

NE 155, midterm 1 review S17
March 3, 2017

Here are the topics we've covered and that are fair game for the exam.

The exam will be 50 minutes long and closed book.

You may use a calculator.

I will provide a notes sheet with the exam for your use.

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.

- Transport and diffusion equation
 - meaning of terms
 - assumptions in derivation
 - areas of applicability and validity
 - boundary and interface conditions
- Interpolation
 - what it is and what it's for
 - polynomial (Lagrange based): formula and error calculation
 - what we think about when evaluating interpolation quality
 - piecewise polynomials
- Approximation using least squares
 - what it is and what it's for
 - the normal equations
- Differentiation: Forming expressions for derivatives and their error terms using Taylor's theorem; orders of accuracy as a function of mesh size ($O(h^x)$)

- Integration
 - Lagrange form of Newton-Cotes
 - composite Newton-Cotes
 - both how you derive these rules and compute the errors
 - quality of integration
 - closed vs. open NC
- 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