A computational model of outguessing

Tamás L. Balogh[a], **János Kormos**[b]

[a]Faculty of Economics and Business Adiministration, University of Debrecen
tamas.balogh@econ.unideb.hu

[b]Faculty of Informatics, University of Debrecen
kormos.janos@inf.unideb.hu

Abstract

There exists several behavioral game theory equilibrium concepts for non-cooperative games. A well-known model family is the so-called *iterative reasoning models*. Reasoning models in general aim at explaining how "smarter" people may win more frequently in several well-known simultaneous zero-sum games - like the Rock-Paper-Scissors game or the Beauty contest game.

The concept of iterative reasoning for two-person games is defined as follows. If Player A plays a certain action, while Player B plays the best response to this action, then we say that Player B outguessed Player A and played according to 1-reasoning. If now Player A outguesses Player B, then Player A plays according to 2-reasoning. Following this rule, the level of resoning can be any k positive integer, where the concept is defined as k-reasoning.

We restrict attention to two-person repeated games where players make their de- cisions based on their actions of the previous round of a certain game. An important requirement is that the game does not have a pure strategy Nash equilibrium. Here, the stochastic processes of the players' decisions and their expected payoffs can be described by Markov chains.

By running our simulation, the transition matrix of the corresponding Markov chain is calculated. Then, the long term strategy choice distributions and expected payoffs of both players are obtained and can even be visualized. Our Matlab script can be run for 2-by-2 and 3-by-3 bimatrix games, where the payoff matrices and the reasoning levels of both players can be set by the user. Therefore, our concept serves as a comparison tool for all models that assume different levels of iterative reasoning.

Keywords: outguessing, computational game theory, Markov chains, reasoning