MATH 6397: Stochastic Processes in Biology

Lectures: TTh 10 – 11:30 in PGH 350

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Prerequisites:

Two semesters of calculus, undergraduate probability, some knowledge of differential equations and linear algebra.

Text:

There is no required textbook, but the following will be useful as references: *An Introduction to Stochastic Modeling* by Howard M. Taylor and Samuel Karlin, *Computational Cell Biology* edited by C. Fall, *The analysis of time series: an introduction* by Chris Chatfield, and *Stochastic Processes in Physics and Chemistry* by N.G. van Kampen.

Topics Covered:

While deterministic models of biological systems can offer valuable insights into their function and behavior, they do not fully capture the effects of randomness and variability which are fundamental features of nearly all biological systems. In this course we will apply the theory of probability and stochastic processes to models of biological systems. Students taking the course should be comfortable with multivariate calculus, differential equations and linear algebra. Topics to be covered include: a review of probability, including numerical techniques for generating random samples, Markov processes with discrete and continuous space variables, diffusion processes, Wiener and Ornstein-Uhlenbeck processes, point processes, Gillespie's algorithm and other algorithms for simulating stochastic processes and their application in biology, statistical analysis of time series, power spectra of random processes. A portion of the course will be devoted to numerical simulations of stochastic systems using MATLAB.

Computers:

There will be several computational challenges that will require the use of Matlab. You will need to learn the basics of Matlab on your own. Here are a couple of tutorials to get you started

http://www.math.ufl.edu/help/matlab-tutorial/

http://www.math.utah.edu/lab/ms/matlab/matlab.html

The first assignments will also involve some basic Matlab programing. These should take a relatively short time to go over.

How to get in touch with me:

The best way to get in touch with me is by e-mail. Use it if you have a question that can be answered quickly, or need to set up an appointment.

Homework:

There will be 4 homework assignments during the semester. You are free to work together on the homework sets, however the work you turn in must be your own. In other words you are encouraged to work together on solving the problems, but not to copy the solutions from other students. To insure that this is the case, *write up the solutions on your own*, and not in a group. **I will hold you to this standard, and if will investigate any cases of plagiarism.**

The homeworks will be worth 20% of your grade.

Project:

There will be a research project for the course. You will be able to choose your own topic (as long as it is within the scope of the course). There will also be a set of potential projects that will be available from the instructors.

The topic will be decided in consultation with the instructor. You will also prepare a short oral presentation on the paper to the class. Papers will be submitted both electronically (in .doc, .rtf or .pdf format) and as a hard copy. Presentations will be submitted in .ppt, .key or .pdf format. Submitted papers and presentations become the property of the class and may be given to future classes as examples (with your identifying information removed).

Deadlines:

9/17	topic proposal
10/6	one page synopsis
10/27	first draft of paper
11/17	second draft of paper

The course will also have dedicated writing studios – more information will be provided during the first lecture. Tentatively, there will be additional meetings on 9/8, 9/20, 10/13, 11/10 and 1/21 to discuss your assignments.

Separate guidelines for the assignments will be provided.

Attendance:

Attendance is strongly encouraged.

Reading Assignments:

Reading assignments from the textbooks are indicated in the course schedule. You will be expected to read the assigned chapters carefully, ahead of time and to participate in the discussions in class.

Grades:

Grades will be assigned on the following basis:

5%	class participation
35%	project
30%	homework
30%	final exam

Please see the schedule for the dates of the exams.

Academic Honesty:

Dishonesty includes cheating on your homework, falsifying data, and misrepresenting the work of others as your own (plagiarism). I will take all instances of academic dishonesty very seriously. I urge you to read the sections of the student handbook discussing academic dishonesty and the disciplinary actions it entails.