

COMP30660 - Computer Arch & Org (Conv) -2022/23

Assignment 2: Multiprocessing

[15 Points]

Objective

The objective of this exercise is to evaluate speedup derived using multiple CPU cores through the multiprocessing facility in Python.

Submission: This project can be done individually or in groups of two.

What is provided?

Two options are available on the Brightspace page that provide a basic multiprocessing framework. Each option will be described in more details below.

- Option 1: Jupyter notebook file (MultiprocessingCore.ipynb)
- Option 2: Python script file (MultiprocessingCore.py)

You can use any option for the assignment.

Option 1: Running using notebook file:

Two helper python script files have been provided to calculate square root (sqrt_fn.py) and check prime numbers (prime_fn.py). You have to keep these three files in the same location when you are running the notebook.

Option 2: Running using python script:

This script contains all the required helper functions and main codes together. You can directly run this script.

Both notebook file and python script file contain the code to set up a multiprocessing Pool and use it to process tasks. If multiple cores are available, the Pool can use them to speed up the processing. An example has been provided in both running options to calculate the square root of a particular number. As this square-root function is very simple, the impact of using multiple cores will not be significant in this case. A naive function for checking primes is also provided (in prime_fn.py script and in main python script). Using this function to check large numbers (8 digits) will consume significant time and the speedup achieved using multiple cores will be evident.

There are plenty of primes to be found here: <https://primes.utm.edu/lists/small/millions/>

Tasks

1. Connect the check_prime function to the Pool processing function. Generate sets of work (numbers to be checked) to be processed by the pool. Quantify the speedup achieved with multiple cores (at least 2). **What lessons can be learned from these results?** (70%)

2. Complete only one of the following.

- a. Identify an alternative processing task that will also test the CPU and repeat the assessment. **What lessons can be learned from these results? (30%)**
- b. Repeat the exercise in 1 running on a VM through VirtualBox and assess the impact (performance hit) of using the VM. **(30%)**

**Note: Generally on a Mac, the Python multiprocessing package seems to work better under Python 3.*

Deliverables

Your submission should have two components:

- Your code : This can be a jupyter notebook file or a python script (make sure to attach all the used helper files if any). The codes should be runnable.
- A PDF document (**not more than 2 pages**) presenting the results of your evaluations with a font size no smaller than 10pt Arial.

Each individual should make a submission **on BrightSpace**. i.e. pairs should submit two copies of the same submission where the **names of contributors should be stated clearly in each copy**.