

Mathematical Modeling course notes

Dr. Nathaniel Miller

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Math 537: Mathematical Modeling, Spring 2011

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Illuminate Meeting Times: M (section 970)/ T (section 971) 7:00–8:30 pm

Required text: None

Office Hours: On Elluminate, Wednesdays, 3:30–5:00 pm, Thursdays 4:30–6:00 pm, and Sundays 9:00–10:00 am; and by appointment. See the course Blackboard site for a link to the Elluminate sessions.

Other Available Elluminate Times: Sessions will be available on Elluminate for groups to work together from 3 pm until 11:45 pm Wednesday to Friday, and 8 am until 11:45 pm on Saturdays and Sundays.

“The royal road to knowledge,
it is easy to express:
to err, and err, and err again,
but less, and less, and less.”

This is a class about mathematical modeling. It will be about using mathematics to model situations in the real world in order to understand it and to make recommendations and predictions. It will also be about clearly communicating your findings to others. We will try to understand situations from many different mathematical perspectives, including numerically, graphically, algebraically, and verbally (the “rule of four”).

We will be meeting once a week on Elluminate as a class. Each week, a new modeling problem or problems will be introduced. You will work on these problems, usually in groups, during our class meeting time and then during the rest of the week. The following week, you will turn in a written report on the problems, and we will discuss them as a class. You will then typically have one more week to revise them and turn in a final draft the following week.

Homework assignments will typically be due on Blackboard on Sunday nights at midnight so that I can have time to look them over before our class meeting time.

Catalog Course Description: Graduates only. Introduction to the process of mathematical modeling and its use in teaching secondary school mathematics. Emphasizes development and communication of models.

Technology: This will be a technology intensive course. In addition to using Elluminate to discuss problems, we will be using a variety of spreadsheet programs to model them, and word processing programs to write them up. We will be using Geogebra, Excel, and the Google Docs spreadsheet as spreadsheet programs. GeoGebra is a free program and can be downloaded from the link on the course webpage.

Group Work: We will often work in groups in this course. Whenever a group hands in a written assignment, they are required to put on the paper the names of those who participated fully, and only those names. Your name on the assignment certifies that you participated equally in the project. It is dishonest to turn in work that is not solely and equitably the creation of the team members. You are not required to include on the report the name of someone who started but did not finish, or who did not contribute their share. Groups will be expected to find time to work together on the group problems outside of our class meeting time. This is a three credit course, so you should expect to be spending several hours a week working on this class outside of our official meeting time.

Outside Sources: The central aim of this course is to give you experience developing your own mathematical models. You therefore should not consult outside sources for information about ways that other people have constructed models for the same situations. However, you may wish to look for external data to compare your models to; this is acceptable and is encouraged. So, it is okay to look at external sources for data about situations you are modeling, but not okay to look for solutions to the problems we are working on.

Academic Integrity: Students are expected to conduct themselves in accordance with the highest standards of scholarship and professional behavior and with UNC's Honor Code. Cheating and plagiarism create an environment that makes it difficult for real learning to occur, and they are absolutely unacceptable. Evidence of cheating or plagiarism will be treated very seriously, and will result in a failing grade on the assignment or in the course, in addition to any University disciplinary action.

Electronic Discussion Board: An electronic discussion board for this class has been set up on Blackboard. This is a great forum for continuing class discussions outside of our synchronous meeting time. Participation on this discussion board will count as part of your class participation grade. You should try to have on average at least one substantive post on the discussion board per week. If you'd like to, you can subscribe to the discussion board forum on Blackboard so that you get emailed whenever someone posts something.

Homework: Most homework for this class will be written reports. In writing them, you should imagine that you are writing a report as a consultant for a peer: someone who has roughly the same mathematical background that you do (such as another teacher at your school), but who has not yet thought carefully about the problem you are working on. Most reports will be submitted twice: once as a rough draft that I will make comments on, and once as a final report that will receive a grade.

Homework submission for this class will be online, through the course Blackboard site. Homework should be submitted as a .doc (the old Microsoft word format), .rtf, or .pdf file. Files in other formats will not be accepted. My preference is to receive files in the .doc format. If you are using the latest version of Microsoft word, the default format for files is .docx, but this format includes mathematical formulas that are not compatible between PCs and Macs, so you will need to save your files in the older format.

Modeling Contest and Exam: Towards the end of the class we will have a modeling contest, similar to the High School Contest in Modeling which is held every year. In this contest, groups will have a week to prepare a report on a new modeling problem without any outside help. There will also be a take-home final exam.

Office Hours: I will be having online office hours on Elluminate. We will frequently be working in groups in this class, and will have group assignments to be completed outside of our class meeting time. I encourage groups to work together on Elluminate during my office hours so that you can check in with me and get guidance as you are working on problems.

Grades: 80% of the grade will be determined by written individual and group assignments; 20% will be determined by the take-home final exam.

Method of Evaluation: letter graded, with a traditional grade breakdown (A = 93.33–100, A- = 90–93.32, B+ = 86.66–89.99, B = 83.33–86.65, B- = 80–83.32, C+ = 76.66–79.99, C = 73.33–76.65, C- = 70–73.33, D = 60–69.99, F = less than 60)

Outline of Course Content:

- Introduction to the modeling process
- Financial models
- Population growth models
- Continuous models

- Discrete Dynamical Systems

Course Objectives:

- Gain experience with modeling as an open-ended process including investigation, analysis, and communication
- Explore connections to K-12 curriculum, especially algebra and data analysis
- Explore modeling related to current events and quantitative literacy
- Gain experience with the Rule of Four, connecting graphical, algebraic, numerical, and verbal descriptions of problems

Plans may change: Because this is the first time that this class has been offered online at UNC, it is hard to predict how things may go. So, please understand that this syllabus represents my plans for the course, but some things may change depending on how the course is going. Please don't hesitate to let me know if you have ideas about changes that might improve the class, or if you think the class is too hard, too easy, too fast, or too slow.

Students with Disabilities: Any student requesting disability accommodation for this class must inform the instructor giving appropriate notice. Students are encouraged to contact Disability Support Services at (970) 351-2289 to certify documentation of disability and to ensure appropriate accommodations are implemented in a timely manner.

(Very) Tentative Class Schedule

week	date	Problem
1	1/10	Rabbit Populations
2	1/17	Financial Models pt 1
3	1/24	Financial Models pt 2 / Ft. Collins Temp.
4	1/31	More Population growth Part 1
5	2/7	More Population growth Part 2
6	2/14	More Population growth 4 Part 2
7	2/21	Continuous Models Part 1
8	2/28	Continuous Models Part 2
9	3/7	Iteration
-	3/14	Spring Break—no class.
10	3/21	Iteration
11	3/28	Iteration
12	4/4	Controlling Animal Populations
13	4/11	Modeling contest
14	4/18	Housing Prices
15	4/25	Final Exam given out
16	5/2	Final Exam due