EECS 739: Homework 4

Due: May 4, 2017 (at 11am)

Important Note: No late homework will be accepted since this is the last day of class, and I will be handing out solutions in class.

Questions:

1. (20 points) Implement the serial pattern search method in C/C++.

2. (20 points) Test your serial algorithm on the unconstrained minimization of the Rosenbrock function given by

$$f(x, y) = (1 - x)^2 + 100(y - x^2)^2$$

using $(x_0, y_0) = (-1.2, 1)$. Run enough iterations to obtain reasonable convergence. Plot the iterates your method generates on top of a contour plot of f. (You can use Matlab or another mathematical software package to generate the plot.)

For this question and the last one, you are to determine a pattern which makes sense for the problem being solved. This includes the number of points in the pattern, the directions, the initial length of each leg in the pattern, etcetera.

3. (30 points) Implement the synchronous parallel pattern search method in CUDA.

4. (30 points) Test your parallel algorithm on the unconstrained minimization of the extended Rosenbrock function given by

$$f(x_1, x_2, x_3, ..., x_n) = \sum_{i=1}^{n-1} \left[100 \left(x_i^2 - x_{i+1} \right)^2 + (x_i - 1)^2 \right].$$

Test your algorithm with numerous random starting points and record whether or not the method converges to a global minimimum for the case when $n = 10$. Employ reasonable convergence criteria. In addition, consider the method to have not converged if it does not satisfy your convergence criteria within 20 iterations. Run it with different block sizes and numbers of threads. **It is OK to use block sizes and numbers of threads that divide the problem dimension easily.** Report the wall clock time and the speedup obtained in each case.