

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q1 q1_scan_factorial.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q2 q2_findelement.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q3 q3_scan.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q4 q4_pattern.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q5 q5_matrixop.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q6 q6_pi.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 4 exe/q1
[3] Sum of all factorials: 33
```

```
// Induce MPI error: MPI_COMM_WORLD -> MPI_COMM_NULL
6CSEC2@debian:~/Documents/230905252/Lab4$ mpicc -o exe/q1 q1_scan_factorial.c
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 4 exe/q1
```

```
5      MPI_ERR_COMM: invalid communicator
5      MPI_ERR_COMM: invalid communicator
5      MPI_ERR_COMM: invalid communicator
5      MPI_ERR_COMM: invalid communicator
```

```
-----  
MPI_ABORT was invoked on rank 1 in communicator MPI_COMM_WORLD  
with errorcode 5.
```

```
NOTE: invoking MPI_ABORT causes Open MPI to kill all MPI processes.  
You may or may not see output from other processes, depending on  
exactly when Open MPI kills them.
```

```
-----  
[debian:520127] 3 more processes have sent help message help-mpi-api.txt / mpi-abort
```

```
[debian:520127] Set MCA parameter "orte_base_help_aggregate" to 0 to see all help / error messages
```

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 3 exe/q2
```

```
Enter 3x3 matrix:
```

```
1 2 3
4 5 6
5 7 8
```

```
Enter element to find: 5
```

```
[0] Count of instances of 5: 2
```

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 4 exe/q3
```

```
Enter 4x4 matrix:
```

```
1 2 3 4
1 2 3 1
1 1 1 1
2 1 2 1
```

```
Output 4x4 matrix:
```

```
[0] 1 2 3 4
[1] 2 4 6 5
[2] 3 5 7 6
[3] 5 6 9 7
```

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 4 exe/q4
```

```
Enter string of length 4: PCAP
```

```
[0] Output string: PCCAAAPPPP
```

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 5 exe/q5
```

```
Enter 5x5 matrix:
```

```
1 2 3 4 5
5 4 3 2 1
10 3 13 14 15
11 22 11 33 44
1 12 5 4 6
```

```
Output 5x5 matrix:
```

0	1	1	1	1
22	0	2	2	2
13	13	0	3	3
33	33	33	0	2
44	44	44	44	0

```
6CSEC2@debian:~/Documents/230905252/Lab4$ mpirun -n 1000 --oversubscribe exe/q6
```

```
[0] Approximation of PI: 3.141592736923126
```

