MATH 605 – Stochastic methods for biology
Fall 2011 Syllabus

Time and place: MWF: 1:20 PM - 2:10 PM, Van Vleck B231.

Instructor: David Anderson
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Office hours: Mondays and Wednesdays, 2:20 PM - 3:20 PM, and by appointment.

Course webpage: http://www.math.wisc.edu/~anderson/605F11/605F11.html

I will use the class email list to send out corrections, announcements, etc. Please check your wisc.edu email regularly.

Course content: This course is, first and foremost, an introduction to stochastic processes (models that incorporate randomness) that is equivalent in level, and to a large extent content, to Math 632. Thus, we will cover

- discrete time Markov chains,
- branching processes,
- the basics of point processes,
- continuous time Markov chains, and
- diffusion processes (those incorporating “Brownian motion”).

However, the applications will be drawn primarily from the biosciences, with a special emphasis on the continuous time Markov chains used to model biochemical and other population processes. Further, as simulation is a large part of how scientists study their models, we will spend considerable time on these methods (such as the well known “Gillespie Algorithm”). Matlab will be the software package of choice for the course and each homework assignment will incorporate at least one Matlab exercise.

Intended audience: Advanced undergraduate students and/or graduate students in mathematics, physics, computer science, engineering, and related disciplines with an interest in biology, and students in biochemistry, biology, and related disciplines, with an interest in quantitative approaches in biology.

Prerequisites: It is important that the student has taken Calculus and an introductory probability course (at the level of Math 331/431 or Stat 309/311). I will, however, quickly review the needed probability at the beginning of the course, and then throughout the course as needed. A basic knowledge of ordinary differential equations and linear algebra is also important. Having some experience with writing codes would also be useful, though not strictly necessary as this can be learned during the course.
Textbook: There is no official text for the course. Instead, I will provide lecture notes.

Optional texts (on reserve in math library):


Grading: In determining your final numerical grade your work will be weighted in the following manner:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>25%</td>
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<tr>
<td>First Midterm</td>
<td>25%</td>
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<tr>
<td>Second Midterm</td>
<td>25%</td>
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<tr>
<td>Final exam/project</td>
<td>25%</td>
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Homework Assignments: Reading assignments and homework exercises will be given in class and posted on the course website. It is your responsibility to get this information. Some notes on homework:

- Homework will be assigned approximately every other week. No late papers will be accepted. You can bring the homework earlier to the instructor's office or mailbox.

- Working in groups on homework assignments is *strongly encouraged*; however, every student must write their own assignments.

- Organize your work neatly. Use proper English. Write in complete English or mathematical sentences. Answers should be simplified as much as possible.

- I strongly encourage students to type up their solutions (perhaps in Latex).

- Put problems in the correct order and staple your pages together.

- Do not use paper torn out of a binder.

- Be neat. There should not be text crossed out.

- Recopy your problems. *Do not hand in your rough draft or first attempt.*

Matlab: Each homework assignment will involve some use of Matlab, which is a mathematical software package. If you do not already have Matlab (and I'm guessing most, if not all, of you do not have Matlab on your personal computers) then you can use Matlab on any Windows machine in a University of Wisconsin computer lab. A list of the labs, with a map, is available on the course website (or just go through the DOIT website).

Exams: There will be two midterm examinations and a final (or final project). You will not be allowed to use calculators, your notes, or your textbook during exams (however, some homework problems will require calculators). No make-up midterm exams will be given unless proof of extraordinary circumstance is provided at least one week before the exam day. According to university policy, no early final exams will be given for ANY reason.