A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 93022

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Third Semester

Computer Science and Engineering

19UMA322- Probability, Queueing Theory and Numerical Methods

(Regulation 2019)

(Common to Information Technology)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. If X is the discrete random variable having the probability mass function, then K value is . CO1- App

X	1	2	5
P(X)	$9k^2$	k^2+2k	k

(a)1/5 (b) -1/5 (c) -1/2 (d) 1/2

2. A Continuous r.v has a p.d.f $f(x)=3x^2,\ 0\le x\le 1$, $If\ P(X>b)=0.05$, then value of b is CO1- App

(a) 0.9308 (b) 0.9803 (c) 0.9830 (d) 0.9038

3. Choose the correct relation between L_s, L_q, W_s & W_q CO6- U

(a) $\frac{L_s}{L_q}<\frac{W_s}{W_q}$ (b) $\frac{L_q}{L_s}>\frac{W_q}{W_s}$ (c) $\frac{L_q}{W_q}=\frac{L_s}{W_s}$ (d) $\frac{L_q}{W_q}<\frac{L_s}{W_s}$

4. For a model (M/M/1): (∞ /FCFS)The arrival rate is 3 per hour and service rate is 4 per hour then W_s CO2- App

(a) 55 Minutes (b) 65 Minutes (a) 60 Minutes (b) None of the above

5. One of the normal equation of parabola $y=a+bx+cx^2$ is CO6- U

(a) $\Sigma xy = a\Sigma x + b\Sigma x^2 + c\Sigma x^3$ (b) $\Sigma xy = a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4$ (c) $\Sigma y^2 x = a\Sigma x^2 + b\Sigma x^3 + c\Sigma x^4$ (d) $\Sigma xy^2 = a\Sigma x + b\Sigma x^2 + c\Sigma x^3$

6. _____ number of normal equations are required to fit a straight line in method of least squares CO6- U

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

7. For a 3 ×3 matrix , 5, 10 are the Eigen values, trace of matrix is equal to 3 then dominant Eigen value CO6- U

(a) 12 (b) -12 (c) -13 (d) 10

8. Iteration method converges if $|g^1(x)|$ __________ CO6- U

(a) >1 (b) <1 (c) =0 (d) >0

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

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

10. The first two steps of the fourth order Rungekutta method use ----- CO6- U

(a) Backward Euler's method (b)Taylor's series method

(c) Forward Euler's method (d) Euler's method

PART – B (5 x 2= 10Marks)

11. For Binomial distribution mean is 10 and variance is 4, Compute $P(X = 2)$ CO1- App

12. Write down the little's formula CO6- U

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

14. Write the condition of convergence of Newton's method CO6- U

15. Write down the Adam's predictor and corrector formula. CO5 U

PART – C (5 x 16= 80Marks)

16. (a) (i)) A RV X has the following distribution CO1-Ana (8)

x	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i) Calculate the value of 'k'

(ii) Calculate $P(X < 5)$ & $P[1.5 < X < 4.5 / X > 2]$

(iii) Calculate Cumulative Distribution Function

(ii) Compute the moment generating function of Exponential distribution and hence find it's mean and variance CO1-Ana (8)

Or

(b) (i) A RV X has the following distribution CO1 -Ana (8)

x	0	1	2	3	4	5	6
P(X)	a	2a	2a	3a	3a	6a	8a

(i).Compute $P(X \geq 2)$ and $E(X)$

(ii) Compute $Var(X)$

(ii) If the density function of a continuous r.v X is given by CO1 -Ana (8)

$$f(x) = \begin{cases} ax & 0 \leq x \leq 1 \\ a & 1 \leq x \leq 2 \\ 3a - ax & 2 \leq x \leq 3 \\ 0 & otherwise \end{cases}$$

(a) Compute the value of "a"

(b) Compute the c.d.f of X

17. (a) Assume that the good trains are coming in a yard at the rate of 30 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 36 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 (16)

Or

(b) Customers arrive at a watch repair shop according to a Poisson process at a rate of one per every 11 minutes, and the service time is an exponential random variable with mean 6 minutes. Identify the Model , Compute the following i) the average number of customers in the shop L_s ii) the average time a customer spends in the shop W_s iii) the average number of customers in the queue L_q iv) the probability that the server is idle. CO2 -Ana (16)

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

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

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

X	1	2	3	4	5
Y	5	12	26	60	97

Or

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

X	1	3	5	7
Y	4	8.5	11.5	15

(ii) Applying least square method techniques fit the curve $y = ab^x$ with the following data: CO3-App (8)

X	1	2	3	4	5
Y	150	99	60	48	18

19. (a) (i) Compute the real positive root of $x \log_{10} x = 4.5$ 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)

$3x - 13y - 3z = 49$, $5x - 6y + 17z = 45$, $11x + 2y - 2z = -31$

Or

(b) (i) Applying Power method compute numerically largest Eigen value of $\begin{pmatrix} 9 & 10 & 8 \\ 10 & 5 & -1 \\ 8 & -1 & 3 \end{pmatrix}$ by taking $X_0 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ CO4 -App (8)

(ii) Compute the real positive root of $3x - \cos x = 1$ by Iterative method CO4 -App (8)

20. (a) (i) Using R.K Method of 4th order, solve $\frac{dy}{dx} = y - x^2$ with y (0.6) = 1.7379, Compute y (0.8) by taking h=0.2 CO5- App (8)

(ii) Using Taylor series method Compute y(0.1) for CO5- App (8)

$\frac{dy}{dx} = x^2 y - 1$ with y(0) = 1

Or

(b) Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$, $y(0.6) = 3.68$, Compute $y(0.8)$ by Milne's Predictor & Corrector method CO5- App (16)