FACTORIZATION OF DISCRETE DYNAMICAL SYSTEMS

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Abstract: Boolean automata networks, genetic regulation networks, and metabolic networks are just a few examples of modeling by discrete dynamical systems (DDS). Unfortunately, in most cases, real phenomena modeled by DDS have very complex dynamics. However, it has been empirically observed that in many cases this complex behavior seems to be the result of the ?cooperation? of many simpler systems. Equipping finite discrete dynamical systems with an algebraic structure of semiring provides a suitable context for hypothesis verification on the dynamics of DDS. Indeed, a hypothesis on the systems can be translated into polynomial equations over DDS (with a constant right-hand term). Solutions to these equations provide the validation to the initial hypothesis. The issue is that general equations over DDS are plagued by undecidability. In order to avoid the swamp of undecidability, we study the original equation through some abstractions of the problem (regarding different properties of the possible solutions such as cardinality of sets of states, asymptotic and transient behavior). We will show how one can solve, simplify and intersect them to identify the possible solutions to validate or not an initial hypothesis.