Homework 1: Due October 9th, 2017

First, do these problems. These will be graded for completion.

• 1.1: 8 (just submit “I did it” if you did it.), 9 (notice there’s just one short question at the end.), 10
• 1.2: 4 (obviously, not using Theorem 1.2.3), 16a, 20, 21 (a and b, not c)

Then do these problems. These will be graded for correctness.

1. Using basic programming only (i.e., not using MATLAB’s built in matrix multiplication), write a MATLAB function that takes as input two matrices, and outputs their product.

2. What are the two main ways we can measure the speed of an algorithm/program? What are their respective strengths and weaknesses?

3. Consider the differential equation \( f''(x) - 2f(x) = x \) on the interval \([0, 3]\). Set up and solve a matrix problem to estimate the solution to this equation with \( f(0) = 0 \) and \( f(3) = 0 \). Use 6 subintervals, i.e., use a “mesh size” of 1/2. Turn in 1. The \( A\vec{x} = \vec{b} \) you set up, 2. The solution vector \( \vec{x} \) (You may use MATLAB to find it.), 3. A sketch of the graph of your approximate solution \( f(x) \). (Hint: Your matrix should be 5x5.)

For additional practice, here are some optional problems. These should not be turned in.

• 1.2: 16b, 21c

• Explain why an algorithm of \( O(n^2) \) may not be faster than an algorithm of \( O(n^3) \), even though they are calculating the same thing.

• Set up and solve (using MATLAB) a matrix problem to estimate the solution to \( f''(x) + 3f'(x) - f(x) = \sin(x) \) on the interval \([0, \pi]\) with boundary conditions \( f(0) = 0 \) and \( f(\pi) = 0 \). Use 6 subintervals.