Continuous Optimization: Assignment 5

Due on May 28, 2024

Honglu Ma **Hiroyasu Akada** **Mathivathana Ayyappan**

Exercise 1

Consider quadratic function $f(x) = \frac{1}{2}x^\top Qx + b^\top x$ where Q is a symmetric positive definite matrix. Using Newton's method we obtain

$$\begin{aligned} x^{(1)} &= x^{(0)} - (\nabla^2 f(x^{(0)}))^{-1} \nabla f(x^{(0)}) \\ &= x^{(0)} - Q^{-1}(Qx^{(0)} + b) \\ &= x^{(0)} - Q^{-1}Qx^{(0)} + Q^{-1}b \\ &= x^{(0)} - x^{(0)} + Q^{-1}b \\ &= Q^{-1}b \end{aligned}$$

$\nabla f(x^{(1)}) = -QQ^{-1}b + b = 0 \Rightarrow x^{(1)}$ is the global minimizer