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

Question Paper Code: 53022

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

Third Semester

Computer Science Engineering

15UMA322 - PROBABILITY, STATISTICS AND QUEUEING SYSTEMS

(Common to Information Technology branch)

(Regulation 2015)

(Statistical tables are may be permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The mean and variance of the Binomial distribution are 4 and 3 respectively. Find P(X=0). CO1- R

   (a) $(1/4)^{16}$ (b) 1/4 (c) $(3/4)^{16}$ (d)3/4

2. Find λ, if X follows Poisson Distribution such that P(X=2)=3P(X=3). CO1- R

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

3. Cov (X, Y) = CO2- R

   (a) E (XY) – E(X) E (Y) (b) E(X')E(Y') – E(X.Y)

   (c) E (X)E(Y) – E(X.Y) (d) E(XY)– E(X')E(Y')

4. If X and Y are independent RVs with variances 8 and 5.find the variance of 3X+4Y. CO2- R

   (a) 152 (b) 153 (c) 163 (d) 162

5. The number of experimental units in the block is called as CO3- R

   (a) Block design (b) Block size (c) Complete block unit (d) Unit size

6. A _____ is a variable defining a categorization. CO3- R

   (a) Fixed Factor (b) Factor (c) Local Control (d) Error Control

7. What do the letter "d" in the symbolic representation (a/b/c): (d/e) of a queueing model represent? CO4- R

(a) Service distribution (b) System capacity

(c) Arrival distribution (d) No.of. server

8. M/G/1 Queuing system is Markovian – Comment the statement CO4- R

(a) Correct (b) Wrong (c) Partially Correct (d) None of these

9. Find the expected number of customers in the system, if λ=1/13 and μ=1/4 in (M/M/1);(∞/FCFS) CO5- R

(a) 0.4444 (b) 0.777 (c) 1.4444 (d) 1.04

10. The service facilities are arranged in a sequence and the flow is always in a single direction is called _____ CO5- R

(a) Series Queue (b) Open Queue (c) Closed Queue (d) Parallel Queue

PART – B (5 x 2= 10 Marks)

11. A fair coin is tossed twice; find($X \leq 1$) where X denotes number of heads in each experiment. CO1- R

12. Define Conditional distribution for two-dimensional discrete and continuous random variable. CO2- R

13. List out the three basic principles of experimental design. CO3- R

14. Write Little's formula for Queuing Theory. CO4- R

15. Define: Open Jackson Networks. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) (i) An electrical firm manufactures light bulbs that have the length of life which is normally distributed with mean of 800 hours and standard deviation of 40 hours. Find the probability that a bulb burns between 778 and 834 hours. CO1- App (8)

(ii) The density function of a continuous random variable X is given by CO1- App (8)

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

Find the value of 'a'and CDF of X

Or

(b) (i) Find the MGF mean and variance of Gamma distribution. CO1- App (12)

(ii) A coin is tossed two times, if X denotes the number of heads. Find the probability distribution of X. CO1- App (4)

17. (a) The joint probability distribution of two dimensional random variable (X,Y) is given by $f(x,y)=\frac{1}{3}(x+y)$, $0 \le x \le 1, 0 \le y \le 2$. Find the correlation coefficient. Also find the equations of two lines of regression. CO2- App (16)

Or

(b) (i) Calculate the correlation coefficient for the following data CO2- Ana (8)

x: 65 66 67 67 68 69 70 72

y: 67 68 65 68 72 72 69 71

(ii) If the joint PDF of (X, Y) is given by $f(x, y) = e^{-(x+y)}$, $x>0$, $y>0$, Prove that X and Y are uncorrelated. CO2- Ana (8)

18. (a) Analyze the following latin square experiment. CO3- Ana (16)

A 105	B 95	C 125	D 115
C 115	D 125	A 105	B 105
D 115	C 95	B 105	A 115
B 95	A 135	D 95	C 115

Or

(b) Analyze the variance in latin square of yields (in kgs) for paddy where P,Q,R,S denote the different methods of calltivation. CO3- Ana (16)

S 122	P 121	R 123	Q 122
Q 124	R 123	P 122	S 125
P 120	Q 119	S 120	R 121
R 122	S 123	Q 121	P 122

19. (a) 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. what fraction of time all the typists will be busy ? what is the average number of letters waiting to be typed? CO4- App (16)

Or

(b) Patients arrive at a clinic according to Poisson distribution at a rate of 30 patients per hour. The waiting room dose not accommodate more than 14 patients.Examination time per patient is exponential with mean rate of 20 per hour. CO4- App (16)

(i) Find the effective arrival rate at the clinic.

(ii) What is the probability that an arriving patient will not wait.

(iii) What is the expected waiting time until a patient is discharged from the clinic?

20. (a) Derive the Pollaczek- Khintchine formula for M/G/1 queue. Hence deduce the result for the queues M/D/1 and $M/E_k/1$ as special cases. CO5- U (16)

Or

(b) In a network of three service stations 1, 2, 3, customers arrive at 1, 2, 3 from outside, in accordance with the Poisson process having rates 5,10,15 respectively. The service times with the three stations are exponential with respective rates 10, 50, 100. The customer completing service at station 1 is equally like to go to station 2 or go to station 3 or leave the system. A Customer departing from service at station 2 always goes to station 3. A departure from service at station 3 is likely to go to the station 2 or leave the system. What is the average number of customer in the system? And what is the average time the customer spend in a system? CO5- U (16)