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

Question Paper Code: 34021

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Computer Science and Engineering

01UMA421 - APPLIED STATISTICS AND QUEUEING NETWORKS

(Common to Information Technology)

(Statistical table is permitted)

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. State the axioms of probability.
2. If a random variable 'X' has a uniform distribution in (-3, 3), find $P(X < 2)$.
3. If two random variable X and Y have pdf $f(x, y) = ke^{-(2x+y)}$ for $x, y > 0$. Evaluate k
4. Show that $Cov^2(x, y) \le Var(x).Var(y)$.
5. What are the basic principles of Design of Experiemnts?
6. Write down the ANOVA table for one way classification.
7. Define a steady state condition.
8. Write Little's formula.
9. Define series queues. Give examples.
10. Define Open and Closed queuing networks.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) A continuous random variable X has p.d.f $f(x) = K x^2 e^{-x}$, $x \ge 0$. Find the r^{th} moment of X about the origin. Hence find mean and variance of X. (8)

(ii) In a component manufacturing industry, there is a small probability of 1/500 for any component to be defective. The components are supplied in packs of 10. Use Poisson distribution to calculate the approximate number of packets containing (a) no defective (b) two defective components in a consignment of 10000 packets. (8)

Or

(b) In a large consignment of electric bulb 10% are defective random sample of 20 is taken for inspection. Find the probability that (1) All are good bulbs (2) At most there are 3 defective bulbs (3) Exactly there are 3 defective bulbs. (16)

12. (a) (i) The random variable [X, Y] has the following joint p.d.f

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

Obtain the marginal distribution of X and Y and compute co variance [X, Y]. (8)

(ii) 20 dice are thrown. Find approximately the probability that the sum obtained is between 65 and 75 using central limit theorem. (8)

Or

(b) (i) Obtain the equation of the lines of regression for the following data (8)

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

(ii) The joint probability mass function of X and Y is given below

y \ x	-1	1
0	$\frac{1}{8}$	$\frac{3}{8}$
1	$\frac{2}{8}$	$\frac{2}{8}$

Find correlation coefficient of (X, Y). (8)

13. (a) The following is a Latin square of a design, when 4 varieties of seeds are being tested. Set up the analysis of variance table and state your conclusion. (16)

A105	B95	C125	D115
C115	D125	A105	B105
D115	C95	B105	A115

Or

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

*B*90	*E*80	*C*134	*A*112	*D*92
*E*85	*D*84	*B*70	*C*141	*A*82
*C*110	*A*90	*D*87	*B*84	*E*69
*A*81	*C*125	*E*85	*D*76	*B*72
*D*82	*B*60	*A*94	*E*85	*C*88

Carry out an analysis of variance. What inference can you draw from the data given? (16)

14. (a) Honda auto service station has 5 mechanics, each of whom can service a motorbike in 2 hours on an average. The motorbikes are registered at a single counter and then sent for servicing to different mechanics. Motorbikes arrive at the service station at an average rate of 2 per hour. Determine

(i) Probability that the system shall be idle,

(ii) Probability that there shall be 3 and 8 motorbikes in the station,

(iii) Expected number of motorbikes in the service station and queue,

(iv) Average waiting time in the queue,

(v) Average time spent by a motorbike in waiting and getting serviced. (16)

Or

(b) Honda auto service station has 5 mechanics, each of whom can service a motorbike in 2 hours on an average. The motorbikes are registered at a single counter and then sent for servicing to different mechanics. Motorbikes arrive at the service station at an average rate of 2 per hour. Determine

(i) Probability that the system shall be idle,

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(iii) Expected number of motorbikes in the service station and queue,

(iv) Average waiting time in the queue,

(v) Average time spent by a motorbike in waiting and getting serviced. (16)

15. (a) Derive the expected steady state system size for the single server system with Poission input and general service (Pollaczek-Khintchine formula). (16)

Or

(b) In a computer programs for execution arrive according to poission law with a mean of 5 per min. Assume that the system is busy. The service time is

(i) uniform between 8 and 12 seconds,

(ii) a discrete distribution with values equal to 2,7,12 seconds and corresponding probabilities 0.2, 0.5 and 0.3. Find L_s , L_q , W_s , W_q. (16)