ELEG5481 Signal Processing Optimization Techniques
Tutorial 4

Feb. 24, 2013

Q1. *Cone of polynomials nonngegative on [0,1].* Let K be defined as

$$K = \{c \in \mathbf{R}^n \mid c_1 + c_2 t + \ldots + c_n t^{n-1} \geq 0 \text{ for } t \in [0,1]\},$$

i.e., K is the cone of (coefficients of) polynomials of degree $n-1$ that are nonnegative on the interval $[0,1]$. Show that K is a proper cone.

Q2. Show by definition that the function $f(x) = \|Ax - b\|$ is convex.

Q3. Show by the first order condition that the function $f(x) = 1/(x_1 x_2)$ with domain $\mathbf{R}^2_{++}$ is convex.

Q4. Show by using the second order condition that the function $f(x,t) = -\log(t^2 - x^T x)$ is convex in the domain $\{(x,t) \in \mathbf{R}^n \times \mathbf{R} \mid t > \|x\|_2\}$.