ECE5640 **High Performance Computing** **Spring 2014**

Homework 3: Due Friday, February 7 at noon

Homework is due on Friday, February 7 at noon. Handwritten answers to book problems is fine. Code, scripts and output files should be uploaded to Blackboard. If you scan your homework, make sure it is legible!

Programs should be run on the Discovery cluster.

1. (15 pts) Run `hello world from <your_username>`, based on the code from lecture 7 slide 43, on the discovery cluster using MPI. Run on 20 and 40 processes. Report your run times. Turn in your code, shell script and the output.

2. (15 pts) Repeat question 1 using an MPI broadcast command in place of the for loop to broadcast the message to all the processes from the master node. Run on 20 and 40 processes. Report your run times. Turn in your code, shell script and the output.

3. (30 pts) Implement the ring communications from Lecture 7, slides 45 through 48. Run on 20 and 40 processes. Report your run times. Turn in the shell script and the output.

4. (40 pts) Write MPI code to sum a vector of values `vect1[i]`. The result should be placed in a variable called `totsum`. Initialize your vector to integers such that `vect1[i] = i+1`. Note that this is the MPI version of your code from Homework 2. Your vector should be split among the available processes, and each process should add its own components. Use an MPI reduction operator to sum the results on the master process. Your code should work on any number of processes. Compute the runtime of your code. Run with different number of processes and different length vectors. Turn in your code and bash script. Give advice to someone running this code regarding how they should parallelize it. How many processes is optimal? How large does your vector need to be to see speedup? Would you advise that a user use OpenMP or MPI to parallelize their code? Explain your answer.