D I S S E R T A T I O N D E F E N S E

Samid Hoda

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324 GSIA (West Wing)

Essays on Equilibrium Computation, MDD-based Constraint Programming and Scheduling

This thesis addresses three topics: solving the Nash Equilibrium problem for two-player zero-sum games presented in extensive form, constraint programming using multivalued decision diagrams and scheduling cranes in a factory.

In the first chapter, we develop a first-order method based on a smoothing technique of Nesterov that allows us to solve problems that are several orders of magnitude larger than was possible previously.

The second chapter investigates constraint programming based on multivalued decision diagrams (MDDs). We present a systematic framework for designing filtering algorithms for MDDs as well as concrete instantiations for several different global constraints. We also discuss some ideas for primal heuristics and branching schemes using MDDs. The third chapter describes our implementation of a solver for constraint satisfaction problems where the domain-store has been replaced by MDDs. In the fourth chapter we present a case study of propagating `among' constraints using our framework and provide more evidence that MDD-based propagation can result in enormous reduction in the size of the search tree and solution time.

In the final chapter of this thesis we address the problem of scheduling a pair of cranes that share a track to best follow a production schedule. We focus on the problem of solving the optimal control problem for the trajectories and present a dynamic programming solution.