

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ECE) (2011 Batch Elective-III) (Sem.-7,8)

B.Tech.(ETE) (2011 Onwards Elective-III)

OPERATION RESEARCH

Subject Code : BTEC-918

Paper ID : [A3013]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

- a) Solve the following LP problem graphically $\text{Max } Z = 8x_1 + 7x_2$ subject to $3x_1 + x_2 \leq 66$, $x_1 + x_2 \leq 45$, $x_2 \leq 40$ and $x_1, x_2 \geq 0$
- b) Write a short note on sequencing decision problem for n jobs on two machines.
- c) Obtain the dual of the following problem. $\text{Min } Z = 3x_1 - x_2 + x_3$, subject to $2x_1 - 3x_2 + x_3 \leq 5$, $4x_1 - 2x_2 \geq 9$, $-8x_1 + 4x_2 + 3x_3 = 8$, $x_1, x_2 \geq 0$, x_3 is unrestricted.
- d) State and prove weak duality theorem.
- e) The simplex method has been applied to a certain linear problem and three optimal solutions have been reached $X_1 = (2, 1, 0, 5)$, $X_2 = (3, 0, 2, 4)$, $X_3 = (0, -6, 3, 3)$ Determine all the optimal solutions.
- f) State the Bellman's principle of optimality.
- g) Explain Maxi-Min and Mini-Max principle used in game theory.
- h) The Secretary of a school is taking bids on the city's four school bus routes. Four companies have made the bids as detailed in the following table

	Bids			
	Route 1	Route 2	Route 3	Route 4
Company 1	Rs. 4000	Rs. 5000	—	—
Company 2	—	Rs. 4000	—	Rs. 4000
Company 3	Rs. 3000	—	Rs. 2000	—
Company 4	—	—	Rs. 4000	Rs. 5000

Suppose each bidder can be assigned only one route. Use the assignment model to minimize the school's cost of running the four bus routes.

- i) Consider the LPP of maximization form, whose simplex table at some iteration is given below:

BV	x_1	x_2	x_3	x_4	Sol
$z_1 - c_1$	F	0	G	0	
x_2	B	1	4	0	D
x_4	-3	A	C	1	E

State the conditions on A, B, C, D, E, F and G in each of the following case so that the given statement is true.

- Current solution is optimal.
 - Given LPP has unbounded solution.
- j) A and B play game in which each has three coins, a 5 paise, a 10 paise and a 20 paise. Each player selects a coin without the knowledge of the other choice. If this sum of the coin is an odd amount A wins B's coin; if the sum is even, B wins A's coin. Find the best strategy for each player and the value of the game.

SECTION-B

2. Solve the following L.P. problem graphically:

$$\text{Max } Z = 8000x_1 + 7000x_2$$

$$\text{Subject to } 3x_1 + x_2 \leq 66; x_1 + x_2 \leq 45; x_1 \leq 20; x_2 \leq 40; x_1, x_2 \geq 0$$

3. Solve the following linear programming problem by dual simplex method

$$\text{Minimize } Z = x_1 + 2x_2 + 3x_3$$

$$\text{Subject to } x_1 - x_2 + x_3 \geq 4; x_1 + x_2 + 2x_3 \leq 8; x_2 - x_3 \geq 2 \text{ and } x_1, x_2, x_3, \geq 0$$

4. Obtain an initial basic feasible solution to the transportation problem

Ware house factory	W1	W2	W3	W4	Factory capacity
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Ware house requirement	5	8	7	14	

Is this solution an optimal solution? If not, obtain the optimal solution.

5. Solve the following (2×4) game

		B			
A		I	II	III	IV
	I	2	2	3	-1
	II	4	3	2	6

6. Using Dynamic programming, solve

$$\text{Min } Z = x_1^2 + x_2^2 + x_3^2 \quad \text{s.t. } x_1 + x_2 + x_3 \geq 15; x_1, x_2, x_3 \geq 0$$

SECTION-C

7. Six jobs go first over machine I and then over II. The order of completion of jobs has no significance. The following table gives the machine times in hours for six jobs on the two machines:

Job No.	1	2	3	4	5	6
Time on machine 1	5	9	4	7	8	6
Time on machine II	7	4	8	3	9	5

8. Solve the L.P.P. by Big-M method.

$$\text{Maximize } Z = 2x_1 - x_2 + x_3 + 50$$

$$\text{s.t. } 2x_1 + 2x_2 - 6x_3 \leq 16, 12x_1 - 3x_2 + 3x_3 \geq 6, -2x_1 - 3x_2 + x_3 \leq 4, x_1, x_2, x_3 \geq 0.$$

9. Solve the game whose pay-off matrix is given by

$$\begin{bmatrix} 3 & 2 & 4 & 0 \\ 2 & 4 & 2 & 4 \\ 4 & 2 & 4 & 0 \\ 0 & 4 & 0 & 8 \end{bmatrix}.$$