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

Question Paper Code: U3022

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

Third Semester

Computer Science and Engineering

21UMA322- PROBABILITY, QUEUEING THEORY AND NUMERICAL METHODS

(Regulations 2021)

(Common to Information Technology)

Duration: Three hours | Maximum: 100 Marks

Answer All Questions

PART A - (10 x 2 = 20 Marks)

1. If $P(X = x) = \frac{k}{x}, x = 1,3,4,5$ represents p.m.f , compute the value of 'K' — CO1- App

2. If Correlation coefficient $\gamma = 0.4, \sigma_x = 5, \sigma_y = 8$, find the covariance value — CO1 -App

3. Explain Kendall's Notation (a/b/c): (d/e) of a queueing model — CO6 -U

4. State various disciplines in queuing model. — CO6 -U

5. Write the normal equations for fitting a parabola $y = ax^2 + bx + c$ — CO3- App

6 Write down the Normal Equations of the curve $y = a + bx + cx^2$ — CO3- App

7 Write the condition of convergence of Newton's method — CO4 -App

8 Using Newton's Raphson for two steps $x^3 - 2x - 5 = 0$ by taking $x_0 = 2.3$ — CO4- App

9 Using Euler's method Compute y(0.1) given $\frac{dy}{dx} = y - x^2$, y(0) =1 — CO5- App

10 Write down the Milne's predictor and corrector formula. — CO6-U

PART – B (5 x 16= 80 Marks)

11. (a) (i) A RV X has the following distribution , Compute variance — CO1-App (8)

x	0	1	2	3	4	5	6
P(X)	a	2a	2a	4a	5a	10a	13a

(ii) Calculate the Correlation coefficient for the following data CO1-App (8)

X	55	56	57	57	58	50	60	62
Y	77	78	75	78	76	72	79	81

Or

(b) (i) Compute the moment generating function of Poisson distribution and hence Compute it's mean and variance CO1-App (8)

(ii) If $f(x) = kx^3 e^{-x}$, $0 < x < \infty$ Compute the value of k , Variance of the distribution and also compute $E(2X + 3)^2$ CO1-App (8)

12. (a) (i) Assume that the good trains are coming in a yard at the rate of 32 trains per day and suppose that the inter arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 37 minutes. If the yard can admit 9 trains at a time(there being 10 lines, one of which is reserved from shunting purpose), Identify the Model ,Compute the probability that the yard is empty and Compute the average queue length. CO2-Ana (8)

(ii) In a car - wash service facility, cars arrive for service according to Poisson distribution with mean 5 per hour. The time for washing and cleaning each car has exponential distribution with mean 12 minutes per car. The facility cannot handle more than one car at a time and has a total of 5 parking spaces. Find (a) the effective arrival rate (b) What is the probability that an arriving car will get service immediately upon arrival? (c) Find the expected number of parking spaces occupied. CO2-Ana (8)

Or

(b) There are three typists in an office. Each typist can type an average of 6 letters per hour. If letters arrive for being typed at the rate of 15 letters per hour. Identify the Model , what fraction of time all the typists will be busy? What is the average number of letters waiting to be typed? CO2-Ana (16)

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

X	1	2	6	7	9	12	13
Y	11.2	13.1	15.3	16.1	18.6	23.4	25

(ii) Applying method of moments, fit a straight line to the following data CO3-App (8)

X	2	4	6	8	10	12	14
Y	20.3	18.5	17	14.8	13.2	11.5	9.6

Or

(b) (i) Applying group average method fit a second degree parabola $y = a + bx + cx^2$ for the following data CO3-App (8)

X	1	2	4	5	6	7	8	9	11
Y	15.2	18.9	28.6	34.8	41.7	49.4	58.3	67.4	88.3

(ii) Applying least square method techniques fit the curve $y = be^{ax}$ with the following data: CO3-App (8)

X	1	2	4	5	6	7	8	10
Y	735	746	769	780	792	805	814	841

14. (a) (i) Compute the real positive root of $4x - \cos x - 5 = 0$ by Newton's Raphson Method. Correct to 3 decimal places CO4-App (8)

(ii) Using Gauss Seidel method, solve the following Equations CO4-App (8)

x +3y+52z=173.61, x-27y+2z = 71.31 , 41x -2y +3z =65.46

Or

(b) (i) Applying Power method compute numerically largest Eigen value of $\begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$ CO4-App (8)

(ii) Using Gauss Elimination method , Solve 4x + 2y +z = 14, x + 5y -z = 10, x + y + 8z =20 CO4-App (8)

15. (a) (i) Using R.K Method of 4th order, solve $\frac{dy}{dx} = 1 + y^2$ with y (0) = 0, Compute y (0.2)by taking h=0.2 CO5-App (8)

(ii) Given $\frac{dy}{dx} = -xy^2$ with y (0) = 2, Compute y approximately for x=0.1 by Euler's method in five steps CO5-App (8)

Or

(b) Given $\frac{dy}{dx} = x^2(1+y)$, y(1) =1 , y(1.1) =1.233 , y(1.2) =1.5485, y(1.3) = 1.9789 Evaluate y(1.4) By Adams – Bash forth Method CO5-App (16)