

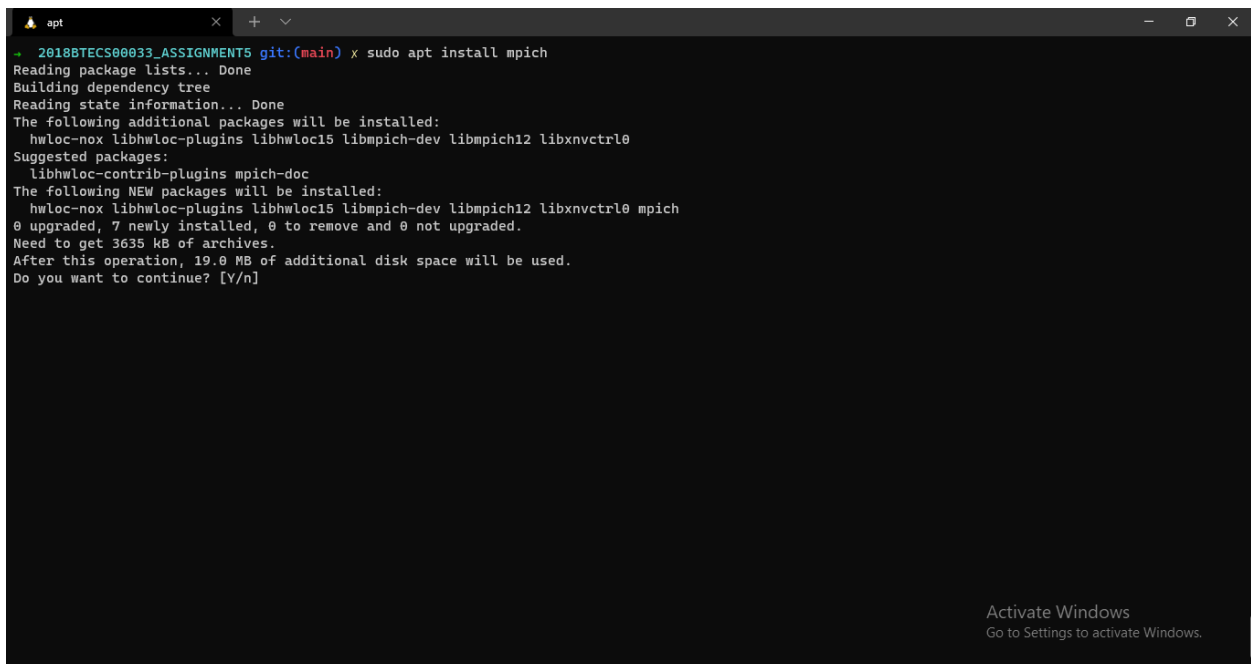
## Practical No. 4B

### Exam Seat No:

1. 2018BTECS00033 - Mahendra Bhimrao Garge

### Problem Statement 1: Installation of MPI

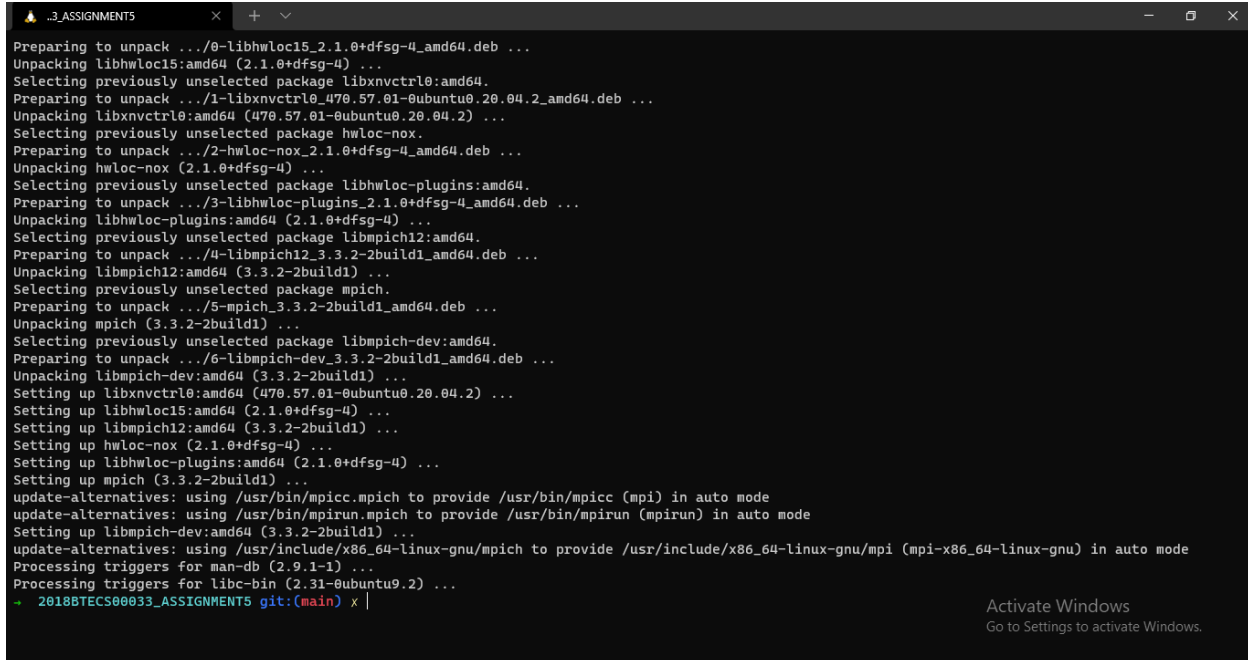
#### Screenshot 1:



```
apt
- 2018BTECS00033_ASSIGNMENT5 git:(main) x sudo apt install mpich
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  hwloc-nox libhwloc-plugins libhwloc15 libmpich-dev libmpich12 libxnvctrl0
Suggested packages:
  libhwloc-contrib-plugins mpich-doc
The following NEW packages will be installed:
  hwloc-nox libhwloc-plugins libhwloc15 libmpich-dev libmpich12 libxnvctrl0 mpich
0 upgraded, 7 newly installed, 0 to remove and 0 not upgraded.
Need to get 3635 kB of archives.
After this operation, 19.0 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

**Information 1:** As I am running Windows Subsystem for Linux, it runs Ubuntu linux. So I installed the MPI with the use of **mpich** which was available in official repositories of Ubuntu.

## Screenshot 2:



```
.3_ASSIGNMENTS
Preparing to unpack .../0-libhwloc15_2.1.0+dfsg-4_amd64.deb ...
Unpacking libhwloc15:amd64 (2.1.0+dfsg-4) ...
Selecting previously unselected package libxnvctrl0:amd64.
Preparing to unpack .../1-libxnvctrl0_470.57.01-0ubuntu0.20.04.2_amd64.deb ...
Unpacking libxnvctrl0:amd64 (470.57.01-0ubuntu0.20.04.2) ...
Selecting previously unselected package hwloc-nox.
Preparing to unpack .../2-hwloc-nox_2.1.0+dfsg-4_amd64.deb ...
Unpacking hwloc-nox (2.1.0+dfsg-4) ...
Selecting previously unselected package libhwloc-plugins:amd64.
