Assignment 3
High Performance Computing I
CE620/CSE547/MAE609/MTH667/PHY515
Fall 2015
Due 11:59 PM 11/06/2015

Instructions

Work all problems. You may consult with others, but the work submitted must be your own. Code may be written in `C`, `C++`, or `Fortran`. Submit all code through UBLearns, including steps to compile and run different experiments. Please submit written answers electronically through UBLearns. Clarity of code and plots will be a component of the credit you receive.

Problem 1

Redo Problem 4 of HW#2 (estimating π using the midpoint rule) now using MPI. You may find the following progression helpful.

1. First, let all points live on all processors, i.e. every processor constructs all of the grid, and just parallelize the computation of π.
2. Now divide up the points as equally as possible over the processors. Have each processor only build it's part of the grid and evaluate those points.

Study both strong scaling and weak scaling of the final version of your code to at least 2 nodes at CCR. Use the Karp-Flatt metric to estimate the serial fraction of your code.

Problem 2

Redo Problem 2 of HW#2 (estimating the area of the Mandelbrot set), now using MPI. You will try a few different strategies for this problem to exercise splitting up communicators.

1. Partition the number of points equally over each processor.
2. Partition MPI_COMM_WORLD into two groups. Partition the number of points between these two groups. Now, within each group, partition the workload and work within each group. Only the root process of each group should interact between the groups.

Study both strong scaling and weak scaling for each case on at least 2 nodes at CCR.