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DESCRIPTIONAL COMPLEXITY OF PUSHDOWN STORE LANGUAGES

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ABSTRACT

It is well known that the *pushdown store language* $P(M)$ of a pushdown automaton (PDA) M — i.e., the language consisting of words occurring on the pushdown along accepting computations of M — is a regular language. Here, we design *succinct nondeterministic finite automata* (NFA) accepting $P(M)$. In detail, an upper bound on the size of an NFA for $P(M)$ is obtained, which is quadratic in the number of states and linear in the number of pushdown symbols of M. Moreover, this bound is shown to be asymptotically optimal.

Then, several restricted variants of PDA — namely: PDA which never pop, stateless PDA, and counter machines — are considered, leading to improved constructions. In all cases, we prove the asymptotical optimality of the size of the resulting NFA.

Finally, we apply our results to decidability questions related to PDA, and obtain solutions in deterministic polynomial time.

Keywords: pushdown automata, pushdown store languages, descriptional complexity, decidability questions

1. Introduction

Beside the formal definition of the accepted or generated language, the introduction of an accepting or generating device always brings the attention to several "auxiliary" formal structures related to the device itself. Such structures, which can be either crucial part of or derived from device definition, are not only interesting *per se*, but

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