D 130229 **(Pages : 4)** **Name.......................................**

Reg. No....................................

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2025

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Syllabus)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

All questions can be answered.
Each question carries 2 marks.
(Ceiling 20 marks)

1. The equation of the line segment joining $(2,1)$ and $(5,7)$ is ————————.
2. Define a hyperplane in $\mathbb{R}^2$.
3. Convert the linear programming problems given below to canonical form :

   Maximize $f(x, y) = -x - 2y$ subject to
   $2x - y \geq 10 \quad 3y - x \leq 8, \quad x \geq 0, y \geq 0.$

4. Draw and shade a convex subset of $\mathbb{R}^2$ having no extreme points.
5. Consider the canonical maximum tableau below :

x	y	-1	
3	1	5	$= -t_1$
-7	1	8	$= -t_2$
4	9	13	$= f$

State the canonical maximization linear programming problem represented by the tableau above.

Turn over

6. Write the basic solution of the linear programming problem given below :

Maximize $f(x, y) = 200x + 150y$ subject to
$x + 2y \leq 11, \quad 2x + 2y \leq 30, \quad 2x + 2y \leq 25 \quad x \geq 0, y \geq 0.$

7. Write the canonical slack minimization linear programming problem.

8. State Von-Neumann Minimax Theorem.

9. What is complementary slackness of a dual canonical linear programming problem ?

10. What is balanced transportation problem ?

11. What is the pure strategy of a matrix game ?

12. What is a basic feasible solution of a transportation problem ?

Section B (Paragraph/Problem Type)

All questions can be answered.
Each question carries 5 marks.
(Ceiling 30 marks)

13. Show that the linear programming problem :

Maximize $f(x, y) = 3x + 2y$ subject to
$2x - y \leq -1, \quad x - 2y \geq 0, \quad x \geq 0, y \geq 0.$

is infeasible.

14. Solve the linear programming problem graphically :

Maximize $f(x, y) = 5x + 2y$ subject to
$x + 3y \leq 14, \quad 2x + y \leq 8, \quad x \geq 0, y \geq 0.$

15. Apply the simplex algorithm to the maximum tableau given below :

$$\begin{array}{cc|c|l} x_1 & x_2 & -1 & \\ \hline 2 & 1 & 8 & = -t_1 \\ 1 & 2 & 10 & = -t_2 \\ \hline 30 & 50 & 10 & = f \end{array}$$

16. Solve the unconstrained problem :

Maximize $f\left(x, y\right) = x + 3y$ subject to
$x + 2y \leq 10, \quad -3x - y \leq -15.$

17. A tableau of the balanced assignment problem is given below :

$$\begin{array}{|ccc|}\hline 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \\ \hline\end{array}$$

Find a permutation set of zeros.

18. Solve the assignment problem given below :

$$\begin{array}{|ccc|}\hline 38 & 21 & 34 \\ 41 & 14 & 36 \\ 28 & 20 & 25 \\ \hline\end{array}$$

19. What is a two-person zero-sum matrix game ?

Section C (Essay Type)

Answer any **one** *of the following question.*
The question carries 10 *marks.*

20. Solve the transportation problem by using Vogel Advanced-Start Method :

	M_1	M_2	M_3	
W_1	2	1	2	40
W_2	9	4	7	60
W_3	1	2	9	10
	40	50	20	110

Turn over

21. A company wishes to assign five of its workers to five different jobs. The rating of each worker with respect to each job on a scale of 0 to 10 is given by the following table :

	J_1	J_2	J_3	J_4	J_5
W_1	5	4	2	8	5
W_2	7	6	4	6	9
W_3	5	5	3	3	2
W_4	4	3	5	5	4
W_5	3	6	4	10	2

If the company wishes to maximize the total rating of the assignment, find the optimal assignment plan and the corresponding maximum total rating.

(1 × 10 = 10 marks)

D 110211 **(Pages : 3)** **Name.......................................**

Reg. No...................................

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2024

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A ((Short Answer Type)

All questions can be answered.
Each question carries 2 marks.
Ceiling 20 Marks.

