

## Multiagent Systems

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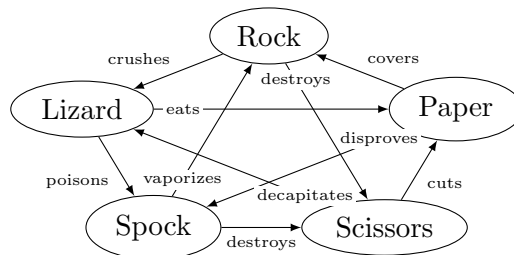
### Exercise Sheet 8

**Due: Friday, July 4, 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  $\text{\LaTeX}$  for typesetting your solutions. As always so far, you might solve the exercises in English or German.

#### Exercise 8.1 (Strategic Games, 4 points)

Formalize the game “Rock, Paper, Scissors, Lizard, Spock”<sup>1</sup> as a strategic game, i.e., specify a set of players, sets of actions for all players, and utility functions in terms of a payoff matrix. The winners of the possible pairings follow from the following graph.



#### Exercise 8.2 (Voting systems, 6 points)

Consider the following example, derived from the politics in the UK example presented in the lecture:  $\Omega = \{\omega_S, \omega_F, \omega_C\}$ , where  $\omega_S$  represents the Social Democratic Party (SPD),  $\omega_F$  the Free Democratic Party (FDP) and  $\omega_C$  the Christian Democratic Union (CDU).

Voters have the following preferences:

- 43% of  $|Ag|$  are left-wing voters:  $\omega_S \succ \omega_F \succ \omega_C$
- 12% of  $|Ag|$  are center voters:  $\omega_F \succ \omega_S \succ \omega_C$
- 45% of  $|Ag|$  are right-wing voters:  $\omega_C \succ \omega_F \succ \omega_S$

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<sup>1</sup><http://www.slashfilm.com/2008/11/27/votd-rock-paper-scissors-lizard-spock/>

(a) Based on the following voting procedures, which party will win an election?

- Plurality
- Sequential majority elections with election agenda  $\omega_S, \omega_F, \omega_C$

(b) Is it possible to fix the election agenda in favor of any outcome?

(c) A new fourth party  $\omega_N$  emerges altering the preferences of the voters to:

- 38% of  $|Ag|$  are left-wing voters:  $\omega_S \succ \omega_F \succ \omega_N \succ \omega_C$
- 11% of  $|Ag|$  are center-left voters:  $\omega_F \succ \omega_S \succ \omega_N \succ \omega_C$
- 39% of  $|Ag|$  are right-wing voters:  $\omega_C \succ \omega_F \succ \omega_S \succ \omega_N$
- 12% of  $|Ag|$  are voters of the new party:  $\omega_N \succ \omega_C \succ \omega_S \succ \omega_F$

Is it possible to fix the election agenda in sequential majority elections?  
If so, in favor of which party?

(d) Who is the winner of the election using the following voting procedures:

- The Borda count
- The Slater ranking