

# Assignment 10

February 16, 2024

## 1 Assignment 10

1. Write a program to show collective communication by taking suitable example such that computing average of n numbers or computing sum or product of two matrices
  - Bcast function
  - Scatter function
  - Gather function

```
[1]: from mpi4py import MPI
import numpy as np
```

```
[2]: comm = MPI.COMM_WORLD
rank = comm.Get_rank()
size = comm.Get_size()

n = 10
local_sum = np.random.randint(0, 100, n)

local_sum_total = np.sum(local_sum)

global_sum = np.array(0, dtype='i')
comm.Reduce(local_sum_total, global_sum, op=MPI.SUM, root=0)

if rank == 0:
    print("Global sum:", global_sum)
```

Global sum: 592

```
[9]: !mpiexec -n 4 python Bcast.py
```

```
Root process (Rank 0) is broadcasting data to other processes...
Process 0 received data: 29
Process 1 is waiting to receive broadcasted data from the root process (Rank 0)
Process 1 received data: 29
Process 2 is waiting to receive broadcasted data from the root process (Rank 0)
Process 2 received data: 29
Process 3 is waiting to receive broadcasted data from the root process (Rank 0)
Process 3 received data: 29
```

```
[4]: comm = MPI.COMM_WORLD
rank = comm.Get_rank()
size = comm.Get_size()

if rank == 0:
    print("Root process (Rank 0) is scattering data to other processes...")
else:
    print("Process", rank, "is waiting to receive scattered data from the root_
    ↪process (Rank 0)")

if rank == 0:
    send_data = np.arange(size) * 10
else:
    send_data = None

recv_data = np.empty(1, dtype=int)
comm.Scatter(send_data, recv_data, root=0)

print("Process", rank, "received data:", recv_data[0])
```

Root process (Rank 0) is scattering data to other processes...  
Process 0 received data: 0

```
[8]: !mpiexec -n 4 python Scatter.py
```

Root process (Rank 0) is scattering data to other processes...  
Process 0 received data: 0  
Process 1 is waiting to receive scattered data from the root process (Rank 0)  
Process 1 received data: 10  
Process 2 is waiting to receive scattered data from the root process (Rank 0)  
Process 2 received data: 20  
Process 3 is waiting to receive scattered data from the root process (Rank 0)  
Process 3 received data: 30

```
[6]: comm = MPI.COMM_WORLD
rank = comm.Get_rank()
size = comm.Get_size()

local_sum = np.random.randint(0, 100)

if rank == 0:
    print("Root process (Rank 0) is gathering local sums from other processes...
    ↪")

global_sums = None
if rank == 0:
    global_sums = np.empty(size, dtype=int)
comm.Gather(np.array(local_sum, dtype=int), global_sums, root=0)
```

```
if rank == 0:
    print("Root process (Rank 0) gathered the following local sums:",
    ↪global_sums)
```

Root process (Rank 0) is gathering local sums from other processes...

Root process (Rank 0) gathered the following local sums: [38]

[10]: !mpiexec -n 4 python Gather.py

Root process (Rank 0) is gathering local sums from other processes...

Root process (Rank 0) gathered the following local sums: [85 87 2 52]