AMSC/CMSC 460 Study Outline for the final

The following outline consists of topics that may appear on the final exam. (Note the absence of barycentric interpolation, Gaussian quadrature, and ordinary differential equations.) Although any topics covered in the course may appear on the final, the emphasis will be on topics covered after the midterm. In the accompanying references, V refers to Van Loan's *Introduction to Scientific Computing*, S refers to Stewart's *Afternotes on Numerical Analysis* and C refers to material treated in class. If an item contains references to both books you should study both.

1. Error
    1. Measurement error (C)
    2. Truncation error (V1.4.2, S24)
    3. Rounding error (V1.4.3, S6.11–6.22)
    4. Absolute and relative error (V1.4.1, S1.10–1.14)
2. Floating-point arithmetic (V1.4.4, S6)
    1. base, fraction (significand), exponent, normalization
    2. IEEE floating point
    3. Overflow and underflow
    4. Rounding unit
    5. Error in floating-point arithmetic
3. Rounding error analysis (S7-8)
    1. Backward error analysis
    2. Perturbation analysis
    3. Cancellation
4. Polynomial interpolation
    1. Natural form (V2.1, S18.1-18.10)
    2. Lagrange form (S18.11–18.14)
    3. Newton form (V2.2–2.3, S19.5–19.12)
    4. Evaluation (V2.1.4, V2.2.3, S19.2–19.4, S19.7–19.8)
    5. Error (V2.3.2, S20.1–20.5)
5. Piecewise polynomial interpolation
    1. Piecewise linear interpolation (V3.1)
    2. Table lookup (V3.1.2)
    3. Spline interpolation (V3.3)
6. Numerical integration
    1. Change of interval (S21.4–21.7)
    2. Newton-Cotes formulas (V4.1)
    3. Construction by undetermined coefficients (S21.19–21.20)
    4. Simple and composite trapezoidal rule (S21.8–21.15)
    5. Simple and composite Simpson's rule (S21.19–22.8)
    6. Singularities (S22.9–22.13)

7. Matrices
    1. Basic operations (S9)
    2. Matrix multiplication (V5.2.3)
    3. Matrices and memory (S11.1–11)
8. Theory of linear equations
    1. Characterization of nonsingularity (S10.1–3)
    2. Norms (S15.1–10, V5.3.5)
    3. Perturbation theory and condition numbers (S15.11–16.4 V6.4.1–2.)
9. Solution of linear systems
    1. Triangular systems (S10.6–10.13, V6.1.1–2)
    2. Gaussian elimination (S13.5–14.13, V6.3.1–3, 6.3.5)
    3. Stability (S16.10–17.14, V6.3.4)
10. Least squares problems
    1. Lest squares fittine (V7.1.1–2)
    2. The QR factorization (Vpp.247–248, 7.2.3))
11. Nonlinear Equations
    1. Interval bisection (V81.1.2, S1.3–9)
    2. Newton's method (S2.1–14, V8.1.3)
    3. Combining Newton and Bisection (V8.1.4, Project 6)
    4. Condition of a root (S5.17–21)