Math 445 Statistical, Dynamical, and Computational Modeling

Course Instructor / Information:

John Bardsley, Professor, Mathematics, University of Montana
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Office Hours: 2-3pm, right after class, MTWF, and other times by appointment.

Course Web: http://www.math.umt.edu/bardsley/courses/445/445.html
Place and Time: Room 306, 1:10-2pm

Course Format: Approximately 3 lectures + 1 lab/practice session per week: MTWF 1:10 AM-2:00 PM, Math 306. The lectures and practice sessions will be videotaped and posted on the web.

Prerequisites: Consent of instructors

Learning Goals: Upon completion of this course, a student will be able to:
- Explain the basic statistical tools for exploratory data analysis, inference, and estimation with linear and nonlinear models;
- Model real data and utilize modern tools for quantifying uncertainty in model parameter estimates, such as the Delta Method, bootstrapping, and Markov chain Monte Carlo;
- Explain how to formulate simple biological models in terms of scalar differential equations and systems of differential equations;
- Apply qualitative and quantitative methods for analysis of biological models formulated in terms of differential equations;
- Independently develop functional computer programs of low complexity (10-50 lines of code), and effectively utilize, modify, or extend existing computer programs of intermediate complexity (100-1000 lines);
- Apply knowledge of programming languages and algorithmic complexity to make well-informed decisions when designing programs, selecting programming tools, and utilizing algorithms;
- Apply statistical and computational methods to numerically fit a system of differential equations to real data, and summarize the analysis in a final paper.

Computing Information: **MATLAB** will be used in class and will be required for many homework problems throughout the course. This software is available in a number of computer labs on the UM campus (including MA 206 and MA 306). Instruction on specific aspects of the software will be provided in class, and relevant code or functions will be provided on the course webpage (see above).

Handouts/Fac-Pac: The students will be supplied with handouts summarizing lecture content prior to each lecture, with templates of the computer programs, and with copies of journal articles pertinent to problems and approaches discussed in the course. At the end of some weeks, lecture related material written in a book type format (Fac-Pac) will be distributed to the students for reading and comments. Some supplementary reading material may also be provided if needed.

Incomplete (I) Grades: Incompletes (I's) are given at the discretion of the course instructors. See online UM catalog for the conditions under which an "I" may be given.

Grading (subject to modification): Several homework assignments will be given during the semester (1/2 of the final grade). There will, likely, be two take home midterm exams (1/4 of the final grade). The final project will involve group work on a modeling problem, a written report and oral presentation by the groups (1/4 of the final grade). The homework assignments for *undergraduate students* will consist of a smaller number of problems compared to the assignments for graduate students (i.e., for undergraduates some more complicated problems will be omitted from grading), and the midterms for the undergraduates will contain fewer questions. Your final grade for this course will be given according to the +/- grading system, tentatively based on the percentage intervals given below. You may talk to a course instructor about your grade at any point during the course. For international students the letter grades will be converted to equivalent numerical or percentage grades.

Tentative grading intervals:
A: [85%, 100%]; B: [70%, 85%); C: [55%, 70%); D: [40%, 55%); F: [0%, 40%).

Adding/Dropping. Changing Grading Option: For the UM's policies and deadlines for making such changes, see: http://archive.umt.edu/catalog/14_15/academics/academic-policy-procedure.php. I am unlikely to recommend approval of late drops or changes in grading options except in EXTREME circumstances (see the UM online catalog).

Academic Misconduct: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/vpsa/policies/student_conduct.php.

Disability Services: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact DSS in Lommasson 154. We will work with you and DSS to provide an appropriate accommodation.

Final Exam (for UM students): December 14, Tuesday, 1:10-3:10, final project presentations.