

Parallel and Distributed Computing
CSE4001
Fall Semester 2020-21

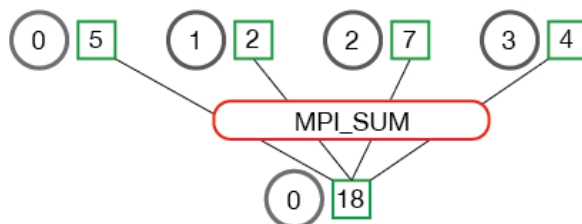
Lab Assignment 9

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Aim:

Write a C program to use MPI_Reduce that divides the processors into the group to find the addition independently.

MPI_Reduce



Hint. The function prototype is as follows:

```
MPI_Reduce(  
    void* send_data,  
    void* recv_data,  
    int count,  
    MPI_Datatype datatype,  
    MPI_Op op,  
    int root,  
    MPI_Comm communicator)
```

Source Code:

```
openmpi-2.0.4 — vim reduce.c — 104x30
#include<stdio.h>
#include<mpi.h>

int main(int argc, char* argv){

    int rank, n;

    MPI_Init(&argc, &argv);

    MPI_Comm_size(MPI_COMM_WORLD, &n);
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);

    int globalSum, sum = 0;
    int arr[] = {1, 3, 5, 7};

    if(rank == 0){
        printf("Addition of elements taking place for array [1, 3, 5, 7]\n");
    }

    for(int i = rank ; i < 4 ; i += n){
        sum += arr[i];
    }

    MPI_Reduce(&sum, &globalSum, 1, MPI_INT, MPI_SUM, 0, MPI_COMM_WORLD);

    if (rank == 0){
        printf("Global Sum: %d\n", globalSum);
    }
}
```

Execution:

```
openmpi-2.0.4 — -zsh — 104x30
[ishaanohri@ishaans-mbp openmpi-2.0.4 % mpicc -o reduce ./reduce.c
[ishaanohri@ishaans-mbp openmpi-2.0.4 % mpirun -np 4 reduce
Addition of elements taking place for array [1, 3, 5, 7]
Global Sum: 16
[ishaanohri@ishaans-mbp openmpi-2.0.4 %
```

Remarks:

```
int MPI_Reduce(const void *sendbuf, void *recvbuf, int count, MPI_Datatype
datatype, MPI_Op op, int root, MPI_Comm comm)
```

In the above command

- sendbuf is the address of send buffer
- count is the number of elements in the send buffer
- datatype is the data type of elements of send buffer
- op is the reduce operation
- root is the rank of root process
- comm is the communicator
- recvbuf is the address of the receive buffer

Using MPI_Reduce, MPI process can apply a reduction calculation. The values sent by the MPI processes will be combined using the reduction operation given and the result will be stored on the MPI process specified as root.