Math 351, Elementary Numerical Analysis I, Fall 2013

Class Time:	MWF 2-2:50p.m. in 300 Villard Hall
Instructor:	Dr. Marcin Bownik
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Office Hours:	9:30-10:30 Mon. Fri., 11-12 Wed., or by appointment
Textbook:	W. Cheney, D. Kincaid, *Numerical Mathematics and Computing*, 6th edition

1. **Background and Goals.** This course introduces students to the subject of numerical analysis. Numerical analysis is the study of methods and algorithms for mathematical computation, with an emphasis on techniques for approximating solutions to numerical problems and managing the error. Topics include: approximations by Taylor series, representation of numbers in different bases, loss of significance, methods for locating roots of equations, polynomial interpolation, and numerical integration. The course, which is the first of two in the sequence, covers most of chapters 1–6 of the textbook.

2. **Learning Outcomes.** Students should be able make computation in a finite precision arithmetic, identify machine numbers corresponding to exact calculations, find relative errors of machine computations, and identify situations when large machine errors can occur. They should be able to compute loss of significant digits for machine arithmetic operations, foresee situations when computations can not be done accurately, and propose methods of avoiding loss of significance. Students should be able to perform methods for locating roots of equations such as: bisection method, Newton's method, and secant's method, analyze convergence of these methods, estimate errors of approximations, and show limitations of each method. They should be able to compute interpolating polynomials by Lagrange interpolation and divided differences, demonstrate fundamental properties of interpolating polynomials, and estimate errors in polynomial interpolation. They need to derive formulas for approximating first and higher order derivatives of functions, estimate corresponding errors, and compute derivatives using Richardson extrapolation method. Students should be able to compute approximations of integrals using methods such as: Riemann sums, midpoint rule, trapezoid rule, Simpsons' rule, Romberg's method, estimate corresponding errors, and analyze the number of steps needed to get results with desired accuracy.

3. **Mathematica.** For the in-class computer demonstrations we will use Mathematica, a powerful computer program for symbolic and numerical mathematical computations. You may also want to use it for your homework and project. Mathematica is available

to students for instructional/academic research purposes only. It can be installed from Information Technology site at `https://it.uoregon.edu/software/mathematica`.

4. **Exams.** There will be an in-class midterm exam on Wed. Nov. 6 and a final exam on Thu. Dec. 12, 3:15-5:15p.m.

5. **Homework.** Homework problems will be assigned every week and be due in class on Wednesday on the material of the previous week. No late homework will be accepted. You may work work with your classmates under the following conditions:
   - you must individually write your assignment,
   - you must acknowledge the cooperation by including the name of the person(s).

6. **Project.** Part of your grade will be based on a programming or research project due on the last day of class. Possible projects include implementing the algorithms discussed in class in your favorite programming language, or researching a numerical analysis topic.

7. **Grading.** The grading distribution will be as follows:

Homework:	20%
Midterm Exam:	20%
Project:	20%
Final Exam:	40%