Lab for January 23

CAAM 520, Spring 2019

1 Parallel matrix-vector product

This lab is an exercise in using MPI to compute a dense matrix-vector product $\boldsymbol{b} = \boldsymbol{A}\boldsymbol{x}$. In class, we parallelized this matrix-vector product using a row-based decomposition and `MPI_Allgather`. For this lab, please modify the code to perform a matrix-vector product using a column-based decomposition. Check your answer using simple values for $\boldsymbol{A}, \boldsymbol{x}$.

Things your code should do:

- Initialize $\boldsymbol{x}$ on rank 0 and distribute it to other ranks using `MPI_Scatter`..
- Compute the matrix-vector product using column-based storage using `MPI_Alltoall`.
- Accumulate the resulting to rank 0 using `MPI_Gather` and print out the result.

A few additional exercises if you have time:

- Compute the norm of $\boldsymbol{A}\boldsymbol{x}$ using `MPI_Reduce` or `MPI_Allreduce`.
- Modify your code to store more than one column per processor
- Consider a "block" parallel decomposition strategy. How would one parallelize this?

2 Logging into NOTS

Finally, make sure that you can SSH into NOTS and run jobs using the SLURM workload manager. Use `scp` to copy files to your NOTS home directory. For the examples discussed in class, you should only need a few commands:

1. `module load MPICH`
2. `sbatch myjob.slurm` to run a job script (see documentation for an example).

`squeue -u \username"` is also useful for checking the status of jobs.