
Abstract

This paper explores algorithmic aspects of Path puzzles, a pencil-and-paper puzzle introduced in 2013 and proven NP-complete in 2020. Specifically, this paper presents two algorithmic approaches for solving Path puzzles: the imperative backtracking technique and the declarative SAT-based method. This paper shows that the asymptotic running time of the backtracking method in solving an arbitrary Path puzzle instance of size $m \times n$ is $O(3^{mn})$. Additionally, the paper presents a SAT encoding scheme that converts the puzzle's rules into propositional formulas, enabling the SAT solver to determine the solution. Experimental findings highlight the effectiveness of the backtracking approach for puzzles of sizes up to 7×7 , while the SAT-based approach shines when handling puzzles of sizes more than 7×7 .

Keywords: asymptotic complexity, backtracking, NP-complete, Path puzzles, propositional formulas, SAT solver