18334

D 10673 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS–UG)

Mathematics

MTS 5D 03—LINEAR MATHEMATICAL MODELS

(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. Does the line $y = -x + 5$ intersect the point $(3, -1)$? Why ?
2. Let $g(x) = -4x + k$ where k is a constant. If $g(3) = 5$, find the value of k.
3. Solve the system of equations $3x + y = 5$, $3x = 6$.
4. Write the augmented matrix for the system of equations $3x + y = 6$, $2x + 5y = 15$.
5. Find values of x, y if $\begin{bmatrix} 3 & 4 \\ -8 & 1 \end{bmatrix} = \begin{bmatrix} 3 & 2y \\ x & 1 \end{bmatrix}$.
6. Find the product of matrices : $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} -1 & 5 \\ 0 & 3 \end{bmatrix}$.
7. Graph the linear inequality $x \leq 3y$.
8. Define the term *corner point*. State the corner point theorem.
9. Give an example for a maximization problem in standard form with 2 variables.
10. Sketch the feasible region for the linear programming problem :

    Maximize $Z = 2x + 3y$ subject to $x \geq 0, y \geq 0$.
11. What are the conditions to be satisfied to call a linear programming problem to be in standard minimum form ?

Turn over

12. Write the matrix form of the linear programming problem :

Minimize $W = 8y_1 + 16y_2$

subject to $y_1 + 5y_2 \geq 9$
$2y_1 + 2y_2 \geq 10$
$y_1 \geq 0, y_2 \geq 0.$

Section B

$(8 \times 3 = 24)$

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

13. In recent years, the percentage of the U.S. population age 18 and older who smoke has de at a roughly constant rate, from 24.1% in 1998 to 20.6% in 2008. Find the equation describ linear relationship.

14. Solve the system of equations :

$3x + 10y = 115$
$11x + 4y = 95$

using echelon method.

15. A convenience store sells 23 sodas one summer afternoon in 12-, 16-, and 20-*oz* cups (small, m and large). The total volume of soda sold was 376 *oz*. Suppose that the prices for a small, m and large soda are \$1, \$1.25, and \$1.40, respectively, and that the total sales were \$ How many of each size did the store sell ?

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

$x + 3y - 2z = 4$
$2x + 7y + 3z = 8$
$3x + 8y + 5x = -4.$

17. Graph the feasible region for the following system of inequalities and tell if it is bou unbounded :

$3x - 2y \geq 6$
$x + y \leq -5$
$y \leq -6$

18. Find the maximum value of the objective function $z = 3x + 4y$, subject to the const $-x + 2y \leq 4, x \geq 0, y \geq 0.$

19. Add slack variables to the following linear programming problem and write the initial simplex tableau:

Maximize $Z = 3x_1 + 2x_2 + x_3$

subject to $2x_1 + x_2 + x_3 \leq 150$
$2x_1 + 2x_2 + 8x_3 \leq 200$
$2x_1 + 3x_2 + x_3 \leq 320$
and $x_1, x_2, x_3 \geq 0$.

(5 × 5 = 25 marks)

Section C

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

20. Assume that the demand of an item A increases as the price decreases. If the weekly demand for A is q (in dollar \$) and the price is p then suppose that they are related by the linear relation $D(p) = 9 - 0.75q$.

(a) Find the quantity demanded at a price of \$ 5.25 per item and at a price of \$ 3.75 per item.

(b) It is also noticed that the quantity of item A supplied decreased as the price decreased. If price p and supply q are related by the linear function $S(p) = 0.75q$, find the quantity supplied at a price of \$ 5.25 per item and at a price of \$ 3.00 per item.

(c) Graph both functions $D(p)$ and $S(p)$ on the same axes.

21. Solve the problem using simplex method :

Maximize $Z = 12x_1 + 15x_2 + 5x_3$

subject to $2x_1 + 2x_2 + x_3 \leq 8$
$x_1 + 4x_2 + 3x_3 \leq 12$
$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

(1 × 11 = 11 marks)