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TESTING THE EQUIVALENCE OF REGULAR LANGUAGES [1, 2]

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ABSTRACT

The minimal deterministic finite automaton is generally used to determine regular languages equality. Using Brzozowski's notion of derivative, Antimirov and Mosses proposed a rewrite system for deciding regular expressions equivalence of which Almeida et al. presented an improved variant. Hopcroft and Karp proposed an almost linear algorithm for testing the equivalence of two deterministic finite automata that avoids minimisation. In this paper we improve this algorithm's best-case running time, present an extension to non-deterministic finite automata, and establish a relationship with the one proposed in Almeida et al., for which we also exhibit an exponential lower bound. We also present some experimental comparative results.

Keywords: Regular languages, minimal automata, regular expressions, derivatives

1. Introduction

The minimal deterministic finite automaton is generally used for determining regular languages equality. Whether the languages are represented by deterministic finite automata, non-deterministic finite automata, or regular expressions, the usual procedure uses the equivalent (unique) minimal finite automaton to decide equivalence. The best known algorithm, in terms of worst-case complexity analysis, for finite automata minimisation is log-linear [11], and the equivalence problem is PSPACE-complete for both non-deterministic finite automata and regular expressions.

Based on the algebraic properties of regular expressions and the notion of derivative, Antimirov and Mosses proposed a terminating and complete rewrite system for deciding their equivalence [7]. In a paper about testing the equivalence of regular expressions, Almeida et al. [3] presented an improved variant of this rewrite system. As suggested by Antimirov and Mosses, and corroborated by further experimental results, a better average-case performance may be obtained.

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