SYLLABUS

MATH 305 Mathematical Modeling: Probabilistic Models
Spring 2009

Time: 10:30-11:45 Tuesday-Thursday in 313 Keller Hall;
11:30-12:20 Wednesday in 208 Physical Sciences Building

Professor: Dr. Ann Castelfranco

Office: 412 Keller Hall (office hours) or Pacific Biosciences Research Center,
Room 206; 1993 East-West Rd.

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E-mail: castelf@pbrc.hawaii.edu
Web site: http://www.math.hawaii.edu/~castelf

Office hours: To be announced in Keller 412, and by appointment (possibly in PBRC 206).

Course Description:
The course will cover basic techniques of probabilistic modeling. Models drawn from
mathematical biology will be used as "case studies" to motivate and illustrate the
mathematical methods as well as to introduce classical areas of mathematical biology
such as population genetics and evolution. The class will present an introduction to
probability theory and stochastic processes, with particular focus on Markov chains.
Applications of both discrete and continuous time Markov chains will be presented.
Other topics may include evolutionary game theory, maximum likelihood estimation and
unbiased stereology. The class will include a computer laboratory that will teach the
basics of programming in the statistical software R and provide computational tools for
simulating and fitting probabilistic models including simulating stochastic processes,
maximum likelihood estimation and Monte Carlo simulation.

Textbook:
Chapman & Hall, 292 pp

Attendance and Grading:
Regular attendance of class lectures is required, since material, which is not in the
textbook, will be presented in the lectures. You are responsible for all material covered
in class even if it does not appear in the text, but only in lectures and handouts:
Homework and lab assignments 10% Weekly
Exam 1 20% Thursday, February 19\textsuperscript{th} (tentative)
Exam 2 20% Thursday, April 9\textsuperscript{th} (tentative)
Modeling project 20% Due Thursday, April 30\textsuperscript{th}
Final exam 30% Thursday, May 14\textsuperscript{th}, 9:45-11:45

**Modeling Project:**
The project will consist of choosing a model to study either from a published research paper or an extension of a model in a textbook; simulating the model, and reproducing the basic results from the paper (textbook). In addition, students will formulate a question that is not fully addressed in the paper, and modify the model to study it, or extend the analysis of the behavior of the model beyond that of the paper. A more open-ended project that requires formulation of a new model is also possible. Students will be required to turn in a written report on their project.

**Computer Lab:**
In order to use the computer lab, students must obey all the terms of use and conditions set forth in the UH Information Technology Resources Policy, which is available on the web at http://www.hawaii.edu/infotech/policies/itpolicy.html.

**General Policies:**

**Missed exams:** A make-up exam will only be given in very unusual circumstances, with one week prior notification (or, in event of an emergency, with very strong documentation of that emergency).

**Homework:** Students are expected to do their own work on homework and lab assignments. Points may be taken off for late assignments. Assignments should be neat and legible. Illegible assignments will be returned without being graded.

**Cheating:** Cheating will not be tolerated in this class. It is the student’s responsibility to ensure that (s)he does not copy from another student, or let another student copy from him or her. If a student is caught cheating, then the standard consequence will be a grade of F in the course.

**Cell phones, etc:** Cell phones and MP3 players must be turned off and kept in your book bag or pocket during class. They are not to be left out on your desk during class.

**Expectations:** Please read the statement at the ‘Academic Expectations’ link at the class web site. It will give you a sense of my expectations for your work and personal responsibility.

**Respect:** A few insensitive people can easily (and inadvertently) irritate many classmates at one time. Please try to respect the personal space of others - in particular, try to limit classroom discussion to that which is appropriate for the class. Also remain seated during the class. It is disruptive and disrespectful to walk in and out of the classroom during the lecture.
<table>
<thead>
<tr>
<th>Week 1</th>
<th>Introduction to probability: random variables, probability distributions, conditional probabilities, independence (Chapter 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Introduction to probability (cont.): expected values, two-dimensional random variables</td>
</tr>
<tr>
<td>Week 3</td>
<td>Geometric probability and applications, stereology (three-dimensional measurement in microscopy) (Chapter 2)</td>
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<tr>
<td>Week 4</td>
<td>Poisson distribution, application to the release of neurotransmitter at synapse (Chapter 3)</td>
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<tr>
<td>Week 5</td>
<td>Maximum likelihood estimation</td>
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<tr>
<td>Week 6</td>
<td>Simulation and random numbers (Chapter 5); Midterm exam 1</td>
</tr>
<tr>
<td>Week 7</td>
<td>Central limit theorem; laws of large numbers (Chapter 6)</td>
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<tr>
<td>Week 8</td>
<td>Definition of a stochastic process, simple random walks (Chapter 7)</td>
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<tr>
<td>Week 9</td>
<td>Random walk with absorbing states</td>
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<tr>
<td>Week 10</td>
<td>Mathematical population genetics and evolution (Chapter 8)</td>
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<tr>
<td>Week 11</td>
<td>Discrete time Markov chains, applications to population genetics</td>
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<tr>
<td>Week 12</td>
<td>Continuous time Markov chains, Poisson processes (Chapter 9); Midterm exam 2</td>
</tr>
<tr>
<td>Week 13</td>
<td>Continuous time birth and death processes</td>
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<tr>
<td>Week 14</td>
<td>Branching processes (Chapter 10)</td>
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<tr>
<td>Week 15</td>
<td>Brownian motion, Intro to stochastic differential equations (Chapter 11); Project due</td>
</tr>
<tr>
<td>Week 16</td>
<td>Diffusion processes (Chapter 12)</td>
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