Convex-Optimization

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Optimization:Basic

Contents

1 Problem

Maximise Z = − x + 2y, subject to the constraints:
x ≥3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 0.

2 Solution

Objective function:

$$z = \max_{\mathbf{x}} \begin{pmatrix} -1 & 2 \end{pmatrix} \mathbf{x} \tag{1}$$

constraints:

x+y≥5
x+2y ≥6
x ≥ 3
y ≥0

Writing all constraints in the matrix form

$$\mathbf{px} = \mathbf{q} \tag{2}$$

$$\begin{pmatrix} 1 & 1 \\ 1 & 2 \\ 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 5 \\ 6 \\ 3 \\ 0 \end{pmatrix} \tag{3}$$

By providing the objective function and constraints to cvxpy,the optimal value gives infinity as result and the problem is unbounded.

Reason: Unbounded means if there exists some direction within the feasible region along which the objective function value can increase (maximization case) or decrease (minimization case) without bound. In such a formulation, the optimal value is negative infinity for a minimization problem, and conversely, positive infinity for a maximization problem.

An unbounded solution is something that typically does not arise in practical applications. When it does occur, it's usually because the formulation is ill-posed, i.e., incorrect in some way, and/or missing some necessary constraints for properly modeling the dynamics of the system under consideration.

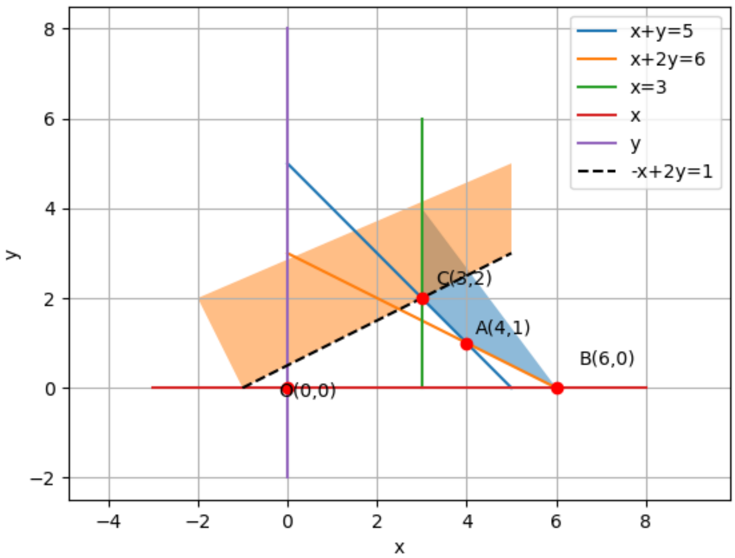
termux commands :

bash basic.sh............using shell command

cvxpy code:

https://github.com/FWC_module1/blob/main/optimization/basic.py

Graphical method:



From Graph,

corner points	z
(3,2)	**1**
(4,1)	-2
(6,0)	-6

Clearly the corner point (3,2) has maximum value for the given objective function.

But, as the feasible region is unbounded ,'**1**' may or may not be the maximum value. So ,we need to graph the inequality -x+2y > 1.
∵ Feasible region of -x+2y > 1 has some points in common with the given constraints .so ,there is no maximum value for z subject to given constraints.