

Algorithms and Uncertainty

Winter Term 2024/25

Exercise Set 9

If you want to hand in your solutions for this problem set, please send them via email to rlehming@uni-bonn.de by Monday evening. Of course, submitting solutions in groups is also possible.

*If you would like to present one of the solutions in class, please also send an email to rlehming@uni-bonn.de stating **which task** you would like to present in **which of the tutorials**. Deadline for the email is Monday, 10:00 pm. Please note that the tasks will be allocated on a first-come-first-serve basis, so sending this email earlier than Monday evening is highly recommended.*

Exercise 1: (0 Points)

By $f = \max_{e \in E} |\{S \subseteq \mathcal{S} | e \in S\}|$ we denote again the frequency of a set system. Consider the 2-Stage Set Cover problem. Give an $O(f)$ -approximation of the optimal policy.

Exercise 2: (3+4 Points)

- a) We have a bucket of 100 balls. Some of them are green, the others are red. We want to find out if the bucket contains more red or green balls. For this, we draw n balls uniformly at random and with replacement from the bucket. Use Hoeffding's inequality to show that the probability for us to guess correctly is at least $1 - \exp\left(-\frac{8}{25}n\right)$, if the bucket contains 10 red and 90 green balls.
- b) Now we have a second bucket of 100 balls. We want to find out, which bucket has more green balls and thus draw n samples from the second bucket as well. Use Hoeffding's inequality and the union bound to show that the probability for us to guess correctly is at least $1 - 2\exp\left(-\frac{2}{25}n\right)$, if the first bucket contains 90 green balls and the second bucket contains 50 green balls.