Network Analysis SS 17
Discrete Modeling

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Deadline: Wednesday, 24 May, 08:00 am

1 Exercise *Tutorial*

Consider the following description of a gene regulatory network:

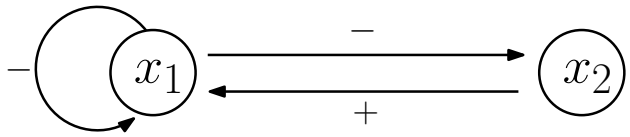
- X_1 activates X_2 synthesis at low concentrations and it represses its own synthesis at high concentrations.
- X_2 represses the synthesis of X_1.

Build and analyse a discrete model using the following the steps:

1. Draw the corresponding interaction graph $\mathcal{I}$.
2. Give a differential equation model of $\mathcal{I}$ using Hill functions.
3. Give the logical equations for the corresponding discrete model.
4. What are the possible values of the discrete variables?
5. What are the logical parameters of the discrete model and what is their range?
6. Give the state table of the discrete model in terms of the logical parameters.
7. Assume that all logical parameters take their maximum value and draw the corresponding asynchronous state transition graph $\mathcal{T}$.
8. Find all stable states and cycles in $\mathcal{T}$.

2 Exercise *Homework*

Consider the following gene interaction network $\mathcal{I}$:



Assume that upon activation, X_1 first acts on X_2, and then on itself, i.e. $\theta_{21} < \theta_{11}$. Build and analyse a discrete model using the following the steps:

1. Give a differential equation model of $\mathcal{I}$ using Hill functions.
2. Give the logical equations for the corresponding discrete model.
3. What are the possible values of the discrete variables?
4. What are the logical parameters of the discrete model and what is their range?
5. Give the state table of the discrete model in terms of the logical parameters.
6. Assume that all logical parameters take their maximum value and draw the corresponding asynchronous state transition graph $\mathcal{T}$.
7. Find all stable states and cycles in $\mathcal{T}$.

Send the solution for exercise 2 until Wednesday 24. May, 08:00 am to `Annika.Roehl@fu-berlin.de`