Soft Computing manuscript No.
(will be inserted by the editor)

A fast P system for finding a balanced 2-partition

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Received: date / Revised version: date

Abstract Numerical problems are not very frequently addressed in the P systems literature. In this paper we present an effective solution to the 2-Partition problem via a family of deterministic P systems with active membranes using 2-division. The design of this solution is a sequel of several previous works on other problems, mainly on the Subset-Sum and the Knapsack problems. Several improvements are introduced and explained.

Key words Complexity Class, Cellular Computing, Active Membranes, **NP**-complete problems

1 Introduction

Cellular Computing is a recent branch of Natural Computing initiated in [4]. Its goal is to abstract computing models from the structure and the functioning of living cells. These models are called *P systems*, they are parallel distributed devices working with multisets of objects (see [6] for a detailed description of P systems and their variants).

The present paper is focused in the design of a family of P systems that solves a numerical NP-complete problem, and in the formal verification of this solution.

The analysis of the solution presented here will be done from the point of view of the complexity classes. A *complexity class* for a model of computation is a collection of problems that can be solved (or languages that can be decided) by some devices of this model with *similar* computational resources.

In this paper we present a *polynomial complexity class* in Cellular Computing with membranes. This class allows us to detect some intrinsic difficulties of the resolution of a problem in the model above mentioned. We will follow the ideas presented in [6] and developed in [10].

The paper is organized as follows: first a formal definition of recognizer P systems is given in the next section; then, in section 3 the polynomial complexity class $\mathbf{PMC}_{\mathcal{AM}}$ is introduced; in sections 4 and 5 a cellular solution for the 2-Partition problem is presented, together with some comments and finally some final remarks are given in section 6.

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