ADCA / MCA (II Year)

Term-End Examination

June, 2010

01149

CS-51 : OPERATIONS RESEARCH

Time : 3 hours *Maximum Marks : 75*

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

1. (a) A company operates mines I, II, III and ore produced from each mine is separated into two grades. The company has a committment to produce at least 54 tons of high grade ore and 65 tons of low grade ore in a week of seven days. The production of two grades of ore and operating cost per day of each mine is shown in the Table below : **5**

Mines	High grade ore in tons per day	Low grade ore in tons per day	Operating cost in rupees per day
I	4	4	2000
II	6	4	2200
III	1	6	1800

Formulate this problem as an Integer linear programming problem for determining the number of days each mine should be operated during a week so as to fulfil its committment at the minimum total operating cost. No need to solve the problem.

(b) In a factory, there are three locations I, II, III where jobs of manufacturing, assembling, packaging the product are being done. The costs of accomplishing different jobs at different locations differ and are shown in the table below : **5**

Location

Jobs	**I**	**II**	**III**
Manufacturing	1800	1500	1600
Assembling	1600	1100	1500
Packaging	900	1000	1200

Find the optimal assignment that minimizes the total cost of accomplishing the jobs.

(c) Explain the terms : inventory, set - up cost, stock out cost, economic order quantity. **4**

(d) What is simulation ? Describe one situation where simulation has been used or can be used. **4**

(e) Describe the historical background and scope of Operations Research. **4**

(f) Customers arrive in a Poisson fashion at a single server service station at an average rate of 4 customers per hour. The service **8** time has an exponential distribution with mean 10 minutes for one customer. Answer the following :

(i) Probability that there is no customer at the service station.

(ii) Probability that the service station is busy.

(iii) Expected number of customers in the system.

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

Minimize $z = x_1 - x_2$

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 : maximum size of a queue, inter - arrival time, service time in the content of a queuing model. **5**

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

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

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) Obtain an optimal solution of the transportation problem given below using North West Corner Rule to find an initial basic feasible solution. 7

	Destinations			Availability ai
Sources	D_1	D_2	D_3	
S_1	2	4	10	20
S_2	6	7	8	30
S_3	1	5	9	50
Requirement bj	30	10	60	

4. (a) Explain the terms : infeasible and unbounded solutions in the content of linear programming. Write two simple linear programming problems in two variables out of which one has infeasible solution and the other one has unbounded solution. 8

(b) Find the dual of the problem : 7

Minimize $z = 2x_1 + x_2 + x_3 - x_4$

Subject to $x_1 + x_2 - 2x_3 + 4x_4 \leq 8$

$$x_1 + x_2 + 0x_3 = 2$$

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

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 A \ Strategies of B	B1	B2	B3	B4
A1	8	-2	9	-3
A2	6	5	6	8
A3	-2	4	-9	5

(b) Use dynamic programming Technique for solving : **9**

Maximize $5x + 9y$

Subject to $-x+5y \leq 3$

$5x+3y \leq 27$

$x, y \geq 0.$