Reg. No. : | | | | | | | | | | |

Question Paper Code: 34021

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Computer Science and Engineering

01UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Statistical table is permitted)

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. The density function of a continuous random variable *X* is

$$f(x) = \begin{cases} k(1-x^2) & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of *K*.

2. State the axioms of probability.

3. The joint p.d.f of the two dimensional random variable (*X, Y*) is given by $f(x,y) = \frac{8xy}{9}$, $1 \le x \le y \le 2$. Find the marginal density function x and y.

4. Show that $Cov^2(x,y) \le Var(x).Var(y)$.

5. What are the basic principles of Design of Experiemnts?

6. Write any two differences between RBD and CRD.

7. Define a steady state condition.

8. What are the characteristics of queueing system?

9. Explain Tandem queue model.

10. Define Open and Closed queuing networks.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) The distribution function of a random variable is given by $F(x)=1-(1+x)^{e^{-x}}$ for $x \geq 0$. Find the density function, mean and variance. (8)

(ii) The number of monthly breakdown of a computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month

(a) without a breakdown

(b) with only one breakdown

(c) with atleast one breakdown (8)

Or

(b) In a large consignment of electric bulb 10% are defective random sample of 20 is taken for inspection. Find the probability that (1) All are good bulbs (2) At most there are 3 defective bulbs (3) Exactly there are 3 defective bulbs. (16)

12. (a) (i) The random variable [*X, Y*] has the following joint p.d.f

$$f(x,y)=\begin{cases}\frac{x+y}{2}, & 0 \leq x \leq 2,\ 0 \leq y \leq 2\\ 0 & ,otherwise\end{cases}$$

Obtain the marginal distribution of *X* and *Y* and compute co variance [*X, Y*]. (8)

(ii) 20 dice are thrown. Find approximately the probability that the sum obtained is between 65 and 75 using central limit theorem. (8)

Or

(b) (i) Obtain the equation of the lines of regression for the following data (8)

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

(ii) The joint probability mass function of X and Y is given below

y \ x	-1	1
0	$\frac{1}{8}$	$\frac{3}{8}$
1	$\frac{2}{8}$	$\frac{2}{8}$

Find correlation coefficient of (X, Y). (8)

13. (a) The following is a Latin square of a design, when 4 varieties of seeds are being tested. Set up the analysis of variance table and state your conclusion. (16)

A105	B95	C125	D115
C115	D125	A105	B105
D115	C95	B105	A115

Or

(b) Analyse the variance in the following Latin square of yields (in kgs) of paddy where *A,B,C,D* denote the different methods of cultivation

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

Examine whether the different methods of cultivation have given significantly different yields. (16)

14. (a) Honda auto service station has 5 mechanics, each of whom can service a motorbike in 2 hours on an average. The motorbikes are registered at a single counter and then sent for servicing to different mechanics. Motorbikes arrive at the service station at an average rate of 2 per hour. Determine

(i) Probability that the system shall be idle,

(ii) Probability that there shall be 3 and 8 motorbikes in the station,

(iii) Expected number of motorbikes in the service station and queue,

(iv) Average waiting time in the queue,

(v) Average time spent by a motorbike in waiting and getting serviced. (16)

Or

(b) Honda auto service station has 5 mechanics, each of whom can service a motorbike in 2 hours on an average. The motorbikes are registered at a single counter and then sent for servicing to different mechanics. Motorbikes arrive at the service station at an average rate of 2 per hour. Determine

(i) Probability that the system shall be idle,

(ii) Probability that there shall be 3 and 8 motorbikes in the station,

(iii) Expected number of motorbikes in the service station and queue,

(iv) Average waiting time in the queue,

(v) Average time spent by a motorbike in waiting and getting serviced. (16)

15. (a) Derive the expected steady state system size for the single server system with Poission input and general service (Pollaczek-Khintchine formula). (16)

Or

(b) In a network of 3 service stations 1,2,3 customers arrive 1,2,3 from outside, in accordance with Poisson process having rates 5, 10,15 respectively. the service times at the 3 stations are exponential with respective rates 10,50, 100. A customer completing service at station 1 is equally like to (1) go to station 2, (2) go to station3 and (3) leave the system. A customer departig from service at station 2 always goes to station 3. A departure from service at station at station 3 is equally like to go to station 2 or leave the system. Then

(i) What is the average number of customers in the system consisting of all the three stations?

(ii) What is the average time a customer spends in the system? (16)