"Optimization"

Shervin Halat

98131018

Homework #1

Implementation Problem

9.

There are multiple mathematical optimization tools and software such as CVX, CVXPY, CVXOPT, CVXR, PICOS, DCCP, DMCP, NCVX and so on. The main differences between these tools are based on kind of 'solvers', 'programming languages', 'APIs', and 'libraries' they implement. Each one of these tools or applications are suitable for some specific optimization problems and may have better performance at some specific tasks. This problem is solved by CVXOPT.

Obtained results are as follows:

$$\begin{aligned} min \quad & f(x) = x_1 + 3x_2 \\ s.t. \quad & -x_1 + x_2 \leq 2 \\ & x_1 + x_2 \geq 2 \\ & x_2 \geq 0 \\ & 2x_1 - 3x_2 \leq 5 \end{aligned}$$

In [60]:

```
1  from cvxopt import matrix, solvers
2
3  A = matrix([ [-1.0, -1.0, 0.0, 2.0], [1.0, -1.0, -1.0, -3.0] ])
4  b = matrix([ 2.0, -2.0, 0.0, 5.0 ])
5  c = matrix([ 1.0, 3.0 ])
6
7  sol = solvers.lp(c,A,b )
8  print(f"\noptimal point x1: {sol['x'][0]}\noptimal point x2 : {sol['x'][1]}"
9  x1_opt, x2_opt = sol['x']
10 opt_val_fun = x1_opt + 3*x2_opt
11 print(f"optimal value function: {opt_val_fun}" )
12
13
```

```
     pcost       dcost       gap    pres   dres   k/t
 0:  1.0000e+00  1.0000e+00  4e+00  6e-01  2e-16  1e+00
 1:  1.6732e+00  1.6745e+00  4e-01  5e-02  2e-16  9e-02
 2:  1.9479e+00  1.9535e+00  2e-01  3e-02  3e-16  5e-02
 3:  1.9994e+00  1.9995e+00  2e-03  3e-04  5e-16  6e-04
 4:  2.0000e+00  2.0000e+00  2e-05  3e-06  2e-16  6e-06
 5:  2.0000e+00  2.0000e+00  2e-07  3e-08  4e-17  6e-08
Optimal solution found.

optimal point x1: 2.0000000179532713
optimal point x2 : -2.5668771769383607e-08
optimal value function: 1.999999940946956
```