Exercises[1]

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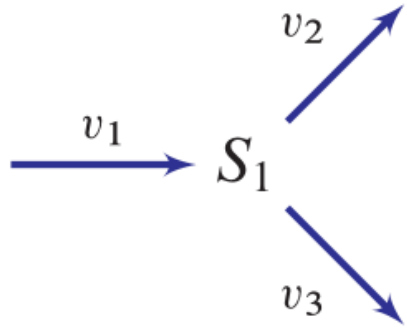
[1] HMS, 2018, v1.0

Exercise 1

1. Construct a simple branched pathway:



Let $v_1 = k_1 X_o$, $v_2 = k_2 S_1$ and $v_3 = k_3 S_1$

Set $k_1 = 0.5, k_2 = 0.75, k_3 = 0.75$ and $X_o = 10$

Build a simulation model and use an event to switch the flux from one limb to the other at time $= 30$.

Exercise 2

1. Construct a simple linear pathway:

$$\rightarrow S_1 \rightarrow S_2 \rightarrow S_3 \rightarrow$$

Let $v_1 = v_o$, $v_2 = k_2 S_1$, $v_3 = k_3 S_2$ and $v_4 = k_4 S_3$

Let $v_o = 5.0$, $k_1 = 0.5, k_2 = 0.75, k_3 = 0.35$, $k_4 = 0.12$

Build a simulation model and run the simulation until it reaches steady state. Use an event to increase all the rate constants by a factor of 30 percent and continue the simulation until it reaches steady state again.

What has happened to the flux and species concentrations?

Can you explain what you observe?

Exercise 3

1. Construct a simple linear pathway:

$$\rightarrow S_1 \rightarrow S_2 \rightarrow$$

Let $v_1 = v_o$, $v_2 = k_2 S_1$, and $v_3 = k_3 S_2$

Let $v_o = 5.0$, $k_1 = 0.5, k_2 = 0.75, k_3 = 0.35$

Build a simulation model and write python code to plot the steady state ratio of S_1/S_2 as a function of k_2.

Exercise 4

1. Construct a simple linear pathway:

$$X_o \rightarrow S_1 \rightarrow S_2 \rightarrow$$

where X_o is a boundary species.

Let $v_1 = k_1 X_o$, $v_2 = k_2 S_1$, and $v_3 = k_3 S_2$

Let $X_o = 5.0$, $k_1 = 0.5, k_2 = 0.75, k_3 = 0.35$

Inject a sine wave into X_o using $X_o := \sin(1.5 \times time)$.

After $time = 10$ switch the sine wave on

After $time = 20$ switch the sine wave off.