EE5327 Optimization

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21 Feb 2019

Linear Programming

Definition

Linear programming is a technique for the optimization of a linear objective function, subject to linear equality and linear inequality constraints.

$$\min_{x} \; c^T x$$

$$\textit{subject to } Ax \leq b$$

$$\textit{and } x \geq 0$$

Question 5.1

Q. Graphically obtain a solution to the following

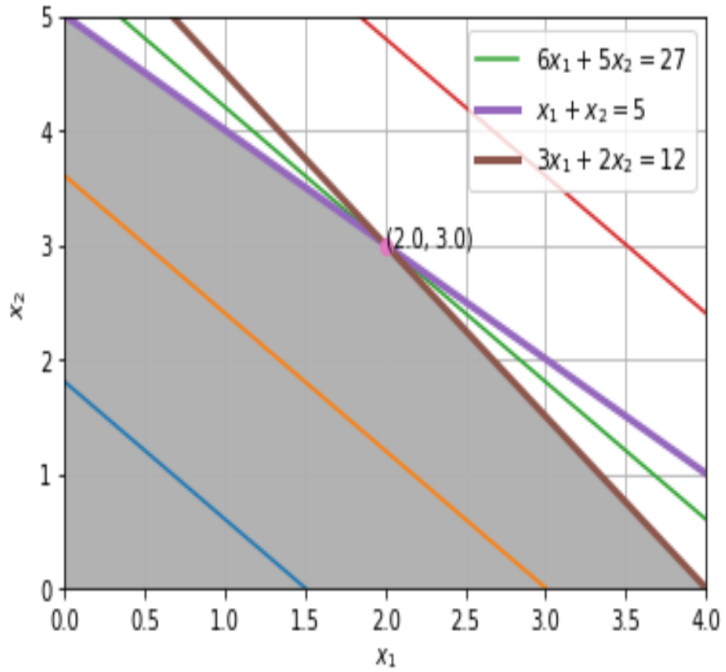
$$\max_{x} \; 6x_1 + 5x_2$$

with constraints

$$x_1 + x_2 \leq 5$$
$$3x_1 + 2x_2 \leq 12$$
$$\textit{where } x_1, x_2 \geq 0$$

Graphical Solution

[9 18 27 36]



vertex of feasible region	corresponding value of $\max_x \; 6x_1 + 5x_2$
(0,0)	0
(0,5)	25
(4,0)	24
(2,3)	27

Question 5.2

Q. Use cvxopt to obtain a solution to problem 5.1.

$$\min_x \; c^T x$$

$$\textit{subject to } Ax \preceq b$$

$$c = \begin{bmatrix} -6 \\ -5 \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 3 & 2 \\ -1 & 0 \\ 0 & -1 \end{bmatrix}, B = \begin{bmatrix} 5 \\ 12 \\ 0 \\ 0 \end{bmatrix}$$

Solution

Code:

```
from cvxopt import matrix
from cvxopt import solvers

A = matrix([ [1.0, 3.0, -1.0, 0], [1.0, 2.0, 0, -1.0] ])
b = matrix([ 5.0, 12.0, 0.0, 0.0 ])
c = matrix([ -6.0, -5.0 ])
sol = solvers.lp(c, A, b)
print(sol['x'])
```

```
Optimal solution found.
[ 2.00e+00]
[ 3.00e+00]
```