Homework 2

CSCE689 Algorithmic Game Theory

Due: Sunday, October 8, 2023 11:59pm.

1. Show that finding Nash equilibria in three-player zero-sum games is no easier than the problem of finding Nash equilibria in two-player general-sum games.

2. Consider the game shown in Figure 1.

   - Write down the sequence-form representation of the game.
   - Suppose Player 1 evenly mixes over her actions. Write down the best response LP for Player 2 to this strategy.
   - Compute a maxmin strategy for Player 2, by explicitly writing down and solving an LP.

3. Prove Lemma 5.2 of the AGT textbook. Prices $\mathbf{p}$ are equilibrium prices iff. in the network $N(\mathbf{p})$ the two cuts $(s, A \cup B \cup t)$ and $(s \cup A \cup B, t)$ are min-cuts. If so, allocations corresponding to any maxflow in N are equilibrium allocations.

Exercise 5.1 of AGT Give a strongly polynomial time algorithm for Fisher's linear case under the assumption that all $u'_{ij}s$ are 0 or 1.
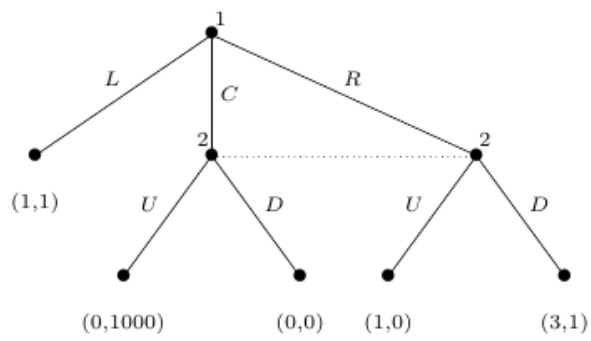
4. Exercise 5.3 of AGT.

Figure 1: An extensive-form game.