PhD Thesis Proposal

Title: Computational aspects of approximate stable outcomes

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Abstract Understanding the computational aspects of stable outcomes in games or, more generally, multi-agent systems, is one of the key goals of algorithmic game theory. Stable outcomes characterize situations in which no agent, or group of agents, has an incentive to unilaterally deviate from the current situation in order to achieve a higher payoff. Pure Nash equilibrium, core stable outcome, stable matching are some of the most notably notions of stability.

This PhD thesis proposal is concerned with those situations in which stable outcomes may not exist or, even if their existence is guaranteed, they are computationally intractable. This is the case, for instance, of congestion games, for which computing a pure Nash equilibrium is PLS-hard [8], weighted congestion games, for which a pure Nash equilibrium may not exist [10], hedonic games, for which it is NP-hard in general to decide the non-emptiness of the core [1], or the stable matching problem, for which a complete stable matching may not exist [11].

One way to overcome the limitations of the non-existence and/or the computational intractability of (exact) stable outcomes is to consider a relaxation of the stability conditions. This relaxation leads to the concept of *approximate* stable outcomes which, generally speaking, characterizes situations where no agent, or group of agents, can *significantly improve* his/their payoff by deviating from the current strategy (see. e.g., [5, 6, 2, 4, 3, 9, 7]). An additional advantage of approximate stable outcomes is that they can accommodate small modelling inaccuracies, in this regard they may be more desirable as solution concepts in practical settings.

The goal of this PhD thesis proposal is to contribute to the understanding of the computational complexity of approximate stable outcomes and to the development of new algorithmic techniques in different scenarios.

Candidate Profile Highly motivated people with a master degree in Computer Science or Mathematics, with strong background in algorithms and complexity theory, good programming skills, and good communication skills in written and spoken english.

References

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