Efficient Algorithms for Graph-Related Problems in Computer-Aided Verification

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Abstract

Fundamental algorithmic problems that lie in the core of many application in formal verification and analysis of systems can be described as graph-related algorithmic problems. Nodes in these problems are of one of two (or three) types, giving rise to a game-theoretic viewpoint: *Player one* nodes are under the control of the algorithm that wants to accomplish a goal, *player two* nodes are under the control of a worst-case adversary that tries to keep player one to achieve her goal, and *random* nodes are under the control of a random process that is oblivious to the goal of player one. A graph containing only player one and random nodes is called a Markov Decision Process, a graph containing only player one and player two nodes is called a game graph. A variety of goals on these graphs are of interest, the simplest being whether a fixed set of nodes can be reached. The algorithmic question is then whether there is a strategy for player one to achieve her goal from a given starting node. In this talk we give an overview of a variety of goals that are interesting in computer-aided verification and present upper and (conditional) lower bounds on the time complexity for deciding whether a winning strategy for player one exists.

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