

## ADSAL-Advanced-Data-Structures-and-Algorithms-Laboratory

GitHub Link: <https://github.com/Raghavdps20/ADSAL-Advanced-Data-Structures-and-Algorithms-Laboratory/tree/main/Lab250909>

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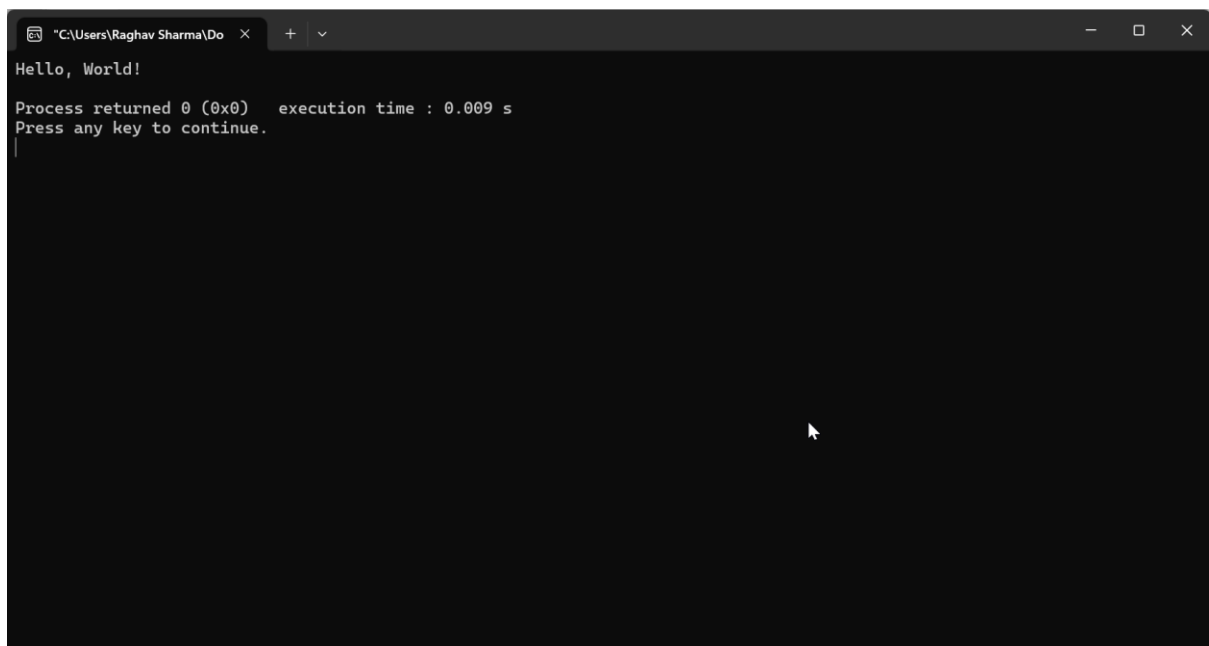
Roll No: 25201313

Date: 09 – 09 – 25

Q1. Print "Hello, World!"

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    printf("Hello, World!\n");
    return 0;
}
```



The screenshot shows a Windows command prompt window with a dark background. The title bar at the top reads "C:\Users\Raghav Sharma\Do" followed by a close button (X) and window control buttons (minimize, maximize, close). The command prompt displays the output of a C program: "Hello, World!". Below this, it shows "Process returned 0 (0x0) execution time : 0.009 s" and "Press any key to continue.". A mouse cursor is visible near the bottom center of the window.

## Q2. Swap Two Numbers

