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GROWTH RATE OF MINIMUM BRANCHING

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ABSTRACT

There are different ways of quantifying the nondeterminism used by a nondeterministic finite automaton (NFA). The amount of nondeterminism is measured as a function of the input length. For most nondeterminism measures the possible growth rates of the measure have been characterized, but this question remains open for the branching of an NFA. Here, we consider a close variant of the branching measure which we call the minimum branching. We show that the minimum branching of an NFA is always either bounded or grows exponentially.

Keywords: finite automata, limited nondeterminism, branching measure

1. Introduction

Finite automata have been extensively studied for over half a century [20] and many variants of finite automata have been considered. Nondeterministic finite automata (NFA) are an important extension and are used in virtually every area of computer science, from process modeling in software engineering [2] to protocol specification [22] in distributed systems. As finite automata are not equipped with external memory, for quantitatively analyzing the complexity of regular languages, the commonly used measures of descriptional complexity count the number of states or the number of transitions of a (nondeterministic) finite automaton [7, 8, 26]. In order to develop a quantitative understanding of the power of nondeterminism, one can also measure the degree of ambiguity or, more generally, the number of nondeterministic steps used by

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