EECS 739: Homework 2
Due: March 7, 2017 (at 11am)

Note: No late solutions will be accepted this time. This is so I can hand out sample solutions on Tuesday in preparation for the midterm exam on Thursday, March 9.

Questions:

1. (20 points) Implement the parallel cyclic reduction algorithm in MPI with C/C++ for use with tridiagonal linear systems with $n = 63$. Assume that n processors are available.

   For this MPI code only, you may hard code the value of $n = 63$. It is also sufficient to use only send/receive commands (both the blocking and nonblocking versions) for communicating the relevant data. (It's also acceptable but not expected to use commands based on gather/scatter/reduce operations.) **These simplifications are being adopted since this is your first MPI program.**

   Test your algorithm on the Slurm cluster with the following parameters: $A = diag(v) + diag(w, 1) + diag(w, -1)$, where $v = ones(63, 1)$ and $w = ones(62, 1)$, and $b = ones(63, 1)$. Note this tridiagonal linear system is specified using Matlab notation. Use 63 processors for your experiment. Report the wall clock time for this experiment.

   Turn-in: Your MPI and C/C++ code and output from the above experiment (with relevant variables printed out at each reduction/solve stage). These items should be printed out in hard copy. Also - e-mail your code and output to shontz@ku.edu. **Note: Both the hard copy and soft copy are required for this question to be graded.**

2. (20 points) What would be different about your code in Question 1 if only 31 processors were available? **Do NOT implement a second version of your code.** Instead, summarize what would be a different in a paragraph or so. Draw an task dependency diagram to go along with your summmary.

3. (20 points) Suppose instead that you are given a pentadiagonal linear system to be solved for some value of n. (Note that pentadiagonal matrices have nonzeros on the main diagonal, the two diagonals above the main diagonal, and the diagonals below the main diagonal. All other matrix entries are zero.) Summarize how the parallel cyclic reduction algorithm can be modified to solve pentadiagonal linear systems in the case when n processors are available. Your summary should be a paragraph or so. **Be sure to state your assumption as to the relationship between n and p.** Draw a task dependency diagram to go along with your summary.