```
#include <stdio.h>
#include <stdlib.h>

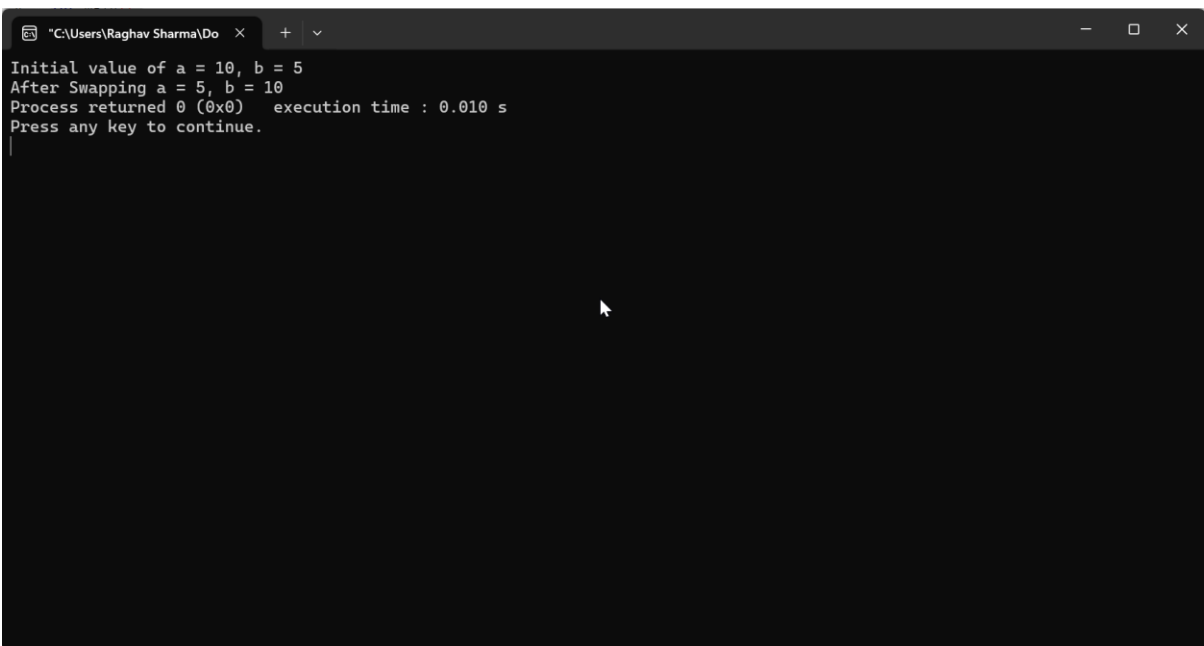
int main()
{
    int a=10;
    int b=5;

    printf("Initial value of a = %d, b = %d \n", a,b);

    int temp = a;
    a = b;
    b = temp;

    printf("After Swapping a = %d, b = %d", a,b);

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" X + v
Initial value of a = 10, b = 5
After Swapping a = 5, b = 10
Process returned 0 (0x0)   execution time : 0.010 s
Press any key to continue.
```

The window title bar shows the file path "C:\Users\Raghav Sharma\Do" and standard Windows window controls (minimize, maximize, close). The output of the program is displayed in the command prompt, showing the initial values of a and b, the result after swapping, the process return code, and the execution time.

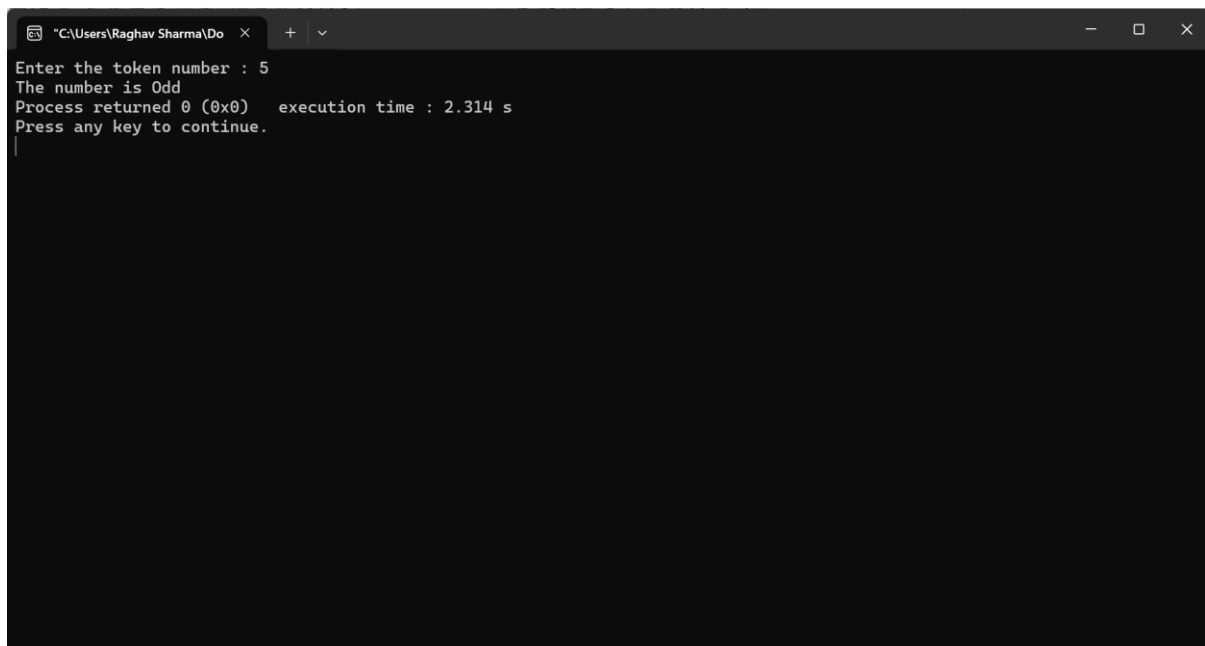
### Q3. Check Even or Odd

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int num;
    printf("Enter the token number : ");
    scanf("%d", &num);

    if(num % 2 == 0){
        printf("The Token number is Even");
    }
    else{
        printf("The number is Odd");
    }

    return 0;
}
```



