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BÜCHI AUTOMATA AND THEIR DEGREES OF NONDETERMINISM AND AMBIGUITY [1]

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ABSTRACT

Nondeterminism and ambiguity in abstract machines can be considered as consumable resources. This was first done by Goldstine, Kintala and Wotschke for finite automata. We extend their method to finite automata which accept words of infinite length, so-called regular ω-automata. We classify the automata with respect to the amount of nondeterminism and ambiguity that is needed to accept a corresponding regular ω-language and present examples for each of the classes. It is a well-known fact that the deterministic regular ω-languages are a proper subset of the nondeterministic ones. Hence we specify the amount of nondeterminism and ambiguity that is necessary to accept a nondeterministic regular ω-language. Finally, we show for all possible amounts of nondeterminism that there is no interrelation between nondeterminism and ambiguity.

Keywords: Büchi automaton, regular ω-language, nondeterminism, ambiguity

1. Introduction

We consider finite-state automata that are able to process words of infinite length, i. e., the corresponding computations never stop. An infinite word is accepted, if in a computation on this word at least one accepting state appears infinitely often. Automata on infinite words play an important role in those areas of computer science where nonterminating computations are considered. They serve for specifying and verifying nonterminating systems (see, for instance [12, 11]). A system specification can be translated to an automaton, thus reducing questions about the system to decision problems in automata theory. For instance, the correctness of a system with respect to its specification can often be reduced to deciding inclusion of languages accepted by the corresponding automata. It is thus important to study restrictions on automata such that the verifying tasks can be performed efficiently.

Sets of infinite words that are acceptable by finite state automata are called regular ω-languages. There exist various finite state automaton models that are able to accept this language class. A thorough introduction to the field can be found in [4].

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