

**NE 155, midterm 1 review S15**  
**March 9, 2015**

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Here are the topics we've covered and that are fair game for the exam. I encourage you to think about what can reasonably be asked about in 50 minutes if there are a few questions. Also think about what can be asked on an exam at all vs. what really requires a computer.

A goal of mine is for you to understand underlying principles and the meaning behind things. If you understand the meaning most other things will come out of it.

- Vectors and properties
  - vector norms
  - measuring error and determining convergence
- Matrices and properties
  - how to compute a determinant; properties of determinants
  - matrix norms
  - eigenvalues, eigenvectors, and spectral radius
- Direct solutions of linear systems ( $A\vec{x} = \vec{b}$ )
  - diagonal, lower-tri and upper-tri systems
  - LU decomposition
  - tridiagonal systems
- Interpolation
  - polynomial: Lagrange based
  - error calculation
  - piecewise polynomial: spline
- Approximation using least squares
- Differentiation: Forming expressions for derivatives and their error terms using Taylor's theorem

- Integration
  - Lagrange form of Newton-Cotes
  - composite Newton-Cotes
  - both how you derive these rules and compute the errors
- Iterative solutions of linear systems
  - General form of the fixed point iterative method
  - Richardson / Source iteration
  - Jacobi
  - Gauss Seidel
  - SOR
  - convergence
  - preconditioning
- Transport and diffusion equation
  - meaning of terms
  - assumptions in derivation
  - areas of applicability

The exam will be 50 minutes long and closed book.

You may use a calculator.

You may have an 8.5" x 11" page with writing on each side. You must turn it in with the exam.