

# High Performance Computing Lab

## Practical No. 7

### Title of practical:

Installation of MPI & Implementation of basic functions of MPI

### Problem Statement 1:

Implement a simple hello world program by setting number of processes equal to 10

### Code:

```
#include <mpi.h>

#include <iostream>
#include <chrono>

int main(int argc, char *argv[]) {
    int rank, size;
    // Initialize MPI environment
    MPI_Init(&argc, &argv);
    // Get the rank of the process
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
    // Get the number of processes
    MPI_Comm_size(MPI_COMM_WORLD, &size);

    if (rank == 0) {
        std::cout << "Number of processes: " << size << std::endl;
    }

    // Start timer for parallel execution
    auto start = std::chrono::high_resolution_clock::now();

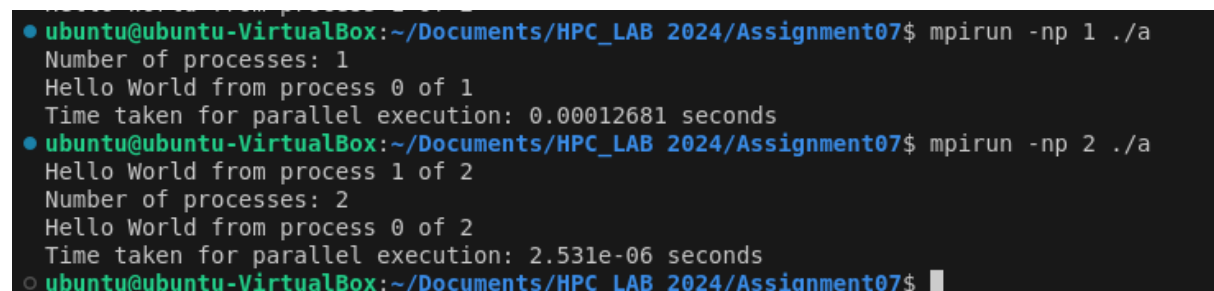
    // Print "Hello World" from each process
    std::cout << "Hello World from process " << rank << " of " << size <<
    std::endl;
    // End timer for parallel execution
    auto end = std::chrono::high_resolution_clock::now();
    std::chrono::duration<double> elapsed_time = end - start;

    if (rank == 0) {
        std::cout << "Time taken for parallel execution: " <<
        elapsed_time.count() << " seconds" << std::endl;
    }
}
```

```
// Finalize the MPI environment
MPI_Finalize();

return 0;
}
```

## Screenshots:



```
● ubuntu@ubuntu-VirtualBox:~/Documents/HPC_LAB 2024/Assignment07$ mpirun -np 1 ./a
Number of processes: 1
Hello World from process 0 of 1
Time taken for parallel execution: 0.00012681 seconds
● ubuntu@ubuntu-VirtualBox:~/Documents/HPC_LAB 2024/Assignment07$ mpirun -np 2 ./a
Hello World from process 1 of 2
Number of processes: 2
Hello World from process 0 of 2
Time taken for parallel execution: 2.531e-06 seconds
○ ubuntu@ubuntu-VirtualBox:~/Documents/HPC LAB 2024/Assignment07$
```

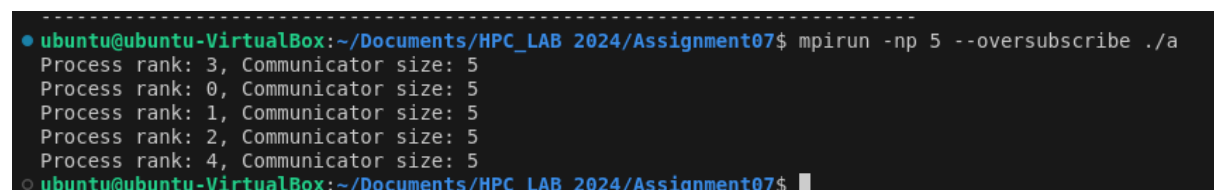
## Information :

With varying number of processors --> Sequence of execution changes as well as time required also changes

## Problem Statement 2:

Implement a program to display rank and communicator group of five processes

## Screenshots:



```
● ubuntu@ubuntu-VirtualBox:~/Documents/HPC_LAB 2024/Assignment07$ mpirun -np 5 --oversubscribe ./a
Process rank: 3, Communicator size: 5
Process rank: 0, Communicator size: 5
Process rank: 1, Communicator size: 5
Process rank: 2, Communicator size: 5
Process rank: 4, Communicator size: 5
○ ubuntu@ubuntu-VirtualBox:~/Documents/HPC LAB 2024/Assignment07$
```

**Information:**

**With varying number of processors --> Sequence of execution changes**