**Blue Waters Petascale Semester Curriculum v1.0**

**Unit 5: MPI**

**Lesson 11: Wave Propagation in MPI**

**Exercise Instructions for Students**

*Developed by R. Phillip Bording for the Shodor Education Foundation, Inc.*



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Write a simple random matrix addition serial code in C and Fortran.

* Add memory allocation methods to the code that defines the dimensions of the matrices
* Define arrays for each matrix and allocate required memory
* Write **do/for** loop(s) to initialize the matrix arrays with some numbers, you could use random number generators.
* Write loops to find the min and max array values.

Distribute the arrays across a one-dimensional processor network with MPI.

* Assume a three deep ghost region between processors.
* Compute the min – max array values in the individual memory spaces and gather them into the global min-max values.
* Use the Linux time command to document entire job runtime.
* Use the Linux timer command to document performance as the array size scales to large numbers – gigabytes of memory.
* Be careful in using reduction operators like: min and max.
* Compare performance of your parallel program with a single processor program.

Do a scaling study and an algorithm complexity analysis of these programs