ME 759
High Performance for Engineering Applications
Assignment 1
Due Thursday 1/30/2020 at 9:00 PM

All commands or code must work on Euler with no modules loaded unless speci ed otherwise. They may behave di erently on your computer, so be sure to test on Euler before you submit.

For this assignment before we have your git repos set up, submit all responses on Canvas.

Please submit clean code. Consider using a formatter like clang-format.

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1. (a) Read the les timing.md and slurm usage.md from the general directory of the ME759 Resource Repo. These are very important documents of the expectations for your assignments throughout the semester.

   (b) Read the hw repos.md le and follow the instructions to create an account. This is very important and must be done in order for you to have a way to turn in HW02.

   (c) At least skim workflow.md. This contains a quick guide for e ectively working between your local computer and Euler.

Answer: No Answer needed for this question.

2. Write a single line of bash for each of the following (you can use pipes and/or redirects).
   Pretend that any les or directories mentioned exist (don't turn them in).

   a) Print the current working directory
   Ans) pwd

   b) Change directories into a directory called somedir
   Ans) cd somedir
        [mv anydir somedir (In case you want to rename a directory)]

   c) List the names of all les in the current directory
   Ans) ls

   d) (Optional) Write a for loop which prints each integer 0 to 10.
   Ans) for((i=1;i<=10;i+=1)); do echo "$i"; done

   e) (Optional) Print the names of all les ending in .txt in the current directory or any of its
      subtree
   Ans) ls *.txt

   f) (Optional) Print the last 2 lines of a plain text le in the current directory called
      sometext.txt
   Ans) tail -n 2 sometext.txt

   g) (Optional) Print the entire contents of a le in the current directory called sometext.txt

   Ans) cat sometext.txt

3. Using Euler and the module command, answer the following questions.

a) Are there any modules loaded (module list) when you log in?
Ans) No modules. (Display: No Modulefiles Currently Loaded).

b) What version (version number) of gcc is available to you without loading any modules?
Ans) gcc (GCC) 8.3.1 20190507 (Red Hat 8.3.1-4)

c) List all gcc modules available on Euler.
Ans)
------------------------------- /usr/local/share/modulefiles -------------------------------
gcc/0_cuda/5.3.0 gcc/4.8.x gcc/5.2.x gcc/6.4.0 gcc/7.x.x   gcc/9.2.0
gcc/0_cuda/6.4.0 gcc/4.9.2 gcc/5.3.0 gcc/6.4.x gcc/8.1.0   gcc/acc/6.3.0
gcc/0_cuda/7   gcc/4.9.x gcc/5.3.x gcc/6.x.x gcc/8.1.x   gcc/acc/8.1.1
gcc/0_cuda/7.1.0 gcc/4.x.x gcc/5.5.0 gcc/7.1.0 gcc/8.2.0   gcc/latest
gcc/0_cuda/8.2.0 gcc/5.1.0 gcc/5.x.x gcc/7.1.x gcc/8.2.0-el7 gcc/next-recommended
gcc/4.4.7   gcc/5.1.x gcc/6.1.0 gcc/7.2.0 gcc/8.2.x   gcc/recommended
gcc/4.8.4   gcc/5.2.0 gcc/6.1.x gcc/7.3.0 gcc/8.x.x

d) Which gcc module is loaded when you run module load gcc and what version number of gcc is loaded by that module?
Ans) Module: gcc/recommended (8.2.0 module)
      Version: gcc (GCC) 8.3.1 20190507 (Red Hat 8.3.1-4)

e) List one other piece of software that you know that has a module on Euler and one sentence about what it does. (If you aren't familiar with any of the other software, look one up and write a sentence about it.)

Ans) anaconda
Anaconda is a free and open-source distribution of the Python and R programming languages for scientific computing that aims to simplify package management and deployment.

4. Write a bash script called task4.sh with a Slurm header which asks for

    2 CPU cores

    A job name of FirstSlurm

      An output le called FirstSlurm.out An
      error le called FirstSlurm.err

and runs a single command to print the hostname of the machine (compute node) running the job. This job should be submittable by running sbatch task4.sh on the head node.

Ans)
```
#!/usr/bin/env bash
#SBATCH -p wacc
#SBATCH -J FirstSlurm

#SBATCH -o %x.out -e %x.err

#SBATCH -c 2

hostname
```

5. Research some useful Slurm tools (one sentence responses):

a) Explain what SLURM SUBMIT DIR is in the environment of a running Slurm job.
Ans) It is the directory within which the script is submitted/invoked from

b) In what directory does a Slurm job on euler begin execution. You should run some jobs to check this?
?Ans) It is the directory within which the script is submitted/invoked from

c) Explain what SLURM JOB ID is in the environment of a running Slurm job.
Ans) It is the unique number provided to each batch job allocated.

d) Explain what the following script header line speci es: #SBATCH --array=0-9
Ans) It means to set a Batch Job array with array values ranging from 0 to 9.

e) Explain what SLURM ARRAY TASK ID is in the environment of a running Slurm job with the header from part (d).
Ans) It is set to the index value of job array.

f) Explain what the following script header line speci es: #SBATCH --gres=gpu:1
Ans) It means to request special hardware in the form of Generic Resource(gres) and in this case, it is meant to request for one GPU.

6. Write a C++ program called task6.cpp which takes a command line argument N, and prints out each integer from 0 to N (including 0 and N) separated by spaces on a single line ending in a newline.

   Compile command: g++ task6.cpp -Wall -O3 -o task6

   Run command: ./task6 N

   Expected output (followed by newline): 0 1 2 3   N

   Expected output for N = 6 (followed by newline): 0 1 2 3 4 5 6

Ans)
```cpp
#include <iostream>

using namespace std;

int main(int argc, char **argv)
{
    int n;
    n = atoi(argv[1]);
    for(int i = 0; i < n; i++) {
        cout<< i << " ";
    }
    cout << n << endl;
    return 0;
}
```