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

Question Paper Code: 44021

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

Fourth Semester

Computer Science and Engineering

14UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

(Statistical Tables are permitted)

PART A - (10 x 1 = 10 Marks)

1. The events A and B are independent with P (A)= 0.5 and P(B)= 0.8. Find the probability that neither of the event occurs.

   (a) 0 .5 (b) 0.1 (c) 0.2 (d) 0.3

2. The moment generating function of exponential distribution is

   (a) $\frac{1}{\lambda - t}$ (b) $\frac{t}{\lambda - t}$ (c) $\frac{\lambda}{\lambda - t}$ (d) $\frac{t^2}{\lambda^2 - t}$

3. C_{XY} is the covariance of X and Y, then C_{XY} =

   (a) $E[XY] - E[X]\,E[Y]$ (b) $E[XY] + E[X]\,E[Y]$

   (c) $E[XY] * E[X]\,E[Y]$ (d) $E[XY] \,/\, E[X]\,E[Y]$

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. Expand R.B.D

(a) Root Between Divisors (b) Real Numbers Between Divisors

(c) Randomized Block Designed (d) Root Between Deviation

6. In a 4 X 4 latin square, the total of such possibilities are

(a)8 (b)10 (c)200 (d)576

7. Average time a customer waits before being served

(a) W_s (b) W_q (c) L_s (d) L_q

8. Average time a customer waits before being served

(a) W_s (b) W_q (c) L_s (d) L_q

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. In the model $(M/G/1)$ if the service time follows exponential distribution then the model reduces to

(a) Model I (b) Model II (c) Model III (d) Model IV

PART - B (5 x 2 = 10 Marks)

11. State Baye's theorem.

12. The random variable (X, Y) have the joint p.d.f $f(x,y) = x + y \quad 0 \le x \le 1,\ 0 \le y \le 1$.Find the marginal density function of Y.

13. What do you understand by design of experiments?

14. Define Steady State and Transient state?

15. Define Open Jackson Networks?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) A random variable *X* has the following probability distribution.

X	-2	-1	0	1	2	3
P(X)	0.1	*K*	0.2	2*K*	0.3	3*K*

(1) find the value of *K*, (2) Evaluate $P(X<2)$ and $P(-2<X<2)$,

(3) obtain the mean of *X*. (8)

(ii) A continuous random variable *X* has a pdf $f(x) = kx^2 e^{-x}; 0 < x < 1$. Find (1) k (2) mean (3) variance. (8)

Or

(b) (i) A coin is tossed until a head appears or until it has been tossed three times. Given that the head does not appear on the first toss, find the probability that the coin is tossed three times. (8)

(ii) Suppose the height of men of a certain country are normally distributed with average 68 and standard deviation 2.5, find the percentage of country men who are (i) between 66 and 71 (ii) Approximately 6 fit tall. (8)

17. (a) (i) Given $f_{xy}(x, y) = cx\,(x - y), 0 < x < 2, -x < y < x, and$ 0 elsewhere, (1) evaluate 'c' (2) find $f_x(x)$ (3) $f_{y/x}(y/x)$ and (4) $f_y(y)$. (8)

(ii) If X and Y each follow an exponential distribution with parameter 1 and are independent, find the pdf of U = X – Y. (8)

Or

(b) (i) If *X*,*Y* and *Z* are uncorrelated random variables with zero mean and standard deviations 5,12 and 9 respectively and if $U = X + Y$ and $V = Y + Z$, find the correlation coefficient between *U* and *V*. (8)

(ii) A distribution with unknown mean has variance equal to 1.5. Use central limit theorem to find how large a sample should be taken from the distribution in order that the probability will be atleast 0.95 that the sample mean will be within 0.5 of the population mean. (8)

18. (b) (i) The following data represent the number of units of production per day turned out by 5 different workers using 4 different types of machine.

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

Find SSC, SSR, SSE for the above data. (12)

(ii) State difference between LSD and RBD. (4)

Or

(b) Analyze the variance in the Latin square of yields (in kgs) of paddy where P,Q, R, S denote the different methods of cultivation.

S122	P121	R123	Q122
Q124	R123	P122	S125
P120	Q119	S120	R121
R122	S123	Q121	P122

Examine whether the different methods of cultivation have given significantly different yields. ($F_{0.05}$ $(3,6) = 4.76$). (16)

19. (a) (i) Explain Markovian Birth – Death process and obtain the expressions for steady state probabilities. (8)

(ii) A supermarket has two girls attending sales at the counters. If the service time for each customer is exponential with mean 4 min and if people arrive in Poisson fashion at the rate of 10 per hour. What is the probability that the customers has to wait for service? (8)

Or

(b) (i) A bank has 2 tellers on saving accounts. The customers arrive in a Poisson fashion with mean arrival rate of 16 per hour. The service time is exponential with mean service time of 20per hour per customer. Calculate P_0. (6)

(ii) Patients arrive at a clinic according to Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examine time per patient is exponential with mean rate of 20 per hour. (i) What is the probability that an arriving patient will not wait? (ii) Find the effective arrival rate at the clinic. (10)

20. (a) Derive Pollaczek – Khinchine Formula. (16)

Or

(b) (i) A car wash facility operates with only one bay. Cars arrive according to a poisson distribution with a mean of 4 cars per hour and may wait in the facility's parking lot if the bay is busy. The parking lot is large enough to accommodate any number of cars. Find the average number of cars waiting in the parking lot, if the time for washing and cleaning a car follows (i) uniform distribution between 6 and 12minutes. (ii) a normal distribution with mean 12 minutes and S.D 3 minutes.