

## Algorithmic Game Theory

Winter Term 2020/21

Tutorial Session - Week 4

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 heart, feel free to open the lecture notes and have a look.

### **Exercise 1:**

State for each  $M \geq 1$  a network congestion game with two players such that the Price of Anarchy of pure Nash equilibria is at least  $M$ .

### **Exercise 2:**

A *fair cost-sharing game* is a congestion game such that for all resources  $r \in \mathcal{R}$  the delay function can be modeled as  $d_r(x) = c_r/x$  for a constant  $c_r$ . Show that fair cost sharing games with  $n$  players are  $(n, 0)$ -smooth.