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06CS661

**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**
- What is operations research? Mention six phases of an operations research study. (05 Marks)
  - 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)
  - Use graphical method to solve the following LPP:  
 Maximize  $z = 3x_1 + 5x_2$   
 Subject to  $x_1 \leq 4$   
 $2x_2 \leq 12$   
 $3x_1 + 2x_2 \leq 18$   
 $x_1 \geq 0, x_2 \geq 0$  (05 Marks)
  - 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**
- Write four assumptions of linear programming. (04 Marks)
  - Write six key solution concepts of simplex method. (06 Marks)
  - Solve the following LPP using simplex method in tabular form:  
 Maximize  $z = 5x_1 + 4x_2$   
 Subject to  $6x_1 + 4x_2 \leq 24$   
 $x_1 + 2x_2 \leq 6$   
 $-x_1 + x_2 \leq 1$   
 $x_2 \leq 2$  and  $x_1 \geq 0, x_2 \geq 0$  (10 Marks)
- 3**
- Using Big M method solve the following:  
 Minimize  $z = 3x_1 + 2x_2 + x_3$   
 Subject to  $x_1 + x_2 = 7$   
 $3x_1 + x_2 + x_3 \geq 10$   
 and  $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$  (12 Marks)
  - Explain the typical steps in post optimality analysis for linear programming studies. (08 Marks)
- 4**
- Apply revised simplex method to solve the following problem:  
 Maximize  $z = 4x_1 + 3x_2 + 6x_3$   
 Subject to  $3x_1 + x_2 + 3x_3 \leq 30$   
 $2x_1 + 2x_2 + 3x_3 \leq 40$   
 and  $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$  (12 Marks)
  - Explain key relationships between primal and dual problems. (08 Marks)

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

## 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. The world demand for wheat requires 125 million acres of land devoted to wheat production; similarly, 60 million acres of land are required for barley and 75 million acres of land for oats. The total amounts of land available for these purposes in England, France and Spain are 70 million acres, 110 million acres, 80 million acres respectively. The number of hours of labor needed in England, France and Spain to produce an acre of wheat is 18, 13 and 16 respectively. The number of hours of labor needed in England, France and Spain to produce an acre of barley is 15, 12 and 12 respectively. The number of hours of labor needed in England, France and Spain to produce an acre of oats is 12, 10 and 16 respectively. The labor cost per hour in producing wheat is \$9.00, \$7.20 and \$9.90 in England, France and Spain respectively. The labor cost per hour in producing barley is \$8.10, \$9.00 and \$8.40 in 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 land use in each country so as to meet the world food requirement and minimize the total labor cost.  
 i) Formulate this problem as a transportation problem by constructing the appropriate parameter table.  
 ii) Starting with the north west corner rule, interactively apply the transportation simplex 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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