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Due: July 14, 2021 at noon

Algorithms and Uncertainty

Summer Term 2021

Exercise Set 10

Exercise 1: (3 Points)

Consider $f : \mathbb{R}^2 \longrightarrow \mathbb{R} : \mathbf{x} \mapsto \mathbf{x}^T\mathbf{x}$. Show that f is convex.

Exercise 2: (3 Points)

Let $\mathcal{X}$ be a convex set. Prove the following statement: If a function $f : \mathcal{X} \rightarrow \mathbb{R}$ is convex, then any local minimum of f in $\mathcal{X}$ is also a global minimum.

Exercise 3: (5 Points)

Show that Follow-the-Regularized-Leader with Entropical regularization in the experts setting is equivalent to the Multiplicative Weights algorithm.

Hint: It can be helpful to use a Lagrange multiplier, which works in this special case as follows: For $\mathbf{x}$ to be a local optimum of F subject to $\sum_{i=1}^{d} x_i = 1$, it is necessary that there exists a $\lambda \in \mathbb{R}$ such that $\frac{\partial F}{\partial x_i}(\mathbf{x}) - \lambda = 0$ for all i.