BMTH311: Assignment #4

Required Reading.

- Read §6.1, 6.2.1, 6.3, 6.6

To be turned in February 6th, at the start of class.

1. 6.3.1, page 191
2. 6.3.2, page 193
3. Consider the two component signaling model. Suppose that ligand bound receptors must dimerize before becoming active and that this dimerization proceeds in a highly cooperative fashion. Then we can replace equation

   $$R + L \rightleftharpoons C$$

   with an approximate model of dimerization with high cooperativity

   $$R + 2L \rightleftharpoons C.$$

   Use this new model to re-create the plots shown in class: i) response vs. signal and ii) amplification vs. signal. Comment on the important differences between these plots and the ones shown in class.

4. Consider the following simple model.

   $$\xrightarrow{\mu} S_1 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} S_2 \xrightarrow{k_2}$$

   where μ is the time varying signal and $S_1 + S_2$ is the output response.

   (a) Compute the frequency response.
   (b) Set $k_1 = k_{-1} = k_2 = 1$ and make Bode plots for the gain and phase.
   (c) Comment on any interesting features you see in the gain plot and discuss biological implications.

5. 6.8.18, page 224. Note: You aren't required to use the recommended Matlab function. You may wish to instead compute the frequency response analytically using Maple. You are free to choose whichever method you prefer.