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An Introduction to Boolean 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), has vertex set B^n and describes a discrete dynamical system derived from F. The second, called the Interaction Graph (IG), has vertex set [n] and graphically represents the influence of each input on each output of F. The STG is large (2^n vertices) so we would like to know what features of the STG can be inferred from the IG. I will focus on the case when the component functions of F are unate functions, that is, they are monotone on each input.

These functions and graphs arise in the study of genetic regulatory networks. The STG captures qualitative features of gene regulatory networks. I will give an introduction to these concepts and, time permitting, I'll demonstrate an important relationship between stable states in the STG and circuits in the IG.
