Math 420, Spring 2017
Fifth Team Homework
due Tuesday, 18 April, 2017

Exercise 1.

Consider the optimization problem:

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

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:

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

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

$$\begin{array}{ll} \text{minimize} & |trace(C_1 X)| \\ \text{subject to} & trace(C_2 X) = 0 \\ & trace(C_3 X) = 2 \end{array}$$

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.