PRESENTATION

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September 2, 2019

Problem

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- About cvxopt
- Reformulation of given equation

Terminal

Optimal solution

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PROBLEM

The problem

$$\min_{\mathbf{x}} x_{11} + x_{12} \tag{1.1}$$

with constraints

$$x_{11} + x_{22} = 1 \tag{1.2}$$

and

$$\mathbf{X} \succeq 0 \tag{1.3}$$

where

$$\mathbf{X} = \begin{pmatrix} x_{11} & x_{12} \\ x_{12} & x_{22} \end{pmatrix} \tag{1.4}$$

is known as semi-definite programming.Find a numerical solution to this problem.

About cvxopt

CVXOPT is a software package for convex optimization based on python programming language.This package includes solvers for linear programming,quadratic programming,semi-definite programming and more.

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Reformulation of given equation

The cvxopt solver has to be used in order to find a numerical solution.
For this, the given equation can be reformulated as:

$$\min_{\mathbf{x}} \begin{pmatrix} 1 & 1 & 0 \end{pmatrix} \begin{pmatrix} x_{11} \\ x_{12} \\ x_{22} \end{pmatrix} \tag{2.1}$$

such that

$$\begin{pmatrix} 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} x_{11} \\ x_{12} \\ x_{22} \end{pmatrix} = 1 \tag{2.2}$$

and

$$x_{11} \begin{pmatrix} -1 & 0 \\ 0 & 0 \end{pmatrix} + x_{12} \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} + x_{22} \begin{pmatrix} 0 & 0 \\ 0 & -1 \end{pmatrix} \preceq \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix} \tag{2.3}$$

TERMINAL

The code in

https://github.com/likhita26/blob/master/semi−definite%20programming%201.py

shows the following terminal.

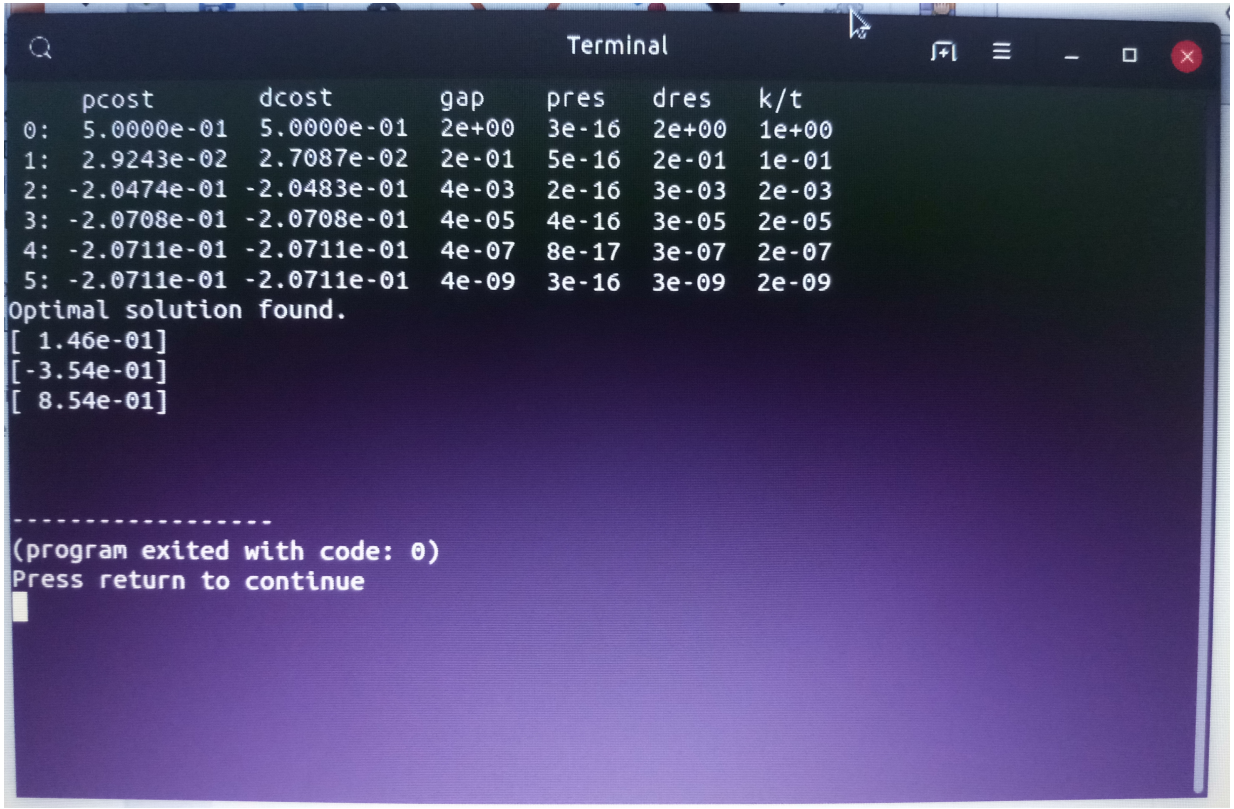

Figure: Terminal

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Optimal Solution

From previous, we get the optimal solution as:

$x_{11} = 0.146$

$x_{12} = -0.354$

$x_{22} = 0.854$

Therefore,the required minimum value is -0.208.

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