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# Case Splitting in an Automatic Theorem Prover for Real-Valued Special Functions

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**Abstract** Case splitting, with and without backtracking, is compared with straightforward ordered resolution. Both forms of splitting have been implemented for MetiTarski, an automatic theorem prover for real-valued special functions such as exp, ln, sin, cos and $\tan^{-1}$. The experimental findings confirm the superiority of true backtracking over the simulation of backtracking through the introduction of new predicate symbols, and the superiority of both over straightforward resolution.

**Keywords** Splitting · Resolution theorem proving · SPASS · MetiTarski

## 1 Introduction

Backtracking, or depth-first search, is one of the most elementary techniques used in Artificial Intelligence. It is the basis of the Prolog programming language and many automated reasoning technologies, including satisfiability checkers (SAT and SMT) and theorem provers based on analytic tableaux. The obvious exception is resolution theorem proving, which works by saturating a set of disjunctive clauses derived from axioms and a negated conjecture, terminating with success if it detects a contradiction. But even some resolution theorem provers (starting with SPASS [14]) support backtracking.

Logically speaking, if (in the course of a proof search) we have established the disjunction $C \vee D$, then the cases $C$ and $D$ can be considered separately. If a

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