1. Draw the set of points (x, y) satisfying the constraints

$$2x + y \leq 8,\ \ x + 2y \leq 10,\ \ x \geq 0, y \geq 0.$$

2. Write the canonical maximization linear programming problem.

3. Define a convex subset of $\mathbb{R}^2$. Also draw a convex set and a non-convex set in $\mathbb{R}^2$.

4. Let S be a convex set in $\mathbb{R}^2$. Define an extreme point of S.

5. Consider the canonical maximum tableau below :

x	y	-1	
1	2	3	$= -t_1$
4	5	6	$= -t_2$
7	8	9	$= f$

State the canonical maximization linear programming problem represented by the tableau above.

6. Write the canonical slack maximization linear programming problem.

7. State Von-Neumann Minimax Theorem.

8. What is complementary slackness of a dual canonical linear programming problem ?

Turn over

9. What is the basic feasible solution of a balanced transportation problem ?

10. Define hyper plane and closed half-space of $\mathbb{R}^n$.

11. What is the mixed strategy of a matrix game ?

12. What is the general balanced assignment problem ?

Section B (Paragraph/Problem Type)

All questions can be answered.
Each question carries 5 *marks.*
Ceiling 30 *marks.*

13. Solve graphically : Maximize $f(x, y) = 30x + 50y$ subject to

$$2x + y \leq 8,\ \ x + 2y \leq 10, x \geq 0, y \geq 0.$$

14. State Duality Theorem.

15. Solve the transportation problem given below :

7	2	4	10
10	5	9	20
7	3	5	30
20	10	30	

16. Solve the assignment problem given below :

38	21	34
41	14	36
28	20	25

17. Write the simplex algorithm for Maximum Tableau's.

18. Find the von Neumann value and the optimal strategy for each player in the matrix games below :

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

19. What is a two-person zero-sum matrix game ?

Section C (Essay Type)

Answer any **one** *of the following questions.*
The question carries 10 *marks.*

20. Solve the canonical linear programming problem using simplex algorithm to the minimum tableau given below :

x_1	20	25	300
x_2	40	20	500
-1	1000	800	0
	$= t_1$	$= t_2$	$= g$

21. Solve the following maximization problem :

Maximize $f(x, y) = x + 3y$ subject to
$x + 2y \leq 10,\ 3x + y \leq 15,\ x \geq 0$, y is unconstrained.

(1 × 10 = 10 marks)

D 50668 **(Pages : 4)** **Name.......................................**

Reg. No...................................

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Each question carries 2 marks.
Ceiling is 20.

1. Define polyhedral convex set. Give an example of a polyhedral convex set in $\mathbb{R}^2$.

2. Convert the following linear programming problem into canonical form :

Maximize $f(x, y) = -2y - x$ subject to

$$\begin{aligned} 2x - y &\geq -1 \\ 3y - x &\leq 8 \\ x, y &\geq 0. \end{aligned}$$

3. Define canonical slack maximization linear programming problem.

4. Pivot on 5 in the canonical maximimum tableau given below :

x_1	x_2	-1		
1	2	3	=	$-t_1$
4	5	6	=	$-t_2$
7	8	9	=	f

5. Define negative transpose.

6. If a canonical maximization linear programming problem is unbounded, prove that the dual canonical minimization linear programming problem is infeasible.

Turn over

7. Explain the following terms :

   a) Two person zero sum game ;

   b) Pay off matrix ; and

   c) Domination in matrix game.

8. State Von Neumann minimax theorem.

9. Let $x, y \in \mathbb{R}$ and consider the matrix game given below :

$$\begin{array}{cc} & \text{II} \\ \text{I} & \begin{bmatrix} x & 0 \\ 0 & y \end{bmatrix}. \end{array}$$

   Determine a necessary and sufficient condition for the matrix game above to reduce by domination to a single entry.

10. Distinguish between balanced and unbalanced transportation problem.

11. Explain briefly the north west corner method to obtain the initial basic feasible solution in transportation problem.

12. Define cycle in a tableau of a bounded transportation problem and give an example.

Section B

Answer any number of questions.
Each question carries 5 *marks.*
Ceiling is 30.

