Lab Submission – 09

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20BCE1294

Program: B.Tech

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Course: CSE4001 – Parallel and Distributed Computing

Faculty: Dr. Sudha A

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Exercise: 09

QUESTION:

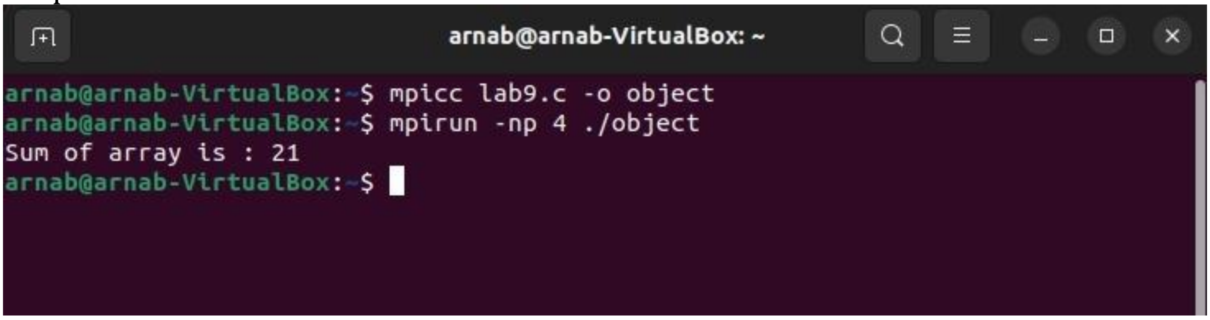
Sum 10 elements using array (use all 6 basic fucntions of MPI)
Using MPI_Send() and MPI_Recv() functions.

Code:

```
#include <mpi.h>

#include <stdio.h>

#include <stdlib.h>

#include <unistd.h>

// size of array
#define n 10

int a[] = {1,2,3,4,5,6};

// Temporary array for slave process
int a2[1000];
int main(int argc, char * argv[]) {

  int pid, np,
  elements_per_process,
  n_elements_recieved;
  // np -> no. of processes
  // pid -> process id
  MPI_Status status;

  // Creation of parallel processes

  MPI_Init( & argc, & argv);

  // find out process ID,
  // and how many processes were started
  MPI_Comm_size(MPI_COMM_WORLD, & np);
  MPI_Comm_rank(MPI_COMM_WORLD, & pid);

  // master process
  if (pid == 0) {
    int index, i;
    elements_per_process = n / np;

    // check if more than 1 processes are run
    if (np > 1) {
      // distributes the portion of array
      // to child processes to calculate
      // their partial sums
      for (i = 1; i < np - 1; i++) {
        index = i * elements_per_process;

        MPI_Send( & elements_per_process,
          1, MPI_INT, i, 0,
          MPI_COMM_WORLD);
        MPI_Send( & a[index],
          elements_per_process,
          MPI_INT, i, 0,
          MPI_COMM_WORLD);
      }
      // last process adds remaining elements
      index = i * elements_per_process;
      int elements_left = n - index;

      MPI_Send( & elements_left,
        1, MPI_INT,
        i, 0,
        MPI_COMM_WORLD);
      MPI_Send( & a[index],
        elements_left,
        MPI_INT, i, 0,
        MPI_COMM_WORLD);
    }
    // master process add its own sub array
    int sum = 0;
    for (i = 0; i < elements_per_process; i++)
      sum += a[i];

    // collects partial sums from other processes
    int tmp;
    for (i = 1; i < np; i++) {
      MPI_Recv( & tmp, 1, MPI_INT,
        MPI_ANY_SOURCE, 0,
        MPI_COMM_WORLD, &
        status);
      int sender = status.MPI_SOURCE;

      sum += tmp;
    }

    // prints the final sum of array
    printf("Sum of array is : %d\n", sum);
  }
  // slave processes
  else {
    MPI_Recv( & n_elements_recieved,
      1, MPI_INT, 0, 0,
      MPI_COMM_WORLD, &
      status);

    // stores the received array segment
    // in local array a2
    MPI_Recv( & a2, n_elements_recieved,
      MPI_INT, 0, 0,
      MPI_COMM_WORLD, &
      status);
    // calculates its partial sum
    int partial_sum = 0;
    for (int i = 0; i < n_elements_recieved; i++)
      partial_sum += a2[i];

    // sends the partial sum to the root process
    MPI_Send( & partial_sum, 1, MPI_INT,
      0, 0, MPI_COMM_WORLD);
  }

  // cleans up all MPI state before exit of process
  MPI_Finalize();
```

```
  return 0;

}
```

Output:



```
arnab@arnab-VirtualBox:~$ mpicc lab9.c -o object
arnab@arnab-VirtualBox:~$ mpirun -np 4 ./object
Sum of array is : 21
arnab@arnab-VirtualBox:~$ 
```

RESULT –SUM OF THE ARRAY IS FOUND TO BE EQUAL TO 21.