Numerical Analysis, Math 4006, Fall 2013

Instructor: Rolf Ryham

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Office Hours: TBA

Topics:

- Numerical Algorithms
  1 Finding roots, Heron's algorithm, and where to start
  2 An unstable algorithm, general roots, and floating points
- Nonlinear Equations
  3 Fixed point iterations and particular methods
  4 Further methods, complex roots, and error propagation
- Linear Systems
  5 Gaussian elimination and factorization
  6 Triangular matrices and pivoting
- Direct Solvers
  7 Direct factorization
  8 Caution about factorization and banded matrices
- Vector Spaces
  9 Normed spaces and triangle inequality
  10 Proving the triangle inequality and relations between norms
  11 Inner product spaces
- Operators
  12 Operators
  13 Schur decomposition
  14 Convergent matrices and powers of matrices
- Nonlinear Systems
  15 Functional iteration
  16/17 Newton's method and convergence

- Iterative Methods

  18 Stationary methods

  19 General splitting and conditions for convergence

- Polynomial Interpolation

  20 Taylor's theorem

  20 Interpolation

  21 Norms on function spaces

- Chebyshev and Hermite Interpolation

  22 Error terms and Chebyshev basis functions

  23 Lebesgue Function

- Approximation Theory

  24 Best approximation polynomials, and Weierstrass' theorem

Textbook: *Numerical Analysis*, Ridgeway Scott,

Software: `Octave` or `Matlab`

Grading Schedule:

25% Midterm 1, 25% Midterm 2, 25% Homework, 25% Final

Homework will be due roughly weekly and is to be turned in on time–late homework will not be accepted–personal mastery is a necessity for performing well in this (and any other) course. Examinations are taken in class.

The internet is very useful for finding things but is not a substitute for real learning. Referring to material found in the textbook is encouraged while solutions taken from online sources are unacceptable.

Important Dates:

- October 10, First Midterm
- November 18, Second Midterm
- December 11-18, Final Examination Period

Disability Statement: Anyone with a documented disability is encouraged to contact the instructor privately and the Office of Disability Services within the first two weeks of class.