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

Question Paper Code: 34021

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fourth Semester

Computer Science and Engineering

01UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Statistical table is permitted)

(Regulation 2013)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. The cdf of a random variable X is $F(x) = 1 - (1 + x)e^{-x}, x > 0$. The pdf of X is
   (a) x (b) xe^{x} (c) xe^{-x} (d) x^2

2. For the following density function $f(x) = ae^{-|x|}, -\infty < x < \infty$. The value of 'a' is
   (a) 1/2 (b) 0 (c) 1 (d) 2

3. If X and Y are independent , then f(x, y) =
   (a) f(x) (b) f(x)f(y) (c) f(y) (d) f(x) + f(y)

4. If $X_1, X_2, \ldots, X_n, \ldots$ is a sequence of independent RVs with $E(X_i) = \mu_i$ and $Var(X_i) = \sigma_i^2, i = 1,2, \ldots$ and if $S_n = X_1 + X_2 + \cdots + X_n$, then under certain general conditions $S_n$follows a
   (a) Binomial distribution (b) Poisson
   (c) Normal (d) Exponential

5. Latin square design are most widely used in the field of
   (a) industry (b) medicine (c) agriculture (d) astronomy

6. The RBD is available for a wide range of treatments

(a) 1 to 12 (b) 2 to 24 (c) 2 to 29 (d) 1 to 29

7. The process in which customer jumps from one queue to another to get service

(a) Balking (b) Reneging (c) Priority (d) Jockeying

8. The effective arrival rate λ' is given by

(a) $\mu(1-\rho)$ (b) $\mu(1-P_0)$ (c) $\mu(1+\rho)$ (d) $\mu(1+P_0)$

9. If there are 2 servers in an infinite capacity Poisson queue system with $\lambda = 10$ per hour and $\mu = 15$ per hour, what is the percentage of idle time for each server?

(a) 33.33% (b) 66.66% (c) 25% (d) 75%

10. No customer may enter the system from outside

(a) Jackson (b) Open Jackson

(c) Closed Jackson (d) None of these

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. A company has two plants to manufacture scooters. Plant I manufactures 80% of the scooters and plant II the rest. AT plant I, 85 out of 100 scooters are rated higher quality and at plant II, only 65 out of 100 scooters are rated higher quality. A scooter is chosen at random. What is the probability that the scooter came from Plant II, if it is known that the scooter is of higher quality. (8)

12. Given the following joint density function

$$f(x,y) = \begin{cases} \frac{8}{k}xy, & 0 \le x \le y \le 2 \\ 0, & otherwise \end{cases}$$

Find (1) value of *k*, (2) marginal density functions,

(3) $P(X \le 1/Y < 3/2)$, (4) $P(X + Y \le 1)$.

(8)

13. 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? (8)

14. 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.

(8)

15. Derive Pollaczek-khinchine formula of M/G/1 queue. (8)