

NON-RECURSIVE TRADE-OFFS FOR DETERMINISTIC RESTARTING AUTOMATA ¹

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ABSTRACT

We investigate the descriptonal complexity of deterministic restarting automata, an automaton model inspired from linguistics. Variants of deterministic and monotone restarting automata build a strict hierarchy whose top is characterized by the Church-Rosser languages and whose bottom is characterized by the deterministic context-free languages. It is shown that between nondeterministic pushdown automata and any level of the hierarchy there are savings in the size of description which cannot be bounded by any recursive function. Interestingly, the converse is also true for the Church-Rosser languages. Moreover, there are non-recursive trade-offs between the family of Church-Rosser languages and any other level of the hierarchy.

Keywords: Descriptonal complexity, non-recursive trade-offs, restarting automata, Church-Rosser languages, context-free languages

1. Introduction

Restarting automata have been introduced in [7] in order to model the so-called “analysis by reduction,” which is a technique used in linguistics to analyze sentences of natural languages that have free word order. The technique consists of stepwise simplification of an extended sentence such that the (in)correctness of the sentence is not affected. A restarting automaton is a finite state device that works on a flexible tape. Attached to the automaton is a read-write (or lookahead) window of fixed size. The automaton works in several cycles. In one cycle it moves the window from left to right along the tape. Dependent on the current state and the current content of

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