

**Math 420, Spring 2018**  
**Fourth Team Homework**  
due Tuesday, 3 April, 2018

**Exercise 1.**

Consider the optimization problem:

$$\begin{array}{ll} \text{minimize} & 2|x_1| + x_2 \\ \text{subject to} & x_1^2 + x_1x_2 + x_2^2 \leq 2 \end{array}$$

1. Prove the problem is a convex optimization problem.
2. Re-write it as one type of the convex optimization problems we studied in class.
3. Write a CVX code and solve it. Send in the CVX code and the print-out of the results.

**Exercise 2.**

Let  $C_1, C_2, C_3$  be the following symmetric matrices:

$$C_1 = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 0 \\ 3 & 0 & -1 \end{bmatrix}, \quad C_2 = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}, \quad C_3 = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}.$$

Consider the following optimization problem where the unknown is a  $3 \times 3$  symmetric matrix  $X = X^T \in \mathbb{R}^{3 \times 3}$ :

$$\begin{array}{ll} \text{minimize} & |\text{trace}(C_1X)| \\ \text{subject to} & \text{trace}(C_2X) = 0 \\ & \text{trace}(C_3X) = 2 \end{array}$$

1. Show this problem is a convex optimization problem.
2. Write the problem as a Linear Program.
3. Implement the problem in CVX and solve it. Print out the code and the solutions.