactly 7 mistakes (ii) fewer than 4 mistakes and (iii) no mistakes on a given page? CO2 - App (8)

Or

(b) (i) A random variable X has a uniform distribution over (-3, 3) compute CO2 -App (8)

(i) P(X < 2) (ii) P(|X| < 1) and (iii) P(X > - 1)

(ii) Explain M.G.F of Binomial distribution and hence find mean and variance. CO2 - App (8)

18. (a) (i) The two dimensional RV (X,Y) has the density function CO3 -App (8)

$$f(x, y) = \frac{x + 2y}{27} \quad x = 0, 1, 2;\ y = 0, 1, 2.$$

Find i) The marginal distribution function of X and Y

ii) Find the conditional distribution of Y for X = 1.

(ii) Obtain the Correlation coefficient for the following data CO3 -App (8)

X	12	15	17	18	23	16	25	27
Y	110	120	124	130	136	122	140	143

Or

(b) (i) Joint pdf of x and y is CO3 -App (8)

$f(x, y) = \begin{cases} 2 - x - y, & 0 \le x, y \le 1 \\ 0 & elsewhere \end{cases}$. find γ_{xy}

(ii) If X and Y are two random variables with joint pdf CO3 -App (8)

$f(x, y) = K(6 - x - y),\ 0 < x < 2,\ 2 < y < 4$

Find (i) K (ii) Marginal density function of x and y.

19. (a) (i) Calculate the arithmetic mean of the following table: CO4 -App (8)

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of students	12	18	27	20	17	6

(ii) Calculate the Variance of the following data: CO4 -App (8)

Marks	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	5	20	14	10	8	5

Or

(b) (i) Compute the Median of the following table: CO4 -App (8)

Marks	0 – 8	8 – 16	16 – 24	24 – 32	32 – 40	40 – 48
No. of students	10	15	17	22	17	9

(ii) Derive the Mode of the following table: CO4 -App (8)

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of students	20	25	27	13	17	10

20. (a) (i)Two random samples gave the following results: CO5 -App (8)

Samples	Size	Sample Mean	Sum of the squares of deviation from the mean
1	10	15	90
2	12	14	108

Examine whether the samples come from the same normal population

(ii) Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results. CO5 -App (8)

Horse A	28	30	32	33	33	29	36
Horse B	30	31	27	29	32	34	

Test whether horse A is running faster than B at 5% level.

Or

(b) (i) The following data are collected on two characters. CO5 -App (8)

	Smokers	Non Smokers
Literates	83	57
Illiterates	45	68

Using chi-square test to find is there any relation between smoking and literacy.

(ii) 4 coins were tossed 160 times and the following results were obtained: CO5 -App (8)

No. of heads:	0	1	2	3	4
Observed frequencies:	17	52	54	31	6

Under the assumption that the coins are unbiased, find the expected frequencies of getting 0, 1, 2, 3, 4 heads and test the goodness of fi