Universität des Saarlandes
FR 6.2 Informatik

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Exercises for Algorithmic Game Theory

http://www.mpi-inf.mpg.de/departments/d1/teaching/ss11/AGT/

Assignment 2 Deadline: Fr 29.4.2011

Exercise 1 *Two-player zero-sum game*

Consider a two-player zero-zum game in matrix form where no two entries in the matrix are the same.

a) Show that there can be at most one pure Nash equilibrium in such a game.

b) Give (small) examples of a game with zero and one Nash equilibria. The payouts in your games should be positive integers in $[1, 10]$.

Exercise 2 *Three-person zero-sum games*

Consider a three-person zero-sum game, which is a game in which the rewards of the three players always sum to zero. Show that finding a Nash equilibrium in such a game is at least as hard as in a general (non-zero-sum) two-player game.

Exercise 3 *Quality of Nash equilibria*

a) Give a two-player game with two pure Nash equilibria, where both players strongly prefer the same Nash equilibrium

b) Give a two-player game with two pure Nash equilibria, where each player strongly prefers a different Nash equilibrium.

The payouts in your games should be positive integers in $[1, 10]$.

Exercise 4 *A random game*

Consider a two-player game given in matrix form where each player has n strategies. Assume that the payoffs for each player are in the range $[0, 1]$ and are selected independently and uniformly at random. Show that the probability that this random game has a pure (deterministic) Nash equilibrium approaches $1 - 1/e$ as n goes to infinity. You may use the fact that $\lim(1 - 1/n)^n = 1/e$ as n goes to infinity.