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A Hoare logic for gene regulatory networks

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When modelling gene regulatory networks, we face the important issue of parameter identification, even if we consider the purely discrete framework introduced by René Thomas. Here, we focus on the exhaustive search of all the parameter values that are consistent with the observed behavior of the gene network. After having sketched the logical framework of René Thomas for modelling gene regulatory networks, we introduce a new approach based on Hoare logic and weakest precondition calculus to generate constraints on possible parameter values. The observed behaviors are first represented by sequences of elementary moves and so they play the role of "programs" of the classical Hoare logic. The backward strategy of the Hoare logic allows one to compute the weakest preconditions under which the execution of the program leads to a state where the post-conditions are satisfied. These preconditions represent the sets of all compatible parametrizations expressed as constraints on the parameters.

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