13. Using graphical method to solve the following linear programming problem :

   Maximize $f(x, y) = x + y$ subject to

$$x - y \leq 3$$
$$2x + y \leq 12$$
$$0 \leq x \leq 4$$
$$0 \leq y \leq 6.$$

14. Write the simplex algorithm for maximum tableaus.

15. Solve the noncanonical linear programming problem given below :

$$\begin{aligned} &\text{Maximize } f(x, y, z) = 2x + y - 2z \text{ subject to} \\ &\qquad x + y + z \leq 1 \\ &\qquad y + 4z > 2 \\ &\qquad x, y, z \geq 0. \end{aligned}$$

16. Prove that a pair of feasible solutions of dual canonical linear programming problems exhibit complementary slackness if and only if they are optimal solutions.

17. Solve the dual canonical linear programming problem given below :

$$\begin{array}{c|cc|c|cc} & x_1 & x_2 & -1 & & \\ \hline y_1 & -1 & -1 & -3 & = & -t_1 \\ y_2 & 1 & 1 & 2 & = & -t_2 \\ \hline -1 & 2 & -4 & 0 & = & f \\ \hline & = s_1 & = s_2 & = g & & \end{array}$$

18. Find the von Neumann value and the optimal strategy for each player in the matrix game given below :

$$\begin{array}{c|ccc|} & & \text{II} & \\ \hline & 2 & -3 & 2 \\ \text{I} & -3 & 4 & -3 \\ & 2 & -3 & 6 \\ \hline \end{array}$$

19. Solve the following transportation problem :

2	1	2	40
9	4	7	60
1	2	9	10
40	50	20	

Section C

Answer any **one** *question.*
The question carries 10 *marks.*

20. Apply simplex algorithm to solve the following maximum tableau :

$$\begin{array}{cc|c|cc} x_1 & x_2 & -1 & & \\ \hline -1 & -2 & -3 & = & -t_1 \\ 1 & 1 & 3 & = & -t_2 \\ 1 & 1 & 2 & = & -t_3 \\ \hline -2 & 4 & 0 & = & f \end{array}$$

21. Write the Hungarian algorithm. Using this algorithm solve the following assignment problem;

4	6	5	10
10	9	7	13
7	11	8	13
12	13	12	17

(1 × 10 = 10 marks)

D 30571 **(Pages : 4)** **Name.......................................**

Reg. No..................................

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2022

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Each question carries 2 *marks.*
Ceiling is 20.

1. Define optimal solution.
2. Draw and shade a bounded polyhedral convex subset in $\mathbb{R}^2$.
3. Represent the following linear programming problem into canonical slack minimization linear programming problem ;

   Minimize $c(x_1, x_2, x_3) = 20x_1 + 30x_2 + 25x_3$ subject to

   $$\begin{aligned} &x_1 + 2x_2 + 2x_3 \geq 200 \\ &2x_1 + 2x_2 + x_3 \geq 150 \\ &x_1, x_2, x_3 \geq 0 \end{aligned}$$

4. Pivot on 5 in the canonical maximum tableau given below :

   $$\begin{array}{|cc|c|cc} \multicolumn{1}{c}{x_1} & \multicolumn{1}{c}{x_2} & \multicolumn{1}{c}{-1} & & \\ \hline 1 & 2 & 3 & = & -t_1 \\ 4 & 5 & 6 & = & -t_2 \\ \hline 7 & 8 & 9 & = & f \\ \hline \end{array}$$

5. Write the simplex algorithm for maximum basic feasible tableaus.
6. Define negative transpose.

Turn over

7. Consider the canonical minimization linear programming problem given below :

   Minimize $g(y_1, y_2) = -y_2$ subject to

   $$\begin{aligned} & y_1 - y_2 \geq 1 \\ & -y_1 + y_2 \geq 2 \\ & y_1, y_2 \geq 0. \end{aligned}$$

   State the dual canonical maximization linear programming problem.

8. If a canonical maximization linear programming problem is unbounded, prove that the dual canonical minimization linear programming problem is infeasible.

