Logical Methods in Computer Science
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PREFACE

This special issue of the Logical Methods in Computer Science (LMCS) journal is dedicated to selected papers presented at the 8th International Joint Conference on Automated Reasoning (IJCAR) 2016, held between 27 June - 2 July, 2016, in Coimbra, Portugal. IJCAR is the premier international joint conference covering all topics in automated reasoning. Every other year, IJCAR is organized as a merger of leading events in automated reasoning: CADE (Conference of Automated Deduction), FroCoS (Workshop on Frontiers of Combining Systems), and TABLEAUX (Conference on Analytic Tableaux and Related Methods).

The six papers included in this special issue underwent a two-round reviewing process. In the first round, the papers were reviewed by at least three reviewer as part of the IJCAR 2016 reviewing process. The top rated papers in the first round, which were also selected for presentation at IJCAR 2016, were then invited for the special issue. The authors submitted revised and extended versions of their conference proceedings papers. The journal submissions were required to contain significant new material. In the second round, the submitted extended papers went through the reviewing process of LMCS. Each paper was reviewed by at least two reviewers.

The papers in this special issue span a wide range of topics in automated reasoning. The six papers together cover topics in Satisfiability (SAT) checking, Satisfiability Modulo Theories (SMT), Theory extensions, Resolution, Proof-Theory of Modal Logic, and Intuitionistic Substructural Logic.

Three-Valued geometric logic is used to express problems representing type correctness and other properties when reasoning about partial functions. The paper "Subsumption Algorithms for Three-Valued Geometric Resolution" solves the subsumption testing problem for geometric resolution by translating it to a generalized constraint satisfaction problem, which can be solved by direct methods or by further translation to propositional SAT. The paper also presents a preprocessing step for generalized constraints.

In structural proof theory, one important problem is to understand and exploit relation between different calculi for the same logic. The paper "Inducing syntactic cut-elimination for indexed nested sequents" studies relationships between different proof calculi for modal logic and the resulting transfer of results. In particular, it considers the difficult case of modal logics defined by Geach axioms and shows that indexed nested sequent calculi correspond to a particular family of labelled sequent calculi. This correspondence is then used to carry over results, first of all cut-elimination, developed in one formalism to the other.

In many cases, it is beneficial to view a theory as an extension of a base theory with additional function symbols and corresponding axioms. If possible, one would like to perform

All articles have already been published in the regular issues of Logical Methods in Computer Science.

reasoning in a theory extension in a hierarchical manner; that is, by exploiting the reasoning on the base theory. The paper "On Interpolation and Symbol Elimination in Theory Extensions" studies the tasks of interpolation and symbol elimination in theory extensions, where the focus is on developing hierarchical techniques that rely on symbol elimination in the base theory.

Advances in Boolean satisfiability checking (SAT) have had an enormous impact on the field of automated reasoning. A crucial component of any reasoning system is the simplification components that help eliminate clauses that are based on redundancy criteria. The paper "Local Redundancy in SAT: Generalizations of Blocked Clauses" explores redundancy criteria based on blocked clauses. It presents a semantic version of blocked clauses, which is also a local redundancy property (depends only on the clauses with which a clause can resolve) like blocked clauses, but the the most general one. The paper also presents alternate characterizations of the notion of semantic blocking.

The concept of "layering" naturally arises to structure the description of a complex system. The paper "Intuitionistic Layered Graph Logic: Semantics and Proof Theory" defines a non-commutative, non-associative variant of the bunched implication logic BI, an intuitionistic substructural logic, with the goal of representing and reasoning about complex systems viewed as layered graphs. The paper develops a labelled tableaux calculus, which is shown to be sound and complete with respect to a Kripke-style semantics over graphs. The paper also establishes decidability of the logic and a Stone-type duality theorem for the logic. The results are extended to a predicate version of the logic, establishing soundness and completeness for an extension of the layered graph semantics.

Satisfiability Modulo Theory (SMT) solvers are specialized reasoning engines that decide satisfiability of formulas from a combination of certain decidable theories. Traditionally, individual theories were required to be stably-infinite, and theories such as finite sets that are not stably-infinite were not easily and efficiently included in the theory combination supported by SMT solvers. The paper "Reasoning with Finite Sets and Cardinality Constraints in SMT" introduces a new calculus for reasoning about membership and cardinality constraints on finite sets that scales better than previous approaches on certain classes of problems.

We thank the authors for their valuable contributions. We are especially grateful to the reviewers for their thorough and extensive feedback. We also thank Stefan Milius for facilitating the process of the reviewing and publication of this special issue in LMCS.

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IJCAR 2016 Special Issue Guest Editors