Verifying a P system generating squares

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Abstract

In [1], an example of a P system generating exactly all the squares of natural numbers greater than or equal to 1 is given. Nevertheless, only an informal proof of this result is presented. In this paper we study a similar P system (only one evolution rule is modified). A formalization of the syntax of the P system following [3] is given, and we perform the verification of this P system through soundness and completeness: (a) every successful computation generates a square greater than or equal to 1 (*soundness*); (b) every natural number greater or equal to 1 is the output of a successful computation of the system (*completeness*). Then we establish the formal verification through the study of the *critical points* of the computations of the P system that give to us important information to characterize the successful computations.

Keywords: Natural Computing, Membrane Computing, Formal Verfication

1 Introduction

In October 1998, Gheorghe Păun ([1]) introduced a new computability model, of a distributed parallel type, based on the notion of *membrane structure*. This model, called *transition P system*, start from the observation that the processes which take place in the complex structure of a living cell can be considered *computations*. Following [1], we can consider the P systems as devices which generate numbers: the sum of multiplicities of objects in the output membrane is the generated number by a computation.

This paper is structured in the following way. In Section 2 some preliminaries about formalization of transition P systems is presented, following [3]. In Section 3 the formal syntax, following Section 2, of Π is given. In Section 4 characterizations of successful computations of the above P system is established. In Section 5 we show that the output of every successful configuration of Π encodes the square of a natural number greater than or equal to 1 (the soundness of the P system) and, also, that the square of every natural number greater than or equal to 1 is generated by some successful computation of Π (the completeness of the P system).

References

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