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Probabilistic Guarded KAT Modulo Bisimilarity: Completeness and Complexity

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Wojciech Rozowski, Tobias Kappé, Dexter Kozen, Todd Schmid and Alexandra Silva

Abstract: We introduce Probabilistic Guarded Kleene Algebra with Tests (ProbGKAT), an extension of GKAT that allows reasoning about uninterpreted imperative programs with probabilistic branching. We give its operational semantics in terms of special class of probabilistic automata. We give a sound and complete Salomaa-style axiomatisation of bisimilarity of ProbGKAT expressions. Finally, we show that bisimilarity of ProbGKAT expressions can be decided in O(n^3 log n) time via a generic partition refinement algorithm.

Presenter: ROZOWSKI, Wojciech

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