Reg. No. :

Question Paper Code: 34021

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. If X is a Poisson variate such that $2P[X = 0] + P[X = 1] = 2P[X = 1]$, find $E[X]$.

2. If X is uniformly distributed over the interval (0, 10), find (a) $P(X>6)$, (b) $P(3 < x < 8)$.

3. Two random variables X and Y have PDF $f(x, y) = k(2x+y)$ for $0 \leq x \leq 2,\ 0 \leq y \leq 3$, solve for k.

4. State central limit theorem.

5. What is the aim of the design of experiments?

6. Compare completely randomized experimental design and latin square design.

7. In a 3 server infinite capacity Poisson queue model if $\frac{\lambda}{s\mu} = \frac{2}{3}$, find P_0.

8. Write Little's formula.

9. Define series queues. Give examples.

10. What do you mean by bottleneck of a network?

PART - B (5 x 16 = 80 Marks)

11. (a) (i) A company has two plants to manufacture scooters. Plant I manufactures 80% of the scooters and plant II the rest. AT plant I, 85 out of 100 scooters are rated higher quality and at plant II, only 65 out of 100 scooters are rated higher quality. A scooter is chosen at random. What is the probability that the scooter came from Plant II, if it is known that the scooter is of higher quality. (8)

(ii) If 10% of the screws produced by an automatic machine are defective, find the probability that of 20 screws selected at random, there are (1) exactly two defectives (2) atmost three defectives (3) atleast two defectives. (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) Given the following joint density function

$$f(x, y) = \begin{cases} \dfrac{8}{k} xy, & 0 \le x \le y \le 2 \\ 0, & otherwise \end{cases}$$

Find   (1) value of k,   (2) marginal density functions,

(3) $P(X \le 1/Y < 3/2)$,   (4) $P(X + Y \le 1)$.

(16)

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

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

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

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

13. (a) A tea company appoints four salesman A, B, C and D and observes their sales in three seasons-summer, winter and monsoon. The figures (in lakhs) are given in the following table:

	A	B	C	D
Summer :	36	36	21	35
Winter :	28	29	31	32
Monsoon :	26	28	29	29

(i) Do the salesman significantly differ in performance?

(ii) Is there significant difference between the seasons? (16)

Or

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

$B90$	$E80$	$C134$	$A112$	$D92$
$E85$	$D84$	$B70$	$C141$	$A82$
$C110$	$A90$	$D87$	$B84$	$E69$
$A81$	$C125$	$E85$	$D76$	$B72$
$D82$	$B60$	$A94$	$E85$	$C88$

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

(16)

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14. (a) A petrol pump station has 4 pumps. The service times follow the exponential distribution with a mean of 6 minutes and cars arrive for service in a poisson process at the rate of 30 cars per hour. Then

        (i)   what is the probability that an arrival would have to wait in line?

        (ii)   Find the average waiting time in the queue, average time spent in the system and the average number of cars in the system.

        (iii) For what percentage of time would a pump be idle on an average.

(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,

    (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)

15. (a) Derive Pollaczek-khinchine formula of M/G/1 queue.   (16)

Or

(b) A TVS company in madurai containing a repair section shared by large number of machines has 2 sequential stations with respective service rates of 3 per hour and 4 per hour. The cumulative failure rate of all the machines is 1 per hour. Assuming that the system behavior can be approximated by the above 2 stage tendon queue, calculate

    (i)   the probability that both service stations are idle

    (ii) the average number of machines in the repair section.

    (iii) the average repair time including the waiting time.

    (iv) the bottleneck of the repair facility.   (16)

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