Preparing to unpack .../3-libhwloc-plugins_2.1.0+dfsg-4_amd64.deb ...
Unpacking libhwloc-plugins:amd64 (2.1.0+dfsg-4) ...
Selecting previously unselected package libmpich12:amd64.
Preparing to unpack .../4-libmpich12_3.3.2-2build1_amd64.deb ...
Unpacking libmpich12:amd64 (3.3.2-2build1) ...
Selecting previously unselected package mpich.
Preparing to unpack .../5-mpich_3.3.2-2build1_amd64.deb ...
Unpacking mpich (3.3.2-2build1) ...
Selecting previously unselected package libmpich-dev:amd64.
Preparing to unpack .../6-libmpich-dev_3.3.2-2build1_amd64.deb ...
Unpacking libmpich-dev:amd64 (3.3.2-2build1) ...
Setting up libxnvctrl0:amd64 (470.57.01-0ubuntu0.20.04.2) ...
Setting up libhwloc15:amd64 (2.1.0+dfsg-4) ...
Setting up libmpich12:amd64 (3.3.2-2build1) ...
Setting up hwloc-nox (2.1.0+dfsg-4) ...
Setting up libhwloc-plugins:amd64 (2.1.0+dfsg-4) ...
Setting up mpich (3.3.2-2build1) ...
update-alternatives: using /usr/bin/mpicc.mpich to provide /usr/bin/mpicc (mpi) in auto mode
update-alternatives: using /usr/bin/mpirun.mpich to provide /usr/bin/mpirun (mpirun) in auto mode
Setting up libmpich-dev:amd64 (3.3.2-2build1) ...
update-alternatives: using /usr/include/x86_64-linux-gnu/mpich to provide /usr/include/x86_64-linux-gnu/mpi (mpi-x86_64-linux-gnu) in auto mode
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
2018BTECS00033_ASSIGNMENT5 git:(main) x |
```

**Information 2:** Installation complete.

## Problem Statement 2:

Q1: Implement a simple hello world program by setting the number of processes equal to 15.