The screenshot shows a Windows command prompt window with the title bar "C:\Users\Raghav Sharma\Do". The window contains the following text:

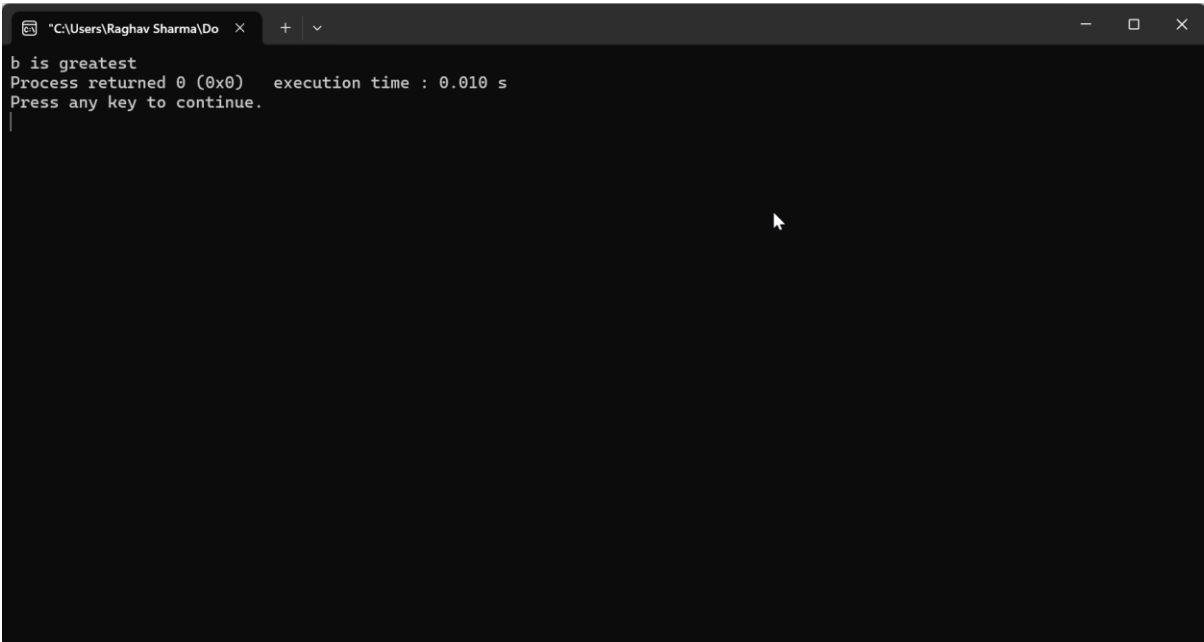
```
Enter the token number : 5
The number is Odd
Process returned 0 (0x0)   execution time : 2.314 s
Press any key to continue.
```

#### Q4. Find Largest of Three Numbers

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int a=10;
    int b=25;
    int c =15;

    if(a>b && a>c){
        printf("a is greatest");
    }
    else if(b>c){
        printf("b is greatest");
    }
    else{
        printf("c is greatest");
    }
    return 0;
}
```



