ON MONOTONE AUTOMATA
AND MONOTONE LANGUAGES [1]

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To Professor BÉLA CSÁKÁNY on his 70th birthday

ABSTRACT

In this paper monotone string and monotone tree languages are studied. For the string case, the monotone languages are characterized by means of regular expressions and syntactic monoids. Tree languages recognized by monotone frontier-to-root and monotone root-to-frontier recognizers are also characterized by syntactic monoids.

Keywords: Automata, tree automata, languages, tree languages

1. Introduction

Monotone automata have a special role in the decomposition theory of automata (cf. [1]). So far no attention has been paid to languages recognizable by monotone recognizers. In this paper we introduce the concepts of monotone string languages and monotone tree languages. In the string case we characterize monotone languages by means of regular expressions and syntactic monoids. For tree languages recognizable by monotone frontier-to-root tree recognizers we apply syntactic monoids given on classes of special trees of HEUTER and THOMAS (see, [4] and [6]). It will turn out that the class of tree languages recognizable by monotone frontier-to-root tree recognizers is incomparable with the class of tree languages recognizable by monotone root-to-frontier tree recognizers. Therefore, we introduce another syntactic monoid more suitable for root-to-frontier recognizers. As it will be shown, in all three cases monotonicity can be characterized by the same properties of syntactic monoids.

For notions and notation not defined here, see [2]

2. Monotone Recognizers and Monotone Languages

A *(partial) automaton* is a system $\mathcal{A} = (X, A, \delta)$, where

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