Solving the BINPACKING Problem by Recognizer P Systems with Active Membranes

Mario J. PÉREZ JIMÉNEZ, Francisco José ROMERO CAMPERO

Dpto. de Ciencias de la Computación e Inteligencia Artificial
E.T.S. Ingeniería Informática. Universidad de Sevilla
Avda. Reina Mercedes s/n, 41012, Sevilla, España
E-mail: {Mario.Perez, Francisco-Jose.Romero}@cs.us.es

Abstract. In this paper we present an effective solution to the BINPACKING problem using a family of recognizer P systems with active membranes, input membrane and external output. The analysis of the solution presented here will be done form the point of view of complexity classes.

1 Introduction.

P systems are an emergent branch in the field of Natural Computing. This unconventional model of computation is presented as a kind of distributed parallel computing model and it is based upon the observation that the processes which take place in the complex structure of a living cell can be considered as computations.

Since Gh. Paun introduced it in [3] several variants have been considered from different approaches. A fairly complete compendium about P systems can be found in [2]. Many of the proposed variants have been proved to be computational complete,their computational power is that of Turing machines; besides some variants of P systems have been proved to be *computational efficient*, they have been shown to be able to solve **NP**-complete problems in polynomial time (see [2] Chapter 7).

The solution presented here has been designed through a family of recognizer P systems with active membranes, input membrane and external output. In particular, P systems with active membranes are studied in [2], section 7.2. We have followed the ideas and schemes used to solve others numerical **NP**-problems as the Subset–Sum in [9] and the Knapsack problem in [10]. Due to the strong similarities of the design of these solutions the idea of a *cellular programming language* seems possible as it is suggested in [12].

The analysis of the presented solution 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. We will study the complexity of the proposed solution within the framework of the *complexity classes in P systems* studied in [7] and [8].

The paper is organized as follows: Section 2 recalls recognizer P systems with active membranes, input membrane and external output. In section 3 the complexity classes for P systems are briefly introduced. Sections 4, 5 and 6 show a cellular solution to the BINPACKING problem. In section 7 we use a CLIPS simulator for recognizer P systems with acive membranes to show a session for the BINPACKING problem. Conclusions are given in section 8.

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