What to study for the Midterm

Review the homeworks (excluding the bonus problem)

Chapter 2

Section 2.1 – Skip.

Section 2.2

Least-square fit

-Know how to do Linear Fit. (slide 2.11~2.14)

-Understand benefits/disadvantages for higher-order polynomial fit (slide 2.15).

Piecewise Polynomial Approximation

-Understand the concept of why it's needed to improve the curve prediction.

-Know the four conditions (slide 2.18) to formulate the cubic-spline.

Section 2.3

Numerical Integration

-Know the formulation of Rectangle, Trapezoidal and Simple's rule. (slide 2.23, 2.25, 2.27)

-Skip Gauss quadrature rule.

Numerical Differentiation

-Know the formulation for Forward+Backward and Central Difference and their respective order of error, i.e. $o(h^2)$. (slide 2.37 ~2.38)

Extrapolation

-Know the formulation for Richardson's extrapolation method and the two examples in the notes (slide 2.39 ~ 2.40)

Section 2.4

Root Finding

-Understand Bisection (slide 2.45) and Newton-Raphson (slide 2.53~2.54 & 2.61)

-The best examples for Newton-Raphson method are in Prob. 2 & 4 HW2.

Section 2.5

Intro to ODE – Read slide 2.67 ~ 2.88

-Know the formulation for Forward Euler (slice 2.71) + Backward Euler (slide 2.83~2.84) schemes. You should be able to derive the matrix equation in Prob. 5 in HW2 which will help you understand Backward Euler scheme better.

-Skip the remainder of chap. 2

Chapter 3

Section 3.1 – skip

Section 3.2

-Understand which is more appropriate; Direct or Iterative method? (slide3.9~3.10)

Section 3.3

-Know how to do Gauss-Elimination + LU decomposition by hand. Try to LU decompose the 4x4 matrix in slide 3.21.

-Know the order of operation for LU decomposition

-Understand the benefits of using LU decomposition compared to Gauss-Elimination (slide 3.23)

-Know the pivoting concept (slide 3.26~3.29)

-Skip Cholesky Factorization

-Know how to compute the vector norms, system & solution residual and condition number (slide 3.33 ~ 3.35)

-Understand the remedies for stiff systems (slide 3.40)

Equations and Formulations to memorize

-Rectangle, Trapezoidal and Simpson's Rule

-Forward + Backward and Central Difference scheme

-Richardson's Extrapolation

-Formulation for Bisection & Newton-Raphson method

-Forward + Backward Euler scheme