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

Question Paper Code: 41401

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Computer Science and Engineering

01UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

(Statistical table is permitted)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. State the axioms of probability.

2. Write down the probality mass function of the poission distribution which is approximately equal to *B* (100, 0.02).

3. If two random variable *X* and *Y* have pdf $f\,(x, y) = ke^{-(2x+y)}$ for *x, y* >0. Evaluate *k*

4. If X is uniformly distributed inin $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ find the pdf of *Y*= *tan X*.

5. Compare RBD and LSD.

6. What do you mean by analysis of variance?

7. Write down Kendall's Notation for representing queuing models.

8. If λ = 4 per hour and μ = 12 per hour in an *(M / M / I)* : *(4 / FIFO)* queuing system, find the probability that there is no customer in the system.

9. Explain Tandem queue model.

10. Define Open and Closed queuing networks.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Three machines *A*, *B* and *C* with capacities proportional to 4:2:3 are producing identical items. The percentage that the machine produce defectives are 4%, 3% and 5% respectively. At the end of a day from the total production one item is selected at random and is found defective. What is the chance that it came from machine *B*? (8)

(ii) Derive MGF, mean and variance of Geometric distribution. (8)

Or

(b) (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 and (c) with atleast one breakdown. (8)

12. (a) (i) The joint p.d.f of *X* and *Y* is given by

$$f(x, y) = \begin{cases} 2 - x - y, & 0 < x < 1, 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find Cov(*X*, *Y*). (8)

(ii) If $X_1, X_2, X_3, \ldots\ldots X_n$ are Poisson variates with parameter $\lambda = 2$, use central limit theorem to estimate $P(120 \leq S_n \leq 160)$, where $S_n = X_1 + X_2 + X_3 + \ldots\ldots + X_n$ and $n = 75$. (8)

Or

(b) (i) Let the random variables *X* and *Y* have the joint probability density function

$$f(x, y) = \begin{cases} \frac{3}{2}(x^2 + y^2) & , 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0 & , \textit{otherwise} \end{cases}$$

Compute the correlation coefficient between *X* and *Y*. (8)

(ii) A random sample of size 100 is taken from a population whose mean is 60 and variance is 400. Using central limit theorem, with what probability can we assert that the mean of the sample will not differ from $\mu = 60$ by more than 4? (8)

13. (a) A tea company appoints four salesman *A, B, C* and *D* and observes their sales in three seasons-summer, winter and monsoon. The figures (in lakhs) are given in the following table.

	A	B	C	D
Summer :	36	36	21	35
Winter :	28	29	31	32
Monsoon :	26	28	29	29

(i) Do the salesman significantly differ in performance?
(ii) Is there significant difference between the seasons? (16)

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) 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. Then

(i) what is the probability that an arrival would have to wait in line?
(ii) Find the average waiting time in the queue, 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.

(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 computer programs for execution arrive according to poission law with a mean of 5 per min. Assume that the system is busy. The service time is

(i) uniform between 8 and 12 seconds,

(ii) a discrete distribution with values equal to 2,7,12 seconds and corresponding probabilities 0.2, 0.5 and 0.3. Find L_s , L_q , W_s , W_q. (16)