

EE5327 Optimization

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4.5 Minimize

$$f(x) = -x_{11} - 2x_{12} - 5x_{22} \quad (1)$$

subject to

$$2x_{11} + 3x_{12} + x_{22} = 7 \quad (2)$$

$$x_{11} + x_{12} \geq 1 \quad (3)$$

$$x_{11}, x_{12}, x_{22} \geq 0 \quad (4)$$

$$\begin{pmatrix} x_{11} & x_{12} \\ x_{12} & x_{22} \end{pmatrix} \succeq 0 \quad (5)$$

by converting the problem into a convex optimization problem in two variables and using graphical plots.

By converting to two variable convex problem

Minimize

$$9x_{11} + 13x_{12} \tag{6}$$

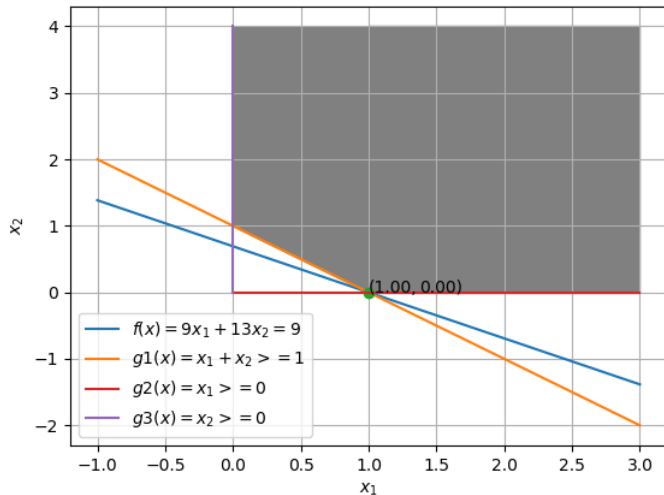
subject to

$$x_{11} + x_{12} \geq 1 \tag{7}$$

$$x_{11}, x_{12} \geq 0 \tag{8}$$

$$\begin{pmatrix} x_{11} & x_{12} \\ x_{12} & x_{22} \end{pmatrix} \succeq 0 \tag{9}$$

Graphical Solution



We Get:

$$x_{11} = 1 \quad (10)$$

$$x_{12} = 0 \quad (11)$$

By substituting these values in equation (2)

$$2x_{11} + 3x_{12} + x_{22} = 7 \quad (12)$$

We Get:

$$x_{11} = 1 \quad (13)$$

$$x_{12} = 0 \quad (14)$$

$$x_{22} = 5 \quad (15)$$

Our Solution is::

$$\begin{pmatrix} 1 & 0 \\ 0 & 5 \end{pmatrix} \quad (16)$$

Its Eigenvalues are: 1,5

Hence it is a positive semidefinite matrix

$$\begin{pmatrix} 1 & 0 \\ 0 & 5 \end{pmatrix} \succeq 0 \quad (17)$$