Reg. No. :

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M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

First Semester

Computer Networks

MA 9219/MA 9329/MA 904/UMA 9128 — OPERATIONS RESEARCH

(Common to M.Tech. Chemical Engineering/M.E. Computer Science and Engineering/M.E. Software Engineering/M.E. Computer Networking and Engineering/M.E. Network Engineering/M.Tech. Information Technology)

(Regulation 2009)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define steady state.

2. In $(M/M/3):(\infty/FIFO)$ queueing model, $\frac{\lambda}{\mu C} = \frac{2}{3}$. Find the average number of customer in the non empty queue.

3. Write down Pollaczek – Kinchine formula.

4. Define closed queueing network.

5. Define pseudo random number.

6. Define Monte Carlo simulation technique.

7. Solve the following linear programming problem graphically :

   Maximize $z = x + y$,

   Subject to $2x + y \leq 6$,

   $x + 2y \leq 6$,

   $x, y \geq 0$.

8. How do you convert the maximization assignment problem into a minimization one?

9. State the Kuhn–Tucker necessary and sufficient conditions in non linear programming.

10. Define Quadratic programming problem.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) A T.V. repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? (8)

(ii) A supermarket has two girls ringing up sales at the counters. If the service time for each customer is exponential with mean 4 minutes and if the people arrive in Poisson fashion at the rate of 10 per hour. What is the probability of having to wait for service? What is the expected percentage of idle time for each girl? (8)

Or

(b) (i) Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines one of which is reserved for shunting purposes), calculate the probability that the yard is empty and find the average queue length. (8)

(ii) 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. What is the probability that an arrival would have to wait in line? Find the average waiting time, average time spent in the system and the average number of cars in the system. (8)

12. (a) (i) An automatic car wash facility operates with only one bay. Cars arrive according to a Poisson distribution with a mean of 4 cars/hour and may wait in the facility's parking lot if the bay is busy. Find L_s, L_q, W_s, W_q if the service time constant and equal to 10 minutes. Also find L_s, L_q, W_s, W_q if the service time follows uniform distribution between 8 and 12 minutes.

(ii) For a 2 stage (service point) sequential queue modal with blockage compute L_s, W_s if $\lambda = 1$, $\mu_1 = 1$ and $\mu_2 = 2$.

Or

(b) (i) In a car manufacturing plant, a loading crane takes exactly 10 minutes to load a car into a wagon and again to come back to position to load another car. If the arrival of cars is Poisson with air average of 1 every 20 minutes, calculate the average waiting time of a car.

(ii) A repair facility shared by a large number of machines has 2 sequential stations with respective service rates of 2 per hour and 3 per hour. The cumulative failure rate of all the machines is 1 per hour. Assuming that the system behavior may be approximated by the 2 stage tandem queue, find the average repair time including the waiting time. Also find time probability that both the service stations are idle.

13. (a) A bakery keeps stock of a popular brand of cake. Previous experience shows the daily demand pattern for the item with associated probabilities as giver, below :

Daily Demand (number)	:	0	10	20	30	40	50
Probability	:	0.01	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random numbers to simulate the demand for next 10 days. Random numbers : 25, 39, 65, 76, 12, 05, 73, 89, 19, 49. Also estimate the daily demand for the cakes on the basis of simulated data.

Or

(b) A dentist schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probability and time actually needed to complete the work.

Category of service	Time required(minutes)	Probability of category
Filling	45	0.40
Crown	60	0.15
Clearing	15	0.15
Extracting	45	0.10
Checking	15	0.20

Simulate the dentist's clinic for four hours anti determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8.00 am. Use the following random numbers for handling the above problem : 40, 82, 11, 34, 25, 66, 17, 79.

14. (a) Use simplex method to minimize $z = x_2 - 3x_3 + 2x_5$

Subject to $3x_2 - x_3 + 2x_5 \leq 7$,

$-2x_2 + 4x_3 \leq 12$,

$-4x_2 + 3x_3 + 8x_5 \leq 10$,

$x_2, x_3, x_5 \geq 0$.

Or

(b) Find the optimal transportation cost of the following matrix, using least cost method for finding the initial solution.

Market

		A	B	C	D	E	Supply
	P	4	1	2	6	9	100
Factory	Q	6	4	3	5	7	120
	R	5	2	6	4	8	120
	Demand	40	50	70	90	90	

15. (a) Using Lagrange's multiplier method, solve the Non Linear programming problem

Minimize $z = x_1^2 + x_2^2 + x_3^2$,

Subject to $4x_1 + x_2^2 + 2x_3 = 14$.

Or

(b) Solve the Non Linear Programming problem :

Maximize $z = 2x_1^2 + 12x_1x_2 - 7x_2^2$

Subject to the constraint : $2x_1 + 5x_2 \leq 98$

$x_1, x_2 \geq 0$.