



High Performance Computing- 2025

Assignment 1 – MPI

Deadline & Submission:

1. **Teams:** Max three students in the team.
2. Upload it on Classroom with file named A1_student1ID_student2ID.zip
eg. A1_20130002_20130001.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. Any student may be asked at any point during the semester to re-implement the entire assignment individually during lab time or the lecture.
6. The team members must be different for each assignment.

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.



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- 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



Problem2 Statement (Caesar Cipher Encryption):

Write a parallel c program to implement Caesar Cipher Encryption algorithm.

This is the simplest of all, where every character of the message is replaced by its next 3rd character. Additionally, prompt the user from the console to choose to encode or decode the text.

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.

Example:

For encryption:

Input: tutorial

Output: wxwruldo

For decryption:

Input: wxwruldo

Output: tutorial

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

Parallelization Scenario:

- ✓ Master Process Reads a String from user.
- ✓ The String gets scattered among the processes.
- ✓ Every process converts the characters of its String portion to be encrypted/decrypted.
- ✓ The encrypted/decrypted String portions to be gathered at the master process.
- ✓ The master process prints the String.