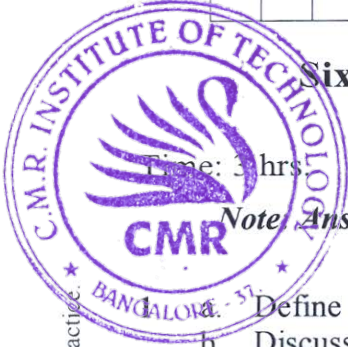


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**Sixth Semester B.E. Degree Examination, Jan./Feb. 2023**  
**Operations Research**

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- a. Define Operation Research. (04 Marks)
- b. Discuss basic components of LP model. (04 Marks)
- c. A computer company manufactures laptops and desktops that fetch total profit of Rs.700/- and 500/- per unit respectively. Each unit of laptop takes 4 hours of assembly time and 2 hours of testing time while each unit of desktop requires 3 hours of assembly time and 1 hour for testing. In a given month the total number of hours available for assembly is 210 hours and for inspection is 90 hours. Formulate the problem as LPP in such a way that the total profit is maximum. (08 Marks)

**OR**

- 2 a. Describe the steps involved in the formulation of LPP. (04 Marks)
- b. Explain the terms : (i) Feasible solution (ii) unbounded solution (04 Marks)
- c. A company produces two types of leather belts A and B and their profits are 40 and 30 rupees respectively. Each belt of type A requires twice as much a time as required for B. Company can produce 1000 belts per day. Leather is sufficient only for 800 belts per day. Belt A requires fancy buckles, there are only 400 buckles per day. For B only 700 buckles per day are available. How should the company manufacturers the 2 types of belts in order to maximize overall profit? Solve using graphical method. (08 Marks)

**Module-2**

- 3 a. Define with example : (i) Slack variable (ii) Surplus variable (iii) Basic feasible solution. (06 Marks)
- b. Solve the following LPP using simplex method :  

$$Z_{\max} = 3x_1 + 2x_2$$
 Subjected to  $x_1 + x_2 \leq 40$   
 $x_1 - x_2 \leq 20$   
 where  $x_1, x_2 \geq 0$  (10 Marks)

**OR**

- 4 a. Solve the following LPP using Big M method :  
 Minimize  $z = 2x_1 + 3x_2$   
 Subjected to constraints  $x_1 + 2x_2 \leq 4$   
 $x_1 + x_2 = 3$  and  
 $x_1$  and  $x_2 \geq 0$  (10 Marks)
- b. Explain briefly two phase method. (06 Marks)

**Module-3**

- 5 a. Explain the procedure of dual simplex method. (06 Marks)
- b. Use dual simplex method to solve the following LPP :  
 Minimize  $z = 2x_1 + x_2 + 3x_3$   
 Subjected to  $x_1 - 2x_2 + x_3 \geq 4$   
 $2x_1 + x_2 + x_3 \leq 8$  and  $x_1 - x_3 \geq 0$  with all variables non negative. (10 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.

OR

- 6 a. Explain briefly : (i) Formulation of dual linear programming problem.  
(ii) Unrestricted variables. (06 Marks)
- b. The dual simplex method to solve the following problem :  
Maximize  $z = -2x_1 - 3x_2$   
Subjected to  $x_1 + x_2 \geq 2$   
 $2x_1 + x_2 \leq 10$   
 $x_1 + x_2 \leq 8$   
with  $x_1$  and  $x_2$  non negative. (10 Marks)

**Module-4**

- 7 a. Explain North-West corner method with an example. (06 Marks)
- b. Using Vogel's Approximation Method (VAM), solve the following transportation problem :

	Demand			
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	
O <sub>1</sub>	2	7	4	5
O <sub>2</sub>	3	3	8	8
O <sub>3</sub>	5	4	7	7
O <sub>4</sub>	1	6	2	14
	8	8	18	

(10 Marks)

OR

- 8 a. Explain different types of assignment problems. (06 Marks)
- b. Four new computers (C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub>) are to be installed in a computer center. There are 5 vacant places (A, B, C, D and E) available. Because of limited space C<sub>2</sub> cannot be placed at C. and C<sub>3</sub> cannot be placed at A. The assignment cost of the computers to the places is given below. Find the optimal assignment.

	A	B	C	D	E
C <sub>1</sub>	4	6	10	5	6
C <sub>2</sub>	7	4	-	5	4
C <sub>3</sub>	-	6	9	6	2
C <sub>4</sub>	9	3	7	2	3

(10 Marks)

**Module-5**

- 9 a. Explain two person zero-sum game and non zero-sum game with example. (06 Marks)
- b. Solve the following game whose pay off matrix is,

	Player B	
Player A	3	-2
	2	5

(10 Marks)

OR

- 10 a. List the applications of game theory. (04 Marks)
- b. Explain min-max and max-min principle. (04 Marks)
- c. Distinguish between pure strategy and mixed strategy. (04 Marks)
- d. Explain the concept of dominance. (04 Marks)

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