

## Algorithms and Uncertainty

Winter Term 2024/25

Exercise Set 8

*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: (4 Points)

Show that Stochastic Set Cover can be reduced to the deterministic problem. To this end, define a different universe of elements  $U'$ , family of subsets  $\mathcal{S}'$ , and costs  $(c'_{S'})_{S' \in \mathcal{S}'}$  appropriately. Any solution of this Set Cover instance then corresponds to a policy of the same cost.

### Exercise 2: (3+4+2 Points)

We consider the following modified version of the Boosted Sampling algorithm for Stochastic Steiner Tree from the lecture. The only difference is that it uses  $\ell$  sets  $S_1, \dots, S_\ell$  in the first phase. Show that the approximation guarantee is  $\max\{2(1 + \frac{\lambda}{\ell+1}), 2(\frac{\ell}{\lambda} + 1)\}$ . To this end, consider the following tasks concerning the cost of the respective phases.

- (a) Give an appropriate analysis for the first phase.
- (b) Give an appropriate analysis for the second phase.
- (c) Combine both results to derive the desired approximation guarantee.