Math/CS 465, Topics: NUMERICAL ANALYSIS
Rhodes College
Fall Semester, 1998

Logistics
Meeting time and place: M hour, 9:40 – 11:10 TT: 207 Kennedy

Instructor: Tom Barr      Office: 316
Ohlendorf
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Office hours: 2-3 MW
1:30 – 3 TT
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Academic Volume: Faculty folders: A-F: tombarr: MathCS465

Purpose and Goals: The purpose of this course is to acquaint the student with the
potentialities of mathematics and computers in solving numerical problems which arise in
the sciences. We will deal with mathematical questions of how to generate solutions to
such problems and with questions of implementing these methods on the computer.
Topics to be included in this course are: FORTRAN programming, floating-point
arithmetic, approximation of roots of equations, interpolation and polynomial
approximation, numerical differentiation and integration and solutions of systems of
linear equations. Other topics such as least-squares approximation of initial-value
problems for ordinary differential equations may be included as time permits.

Tentative Outline of the Course:

1. Preliminaries
   Software: Introduction to FORTRAN 77, Review of Mathematica Number
   representation, floating point arithmetic, truncation, round-off error, etc.
2. Approximating the roots of equations
   Bisection algorithm
   Fixed-point iteration
   Newton’s method
   Systems of equations and the method of steepest descent
3. Approximation of functions
   Polynomial interpolation
   Spline approximation
   Least squares
4. Approximation of Calculus Operations
   Numerical differentiation
Numerical Integration
   Trapezoid rule
   Simpson’s rule
   Romberg’s algorithm
   Gaussian Quadrature
5. Approximate solutions for initial value problems
   Euler’s Method
   The Runge-Kutta method
6. Approximation in linear algebra
   Gaussian elimination with scaled partial pivoting
   Special systems
   Eigenvalues and Eigenvectors
7. Other topics as time permits

Activities: Regular homework assignments, mostly problems from the textbook and programs, will be graded. The two tests are tentatively scheduled for

   Tuesday, 13 October
   Tuesday, 24 November

They will be approximately 1-1/2 hour in duration, taken in class without books or notes, unless otherwise noted. The term projects will take the form of an expository paper and a class presentation based on that paper. Schedule a meeting with me on or near 22 October to finalize your topic, and schedule another meeting with me on or near 19 November to make a brief (1/2 hour) presentation on a portion of what you will be covering in your paper and class presentation. I will distribute a list of possible topics and resources; you are certainly encouraged to investigate your own as well.

Grading:

   2 Tests @ 20% each            40%
   Homework                       20%
   Paper and Presentation         15%
   Final Exam                     25%

The Honor Code: By writing your name on work which is submitted to be graded you assert that you have not received aid in completing the work from any other individual, verbally or in writing. By the same token you are obliged to report to the instructor or the Honor Council any transgression of the Honor Code which you witness.