

California State Polytechnic University, Pomona
Computer Science 3700-01, Spring 2024

Lab #1 – Due February 14, 2024 @7:00pm

The exercise is intended to help you to become familiarize with our CPP HPC environment.

1. Log into your `hpc.cpp.edu` account using SSH or Putty
2. Use the 'mkdir' command to create a directory `cs3700_lab01`
3. Use the 'cd' command to change into the newly created directory `cs3700_lab01`
4. Use an editor to type the following python program and save as `sum_mpi.py`. Note, be consistent with your indentation. Python uses indentation to indicate block of code.

```
#!/usr/bin/python3.4

from mpi4py import MPI
import numpy
import math

world = MPI.COMM_WORLD
numprocs = world.size
myid = world.rank
procname = MPI.Get_processor_name()

print('Process %d on %s' %(myid, procname))

TRIALS = 20
ARRAY_SIZE = 1000000

# initialize array with 0..n-1
numbers = numpy.arange(ARRAY_SIZE)

s = ARRAY_SIZE // numprocs
s0 = s + ARRAY_SIZE%numprocs

startIndex = s0 + (myid-1)*s
endIndex = startIndex + s

totalTime = 0
for j in range(0, TRIALS):
    if myid == 0:
        startwtime = MPI.Wtime()

        part_sum = None

        if myid == 0: # master worker
            part_sum = numpy.sum(numbers[0:s0])
            print("Trial %d: Master %d - s0 %d; part_sum %ld"
                  %(j, myid, s0, part_sum))
        else: # slave worker
            part_sum = numpy.sum(numbers[startIndex+1:endIndex])
            print("Trial %d: Slave %d - startIndex %d endIndex %d; part_sum %ld"
                  %(j, myid, startIndex+1, endIndex, part_sum))

        sum = world.reduce(part_sum, op=MPI.SUM, root=0)

        if myid == 0:
            endwtime = MPI.Wtime()
            runTime = endwtime - startwtime
            print('Trial %d : Execution time (sec) = %f, sum = %d' %(j, runTime, sum))
            totalTime += runTime

world.barrier()

if myid == 0:
    print('Average time for %d trials = %s' %(TRIALS, totalTime/TRIALS))

5. Use editor to create an SBATCH script sum_mpi.sh
#!/bin/bash
#SBATCH --job-name=SUM_MPI
```

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```
#SBATCH --output=SUM_MPI.txt
#SBATCH --mem-per-cpu=1024
#SBATCH --partition=compute
#SBATCH --nodes=2
#SBATCH --time=00:02:00

. /etc/profile.d/modules.sh

module load openmpi/2.1.2
module load python/3/mpi4py/3.0.0

export MPI_HOME=/opt/openmpi-2.1.2
export PATH=${MPI_HOME}/bin:${PATH}
mpirun python3.4 sum_mpi.py
```

6. Use the 'chmod' command to change the `sum_mpi.py` permission to allow user, group, other to execute. Note, by default, the `.py` file is not an executable.
7. Use `sbatch` to submit your `sum_mpi.sh` job
8. Check your job status using `sacct` command. When complete, look at the generated output log file for errors.

Lab Submission

1. Create a zip file of your `cs3700_lab01` directory and rename the zip file to `cs3700_lab01_your-bronconame.zip` (e.g. `cs3700_lab01_thuang.zip`)
2. Use secure copy (e.g., `scp` or WinSCP) to copy your zip to your local computer
3. Verify your zip file contains the right directory and all your lab files by unzipping it before submission.
4. **NOTE: It is important to name your directory and files exactly according to the instructions above, all in lowercase. Your zip file must unzip into a directory with your files inside. If I am unable to unzip or locate your files inside the unzipped directory, I won't grade your assignment.** For example, if your bronco-name is `thuang`, your zip file submission should look as follow.

```
$ ls cs3700_lab01_thuang.zip
Cs3700_lab01_thuang.zip

$ unzip cs3700_lab01_thuang.zip
Archive:  cs3700_lab01_thuang.zip
  creating: cs3700_lab01/
  extracting: cs3700_lab01/sum_mpi.py
  extracting: cs3700_lab01/sum_mpi.sh
  extracting: cs3700_lab01/SUM_MPI.txt

$ ls cs3700_lab01
sum_mpi.py    sum_mpi.sh  SUM_MPI.txt
```

5. Submit your zip file to Canvas.
 - a. Login to Canvas
 - b. Click CS 3700.01 -> Assignments -> Lab 01
 - c. Attach the zip file and click the Submit button.