Netzwerkanalyse SS 2015
Alexander Bockmayr
Therese Lorenz

Exercise Sheet 1

April 20, 2015

Exercise 1. *Tutorial*
We consider the following chemical reaction

$$2CH_4 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C_2H_2 + 3H_2$$

a) Give a differential equation model of the chemical reaction system assuming mass action kinetics.

b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws.
Choose reasonable parameters for the time course and plot the concentrations against time.

Exercise 2. *Tutorial*
We consider the following chemical reaction

$$C_3H_8 + 5O_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 3CO_2 + 4H_2O$$

a) Give a differential equation model of the chemical reaction system assuming mass action kinetics.

b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws.
Choose reasonable parameters for the time course and plot the concentrations against time.

Exercise 3. *Tutorial*
We consider the following chemical reaction

$$N_2 + 3H_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2NH_3$$

a) Give a differential equation model of the chemical reaction system assuming mass action kinetics.

b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws.
Choose reasonable parameters for the time course and plot the concentrations against time.

Exercise 4. *Homework* 4 P.
We consider the chemical network consisting of the activation of a protein substrate P with intermediate complex C and enzyme E (kinase), and the deactivation of Q using a phosphatase F and intermediate complex D. The corresponding chemical reactions are:

$$E + P \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C \xrightarrow{k_2} E + Q$$
$$F + Q \underset{k_{-3}}{\overset{k_3}{\rightleftharpoons}} D \xrightarrow{k_4} F + P$$

a) Give the vectors S and $R(S)$ and the matrix Γ for the differential equation model.

b) Implement the model in Copasi. Use the standard values for the concentrations and for the following rate laws:

$$k_i = i \cdot 0.1 \qquad \text{and} \qquad k_{-i} = i \cdot 0.01$$

Choose reasonable parameters for the time course and plot the concentrations against time.

Send the model and the solutions until Friday 24th, 10 a.m. to `Therese.Lorenz@fu-berlin.de`.