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GENERALIZED P COLONY AUTOMATA

Kristóf Kántor, György Vaszil

Department of Computer Science, Faculty of Informatics, University of Debrecen
Kassai út 26, 4028 Debrecen, Hungary
e-mail: rapid90x@gmail.com, vaszil.gyorgy@inf.unideb.hu

ABSTRACT

We study the computational power of a generalized notion of P colony automata which read multiset sequences as inputs. Unlike "traditional" P colony automata, where the applied tape rules require the reading of one and the same object in each computational step, in this generalized variant, different tape rules might read different objects, and then the input sequences consist of the multisets containing the objects introduced by the tape programs during the sequence of computational steps of a computation.

Keywords: Colonies, Membrane systems, P colonies, P automata, P colony automata

1. Introduction

P colonies are variants of very simple membrane systems, popular and widely studied computational models. They represent an area in the intersection of membrane computing and grammar systems, as they are membrane system which are similar to so-called colonies of simple grammars. The study of grammar systems was launched by the introduction of cooperating, distributed (CD) systems of grammars by E. Csuhaj-Varjú and J. Dassow in [3], after which the theory developed extensively, several related models were proposed and studied. An interesting one of these models is the above mentioned colony of grammars, see [9], which is a collection of very simple generative grammars (each generating a finite language) cooperating in such a way that together, as a system, they are able to generate fairly complicated infinite languages. For more on grammar systems in general, and colonies in particular, the interested reader is referred to the monograph [4], for details on membrane computing, see [13].

P colonies also consist of a collection of very simple computing agents which, similarly to the colonies of grammars, interact in a shared environment, see [10, 11]. The environment and the colony members (the computing agents) are both described by multisets of objects. These multisets are processed by the colony members using transformation rules (rewriting rules) and communication rules (rules for exchanging objects between the colony members and the environment). Several rules are grouped into programs, which execute the rules they contain in parallel. A computation consists of a sequence of computational steps during which the colony members execute