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# ON A FAMILY OF NONDETERMINISTIC FINITE AUTOMATA [1]

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ABSTRACT

In this paper, we study the succinctness properties of a family of one-way $n$-state nondeterministic finite automata $A_n$ over a two-letter alphabet. It is shown ([4], [5]) that the smallest equivalent deterministic finite automaton has $2^n$ states, the smallest equivalent polynomially ambiguous nondeterministic finite automaton has $2^n - 1$ states, and any equivalent nondegenerate sweeping automaton has at least $2^n$ states. We conjecture that the family $A_n$ can be used to show that the complexity class L (deterministic logarithmic space) is properly contained in NL (nondeterministic logarithmic space), and any equivalent two-way deterministic finite automaton would require an exponential number of states.

*Keywords:* Finite automata, sweeping automata, descriptional complexity.

## 1. Introduction

The simplest machine model for denoting regular languages is the one-way deterministic finite automaton. It is well known that the use of nondeterminism and two-way movements of the tape head would not change the class of languages denoted. The readers are referred to [3] for the basic definitions of one-way deterministic finite automata (DFA), one-way nondeterministic finite automata (NFA), two-way deterministic finite automata (2DFA) and two-way nondeterministic finite automata (2NFA).

Tradeoffs in the descriptional complexity of different finite automata models were extensively studied. MEYER and FISCHER [6] showed that there exists a family of $n$-state NFA such that the equivalent smallest DFA has $2^n$ states. MOORE [8] also proved the same result using a different family of languages.

In this paper, we study the succinctness properties of a family of NFA $A_n$ (defined in Section 2) over a two-letter alphabet. It is shown [4] that the smallest equivalent DFA has $2^n$ states and the smallest equivalent polynomially ambiguous NFA has $2^n - 1$ states.

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