MATH 605 – Stochastic methods for biology
Fall 2013 Syllabus

Time: Tuesday and Thursday, 1:00 PM - 2:15 PM
Place: Van Vleck B139.

Instructor: *David Anderson*
Office: *617 Van Vleck*
E-mail: *anderson@math.wisc.edu*
Office hours: Tuesday, 3:30-4:30pm, Friday, 1:00-2:00pm, and by appointment.

How to contact the me: please find me before and after class, during office hours, and via email.

Course webpage: `http://www.math.wisc.edu/~anderson/605F13/605F13.html`

Check this page regularly!

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. No prior experience with Matlab will be assumed. Matlab can be found on any Windows based machine in a University of Wisconsin computer lab. A list of the labs can be found on the course webpage.

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 you have taken Calculus and an introductory probability course (at the level of Math 331/431 or Stat 309/311). 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. (It would be a favor to me if you point out any errors or poorly written parts.)

Optional texts (on reserve in math library):

- *Stochastic Modelling for Systems Biology*, 2006, Darren Wilkinson.
- *An Introduction to Stochastic Processes*, 2nd ed., 2006, Gregory Lawler.
- *Adventures in Stochastic Processes*, Sidney Resnick.

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

Homework:	15%
First Midterm:	25%
Second Midterm:	25%
Final exam:	35%

There is a good chance the exams will be evening exams.

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. They are due at the beginning of the marked class. Some notes on homework:

- No late papers will be accepted.
- Working in groups on homework assignments is ***strongly encouraged***; however, every student must write their own assignments using their own language.
- Organize your work neatly. Use proper English. Write in complete sentences that incorporate the mathematics into them. Answers should be simplified as much as possible, but not so much that the arguments are difficult to follow.
- I strongly encourage students to type up there solutions (perhaps in LaTeX).
- 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.

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