9. Define complementary slackness.

10. Explain von Neumann minimax theorem.

11. Explain briefly the minimum entry method to obtain an initial basic feasible solution in transportation problem..

12. What is an assignment problem ?

Section B

Answer any number of questions.
Each question carries 5 *marks.*
Ceiling is 30.

13. Using geometrical method, solve the following linear programming problem :

    Maximize $f(x, y) = 5x + 2y$ subject to

    $$\begin{aligned} & x + 3y \leq 14 \\ & 2x + y \leq 8 \\ & x, y \geq 0. \end{aligned}$$

14. Solve the following canonical linear programming problem by simplex method :

$$\begin{array}{cc|c|cc}
x & y & -1 & & \\
\hline
-1 & -1 & -2 & = & -t_1 \\
1 & -2 & 0 & = & -t_2 \\
-2 & 1 & 1 & = & -t_3 \\
\hline
-1 & 3 & 0 & = & f
\end{array}$$

15. Solve the noncanonical linear programming problem given below :

Maximize $f(x,y) = x + 3y$ subject to

$x + 2y \leq 10$
$3x + y \leq 15$
$x \geq 0.$

16. State and prove duality theorem.

17. Find the von Neumann value and the optimal strategy for each players in the matrix game given below :

$$\begin{array}{c|cccc|} & & & \text{II} & \\ & 2 & 1 & 4 & 2 \\ & 1 & 2 & 1 & 1 \\ \text{I} & -2 & 6 & 3 & -2 \\ & 3 & -3 & 5 & 1 \\ & 1 & 2 & 2 & 1 \end{array}$$

18. Explain briefly north west corner method and use it to obtain the initial basic feasible solution of the transportation problem given below :

$$\begin{array}{|ccc|c} \hline 2 & 1 & 2 & 40 \\ 9 & 4 & 7 & 60 \\ 1 & 2 & 9 & 10 \\ \hline 40 & 50 & 20 & \end{array}$$

19. Solve the assignment problem given below :

38	21	34
41	14	36
28	20	25

Section C

Answer any **one** *question.*
The question carries 10 *marks.*

20. Solve the dual noncanonical linear programming problem given below :

$$\begin{array}{c|ccc|c|c} & \textcircled{x_1} & x_2 & x_2 & -1 & \\ \hline \textcircled{y_1} & 0 & -1 & -1 & -1 & = 0 \\ y_2 & -1 & -3 & 4 & 0 & = -t_1 \\ y_3 & -1 & 2 & -3 & 0 & = -t_2 \\ \hline -1 & -1 & 0 & 0 & 0 & = f \\ \hline & = 0 & = s_1 & = s_2 & = g & \end{array}$$

Turn over

21. Write transportation algorithm and use this algorithm solve the following transportation problem :

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

(1 × 10 = 10 marks)

D 30562 **(Pages : 4)** **Name.......................................**

Reg. No...................................

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2022

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2019 Admissions only)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions. Each question carries 2 *marks.*
Ceiling is 20.

1. Convert the following linear programming problem into canonical form :

   Maximize $f(x, y) = -2y - x$ subject to

$$\begin{aligned} 2x - y &\geq -1 \\ 3y - x &\leq 8 \\ x, y &\geq 0. \end{aligned}$$

2. Draw and shade the region of a bounded polyhedral convex subset of $\mathbb{R}^2$ in the first quadrant.

3. Represent the following linear programming problem into canonical slack form :

   Maximize $f(x_1, x_2) = 200x_1 + 150x_2$ subject to

$$\begin{aligned} x_1 + 2x_2 &\leq 20 \\ 2x_1 + 2x_2 &\leq 30 \\ 2x_1 + x_2 &\leq 25 \\ x_1, x_2 &\geq 0. \end{aligned}$$

4. Define infeasible linear programming problem.

5. Pivot on 4 in the canonical maximum tableau given below :

$$\begin{array}{cc|c|l} x & y & -1 & \\ \hline 1 & 2 & 3 & = -t_1 \\ 4 & 5 & 6 & = -t_2 \\ \hline 7 & 8 & 9 & = f \end{array}$$

Turn over

6. Write the simplex algorithm for minimum tableaus.

7. What do you mean by complementary slackness ?

8. State Duality theorem.

9. Consider the canonical minimization linear programming problem given below :

Minimize $g(y_1, y_2) = -y_2$ subject to

$$\begin{aligned} y_1 - y_2 &\geq 1 \\ -y_1 + y_2 &\geq 2 \\ y_1, y_2 &\geq 0. \end{aligned}$$

State the dual canonical maximization of the linear programming problem.

