Reg. No: | | | | | | | | | | | | |

Question Paper Code :R3M29

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

Third Semester

Artificial Intelligence and Machine Learning

R21UMA329-COMPUTATIONAL STATISTICS AND NUMERICAL METHODS

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. The correlation coefficient between two variables x and y is ---------- of the regression coefficients. CO6-U

   (a) the arithmetic mean (b) the geometric mean

   (c) the harmonic mean (d) the root mean square

2. If $r = 0.8$, $b_{xy} = 0.32$ then what will be the value of b_{yx} CO1-App

   (a) 0.48 (b) 0.52 (c) 2 (d) 1

3. In Chi-square the sample observations should be CO6-U

   (a) dependent (b) independent (c) equal (d) none of these

4. Student's t-statistic is applicable in case of: CO6-U

   (a) Equal number of samples (b) Un equal number of samples

   (c) Small samples (d) All the above

5. Fit a straight line for the given pairs of (x,y) which are (0,3), (1,6), (2,8), (3,11), (4,13), (5,14) CO3-App

   (a) $y = 2.02\,x$ (b) $y = 2..26\,x + 3.52$ (c) $y = 3.52\,x$ (d) $y = 4 + 3.x$

6. _____ number of observed equations are required to fit a straight line in method of moments. CO6-U

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

7. _____ prior values are required to predict the next value in Adam's method. CO6-U

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

8. Predictor-Corrector methods are _____ starting methods CO6-U
(a) self (b) not self (c) identity (d) None of these

9. PDE of second order, if $B^2-4AC> 0$ then CO6-U
(a) parabolic (b) elliptic (c) hyperbolic (d) None of these

10. $u_{xx}+u_{yy}=f(x,y)$ is a _____ equation CO6-U
(a) Laplace (b) Poisson (c) heat (d) wave

PART – B (5 x 2= 10Marks)

11. The two variable x and y have the Regression lines $4x-5y+33=0$ & $20x=9y-107=0$ if the variance of y is 16 Find the standard deviation of x. CO1-App

12. What are Type I and Type II error? CO6-U

13. Transform the curve $y=ae^{bx}$ into the straight line equation form . CO3-App

14. Using Taylor's series method find $y(0.1)$ given $y'=1+y$ with $y(0)=1$. CO4-App

15. Classify $u_{xx}-2u_{xy}+u_{yy}=0$. CO6-U

PART – C (5 x 16= 80Marks)

16. (a) (i) Calculate the coefficient of correlation of the following data CO1-App (8)

X	51	63	63	49	50	60	65	63	46	50
Y	49	72	75	50	48	60	70	48	60	56

(ii) Calculate the Correlation coefficient between X and Y from following table CO1-App (8)

X / Y	18	19	20	21
200-250	4	4	2	1
250-300	3	5	4	2
300-350	2	6	8	5
350-400	1	4	6	10

Or

(b) (i) Calculate the rank correlation coefficient between marks in Physics and Chemistry CO1-App (8)

Marks in Physics	35	56	50	65	44	38	44	50	15	20
Marks in Chemistry	50	35	70	25	35	58	75	60	55	35

(ii) Calculate the Regression equation between the marks in X and Y CO1-App (8)

X	62	64	65	69	70	71	72	74
Y	126	125	139	145	165	152	186	208

17. (a) (i) The following data are collected on two characters. CO2-Ana (8)

	Smokers	Non Smokers
Literates	460	140
Illiterates	240	160

Using chi-square test to find is there any relation between smoking and Non Smokers

(ii)The theory predicts the population of beans in the four groups A, B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? CO2-Ana (8)

Or

(b) (i) In one sample of 10 observations, the sum of the squares of the deviations of the sample values from the sample mean was 120 and in another sample of 12 observations it was 314. Test whether this difference is significant at 5% level of significance CO2-Ana (8)

(ii) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, CO2-Ana (8)

Diet A	5	6	8	1	12	4	3	9	6	10
Diet B	2	3	6	8	10	1	2	8		

recorded the following increase in weight. Find the variances are significantly different.

18. (a) (i) Fit a straight line fit Using least square method CO3-App (8)

X	0	5	10	15	20	25
Y	12	15	17	22	24	30

(ii) By Applying group average method, obtain a second degree curve which fits best in the following data CO3-App (8)

X	87.5	84.0	77.8	63.7	46.7	36.9
Y	292	283	270	235	197	181

Or

(b) (i) Fit the curve $y = ax^b$ using group average method for the following data — CO3-App (8)

X	10	20	30	40	50	60	70	80
Y	1.06	1.33	1.52	1.68	1.81	1.91	2.01	2.11

(ii) In a random sampling from normal population $N(\mu, \sigma^2)$ Find the maximum likelihood estimators for1) μ when σ^2 is known 2) σ^2 when μ is known and 3) the simultaneous estimation of μ and σ^2 — CO3-App (8)

19. (a) (i) Using R-K method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$. — CO4-App (8)

(ii) Using Taylor's series method find $y(1.1)$ given $y' = x + y$ with h=0.1, $y(1) = 0$. — CO4-App (8)

Or

(b) Given $\frac{dy}{dx}$ =1+ y^2, y(0) =0 , y(0.2) = 0.2027 , y(0.4) =0.4228, y(0.6) = 0.6841 evaluate y(0.8) by Adams – Bash forth Method. — CO4-App (16)

20. (a) (i) Solve $\frac{\partial^2 u}{\partial x^2} = 2\frac{\partial u}{\partial t}$, u(0,t) = 0 , u(4,t) = 0 , u(x,0) = x(4 - x) . Take h = 1 and find the values of u up to t = 5 using Bender-Schmidt's difference equation — CO5-App (8)

(ii) Using Crank-Nicholson's difference equation to solve $\frac{\partial^2 u}{\partial x^2} = 16\frac{\partial u}{\partial t}$ u(0,t) = 0 , u(1,t) = 100t , u(x,0) = 0 compute u for one time step function with h=0.25 — CO5-App (8)

Or

(b) Solve the Poisson equation $u_{xx} + u_{yy} = -x^2 y^2$, over the square region bounded by the lines x = 0, y = 3 given that u = 10 throughout the boundaries taking h = 1 — CO5-App (16)