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January 26, 2026
Due: February 2, 2026 at 10:00 p.m.

Algorithms and Uncertainty

Winter Term 2025/26

Exercise Set 14

If you would like to present one of your solutions in class, please use the following link to book a presentation slot by Monday evening:
https://terminplaner6.dfn.de/b/e280bc705b3f687076daf1e76e3ec3dd-1580390
A short meeting to discuss your solution is mandatory before presenting it in class. To book a time slot for this meeting, please use the following link by Monday evening as well:
https://terminplaner6.dfn.de/b/e24010b985e306418ae65927972909b2-1580378

Exercise 1: (3 Points)
Prove Observation 24.4: If R is σ-strongly convex and $f_1, f_2, \ldots$ are convex then $R + \sum_t f_t$ is σ-strongly convex.

Exercise 2: (4 Points)
Derive a regret bound for Follow-the-Regularized-Leader if the Lipschitz constant depends on the time step, that is,

$$f_t(\mathbf{u}) - f_t(\mathbf{v}) \leq L_t \|\mathbf{u} - \mathbf{v}\| \quad \text{for all } \mathbf{u}, \mathbf{v} \in S \ .$$

Exercise 3: (4 Points)
Let $G = (V, E)$ be a graph with edge capacities $(c_e)_{e \in E}$, a source $s \in V$ and a sink $t \in V$. Let $\mathcal{P}$ be the set of all s-t paths in G and $|\mathcal{P}| \leq m = |E|$. Show that, if $T \geq \frac{4}{\epsilon^2} |\mathcal{P}| \log m$, the algorithm from lecture 24 then guarantees $\sum_{P \in \mathcal{P}} x_P \geq (1 - \epsilon) F^*$ when using Multiplicative Weights as the experts algorithm with $\eta = \frac{\epsilon}{2}$.