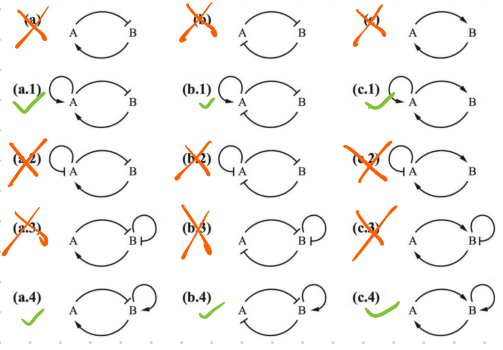
Homework 5.1 Ruling out Oscillations



$\frac{dA}{dt} = f_A(A,B)$

$\frac{\partial B}{dt} = f_B(A,B)$

for single inputs

$\frac{dx}{dt} = \frac{1}{1+y^n} - \gamma_x x \; \{ f(x,y) \rightarrow \frac{\partial f_x}{\partial x} = -\gamma_x$

$\frac{dx}{dt} = \frac{y^n}{1+y^n} - \gamma_x x \; \{ f(x,y) \rightarrow \frac{\partial f_x}{\partial x} = -\gamma_x$

$-\gamma_x - \gamma_y \neq 0$

∴ $\exists -\gamma_x - \gamma_y$ will never change sign on D

where $x,y \in \{(A,B),(B,A)\}$

for double inputs

Appendix A shows the following for the Hill functions:

two activators, Both $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} > 0$

two repressors, Both $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} < 0$

one activator one repressor $\frac{\partial f}{\partial x} > 0 \quad \frac{\partial f}{\partial y} < 0$

∴ if double input is activating itself, condition is not satisfied

But if it's repressing itself, the condition is satisfied