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PSPACE LIMITS THE POWER OF UNIFORM FAMILIES OF P SYSTEMS WITH ACTIVE MEMBRANES

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ABSTRACT

P system with active membranes is probably the most intensively studied model of membrane systems. It was previously shown that many variants of these P systems can solve NP-hard problems in polynomial time, using the strategy of trading space for time. The reverse problem of finding the upper bound of their power was studied, too, and a result showing the upper bound by the complexity class **PSPACE** was published. In this publication, however, an *altered* definition of families of P systems was used. An analogous result has not been shown yet for polynomially uniform families of P systems with active membranes under their *standard* definition, and it was questioned whether such a result holds or not. Here we resolve this open problem positively and we show that the mentioned families of P systems with active membranes can solve, in polynomial time, at most the class of problems **PSPACE**. Together with other previously known results we can conclude that these families are a member of the Second Machine Class as, e. g., the alternating Turing machine or the PRAM computer.

Keywords: Membrane computing; P system; Active membrane; PSPACE

1. Introduction

Membrane systems (or P systems) [7] are multiset processing nature-inspired computing models studied during the last fifteen years. Besides established natural computing topics like artificial neural networks, genetic algorithms, ant algorithms, DNA computing etc., P systems are trying to capture computational aspects of cell metabolism and information interchange. Particularly, they focus on selective particle recognition by membranes, controlled transport through protein channels, cell metabolism or membrane division and dissolution. These processes are modeled in P systems by means of parallel multiset processing in separate cell-like regions. The aim of these models is to identify operations which give to cellular systems their information-processing