Mathematical Optimization, Quiz 2

YTU, Myanmar 2019

Problem 1

You are given an affine function $f : \mathbb{R}^n \to \mathbb{R}$, defined as

$$f(x) = a^{\mathrm{T}}x + b, \tag{1}$$

where $a \in \mathbb{R}^n$ and $b \in \mathbb{R}$. Let f_1 denote the first-order approximation of f at an arbitrary $x_0 \in \mathbb{R}^n$. Show that $f(x) = f_1(x)$ for all $x \in \mathbb{R}^n$.

Problem 2

You are given a quadratic function $f : \mathbb{R}^n \to \mathbb{R}$, defined as

$$f(x) = x^{\mathrm{T}}Px + q^{\mathrm{T}}x + b, \tag{2}$$

where $P \in \mathbb{S}^{n\times n}$, $q \in \mathbb{R}^n$, and $b \in \mathbb{R}$. Let f_2 denote the second-order approximation of f at an arbitrary $x_0 \in \mathbb{R}^n$. Show that $f(x) = f_2(x)$ for all $x \in \mathbb{R}^n$.