CS 4970 - Parallel Programming

Assignment 3 - Due 2021.09.16

Overview: The purpose of this assignment is to break up data across multiple nodes, alter the data, and send it back and have process 0 save the data to a file.

Currently:

In class, we examined and compiled the .cpp file: MPI_scattervgatherv_example.cpp. It currently performs the following:

(1) At runtime, a command line argument gives the length of the array to populate and then scatter/gather.
(2) All of the shares of the array, displacements are calculated.
(3) All of the adjusted shares of the array, and corresponding adjusted displacements are computed – for overlap.
(4) The large array is scattered in two ways – no overlap, and overlap.
(5) The processes alter their no overlap arrays.
(6) Process 0 gathers the no overlap arrays and stores them in the array from which they were scattered.

Future Work:

So your job is to take MPI_scattervgatherv_example.cpp and modify it to perform the following:

(1) Instead of a command line argument, define two arrays of type double and length 10000, these will be x and y values.
(2) The overlap in the original program was 2 (2 on left and 2 on right where allowable), make the overlap 3.
(3) The minimum number of array elements each process should receive is 10, which should not be a problem.
(4) The x array should be evenly spaced values on the interval $[0, 10]$.
(5) The y array should be $\cos(x)$ for each x-value in the x array.
(6) The y array will be scattered using the overlapping shares and displacements.
(7) Each process will adjust their y array by multiplying the entries by (-1)
(8) Each process will take the relevant entries in the overlapped array and copy them to the non-overlap array.
(9) The modified non-overlapped y arrays will be gathered back to process 0.
(10) Process 0 will dump the data to a file in the format found int he MPI_fileIO.cpp program.