D 30575 2s 243994

(Pages : 4)

Name.....

Reg. No.....

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

Mathematics

MTS 5D 03—LINEAR MATHEMATICAL MODELS

(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. Find the equation of the line through (0,–3) with slope $\frac{3}{4}$.
2. Find k such that the line through (4,–1) and (k, 2) is parallel to $2x + 3y = 6$.
3. Solve the system of equations :

   $2x+3y-z=1$

   $3x+5y+z=3$

   where z is the parameter.

4. Let $A=\begin{bmatrix}-2 & 4\\ 0 & 3\end{bmatrix}$ and $B=\begin{bmatrix}-6 & 2\\ 4 & 0\end{bmatrix}$. Find $-4A + 5B$.

5. Find the inverse of $B=\begin{bmatrix}1 & 3\\ 2 & 7\end{bmatrix}$.

6. Graph the linear inequality $y \geq x-3$.
7. Explain briefly the steps to use in solving a linear programming problem by graphical method.
8. Graph the solution of each of the following inequalities and tell whether the region is bounded or unbounded :

   $x+y\leq 6$

   $2x-y\geq 3$.

Turn over

9. Explain standard maximum form of a linear programming problem.

10. Introduce slack variables as necessary and write the initial simplex tableau for the li programming problem given below :

Find $x_1 \geq 0$ and $x_2 \geq 0$ such that

$4x_1 + 2x_2 \leq 5$

$x_1 + 2x_2 \leq 4$

and $z = 7x_1 + x_2$ is maximized.

11. Find the transpose of the matrix $A = \begin{bmatrix} 4 & 5 & -3 & 15 \\ 7 & 14 & 20 & -8 \\ 5 & 0 & -2 & 23 \end{bmatrix}$.

12. State the dual of the linear programming problem given below :

Maximize $z = 4x_1 + 3x_2 + 2x_3$

subject to $x_1 + x_2 + x_3 \leq 5$

$x_1 + x_2 \leq 4$

$2x_1 + x_2 + 3x_3 \leq 15$

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

Section B

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

13. A firm producing poultry feed finds that the total cost C (x) in dollars of producing and units is given by C (x) = 20x + 100. Management plans to charge \$24 per unit for the fe

(a) How many units must be sold for the firm to break-even ?

(b) What is the profit if 100 units of feed are sold ?

(c) How many units must be sold to produce a profit of \$900 ?

14. Use Gauss-Jordan method to solve the following system of equations :

$x + 5z = -6 + y$

$3x + 3y = 10 + z$

$x + 3y + 2z = 5$

15. Find A^{-1} if $A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & -2 & -1 \\ 3 & 0 & 0 \end{bmatrix}$.

16. Find the maximum value of the objective function $Z = 3x + 4y$ subject to the following constraints

$2x + y \leq 4$

$-x + 2y \leq 4$

$x \geq 0, y \geq 0$

17. Set up the initial simplex tableau for the following problem :

A farmer has 100 acres of available land on which he wishes to plant a mixture of potatoes, corn, and cabbage. It costs him \$400 to produce an acre of potatoes, \$160 to produce an acre of corn, and \$280 to produce an acre of cabbage. He has a maximum of \$20,000 to spend. He makes a profit of \$120 per acre of potatoes, \$40 per acre of corn, and \$60 per acre of cabbage. How many acres of each crop should he plant to maximize his profit?

18. Pivot about the indicated 2 of the following initial simplex tableau :

x_1	x_2	x_3	s_1	s_2	s_3	z	
[2]	1	1	1	0	0	0	150
1	2	8	0	1	0	0	200
2	3	1	0	0	1	0	320
−3	−2	−1	0	0	0	1	0

19. Explain briefly the steps involved in solving a standard maximum linear programming problem by simplex method.

Section C

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

20. Solve the following system of equations by using inverse of the coefficient matrix :

$-x - y - z = 1$

$4x + 5y = -2$

$y - 3z = 3$

21. Use simplex method to solve the following linear programming problem :

Maximize $z = 12x_1 + 10x_2$

subject to $x_1 + 2x_2 \geq 24$

$x_1 + x_2 \leq 40$

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

(1 × 10 = 10 mar