

## C hello.c

```
1  #include <mpi.h>
2  #include <stdio.h>
3
4  int main(int argc, char *argv[])
5  {
6      int rank, size;
7
8
9      MPI_Init(&argc, &argv);
10
11     |
12     MPI_Comm_size(MPI_COMM_WORLD, &size);
13
14
15     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
16
17
18     printf("Hello World from process %d out of %d processes\n", rank, size);
19
20     if(rank == 0) printf("Q0, Adarsh Ranjan 230962278");
21
22
23     MPI_Finalize();
24
25     return 0;
26 }
27
```

```
(base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpicc hello.c -o hello
(base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpirun -np 4 ./hello
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Hello World from process 0 out of 4 processes
Hello World from process 1 out of 4 processes
Hello World from process 2 out of 4 processes
Hello World from process 3 out of 4 processes
Q0, Adarsh Ranjan 230962278(base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$
```

## C q1.c

```
1 #include <mpi.h>
2 #include <stdio.h>
3
4 long power(int base, int exp) {
5     long res = 1;
6     for (int i = 0; i < exp; i++) {
7         res *= base;
8     }
9     return res;
10 }
11
12 int main(int argc, char *argv[])
13 {
14     int rank, size;
15     int x = 2;
16
17     MPI_Init(&argc, &argv);
18
19     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
20     MPI_Comm_size(MPI_COMM_WORLD, &size);
21
22     long result = power(x, rank);
23
24     printf("Process %d: %d^%d = %ld\n", rank, x, rank, result);
25
26     if (rank % 2 == 0)
27         printf("Process %d says: Hello\n", rank);
28     else
29         printf("Process %d says: World\n", rank);
30
31
32     if(rank == 0) {
33         printf("Q1, Adarsh Ranjan 230962278\n");
34     }
35
36     MPI_Finalize();
37
38     return 0;
39 }
```

```
(base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpirun -np 4 ./q1
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Process 0:  $2^0 = 1$ 
Process 0 says: Hello
Q1, Adarsh Ranjan 230962278
Process 3:  $2^3 = 8$ 
Process 3 says: World
Process 1:  $2^1 = 2$ 
Process 1 says: World
Process 2:  $2^2 = 4$ 
Process 2 says: Hello
```

```
q2.c
1 #include <mpi.h>
2 #include <stdio.h>
3
4 int main(int argc, char *argv[])
5 {
6     int rank, size;
7     int a = 20, b = 10;
8
9     MPI_Init(&argc, &argv);
10
11    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
12    MPI_Comm_size(MPI_COMM_WORLD, &size);
13
14    if (size < 4)
15    {
16        if (rank == 0)
17            printf("Please run with at least 4 processes\n");
18        MPI_Finalize();
19        return 0;
20    }
21
22    if (rank == 0)
23        printf("Addition: %d + %d = %d\n", a, b, a + b);
24    else if (rank == 1)
25        printf("Subtraction: %d - %d = %d\n", a, b, a - b);
26    else if (rank == 2)
27        printf("Multiplication: %d * %d = %d\n", a, b, a * b);
28    else if (rank == 3)
29        printf("Division: %d / %d = %d\n", a, b, a / b);
30
31    if(rank == 0) printf("Q2,Adarsh Ranjan 230962278");
32
33
34    MPI_Finalize();
35    return 0;
36}
37
```

```
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpicc q2.c -o q2
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpirun -np 4 ./q2
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Subtraction: 20 - 10 = 10
Multiplication: 20 * 10 = 200
Division: 20 / 10 = 2
Addition: 20 + 10 = 30
```

Q2, Adarsh Ranjan 230962278 (base) mca@computinglab25-22:~/Desktop/PPL\_230962278/Week1\$ █

C q3.c

```
1 #include <mpi.h>
2 #include <stdio.h>
3 #include <string.h>
4 #include <ctype.h>
5
6 int main(int argc, char *argv[])
7 {
8     int rank, size;
9     char str[] = "HELLO";
10    int len = strlen(str);
11    char ch;
12
13    MPI_Init(&argc, &argv);
14
15    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
16    MPI_Comm_size(MPI_COMM_WORLD, &size);
17
18    if (rank < len)
19    {
20        ch = str[rank];
21
22        if (islower(ch))
23            ch = toupper(ch);
24        else
25            ch = tolower(ch);
26    }
27
28    MPI_Gather(&ch, 1, MPI_CHAR,
29                str, 1, MPI_CHAR,
30                0, MPI_COMM_WORLD);
31
32    if (rank == 0)
33        printf("Toggled String: %s\n", str);
34
35    if(rank == 0) printf("Q3, Adarsh Ranjan 230962278");
36
37
38    MPI_Finalize();
39    return 0;
40 }
```

```
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpicc q3.c -o q3
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpirun -np 5 ./q3
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Toggled String: hello
Q3, Adarsh Ranjan 230962278(base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$
```

## C q4.c

```
1 #include <mpi.h>
2 #include <stdio.h>
3
4 long long factorial(int n)
5 {
6     long long fact = 1;
7     for (int i = 1; i <= n; i++)
8         fact *= i;
9     return fact;
10 }
11
12 long long fibonacci(int n)
13 {
14     long long a = 0, b = 1, c;
15     if (n == 0)
16         return 0;
17     for (int i = 2; i <= n; i++)
18     {
19         c = a + b;
20         a = b;
21         b = c;
22     }
23     return b;
24 }
25
26 int main(int argc, char *argv[])
27 {
28     int rank;
29
30     MPI_Init(&argc, &argv);
31     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
32
33     if (rank % 2 == 0)
34         printf("Process %d (Even): Factorial = %lld\n", rank, factorial(rank));
35     else
36         printf("Process %d (Odd): Fibonacci = %lld\n", rank, fibonacci(rank));
37
38     if(rank == 0) printf("Q4, Adarsh Ranjan 230962278");
39
40
41     MPI_Finalize();
42     return 0;
43 }
```

```
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpicc q4.c -o q4
• (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week1$ mpirun -np 6 ./q4
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Process 4 (Even): Factorial = 24
Process 2 (Even): Factorial = 2
Process 3 (Odd): Fibonacci = 2
Process 1 (Odd): Fibonacci = 1
Process 5 (Odd): Fibonacci = 5
Process 0 (Even): Factorial = 1
```

Q4, Adarsh Ranjan 230962278(base) mca@computinglab25-22:~/Desktop/PPL\_230962278/Week1\$ □