OVERVIEW AND DETAILED EXPLANATION OF THE GRAPHICAL METHOD FOR SOLVING LINEAR PROGRAMMING PROBLEMS

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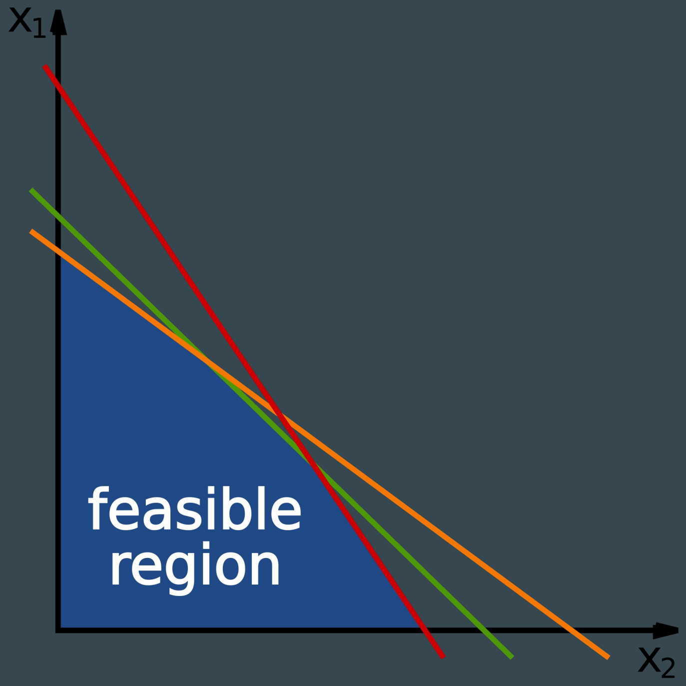
CA 1 : PROJECT MANAGEMENT AND ENTREPRENEURSHIP (HSMC701)

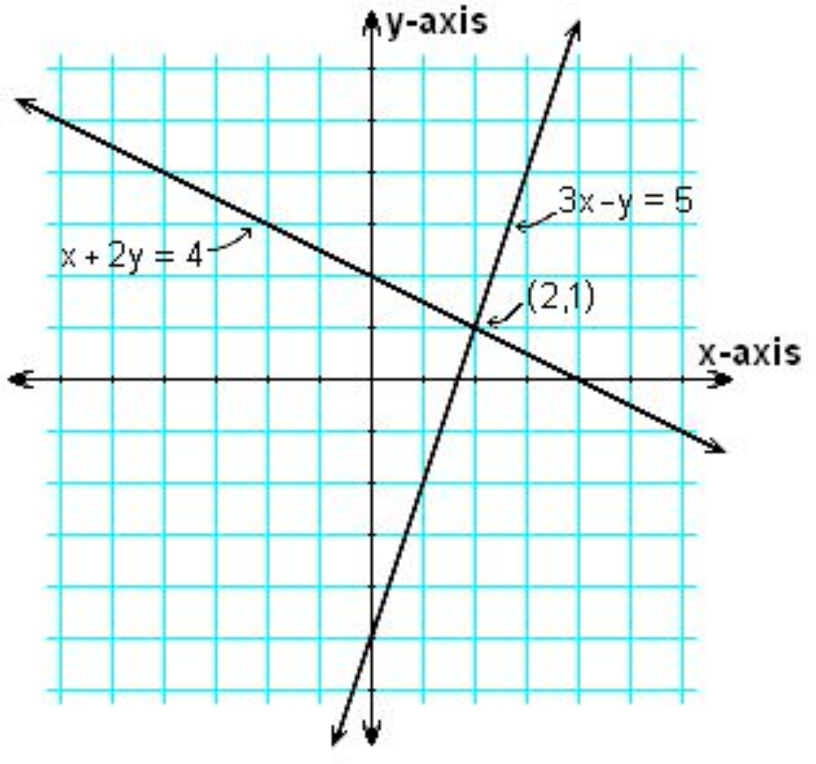
CSE : SEMESTER 7

CONTENT



INTRODUCTION

The graphical method is a visual technique used to solve linear programming (LP) problems, particularly useful for problems involving two variables. It involves plotting the constraints and objective function on a graph to identify the feasible region and determine the optimal solution.



OVERVIEW OF LINEAR PROGRAMMING

Linear programming is a mathematical method for determining a way to achieve the best outcome in a given mathematical model. Its applications can be found in various fields such as business, economics, engineering, and military applications. An LP problem typically consists of:

1. **Objective Function**: A linear function that needs to be maximized or minimized.
   - **Example**: Maximize Z=c1x1+c2x2Z
   - **Constraints**: A set of linear inequalities or equations that define the feasible region.
   - **Example**: a1x1+b1x2 ≤ d1
   - These constraints may also include non-negativity restrictions: x1≥0 and x2≥0.
2. **Decision Variables**: The variables that influence the outcome of the objective function.

STEPS IN GRAPHICAL METHOD

Formulate the LP Problem:

- Define the objective function and constraints in standard form.

