# Graduation project proposal:
Performance Optimization by Playing Games

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1 Subject

In this assignment you will look at performance optimization of production systems using game theory, the mathematical theory that deals with modeling of conflict and cooperation between intelligent rational decision-makers. Game theory is an active research area that has applications in many fields, such as economics, logic, psychology, computer science, and electrical engineering. Game theory can also be used to optimize the performance of systems in an unpredictable or uncontrollable environment. In this case, the system controller is modeled as a player, and the environment is modeled as its opponent player. Synthesizing an optimal controller corresponds to finding a winning strategy for the controller player in terms of the game. There are games that can optimize for throughput, or try to prevent that unsafe system states are ever reached.
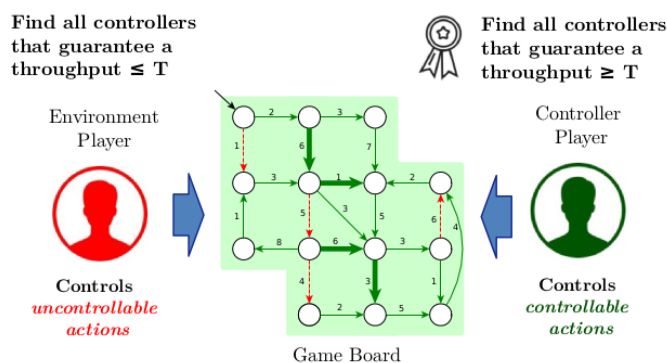
In this assignment, you will investigate existing games, and develop new games if needed, that can be used for performance analysis and optimization of systems. Because systems are often optimized for multiple criteria, and need to adhere to certain requirements, multi-objective optimization under constraints is part of the assignment. For instance, finding all controllers that satisfy a throughput bound, and then find the best one in terms of minimal latency and maximal energy efficiency.

2 Assignment

In this assignment you will investigate and develop available game-theoretic models for system performance analysis and optimization. The following steps are suggested:

1. Get acquainted with typical performance optimization criteria for systems, such as minimal latency, maximal throughput or energy-use minimization.

2. Investigate existing game-theoretic models that can be used for performance analysis and optimization of systems.

3. Develop and implement game-theoretic models that allow optimization of systems using multiple criteria.

4. Analyze the scalability of these solvers on synthetic and real-world models.

5. Report your approach and findings in a Master thesis or graduation paper and a public presentation.

3   I want to know more!

The project is hosted by the Electronic Systems (ES) group, Electrical Engineering department.

If you are interested in this topic (or something similar) for a project or internship, please contact Bram van der Sanden (`b.v.d.sanden@tue.nl`) for more information.