CSC 335\textsuperscript{1} / F06
Numerical Methods

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Office Hours: T 1:30-3:00 WSC, W 1:00-1:30 CSB, W 3:30-4:30 WSC (or by appointment)

\textit{Computing is not about numbers, it is about insight. – R.W. Hamming}

CSC 335 is a course to introduce students 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 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 Maple 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. 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 develop 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 2:00-2:50 a.m., Room 301 CSB.

Course Materials
\textit{Numerical Analysis, 8th ed.}, Burden and Faires
Scientific Calculator

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.

\textsuperscript{1}Cross listed as MAT 335
Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests (4 @ 100 pts)</td>
<td>400 pts</td>
</tr>
<tr>
<td>Programming Projects (2 @ 100 pts)</td>
<td>200 pts</td>
</tr>
<tr>
<td>Homework/programming assignments (8 @ 25 pts)</td>
<td>200 pts</td>
</tr>
<tr>
<td>Final Exam</td>
<td>200 pts</td>
</tr>
<tr>
<td><strong>Total Possible</strong></td>
<td>1000 pts</td>
</tr>
</tbody>
</table>

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

A  \( \geq 900 \) pts  
B  \( \geq 800 \) pts  
C  \( \geq 700 \) pts  
D  \( \geq 600 \) 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.

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.

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: Individual homework problems will be graded on a three point scale and the composite score from all problems on a given assignment converted to a 25 point scale. Points will be awarded as follows: 3 (essentially correct), 2 (minor errors or omissions), 1 (major errors or omissions), 0 (no effort). 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.

American Disability Act: “If you believe that you possess a disability for which reasonable accommodation must be made, you must consult with the instructor at the close of the initial class meeting. The instructor will refer you to the Office of the Dean of Students for evaluation, documentation of your disability, and a recommendation as to the accommodation, if any, to be provided. If you do not consult with the instructor and follow up with the Office of the Dean of Students, as instructed 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

<table>
<thead>
<tr>
<th>Week Starting</th>
<th>Chapter</th>
<th>Lecture Topics</th>
</tr>
</thead>
</table>
| August 21<sup>st</sup> | Chapter 1 | Introduction  
Math Preliminaries  
Roundoff Errors |
| August 28<sup>th</sup> | Chapter 2 | Algorithms and Convergence  
Bisection and Fixed Point Methods  
Newton’s Method  
Error Analysis for Iterative Methods |
| September 4<sup>th</sup> | | Holiday – Labor Day  
Convergence Acceleration  
Zeros of Polynomials |
| September 11<sup>th</sup> | Chapter 3 | Interpolation and the Lagrange Polynomial  
Divided Differences |
| September 18<sup>th</sup> | | Hermite Interpolation  
Cubic Splines |
| September 25<sup>th</sup> | Chapter 4 | Numerical Differentiation  
Elementary Numerical Integration |
| October 2<sup>nd</sup> | | Romberg Integration  
Adaptive and Gaussian Quadrature  
Multiple Integrals |
| October 9<sup>th</sup> | Chapter 5 | FALL BREAK  
Elementary theory of Ordinary Differential Equations  
Initial Value Problems  
Euler’s Methods |
| October 16<sup>th</sup> | | Taylor Polynomial Methods  
Runge-Kutta Methods |
| October 23<sup>rd</sup> | Chapter 6 | EXAM #2, 10/23/06  
Direct Solutions for Linear Systems of Equations  
Matrix Operations  
Gaussian Elimination and Pivoting |
| October 30<sup>th</sup> | | Matrix Factorization  
Special Matrices |
| November 6<sup>th</sup> | Chapter 7 | Iterative Techniques for Matrix Algebra  
Solving Linear Systems |
| November 13<sup>th</sup> | | Error Bounds for Iterative Matrix Techniques  
EXAM #3, 11/17/06 |
| November 20<sup>th</sup> | Chapter 8 | Least Squares Approximation  
THANKSGIVING |
| November 27<sup>th</sup> | | Orthogonal Polynomials  
Trigonometric Polynomial Approximation  
Fast Fourier Transforms |
| December 4<sup>th</sup> | Chapter 10 | Newton’s Method for Nonlinear Systems  
Steepest Descent Techniques  
EXAM #4, 12/6/06  
REVIEW |
| December 11<sup>th</sup> | | FINAL EXAM, 12/11/06, 2 p.m. |

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<sup>²</sup> I reserve the right to modify this schedule as situations warrant.
Electronic Mailing List Procedures

For numerous reasons I decided recently to move all of my course related e-mail distribution lists to an electronic mail server. If you want to get e-mail that I send to the class (like what to study for exams), then you must subscribe to this e-mail list server. However, since there is the possibility that people can abuse such servers, I have added a few security features. While these security features make it a little harder to subscribe or unsubscribe from the list, they also protect you from getting “spammed”.

To subscribe to the list server, send an e-mail to

majordomo@theochem.mercer.edu

with no subject and a message that says

subscribe csc335-L <address> <-- your preferred e-mail address
end

The end at the end is important. If you send this message from the e-mail address where you typically receive e-mail, you can leave the address blank. If you want to receive e-mail at another address, then include the FULL e-mail address above. For example, if you read your e-mail from the account surfer@yahoo.com you would get onto that account and send the following message to majordomo@theochem.mercer.edu:

subscribe csc335-L
end

If your name were John Smith and you want to receive e-mail at your Mercer e-mail, then you would simply send:

subscribe csc335-L
end

to majordomo@theochem.mercer.edu from your Mercer e-mail account. Now, if you subscribe to the list server from your Mercer e-mail, but you want the messages to go to your surfer@yahoo.com address, then you would send the following message:

subscribe csc335-L surfer@yahoo.com
end

To avoid any security issues, the listserver will send a message to the account that is supposed to receive the e-mails asking you to verify your request. Simply send a second message to majordomo@theochem.mercer.edu with the security tag sent to you by the listserver. The security tag will look something like

auth 7f71777b subscribe csc335-L smith_ja@acadmn.mercer.edu

So the response you send to majordomo@theochem.mercer.edu would be (depending on the security tag sent to you):

auth 7f71777b subscribe csc335-L smith_ja@acadmn.mercer.edu
end

An added bonus to this is that if you want to send an e-mail to all the students in the class, you can simply send it to csc335-L@theochem.mercer.edu and it will go to everyone subscribed! At the end of the term I will delete the subscription list. If you, however, want to unsubscribe before then, simply send a message to majordomo@theochem.mercer.edu with the message

unsubscribe csc335-L
end

If you have problems getting on the listserver, come see me. If you want to contact just me then please send e-mail to pounds_aj@mercer.edu.