Computational Complexity in P systems

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One of the main goals of *Complexity Theory* is the study of the resources required for solving problems, and to provide tools allowing to classify the problems regarding to the amount of resources needed for their resolution. In this talk some *complexity classes* for P systems are presented. These classes allows us to detect some of the inherent difficulties to the computational resolution of some problems, and they provide a classification of the *abstract problems* according to the resources they need to be solved in a given model of Cellular Computing with Membranes. Of course, such a classification demands a precise and formal definition about the concept of *abstract problem* and the model to be considered. In this way, we will begin by presenting some formal definitions for common kind of problems in computer science: *combinatorial optimization problems*, *minimization problems* and *decision problems.*

In order to solve an abstract problem by a computational device, the instances of the problem must be represented (encoded) in an adequate way that the device understands. P systems take multisets as input and handle them through computations. Hence the input in this model is provided in *unary*, so it is necessary to analyze with more details when we say a problem to be polynomial-time solvable in the framework of Membrane Computing (usually, to solve a problem a family of P systems is given where each of them is associated with a set of input data having the same *size*). The possibility of considering cellular systems using active membranes with three, two or none electrical charge (in this last case with the possibility of adding some additional ingredient) is studied.

We emphasize that one of the most interesting questions about complexity classes in P systems is to determine the *minimal amount of resources* needed to obtain exactly the classic complexity classes (**P**, **NP**, co-**NP**, **PSPACE**, **L**, **NL**, etc.)

References

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