# 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

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

In [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: 407
```

In [3]:
```
!mpiexec -n 4 python Bcast.py
```

```
Root process (Rank 0) is broadcasting data to other processes...
Process 0 received data: 20
Process 1 is waiting to receive broadcasted data from the root process (Rank 0)
Process 1 received data: 20
Process 2 is waiting to receive broadcasted data from the root process (Rank 0)
Process 2 received data: 20
Process 3 is waiting to receive broadcasted data from the root process (Rank 0)
Process 3 received data: 20
```

In [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 (Ran

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
```

In [5]:
```
!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
```

In [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: [88]
```

In [7]:
```
!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: [79 32 30 23]
```

In [ ]: