QP CODE: 21101241

21101241

Reg No : ....................

Name : ....................

# B.Sc DEGREE (CBCS) EXAMINATION, APRIL 2021

## Sixth Semester

## Choice Based Core Course - MM6CBT01 - OPERATIONS RESEARCH

Common for B.Sc Mathematics Model I & B.Sc Mathematics Model II Computer Science

2017 Admission Onwards

BBF84410

Time: 3 Hours | Max. Marks : 80

### Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. When a basic feasible solution to an LP problem becomes degenerate and non – degenerate.
2. Write the conditions that should be satisfied for an alternative optimal solution to exist in the graphical method of LP an Problem.
3. Convert into standard form
   Maximize $Z = 3x_1 + 2x_2$ subject to the constraints
   $2x_1 + x_2 \leq 2$,
   $3x_1 + 4x_2 \geq 12$, $x_1 , x_2 \geq 0$
4. Define surplus variable . Introduce surplus variable in proper way for the constraint $3x + 2y + z \geq 5$.
5. Convert into standard form
   Minimize $Z = 2x_1 + x_2 + 4x_3$ subject to constrasints
   $-2x_1 + 4x_2 \leq 4$, $x_1 + 2x_2 + x_3 \geq 5$ ,
   $2x_1 + 3x_3 \leq 2$ , $x_1 , x_2 \geq 0$ and $x_3$ unrestricted in sign.
6. Write any two standard results on duality.
7. Define a loop in a transportation table.
8. Describe the enumeration method to solve an assignment problem.

9. Find an Initial Basic Feasible Solution by North West Corner Method:

| | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| O1 | 1 | 2 | 1 | 4 | 30 |
| O2 | 3 | 3 | 2 | 1 | 50 |
| O3 | 4 | 2 | 5 | 9 | 20 |
| Demand | 20 | 40 | 30 | 10 | |

10. Find an optimal assignment to minimize cost:

Contractor

| Job | A | B | C | D |
|---|---|---|---|---|
| 1 | 12 | 30 | 21 | 15 |
| 2 | 18 | 33 | 9 | 31 |
| 3 | 44 | 25 | 21 | 21 |
| 4 | 14 | 30 | 28 | 14 |

11. Use principles of dominance to reduce the size of payoff matrix to 2 x 2.

Player B

| Player A | $B_1$ | $B_2$ | $B_3$ |
|---|---|---|---|
| $A_1$ | 10 | 5 | -2 |
| $A_2$ | 13 | 12 | 15 |
| $A_3$ | 16 | 14 | 10 |

12. Explain the graphical method of solving 2 X n and m X 2 games.

(10×2=20)

**Part B**

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A firm plans to purchase at least 200 quintals of scrap containing high quality metal X and low quality metal Y . It decides that the scarp to be purchased must contain at least 100 quintals of metal X and not more than 35 quintals of metal Y. The firm can purchase the scarp from two suppliers A and B.in unlimited quantities. The percentage of X and Y metals in terms of weight in the scarp supplied by A and B is given below.

| Metals | Supplier A | Supplier B |
|---|---|---|
| X | 25% | 75% |
| Y | 10% | 20% |

The price of A's scarp is RS 200 per quintal and that of B is Rs.400 per quintal. The firm wants to determine the quantities that it should buy from the two suppliers so that the total cost is minimized. Formulate this problem as an LP Problem .

Use the Graphical method to solve the given LP problem.

14. Maximize $Z = 7x_1 + 3x_2$ subject to the constraints
$x_1 + 2x_2 \geq 3$, $x_1 + x_2 \leq 4$, $0 \leq x_1 \leq 5/2$, $0 \leq x_2 \leq 3/2$, $x_1, x_2 \geq 0$.

15. Find first two tables of Simplex method of solving LP problem. ,
Maximize $Z = 3000x + 2000y$ , Subject to the constraints 0 .
$5x + 2y \leq 180$,
$3x + 3y \leq 135$, $x, y, z \geq$

16. Solve the following LP problem
Maximize $Z = 6x_1 + 4x_2$ subject to the constraints
$2x_1 + 3x_2 \leq 30$,
$3x_1 + 2x_2 \leq 24$,
$x_1 + x_2 \geq 3$, $x_1, x_2 \geq 0$.

17. Write the dual of the following LP problem.
Maximize Z = 3x1 + x2 + 2x3 – x4 subject to the constraints
2x1 - x2 + 3x3 + x4 = 1 ,
x1 + x2 – x3 + x4 = 3 , x1 , x2 ≥ 0 and x3 , x4 unrestricted in sign.

18. Write the advantages of duality.

19. Find an Initial Basic Feasible Solution by Vogel's Approximation Method and test for optimality:

| | D1 | D2 | D3 | Supply |
|---|---|---|---|---|
| O1 | 3 | 4 | 6 | 100 |
| O2 | 7 | 3 | 8 | 80 |
| O3 | 6 | 4 | 5 | 90 |
| O4 | 7 | 5 | 2 | 120 |
| Demand | 110 | 110 | 60 | |

20. Find an optimal assignment to minimize hours used:

Jobs

| | | I | II | III | IV |
|---|---|---|---|---|---|
| | 1 | 5 | 3 | 2 | 8 |
| Women | 2 | 7 | 9 | 2 | 6 |
| | 3 | 6 | 4 | 5 | 7 |
| | 4 | 5 | 7 | 7 | 8 |

21. Solve the game whose payoff matrix is given below.

Player B

| Player A | $B_1$ | $B_2$ |
|---|---|---|
| $A_1$ | 5 | 1 |
| $A_2$ | 3 | 4 |

(6×5=30)

## Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. Use Big –M method to solve the following LP problem.

Maximize $Z = 3x - y$ subject to the constraints

$2x + y \leq 2$

$x + 3y \geq 3,$

$y \leq 4, \quad x, y \geq 0.$

23. Solve the following Transportation Problem to maximize profit:

| | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| O1 | 6 | 6 | 11 | 15 | 80 |
| O2 | 4 | 6 | 10 | 12 | 120 |
| O3 | 6 | 4 | 7 | 6 | 150 |
| O4 | 4 | 10 | 14 | 14 | 70 |
| O5 | 8 | 8 | 7 | 9 | 90 |
| Demand | 100 | 200 | 120 | 80 | |

24. Find an optimal assignment to minimize cost. Also find an alternate optimal assignment, if it exists:

| | | Job | | | |
|---|---|---|---|---|---|
| | | I | II | III | IV |
| Labourer | 1 | 42 | 35 | 28 | 21 |
| | 2 | 30 | 25 | 20 | 15 |
| | 3 | 30 | 25 | 20 | 15 |
| | 4 | 24 | 20 | 16 | 12 |

25. Transform the game into an equivalent linear programming problem and solve the game for two players A and B by using the simplex method

| | Player B | | |
|---|---|---|---|
| Player A | $B_1$ | $B_2$ | $B_3$ |
| $A_1$ | 1 | -1 | 3 |
| $A_2$ | 3 | 5 | -3 |
| $A_3$ | 6 | 2 | -2 |

(2×15=30)