

Parallel and Distributed Computing (ALL Sections) – Spring 2022

Assignment 1

Date: 17-02-2022

Due date: Saturday 26th February 2022 (10:00PM)

Total Marks: 80

Late Submission Policy:

- 26th Feb 10:59 PM [25% Marks deductions]
 - 26th Feb 11:59 PM [50% Marks deductions]
 - 27th Feb at 12:00 AM and onwards – ZERO Marks
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Consider the following traditional algorithm of the Matrix-Matrix Multiplication that uses 2 square matrices to produce the 3rd one:

SQUARE-MATRIX-MULTIPLY(A, B)

```
1   $n = A.rows$ 
2  let  $C$  be a new  $n \times n$  matrix
3  for  $i = 1$  to  $n$ 
4      for  $j = 1$  to  $n$ 
5           $c_{ij} = 0$ 
6          for  $k = 1$  to  $n$ 
7               $c_{ij} = c_{ij} + a_{ik} \cdot b_{kj}$ 
8  return  $C$ 
```

Task-1 [5 Marks]: Implement the serial versions of the application.

Task-2 [60 Marks]: Implement two parallel versions of the application using *pthread*s. The two parallel versions should be developed as per following description. While executing the parallel version command line argument should be entered to represent how many thread to create for parallel execution. The command line values for creating number of threads should be 2, 4, 8, or 16. For execution purpose use large size matrix (2048 by 2048) OR (4096 by 4096). Use float type data structures for matrices and populate with random or fix values.

(1) **Parallel Version-1:** The data-computation or distribution by threads should be **block-wise** (where appropriate use **row-wise** or **columns-wise blocks** distribution). Number of blocks should be equal to the number of threads used by the parallel version.

(2) **Parallel Version-2:** The data-computation by threads should be cyclic (where appropriate use **row-wise** or **columns-wise cyclic** distribution or direct computations). Number of blocks will be higher i.e., 4 times more as compared to the number of threads used by the parallel version.

Task-3 [10 Marks]: Implement a **correctness checking function** that should compare the resultant matrix produced by the corresponding serial execution of the application and parallel execution of the application (by comparing each corresponding value of the Matrix C).

NOTE: The parallelization without correct results is useless. That's mean if the results could not be verified then the Task-2 will be marked Zero.

What to submit [5 Marks for correctly following the submission instructions]:

A single zip folder containing the following files. The zip folder should be named as
“A1_Section_RollNumber.zip”

- (1) Code files
- (2) A demo video related to the three tasks (3 minutes each), so the total video duration should not exceed 10 minutes.

Best of Luck!