1. Solve these problems and submit by 21 April (Sunday) 9am before the discussion session.
2. There is no penalty for submitting incorrect attempts
3. However, plagiarism will result in serious penalties, such as an F grade.

[2] 1. What is the minimum distance between two parallel half-spaces $\{\mathbf{x} \in \mathbb{R}^n | \mathbf{a}^T\mathbf{x} \leq b_1\}$ and $\{\mathbf{x} \in \mathbb{R}^n | \mathbf{a}^T\mathbf{x} \geq b_2\}$?

[2] 2. Is the following set affine: $\{\mathbf{x} \in \mathbb{R}^n | \|\mathbf{x} - \mathbf{x}_1\|_1 \leq \|\mathbf{x} - \mathbf{x}_2\|_1\}$?

[2] 3. Show that the set $\{\mathbf{x} \in \mathbb{R}^n | \|\mathbf{x}\|_\infty \leq 1\}$ is a polyhedra and express it as an intersection of finite number of half spaces (and hyperplanes, if required).

[2] 4. Given θ, consider the set $\mathcal{S} = \{\mathbf{x} \in \mathbb{R}^n | \|\mathbf{x} - \mathbf{a}\|_2 \leq \theta\|\mathbf{x} - \mathbf{b}\|_2\}$ for $\mathbf{a} \neq \mathbf{b}$. Show that $\mathcal{S}$ is a halfspace for $\theta = 1$, convex for $\theta < 1$. Give an example to prove that $\mathcal{S}$ can be non-convex for $\theta > 1$.

[2] 5. Show that the intersection of two convex cones is a convex cone.