

# CS 240A: Applied Parallel Computing // Homework 1

Assigned January 17, 2006

Due by class time Wednesday, January 25

The object of this problem is to write a parallel program to multiply a (dense) matrix by a vector, and to use this routine in an implementation of the power method to find the largest-magnitude eigenvalue of the matrix. You will write your program as a function called `powermethod`, as if it were a routine in a library of parallel tools. We will grade it by calling it from a test harness routine that we write, called `harness1`. Our test harness includes a data generator, a routine to validate the output of `powermethod`, and code to time the call. The test harness code is also in the `hw1` directory: you may (and should) use it as you develop your code. However, you should not modify the test harness code, since we will use the original test harness (with a slightly different data generator) to evaluate your routine.

The `hw1` directory has subdirectories with C-MPI and UPC versions of the test harness. It also has a subdirectory with a sequential Matlab version of the power method routine and of the test harness. The Matlab codes are just to help you understand the problem, and to let you run small test cases to check your results. The Matlab files are:

- `powermethod.m`: Matlab code for library routine
- `harness1.m`: Matlab code for our test harness
- `genmatrix1.m`: Matlab code for our data generator
- `validate1.m`: Matlab code for our validation routine

Your assignment is to write the `powermethod` routine in *both* C-MPI and UPC, and test it on matrices as large as you can. You should use our local cluster, `cluster2`. (If you wish you may also try your code on DataStar and the Minnesota X1, but that's not required for this assignment. The second and third assignments will require you to use those machines.) You should do enough experiments to see how your code scales as the number of processors and the size of the matrix change. Try your code on 1, 2, 3, 4, and 8 processors (at least). For this assignment, your grade will only depend on the code's running correctly, not on its performance. However, for the next two homeworks, performance will be a large part of the grade (at least 50%).

The file `hw1/faq.text` has some details of how to get things working. We'll be adding to that file during the course of the assignment as questions come up.