Homework 1

Assigned: 01/21/2020   *Due: 01/31/2020*

Problems from Boyd & Vandenberghe: 2.8, 2.13, 2.15 (a-f), 2.16, 2.20, 2.31

Bonus questions: Bonus questions are completely optional. If a certain threshold of correctness is exceeded, you will earn an additional 0.5 marks on your assignment grade. These are fun, challenging problems, and we ask that you try your best to get as far into the proofs/answers as you can *without consulting outside sources!* Once you get stuck, indicate the point at which you were stuck in your solutions with a "**I made it this far on my own**," after which, you should indicate what outside source you consulted in order to finish the problem, in accordance with the Penn Academic Integrity policy.

1. Describe in simple terms the convex hull of the set orthogonal matrices $O(d) = \{U \in \mathbb{R}^{d \times d} \,|\, U^\top U = I\}$.

2. Prove the Caratheodory theorem, which states that if a point $x \in \text{conv}(P) \subseteq \mathbb{R}^d$, then x can be written as a convex combination of at most $d + 1$ points in P.