Collective Communication

Collective communication is communication that involves all the processes in a communicator.

1. /* it sends a copy of the data in **message** on process **root** to each process in the communicator **comm**. */

```
int MPI_Bcast(
        void *          message     /* in/out */,
        int             count       /* in     */,
        MPI_Datatype    datatype    /* in     */,
        int             root        /* in     */,
        MPI_Comm        comm        /* in     */)
```

2. /* each process contains an **operand**, and all of them are combined using a binary **operator** that is successively applied to each. */

```
int MPI_Reduce(
        void *          operand     /* in  */,
        void *          result      /* out */,
        int             count       /* in  */,
        MPI_Datatype    datatype    /* in  */,
        MPI_Op          operator    /* in  */,
        int             root        /* in  */,
        MPI_Comm        comm        /* in  */)
```

3. /* it gathers the data stored in each process's **send_data** into the memory referenced by **recv_data** on the process with rank **root**. */

```
int MPI_Gather(
        void *          send_data   /* in  */,
        int             send_count  /* in  */,
        MPI_Datatype    send_type   /* in  */,
        void *          recv_data   /* out */,
        int             recv_count  /* in  */,
        MPI_Datatype    recv_type   /* in  */,
        int             root        /* in  */,
        MPI_Comm        comm        /* in  */)
```

4. /* it distributes the memory referenced by **send_data** across the processes in **comm**. */

```
int MPI_Scatter(
        void *          send_data   /* in  */,
        int             send_count  /* in  */,
        MPI_Datatype    send_type   /* in  */,
        void *          recv_data   /* out */,
        int             recv_count  /* in  */,
        MPI_Datatype    recv_type   /* in  */,
        int             root        /* in  */,
        MPI_Comm        comm        /* in  */)
```

5. /* this has the effect of gathering the contents of each process's **send_data** into each process's **recv_data**.

```
int MPI_Allgather(
        void *          send_data   /* in  */,
        int             send_count  /* in  */,
        MPI_Datatype    send_type   /* in  */,
        void *          recv_data   /* out */,
        int             recv_count  /* in  */,
        MPI_Datatype    recv_type   /* in  */,
        MPI_Comm        comm        /* in  */)
```

6. /* all the communicator will have the result stored in the memory referenced by **result**. */

```
int MPI_Allreduce(
        void *          operand     /* in  */,
        void *          result      /* out */,
        int             count       /* in  */,
        MPI_Datatype    datatype    /* in  */,
        MPI_Op          operator    /* in  */,
        MPI_Comm        comm        /* in  */)
```