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Algorithmic Game Theory

Winter Term 2020/21

Tutorial Session - Week 1

You are supposed to work on these tasks in class together with your fellow students. Therefore, you are sent into Zoom Breakout-Rooms together with 1-3 other students. Once entered, make sure your camera and microphone are switched on. If you do not know each other yet, each of you could start with a very quick introduction: What's your name? Do you study Computer Science or maybe something else (Maths, Economics,...)? Do you have any prior knowledge in Algorithmic Game Theory already or is this your first course in AGT?

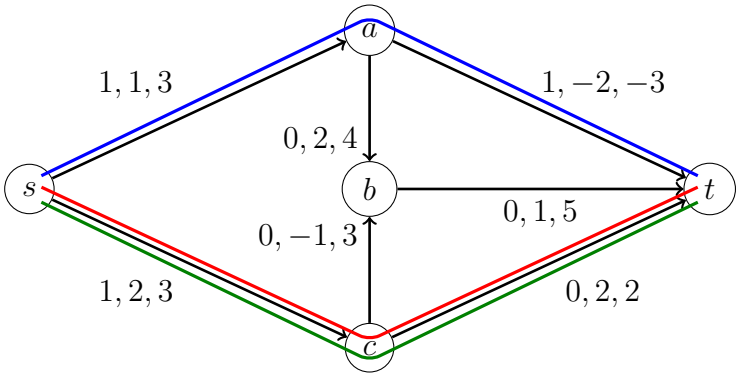
Afterwards, you are supposed to discuss the exercises on this sheet. Note that you should see this also as a chance to talk about definitions, proof ideas and techniques used in the lecture in addition to only working out a formal solution for the tasks. If you do not know a definition or theorem by hard, feel free to open the lecture notes and have a look. Further, if you have any questions, I will drop by in your Breakout-Room to discuss possible issues with you.

If there is some remaining time at the end of the tutorial, all of us will meet again so that you can share your ideas on the tasks with the whole group.

Exercise 1:
Consider the following symmetric network congestion game with players blue, red and green and their corresponding beginning strategies.

a) Formalize the network congestion game depicted below. For this purpose, specify the tuple $\Gamma = (\mathcal{N}, \mathcal{R}, (\Sigma_i)_{i\in\mathcal{N}}, (d_r)_{r\in\mathcal{R}})$. It suffices to state the delay function of a single resource/edge.

b) Find a pure Nash equilibrium by stating a sequence of best response improvement steps.



Exercise 2:
Consider congestion games with a constant number of players. Show that the length of every sequence of improvement steps is bounded polynomially in the number of player strategies.