CS-51

ADCA / MCA (II Year)

Term-End Examination

December, 2007

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 manufacturer produces machines of Types I and II. Each machine of Type I requires 4 hours of grinding and 2 hours of polishing, whereas each machine of Type II requires 2 hours of grinding and 4 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder and each polisher works 40 hours a week. Profit on one machine of Type I is Rs. 30 and the profit on one machine of Type II is Rs. 40. Whatever is produced is sold in the market. Formulate this problem as an Integer Linear Programming Problem to find how many machines of Types I and II should be produced so as to maximize the profit per week. No need to solve the formulated problem. 5

(b) In a computer centre, 3 programmes A_1, A_2, A_3 are are to be assigned to 3 programmers P_1, P_2, P_3 whose times in writing programmes differ and are shown in the table below.

	P_1	P_2	P_3
A_1	30	70	10
A_2	50	60	20
A_3	50	50	30

Find the optimal assignment that minimizes the total time in writing the programmes. 5

(c) Describe the historical background and scope of Operations Research in brief. 4

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

(e) Explain the terms : inventory, set-up cost, stock out cost, economic order quantity. 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 :

(i) The probability that there are n (n = 0, 1, ...) 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. 8

2. (a) Apply the simplex method to solve the problem

Maximize $z = 2x_1 - x_2$

subject to

$$x_1 + x_2 \leq 2$$
$$-x_1 + 2x_2 \leq 2$$
$$x_1, x_2 \geq 0$$

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(b) Describe the queueing problem. Explain the terms : inter-arrival time, time spent in the queueing system, queue discipline in the context of a queueing model. *5*

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

Minimize $z = x_1^2 + x_2^2 - 2x_1 - 2x_2 + 2$

subject to

$$x_1 + 2x_2 \leq 2$$
$$x_1, x_2 \geq 0$$

and hence solve it. *8*

(b) Find an optimal solution of the transportation problem given below using the North West Corner Method to find an initial basic feasible solution.

		Destinations			
		1	2	3	Availability
Sources	1	2	6	3	40
	2	4	5	7	60
	3	6	3	2	30
Requirement		30	50	50	

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4. (a) Explain the terms ; unique and multiple optimal solutions in the context of linear programming. Write two simple linear programming in two variables out of which one has a unique optimal solution and the other one has multiple optimal solutions. *8*

(b) Write the dual of the problem

Maximize $z = 5x_1 + 12x_2 + 4x_3$

subject to

$$x_1 + 2x_2 + x_3 \leq 5$$

$$2x_1 - x_2 + 3x_3 = 2$$

$$x_1, x_2, x_3 \geq 0$$ *7*

5. (a) Determine the saddle point solution indicating the strategies for the players A and B together with the value of the game. The payoff matrix for the player A is given below :

	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

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(b) Use dynamic programming technique to find the point (y_1, y_2) $(y_1, y_2 \geq 0)$ on the curve $4y_1^2 + 9y_2^2 = 36$ which is nearest the origin. *9*