Multiagent Systems

Prof. Dr. B. Nebel — University of Freiburg
Dr. C. Becker-Asano, Dr. S. Wölfl, A. Hertle — Department of Computer Science
Summer term 2014

Exercise Sheet 7

Due: Friday, June 27, 2pm

Important: Each exercise sheet is to be solved in groups of **two students**. Thus, please note your names on each solution sheet and, if applicable, in the source code (as a comment on top of each source file). The solutions are to be handed in as pdf or plain text files (UTF-8 encoded) using the SVN. We strongly suggest the use of LaTeX for typesetting your solutions.
As always so far, you might complete your solutions in English or German.

Exercise 7.1 (Nash equilibria, 1.5+1.5 Punkte)

Recall the bar scene from the film "A Beautiful Mind" (in case you have not seen the movie or you do not remember the scene: `http://www.haverford.edu/math/lbutler/GoverningDynamics.mov`).

(a) Formalize the game for two men/women, where the payments are 2, 1 und 0 for both, if they win the heart of the blond, a brunette or none of the other guests, respectively.

(b) Is the analysis in the film correct? Analyze the game for pure Nash equilibria.

Exercise 7.2 (Jason, Game Theory; 8 points)

In this exercise you will implement game theoretic concepts in Jason. At first, you might study the code present in the Jason-subfolder "examples/iterated-prisoners-dilemma". It is an example implementation of the prisoner's dilemma in its iterated form, also known as Axelrod's tournament.
Your task will be to implement a similar game, namely the "Competitive Ultimatum Game" (CUG) for at least four agents (see also `http://en.wikipedia.org/wiki/Ultimatum_game`). In each round the "arbiter" agent designates another agent as the responder (until all players were responders once, in which moment the sequence starts over), to which all remaining agents make proposals of the following form:

- Each proposer is given 100 coins per round.
- He decides how many coins to keep and offers the remaining coins to the one responder agent.

- The responder agent can accept at most one of the offers, in which case the coins are split accordingly between that proposer and the responder.
- All other proposers gain no coins at all, because they have to return all coins to the arbiter.

All proposals are public, meaning that all agents have complete and accurate knowledge about all other agents' actions. With this framework solve the following tasks:

(a) Program a player agent that always splits the coins randomly. Let three of these agents play the game (together with an extra arbiter agent, of course). Report on the results and argue why the agents perform the way they do.

(b) Program a player agent that follows some strategy by taking the outcome of previous rounds into account to decide, how to split the coins in each round. Let three of these agents play against each other and report on the results. Give reasons for these results.

(c) Finally, let two random agents (from part a) play against to strategic agents (from part b) and report on the results. Did you expect the outcome? Why, or why not?

(Each time a total of 100 rounds should be played.)