```
"C:\Users\Raghav Sharma\Do"
b is greatest
Process returned 0 (0x0)   execution time : 0.010 s
Press any key to continue.
```

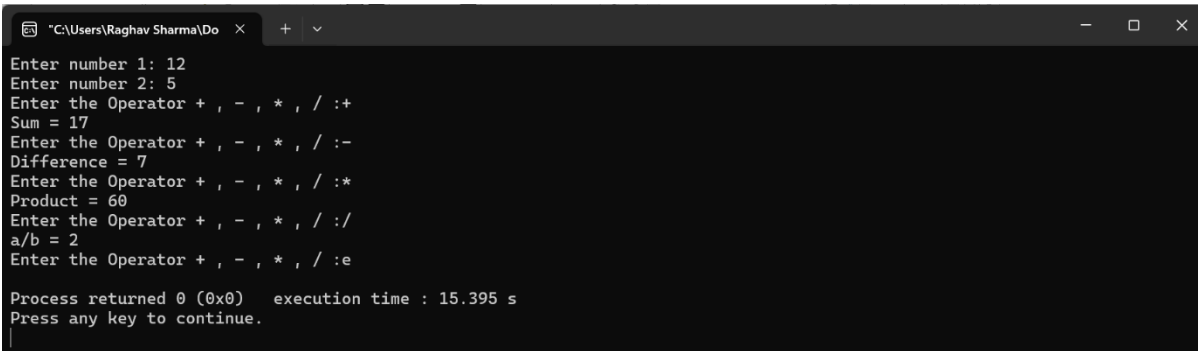
#### Q5. Simple Calculator (switch case)

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int a,b;
    char c;
    printf("Enter number 1: ");
    scanf("%d", &a);
    printf("Enter number 2: ");
    scanf("%d", &b);

    while(1){
        printf("Enter the Operator + , - , * , / :");
        scanf(" %c", &c);

        switch (c){
            case '+':
                printf("Sum = %d \n", a+b);
                break;
            case '-':
                printf("Difference = %d \n", a-b);
                break;
            case '*':
                printf("Product = %d \n", a*b);
                break;
            case '/':
                printf("a/b = %d \n", a/b);
                break;
            case 'e':
                return 0;;
            default:
                printf("Wrong input \n");
                break;
        }
    }
    return 0;
}
```



```
"C:\Users\Raghav Sharma\Do" x + v
Enter number 1: 12
Enter number 2: 5
Enter the Operator + , - , * , / :+
Sum = 17
Enter the Operator + , - , * , / :-
Difference = 7
Enter the Operator + , - , * , / :*
Product = 60
Enter the Operator + , - , * , / :/
a/b = 2
Enter the Operator + , - , * , / :e

Process returned 0 (0x0)   execution time : 15.395 s
Press any key to continue.
```

## Q6. Factorial of a Number

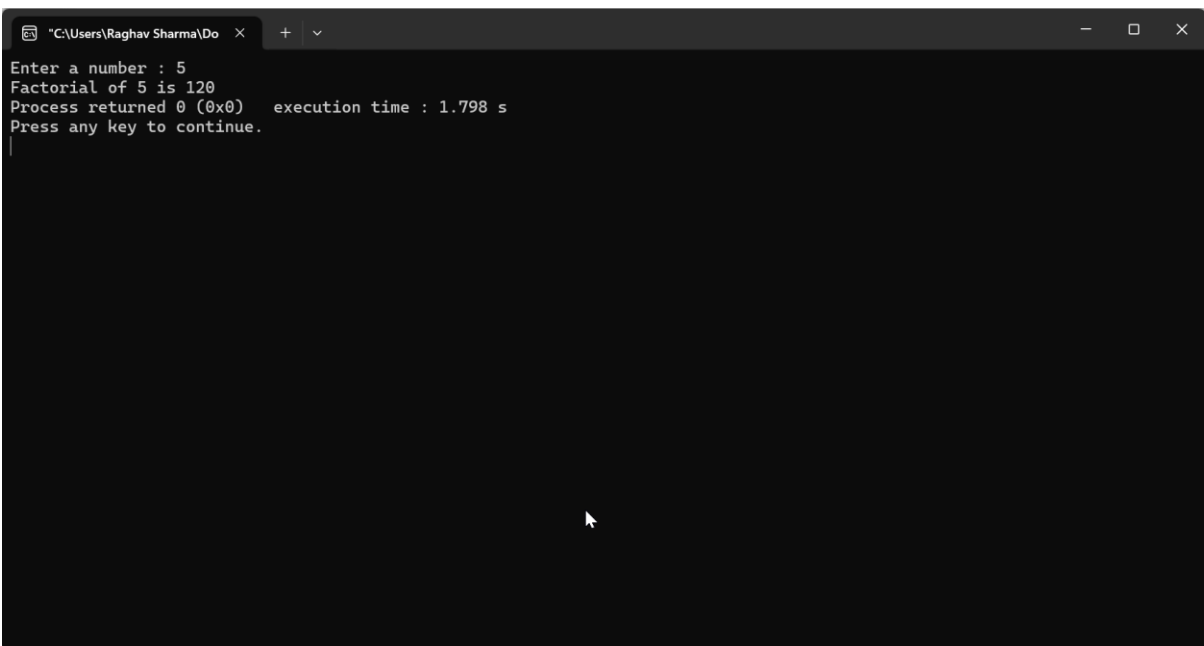
```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int num;
    int fact = 1;
    int i;
    printf("Enter a number : ");
    scanf("%d", &num);

    for(i=1; i<=num; i++){
        fact = fact * i;
    }

    printf("Factorial of %d is %d", num, fact);

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter a number : 5
Factorial of 5 is 120
Process returned 0 (0x0)    execution time : 1.798 s
Press any key to continue.
```

