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Question Paper Code : 81756

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

First Semester

Computer Science and Engineering

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

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

(Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Determine average arrival rate per hour and average inter arrival time in hours for the cases given here :

   (a) Two arrivals occur every 10 minutes

   (b) Average interval between successive arrivals is 30 minutes.

2. Write Little's formula and the relation between W_s and W_q.

3. Write the expression of L_s, L_q in $(M/G/1):(\infty/GD)$ queuing model.

4. Distinguish open and closed network of queues with examples.

5. Define Monte Carlo simulation.

6. How do you compute waiting time in the system and in the queue of an entity in the process of simulation?

7. How do you conclude problem is infeasible while solving a linear programming problem and in graphical method?

8. Costs of assignment for employing 4 workers to complete 4 jobs are given. Find the optimal assignment policy.

		Jobs			
		1	2	3	4
Worker	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	7
	D	5	11	9	2

9. For what type of non linear programming problem, Lagvangean method is used? Write the Lagrangean function.

10. Write the Khun – Tucker conditions for the NLP problem.

Max $Z = 3x_1^2 + 14x_1x_2 - 8x_2^2$

Subject to $3x_1 + 6x_2 \leq 72, x_1, x_2 \geq 0$.

PART B — (5 × 16 = 80 marks)

11. (a) Visitor's parking at a local hotel on a high way is limited to 5 spaces (Car) only. Cars making use of this space arrive according to a Poisson distribution at the rate of 6 in an hour. Eating time of visitors is exponentially distributed with mean 30 minutes. Visitors who can't find an empty space may temporarily wait inside the lot until a parked car leaves. Temporary space can hold 3 cars. Other cars with no parking on temporary space will go elsewhere. Determine the following :

(i) P_n, the probability of having n cars in the system

(ii) Effective arrival rate

(iii) Average number of cars in the lot

(iv) Average time a car waits for a parking space

(v) Occupancy of the parking spaces (average space used)

(vi) Average utilization of parking spaces. (16)

Or

(b) Derive L_q, L_s, W_s, W_q for single server queue where arrivals are Poisson, service is exponential and there is no limit on the size of the queue.

12. (a) (i) A repair facility shared by a large number of machines has two sequential stations with respective rates 1 and 2 per hour. The cumulative failure rate of all the machines is 0.5 per hour. Assume the system behaviour is two stage tandem queue (open), determine the average repair time. (8)

(ii) Discuss open and closed queue of jobs for a central server. (8)

Or

(b) (i) An automatic car wash facility operates with one bay. Cars arrive according to Poisson distribution, with a mean of 4 in an hour and may wait in the facility's parking lot if the bay is busy. If the service time is constant and is 10 min find L_s, L_q, W_s, W_q. (10)

(ii) In the above problem if each car has two stages of cleaning each stage requiring 5 mins, find P. Assume service times to be exponential with mean 5 min. (6)

13. (a) (i) Demonstrate Monte Carlo simulation in a problem of your choice. (10)

(ii) Distinguish discrete, continuous models and also deterministic, stochastic models with an examples. (6)

Or

(b) Assume inter arrival, service times of 15 customers and hand simulate the queue to gather the statistics of average wait time in the queue, average queue length, occupancy of the server. Assume one server is available and service pattern is FIFO.

14. (a) (i) In our daily diet, protein, fat, carbohydrate are required with a minimum of 5, 2, 3 units respectively. The table next gives the availability of these essential things in 3 food items. Set up a linear programming problem. (6)

Food	Yield/Unit			Cost/Unit
	Protein	Fat	Carbohydrate	
Bread	4	1	2	12
Butter	3	2	1	60
Milk	3	2	1	7
Minimum requirement	5	2	3	

(ii) Min $Z = 3x_1 + 2x_2$ subject to $5x_1 + x_2 \geq 10$, $x_1 + x_2 \geq 6$, $x_1 + 4x_2 \geq 12$, $x_1, x_2 \geq 0$ using two phase method. (10)

Or

(b) Solve, using a graph the following LPP,

(i) Min $Z = 5x_1 + 2x_2$ subject to $3x_1 + x_2 \geq 3$, $3x_1 - 2x_2 \leq 6$, $x_1 + x_2 \leq 4$, $x_1, x_2 \geq 0$. (8)

(ii) Find the minimum transportation cost of the problem given below. (8)

		Destination			
		X	Y	Z	Availability
Source	A	8	7	3	60
	B	3	8	9	70
	C	11	3	5	80
Demand		50	80	80	210

15. (a) (i) Solve the following non linear programming problem using Lagrangean method. (8)

Min $Z = 2x_1^2 - 3x_2^2 + 18x_2$

Subject to $2x_1 + x_2 = 8, x_1, x_2 \geq 0.$

(ii) Discuss the procedure of solution of an NLP by quadratic programming. (8)

Or

(b) Solve the following NLP using Wolfe's method.

Max. $Z = 40x_1 + 6x_2 - 4x_1x_2 - 2x_1^2 - 8x_2^2$

Subject to $6x_1 + 2x_2 \leq 36$

$x_1, x_2 \geq 0.$ (16)