Optimization

EE18MTECH11006,EEMTECH11007

February 21, 2019

4.3 Solve the following problem by cvxpy

$$\begin{aligned}
&\underset{x}{\text{minimize}} \quad x_{11} + x_{12} \\
&\text{subject to} \quad x_{11} + x_{22} = 1, \\
&X \succeq 0 (PSD) \\
&\text{where } X = \begin{bmatrix} x_{11} & x_{12} \\ x_{12} & x_{22} \end{bmatrix}
\end{aligned}$$

Solution

```
import cvxpy as cvx
from numpy import matrix, round, eye
X = cvx.Variable((2,2),PSD = True)
B = eye(2)
v = matrix([[1],[0]])
u = matrix([[1],[1]])
w = matrix([[1, 0, 0, 1]])
f = u.transpose()*X.T*v
T = cvx.bmat([[X,B],[B,X]])
obj = cvx.Minimize(f)
constraints = [w * T * w.transpose() == 1]$
cvx.Problem(obj, constraints).solve()
print ("Minimum of f(x) is ",round(f.value,2),"at X=", X.value )
```

Minimum of $f(x)$ *is* $[[-0.21]]$ *at*

$$X = \begin{bmatrix} 0.14644661 & -0.35355352 \\ -0.35355352 & 0.85355377 \end{bmatrix}$$

Problem 5.3

Solve the following problem by cvxpy

$$\begin{aligned} \underset{x}{\text{maximize}} \quad & 6x_1 + 5x_2 \\ \text{subject to} \quad & x_1 + x_2 \leq 5, \\ & 3x_1 + 2x_2 \leq 12, \\ & \text{where } x1, x2 \geq 0 \end{aligned}$$

Solution

```
from cvxpy import *
from numpy import matrix
A = matrix([ [1.0, 3.0], [1.0, 2.0 ]])
b = matrix([ 5.0, 12.0 ])
c = matrix([ 6.0, 5.0 ])
x = Variable((2,1),nonneg=True)
f = c*x
obj = Maximize(f)
constraints = [A.transpose() * x <= b.transpose()]
Problem(obj, constraints).solve()
print(f.value,x.value)
```

$$\textit{Optimal solution is } [2.00e+00]\ [3.00e+00]$$