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Question Paper Code:U3M22

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

Third Semester

Computer Science and Engineering

21UMA322-Probability, Queueing Theory and Numerical Methods

(Regulations2021)

(Common to Information Technology)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10Marks)

1. If A and B are independent events then $P(A\cap B)$ = CO6- U

(a) 0 (b) P (A). P(B) (c) P(A) +P(B) (d) P(A) – P(B)

2. If A and B are mutually exclusive events then $P(A\cup B)$ = CO6- U

(a) 0 (b P(A) – P(B) (c) P (A). P(B) (d) P (A) + P(B)

3. The relation between L_s & L_q is CO6- U

(a) $L_s = \lambda L_q$ (b) $L_q = \lambda L_s$ (c) $L_q = L_s + \frac{\lambda}{\mu}$ (d) $L_s = L_q + \frac{\lambda}{\mu}$

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) 55 Minutes (b) 65 Minutes

5. In method of moments ,the first moment is denoted by CO6- U

(a) ΔyΣx (b) ΔxΣyΔx (c) ΔxΣxy (d) ΔyΣxy

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

(a) 1 (b) 2 (a) 1 (b) 2

7. Order of convergence of iteration method is CO6- U

(a) 1 (b) 2 (a) 3 (b) 0

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

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

9. In Euler's method, if h is small, the method is too _______ CO6- U

(a) fast (b) slow (c) average (d) None of these

10. Predictor-Corrector methods are ________ starting methods CO6- U

(a) self (b) not self (c) identity (d) None of the above

PART – B (5 x 2= 10Marks)

11. For Binomial distribution mean is 6 and variance is 2, Compute P[X=x]. CO1- App

12. What do you mean by effective arrival rate? CO2- App

13. Write down the Normal Equations of the curve $y = ab^x$ CO3- App

14. Write the iterative formula for finding $\sqrt{a}$ CO6- U

15. Write down the Adam's predictor and corrector formula. CO6- U

PART – C (5 x 16= 80Marks)

16. (a) (i) Obtain the Correlation coefficient for the following heights (in inches) of fathers X and their sons Y. CO1-App (8)

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

(ii) The number of monthly breakdowns of a computer is a R.V. having a Poisson distribution with mean equal to 1.8. Find the Probability that his computer will function for a month (a)Without a breakdown (b) With only one breakdown (c) With at least one breakdown CO1-App (8)

Or

(b) (i) In a large consignment of electric bulbs 10 % are defective. A random sample 20 bulbs are taken for inspection. Find the probability that (i) all are good bulbs (ii) exactly three defective bulbs. CO1 -Ana (8)

(ii) If $f(x) = \begin{cases} \dfrac{k}{1+x^2}, & -\infty < x < \infty \\ o & , elsewhere \end{cases}$ is the Probability Density Function of a Random variable X , CO1 -Ana (8)

(i) Find K

(ii) distribution function of F(x)

17. (a) A petrol pump station has 4 pumps. The service times follow the exponential distribution with a mean of 6 minutes and cars arrive for service in a Poisson process at the rate of 30 cars per hour. CO2 -Ana (16)

(i) What is the Probability that an arrival would have to wait in line?

(ii) Find the average number of cars in the system and in the queue?

(iii) Find the average waiting time of a customer in the system and in the queue?

(iv) Find the idle of a pump station?

Or

(b) (i) A T.V. repairman finds that the time spent on his job has an exponential distribution with 30 minutes. The repair sets in the order in which they come, which follow Poisson arrival pattern with average rate of 10 per 8 hour day., Identify the queuing model, CO2 -Ana (8)

(a) What is the repairman's expected idle time each day?

(b) How many jobs are ahead of an average set brought in?

(c) What is the average queue length?

(ii) The one person barber shop can accommodate a maximum of 5 people at a time (4 waiting and 1 getting haircut, Customers arrive according to a Poisson distribution with mean 5 per hour. The barber cuts hair at an average rate of 4 per hour. (i) What percentage of time is the barber idle? (ii) What fraction of the potential customers are turned away? (iii) What is the expected number of customers waiting for a haircut? CO2 -Ana (8)

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	1	2	3	4
Y	0.30	0.64	1.32	5.40

Or

(b) (i) 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

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

X	0	1	2	3	4
Y	1	1.8	3.3	4.5	6.3

19. (a) (i) Solve the equation 3x – cos x - 1 =0 by Newton Raphson method correct to 4 decimal places. CO4-App (8)

(ii) Solve 27x + 6y – z = 85, 6x + 15y +2z = 72, x + y + 54z =110 by Gauss Seidel Method CO4-App (8)

Or

(b) (i) Using Power method find numerically largest Eigen value of CO4 -App (8)

$$\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$$

(ii) Solve the system of equations by Gauss Elimination methods CO4 -App (8)
x+3y +3z = 16, x +4y +3z = 18,x +3y + 4z =19

20. (a) (i) Using Taylor's series method find $y(1.1)$ given $y' = x + y$ with $y(1) = 0$ CO5- App (8)

(ii) Solve $\frac{dy}{dx} = y - x^2$ with y(0) = 1, at x= 0.2 , $x = 0.4$ by Euler's method CO5- App (8)

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)