1 Exercise Set No. 1

- 1. Prove or disprove that the following functions are convex:
 - $f(x) = -\log(x)$ $x \in \mathbb{R}^{>0}$
 - f(x) = |x| $x \in \mathbb{R}$
 - f(x) = x $x \in \mathbb{Z}$
- 2. Consider the following optimization:

x

$$\min_{\substack{1 \in \mathbb{R}^{\geq 0}, x_2 \in \mathbb{R}^{\geq 0}}} (x_1 - \frac{1}{2})^2 + (x_2 - a)^2 \\
s.t. \\
x_1 + x_2 \leq 1 \\
2x_1 - x_2 \geq b$$
(1)

- (a) Set b = 1 and plot the feasible region.
- (b) For which values of b the optimization is infeasible?
- (c) Write a CVX code which solves this optimization. Set a = b = 1. What is the optimal value? What is the optimal point?
- (d) Set $b = \frac{1}{2}$. Investigate by calculation for every value of a which constraints in CVX are active at the optimal point.