The window title bar shows the file path "C:\Users\Raghav Sharma\Do" and standard Windows window controls (minimize, maximize, close). The output indicates that the program successfully calculated the factorial of 5 as 120 and returned 0, indicating successful execution.

### Q7. Fibonacci Series (first n terms)

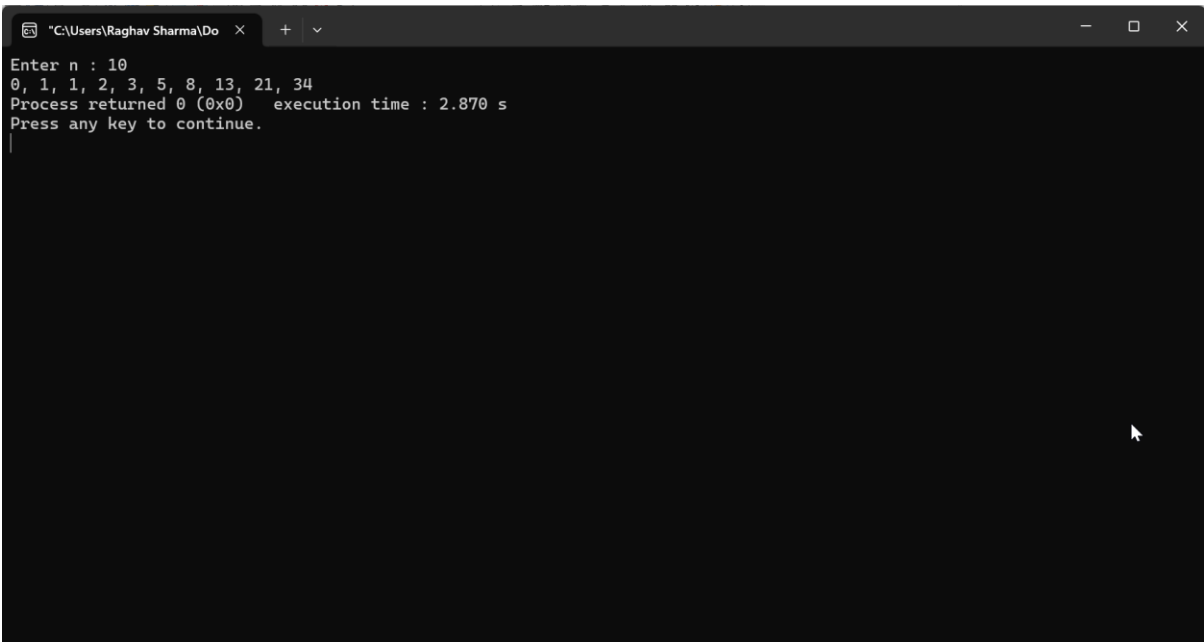
```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int a = 0;
    int b = 1;
    int c = a+b;
    int n;
    int i;

    printf("Enter n : ");
    scanf("%d", &n);

    for (i = 0; i<n; i++){
        printf("%d", a);
        if(i<n-1){
            printf(", ");
        }
        a=b;
        b=c;
        c=a+b;
    }

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" × + ▾
Enter n : 10
0, 1, 1, 2, 3, 5, 8, 13, 21, 34
Process returned 0 (0x0)   execution time : 2.870 s
Press any key to continue.
```

