Math 405: Introduction to Computational Mathematics
Reading and Homework Assignment 1

Prof. Wickerhauser

You are allowed to collaborate with one other person on homework, but then you must indicate both contributor's names on your solution sheet.

You are also encouraged to work additional exercises from the indicated sections, although the homework grade will be based only on the exercises listed below.

Please return your solutions to me by the end of class on the due date. **Late homework will not be accepted.**

Read Sections 1.1–1.4.

Exercise 1:

Pick a computer and find the smallest positive number ϵ_0 satisfying $1.0 + \epsilon_0 > 1.0$. Hint: use bisection.

Exercise 2:

Suppose that a computer has $\epsilon_0 = 10^{-7}$ and rounds to the nearest representable number. Predict what would happen if it tried to evaluate the expression

$$\sum_{k=1}^{10^8} 1.0$$

in floating-point arithmetic.

For the following two problems, let $f(x) = x^2 e^{-x}$ and put

$$d_1 = f'(1); \qquad d_2 = [f(1.0+h) - f(1.0)]/h; \qquad d_3 = [f(1.0+h) - f(1.0-h)]/2h.$$

Exercise 3:

Prove that, in exact arithmetic, $\lim_{h\to 0} d_2 = \lim_{h\to 0} d_3 = d_1$.

Exercise 4:

Compute d_1, d_2 and d_3 on the computer you picked for Problem 1, using small values of h. Which gives the better estimate for d_1? Given ϵ_0, how close could you get with d_2 and d_3?