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

Question Paper Code: U3M29

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

Third Semester

Artificial Intelligence and Machine learning

21UMA329 COMPUTATIONAL STATISTICS AND NUMERICAL METHODS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. The correlation coefficient is independent of CO6- U

(a) Change of origin only (b) Change of scale only

(c) Change of origin and scale (d) neither (a) nor (b)

2. The Regression coefficient y on x is CO6- U

(a) $\gamma \frac{\sigma_x}{\sigma_y}$ (b) $\gamma \frac{\sigma_y}{\sigma_x}$ (c) $\frac{\sigma_x}{\sigma_y}$ (d) $\frac{\sigma_x}{\gamma\sigma_y}$

3. F-test is used to test for equality of _____ CO6- U

(a) Mean (b) Variance (c) ratio (d) all the above

4. Choose the F-test CO6- U

(a) $F = S_1^2/ S_2^2 , S_1 > S_2$ (b) $F = S_2^2/ S_1^2 , S_1 > S_2$ (c) F = 0 (d) None of the above

5. _____ 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

6. In method of moments ,the second moment is denoted by CO6- U

(a) $\Delta y\, \Sigma xy^2$ (b) $\Delta x\, \Sigma xy$ (c) $\Delta x\, \Sigma x^2 y$ (d) $\Delta y\, \Sigma xy^2$

7. Predictor-Corrector methods are _____ starting methods CO6- U

(a) self (b) not self (c) identity (d) None of these

8. The Fourth order Runge-Kutta methods are used widely in _____ CO6- U
solution to differential equations
(a) abstract (b) graphical (c) numerical (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) elliptic (b) parabolic (c) hyperbolic (d) Non homogeneous

PART – B (5 x 2= 10Marks)

11. A programmer while writing a program for correlation coefficient between two variable x and y from 30 pairs of observations. obtained following results $\sum x = 300$, $\sum y = 210$, $\sum x^2 = 3718$, $\sum y^2 = 2000$, $\sum xy = 2100$ .At the time of checking it was found that he had copied down two pairs (18,20) and (12,10) instead of correct values (10,15) and (20,15) Obtain the correct value of correlation coefficient. CO1- App

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

13. Write down the Normal Equations of the curve $y = bx^a$ CO6- U

14. Using Euler's method find y(0.1) given $\frac{dy}{dx}$ =1+ y^2, y(0) =0 CO4 -App

15. Classify $u_{xx} - 2u_{xy} + u_{yy} = 0$ CO5 -App

PART – C (5 x 16= 80Marks)

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

X	100	200	300	400	500	600	700
Y	30	50	60	80	100	110	130

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

X / Y	25-35	35-45	45-55	55-65	65-75
20-30	3	10	3	-	-
30-40	-	15	25	3	-
40-50	-	-	5	3	2
50-60	-	7	10	-	-
60-70	5	6	-	3	-

Or

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

Marks in English	48	60	72	62	56	40	39	52	30
Marks in Science	62	78	65	70	38	54	60	32	31

(ii) Calculate the Regression equation between the marks in Science and Social CO1- App (8)

Marks in Science	25	28	35	32	31	36	29	38	34	32
Marks in Social	43	46	49	41	36	32	31	30	33	39

17. (a) (i) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. Do the estimates of the population variance differsignifically at 5% level? CO2- Ana (8)

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15		

(ii) Four coins are tossed 160 times. The number of heads observed is given below. Examine if the coins are unbiased, by employing χ^2 goodness of fit. CO2- Ana (8)

No of Heads	0	1	2	3	4
Frequency	17	52	54	31	6

Or

(b) (i) Two researchers A and B adopted different techniques while rating the students level. Can you say that the techniques adopted by them are significant? CO2- Ana (8)

Researchers	Below Average	Average	Above Average	Geniu s	Total
A	40	33	25	2	100
B	86	60	44	10	200
Total	126	93	69	12	300

(ii) To verify whether a course in accounting improved performance, a similar test was given to 12 participants both before and after the course. The marks are: Was the course was useful? CO2- Ana (8)

Before	44	40	61	52	32	44	70	41	67	72	53	72
After	53	38	69	57	46	39	73	48	73	74	60	78

18 (a) (i) Applying least square method techniques fit a straight line $y = a + bx$ CO3- App (8)

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X	0	3	5	6	8	10	12
Y	2	5	8	9	11	12	15

(ii) Applying method of moments fit a straight line $y = ax + b$ CO3- App (8)

X	1	2	3	4
Y	1.7	1.8	2.3	3.2

Or

(b) (i) By Applying method of moments, obtain a second degree curve which fits best in the following data CO3- App (8)

X	1	2	3	4
Y	0.30	0.64	1.32	5.40

(ii) Obtain the equation of the form $y = ax + bx^2$ using group average method — CO3- App (8)

X	1.1	2	3.2	4	5.5	6.3
Y	5.3	14.2	30.1	43.8	77.3	97.8

19. (a) Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$, $y(0.6) = 3.68$ Find $y(0.8)$ by Milne's Predictor & Corrector method. — CO4- App (16)

Or

(b) (i) Using R-K method of fourth order, find $y(0.1)$ for the initial value problem $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$ — 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)

20. (a) (i) Solve $\frac{\partial^2 u}{\partial x^2} = 32\frac{\partial u}{\partial t}$, u(0,t) = 0 , u(1,t) = t , u(x,0) = 0 . Take h = 0.25 and find the values of u up to t = 1 using Bender-Schmidt's difference equation — CO5- App (8)

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

Or

(b) Solve $\nabla^2 \mathbf{u} = -\mathbf{10(x^2 + y^2 + 10)}$ over the square mesh with sides $\mathbf{x = 0, x = 3, y = 0, y = 3}$ with u=0 on the boundary and mesh length 1 unit. — CO5- App (16)