Graph the Constraints:

- Each constraint can be represented as a line on a graph.
- To graph a constraint, convert the inequality into an equation and find the intercepts (where the line crosses the axes).
- Shade the feasible region based on the inequality direction (for example, below the line for ≤\leq≤ constraints).

Identify the Feasible Region:

- The feasible region is the area on the graph where all the constraints overlap. This region contains all possible solutions that satisfy all constraints.

STEPS IN GRAPHICAL METHOD (CONTINUED)

Plot the Objective Function:

- Choose a value for the objective function and graph it as a line. The slope of this line depends on the coefficients in the objective function.
- Move parallel to the objective function line to find the optimal point.

Find the Optimal Solution:

- The optimal solution lies at one of the vertices (corner points) of the feasible region.
- Calculate the objective function value at each vertex to find the maximum or minimum value.

Interpret the Results:

- Identify which vertex provides the optimal value and interpret the corresponding values of the decision variables.

EXAMPLE USING CORNER POINT METHOD

Maximize: $Z = 8x + y$

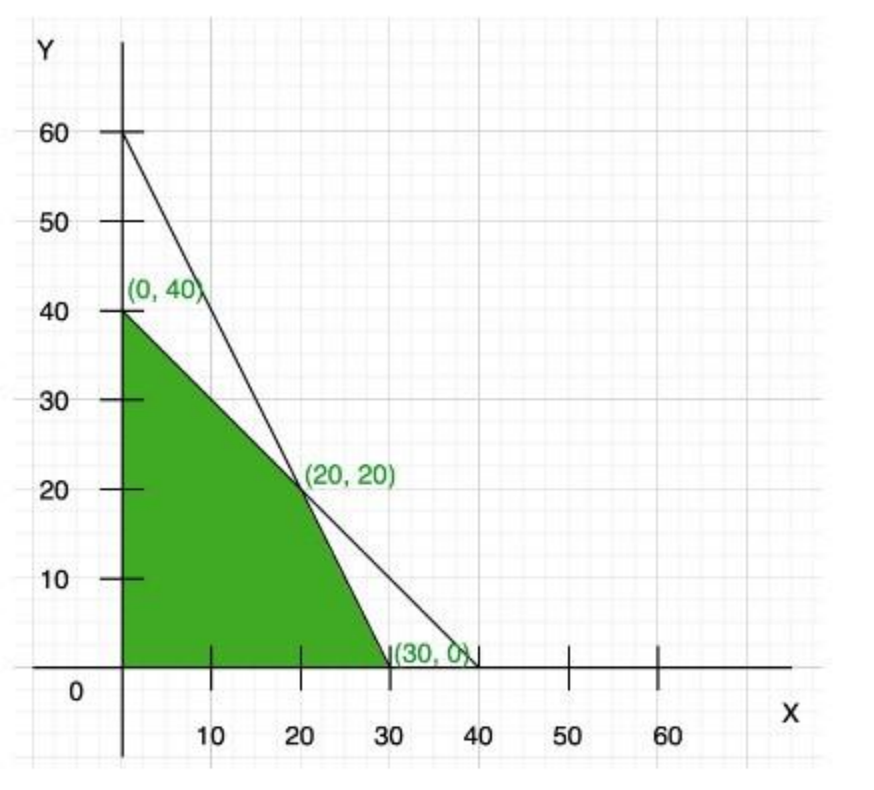
Constraints are,

- $x + y \leq 40$
- $2x + y \leq 60$
- $x \geq 0,\ y \geq 0$

Solution:

Step 1: Constraints are,

- $x + y \leq 40$
- $2x + y \leq 60$
- $x \geq 0,\ y \geq 0$



Step 2: Draw the graph using these constraints.

EXAMPLE USING CORNER POINT METHOD (EXAMPLE)

Here both the constraints are less than or equal to, so they satisfy the below region (towards origin). You can find the vertex of feasible region by graph, or you can calculate using the given constraints:

$x + y = 40$ …(i)

$2x + y = 60$ …(ii)

Now multiply eq(i) by 2 and then subtract both eq(i) and (ii), we get

$y = 20$

Now put the value of y in any of the equations, we get

$x = 20$

So the third point of the feasible region is (20, 20)

EXAMPLE USING CORNER POINT METHOD (EXAMPLE)

Points	Z = 8x + y
(0, 0)	0
(0, 40)	40
(20, 20)	180
(30, 0)	240

Step 3: To find the maximum value of Z = 8x + y. Compare each intersection point of the graph to find the maximum value

So the maximum value of Z = 240 at point x = 30, y = 0.

CONCLUSION

The graphical method for solving linear programming problems is a straightforward and visual approach, ideal for problems with two variables. It involves plotting the constraints and objective function on a graph to identify the feasible region and determine the optimal solution by evaluating the objective function at the vertices of this region. While highly intuitive and easy to understand, making it an excellent educational tool, this method is limited to problems with only two decision variables and becomes impractical for higher-dimensional problems where more advanced techniques like the Simplex method are required.

REFERENCES

→ https://www.geeksforgeeks.org/graphical-solution-of-linear-programming-problems/

THANK YOU