10. Using VAM to obtain an initial basic feasible solution of the transportation problem given below :

3	2	1	30
2	5	9	75
40	30	50	

11. Write the Hungarian algorithm for solving assignment problem.

12. Explain Northwest-corner method for obtaining initial basic feasible solution in transportation problem.

Section B

Answer any number of questions.
Each question carries 5 *marks.*
Ceiling is 30.

13. Solve the following linear programming problem by geometrical method :

Maximize $f(x, y) = 5x + 2y$ subject to

$$\begin{aligned} x + 3y &\leq 14 \\ 2x + y &\leq 8 \\ x, y &\geq 0. \end{aligned}$$

14. Solve the following canonical linear programming problem using simplex algorithm :

x_1	x_2	-1	
-1	1	1	$= -t_1$
1	-1	3	$= -t_2$
1	2	0	$= f$

15. Solve the following canonical linear programming problem by simplex method :

x_1	1	– 1	– 2
x_2	1	– 1	4
– 1	3	– 2	0
	$= t_1$	$= t_2$	g

16. Solve the non-canonical linear programming problem given below :

Maximize $f(x, y) = x + 3y$ subject to

$$x + 2y \leq 10$$
$$3x + y \leq 15$$
$$x \geq 0.$$

17. Write the dual simplex algorithm for minimum tableaus.

18. A company wishes to assign five of its worker to five different jobs (one worker to each job and vice versa). The rating of each with respect to each job on a scale of 0 to 10 (10 being high rating) is given by the following table :

	J_1	J_2	J_3	J_4	J_5
W_1	5	4	2	8	5
W_2	7	6	4	6	9
W_3	5	5	3	3	2
W_4	4	3	5	5	4
W_5	3	6	4	10	2

If the company wishes to maximize the total rating of the assignment, find the optimal assignment plan and corresponding maximum total rating.

19. Apply the minimum entry method to obtain the initial basic feasible solution for the transportation problem given below :

4	5	5
3	2	7
6	3	9
7	5	4
14	11	

Turn over

Section C

Answer any **one** *question.*
Each question carries 10 *marks.*
Maximum marks 10.

20. Apply simplex algorithm to the maximum tableau :

$$\begin{array}{|cc|c|l} x_1 & x_2 & -1 & \\ \hline -1 & -2 & -3 & = -t_1 \\ 1 & 1 & 3 & = -t_2 \\ 1 & 1 & 2 & = -t_3 \\ \hline -2 & 4 & 0 & = f \\ \hline \end{array}$$

21. Write transportation algorithm. Using this algorithm solve the following transportation problem :

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

(1 × 10 = 10 marks)

D 10669 **(Pages : 4)** **Name.......................................**

Reg. No..................................

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Define canonical minimization linear programming problem.
2. Give an example of a bounded polyhedral convex subset in $\mathbb{R}^2$.
3. State the canonical minimization linear programming problem represented by the following tableau :

$$\begin{array}{c|cc|c|}
\hline
x & 1 & 2 & 3\\
y & 4 & 5 & 6\\
\hline
-1 & 7 & 8 & 9\\
\hline
\multicolumn{1}{c}{} & =t_1 & \multicolumn{1}{c}{=t_2} & \multicolumn{1}{c}{g}
\end{array}$$

4. Define unbounded linear programming problem.
5. Pivot on 5 in the canonical maximum tableau given below :

$$\begin{array}{|cc|c|l}
\multicolumn{1}{c}{x_1} & \multicolumn{1}{c}{x_2} & \multicolumn{1}{c}{-1} & \\
\hline
1 & 2 & 3 & =-t_1\\
4 & 5 & 6 & =-t_2\\
\hline
7 & 8 & 9 & =f\\
\hline
\end{array}$$

6. Write the simplex algorithm for maximum tableaus.
7. What do you mean by complementary slackness ?
8. State Duality theorem.

