Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

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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 Max $Z = 8x_1 + 7x_2$ subject to $3x_1 + x_2 \le 66$, $x_1 + x_2 \le 45$, $x_2 \le 40$ and $x_1, x_2 \ge 0$

b) Write a short note on sequencing decision problem for n jobs on two machines.

c) Obtain the dual of the following problem. Min $Z = 3x_1 - x_2 + x_3$, subject to $2x_1 - 3x_2 + x_3 \le 5$, $4x_1 - 2x_2 \ge 9$, $-8x_1 + 4x_2 + 3x_3 = 8$, $x_1, x_2 \ge 0$, 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.

a) Current solution is optimal.

b) 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:

$Max\ Z = 8000x_1 + 7000x_2$

Subject to $3x_1 + x_2 \le 66; x_1 + x_2 \le 45; x_1 \le 20; x_2 \le 40; x_1, x_2 \ge 0$

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

$Minimize\ Z = x_1 + 2x_2 + 3x_3$

Subject to $x_1 - x_2 + x_3 \ge 4; x_1 + x_2 + 2x_3 \le 8; x_2 - x_3 \ge 2$ and $x_1, x_2, x_3, \ge 0$

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

A \ B	I	II	III	IV
I	2	2	3	–1
II	4	3	2	6

6. Using Dynamic programming, solve

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

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.

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

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

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

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