```
#include <mpi.h>
#include <stdio.h>

int main(int argc, char **argv)
{
    MPI_Init(NULL, NULL);

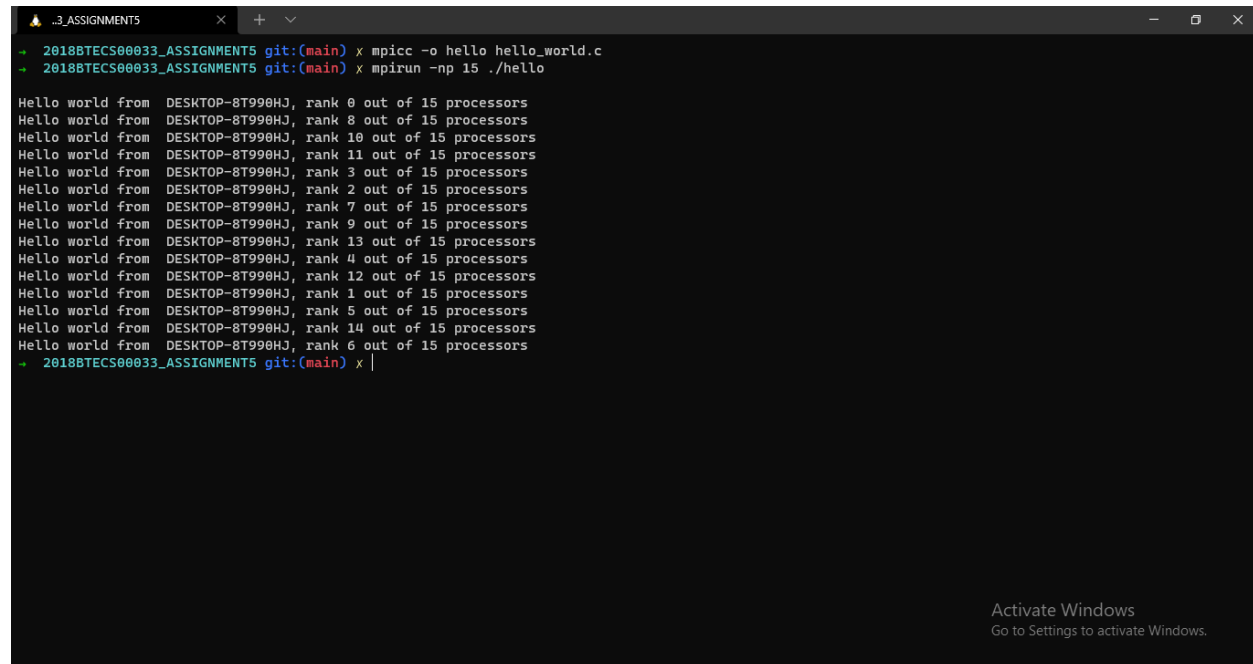
    int size;
    MPI_Comm_size(MPI_COMM_WORLD, &size);

    int rank;
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);

    char processor_name[MPI_MAX_PROCESSOR_NAME];
    int name_len;
    MPI_Get_processor_name(processor_name, &name_len);
```

```
printf("Hello world from %s, rank %d out of %d processors\n",  
      processor_name, rank, size);  
  
MPI_Finalize();  
}
```

### Screenshot 3:



```
.3_ASSIGNMENT5 x |  
2018BTECS00033_ASSIGNMENT5 git:(main) x mpicc -o hello hello_world.c  
2018BTECS00033_ASSIGNMENT5 git:(main) x mpirun -np 15 ./hello  
Hello world from DESKTOP-8T990HJ, rank 0 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 8 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 10 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 11 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 3 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 2 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 7 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 9 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 13 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 4 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 12 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 1 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 5 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 14 out of 15 processors  
Hello world from DESKTOP-8T990HJ, rank 6 out of 15 processors  
2018BTECS00033_ASSIGNMENT5 git:(main) x |
```

**Information 3:** Hello World program with number of processes as 15

### Problem Statement 3:

Q2. Implement a program to display rank and communicator group of ten processes

```
#include <mpi.h>
#include <stdio.h>

int main(int argc, char **argv)
{
    MPI_Init(NULL, NULL);

    int size;
    MPI_Comm_size(MPI_COMM_WORLD, &size);

