A   Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: U3029

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

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 equation of Regression line of X on Y is   CO6- U

   (a) $(x - \bar{x}) = \gamma \dfrac{\sigma_x}{\sigma_y}(y - \bar{y})$ (b) $(y - \bar{x}) = \gamma \dfrac{\sigma_x}{\sigma_y}(x - \bar{y})$ (c) $(y - \bar{y}) = \gamma \dfrac{\sigma_x}{\sigma_y}(x - \bar{x})$ (d) $(y - \bar{y}) = \gamma \dfrac{\sigma_y}{\sigma x}(x - \bar{x})$

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

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

3. t-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 normal equations are required to fit a parabolic curve in method of least squares   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. _____ prior values are required to predict the next value in Milne's method   CO6- U

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

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. The coefficient of Rank correlation of marks obtained by 10 students in Maths and   CO1- App
    Physics was found to be 0.8. It was late discovered that the difference in ranks in two
    subjects obtained by one of the student was wrongly taken as 5 instead of 8. Find the
    correct coefficient of Rank correlation.

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

13. Transform the curve $y = ae^{bx}$ into the straight line equation form   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 $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ CO5 -App

PART – C (5 x 16= 80Marks)

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

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

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

X \ Y	30-40	40-50	50-60	60-70	70-80
150-155	1	3	7	5	2
155-160	2	4	10	7	4
160-165	1	5	12	10	7
165-170	-	3	8	6	3

Or

U3029

(b) (i) Calculate the rank correlation coefficient of the following data   CO1- App   (8)

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	62	45	81	60	68	48	50	70

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

X	12	15	17	18	23	16	25	29
Y	110	120	124	130	136	122	140	143

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	Genius	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

U3029

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

X	5	10	15	20	25
Y	16	19	23	26	30

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

X	2	4	6	8	10	12	14
Y	20.3	18.5	17	14.8	13	11.2	9.4

Or

(b) (i) Fit a straight line fit of the form $y = a + bx$ 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 degreecurve   CO3- App   (8)
which fits best in the following data

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

19. (a)   CO4- App   (16)

Given $\dfrac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$,

$y(0.6) = 3.68$ Find $y(0.8)$ by Milne's Predictor & Corrector method.

Or

(b) (i) Using R-K method of fourth order, find $y(0.1)$ for the initial value   CO4- App   (8)

problem $\dfrac{dy}{dx} = x + y^2$ with $y(0) = 1$

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

20. (a)   CO5- App   (8)

(i) Solve $\dfrac{\partial^2 u}{\partial x^2} = 32 \dfrac{\partial u}{\partial t}$, 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 = 5 using Bender-Schmidt's
difference equation.

(ii) Using Crank-Nicholson's difference equation to solve $\dfrac{\partial^2 u}{\partial x^2} = \dfrac{\partial u}{\partial t}$ CO5- App   (8)

u(0,t) = 0 , u(1,t) = t , u(x,0) = 0. compute u for one time step function with
h=0.25 .

Or

(b) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, 0<x<1, 0<y<1 , u(0,y)=0,   CO5- App   (16)
u(x,0) = 0, u(1,y)=100, u(x,1)=100 and h=1/3

U3029