Numerical Analysis
Fall 2013
MATH 375.01 (3 credits), M_W_F, 2:00PM-2:50PM, Wickersham 101

Prerequisites: Grades of C- or better in each of MATH 311 (*Calculus III*), MATH 322 (*Linear Algebra*), and CSCI 161 (*Introduction to Computing I*) are the prerequisites for this course.

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Office Hours: 10:00-10:50AM (MWF), 2:00-2:50PM (TuTh) or by appointment
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Textbook: *Numerical Analysis*, 9th edition, Richard L. Burden and J. Douglas Faires, Brooks/Cole Publishing Company, Pacific Grove, California 2010, ISBN: 978-0538733519.

Objectives: MATH 375 is intended to be an introduction to modern approximation techniques. Development of algorithms, their precise mathematical analysis, and an analysis of their errors will be emphasized. Students will apply and extend their knowledge of calculus and linear algebra, and use their skills of programming in Java or C++ to develop algorithms for useful numerical routines. As often as possible "real world" problems will be introduced and discussed.

Course Contents:

- Mathematical preliminaries (Chap. 1)
  - Review of calculus
  - Round–off errors and computer arithmetic
  - Errors in scientific computation
- Solutions of equations in one variable (Chap. 2)
  - Bisection method
  - Fixed–point iteration
  - Newton–Raphson method
  - Secant method
  - Error analysis for iterative methods
  - Accelerating convergence
- Direct methods for solving linear systems (Chap. 6)
  - Linear systems of equations
  - Gaussian elimination
  - Pivoting strategies
  - Linear algebra and matrix inversion
  - Matrix factorization
- Numerical differentiation and integration (Chap. 4)
  - Numerical differentiation

  - Basic quadrature rules
  - Composite quadrature rules
  - Gaussian quadrature
  - Adaptive quadrature methods
- Interpolation and Polynomial Approximation (Chap. 3)
  - Interpolation and the Lagrange Polynomial
  - Divided differences
  - Cubic spline interpolation
- Approximation Theory (Chap. 8)
  - Discrete least squares approximation
  - Orthogonal polynomials and least squares approximation
  - Rational function approximation
  - Trigonometric polynomial approximation
- Iterative techniques in matrix algebra (Chap. 7)
  - Convergence of vectors
  - Eigenvalues and eigenvectors
  - Jacobi and Gauss-Seidel Methods
  - Error bounds and iterative refinement

If time permits, other topics may be covered as well.

Attendance: Students are expected to attend all class meetings. If you must be absent from class you are expected to complete class requirements (tests and/or homework assignments) prior to the absence. Students who miss a test should provide a valid excuse, otherwise you will not be allowed to make up the test. Tests should be made up within one week of their scheduled date. No final exam exemptions.

Homework: Homework assignments will consist of a mixture of pencil and paper written assignments and programming assignments. Programming assignments must be submitted electronically through your personal Dropbox folder found in the Desire2Learn course management software.

Students are expected to do their homework and participate in class. Students should submit all homework by the date due. Late homework will not be accepted without valid excuse. Discussion and collaboration between students on homework assignments is encouraged, but homework submitted for grading should be written up separately. Submitted written homework and programming assignments should not be merely identical copies of other students' work (changing a variable name in a program does not make a program unique or original).

Tests: A test will be given after completing the material from each of Chapters 2, 4, and 8. The exact dates of the tests will be announced in class one week before they are given (earlier if possible). The final exam scheduled for Thursday, December 12, 2013, 10:15AM–12:15PM will be comprehensive.

Grades: Course grade will be calculated as follows.

Tests	45%
Homework	35%
Exam	20%

I keep a record of students' test, homework, and exam scores. Students should also keep a record of graded assignments, tests, and other materials. The course letter grades will be calculated as follows.

90-92	A−	93-100	A		
80-82	B−	83-86	B	87-89	B+
70-72	C−	73-76	C	77-79	C+
60-62	D−	63-66	D	67-69	D+
		0-59	F		

Course Repeat Policy An undergraduate student may not take an undergraduate course of record more than three times. A course of record is defined as a course in which a student receives a grade of A, B, C, D, (including + and −) F, U, Z or W. The academic department offering a course may drop a student from a course if the student attempts to take a course more than three times.[1]

Inclement Weather Policy: If we should miss a class day due to a school closing because of weather, any activities planned for that missed day will take place the next time the class meets. For example, if a test is scheduled for a day that class is canceled on account of snow, the test will be given the next time the class meets.

Cell Phones: Silence (or better yet, turn off) all cellular telephones upon entering the classroom. Leaving class to initiate or receive a telephone call will not be tolerated and students doing so will not be re-admitted to the classroom until the following class meeting. Texting or tweeting during class interferes with the learning process. Students distracted by their cell phones are not engaged in class and will find, over the course of the semester, that learning and course grade will suffer.

Final Word: Math is not a spectator sport. What you learn from this course and your final grade depend mainly on the amount of work you put forth. Daily contact with the material through homework assignments and review of notes taken during lectures is extremely important. Organizing and conducting regular study sessions with other students in this class will help you to understand the material better.

No one can guarantee you success in this course. Your responsibilities and the instructor's expectation are outlined above. There will be no second chances, "do-overs", or extra credit assignments.

[1] Memorandum to mathematics faculty from Dr. Charles G. Denlinger, Assistant Chair, Department of Mathematics, August 30, 2004.