

Bound Founded Answer Set Programming

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Abstract

Answer Set Programming (ASP) is a powerful modelling formalism that is very efficient in solving combinatorial problems. ASP solvers implement the stable model semantics that eliminates circular derivations between Boolean variables from the solutions of a logic program. Due to this, ASP solvers are better suited than propositional satisfiability (SAT) and Constraint Programming (CP) solvers to solve a certain class of problems whose specification includes inductive definitions such as reachability in a graph. On the other hand, ASP solvers suffer from the *grounding bottleneck* that occurs due to their inability to model finite domain variables. Furthermore, the existing stable model semantics are not sufficient to disallow circular reasoning on the bounds of numeric variables. An example where this is required is in modelling shortest paths between nodes in a graph. Just as reachability can be encoded as an inductive definition with one or more base cases and recursive rules, shortest paths between nodes can also be modelled with similar base cases and recursive rules for their *upper bounds*. This deficiency of stable model semantics introduces another type of grounding bottleneck in ASP systems that cannot be removed by naively merging ASP with CP solvers, but requires a theoretical extension of the semantics from Booleans and normal rules to bounds over numeric variables and more general rules. In this work, we propose Bound Founded Answer Set Programming (BFASP) that resolves this issue and consequently, removes all types of grounding bottleneck inherent in ASP systems.

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