

# Solving SAT with membrane creation

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**Abstract.** Membrane Computing is a branch of Natural Computing which starts from the assumption that the processes taking place in the compartmental structure of a living cell can be interpreted as computations. In this paper we present a solution to the SAT problem using Membrane Computing devices (P systems) where an exponential number of membranes can be created from objects in polynomial time.

**Keywords:** Natural Computing, Membrane Computing, Cellular Complexity Classes, SAT problem.

## 1 Introduction

Membrane Computing is an emergent branch of Natural Computing introduced by Păun in [9]. Since then it has received important attention from the scientific community. In fact, Membrane Computing has been selected by the Institute for Scientific Information, USA, as a fast *Emerging Research Front* in Computer Science, and [8] was mentioned in [12] as a highly cited paper in October 2003.

This new non-deterministic model of computation starts from the assumption that the processes taking place in the compartmental structure of a living cell can be interpreted as computations. The devices of this model are called *P systems*.

Roughly speaking, a P system consists of a cell-like membrane structure, in the compartments of which one places multisets of objects which evolve according to given rules in a synchronous non-deterministic maximally parallel manner<sup>1</sup>. The representation of data as multisets is an abstraction from the way in which chemical compounds are found in living cells.

Membrane Computing is a cross-disciplinary field with contributions by computer scientists, biologists, formal linguists and complexity theoreticians, enriching each others with results, open problems and promising new research lines.

In this paper we present a contribution from the computational side. We introduce a family of P systems with *membrane creation*, constructed in an

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<sup>1</sup> A layman-oriented introduction can be found in [10] and further bibliography at [13].

*uniform way*, that solves the problem of determining for a given formula in conjunctive normal form whether it is *satisfiable* or not (the SAT problem).

The paper is organised as follows: first P systems with membrane creation are introduced in the next section. In section 3 recognizer P systems (devices that capture the intuitive idea underlying the concept of algorithm) are presented. The solution in the framework of *membrane creation* to the SAT problem is given in section 4. Finally, some formal details and conclusions are given.

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