Exam 1

October 11, 2018

Reading
You are responsible for all material covered in class. Exam 1 will cover Chapters 4 (with the exception of section 4.6), 5 and 6.

Main Themes
1. Rootfinding
   (a) Understanding the notion of order of convergence of various methods (we covered Bisection, Secant, Newton).
   (b) Derivation of Newton's method
   (c) Derivation of convergence of order of convergence for Newton, Bisection
   (d) Newton’s method and roots of high multiplicity
   (e) Stopping criteria and error estimation
   (f) Advantages/ Disadvantages of each method

2. Fixed Point Iteration Schemes
   (a) What is a fixed point iteration scheme?
   (b) Usage of contraction mapping theorem

3. Floating point arithmetic
   (a) Definitions - floating point number system, single vs double precision, machine epsilon, roundoff error
   (b) Effect of roundoff errors on computations e.g. numerical differentiation

4. Stability of algorithms
   (a) What is a stable algorithm? unstable?
   (b) What is a well conditioned problem? ill-conditioned?
   (c) Loss of significance errors and how to avoid them
   (d) Local truncation error/ Discretization error

Practice problems
In addition you may find the following practice problems useful.
1. Chapter 4 - 1,3,6,12,16
2. Chapter 5 - 3,5,7,8
3. Chapter 6 1e,f