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

Question Paper Code: 44021

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

Fourth Semester

Computer Science and Engineering

14UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Regulation 2014)

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 bag contains 5 balls and it is not know how many of them are white. Two balls are drawn at random from the bag and they are noted to be white. What is the change that all the balls in the bag are white? (8)

12. Two random variables X and Y have joint probability density function $f(x,y) = \begin{cases} c(4-x-y), 0 \le x \le 2, 0 \le y \le 2 \\ 0, \quad \textit{elsewhere} \end{cases}$. Find the equation of two lines of regression. (8)

13. The following data represent the number of units of production per day turned out by different workers using 4 different types of machines.

		Machine Type			
	1	44	38	47	36
	2	46	40	52	43
Workers	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

(i) Test whether the five mean differ with respect to mean productivity

(ii) Test whether the mean productivity is the same for the four different machine types.

$(F_{0.05}(4,12) = 3.26\,; F_{0.05}(3,12) = 3.49)$. (8)

14. Arrivals of a telephone in a both are considered to be Poisson with an average time of 12 minutes between one arrival and the next. The length of a phone call is assured to be distributed exponentially with mean 4 minutes.

(1) Find the average number of persons waiting in the system?
(2) What is the probability that a person arriving at the booth will have to wait in the queue?
(3) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call?
(4) Estimate the fraction of the day when the phone will be in use.
(5) The telephone department will install a second booth, when convinced that an arrival has to wait on the average for atleast 3 minutes for phone. By how much the flow of arrivals should increase to justify a second booth?
(6) What is the average length of the queue that forms from time to time? (8)

15. Derive Pollaczek – Khinchine Formula. (8)