A Reg. No. :

Question Paper Code: U3022

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

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 - (10x 1 = 10 Marks)

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   CO2- App
   is 4 per hour then W_s

   (a) 55 Minutes   (b) 65 Minutes   (c) 45 Minutes   (d) 60 Minutes

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

   (a) $\Delta y \ \Sigma x$ (b) $\Delta x \ \Sigma y \ \Delta x$ (c) $\Delta x \ \Sigma xy$ (d) $\Delta y \ \Sigma xy$

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

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

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

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

<div align="center">PART – B (5 x 2= 10Marks)</div>

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

<div align="center">PART – C (5 x 16= 80Marks)</div>

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)

<div align="center">Or</div>

(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) A Random Variable X has the following probability distribution   CO1 -Ana   (8)

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

Using the probability mass function, calculate the following

(i) 'a'   (ii) P(X < 3), P(X ≥ 3)   (iii) (0 < X < 5)

(iv) distribution function.

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17. (a) A petrol pump station has 4 pumps. The service times follow the CO2 -Ana (16)
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.
(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 CO2 -Ana (8)
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,
  (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 CO2 -Ana (8)
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?

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

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

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(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   CO3-App   (8)

$y = ab^x$ with the following data:

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   CO4-App   (8)
method correct to 4 decimal places.

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

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 $y' = x + y$ CO5- App   (8)
with $y(1) = 0$

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

Euler's method

Or

(b) Given $\dfrac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$,   CO5- App   (16)

$y(0.6) = 3.68$, Compute $y(0.8)$ by Milne's Predictor &

Corrector method

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