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06CS661

Sixth Semester B.E. Degree Examination, June-July 2009
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define : i) Feasible solution ii) Feasible region iii) Optimal solution **(06 Marks)**

b. A manufacturer produces three models I, II, III of certain product using raw materials A and B. The following table gives the data for the problem :

Raw material	Requirements per unit			Availability
	I	II	III	
A	2	3	5	4000
B	4	2	7	6000
Minimum demand	200	200	150	-
Profit per unit (Rs)	30	20	50	-

Formulate the problem as a linear program model. **(07 Marks)**

c. Using graphical method solve the LPP.

Maximize $Z = 5x_1 + 4x_2$

Subject to $6x_1 + 4x_2 \leq 24$

$x_1 + 2x_2 \leq 6$

$-x_1 + x_2 \leq 1$

$x_2 \leq 2, \quad x_1, x_2 \geq 0$ **(07 Marks)**

2 a. Define slack variable and surplus variable. **(04 Marks)**

b. Find all the basic solutions of the following system of equations identifying in each case the basic and non basic variables.

$2x_1 + x_2 + 4x_3 = 11, \quad 3x_1 + x_2 + 5x_3 = 14$ **(06 Marks)**

c. Using simplex method of tabular form solve the LPP.

Maximize $Z = 4x_1 + 3x_2 + 6x_3$

Subject to $2x_1 + 3x_2 + 2x_3 \leq 440$

$4x_1 + 3x_3 \leq 470$

$2x_1 + 5x_2 \leq 430$

$x_1, x_2, x_3 \geq 0$ **(10 Marks)**

3 a. Using two-phase method solve the LPP.

Minimize $Z = 7.5x_1 - 3x_2$

Subject to $3x_1 - x_2 - x_3 \geq 3$

$x_1 - x_2 + x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$ **(10 Marks)**

b. Using Big-M method solve the CPP.

Maximize $Z = 2x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$ **(10 Marks)**

4 a. Use Revised Simplex Method to solve the LPP.

Maximize $Z = 3x_1 + 5x_2$

Subject to $2x_1 \leq 4$

$2x_2 \leq 12$

$3x_1 + 2x_2 \leq 18$

$x_1, x_2 \geq 0$ **(10 Mark**

b. Explain : i) Weak duality property ii) Strong duality property

iii) Complementary solutions property **(06 Mark**

c. Write the dual of the following :

i) Maximize $Z = 6x_1 + 10x_2$

Subject to $x_1 \leq 14$

$x_2 \leq 16$

$3x_1 + 2x_2 \leq 18$

$x_1, x_2 \geq 0$

ii) Maximize $Z = \begin{pmatrix} 5 & 8 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$

Subject to $\begin{pmatrix} 1 & 2 \\ 1 & 3 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 5 \\ 10 \\ 20 \end{pmatrix}$

$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \geq \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ **(04 Mark**

PART – B

5 a. In Parametric Linear Programming explain about :

i) Systematic changes in the Cj parameters.

ii) Systematic changes in the bj parameters. **(08 Marks**

b. Using dual simplex method solve the LPP.

Maximize $Z = -3x_1 - 2x_2$

Subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \geq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \geq 3$

$x_1, x_2 \geq 0$ **(12 Marks**

6 a. The transporation costs per truck load of cement (in hundreds of rupees) from each plant t each project site are as follows :

Factories \ Project sites	1	2	3	4	Supply
1	2	3	11	7	6
2	1	0	6	1	1
3	5	8	15	9	10
Demand	7	5	3	2	17

Determine the optimal distribution for the company so as to minimize the tota transportation cost. **(12 Marks)**

b. Four jobs are to be done on four different machines. The cost (in rupees) of producing i^{th} jol on the j^{th} machine is given below :

		Machines			
		M_1	M_2	M_3	M_4
Jobs	J_1	15	11	13	15
	J_2	17	12	12	13
	J_3	14	15	10	14
	J_4	16	13	11	17

Assign the jobs to different machines so as to minimize the total cost. **(08 Marks)**

7 a. Solve the game whose payoff matrix to the player A is given below :

		B		
		I	II	III
A	I	1	7	2
	II	6	2	7
	III	5	2	6

(10 Marks)

b. Solve the following (2 x 3) game graphically.

			Y_1	Y_2	Y_3
			I	II	III
A	x_1	I	1	3	11
	$1 - x_1$	II	8	5	2

(10 Marks)

8 a. Use Tabu Search algorithm to find the optimal solution of **(08 Marks)**

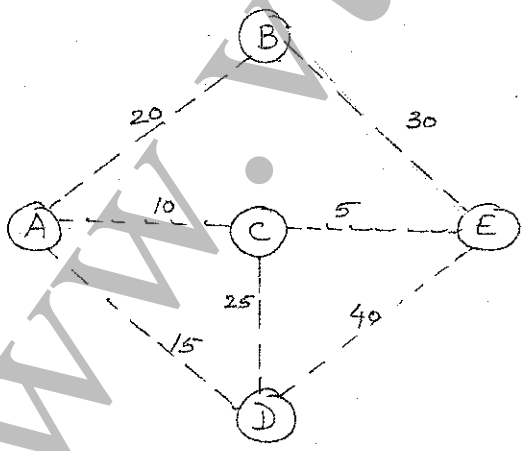

Fig. Q8 (a)

b. Give note on outline of a Basic Simulated Annealing Algorithm. **(06 Marks)**

c. Give note on outline of a Basic Genetic Algorithm. **(06 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.09/Jan.10
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. *Any missing data may be assumed suitably.*

