Faculty of Computers and Artificial Intelligence
Cairo University
Spring-2023

Parallel Processing- 2023

Assignment 1 – MPI

Deadline & Submission:

1. **Teams:** Form a team of two students from the same group or the same TA.
2. Upload it on Classroom with file named A1_student1ID_student2ID_GroupName.zip
   eg. A1_20130002_20130001_S1_S2.zip
3. Code must be in C and MPI & you must run it before sending.
4. Attach a screen shot from the console output for each problem.
5. **Cheating could lead to serious consequences.**

Note:

You must use MPI_SEND & MPI_RECV ONLY on this assignment

Problem1 Statement:

You will develop a parallel program that outputs max number in a given array.

You will use Master-Slave paradigm where

Master:

- Reads size of array.
- Reads elements inside array.
- Distributes the work among slaves processes:
  - Sends size of the array.
  - Sends the assigned partition of the array.

- After each slave finishes its work, master process receives max number and its index from each process.

- Then master computes the max number from max numbers returned from each slave.

- Output the final max number and its index in the original array to user.

Slaves each one will:

- Receives size of the array.

- Receives the portion of the array.

- Calculates max number.

- Sends max number and its index back to master process.

Note: Size of array may not be divisible by number of processes. So, you should handle this case.

Example:

(Your program can output/work like this)

```
Hello from master process.
Number of slave processes is 5

Please enter size of array...
10

Please enter array elements ...
-3 4 2 10 5 8 9 7 -2 -5

Hello from slave#1 Max number in my partition is 4 and index is 1.
Hello from slave#2 Max number in my partition is 10 and index is 1.
Hello from slave#3 Max number in my partition is 8 and index is 1.
Hello from slave#4 Max number in my partition is 9 and index is 0.
Hello from slave#5 Max number in my partition is -2 and index is 0.
Master process announce the final max which is 10 and its index is 3.

Thanks for using our program
```

Note: In this example number of slaves processes is divisible by size of array.

Problem2 Statement (Matrix Multiplication):

Write a matrix multiplication program. Matrices' dimensions and values are taken as an input. Multiply the two matrices together then print the result. You need to implement this program in two modes.

First mode reads the input from the console, and the second one reads the input from a file.

Note: Must use dynamic allocation.

- Example:

Welcome to vector Matrix multiplication program!

To read dimensions and values from file press 1

To read dimensions and values from console press 2

2

Please enter dimensions of the first matrix: 3 2

Please enter its elements:

1 2

5 8

1 5

Please enter dimensions of the second matrix: 2 2

Please enter its elements:

6 8

10 30

Result Matrix is (3x2):

26 68

110 280

56 158