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CS-51

03313

ADCA / MCA (II YEAR)

Term-End Examination

December, 2010

CS-51 : OPERATIONS RESEARCH

Time : 3 hours *Maximum Marks : 75*

Note : *Question number **1** is **compulsory**. Attempt **any three** more questions from questions numbered **2** to **5**.*

1. (a) A furniture maker has 6 units of wood and 28 hours of time available with him. He prepares two Items I and II. Item I requires 2 units of wood and 7 hours of time while Item II requires I unit of wood and 8 hours of time. The profit on Items I and II are Rs.120 and Rs.80 respectively. Formulate this problem as an Integer linear programming problem for determining the number of Items I and II the furniture maker should prepare so as to maximize his profit. No need to solve this problem. 5

(b) Three workers W_1, W_2, W_3 are to be employed for doing three jobs J_1, J_2, J_3. Each worker is to be assigned one and only one job. The payments in rupees to be made to them for doing different jobs differ and are shown in the table below : 5

	Jobs		
Workers	J_1	J_2	J_3
W_1	500	700	400
W_2	300	600	500
W_3	200	300	400

Find the optimal assignment which minimizes the total payment to be made to the workers.

(c) Mention and describe any four techniques of Operations Research. 4

(d) Explain the simulation technique. Give reason for the need to use it. 4

(e) Explain the terms : inventory, holding cost, lead time, ordering cycle. 4

(f) Machines arrive in a Poisson fashion at a single server repair shop at an average rate of 2 machines per hour. The repair time has an exponential distribution with a mean repair time of 15 minutes for one machine. Answer the following : 8

(i) Probability that there are x machines at the shop.

(ii) Probability that there is no machine for repair at the shop.

(iii) Expected time in hours spent by a machine in the repair shop leaving after repair.

2. (a) Use the simplex method to solve the problem 10

Maximize $Z = x_1 - x_2$

Subject to

$x_1 + x_2 \leq 2$

$3x_1 - x_2 \leq 3$

$x_1, x_2 \geq 0$

(b) Describe the queueing problem. Explain the terms : server, time spent in the queue, quene discipline in the context of a queueing model. 5

3. (a) Write Kuhn-Tucker conditions for the problem 8

Minimize $Z = -4x_1 - 6x_2 + 2x_1^2 + 2x_1x_2 + 2x_2^2$

Subject to

$x_1 + 2x_2 \leq 2$

$x_1, x_2 \geq 0$

After this, obtain the linear programming problem with the restricted basis conditions, whose optimal solution would yield the solution of the given problem.

(b) Find an initial basic feasible solution of the transportation problem given below using the least cost method. Hence find its optimal solution. 7

Sources	Destinations			Availability
	D_1	D_2	D_3	a_i
S_1	2	4	5	20
S_2	6	5	8	30
S_3	1	5	9	50
Requirement b_j	30	10	60	

4. (a) Give definition of a convex set and tell two regions in the *xy*-plane out of which one is convex and the other one is not convex. Also give definition of multiple solution (which is also known as alternative solution). Write a linear programming problem in two variables which has multiple solution. 8

(b) Find the dual of the problem : 7

Minimize $Z = x_1 - x_2 + x_3 + x_4$

Subject to $x_1 + x_2 - x_3 = 1$

$x_1 + 2x_2 - 4x_4 \leq 3$

$x_1, x_2, x_3, x_4 \geq 0$

5. (a) Find the saddle point solution mentioning the optimal strategies of the players A and B with the value of the game. The pay off matrix of the player A is given below : 6

Strategies of B / Strategies of A	B_1	B_2	B_3	B_4
A_1	8	6	2	8
A_2	8	9	4	5
A_3	7	5	3	5

(b) Use dynamic programming technique to solve the LPP 9

Maximize $Z = 3x_1 + 5x_2$

Subject to

$x_1 \leq 4$

$x_2 \leq 6$

$3x_1 + 2x_2 \leq 18$

$x_1, x_2 \geq 0.$