# BMTH311: Assignment #5

**Required Reading.**

- Read §7.1, 7.2.1, 7.2.2, 7.3.3, 7.5

**To be turned in February 16th, at the start of class.**

1. Consider the ideas which went into deriving Equations 7.1 in the text. Suppose a complementary strand of RNA (called antisense RNA) can reversibly bind to mRNA. Suppose also that the cell can produce enzymes which degrade mRNA. Remove the term $-\delta_m m(t)$ from the model and replace it by incorporating both of these ideas into a revised version of Equations 7.1. If $E_T$ is the total enzyme concentration, show that there is a minimum required value of $E_T$ for this system to equilibrate and make a hand sketch of the equilibrium value of $m$ versus $E_T$.

2. In class, we made some claims about the switching behavior of the lambda phage model. Try to verify these claims by simulating the system using the parameters given in the text. Begin with $\delta_r$ representing low stress and allow the system to equilibrate. Then use a step function to simulate a DNA damage event and allow the system to equilibrate. Finally, use a step function to simulate the return to a low stress state and allow the system to equilibrate. Produce plots which support the claims made in class and in the text.

3. Textbook, 7.8.11, page 302. Also, run a simulation to support your ideas from part b).

4. Using only OR, AND, and NOT gates, design a genetic circuit which outputs a response only when exactly one (and not more than one) of it's two input signals is present. Develop a differential equation model and run a simulation to support your idea.