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Due: December 04, 2023 at 10:00 p.m.

Algorithms and Uncertainty

Winter Term 2023/24

Exercise Set 8

If you want to hand in your solutions for this problem set, please send them via email to anna.heuser@uni-bonn.de *by Monday evening – make sure to send a pdf-file which contains your name and your email address. 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 anna.heuser@uni-bonn.de *containing the* ***task*** *which you would like to present and in* ***which of the tutorials*** *you would like to do so. Deadline for the email is Monday, 10:00 pm. Please note that the tasks will be allocated via a first-come-first-served procedure, 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 ℓ 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.