Homework 1 and 2
APPM 4720/5720 Fall 2018
Advanced Convex Optimization

Due date: Friday, Sept 7 2018
Theme: Convex sets, convex functions

Instructor: Dr. Becker

Instructions Collaboration with your fellow students is allowed and in fact recommended, although direct copying is not allowed. The internet is allowed for basic tasks. Please write down the names of the students that you worked with. An arbitrary subset of these questions will be graded.

Reading Read chapters 1–3 in [BV2004]

Homework 1

Problem 1: [BV2004] Problem 2.2

Problem 2: [BV2004] Problem 2.8

Problem 3: [BV2004] Problem 2.12

Problem 4: [BV2004] Problem 2.13

Problem 5: [BV2004] Problem 2.35

Homework 2

Problem 1: Using the white wine data from the Spanish wine quality database https://archive.ics.uci.edu/ml/datasets/Wine+Quality hosted at the UCI machine learning repository, compare ordinary least-squares regression

$$\beta_2 = \operatorname{argmin} \|y - X\beta\|_2$$

with more robust ℓ_1 regression (cf. p. 294 §6.1.1 in [BV2004])

$$\beta_1 = \operatorname{argmin} \|y - X\beta\|_1$$

Report on the differences and make observations (e.g., are the estimators significantly different? are there outliers, and if so, does removing the outliers change the estimators?), and probably include a brief plot. You don't need to make a lengthy report, but give at least a few sentences of discussion. You may use any software you wish to solve the regression problems.

What to turn in? Please turn in a short printed document, with plots and text answering the questions above, and print relevant snippets of code (e.g., the part of the code that solves the problems — I don't need to see all of the plotting code, for example). If you have bugs in your code, I won't be able to help you when I grade, but you can always bring your laptop to office hours.