ADCA / MCA (II YEAR)

Term-End Examination

June, 2011

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.*

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1. (a) There are two types of foods A_1 and A_2. Food A_1 has 700 calories, contains 10 grams of protein and costs Rs.75 per unit whereas food A_2 has 500 calories, contains 35 grams of protein and costs Rs.100 per unit. It is required that the diet should have at least 3100 calories and contain at least 100 grams of protein. Formulate this problem as a linear programming problem for determining the number of units of foods A_1 and A_2 so as to minimize the cost of the diet. (No need to solve the problem) **5**

(b) Three jobs J_1, J_2, J_3 are to be assigned to three machines M_1, M_2, M_3. Each of the jobs is to be assigned to one and only one machine. Expenses incurred in doing jobs on different machines differ and are shown in the table given as follows : **5**

Jobs	Workers		
	1	2	3
1	30	40	20
2	20	10	40
3	60	20	70

Find the optimal assignment which minimizes the total expenses incurred in doing the jobs. Also write the total expenses incurred for the optimal assignment.

(c) Explain the terms "Linear Programming" and "Games Theory", with examples. **4**

(d) Explain the simulation technique indicating the situation where its use is warranted. **4**

(e) Explain the terms : Inventory control, Deterministic demand, Probabilistic demand, Economic Order Quantity (EOQ). **4**

(f) In a ration shop with one server, the arrival time of customers has a Poisson distribution with the average arrival rate of 1 customer per minute while the service time of the customers has an exponential distribution with the average service rate of 2 customers per minute. Compute the following showing all the steps. **8**

(i) The probability that there are n (n = 0,1, 2, ...) customers at the shop at any time.

(ii) The average time a customer spends at the shop to get his/her ration.

(iii) The probability that the server is busy.

2. (a) Apply simplex method to solve the following problem : **10**

Maximize $y_0 = -y_1 + 9y_2$

Subject to $3y_1 + y_2 \leq 6$

$y_1 - y_2 \leq 2$

$y_1, y_2 \geq 0$

(b) Describe a queuing system. Explain the terms : Inter arrival time, Queue discipline, waiting time of a customer in the queueing system in the context of a queuing system. **5**

3. (a) Write Kuhn-Tucker conditions for the problem given as follows : **7**

Minimize : $y_0 = y_1^2 + 2y_2^2 - 2y_1 - 4y_2 + 4$

Subject to : $y_1 + y_2 \leq 3$

$y_1, y_2 \geq 0$

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

(b) Using the Least Cost Entry Method to find an initial basic feasible solution, solve the transportation problem minimizing the total cost of transportation given below : **8**

		Destinations			Availability
		D_1	D_2	D_3	
Sources	S_1	$\boxed{2}$	$\boxed{1}$	$\boxed{3}$	20
	S_2	$\boxed{5}$	$\boxed{4}$	$\boxed{1}$	30
	S_3	$\boxed{6}$	$\boxed{7}$	$\boxed{8}$	40
Requirment by		25	15	50	

4. (a) Explain the terms : convex set and its extreme point. Write a simple linear programming problem in two decision variables whose feasible region in convex and has extreme points. Draw a figure showing them there in. 8

(b) For the primal problem given as follows : 7

Minimize : $Z = 5x_1 + 6x_2$

Subject to :

$$x_1 + x_2 \leq 2$$
$$4x_1 + x_2 = 3$$
$$x_1,\ x_2 \geq 0,$$

write its dual in two variables out of which one is unrestricted in sign and the other one is non negative. Also write the dual of the above primal problem and show that it is identical with the primal problem.

5. (a) Find the saddle point solution mentioning the optimal strategies for the Players X and Y together with the value of the game. The payoff matrix for the Player X is as given as follows : 6

		Strategies for Player Y				
Strategies for player X		Y_1	Y_2	Y_3	Y_4	Y_5
	X_1	11	2	12	0	3
	X_2	9	8	9	11	10
	X_3	10	7	11	7	−6

(b) Use dynamic programming technique to find the point (x, y) in the first quadrant on the curve $4x^2 + 9y^2 = 36$ nearest the origin. Also write the distance of the point on the curve from the origin. 9