CSC 335[1] / F09
Numerical Methods

Dr. Andrew Pounds,
Office: Rm. 332 Willett Science Center, (478) 301-5627
e-mail: pounds_aj@mercer.edu
Home Phone: (478) 750-9251 (*No calls after 8 PM)*
Office Hours: W 2:00-3:00 CSB, R 1:30-3:30 WSC (or by appointment)

Computing is not about numbers, it is about insight. – R.W. Hamming

CSC 335 is a course to introduce students to the foundational principles of numerical methods and numerical analysis. Students in CSC 335 will be exposed to the fundamentals of finite precision arithmetic, its associated error, and the propagation of such errors. Students will also be introduced to methods for solving equations in one and multiple variables by using direct and iterative techniques. Methods of numerical differentiation and integration will also be studied. The numerical solution of ordinary differential equations will be be introduced as well as the use of approximation theory to solve nonlinear systems. The use of public domain libraries and packages for numerical computation will be demonstrated. Commercial symbolic algebra packages like *Mathematica* and *MuPad* will also be used in the class.

Students taking CSC 335 are expected to have a working knowledge of a high level programming language such as C, C++, Fortran, or JAVA. Strategies for high performance code development and project management with these languages will be discussed during the course. Rapid code prototyping utilizing the Python programming language will also be introduced. Students in CSC 335 are expected to read at the college level and also have a working knowledge of differential and integral calculus. Topics from multivariable calculus, linear algebra, and differential equations will be introduced as needed.

Upon completion of this course, a student will demonstrate competence in each of the following areas:

- understanding the errors incurred when one utilizes finite precision arithmetic and applying these concepts on homework and tests,
- the ability to development direct and iterative software algorithms to solve well formed problems from the mathematics literature and applying these concepts on homework and tests,
- the ability to write numerical programs suitable for solving problems from the natural and physical sciences and applying these skills to programming projects.

Class Meeting Times and Locations
Lecture: MWF 1:00–1:50 a.m., Room 301 CSB.

Course Materials
Required: *Numerical Analysis, 8th ed.*, Burden and Faires
Scientific Calculator
Recommended: *Python: Programming in Context*, Miller and Ranum
Fortran, C, and Algorithms, 3rd ed., Ratzer and Vybihal

Course Structure

Topics from nine chapters of the text will be covered during the semester in the order listed on the class schedule. The lecture time will be used to expound on and augment the text, discuss problem solving strategies, and demonstrate algorithms. Students are responsible for all material covered in class as well as the material from the textual sections listed in the class schedule. Eight assignments and two projects will be submitted for grading. Four 50 minute exams will be given per the schedule. A three hour final exam will be administered at the end of the term.

[1] Cross listed as MAT 335

Grading

Tests (4 @ 100 pts)	400 pts
Programming Projects (2 @ 100 pts)	200 pts
Homework/programming assignments (8 @ 25 pts)	200 pts
Final Exam	200 pts
Total Possible	1000 pts

The following grading scale is assured but *may* be *slightly* lowered based on test results.

A ≥900 pts
B ≥800 pts
C ≥700 pts
D ≥600 pts
F <600 pts

General Information

Honor Code: All students in CSC 335 are expected to adhere to the Mercer University Honor Code. Any suspected violations will be reported to the Honor Council for further investigation.

Many students have difficulty in determining how to apply the Mercer honor code to computer science courses. A few general guidelines should help you in deciding whether you are violating the honor code or not.

1. You are allowed to receive help on your programs from other students, provided the purpose of the help is to help you understand your own program better, not to write your program for you.
2. You are NOT allowed to use copies of programs written by other students, or copies of programs from published sources, even if you plan to modify them extensively.
3. You are NOT allowed to give copies of your programs, or parts of your programs, to other students in any form.
4. YOU MUST WRITE YOUR OWN CODE. DO NOT COPY PROGRAMS OR PARTS OF PROGRAMS FROM ANY SOURCE UNLESS I TELL YOU TO DO SO.

Any violation of the above policies will be treated as academic dishonesty and a violation of the Mercer Honor Code.

Attendance: Except for the first day of the semester, attendance will not be taken. However, students are still accountable for all material covered in class as well as any announcements made during the lecture period. If you think that you might have the H1N1 virus, please contact me via e-mail and then contact Student Health Services and the associate Dean of CLA via phone.

Homework: Students are encouraged to work together on homework assignments. Each person, however, must turn in their own assignments in their own words.

Homework Grading Policy: Homework problems will typically be divided into two sections: book problems and special problems from me. Individual problems from the book will be graded on a three point scale and the composite score from all problems on a given assignment converted to a 15 point scale. Points will be awarded as follows: 3 (essentially correct), 2 (minor errors or omissions), 1 (major errors or omissions), 0 (no effort). The point breakdown for problems from me will be indicated on the homework handouts and the composite score converted to a 10 point scale. Each homework assignment is worth a total of 25 points. Homework will be considered late if it is not turned in by 5:00 p.m. on the date due. Late homework will be penalized 33% per day.

