Lab 11 - MPI
NERS/ENGR 570 Fall 2020

Nov. 13th, 2020

Before you begin

- Find a partner to pair up with (work with your project group if possible)
- Establish a terminal session on Great Lakes.
- Create a copy of the `laplace_serial` file downloaded in last week's lab, or reclone the OpenMP examples (https://github.com/bkochuna/OpenMP_Examples)

Exercise 1 - Simulated Annealing

For this exercise we will use the same short program as Lab 9 that solves a simulated annealing problem for a plate with a fixed boundary condition. This constitutes solving Laplace's equation given by:

$$\nabla^2 T = 0$$

Note that this is similar to Poisson's equation. Therefore, we discretize with finite difference creating a 5-point stencil. In this problem the solution is obtained via Gauss-Seidel iteration, so the resulting fixed point iteration scheme is given by:

$$T_{i,j}^{(k+1)} = \frac{1}{4}\left(T_{i-1,j}^{(k+1)} + T_{i+1,j}^{(k)} + T_{i,j-1}^{(k+1)} + T_{i,j+1}^{(k)}\right)$$

The convergence criteria used in this problem is based on the infinity norm of the difference between consecutive iterates or:

$$\varepsilon = max\left|T_{i,j}^{(k+1)} - T_{i,j}^{(k)}\right|$$

The goal of this exercise is to modify the existing `SimulatedAnnealing` program to use MPI to solve the equation in parallel.

During lab we will examine the program and decide how to parallelize. This procedure will generally follow:

1. Test the environment for MPI and write some basic info about number of processes
2. Develop the parallel algorithm
3. Implement the MPI parallelism and debug
4. Measure speedup
5. Repeat steps 2 through 4 time permitting and try to modify algorithm to achieve better speedup.

Deliverables

For exercise 1

1. Upload your modified source file for the `SimulatedAnnealing` example to Canvas following lab to show how much progress you made.

Otherwise your grade is based on your participation in the exercises during lab, and no outside work is required. *Have a good weekend!*