



# CBCS SCHEME

15CS653

USN

## Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020 Operations Research

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Define operations research. Explain the six major phases of operations research. (08 Marks)  
b. Solve the Linear programming problem graphically.

$$Z_{\max} = 20x_1 + 24x_2$$

$$\text{Subject to : } 2x_1 + 3x_2 \leq 1500$$

$$3x_1 + 2x_2 \leq 1500$$

$$x_2 \leq 450 \text{ and}$$

$$x_1, x_2 \geq 0.$$

(08 Marks)

OR

- 2 a. Old hens can be bought at Rs.50 –each but young ones cost Rs.100 each. The old hens lay 3 eggs/week and young hens 5 eggs/week. Each egg costs Rs.2. A hen costs Rs. 5 per week to feed. If a person has only Rs. 2000 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 40 hens. (08 Marks)

- b. With reference to Linear Programming Problem (LLP) define the following :

i) Feasible solution ii) Unbounded solution iii) Optimal solution iv) Feasible region.

(08 Marks)

### Module-2

- 3 a. Use simplex method to solve the following LPP (Linear Programming Problem).

$$\text{Max } z = 3x_1 + 9x_2$$

$$\text{Subject to } x_1 + 4x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4 \text{ and}$$

$$x_1, x_2 \geq 0.$$

(08 Marks)

- b. Solve using penalty method (Big-M)

$$\text{Max } Z = 3x_1 - x_2$$

$$\text{Subject to : } 2x_1 + x_2 \geq 2$$

$$x_1 + 3x_2 \leq 3$$

$$x_2 \leq 4 \text{ and}$$

$$x_1, x_2 \geq 0.$$

(08 Marks)

OR

- 4 a. Obtain all the basic solutions for the system of linear equations :

$$2x_1 + x_2 + 4x_3 = 11$$

$$3x_1 + x_2 + 5x_3 = 14.$$

(06 Marks)

- b. Use two phase simplex method to solve the following LPP.

$$\text{Max } z = 5x_1 - 4x_2 + 3x_3$$

$$\text{Subject to } 2x_1 + x_2 - 6x_3 = 20$$

$$6x_1 + 5x_2 + 10x_3 \leq 76$$

$$8x_1 - 3x_2 + 6x_3 \leq 50 \text{ and}$$

$$x_1, x_2, x_3 \geq 0.$$

(10 Marks)

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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.

**Module-3**

- 5 a. Write the dual of the following primal LPP.

$$\text{Max } z = 3x_1 - x_2 + x_3$$

$$\text{Subject to : } 4x_1 - x_2 \leq 8$$

$$8x_1 + x_2 + 3x_3 \geq 12$$

$$5x_1 - 6x_3 \leq 13$$

$$x_1, x_2, x_3 \geq 0.$$

(08 Marks)

- b. Use dual Simplex method to solve the following LPP :

$$\text{Max } z = -3x_1 - x_2$$

$$\text{Subject to : } x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2$$

$$x_1, x_2 \geq 0.$$

(08 Marks)

OR

- 6 a. List out the procedural steps used to solve a LPP using dual simplex method. (08 Marks)

- b. Explain briefly the essence of duality theory with an example. (08 Marks)

**Module-4**

- 7 a. Determine an initial basic feasible solution to the following transportation problem using North West Corner's rule. (05 Marks)

O/D	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply
01	6	4	1	5	14
02	8	9	2	7	16
03	4	3	6	2	5
Required	6	10	15	4	35

- b. Four jobs are to be done on four different machines. The cost [in rupees] of producing
- $i^{\text{th}}$
- job on
- $j^{\text{th}}$
- machine is given below :

		Machine			
		M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>
Jobs	J <sub>1</sub>	15	11	13	15
	J <sub>2</sub>	17	12	12	13
	J <sub>3</sub>	14	15	10	14
	J <sub>4</sub>	16	13	11	17

Assign the jobs to different machine so as to minimize the total cost. (06 Marks)

- c. Find an initial basic feasible solution for the following transportation problem using least cost or matrix minima method :

19	30	50	10	7
70	30	40	60	9
40	80	70	20	18
5	8	7	14	

(05 Marks)

OR

- 8 a. Determine the optimum basic feasible solution for the following transportation problem. Obtain initial basic feasible by vogels approximation method. (08 Marks)

O/D	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply
01	2	2	2	1	3
02	10	8	5	4	7
03	7	6	6	8	5
Demand	04	3	4	4	

- b. Solve the following assignment problem. If it is treated as a salesman problem and the cell entries represent cost in rupees. Find the least cost route such that salesman does not visit any city twice.

	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

(08 Marks)

**Module-5**

- 9 a. Solve the game using principle of dominance method whose payoff matrix to the player – A is given in the table. (08 Marks)

		Player – B		
		I	II	III
Player – A	I	1	7	2
	II	6	2	7
	III	5	2	6

- b. Give a note on basic simulated annealing algorithm and basic genetic algorithm. (08 Marks)

OR

- 10 a. Solve the following game graphically. (08 Marks)

		Player–B		
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
Player–A	A <sub>1</sub>	2	6	22
	A <sub>2</sub>	16	10	4

- b. Explain briefly the nature of metaheuristics. (05 Marks)  
 c. Find the value of the game :

		P <sub>2</sub>	
		I	II
P <sub>1</sub>	I	-4	6
	II	2	-3

(03 Marks)

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