Missed Exams: Anyone missing an exam for *any* reason (personal illness, death in the immediate family, or other emergency) must notify Dr. Pounds in advance. The absence will be considered unexcused otherwise. Make-up exams will be individually scheduled.

Partial Credit: Partial credit will not be awarded on any exam unless individuals show their work and clearly delineate how they arrived at their answers.

Re-grading Policy: If a student suspects that an error was made in the grading of a submitted work, they may return the paper for re-grading with the understanding that the entire work will be re-graded and not only the portion in question.

Posting of Grades: Grades will not be posted. If you are curious about your cumulative grade, see Dr. Pounds.

E-mail Listserve: I maintain an e-mail listserve which I use use copiously to send information to the class and which you can use to communicate with each other. To sign up for the listserve and to learn how to send information to it, please go to: `http://theochem.mercer.edu/mailman/listinfo/csc335`.

Departmental Computing Facilities: While students may work on their own computer systems to develop code for the class, students are encouraged to work on the departmental server named *cobra* (`cobra.cs.mercer.edu`). This server is guaranteed to have all of the requisite compilers and software libraries required to build code for this course. All programs will be tested on *cobra* – SO MAKE SURE YOUR CODE RUNS ON *cobra*. Students who need to use *Mathematica* can access it from the computer labs in the Computer Science Building or the Chemistry Department. Students wanting to use *MuPAD* can access it in the Chemistry Computing Laboratory. If you need information on how to transfer code to *cobra*, just ask me.

Editors: I get asked this question every year – so I am going to go ahead and answer it here. I don't care what editors you use to develop your code. You can use *eclipse*, *Emacs*, *vim*, *joe*, *jed*, etc. Just know that all of those are not available on all systems. You are GUARANTEED to find *vi* on any Unix box. Just know that the FINAL version of your program has to be on *cobra* in a format that can be read and compiled in a normal manner.

Seminar Attendance: There will be a few seminars this semester that are designed specifically for you but that contain information that needs to be more widely disseminate to the campus. We will work out the time for these seminars with your respective schedules (most likely Friday mornings at 10:00 am) but attendance at the ones specifically targeting your class will be mandatory.

American Disability Act: "Students with a documented disability must inform the instructor at the close of the first class meeting. The instructor will refer you to the Student Support Services office for consultation regarding evaluation, documentation of your disability, and a recommendation as to the accommodation, if any, to be provided. Students must provide instructors with an accommodation form from Student Support Services listing reasonable accommodation to sign and return to Student Support Services. The Student Support Services office is located on the 3rd floor of the Conned Student Center. If you do NOT consult with the instructor and follow up at the Student Support Services office during the first two weeks of classes, as provided above, you will thereby waive any claim to a disability and the right to any accommodation pertaining thereto."

Electronic Submission of Materials: "Students bear sole responsibility for ensuring that papers or assignments submitted electronically to a professor are received in a timely manner and in the electronic format(s) specified by the professor. Students are therefore obliged to have their e-mail client issue a receipt verifying that the document has been received. Students are also strongly advised to retain a copy of the dated submission on a separate disk. Faculty members are encouraged, but not required, to acknowledge receipt of the assignment."

Tentative Class Schedule[2]

Week Starting	Chapter	Lecture Topics
August 25th	Chapter 1	Introduction Math Preliminaries Roundoff Errors
August 30th	Chapter 2	Algorithms and Convergence Bisection and Fixed Point Methods Newton's Method Error Analysis for Iterative Methods
September 6th		**Holiday – Labor Day – 9/7/09** Convergence Acceleration Zeros of Polynomials
September 13th	Chapter 3	Interpolation and the Lagrange Polynomial Divided Differences
September 20th		Hermite Interpolation Cubic Splines **EXAM #1, 9/23/09**
September 27th	Chapter 4	Numerical Differentiation Elementary Numerical Integration
October 4th		Romberg Integration Adaptive and Gaussian Quadrature Multiple Integrals
October 11th	Chapter 5	Elementary theory of Ordinary Differential Equations Initial Value Problems Euler's Methods **FALL BREAK – 9/15/09-9/16/09**
October 18th		Taylor Polynomial Methods Runge-Kutta Methods **EXAM #2, 10/23/09**
October 25th	Chapter 6	Direct Solutions for Linear Systems of Equations Matrix Operations Gaussian Elimination and Pivoting
November 1st		Matrix Factorization Special Matrices
November 8th	Chapter 7	Iterative Techniques for Matrix Algebra Solving Linear Systems
November 15th		Error Bounds for Iterative Matrix Techniques **EXAM #3, 11/18/09**
November 22nd	Chapter 8	Least Squares Approximation **THANKSGIVING BREAK – 11/25/09-11/27/09**
November 29th		Orthogonal Polynomials Trigonometric Polynomial Approximation Fast Fourier Transforms
December 6th	Chapter 10	Newton's Method for Nonlinear Systems Steepest Descent Techniques **EXAM #4, 12/9/09** **REVIEW**
December 13th		**FINAL EXAM, 12/18/09, 7 p.m.** (Friday)

[2]I reserve the right to modify this schedule as situations warrant.