Journal of Automata, Languages and Combinatorics **27** (2022) 1–3, 47 – 77

REVERSIBLE SHRINKING TWO-PUSHDOWN AUTOMATA

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ABSTRACT

The deterministic shrinking two-pushdown automata characterize the deterministic growing context-sensitive languages, known to be the Church-Rosser languages. Here, we initiate the investigation of *reversible* two-pushdown automata, RTPDAs, in particular the shrinking variant. We first obtain that in the general case the class of recursively enumerable languages is characterized by RTPDAs, whereas in the shrinking case we show a separation of the deterministic and reversible shrinking two-pushdown automata, and we prove that these are incomparable with the (deterministic) context-free languages. We further show that the properties of emptiness, (in)finiteness, universality, inclusion, equivalence, regularity, and context-freeness are not even semidecidable for shrinking RTPDAs.

Keywords: unconventional models of computation, reversible computing, shrinking two-pushdown automata, Church-Rosser languages

1. Introduction

Reversible variants of universal computation models, for example, Turing machines, are usually equal in power to irreversible (deterministic) ones at least when considered as language acceptors – for functions the picture is somewhat more complex [1]. For subuniversal models, however, equality is very model-dependent. For example, one-way reversible (multihead) finite automata [7, 14], reversible pushdown automata [6], and reversible Turing machines with run-times between real-time and linear time [3], are *not* equal to their deterministic variants in expressive power, but two-way reversible multihead finite automata [12] and reversible linear-bounded automata [8]

A preliminary version of this work was presented at the *10th Conference on Language and Automata Theory and Applications (LATA 2016)*, Prague, Czech Republic, March 14–18, 2016, and it is published in [2].