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Modal logic S5 satisfiability in answer set programming. (English) Zbl 07454767
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Summary: Modal logic S5 has attracted significant attention and has led to several practical applications, owing to its simplified approach to dealing with nesting modal operators. Efficient implementations for evaluating satisfiability of S5 formulas commonly rely on Skolemisation to convert them into propositional logic formulas, essentially by introducing copies of propositional atoms for each set of interpretations (possible worlds). This approach is simple, but often results into large formulas that are too difficult to process, and therefore more parsimonious constructions are required. In this work, we propose to use Answer Set Programming for implementing such constructions, and in particular for identifying the propositional atoms that are relevant in every world by means of a reachability relation. The proposed encodings are designed to take advantage of other properties such as entailment relations of subformulas rooted by modal operators. An empirical assessment of the proposed encodings shows that the reachability relation is very effective and leads to comparable performance to a state-of-the-art S5 solver based on SAT, while entailment relations are possibly too expensive to reason about and may result in overhead.

MSC:
68N17 Logic programming

Keywords:
modal logic; S5; answer set programming; Kripke semantics

Software:
Spartacus; InKreSAT; LoTREC; Clingo

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References:

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