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

Question Paper Code: 44001

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

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

(Smith chart may be permitted)

PART A - (10 x 1 = 10 Marks)

1. 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

2. 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

3. The correlation coefficient value lies between
   (a) -1 to 0 (b) 0 to 1 (c) -1 to 1 (d) 1 to 2

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. LSD is known to be suitable for a case when the number of treatments is between

(a) 5 and 12 (b) 6 and 11 (c) 4 and 10 (d) 3 and 100

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

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

9. The another name of the series queues model is

(a) Two stage queue (b) Tandem queue

(c) Balance queue (d) One stage queue

10. Pollaczek-Khinchine formula is

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

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) For a certain binary communication channel, the probability that a transmitted '0' received as a '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probability that a '0' is transmitted is 0.4 , find the probability that

(a) a '1' is received and (b) a '1' was transmitted given that a '1' was received. (8)

(ii) A random variable X has a pdf$f(x) = kx^2e^{-x}, x \ge 0$. Find k, mean and variance. (8)

Or

(b) (i) The probability density function of a random variable X is given by

$$f(x)=\begin{cases} kx(2-x)^2 & 0<x<2 \\ 0 & \textit{otherwise} \end{cases}$$

Find K, Mean and variance of the distributions. (8)

(ii) Derive the M.G.F, Mean and variance of Gamma distribution. (8)

17.(a) (i) The joint pdf of a two dimensional random variable is given by

$f(x,y)=xy^2+\frac{x^2}{8}, 0\le x\le 2, 0\le y\le 1$. Compute *P (X >1/ Y < 1/2)*. (8)

(ii) If the joint pdf is given by $f_{XY}(x,y)=x+y; 0\le x,y\le 1$, find the pdf of $U = XY$.

(8)

Or

(b) 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.

(16)

18. (a) Analyse the variance in the following Latin square of yields (in kgs) 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 (16)

Or

(b) Analyze the data using Latin square experiment. (16)

B25	A18	E27	D30	C27
A19	D31	C29	E26	B23
C28	B22	D33	A18	E27
E28	C26	A30	B25	D33
D32	E25	B23	C28	A20

19. (a) (i) A super market has a single cashier. During the peak hours, customers arrive at a rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour. Find (i) the probability that the cashier is idle. (ii) the average number of customers in the queuing system (iii) the average time a customer spends in system. (8)

(ii) A two-person barber shop has five chairs to accommodate waiting customers. Potential customers who arrive when all five chairs are full leave without entering the barber shop. Customers arrive at the average rate of 4 per hour and spend an average of 12 minutes in the barber chair. Compute P_0 and $E(N_q)$.(8)

Or

(b) A TV repairman find that the time spent on his job has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came and if the arrival of sets is approximately Poisson with an average of 10 per 8 hour day. What is the repairman's expected idle time each day? How many jobs are ahead of average set just brought? (16)

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

Or

(b) In a leading hotel, there is a separate section for parcel. There are 3 bill collectors who gets the orders from the customers and issues the bill and collects money. On finishing the job with any one of the bill collectors, the customer goes to the next section where the chief cook issues the items needed for the customers. The customers enter the hotel at a poisson fashion at the rate of 6 per hour. Each bill collector takes 15 minutes for noting the items and issuing the bill in an exponential fashion. The chief cook issues the items who takes on the average 3 minutes per customer to pack and give it to the customers. Find the average number of customers in the hotel and the average waiting time of a customer in the hotel. (16)