

VTU B.E/B.TECH QUESTION PAPER SET

CBCS SEMESTER VI

OPERATIONS RESEARCH

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15CS653

Sixth Semester B.E. Degree Examination, June/July 2018
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. List and explain the various phases of an operations research study. (06 Marks)
- b. An agriculturist has a farm with 126 acres. He produces Tomato, Mango and Potato. Whatever he raises is fully sold in the market. He gets Rs.5/- for Tomato/kg, Rs.4/- for Mango/kg and Rs.5/- for Potato/kg. The average yield is 1,500 kg of Tomato/acre, 1800 kg of Mango/acre and 1200kg of Potato/acre. To produce each 100kg of Tomato and Mango and to produce each 80kg of Potato a sum of Rs.12.50 has to be used for manure. Labour required for each acre to raise the crop is 6 man-days for Tomato and Potato each and 5 man-days for Mango. A total of 500 man-days of labour at a rate of Rs.40/- per man day are available. Formulate this as a LP model to maximize the agriculturist's total profit. (10 Marks)

OR

- 2 a. Define: i) Feasible region ii) Feasible solution iii) Optimal solution (06 Marks)
- b. Solve the following LPP by graphical method,
 Minimize $Z = 20x_1 + 10x_2$
 Subject to $x_1 + 2x_2 \leq 40$
 $3x_1 + x_2 \geq 30$
 $4x_1 + 3x_2 \geq 60$
 $x_1, x_2 \geq 0$. (10 Marks)

Module-2

- 3 a. Define slack variable, surplus variable and basic solution. (06 Marks)
- b. Solve the following LPP using simplex method.
 $Z_{\max} = 2x_1 + 2x_2 + 4x_3$
 Subject to the constraint
 $2x_1 + 3x_2 + x_3 \leq 240$
 $x_1 + x_2 + 3x_3 \leq 300$
 $x_1 + 3x_2 + x_3 \leq 300$
 $x_1, x_2, x_3 \geq 0$. (10 Marks)

OR

- 4 a. Solve the following LPP by two phase method
 $Z_{\max} = 3x_1 - x_2$
 Subject to the constraint
 $2x_1 + x_2 \geq 2$
 $x_1 + 3x_2 \leq 2$
 $x_2 \leq 4$
 $x_1, x_2 \geq 0$. (08 Marks)

b. Solve the following LPP by Big-M method,

Maximize $Z = 2x_1 + 3x_2 + 10x_3$

Subject to $x_1 + 2x_3 = 0$

$x_2 + x_3 = 1$

$x_1, x_2, x_3 \geq 0.$

(08 Marks)

Module-3

5 a. Explain the following:

i) The essence of duality theory.

ii) Primal dual relationship.

(06 Marks)

b. Write the duals for the following LPP:

i) Maximize $Z = x_1 + 2x_2 + x_3$

Subject to the constraint $2x_1 + x_2 + x_3 \leq 2$

$-2x_1 + x_2 - 5x_3 \geq -6$

$4x_1 + x_2 + x_3 \leq 6$

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

ii) Maximize $Z = 3x_1 + 5x_2 + 7x_3$

Subject to the constraint $x_1 + x_2 + 3x_3 \leq 10$

$4x_1 - x_2 + 2x_3 \geq 15$

and $x_1, x_2 \geq 0$ and x_3 is unrestricted variable.

(10 Marks)

OR

6 a. Give the characteristics of dual problem.

(06 Marks)

b. Solve the following LPP using dual simplex method

Minimize $Z = 2x_1 + x_2 + 3x_3$

Subject to $x_1 - 2x_2 + x_3 \geq 4$

$2x_1 + x_2 + x_3 \leq 8$

$x_1 - x_3 \geq 0.$

with all the variables non negative.

(10 Marks)

Module-4

7 a. Find initial basic feasible solution by North-West corner method.

		Destination				
		D ₁	D ₂	D ₃	D ₄	Requirement
Factory	F ₁	3	3	4	1	100
	F ₂	4	2	4	2	125
	F ₃	1	5	3	2	75
Demand		120	80	75	25	

(06 Marks)

b. Solve the following transportation problem and determine optimal distribution for the company so as to minimize the total transportation cost. Use VAM method to find the initial basic feasible solution.

(10 Marks)

Factories	Warehouses			Available
	W ₁	W ₂	W ₃	
F ₁	16	20	12	200
F ₂	14	8	18	160
F ₃	26	24	16	90
Required	180	120	170	

OR

- 8 a. Explain various steps involved in Hungarian algorithm with example. (06 Marks)
 b. Solve the following assignment problem. Assign 4 tasks to 4 persons so as to minimize the total cost. (10 Marks)

		Person			
		P ₁	P ₂	P ₃	P ₄
Tasks	T ₁	42	35	28	21
	T ₂	30	25	20	15
	T ₃	30	25	20	15
	T ₄	24	20	16	12

Module-5

- 9 a. Explain the following:
 i) Minimax and Maximin principle.
 ii) Pure and mixed strategies
 iii) Two person zero sum game. (06 Marks)
 b. Solve the following game using the concept of dominance. Write the strategies adopted by each player and find value of game. (10 Marks)

		B				
		I	II	III	IV	V
A	I	6	15	30	21	6
	II	3	3	6	6	4
	III	12	12	24	36	3

OR

- 10 a. Solve the following game by graphical method:

		B				
		I	II	III	IV	V
A	I	2	-1	5	-2	6
	II	-2	4	-3	1	0

- b. Explain briefly: i) Genetic algorithm ii) Tabu search. (06 Marks)
 (10 Marks)

