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CS-51

ADCA / MCA (II YEAR)

Term-End Examination

00620

December, 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**.*

1. (a) A company produces two types of Alloys A_1 and A_2. Alloy A_1 contains 50% copper and 50% zinc where as Alloy A_2 contains 75% copper and 25% zinc. Net profits are Rs. 6000 per ton on A_1 and Rs. 5000 per ton on A_2. The daily supply to the company of copper is 15 tons and that of zinc is 10 tons. Formulate this problem as a linear programming problem for determining the number of tons of Alloys A_1 and A_2 should be produced so as to maximize the daily net profit (No need to solve this problem) 5

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

Job	Workers		
	1	2	3
1	40	30	20
2	10	50	40
3	30	40	40

Find the optimal assignment which minimizes the total payment to workers for doing the jobs. Also write the total payment for the optimal assignment.

(c) Explain the terms "Non-linear Programming" and "Integer Programming". 4

(d) What is simulation ? Indicate the reasons for using it. 4

(e) Explain the terms : Inventory, Ordering cycle, lead time, stock out cost. 4

(f) In a TV repair shop with one server, TVs arrive at the shop in a Poisson fashion at the average rate of 2 TVs per hour while the repair time of TVs has an exponential distribution with the average repair rate of 4 TVs per hour. Compute the following : 8

(i) The probability that these are n ($n=0, 1, 2, \ldots$) TVs at any time.

(ii) Average number of TVs at the shop.

(iii) The probability that the server is idle.

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

$$\text{Minimize } x_0 = x_1 - x_2$$

Subject to

$$2\,x_1 + x_2 \leq 4$$

$$2\,x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

(b) Describe a queueing system. Explain the terms : Server, Kendall's notation, time spent by a customer in the queueing system in the content of a queueing system. **5**

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

$$\text{Minimize } x_0 = x_1^2 + x_2^2 - 2x_1 - 2x_2 + 2$$

Subject to

$$x_1 + 2\,x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

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

(b) Using the North West Corner Method to find an initial basic feasible solution, solve the transportation problem minimizing the total cost of transportation given as follow : 8

Destinations					
		D_1	D_2	D_3	Availability a_i
Sources	S_1	$\boxed{1}$	$\boxed{3}$	$\boxed{6}$	10
	S_2	$\boxed{4}$	$\boxed{1}$	$\boxed{10}$	30
	S_3	$\boxed{2}$	$\boxed{1}$	$\boxed{6}$	40
	Requirement b_j	20	25	35	

4. (a) Explain the terms : unbounded solution and multiple solutions in the content of linear programming problem. Then write two simple linear programming problems in two decision variables out of which one has an unbounded solution and the other one has multiple solutions. 8

(b) For the primal problem 7

$$\text{Maximize } z = 3\,x_1 - 4x_2$$

subject to $-x_1 + 3x_2 = 7$

$$-x_1 + 2x_2 = 3$$

$$x_1,\ x_2 \geq 0,$$

Write its dual in two variables both of which are unrestricted in sign. Also write the dual of 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	13	3	-1	4	3
	X_2	2	7	1	3	4
	X_3	6	10	0	8	6

(b) Use dynamic programming technique to find the point (x, y) in the first quadrant on the straight line $3x + 2y = 6$ nearest the origin. Also write the distance of the point on the line nearest the origin. 9