1. Write a shell script and C program to perform the following string operations:
a) To extract a substring from a given string.

→SHELL SCRIPT

```
echo "String: We welcome you in Operating System Lab."
str="Model Institute of Engineering and Technology"
substr="${str:0:10}"
substr2="${str:-3:4}"
substr3="${str:10:24}"
echo -e "\nExtracting the substring from index 0 upto index 10: $substr\n"

echo -e "\nExtracting the substring from index -3 upto index 4: $substr2\n"

echo -e "\nExtracting the substring from index 10 upto index 24: $substr3\n"
```

```
rakshit@RG:~/sample$ ./substring.sh
String: We welcome you in Operating System Lab.

Extracting the substring from index 0 upto index 10: Model Inst

Extracting the substring from index -3 upto index 4: Model Institute of Engineering and Technology

Extracting the substring from index 10 upto index 24: itute of Engineering and

rakshit@RG:~/sample$
```

→C PROGRAM

```c
#include <stdio.h>
int main()
{
        char str[50]="Model Institute of Engineering and Technology";

        // character extraction
    printf("Extracting the substring from index 0 up to index 10:-");{
        for (int i = 0; i<=10; i++) {
                if (str[i] != ' ') {

                        printf("%c", str[i]);
                }
        }
        }
        printf("\n\n");
        printf("Extracting the substring from index -3 up to index 4:-");{
        for (int i = -3; i<=4; i++) {
                if (str[i] != ' ') {
                        printf("%c", str[i]);
                }
        }
        }
        printf("\n\n");
         printf("Extracting the substring from index 10 up to index 20:-");{
        for (int i = 10; i<=20; i++){
                if (str[i] != ' ') {
                        printf("%c", str[i]);
                }
        }
         }
         printf("\n\n");
        return 0;
}
```

```
rakshit@RG:~/sample$ gcc substring.c
rakshit@RG:~/sample$ ./a.out
Extracting the substring from index 0 up to index 10:-ModelInsti

Extracting the substring from index -3 up to index 4:-Model

Extracting the substring from index 10 up to index 20:-ituteofEn

rakshit@RG:~/sample$
```

b) To find the length of a given string.

→SHELL SCRIPT

```
str="Model Institute of Engineering and Technology"
echo "The total no of char in the string are: ${#str}"
```

```
rakshit@RG:~/sample$ ./string_len.sh
The total no of char in the string are: 45
rakshit@RG:~/sample$
```

→C PROGRAM

```c
#include<stdio.h>
#include<stdio.h>
int main()
{
    int a;
    char str[100]="Model Institute of Engineering and Technology";
    a=strlen(str);
    printf("Length of The string : %d",a);
}
```

```
rakshit@RG:~/sample$ gcc string_len.c
rakshit@RG:~/sample$ ./a.out
Length of The string : 45
rakshit@RG:~/sample$
```

2. Compare the running time of above shell script and C program using the time command.

```
rakshit@RG:~/sample$ time ./string_len.sh
The total no of char in the string are: 45

real    0m0.003s
user    0m0.002s
sys     0m0.001s
```

```
rakshit@RG:~/sample$ time ./substring.sh
String: We welcome you in Operating System Lab.

Extracting the substring from index 0 upto index 10: Model Inst

Extracting the substring from index -3 upto index 4: Model Institute of Engineering and Technology

Extracting the substring from index 10 upto index 24: itute of Engineering and

real    0m0.003s
user    0m0.000s
sys     0m0.004s
rakshit@RG:~/sample$ z
```