The window title bar shows the file path "C:\Users\Raghav Sharma\Do" and standard Windows window controls (minimize, maximize, close). The output displays the first 10 terms of the Fibonacci series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34. The process returned 0 (0x0) and the execution time was 2.870 seconds. The prompt asks to press any key to continue.

#### Q8. Reverse a Number

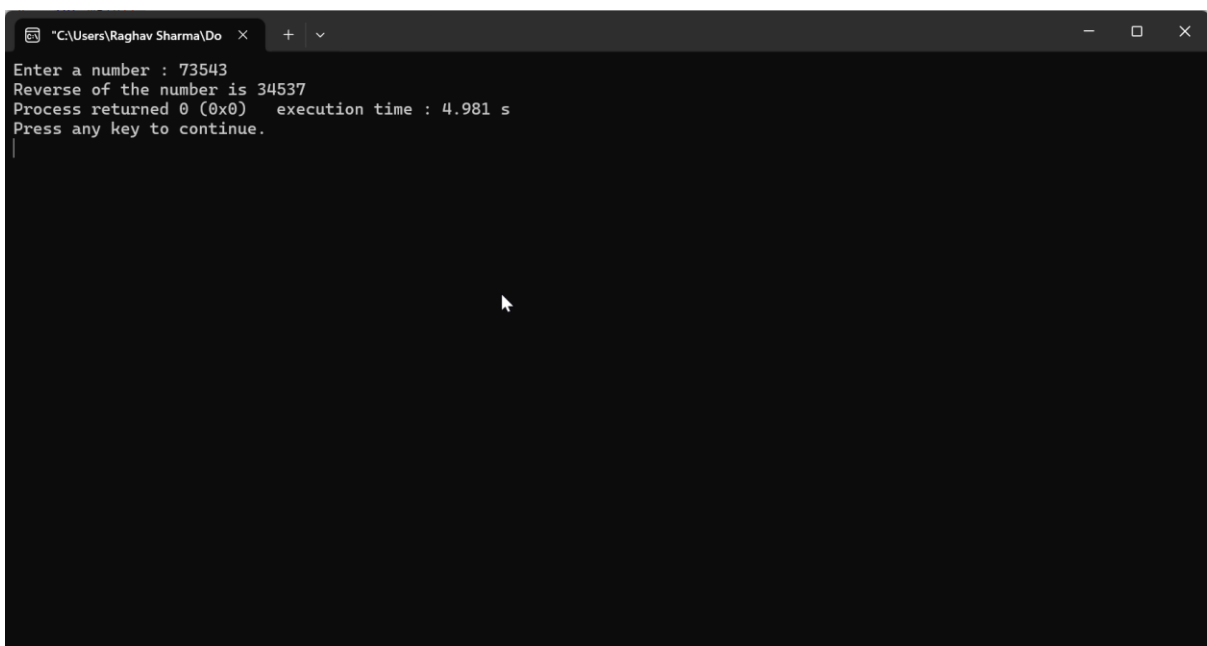
```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int num;
    int sum = 0;
    int digit;
    printf("Enter a number : ");
    scanf("%d", &num);

    while(num>0){
        digit = num%10;
        sum = sum * 10 + digit;
        num = num/10;
    }

    printf("Reverse of the number is %d", sum);

    return 0;
}
```



The screenshot shows a Windows command prompt window with a dark background. The title bar at the top indicates the file path "C:\Users\Raghav Sharma\Do". The window contains the following text:

```
Enter a number : 73543
Reverse of the number is 34537
Process returned 0 (0x0)   execution time : 4.981 s
Press any key to continue.
```

A mouse cursor is visible in the center of the window.



