

Class: Final Year (Computer Science and Engineering)

Year: 2021-22

Semester: 1

Course: High Performance Computing Lab

Batch: B4

Practical No. 04B

➤ **Exam Seat No :**

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Complete the installation of MPI on the platform chosen by you.

Installation:

```
anya@LAPTOP-F25DMQQC: ~
anya@LAPTOP-F25DMQQC:~$ clear
anya@LAPTOP-F25DMQQC:~$ sudo apt install mpich
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libllvm8
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  cpp-7 g++-7 gcc-7 gcc-7-base gfortran gfortran-7 hwloc-nox libasan4 libcilkrts5 libcr-dev libcr0 libgcc-7-dev
  libgfortran-7-dev libgfortran4 libhwloc-plugins libhwloc5 libltdl7 libmpich-dev libmpich12 libstdc++-7-dev libubsan0
  ocl-icd-libopencl1
Suggested packages:
  gcc-7-locales g++-7-multilib gcc-7-doc libstdc++6-7-dbg gcc-7-multilib libgcc1-dbg libgomp1-dbg libitm1-dbg
  libatomic1-dbg libasan4-dbg liblsan0-dbg libtsan0-dbg libubsan0-dbg libcilkrts5-dbg libmpx2-dbg libquadmath0-dbg
  gfortran-multilib gfortran-doc gfortran-7-multilib gfortran-7-doc libgfortran4-dbg libcoarrays-dev blcr-dkms
  libhwloc-contrib-plugins libstdc++7-doc blcr-util mpich-doc opencl-icd
The following NEW packages will be installed:
  gfortran gfortran-7 hwloc-nox libcr-dev libcr0 libgfortran-7-dev libgfortran4 libhwloc-plugins libhwloc5 libltdl7
  libmpich-dev libmpich12 mpich ocl-icd-libopencl1
The following packages will be upgraded:
  cpp-7 g++-7 gcc-7 gcc-7-base libasan4 libcilkrts5 libgcc-7-dev libstdc++-7-dev libubsan0
9 upgraded, 14 newly installed, 0 to remove and 238 not upgraded.
Need to get 45.0 MB of archives.
After this operation, 50.7 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 libasan4 amd64 7.5.0-3ubuntu1~18.04 [358 kB]
Get:2 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 libubsan0 amd64 7.5.0-3ubuntu1~18.04 [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 libcilkrts5 amd64 7.5.0-3ubuntu1~18.04 [42.5 kB]
Get:4 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 g++-7 amd64 7.5.0-3ubuntu1~18.04 [9697 kB]
```

```
any@LAPTOP-F25DMQQC: ~
Setting up libasan4:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up libgfortran4:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up libcilkrts5:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up libubsan0:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up libhwloc5:amd64 (1.11.9-1) ...
Setting up libgcc-7-dev:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up cpp-7 (7.5.0-3ubuntu1~18.04) ...
Setting up libstdc++-7-dev:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up libhwloc-plugins (1.11.9-1) ...
Setting up libgfortran-7-dev:amd64 (7.5.0-3ubuntu1~18.04) ...
Setting up hwloc-nox (1.11.9-1) ...
Setting up mpich (3.3~a2-4) ...
update-alternatives: using /usr/bin/mpirun.mpich to provide /usr/bin/mpirun (mpirun) in auto mode
Setting up gcc-7 (7.5.0-3ubuntu1~18.04) ...
Setting up g++-7 (7.5.0-3ubuntu1~18.04) ...
Setting up gfortran-7 (7.5.0-3ubuntu1~18.04) ...
Setting up gfortran (4:7.4.0-1ubuntu2.3) ...
update-alternatives: using /usr/bin/gfortran to provide /usr/bin/f95 (f95) in auto mode
update-alternatives: using /usr/bin/gfortran to provide /usr/bin/f77 (f77) in auto mode
Setting up libmpich-dev (3.3~a2-4) ...
update-alternatives: using /usr/include/mpich to provide /usr/include/mpi (mpi) in auto mode
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1) ...
any@LAPTOP-F25DMQQC:~$
```

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

Output:

```
TERMINAL  PROBLEMS  OUTPUT  DEBUG CONSOLE
any@LAPTOP-F25DMQQC:/mnt/d/HPC/p4_b$ mpicc -o myexe hello.c
any@LAPTOP-F25DMQQC:/mnt/d/HPC/p4_b$ mpirun -np 15 ./myexe
Hello world from processor LAPTOP-F25DMQQC, rank 0 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 2 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 3 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 4 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 5 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 7 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 8 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 9 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 10 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 11 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 13 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 14 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 1 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 6 out of 15 processors
Hello world from processor LAPTOP-F25DMQQC, rank 12 out of 15 processors
any@LAPTOP-F25DMQQC:/mnt/d/HPC/p4_b$
```

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

Output:

```
TERMINAL  PROBLEMS  OUTPUT  DEBUG CONSOLE
(c) Microsoft Corporation. All rights reserved.

D:\HPC>wsl
anya@LAPTOP-F25DMQQC:/mnt/d/HPC$ mpicc -o myexe rank_and_communicator.c
anya@LAPTOP-F25DMQQC:/mnt/d/HPC$ mpirun -np 10 ./myexe
Hello world from LAPTOP-F25DMQQC, rank 0 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 1 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 2 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 3 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 4 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 5 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 6 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 7 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 8 out of 10 processors with communicator as 1140850688
Hello world from LAPTOP-F25DMQQC, rank 9 out of 10 processors with communicator as 1140850688
anya@LAPTOP-F25DMQQC:/mnt/d/HPC$
```

Github Link : <https://github.com/aniruddhapalekar/HPC>