

Algorithmic Game Theory

Winter Term 2020/21

Tutorial Session - Week 3

As last week, you are supposed to work on these tasks in class together with your fellow students. Therefore, once entered the Zoom Breakout-Rooms, switch on your camera and microphone and start with a quick introduction if you don't know each other yet. Afterwards, you are supposed to discuss the exercises on this sheet. Note that you should see this also as a chance to talk about definitions, proof ideas and techniques used in the lecture in addition to only working out a formal solution for the tasks. If you do not know a definition or theorem by hard, feel free to open the lecture notes and have a look.

Exercise 1:

We define a Congestion Game to be *symmetric*, if $\Sigma_1 = \dots = \Sigma_n$. Let $PNE_{\text{Cong. Game}}$ and $PNE_{\text{Sym. Cong. Game}}$ be the local search problems in PLS of finding a pure Nash equilibrium of a general or symmetric Congestion Games, respectively.

Show: $PNE_{\text{Cong. Game}} \leq_{\text{PLS}} PNE_{\text{Sym. Cong. Game}}$.

Hint: Add an auxiliary resource for each player with a suitable delay function.

Exercise 2:

Let p, p' be coarse correlated equilibria of a cost-minimization game Γ . Prove that any convex combination of the distributions p and p' yields also coarse correlated equilibrium of Γ (i.e., any distribution $q := \lambda p + (1 - \lambda)p'$ for a $\lambda \in [0, 1]$).