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Some Algorithms for Equivalent Transformation of Nondeterministic Finite Automata

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Abstract—In this paper we consider algorithms which allow one to combine several states of a nondeterministic finite automaton into one state. Along with the algorithms for combining states, we adduce one more algorithm for the equivalent transformation of a non-deterministic finite automaton, namely, an algorithm for adding cycles. Problems under consideration imply the development of robust computer programs.

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1. INTRODUCTION

In this paper we continue our study described in earlier papers, where regular languages and nondeterministic finite Rabin–Scott automata (in what follows, NFA) were considered from the viewpoint of the so-called state labelling function.

In this paper we consider algorithms which allow one to combine several states of certain NFA into one. We are not aimed at the establishment of a new algorithm for the vertex minimization of NFA, i.e., the development of an automaton that defines a given regular language and has the minimal possible number of states. Such algorithms are applicable to various problems, in particular, for solving problems of the theory of regular languages ([1, 2]).

The questions considered in this paper are connected with the development of efficient computer programs. Therefore we deliberately omit the estimation of the complexity of algorithms described here. In computer programs based on these algorithms we use heuristic techniques that enable one to decrease the average time of the algorithms ([3]).

Along with algorithms for combining states, in this paper we also consider an algorithm for the equivalent transformation of NFA, namely, an algorithm for adding cycles. We believe that this transformation does not complicate but even simplifies the procedure. For example, it allows one to add cycles that were absent in the initial finite automaton but present in the equivalent basis one.

Similar algorithms are also used in other transformations of automata, in particular, in the sequential transformation of an algorithm that enables one to obtain an automaton equivalent to an arbitrary given one for a regular language. We describe this transformation in this paper.

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