Midterm Exam Outline

Math 104B: Numerical Analysis
Professor: Paul J. Atzberger

- Integration
    - Newton-Cotes Methods (open and closed).
    - Composite Quadrature.
    - Trapezoidal Quadrature, Simpson's Quadrature.
    - Gaussian Quadrature.

- Theory of Ordinary Differential Equations (ODEs)
    - Lipschitz continuity both scalar and vector-valued functions.
    - definition of well-posedness.
    - sufficient criteria for well-posedness.
    - uniqueness, existence, robustness to perturbations.

- Numerical Approximation of ODEs
    - Euler's Method
        - truncation error, error bound, stability.
    - Taylor Methods.
    - Runge-Kutta Methods
        - explicit / implicit methods.
        - second order methods.
        - fourth order methods.
    - Multistep Methods
        - Adams-Moulton Methods.
        - Adams-Bashforth Methods.
        - truncation error and Stability

- Convergence of Methods, Stability, and Stiffness
    - definition of convergence
    - definition of consistency
    - stability of One-step Methods.
    - stability of Multistep Methods
        - root conditions.
    - convergence theory for One-step Methods.
    - convergence theory for Multistep Methods.

- Linear systems and basic solvers
    - Well-posedness of linear systems
    - Gaussian elimination method
    - Pivoting strategies for numerical solvers
    - LU factorization