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10CS/IS661

Sixth Semester B.E. Degree Examination, June/July 2013
Operations Research

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define operations research. List and explain the various phases of an operations research study. **(08 Marks)**

b. A farmer has to plant two kinds of trees P and Q in a land of $400m^2$ area. Each P tree requires at least $25m^2$ and Q tree requires $40m^2$ of land. The annual water requirement of P tree is 30 units and of Q tree is 15 units per tree, while at most 3000 units of water is available. It is also estimated that the ratio of the number of Q trees to the number of P trees should not be less than 6/19 and should not be more than 17/8. The return per tree from P is expected to be one and half times as much as from Q tree. Formulate the problem as an LPP model. **(06 Marks)**

c. Use the graphical method to solve the following LPP.

Minimize $Z = 1.5x_1 + 2.5x_2$

Subject to the constraints $x_1 + 3x_2 \geq 3$,

$x_1 + x_2 \geq 2$

And $x_1, x_2 \geq 0$. **(06 Marks)**

2 a. Define basic solution and obtain all the basic solutions to the following system of linear equations:

$2x_1 + 3x_2 + 4x_3 = 10$,

$3x_1 + 4x_2 + x_3 = 12$

Also, classify the solutions into

i) Basic feasible solution

ii) Degenerate basic solution

iii) Non-degenerate basic feasible solution. **(07 Marks)**

b. Solve the following LPP using simplex method:

Maximize $Z = 10x_1 + 15x_2 + 8x_3$

Subject to the constraints

$x_1 + 2x_2 + 2x_3 \leq 200$,

$2x_1 + x_2 + x_3 \leq 220$,

$3x_1 + x_2 + 2x_3 \leq 180$,

$x_1 \geq 10$,

$x_2 \geq 20$,

$x_3 \geq 30$

and $x_1, x_2, x_3 \geq 0$. **(13 Marks)**

3 a. Solve the following LPP by two-phase simplex method:

Maximize $Z = 3x_1 - x_2$

Subject to the constraints

$2x_1 + x_2 \geq 2$,

$x_1 + 3x_2 \leq 2$,

$x_2 \leq 4$

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

b. Solve the following LPP by Big-M method:
Maximize $Z = -2x_1 - x_2$
Subject to the constraints
$3x_1 + x_2 = 3,$
$4x_1 + 3x_2 \geq 6,$
$x_1 + 2x_2 \leq 4$
and $x_1, x_2 \geq 0.$ **(10 Marks)**

4 a. Solve the following LPP by revised simplex method:
Maximize $Z = 2x_1 + x_2$
Subject to the constraints
$3x_1 + 4x_2 \leq 6,$
$6x_1 + x_2 \leq 3$
And $x_1, x_2 \geq 0$ **(12 Marks)**

b. Explain the following:
i) Weak duality property
ii) Strong duality property
iii) Complementary solutions property
iv) Complementary optimal solutions property. **(08 Marks)**

PART – B

5 a. Write any five key relationships between the primal and the dual problems. **(05 Marks)**

b. Write the duals of the following LPP's.
i) Maximize $Z = 7x_1 + 4x_2 + 5x_3$
Subject to the constraints
$2x_1 - 4x_2 + 3x_3 \leq 10,$
$x_1 + 3x_2 + x_3 \leq 6$
and $x_1, x_2, x_3 \geq 0.$

ii) Minimize $Z = 3x_1 + 2x_2 + x_3$
Subject to the constraints
$2x_1 - 3x_2 + x_3 \leq 5,$
$4x_1 - 2x_2 \geq 9,$
$-8x_1 + 4x_2 + 3x_3 = 8$
and $x_1, x_2 \geq 0$ and x_3 is unrestricted. **(07 Marks)**

c. Solve the following LPP by dual simplex method:
Minimize $Z = 2x_1 + 2x_2 + 4x_3$
Subject to the constraints
$2x_1 + 3x_2 + 5x_3 \geq 2,$
$3x_1 + x_2 + 7x_3 \leq 3,$
$x_1 + 4x_2 + 6x_3 \leq 5$
and $x_1, x_2, x_3 \geq 0.$ **(08 Marks)**

6 a. A company has 3 cement factories located in 3 cities X, Y and Z which supply cement to 4 project sites located in cities A, B, C and D. Each plant can supply 6, 1 and 10 truckloads of cement daily and the daily requirements of the projects are 7, 5, 3 and 2 truckloads respectively. The transportation cost (in thousands of rupees) per truck load of cement from each plant to each project site are shown below.

Plants \ Projects	A	B	C	D
X	2	3	11	7
Y	1	0	6	1
Z	5	8	15	9

Determine the optimal distribution of the company so as to minimize the total transportation cost. Use VAM method to find the initial BFS. **(12 Marks)**

b. Solve the following assignment problem:

Jobs \ Machines	M_1	M_2	M_3	M_4	M_5
J_1	11	17	8	16	20
J_2	9	7	12	6	15
J_3	13	16	15	12	16
J_4	21	24	17	28	26
J_5	14	19	12	11	13

(08 Marks)

7 a. Define the following with respect to games:
i) Pay-off
ii) Zero-sum game
iii) Saddle point. **(03 Marks)**

b. Solve the following game by Dominance principle:

Player A \ Player B	B_1	B_2	B_3	B_4
A_1	3	2	4	0
A_2	3	4	2	4
A_3	4	2	4	0
A_4	0	4	0	8

(06 Marks)

c. Solve the following game by graphical method:

Player A \ Player B	B_1	B_2	B_3	B_4
A_1	8	5	-7	9
A_2	-6	6	4	-2

(07 Marks)

d. Write a short note on decision trees. **(04 Marks)**

8 a. Write the outline of a basic tabu search algorithm. Explain it with the help of a minimum spanning tree problem with constraints. **(10 Marks)**

b. Write short notes on:
i) Simulated annealing; ii) Genetic algorithms. **(10 Marks)**

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