Thomas Kesselheim   January 21, 2026
Anna Heuser

Algorithms and Uncertainty
Winter Term 2025/26
Tutorial Session - Week 13

Exercise 1:
Show that the EXP3 algorithm can also be applied to an instance of Stochastic Multi-Armed Bandits from lecture 17.
Additionally, show that, when setting $\eta = \sqrt{\frac{\ln n}{nT}}$ and $\gamma = n\eta$, this leads to an expected regret of at most $3\sqrt{nT \ln n}$.
Hint: You can use the bound on the external regret of EXP3 from lecture 20.

Exercise 2:
For the normed vector space $(\mathbb{R}^d, \|.\|)$, the unit ball with respect to $\|.\|$ is defined as the set $\{x \in \mathbb{R}^d : \|x\| \leq 1\}$.

(a) Show that the unit ball with respect to the 1-norm is convex.

(b) Show that the unit ball with respect to the 2-norm is convex.

(c) Show that the unit ball with respect to the ∞-norm is convex.

(d) Does the same result hold for an arbitrary p-norm with $p > 1$? What about $p < 1$?