Reg. No.

Choice Based Credit System VI Semester B.Sc. Examination, September 2022 (2021 – 22 Batch Onwards) MATHEMATICS (Special Paper) Linear Programming (Paper – VIII (b))

Time : 3 Hours

Instructions : 1) Answer any ten questions from Part – A. Each question carries 2 marks.

- 2) Answers to Part **A** should be written in the first few pages of the answer book before answers to Part **B**.
- Answer twelve questions from Part B. Each question carries 5 marks.
- 4) Scientific calculators are allowed.

PART - A

- I. Answer **any ten** questions :
 - 1) Define a line segment in \mathbb{R}^n .
 - 2) Pivot on $a_{11} = 2$ in the following canonical maximum table.

Χ	У	1	_
2	3	6	$=-t_1$
1	3	2	=t ₂
0	2	1] = f

3) State the canonical maximization LPP represented by

Х	У	-1	_
1	2	3	=t ₁
4	5	6	=t ₂
7	8	9] = f

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(10×2=20)

Max. Marks : 80

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- -2-
- 4) Convert the following LPP to canonical form.

Maximize : f(x, y) = x + ySubject to $x - y \le 3$ $2x + y \ge 1$ $0 \le x \le 4$ $y \ge 0$.

5) Write the tucker tableau of the canonical maximization LPP.

 $\begin{array}{l} \text{Maximize}: f(x,\,y) = x\\ \text{Subject to } x+y \leq 1\\ x-y \geq 1\\ y-2x \geq 1\\ x,\,y \geq 0. \end{array}$

6) Write the maximum table taking the negative transpose of the minimum table.

X ₁	1	3	6
X ₂	2	4	5
-1	8	7	0
	= t ₁	= t ₂	= g

7) Given the LPP below :

Maximize : $f(x_1, x_2) = x_1 + x_2$ Subject to $x_1 + 2x_2 \le 4$ $3x_1 + x_2 \le 6$ $x_1, x_2 \ge 0$

State the dual canonical minimization LPP.

8) Write the matrix reformulation of canonical maximization LPP.

9) Reduce the table of the matrix game.

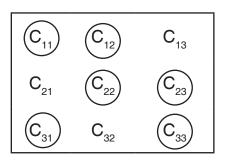
 $\begin{bmatrix} -1 & 1 & -1 & 2 \\ -1 & -1 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$

using domination.

- 10) Define mixed strategy and pure strategy for row player in the matrix game.
- 11) State the general balanced transportation problem.
- 12) Explain the process of converting an unbalanced transportation problem to a balanced transportation problem when supply is more than the demand.
- 13) Find two permutation set of zeros in the following table of balanced assignment problem.

0	0	1
0	0	0
1	0	0

14) Construct a cycle using circled cells in the following table.



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PART – B

II. Answer any twelve questions :

- 1) An appliance company manufactures heaters and airconditioners. The production of one heater requires 2 hours in the parts division of the company and 1 hour in the assembly division of the company. The production of one air-condition requires 1 hour in the parts division of the company and 2 hours in the assembly division of the company. The parts division is operated for atmost 8 hours per day and the assembly division is operated for atmost 10 hours per day. If the profit realized upon sale is \$ 30 per heater and \$ 50 per air-conditioner, how many heaters and air-conditioners should the company manufacture per day so as to maximize profits ? Solve graphically.
- 2) Apply the simplex algorithm to the maximum tableau.

x ₁	X ₂	-1	_
-1	-1	-3	=t ₁
1	2	2	=t ₂
2	-4	0	=f

3) Solve using the simplex algorithm.

X	У	-1	
-1	-1	-2	=t ₁
1	-2	0	$= -t_{2}$
2	1	1	$=-t_3$
_1	3	0	$= t_3$ = f

(12×5=60)

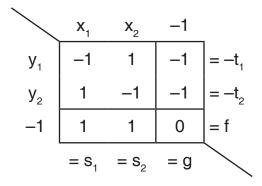
4) Solve :

 $\begin{array}{l} \text{Maximize}: f(x,\,y) = x + 3y\\ \text{Subject to } x + 2y \leq 10\\ 3x + y \leq 15 \end{array}$

5) Solve :

 $\begin{array}{l} \text{Maximize}: f(x,\,y,\,z) = x + 2y + z \\ \text{Subject to } x + y + z = 6 \\ x + y \leq 1 \\ x,\,z \geq 0 \end{array}$

- 6) For any pair of feasible solutions of dual canonical LPP's, prove that g f = SX' + Y'T.
- 7) Solve the dual canonical LPP below.

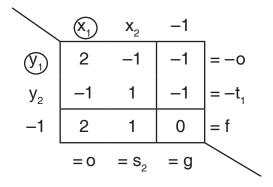


8) Solve the dual canonical LPP below :

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- (X_1) (X_2) -1 **X**₃ -1 1 2 1 (V_1) = -00 2 2 -1 y_2 = -t, 0 1 -1 -1 $= -t_{2}$ У₃ -1 3 -1 1 0 = f = 0 $= S_1$ = g = 0
- 9) Solve the dual non-canonical LPP below.

10) Solve the dual non-canonical LPP.



11) Find the optimal strategies for the row and column players and the Von-Neumann value of the matrix game.

$$\begin{bmatrix} -\frac{5}{3} & 0\\ 5 & \frac{-10}{3} \end{bmatrix}$$

12) Solve the matrix game.

$$\begin{bmatrix} -3 & 4 \\ 2 & -3 \end{bmatrix}$$

- 13) State the transportation algorithm.
- 14) Solve the transportation problem below.

5	12	8	50	26
11	4	10	8	20
14	50	1	9	30
15	20	26	15	-

15) Solve the transportation problem below.

2	1	2	50
9	4	7	70
1	2	9	20
40	50	20	-

- 16) State the Hungarion algorithm to solve a balanced assignment problem.
- 17) Solve the assignment problem.

	J ₁	J_2	J ₃
P ₁	8	7	10
P ₂	7	7	8
\mathbf{P}_{3}^{-}	8	5	7

18) Explain Hungarian Algorithm of solving assignment problem.