Algorithmic Game Theory and Applications

Tutorial 2

Attempt to solve the following questions, so that you are able to contribute to the discussion in the tutorial.

1. Slides of Lecture 4, page 11: Prove that conditions (1) and (2) of the Minimax Theorem are sufficient for a Nash Equilibrium.

2. Consider the zero-sum game given by the following payoff matrix.

$$A = \begin{bmatrix} 9 & 2 & 5 \\ 5 & 9 & 7 \\ 8 & 5 & 7 \end{bmatrix}$$

   Specify the linear programming problem you could use to solve this game, meaning to compute the minimax value of this game, and to compute a minmaximizer strategy for Player 1. What if you wanted to compute also a maxminimizer strategy for Player 2? What is the minimax value of the game?

   Familiarize yourself with the LP solvers in Matlab and Sage (www.sagemath.org) and specify the LP problem in their input format. (solver = 'ppl' in Sage works over the rationals and computes exact solutions.)

3. Find the mixed Nash Equilibrium for the coordination game described in Lecture 1, page 6.

4. Lecture 5 on LP: Think about what kinds of clever heuristics and hacks you could use in the Fourier-Motzkin algorithm to keep the number of constraints as small as possible. E.g., In what order would you try to eliminate variables?