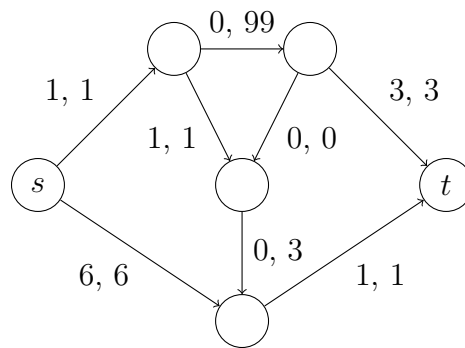


Algorithmic Game Theory and the Internet
 Summer Term 2018
 Exercise Set 2

Exercise 1: (3 Points)

Rewrite the depicted symmetric network congestion game with two players as a bimatrix game like in Example 3.2 of the third lecture. Why is it sufficient to state only the upper or lower triangular matrix?



Exercise 2: (2+1+3 Points)

- Specify the payoff matrix for the well-known game rock-paper-scissors¹. Assume that winning has a cost of -1 , losing a cost of 1 , a tie a cost of 0 .
- Mark the best responses with boxes. Do we have a pure Nash equilibrium?
- Determine a mixed Nash equilibrium.

Exercise 3: (4+2 Points)

Consider the bimatrix game *Battle of the Sexes* given in Example 3.3 of the third lecture.

- Compute a mixed Nash equilibrium by choosing probabilities for one player that will make the other player indifferent between his pure strategies (see Example 3.11).
- Determine the probabilities of the mixed Nash equilibrium graphically by plotting the players' expected costs.

Exercise 4: (5 Points)

We define a strategy $s_i \in S_i$ of a normal-form, cost-minimization game to be *strictly dominated*, if there exists a strategy s'_i such that $c_i(s'_i, s_{-i}) < c_i(s_i, s_{-i})$ for all $s_{-i} \in S_{-i}$. Prove that for all mixed Nash equilibria σ , there is no player $i \in \mathcal{N}$ with a mixed strategy σ_i such that $\sigma_{i,s_i} > 0$ for a strictly dominated strategy $s_i \in S_i$.

¹<https://en.wikipedia.org/wiki/Rock%E2%80%93paper%E2%80%93scissors>