Lab No 1: Date: 07/01/2026

# Introduction to execution environment of MPI

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# Lab Exercises:

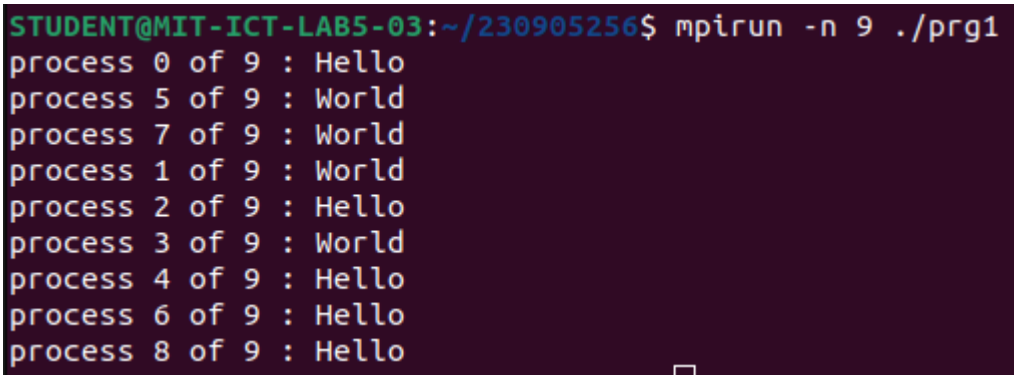
**Q1) Write a simple MPI program to find out pow(x, rank) for all processes where 'x' is the integer constant and 'rank' is the rank of the process. Write a program in MPI where even ranked process prints "Hello" and odd ranked process prints "World" .**

Ans)

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

int main(int argc, char *argv[]){
        int rank, size , n=4;
        MPI_Init(&argc,&argv);
        MPI_Comm_size(MPI_COMM_WORLD,&size);
        MPI_Comm_rank(MPI_COMM_WORLD,&rank);
        int res = pow(n,rank);
        if(rank%2==0){
        printf("process %d of %d : Hello \n",rank,size);
        }else{
        printf("process %d of %d : World \n",rank,size);
        }
        MPI_Finalize();
        return 0;
}
```

Output:




**Q2) Write a program in MPI to simulate simple calculator. Perform each operation using different process in parallel.**

Ans)

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

int main(int argc, char *argv[]){
        int rank, size , n=4;
        int ch, a =4,b = 3, res;
        MPI_Init(&argc,&argv);
        MPI_Comm_size(MPI_COMM_WORLD,&size);
        MPI_Comm_rank(MPI_COMM_WORLD,&rank);
        switch(rank){
        case 0 : res = a + b;
                printf("Process %d of %d : %d \n",rank,size,res);
                break;
        case 1 : res = a - b;
                printf("Process %d of %d : %d \n",rank,size,res);
                break;
        case 2 : res = a * b;
                printf("Process %d of %d : %d \n",rank,size,res);
                break;
        case 3 : res = a / b;
                printf("Process %d of %d : %d \n",rank,size,res);
                break;
        default : res = 0;
                printf("Process %d of %d : %d \n",rank,size,res);
        }

        MPI_Finalize();
        return 0;
}
```

Output:

```
STUDENT@MIT-ICT-LAB5-03:~/230905256$ mpirun -n 5 ./prg2
Process 0 of 5 : 7
Process 1 of 5 : 1
Process 3 of 5 : 1
Process 2 of 5 : 12
Process 4 of 5 : 0
```

**Q3) Write a program in MPI to toggle the character of a given string indexed by the rank of the process . Hint : suppose the string in HELLO and there are 5 processes, then process 0 toggle ‘H’ to ‘h’, process 1 toggle ‘E’ to ‘e’ and so on .**

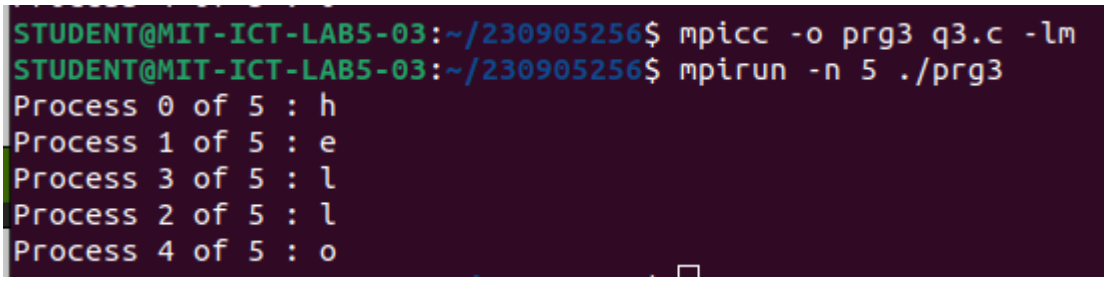
Ans)

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

```
#include<math.h>
#include<string.h>

int main(int argc, char *argv[]){
        int rank, size , n=4;
        char s[] = "HELLO";
        MPI_Init(&argc,&argv);
        MPI_Comm_size(MPI_COMM_WORLD,&size);
        MPI_Comm_rank(MPI_COMM_WORLD,&rank);
        if(rank<strlen(s)){
        s[rank] = tolower(s[rank]);
        printf("Process %d of %d : %c \n",rank, size, s[rank]);
        }
        MPI_Finalize();
        return 0;
}
```

Output:




**Q4) Write a program in MPI where even ranked process prints factorial of the rank and odd ranked process prints ranks Fibonacci number .**

Ans)

```
#include<stdio.h>
#include<mpi.h>
#include<ctype.h>
#include<math.h>
int fact(int a){
        int res = 1;
        while(a!=0){
        res = res * a;
        a--;
        }
        return res;
}
int fib(int a){
        if(a==2 || a == 1) return 1;
        return fib(a-1) + fib(a-2);
        }
int main(int argc, char *argv[]){
```

```
        int rank, size , n=4;
        MPI_Init(&argc,&argv);
        MPI_Comm_size(MPI_COMM_WORLD,&size);
        MPI_Comm_rank(MPI_COMM_WORLD,&rank);
        if(rank%2 == 0){
                printf("Process %d of %d : %d \n",rank, size, fact(rank));
        }else{
                printf("Process %d of %d : %d \n",rank, size, fib(rank));
        }
        MPI_Finalize();
        return 0;
}
```

Output: