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On some special classes of sequential dynamical systems. (English) Zbl 1060.68136

Ann. Comb. 7, No. 4, 381-408 (2003).

Summary: Sequential Dynamical Systems (SDSs) are mathematical models for analyzing simulation systems. We investigate phase space properties of some special classes of SDSs obtained by restricting the local transition functions used at the nodes. We show that any SDS over the Boolean domain with symmetric Boolean local transition functions can be efficiently simulated by another SDS which uses only simple threshold and simple inverted threshold functions, where the same threshold value is used at each node and the underlying graph is d -regular for some integer d . We establish tight or nearly tight upper and lower bounds on the number of steps needed for SDSs over the Boolean domain with 1-, 2- or 3-threshold functions at each of the nodes to reach a fixed point. When the domain is a unitary semiring and each node computes a linear combination of its inputs, we present a polynomial time algorithm to determine whether such an SDS reaches a fixed point. We also show (through an explicit construction) that there are Boolean SDSs with the NOR function at each node such that their phase spaces contain directed cycles whose length is exponential in the number of nodes of the underlying graph of the SDS.

MSC:

[68U20](#) Simulation (MSC2010)

[68Q10](#) Modes of computation (nondeterministic, parallel, interactive, probabilistic, etc.)

[68Q17](#) Computational difficulty of problems (lower bounds, completeness, difficulty of approximation, etc.)

[68Q80](#) Cellular automata (computational aspects)

Cited in 7 Documents

Keywords:

[simulation systems](#)

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