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Sixth Semester B.E. Degree Examination, June/July 2019
Operation 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 operation research. List and explain the various phases of an operation research study. (08 Marks)
- b. A firm manufactures three products A, B and C. The profits per unit product are Rs.3, Rs.2 and Rs.4 respectively. The firm has two machines and the required processing time in minutes for each machine on each product is given below :

Machine	Product		
	A	B	C
X	4	3	5
Y	2	2	4

Machines X and Y have 2000 and 1500 machine-minutes respectively. The firm must manufacture 100A's, 200B's and 50C's but not more than 150A's. Set up an LP model to maximize the profit. (08 Marks)

OR

- 2 a. Use the graphical method to solve the following LPP :
Maximize $Z = x + 0.5y$
Subject to constraints $3x + 2y \leq 12$
 $5x \leq 10$
 $x + y \leq 18$
 $-x + y \geq 4$
where $x, y \geq 0$. (12 Marks)
- b. Define : i) Feasible solution ii) unbounded solution iii) Feasible region iv) Optimal solution. (04 Marks)

Module-2

- 3 a. Find all the basic solutions of the following problem :
Maximize $Z = x_1 + 3x_2 + 3x_3$
Subject to constraints $x_1 + 2x_2 + 3x_3 = 4$
 $2x_1 + 3x_2 + 5x_3 = 7$
Also find which of the basic solution are :
i) basic feasible ii) non-degenerate basic feasible iii) optimal basic feasible. (06 Marks)
- b. Solve the following LPP by Big-M method.
Maximize $Z = -2x_1 - x_2$
Subject to constraints $3x_1 + x_2 = 3$
 $4x_1 + 3x_2 \geq 6$
 $x_1 + 2x_2 \leq 4$
where $x_1, x_2 \geq 0$. (10 Marks)

OR

- 4 a. Solve the following LPP by simplex method.

Maximize $z = 3x_1 + 2x_2$

Subject to constraints $x_1 + x_2 \leq 4$

$$x_1 - x_2 \leq 4$$

and $x_1, x_2 \geq 0$.

(08 Marks)

- b. Solve the following LPP by two-phase simplex method.

Maximize $z = 3x_1 - x_2$

Subject to constraints $2x_1 + x_2 \geq 2$

$$x_1 + 3x_2 \leq 2$$

$$x_2 \leq 4$$

and $x_1, x_2 \geq 0$

(08 Marks)

Module-3

- 5 a. Write applications of dual simplex method.

(06 Marks)

- b. Solve by dual simplex method the following problem :

Maximize $z = 2x_1 + 2x_2 + 4x_3$

Subject to constraints $2x_1 + 3x_2 + 5x_3 \geq 2$

$$3x_1 + x_2 + 7x_3 \leq 3$$

$$x_1 + 4x_2 + 6x_3 \leq 5$$

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

(10 Marks)

OR

- 6 a. Construct the dual of the problem :

i) minimize $z = 3x_1 - 2x_2 + 4x_3$

subject to constraints $3x_1 + 5x_2 + 4x_3 \geq 7$

$$6x_1 + x_2 + 3x_3 \geq 4$$

$$7x_1 - 2x_2 - x_3 \leq 10$$

$$x_1 - 2x_2 + 5x_3 \geq 3$$

$$4x_1 + 7x_2 - 2x_3 \geq 2$$

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

(05 Marks)

ii) maximize $z = 3x_1 + 5x_2$

subject to constraints $2x_1 + 6x_2 \leq 50$

$$3x_1 + 2x_2 \leq 35$$

$$5x_1 - 3x_2 \leq 10$$

$$x_2 \leq 20$$

where $x_1, x_2 \geq 0$.

(05 Marks)

- b. What are the advantages of duality property?

(06 Marks)

Module-4

- 7 a. Find the initial basic feasible solution by using North-West corner rule.

(06 Marks)

	D ₁	D ₂	D ₃	D ₄	Supply
O ₁	1	5	3	3	34
O ₂	3	3	1	2	15
O ₃	0	2	2	3	12
O ₄	2	7	2	4	19
Demand	21	25	17	17	80

- b. Find the initial basic feasible solution using Vogel's approximation method.

(10 Marks)

	W ₁	W ₂	W ₃	W ₄	Availability
F ₁	19	30	50	10	7
F ₂	70	30	40	60	9
F ₃	40	8	70	20	18
Requirement	5	8	7	14	

- 8 a. Solve by matrix minima method and obtain an optimal solution for the following problem:

	Available			
	50	30	220	1
From	90	45	170	3
	250	200	50	4
Required	4	2	2	

(10 Marks)

- b. Solve the following assignment problem :

	J ₁	J ₂	J ₃	J ₄
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	3	15	13	8

(06 Marks)

Module-5

- 9 a. Define : i) pure strategy ii) mixed strategy iii) optimal strategy. (06 Marks)
 b. Solve the following game by dominance principle.

		Player B			
		B ₁	B ₂	B ₃	B ₄
Player A	A ₁	3	2	4	0
	A ₂	3	4	2	4
	A ₃	4	2	4	0
	A ₄	0	4	0	8

(10 Marks)

OR

- 10 a. Solve the following game by graphical method. (06 Marks)

		Player B				
		I	II	III	IV	V
Player A	I	2	-1	5	-2	6
	II	-2	4	-3	1	0

- b. Write short notes on : (10 Marks)
 i) Genetic algorithm
 ii) Tabu search algorithm.
