Introduction to Numerical Methods
Math 471, Section 001

Basics:

Professor:	Anna Gilbert
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Office:	4831 East Hall
Office Hours:	Mondays 11:30 - 1 4831 East Hall, Tuesdays 10:30 - 12 CSE Atrium
Class Times:	TTh 8:30–10:00 am
Location:	1018 Dow
Textbook:	Brian Bradie, *A Friendly Introduction to Numerical Analysis*, 2006.
Website:	http://www.math.lsa.umich.edu/~annacg/courses/m471-f07/

Appointments will only be accepted via email with advance notice of one business day.

Grading: The numerical course grade will be determined as a weighted average of the two exam grades (50%) and the homework grade (50%). The final letter grades are calculated from the numerical scores in a "most favorable" manner. Letter boundaries are determined from the ranking of numerical scores, but there is no *a priori* disbursement of letter grades. Each student with a total score of 90% (resp., 80%, 70%, 60%) is guaranteed a final grade of A-minus (resp., B-, C-, D-minus or higher). The cutoffs are typically a little more generous.

Exam dates (locations TBA):
Midterm 1 (20%): Thursday, October 18, 6–8 pm
Midterm 2 (30%): Tuesday, December 11, 6–8 pm

Exam policy: You will be allowed one sheet of notes on US letter-size paper for the first exam and two sheets for the second. Otherwise, exams are closed notes and closed book; calculators are not permitted. Exam conflicts should be reported immediately. Makeup exams will be administered at the instructor's discretion.

Homework policy: There will be approximately ten homework assignments. The lowest grade will be dropped. Homework will be assigned on Thursday and collected in class the following Thursday. In each assignment, three or four random problems will be graded for correctness and completeness of argument; answers without justification will not earn any credit. You are encouraged to collaborate with other students to solve homework problems, *but* each student must write up and turn in his or her own assignment independently. Unfortunately, we have limited grading support for this course. Therefore, late homework will be accepted only with a documented excuse.

Grading policy: It is important that you understand and agree with the marks you receive on assignments and exams. If your score does not make sense to you, I am glad to discuss the reasoning behind the grade. To protect your privacy, these conversations will only be held during office hours or appointments—never in the classroom. If you wish me to re-grade any material, you must write a detailed explanation of your concern and attach it to the relevant assignment or exam. Be aware that requests for re-grading subject you to double jeopardy: it is possible that your score will decline.

What's this class all about?

Prerequisites: A four-semester calculus sequence including vector calculus and ordinary differential equations (e.g., Math 216, 256, 286, or 316); one semester of linear algebra (e.g., Math 217, 417, or 419); and working knowledge of one high-level computer language (e.g., C, Java, Matlab, etc.).

Background and goals: This is a survey of the basic numerical methods that are used to solve scientific problems. The emphasis is evenly divided between the analysis of the methods and their practical applications. Some convergence theorems and error bounds are proved. The course also provides an introduction to Matlab, an interactive program for numerical linear algebra, as well as practice in computer programming. One goal of the course is to show how calculus and linear algebra are used in numerical analysis.

Content: An *approximate* list of topics follows.

(1) Floating-point arithmetic
(2) Nonlinear equations and root-finding
(3) Solving systems of linear equations
(4) Eigenvalue problems
(5) Polynomial and spline interpolation; regression
(6) Numerical integration
(7) Initial value problems
(8) Two-point boundary value problems

Resources:

You may find the following resources helpful in your quest to learn Matlab.

- N. Higham and D. Higham, *Matlab Guide*. SIAM, 2000.
- `http://www.mathworks.com/`
- `http://www.math.ufl.edu/help/matlab-tutorial/`
- `http://www.engin.umich.edu/caen/technotes/matlab/`
- `http://www.me.pdx.edu/~gerry/MATLAB/`

You may also find the following other textbooks helpful in learning numerical analysis.

- B. Bradie, *A Friendly Introduction to Numerical Analysis*. Prentice–Hall, 2005.
- M. Heath, *Scientific Computing: An Introductory Survey*, 2nd ed. McGraw-Hill, 2002.
- D. Kincaid and W. Cheney, *Numerical Analysis: Mathematics of Scientific Computing*, 3rd ed. Brooks/Cole, 2002.
- J. Mathews and K. Fink, *Numerical Methods using Matlab*, 4th ed. Prentice–Hall, 2004.
- C. Moler, *Numerical Computing with Matlab*. SIAM, 2004. Available free online from `http://www.mathworks.com/moler/`.
- T. Sauer, *Numerical Analysis*. Prentice–Hall, 2006.