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The Conjectures of R. Thomas on Gene Regulatory Networks

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Given a function f: $B^n \to B^n$ where B = {0,1}, we construct two digraphs. The first, called the State Transition Graph (STG), describes a discrete dynamical system on B^n derived from f. The second, called the Interaction Graph (IG), graphically represents the influence of each input on each output of f. In the IG, an activating influence is a positive edge and an inhibiting influence is negative. These graphs form the foundation of a discrete model of gene regulatory networks. I will present proofs of two conjectures of René Thomas in this framework, the first that a positive cycle in the IG is a necessary condition for the presence of multiple fixed points in the STG and the second that a negative cycle in the IG is a necessary condition for the presence of an attractive cycle in the STG.
