Review before second exam (November 5, 2003)

Chapters 2

- The concepts of consistency, stability and convergence, Lax's equivalence theorem
- Methods for determining stability of F.D. schemes, von Neumann stability analysis method
- Concept of explicit and implicit schemes, and their general properties
- Method for dealing with multi-dimensional diffusion problems, stability of such schemes - direct extension, directional splitting and fractional step methods

Chapter 3

- Linear convection – 1-D wave equation
- Courant-Friedrichs-Lewy (CFL) Stability Criterion for wave/advection equations
- PDE and FDE's domain of dependency
- Necessary conditions of stability based on domain of dependencies
- Stability analysis for wave/advection equations solved with various schemes

Chapter 3. Hyperbolic equations

- Phase and amplitude errors for advection schemes
  - Modified equation
  - Definition of errors
  - Derivation of errors
- Computational modes of multi-time level schemes
- Methods for suppressing computational modes
- Asselin time filter
- Comparison of phase and amplitude accuracy of several common schemes
- Practical measure of dissipation and dispersion errors
- Concept of monotonicity
- Methods for multi-dimensional advection and their stability properties

Chapter 4. Nonlinear Hyperbolic equations

- Aliasing, nonlinear instability – their origin and effect
- Methods for controlling nonlinear instability