

More symbolic than symbolic model-checking

Ordered Binary Decision Diagrams (OBDDs) are a data structure used to compactly store and manipulate boolean functions (for a detailed treatment see for instance [5]). The standard application of OBDDs is symbolic model-checking (SMC) [2], where instead of explicitly generating and then inspecting all states of a system, one processes boolean descriptions of sets of states. In particular, OBDDs were successfully applied to analyze pushdown automata (PDA).

The subject of this proposal is to investigate, implement and apply a generalization of OBDDs: instead of a boolean domain, consider some fixed underlying relational structure. Such generalized OBDDs could be used to compactly store a set of values *definable* in the fixed structure. A direct motivation is an effective symbolic implementation of the algorithm for the reachability problem in PDA with atoms [3]. This is a part of a wider research plan concerning applications of an extended set theory, called sets with atoms [1], to uniformly capture various models of computation involving an infinite resource like names, time, data, etc. [1, 4].

In summary, the plan (time permitting) consist of:

- investigation of a generalization of OBDDs;
- implementation of a library for manipulating the generalized OBDDs;
- application of the library for reachability analysis of PDA with atoms.

References

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- [3] L. Clemente and S. Lasota. Reachability analysis of first-order definable pushdown systems. In *Proc. CSL'15*, pages 244–259, 2015.
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- [5] Donald E. Knuth. *The Art of Computer Programming*, volume 4A. <http://www-cs-faculty.stanford.edu/~knuth/fasc1b.ps.gz>.