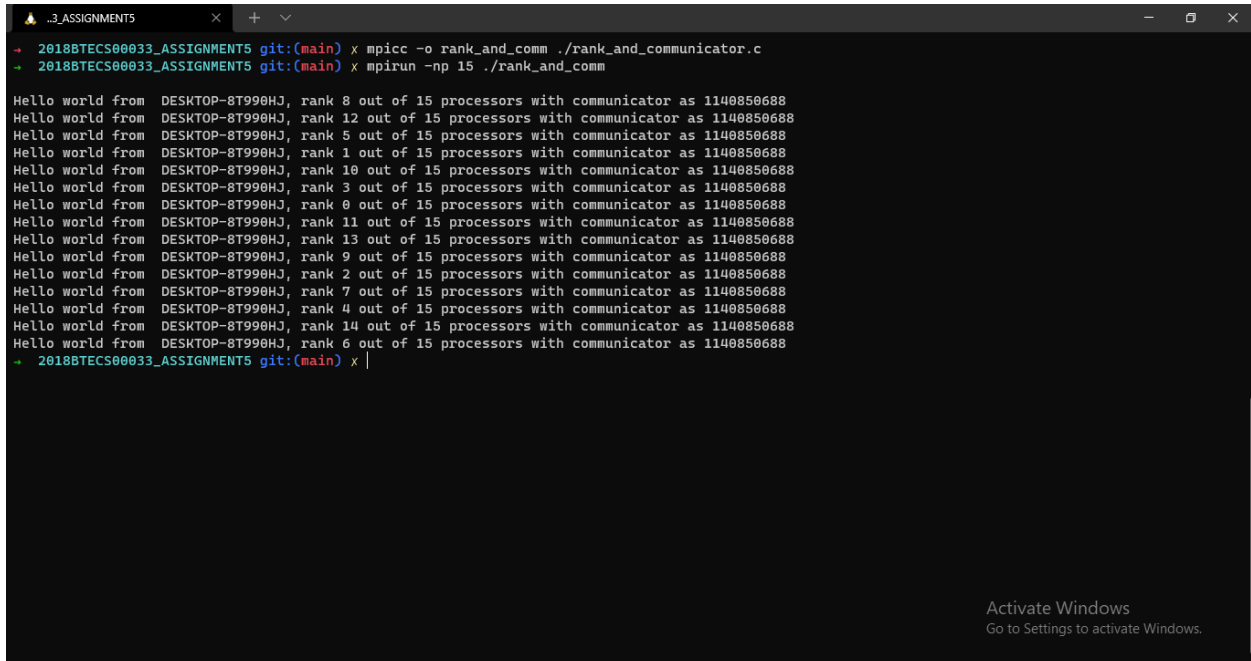
    int rank;
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);

    char processor_name[MPI_MAX_PROCESSOR_NAME];
    int name_len;
    MPI_Get_processor_name(processor_name, &name_len);

    printf("Hello world from %s, rank %d out of %d processors with
communicator as %d\n",
           processor_name, rank, size, MPI_COMM_WORLD);

    MPI_Finalize();
}
```

Screenshot 4:

A screenshot of a terminal window titled ".3\_ASSIGNMENTS". The window shows the execution of an MPI program. The first command is `mpicc -o rank_and_comm ./rank_and_communicator.c`, and the second is `mpirun -np 15 ./rank_and_comm`. The output consists of 15 lines, each starting with "Hello world from" followed by a hostname (DESKTOP-8T990HJ), a rank number (from 8 to 0), and a communicator ID (1140850688). The terminal window has a dark background with light-colored text. At the bottom right, there is a watermark that says "Activate Windows Go to Settings to activate Windows."

```

.3_ASSIGNMENTS
2018BTECS00033_ASSIGNMENTS5 git:(main) x mpicc -o rank_and_comm ./rank_and_communicator.c
2018BTECS00033_ASSIGNMENTS5 git:(main) x mpirun -np 15 ./rank_and_comm

Hello world from DESKTOP-8T990HJ, rank 8 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 12 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 5 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 1 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 10 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 3 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 0 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 11 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 13 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 9 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 2 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 7 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 4 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 14 out of 15 processors with communicator as 1140850688
Hello world from DESKTOP-8T990HJ, rank 6 out of 15 processors with communicator as 1140850688
2018BTECS00033_ASSIGNMENTS5 git:(main) x |

```

**Information 4:** Program showing rank and communicator group of processes.

**Github Link:** <https://github.com/g-mahendra/HPC LAB ASSIGNMENTS>