Math 471 Final Exam List of Topics

- **Lecture Notes** (see also list of topics for midterm):
  - **Polynomial Interpolation**:
    - Existence and uniqueness
    - Lagrange and Newton’s form of the interpolating polynomial,
    - Divided Differences
    - Error in polynomial interpolation
    - Best choice of points and Chebyshev polynomials,
    - Hermite interpolation (Lagrange and Newton form)
    - Piecewise polynomial interpolation (linear, splines).
    - Natural/clamped cubic splines
  
  - **Numerical Differentiation and Integration**:
    - Finite difference approximations
    - Richardson’s extrapolation,
    - 2-Point Boundary Value Problems
    - Numerical integration using polynomial interpolation
    - Method of undetermined coefficients,
    - Trapezoid, Simpson’s and Midpoint rules
    - Local and compound/composite rules,
    - Error in numerical integration
    - Richardson’s extrapolation (again)
    - Numerical error estimation
    - Gram Schmidt orthogonalization,
    - Orthogonal polynomials
    - Gaussian quadrature (Gauss Legendre, Gauss-Laguerre)
  
  - **Numerical Methods for Initial Value Problems**:
    - Taylor series methods
    - Marching methods
    - Derivation using numerical integration
    - Euler, Trapezoid, improved Euler, midpoint rule
    - Local truncation error, and global error
    - Convergence proof for Euler’s method and error bound
    - Runge Kutta methods (order 2, order 4)
    - Multistep methods (Adams Bashforth, Adams Moulton)
    - Implicit methods and root finding/predictor corrector methods
    - Numerical methods for systems of ODE’s
    - High order ODE’s
• Homework assignments 1-10.

• From the Textbook (Brady, A friendly introduction to Numerical Analysis):
  – Chapter 5 (5.1, 5.3-5.7):
  – Chapter 6 (6.1-6.6):
  – Chapter 7 (7.1-7.5, 7.8):
  – Chapter 8 (8.1):