Molekulare Netzwerke SS 14

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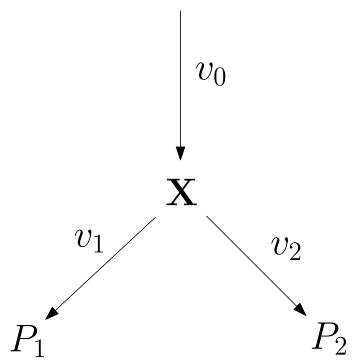
1 Exercise

Consider the following network:



The target fluxes are v_1 and v_2, the corresponding target metabolites are P_1 and P_2 with demand Γ_1 resp. Γ_2.
There exists two *MGS* (Minimal Gene Sets): $\chi_1 = \{g_0, g_1\}$ and $\chi_2 = \{g_0, g_2\}$.

- Which are the corresponding *MFM* (minimal flux modes)?
- What is the maximal number of different steady-states required to minimize the production time of the demanded output?
- How many possible strategies do we need to consider?
- Sketch the strategies.
- Assume that the kinetic parameters η are set to one: $\eta_j = 1$ for $j = 1, 2, 3$. W.l.o.g we assume further that $\tau v_1 = \Gamma_1$ and $\tau v_2 = \Gamma_2$ and set $r := \frac{\Gamma_2}{\Gamma_1} = \frac{v_2}{v_1}$.
  Determine τ in dependence to the upper bounds of v_j and Γ_i for strategy A and B.

- Determine τ (for the strategies A and B) for the given values $ub_0 = 100$ mol/h, $ub_1 = ub_2 = 10$ mol/h and assume the bounds for flux modes involving two reactions are given by $ub^1 = ub^2 = \frac{4}{3}ub$:

    1. $\Gamma_1 = \Gamma_2 = 50$ mol
    2. $\Gamma_1 = 90$ mol and $\Gamma_2 = 10$ mol
    3. $\Gamma_1 = \Gamma_2 = 50$ mol but with different upper bounds: $ub_1 = 5$ mol/h and $ub_2 = 50$ mol/h