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

Question Paper Code: 41401

B.E. / B.Tech. DEGREE EXAMINATION, MAY 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

(Statistical Tables are permitted)

PART A - (10 x 1 = 10 Marks)

1. A box contains 4 bad and 6 good tubes. Two are drawn out from the box at a time. One of them is tested and found to be good. What is the probability that the other one is also good

   (a) $\frac{1}{3}$ (b) $\frac{5}{9}$ (c) $\frac{4}{10}$ (d) $\frac{6}{10}$

2. If a RV 'k' is uniformly distributed over (0, 5), what is the probability that the roots of the equation $4x^2 + 4kx + (k+2) = 0$ are real?

   (a) $\frac{1}{2}$ (b) $\frac{3}{5}$ (c) $\frac{2}{9}$ (d) $\frac{2}{7}$

3. The joint pdf of a RV (X,Y) is given by $f(x, y) = kxye^{-(x^2+y^2)}, x \geq 0, y \geq 0$. Find the value of 'k'

   (a) 2 (b) 3 (c) 4 (d) $\frac{1}{4}$

4. The regression lines are given by $3x + 2y = 26, 6x + y = 31$

   (a) 0.5 (b) -0.5 (c) 0.7 (d) -0.7

5. The science of experimental design is associated with the name

   (a) Latin square (b) RBD

   (c) Latin cubes (d) None of these

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. 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. A continuous RV has a pdf $f(x) = kx^2 e^{-x}, x \geq 0$. Find k, mean and variance.

12. The joint probability mass function of (X, y) is given by $p(x, y) = k)2x + 3y), x = 0, 1, 2; y = 1, 2, 3$. Find the marginal distribution and also find the joint probability distribution of X + Y.

13. What are the basic principles of the design of experiments?

14. Define Kendal's Notation.

15. What do you mean by bottle neck of a network?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) 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)

(ii) Find the moment generating function of an exponential distribution and hence find the mean and variance. (8)

Or

(b) (i) The probability function of an infinite discrete distribution is given by $p(X = j) = \frac{1}{2^j}, j = 1, 2, 3, \ldots$. Verify that the total probability is 1 and find the mean and variance of the distribution. (8)

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

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

(16)

Or

(b) (i) If X and Y are independent random variables with probability density functions $e^{-x}, x \geq 0$ and $e^{-y}, y \geq 0$ respectively , find the density function $U = \frac{X}{X+Y}$ (8)

(ii) A distribution with unknown mean μ 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 at least 0.95 that the sample mean will be within 0.5 of the population mean. (P(|z| < 1.96) = 0.95). (8)

18. (a) Five varieties of wheat A, B, C, D and E were tried. The gross size of the plot was 18 feet x 22 feet, the net plot being 14 feet x 18 feet. Thus the whole experiment occupied an area 90 feet x 110 feet. The plan, the varieties show in each plot and yields obtained in kg. are given in the following:

B90	E80	C134	A112	D92
E85	D84	B70	C141	A82
C110	A90	D87	B84	E69
A81	C125	E85	D76	72
D82	B60	A94	E85	C88

(16)

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) 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-Khintchine formula for the average number of customers in the M/G/1 queueing system. (16)

Or

(b) Automatic 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. If the service time for all cars is constant and equal to 10 minutes, determine Ls, Lq, Ws, Wq. (16)