

Homework #7**Due: Monday, March 19, 2018 ~midnight**

CS 1645/2045

Spring 2017

Question 1:

In this question we will be implementing a trapezoidal approximation method for determining the area under a curve (found in Section 3.2 of the book). In this question you will be implementing a mpi version of this approximation method.

- a. There is an starter file found in the git repository located here:
<https://github.com/bryanmills/hpc-course-2017/tree/master/hw7>
- b. On comet you should be able to execute the following commands:

```
make  
sbatch submit_trap.batch
```
- c. After your job has ran you should verify the output file. You can view your position in the queue using the following command:

```
squeue -u $USER
```
- d. Modify the mpi_trap.c file to properly parallelize the work across all ranks.
 - i. Use MPI_SEND and MPI_RECV to send local_int from all non-zero ranks to rank zero.
 - ii. Once rank zero has the value of local_int you should sum up those values on rank zero.
 - iii. Remember you also need to add up local_int from rank zero.
 - iv. Run your program and verify that the estimated area under the curve by verifying the output.
- e. Lastly, modify the calculations of local_n, local_a, and local_b so that even if the n doesn't evenly divide into the number.
 - i. Modify the submit_trap.batch file to have only 5 mpi tasks, verify that the estimate is the same as when you had 48.

Question 2:

In this question we are going to use MPI_BCAST and MPI_REDUCE to approximate the value of pi using MPI. Again working in the same directory as above.

- a. There is an starter file found in the git repository located here:
<https://github.com/bryanmills/hpc-course-2017/tree/master/hw7>
- b. On comet you should be able to execute the following command:

```
sbatch submit_pi.batch
```
- c. Modify mpi_pi.c to tell all the ranks the value of n using MPI_BCAST. By default only rank 0 will receive stdin values so we need to communicate the value of n to all other nodes. We could do this MPI_SEND/MPI_RECV but MPI_BCAST makes this easier.
- d. Modify mpi_pi.c to sum up all the estimated values found by all the ranks at rank 0. Again you could do this with MPI_SEND/MPI_RECV but use MPI_REDUCE to accomplish the same thing.
- e. Run your new program and verify that the estimate of pi is working in the output.