Part - A

1 a. What is operations research? Mention six phases of an operations research study. **(05 Marks)**

b. Formulate a linear programming model for the problem given below. The Apex television company has to decide on the number of 27-inch and 20-inch sets to be produced at one of its factories. Market research indicates that at most 40 of the 27-inch sets and 10 of 20-inch sets can be sold per month. The maximum number of work hours available is 500 per month. A 27-inch set requires 20 work hours and 20-inch set requires 10 work hours. Each 27-inch set sold produces a profit of \$120 and each 20-inch produces a profit of \$80. A wholesaler agreed to purchase all the television sets produced if the numbers do not exceed the maxima indicated by market research. **(05 Marks)**

c. Use graphical method to solve the following LPP:

Maximize $z = 3x_1 + 5x_2$

Subject to $x_1 \le 4$

$2x_2 \le 12$

$3x_1 + 2x_2 \le 18$

$x_1 \ge 0,\ x_2 \ge 0$ **(05 Marks)**

d. Write the meaning of following terms with respect to a LPP. Give example for each:
i) Feasible solution. ii) Infeasible solution. iii) Feasible region.
iv) Optimal solution. v) CPF solution. **(05 Marks)**

2 a. Write four assumptions of linear programming. **(04 Marks)**

b. Write six key solution concepts of simplex method. **(06 Marks)**

c. Solve the following LPP using simplex method in tabular form:

Maximize $z = 5x_1 + 4x_2$

Subject to $6x_1 + 4x_2 \le 24$

$x_1 + 2x_2 \le 6$

$-x_1 + x_2 \le 1$

$x_2 \le 2$ and $x_1 \ge 0,\ x_2 \ge 0$ **(10 Marks)**

3 a. Using Big M method solve the following:

Minimize $z = 3x_1 + 2x_2 + x_3$

Subject to $x_1 + x_2 = 7$

$3x_1 + x_2 + x_3 \ge 10$

and $x_1 \ge 0,\ x_2 \ge 0,\ x_3 \ge 0$ **(12 Marks)**

b. Explain the typical steps in post optimality analysis for linear programming studies. **(08 Marks)**

4 a. Apply revised simplex method to solve the following problem:

Maximize $z = 4x_1 + 3x_2 + 6x_3$

Subject to $3x_1 + x_2 + 3x_3 \le 30$

$2x_1 + 2x_2 + 3x_3 \le 40$

and $x_1 \ge 0,\ x_2 \ge 0,\ x_3 \ge 0$ **(12 Marks)**

b. Explain key relationships between primal and dual problems. **(08 Marks)**

Part - B

5 a. Write a procedure for sensitivity analysis. **(08 Marks)**

b. Use dual simplex method to solve the following:

Maximize $z = -4y_1 - 12y_2 - 18y_3$

Subject to $y_1 + 3y_3 \geq 3$

$2y_2 + 2y_3 \geq 5$

and $y_1 \geq 0,\ y_2 \geq 0,\ y_3 \geq 0$ **(12 Marks)**

6 a. Suppose that England, France and Spain produce all the wheat, barley and oats in world. Th world demand for wheat requires 125 million acres of land devoted to wheat productior similarly, 60 million acres of land are required for barley and 75 million acres of land fo oats. The total amounts of land available for these purposes in England, France and Spai are 70 million acres, 110 million acres, 80 million acres respectively. The number of hour of labor needed in England, France and Spain to produce an acre of wheat is 18, 13 and 1(respectively. The number of hours of labor needed in England, France and Spain to produc an acre of barley is 15, 12 and 12 respectively. The number of hours of labor needed i England, France and Spain to produce an acre of oats is 12, 10 and 16 respectively. Th labor cost per hour in producing wheat is \$9.00, \$7.20 and \$9.90 in England, France an Spain respectively. The labor cost per hour in producing barley is \$8.10, \$9.00 and \$8.40 i England, France and Spain respectively. The labor cost per hour in producing oats is \$6.90 \$7.50 and \$6.30 in England, France and Spain respectively. The problem is to allocate lan use in each country so as to meet the world food requirement and minimize the total labo cost.

i) Formulate this problem as a transportation problem by constructing the appropriat parameter table.

ii) Starting with the north west corner rule, interactively apply the transportation simple method to obtain an optimal solution. **(12 Marks)**

b. Write different steps in Hungarian algorithm to solve an assignment problem. **(08 Marks)**

7 a. Explain basic characteristics of two person, zero sum game. For the game having following pay off table, determine the optimal strategy for each player by successively eliminating dominated strategies. Indicate the order in which you eliminate strategies. **(10 Marks)**

		Player – 2		
		1	2	3
Player - 1	1	1	2	0
	2	2	-3	-2
	3	0	3	-1

b. Explain how to construct a decision tree and how it is used for decision analysis. **(10 Marks)**

8 Explain briefly:

a. Metaheuristics, its nature, advantage and disadvantage.

b. Tabu search algorithm.

c. Simulated annealing algorithm.

d. Genetic algorithm. **(20 Marks)**

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