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Question Paper Code:93M22

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

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 = 10Marks)

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 (a)1/5 (b) -1/5

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. 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) $\Sigma x\Delta y$ (b) $\Sigma y\Delta x$ (a) $\Sigma x\Delta y$ (b) $\Sigma y\Delta x$

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. 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 (a) 12 (b) -12

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

(a) >1 (b)<1 (a) >1 (b)<1

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

(a) fast (b)slow (a) fast (b)slow

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

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

PART – B (5 x 2= 10Marks)

11. A coin is tossed thrice; Compute the probability that there will appear atleastonehead? CO1- App

12. Explain Kendall's Notation (a/b/c): (d/e) of a queueing model 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 Milne's predictor and corrector formula. CO5 U

PART – C (5 x 16= 80Marks)

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

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

(a). Compute the value of "a" (b). Compute the c.d.f of X

(ii) Using the p.df of an exponential distribution, State and prove memoryless property CO1-Ana (8)

Or

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

x	0	1	2	3	4	5	6	7	8
P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a

i) Compute $P(X \geq 4)$ and $P\left[1 < X < 5 \,/\, X > 3\right]$

ii) Compute $E(X)$

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

X	12	15	17	18	23	16	25	27
Y	110	120	124	130	136	122	140	143

17. (a) (i) Customers arrive at a watch repair shop according to a Poisson process at a rate of 10 per every an hour, and the service time is an exponential random variable with mean 4 minutes. i) Compute the average number of customers in the shop L_s ii) Compute the average time a customer spends in the shop W_s iii) Compute the average number of customers in the queue L_q iv) What is the probability that the server is idle CO2 -Ana (8)

(ii) Patients arrive at a clinic according to Poisson distribution at a rate of 32 patients per hour. The waiting room does not accommodate more than 15 patients. Examination time per patient is exponential with mean rate of 20 per hour. Identify the Model , Compute i) the effective arrival rate at the clinic. ii)the probability that an arriving patient will not wait? iii) the expected waiting time until a patient is discharged from the clinic? CO2 -Ana (8)

Or

(b) 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. Identify the Model , Compute the following i) the Probability that an arrival would have to wait in line? ii) the average waiting time, average time spent in the system and the average number of cars in the system iii) For what percentage of time would a pump be idle on an average? CO2 -Ana (16)

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

X	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) 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)

Or

(b) (i) Using Gauss Seidel method , Solve 28x+4y-z = 32: x+3y+10z = 24 ;

2x+17y+4z = 35 CO4 -App (8)

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

20. (a) (i) Using R.K Method of 4th order, solve $\frac{dy}{dx} = \frac{y}{1+x^2}$ with y (0) = 1, Compute y (0.1) by taking h=0.1 CO5- App (8)

(ii) Given $\frac{dy}{dx} = y + 2x$ with y (0) = 1, Compute y approximately for x=0.5 by Euler's method in five steps 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)