Principles of Synthetic Biology
Midterm Review Outline
Fall 2013

Analyzing Biological Circuits
- Design and draw genetic circuits based on a desired function
- Write mass-action kinetic equations based on a genetic circuit
- Draw qualitative behavior of the circuit over time
- Solve mass-action equations to analyze behavior
  - Identify and graph steady state input/output behavior
  - Graph nullclines and use them to identify stable and unstable steady states
- Apply appropriate assumptions (eg. quasi-steady state, Hill equation etc) where necessary and justify their use
- Identify features that lead to improved switching, bistability, oscillations etc.
- Identify circuit motifs (FFL, feedback, cascades) and their general properties
- Identify useful functions in a given circuit

Biological Concepts
- Promoters: be able to give examples of real promoters, genes commonly used (eg. pLac, pTet, pBAD, LacI, TetR, lambda repressor, etc)
- Be able to explain biological modifications that can:
  - Increase/decrease the expression of a given gene
  - Increase/decrease the stability of a given gene
  - Improve the switch-like behavior of a circuit

Engineering Concepts
- Be able to interpret and draw logic circuits
- Boolean Logic
  - Logic circuit simplification
  - Construct and interpret truth tables
- Build logic gates and circuits with transcriptional machinery