

(8 pages)

Reg. No. : .....

Code No. : 30444 E Sub. Code : CEMA 54

B.Sc. (CBCS) DEGREE EXAMINATION,  
NOVEMBER 2024.

Fifth Semester

Mathematics — Major Elective

OPERATIONS RESEARCH — I

(For those who joined in July 2021-2022 only)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. If the constraints of an LPP is  $\leq$  type, then the variable to be added is  
(a) slack (b) surplus  
(c) artificial (d) none
2. Any solution to a general LPP which satisfies non negative restrictions of the problem is called a \_\_\_\_\_ to the general LPP.  
(a) solution (b) feasible solution  
(c) optimum solution (d) negative solution

3. The cost of surplus variable is  
(a) 1 (b) -1  
(c) 0 (d) M
4. The Big-M method is also known as  
(a) Penalty method (b) Simplex method  
(c) Both (a) and (b) (d) None of the above
5. In a transportation problem feasible solution exists when the number of basic cell is  
(a)  $m + n - 1$  (b)  $m + n + 1$   
(c)  $m - n - 1$  (d)  $m - n + 1$
6. A transportation problem is balanced if  
(a)  $\sum_{i=1}^m a_i \neq \sum_{j=1}^n b_j$  (b)  $\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$   
(c)  $\sum_{i=1}^m a_i < \sum_{j=1}^n b_j$  (d)  $\sum_{i=1}^m a_i > \sum_{j=1}^n b_j$
7. The optimum assignment is  
(a)  $N = n$  (b)  $N \neq n$   
(c)  $N < n$  (d)  $N > n$
8. The algorithm to solve the assignment problem was developed by  
(a) D konig (b) Charnes  
(c) F.L. Hitchcock (d) Kuhn





9. The assignment problem is balanced if
- the number of rows and columns are equal
  - the number of rows and columns are not equal
  - number of rows is less than the number of columns
  - number of rows is greater than the number of columns
10. In a sequencing algorithm, no passing rule is
- the order of the first and last job
  - order in which the machines complete the job
  - the same order of jobs is maintained over each machine
  - none

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).  
Each answer should not exceed 250 words.

11. (a) Solve graphically :
- Maximize :  $z = 3x_1 + 2x_2$
- Subject to :
- $$x_1 - x_2 \leq 1$$
- $$x_1 + x_2 \geq 3$$
- $$x_1, x_2 \geq 0.$$

Or

- (b) Define slack and surplus variables.

Page 3 Code No. : 30444 E

12. (a) Write the dual of
- Maximize  $z = 2x_1 + x_2$
- Subject to
- $$x_1 + 2x_2 \leq 10$$
- $$x_1 + x_2 \leq 6$$
- $$x_1 - x_2 \leq 2$$
- $$x_1 - 2x_2 \leq 1$$
- $$x_1, x_2 \geq 0.$$
- Or
- (b) Use dual simplex method to solve the following LPP

Minimize  $z = 3x_1 + x_2$

Subject to the constraints

$$x_1 + x_2 \geq 1$$

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

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

13. (a) Obtain an initial basic feasible solution to the following transportation problem by North – West corner rule.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

Or

- (b) Explain Vogel's approximation method in transportation problem.

Page 4 Code No. : 30444 E

[P.T.O.]





14. (a) Write the mathematical formulation of an assignment problem.

Or

- (b) Solve the following assignment problem

	1	2	3
A	120	100	80
B	80	90	110
C	110	140	120

15. (a) Solve the following sequencing problem :

Job :	1	2	3	4	5	6	7
M <sub>1</sub> :	3	12	15	6	10	11	9
M <sub>2</sub> :	8	10	10	6	12	1	3

Or

- (b) Explain the procedure for solving  $n$  jobs and 2 machines in sequencing problem.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).  
Each answer should not exceed 600 words.

16. (a) Use simplex method to solve the following LPP

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

Subject to

$$3x_1 + 2x_2 + x_3 \leq 3$$

$$2x_1 + x_2 + 2x_3 \leq 2$$

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

Or

- (b) Explain simplex method.

17. (a) Use Penalty method to solve

$$\text{Maximize } z = 3x_1 + 2x_2 + 3x_3$$

Subject to

$$2x_1 + x_2 + x_3 \leq 2$$

$$3x_1 + 4x_2 + 2x_3 \geq 8$$

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

Or

- (b) Solve the following LPP using dual simplex method.

$$\text{Minimize } z = 2x_1 + 3x_2$$

Subject to

$$2x_1 + 3x_2 \leq 30$$

$$x_1 + 2x_2 \geq 10$$

$$x_1, x_2 \geq 0.$$





18. (a) Explain the MODI method in transportation problem.

Or

- (b) Solve the transportation problem and find the optimum solution.

	1	2	3	4	Availability
A	10	8	11	7	20
B	9	12	14	6	40
C	8	9	12	10	35
Demand	16	18	31	30	

19. (a) Explain Hungarian method in assignment problem.

Or

- (b) Solve the following assignment problem

	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Page 7 Code No. : 30444 E

20. (a) Solve the following sequencing problem

Machines

Jobs	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>
A	13	8	7	14
B	12	6	8	19
C	9	7	5	15
D	8	5	6	15

Or

- (b) Solve the given sequencing problem in the order ABC

Jobs :	1	2	3	4	5	6
Machine A :	12	10	9	14	7	9
Machine B :	7	6	6	5	4	4
Machine C :	6	5	6	4	2	4

Page 8 Code No. : 30444 E

