A   **Reg. No. :** ☐☐☐☐☐☐☐☐☐☐☐☐

<div style="border:1px solid">**Question Paper Code: R1M03**</div>

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

First Semester

Computer Science and Business Systems

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. The range of probability of an event is   CO6 – U

    (a) $0 \le P(E) \le 1$ (b) $0 \le P(E) \le 2$ (c) $1 \le P(E) \le 2$ (d) None of these

2. What is the probability of getting a sum 9 from two throws of a dice?   CO1 – App

    (a) 1/6   (b) 1/8   (c) 1/9   (d) 1/12

3. Which of the following discrete distribution has equal mean and variance?   CO6–U

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

4. 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

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

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

6. The joint probability density function is $f(x, y) = k$, $0 < x < 2$, $0 < y < 1$.   CO3 – App
    Estimate K =

    (a) 4   (b) 1   (c) ½   (d) 2

7. Find the median for the following data 4, 6, 5, 9, 12, 3, 1, 10, 13.   CO4 – App

    (a) 12   (b) 8   (c) 6   (d)10

8. The range of 16, 18, 18, 16, 18, 20, 17, 19, 16, 24. CO4 – App

   (a) 12   (b) 8   (c) 9   (d) 10

9. The degrees of freedom in t-tests is CO6 – U

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

10. Large sample size is. CO6–U

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

PART – B (5 x 2= 10 Marks)

11. Find the mean for the discrete RV X with probability distribution   CO1– App

X	-2	-1	0	1
P(X)	0.2	2k	3k	0.3

12. If Moment generating function $M_x(t) = \dfrac{2}{2 - t}$, find the mean value   CO2– App

13. Let X and Y have Joint PDF $f(x, y) = 2$, $0 < x < y < 1$. Find the Marginal PDF.   CO3– App

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 alternate hypothesis?.   CO6 – U

PART – C (5 x 16= 80 Marks)

16. (a)   (i) There are three urns containing white and black balls. The first urn has 2 white and 3 black balls, the second urn has 4 white and 3 black balls, and the third urn has 3 white and 5 black ball. One urn is chosen at random, and a ball is selected from it, which turns out to be white. What is the probability that it came from the third urn?   CO1 - App   (8)

       (ii) 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 'a' ii) Find $P(X \geq 2), P(2 \leq X \leq 5)$ and iii) Find $E(X)$.

Or

   (b)   (i) The density function of a R.V's X is given by f(x) = Kx(2 − x), $0 \leq x \leq 2$. Find the mean and variance.   CO1 - App   (8)

       (ii) If the MGF of a continuous R.V X is given by $M_x(t) = \dfrac{3}{3 - t}$. Find the mean and variance of X.   CO1- App   (8)

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

(ii) Four coins are tossed simultaneously. What is the probability of   CO2- App   (8)
getting (a) 2 heads (b) atleast 2 heads (c) atmost 2 heads.

Or

(b) (i) Establish the memoryless property of Exponential distribution.   CO2- App   (8)

(ii) The lifetime of a light bulb is X hours, where X can be modeled   CO2 -App   (8)
by an exponential distribution with parameter $\lambda = 0.0125$. a) Find
the mean and variance of the lifetime of a light bulb. b) Find the
probability that the lifetime of a bulb is: (i) less than 100 hours; (ii)
between 50 hours and 150 hours.

18. (a) (i) The joint probability mass function of (X,Y) is given by   CO3 -App   (8)
$P(x, y) = k(2x + 3y)$, $x = 0, 1, 2$; $y = 1, 2, 3$. Find all marginal
distribution function and conditional distribution.

(ii) Joint pdf of x and y is $f(x,y) = \begin{cases} 2 - x - y &, 0 \leq x, y \leq 1 \\ 0 & elsewhere \end{cases}$. Find   CO3 -App   (8)

marginal density function of x and y, mean of x, mean of y.

Or

(b) Calculate the correlation coefficient of the following   CO3 -App   (16)

Height (cm) : X	158	160	163	166	168	171	174	176
Weight (kg) : Y	60	62	64	65	67	69	71	72

And also find Regression Equations x on y & y on x.

19. (a) (i) Compute the Variance of the following data: CO4 -App   (8)

Marks	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
No. of students	20	25	27	13	17	10

(ii) 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	23	25	22	20	33	25

Or

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

Marks	0 – 6	6-12	12-18	18-24	24-30	30-36
No. of students	12	17	20	25	14	6

(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	22	25	18	15	10

20. (a) (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 fit.

Or

(b) (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