

ADCA / MCA (II Year)

Term-End Examination

June, 2008

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) Patients arrive at a doctor's clinic at random and the average rate of arrival is 5 per hour. Determine the probability that during a period of one hour, there is no arrival. Also find the probability that during one hour there are more than 2 arrivals. You may assume that the number of arrivals during an hour follows a Poisson distribution. 5
- (b) If S_1 and S_2 are two convex sets, check whether 4
- (i) $S_1 \cap S_2$ will always be convex.
- (ii) $S_1 \cup S_2$ will always be convex.
- (c) Suppose A is an $n \times n$ integer matrix whose entries are 0, 1 and -1. State the rule to determine if A is a unimodular matrix. 5
- (d) Describe the ABC and VED classification of items in an inventory and its use in inventory management. 8

- (e) List the major limitations of the PERT model. 4
- (f) List the steps involved in the most general case of the simulation process. 4

2. (a) Derive the Kuhn – Tucker conditions for the following problems : 7

$$\text{Maximize : } z = (2x_1 - 5)^2 - (2x_2 - 1)^2$$

$$\text{Subject to } x_1 + 2x_2 \leq 2$$

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

- (b) Using the concept of dominance, reduce the following 3×3 matrix to a two player zero sum matrix game and solve for the optimal strategies of the players and value of the game. 8

	Player II		
Player I	1	-2	3
	-2	-3	1
	4	3	2

3. (a) The pattern of demand for a seasonal product is as follows : 9

Demand (in units)	Probability
1	0.05
2	0.10
3	0.15
4	0.20
5	0.20
6	0.15
7	0.10
8	0.05

The cost of product is Rs. 80 per unit and selling price is Rs. 120. How many units should be purchased for the season so as to maximize expected profit ? Also, if the salvage price of the product is Rs. 20, then would there be any change in the decision on the number of units to be purchased ?

- (b) A farmer buys a quantity of cabbage seeds from a company that claims that approximately 80% of the seeds will germinate if planted properly. If 4 seeds are planted, what is the probability that
- (i) exactly two will germinate ?
- (ii) at least two will germinate ?
4. Solve the following LP problem by using the two phase method :

6

15

$$\text{Minimize : } z = x_1 + x_2$$

$$\text{s.t. } 2x_1 + 4x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

$$\text{and } x_1, x_2 \geq 0$$

5. (a) A big housing colony replaces the common neon lights at the rate of 16 per day. It costs Rs. 100/- to place an order. A neon light kept in storage costs Rs. 2/- a day. Assume that there is no lead time and that shortages are not allowed. What is the EOQ ? How frequently should the orders be placed ? What is the optimal cost (variable costs only) ? 7
- (b) Define the following terms and give one example of each : 8
- (i) Extreme point
 - (ii) Mixed strategy
 - (iii) Deviation variable
 - (iv) Expectation of a random variable