Main Topics for the Midterm Exam (Thursday, March 21)

The exam covers difference equations (Chapters 1–2), plus genetics and math modeling.

- **Difference equations** (and systems of difference equations)
  - solutions (and how they depend on parameters and initial values)
  - equilibria and their local/global stability
  - cycles and their stability
  - techniques for determining long-term behavior (for instance, cobwebbing)
- **Genetics**
  - Hardy-Weinberg law
  - metrics and tree metrics (4-point condition)
- **Math modeling**
  - forward versus backward modeling
  - scientific versus mathematical questions addressed in a research article

The best way to study for the exam is to do many practice problems, including previous homework problems. The following questions might help guide your study.

(1) How do you cobweb?
(2) What techniques are used to analyze the discrete logistic equation, the SIR model, and the Leslie matrix model?
(3) For disease models, what does the value of $\mathcal{R}_0$ tell us?
(4) How do you find equilibria (for a difference equation or a system of difference equations) and determine their stability?
(5) What is the difference between local and global asymptotic stability?
(6) How do you draw a bifurcation diagram?
(7) How do you know if a dissimilarity map is a metric or a tree metric?