Turn over

9. Consider the canonical maximization linear programming problem given below ;

Maximize $f(x_1, x_2) = x_1$ subject to

$$\begin{aligned} &x_1 + x_2 \le 1 \\ &x_1 - x_2 \ge 1 \\ &x_2 - 2x_1 \ge 1 \\ &x_1, x_2 \ge 0 \end{aligned}$$

state the dual canonical minimization of the linear programming problem.

10. Distinguish between balanced and unbalanced transportation problem.

11. Using VAM to obtain a basic feasible solution of the transportation problem given below :

4	5	5
3	2	7
6	3	9
7	5	4
14	11	

12. Explain the minimum entry method for obtaining initial basic feasible solution in transportation problem.

(8 × 3 = 24 marks)

Section B

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Solve the following linear programming problem by geometrical method.

Maximize $f(x, y) = -2y - x$ subject to

$$\begin{aligned} &2x - y \ge -1 \\ &3y - x \le 8 \\ &x, y \ge 0. \end{aligned}$$

14. Solve the following canonical linear programming problem using simplex algorithm :

$$\begin{array}{cc|c|l} x_1 & x_2 & -1 & \\ \hline -1 & 1 & 1 & = -t_1 \\ 1 & -1 & 3 & = -t_2 \\ \hline 1 & 2 & 0 & = f \end{array}$$

15. Solve the canonical linear programming problem using simplex algorithm :

$$\begin{array}{c|cc|c|} \cline{2-4} x & -2 & 1 & -3 \\ y & 1 & -2 & -2 \\ \cline{2-4} -1 & 1 & 0 & 0 \\ \cline{2-4} \multicolumn{1}{c}{} & = t_1 & = t_2 & \multicolumn{1}{c}{g} \end{array}$$

16. Solve the non-canonical linear programming problem given below

Maximize $f(x, y, z) = 2x + y - 2z$ subject to

$$x + y + z \leq 1$$
$$y + 4z = 2$$
$$x, y, z \geq 0.$$

17. Write the dual simplex algorithm for minimum tableaus.

18. Solve the transportation problem given below :

$$\begin{array}{c|ccc|c} \multicolumn{1}{c}{} & M_1 & M_2 & \multicolumn{1}{c}{M_3} & \\ \cline{2-4} W_1 & 2 & 1 & 2 & 50 \\ W_2 & 9 & 4 & 7 & 70 \\ W_3 & 1 & 2 & 9 & 20 \\ \cline{2-4} \multicolumn{1}{c}{} & 40 & 50 & \multicolumn{1}{c}{20} & \end{array}$$

19. Apply Northwest-corner method to obtain the initial basic feasible solution of the transportation problem given below :

$$\begin{array}{|ccc|c} \hline 7 & 2 & 4 & 10 \\ 10 & 5 & 9 & 20 \\ 7 & 3 & 5 & 30 \\ \hline \multicolumn{1}{c}{20} & 10 & \multicolumn{1}{c}{30} & \end{array}$$

(5 × 5 = 25 marks)

Section C

Answer any **one** *question.*
The question carries 11 *marks.*

20. Solve the canonical linear programming problem given below using the simplex algorithm.

$$\begin{array}{|ccc|c|c} \multicolumn{1}{c}{x} & y & z & \multicolumn{1}{c}{-1} & \\ \hline 1 & 2 & 1 & 4 & = -t_1 \\ 2 & 1 & 5 & 5 & = -t_2 \\ 3 & 2 & 0 & 6 & = -t_3 \\ \hline 1 & 2 & 3 & 0 & = f \\ \hline \end{array}$$

Turn over

21. Write the Hungarian algorithm. Using this algorithm solve the following assignment problem :

2	3	2	4
5	8	4	3
5	9	5	2
7	6	7	4

(1 × 11 = 11 marks)