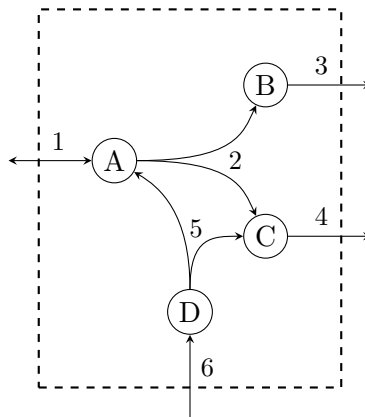


# Exercise Sheet 2

May 8, 2015

## Exercise 1. *Tutorial*

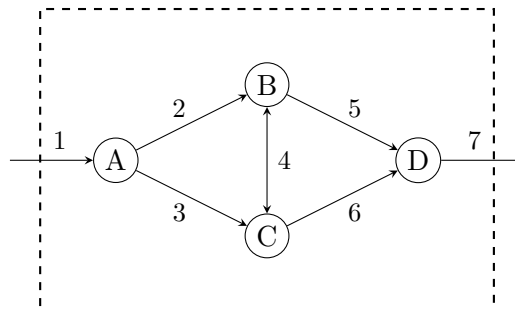
Find a set of elementary flux modes for the following network (assume that all coefficients are in  $\{\pm 1, 0\}$ ):



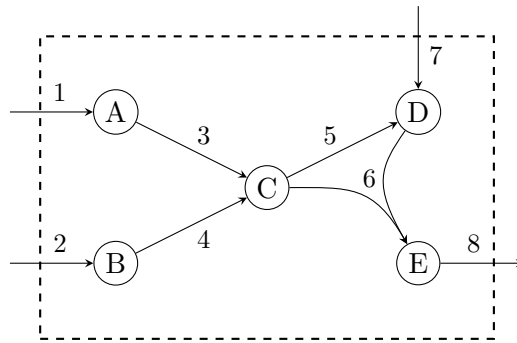
## Exercise 2. *Tutorial*

Find the minimal support vectors and give corresponding elementary flux modes for the following networks (assume that all coefficients are in  $\{\pm 1, 0\}$ ):

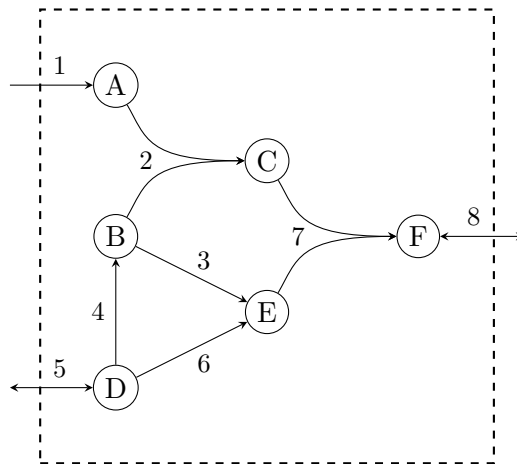
a)



b)



c)

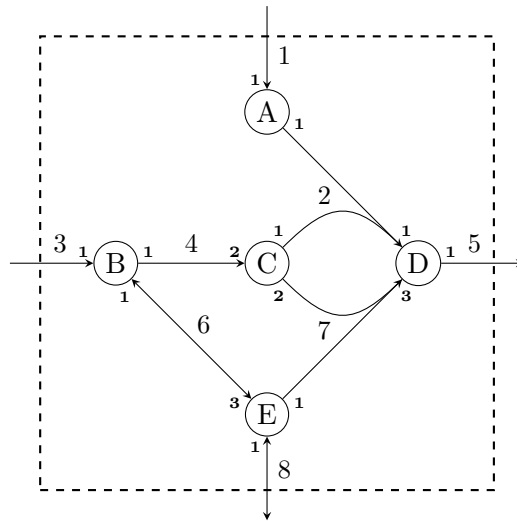


**Exercise 3.** *Homework*

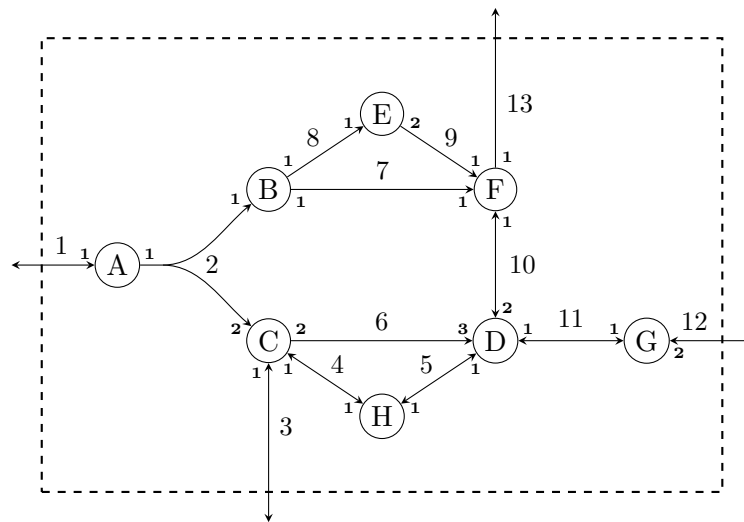
4 P.

Find the minimal support vectors and give corresponding elementary flux modes for the following networks. Which pairs of reactions are fully coupled?

a)



b)



**Exercise 4. Homework**

4 P.

Read the F2C2 article. Use the following methods on the network from Exercise 4 of the first exercise sheet. Please elaborate what you did.

- a) Reduce the network by removing dead-end metabolites and their corresponding blocked reactions and by merging trivial couplings.
- b) Find (un-)couplings using the Trivial Uncoupling and Trivial Directional Coupling rules.

- c) Use the inference rules (the rules given by the transitivity of the coupling relations) to find further coupling.
- d) Use the Feasibility Rule with the (non-reduced) flux-vectors  $v^1 = (2, 1, 2, 1, 1, 0, 1, -1)$  and  $v^2 = (2, 3/2, 1, 1, 0, 1/2, 1, -1)$  to determine further uncouplings.
- e) For which reaction pairs is the coupling status still undetermined?

Note that some of the above rules might not give any results.

Send the solution to the third and fourth exercise until Thursday, 14th, 11:00 p.m. to [Therese.Lorenz@fu-berlin.de](mailto:Therese.Lorenz@fu-berlin.de).