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10CS/IS661

# Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
## Operations Research

Time: 3 hrs. Max. Marks:100

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



### PART – A

1 a. What are different phases of operation research? Briefly explain phases of operations research study. **(08 Marks)**

b. Old hens can be brought at ₹50/each but young ones cost ₹100/- each. The old hens lay 3 eggs/week and young ones lay 5 eggs/week. Each egg sold at ₹2/-. A hen costs ₹5/week to feed. If a person has only ₹3000/- to spend for hens. Formulate the problem to decide how many of each kind of hen should he buy? Assume that he cannot house more than 50 hens. **(06 Marks)**

c. Define the following with respect to a LPP. Give example for each :
(i) Feasible solution
(ii) Feasible region
(iii) Infeasible solution **(06 Marks)**

2 a. Solve the following LPP by using graphical method:
Maximize $Z = 5x_1 + 4x_2$
Subject to $6x_1 + 4x_2 \le 24$
$x_1 + 2x_2 \le 6$
$-x_1 + x_2 \le 1$
$x_2 \le 2$
where $x_1, x_2 \ge 0$ **(08 Marks)**

b. What are methods of post optimality analysis of LPP? **(02 Marks)**

c. Solve the following LPP by using Simplex method.
Maximize $Z = 5x_1 + 3x_2$
Subject to $x_1 + x_2 \le 2$
$5x_1 + 2x_2 \le 10$
$3x_1 + 8x_2 \le 12$
where $x_1, x_2 \ge 0$ **(10 Marks)**

3 a. Solve the following by using Big-M method.
Maximize $Z = 6x_1 + 4x_2$
Subject to $2x_1 + 3x_2 \le 30$
$3x_1 + 2x_2 \le 24$
$x_1 + x_2 \ge 3$
where $x_1, x_2 \ge 0$ **(10 Marks)**

b. Solve the following LPP by using Two-phase Simplex method.
Maximize $Z = 5x_1 + 3x_2$
Subject to $2x_1 + x_2 \le 1$
$x_1 + 4x_2 \ge 6$
where $x_1, x_2 \ge 0$ **(08 Marks)**

c. Mention software packages used to solve LPP. **(02 Marks)**

4 a. Solve the following LPP by using revised Simplex method.
Maximize $Z = 2x_1 + x_2$
Subject to $3x_1 + 4x_2 \leq 6$
$6x_1 + x_2 \leq 3$
where $x_1, x_2 \geq 0$ **(10 Marks)**

b. Explain the following terms :
(i) Weak duality property (ii) Strong duality property (iii) Complimentary solution property. **(06 Marks)**

c. Write the dual of the following :

(i) Maximize $Z = 4x_1 + 10x_2 + 25x_3$
Subject to $2x_1 + 4x_2 + 8x_3 \leq 25$
$4x_1 + 9x_2 + 8x_3 \leq 30$
$6x_1 + 2x_3 \leq 40$
where $x_1, x_2, x_3 \geq 0$

(ii) Minimize $Z = 20x_1 + 40x_2$
Subject to $2x_1 + 20x_2 \geq 40$
$20x_1 + 3x_2 \geq 20$
$4x_1 + 20x_2 \geq 30$
where $x_1, x_2 \geq 0$

**(04 Marks)**

## PART – B

5 a. Briefly explain about sensitivity analysis. **(05 Marks)**

b. Explain primal-dual relationship with an example. **(05 Marks)**

c. Solve the following by using dual simplex method.
Minimize $Z = 2x_1 + 2x_2 + 4x_3$
Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 \leq 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
where $x_1, x_2, x_3 \geq 0$ **(10 Marks)**

6 a. Solve the following transportation problem by using (i) North-West corner method (ii) Vogel's approximation method.

| | | Destination 1 | 2 | 3 | 4 | Supply |
|---|---|---|---|---|---|---|
| Source | 1 | 3 | 1 | 7 | 4 | 300 |
| | 2 | 2 | 6 | 5 | 9 | 400 |
| | 3 | 8 | 3 | 3 | 2 | 500 |
| Demand | | 250 | 350 | 400 | 200 | |

**(10 Marks)**

b. Solve the following assignment problem.

| | | Subject $S_1$ | $S_2$ | $S_3$ | $S_4$ |
|---|---|---|---|---|---|
| Professor | $P_1$ | 2 | 10 | 9 | 7 |
| | $P_2$ | 15 | 4 | 14 | 8 |
| | $P_3$ | 13 | 14 | 16 | 11 |
| | $P_4$ | 3 | 15 | 13 | 8 |

Find the schedule so as to minimize the total subject preparation time for all subjects.
**(10 Marks)**

7 a. Explain following terms with example :
(i) Saddle point (ii) Value of the game (iii) Payoff matrix **(06 Marks)**

b. Solve the following game by dominance principle :

| | | Player B | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Player A | 1 | 2 | 5 | 10 | 7 | 2 |
| | 2 | 3 | 3 | 6 | 6 | 4 |
| | 3 | 4 | 4 | 8 | 12 | 1 |

**(07 Marks)**

c. Solve optimally using graphical method by considering the payoff matrix of player A as shown below:

| | | Player B | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Player A | 1 | 3 | 6 | 8 | 4 | 4 |
| | 2 | -7 | 4 | 2 | 10 | 2 |

**(07 Marks)**

8 Explain the following terms:
a. Metaheuristics, advantages and disadvantages
b. Tabu search algorithm
c. Genetic algorithm
d. Simulated annealing **(20 Marks)**

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