### Q9. Palindrome Number Check

```
#include <stdio.h>
#include <stdlib.h>

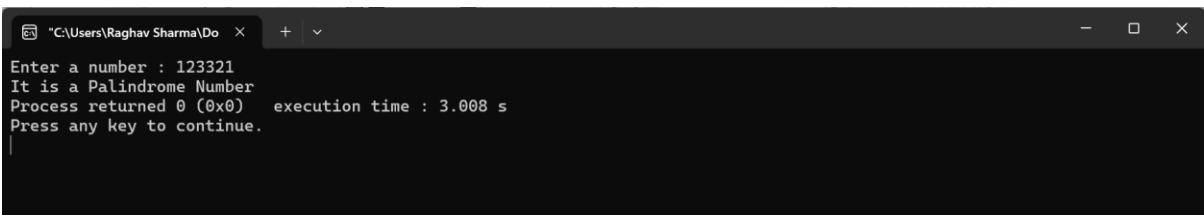
int main()
{
    int num;
    int sum = 0;
    int digit;
    int original;
    printf("Enter a number : ");
    scanf("%d", &num);

    original = num;

    while(num>0){
        digit = num%10;
        sum = sum * 10 + digit;
        num = num/10;
    }

    if(original == sum){
        printf("It is a Palindrome Number");
    }
    else{
        printf("Not a Palindrome Number");
    }

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter a number : 123321
It is a Palindrome Number
Process returned 0 (0x0)   execution time : 3.008 s
Press any key to continue.
```

#### Q10. Count Digits in a Number

```
#include <stdio.h>
#include <stdlib.h>

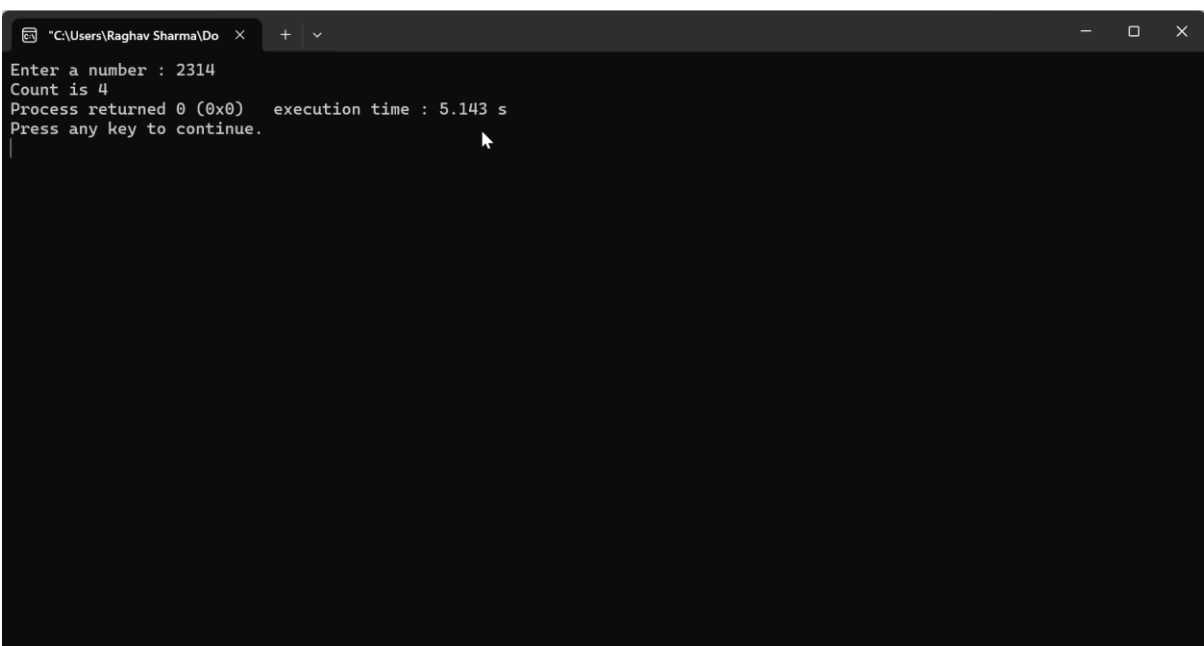
int main()
{
    int num;
    int count = 0;
    int digit;

    printf("Enter a number : ");
    scanf("%d", &num);

    while(num>0){
        count++;
        num = num/10;
    }

    printf("Count is %d", count);

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter a number : 2314
Count is 4
Process returned 0 (0x0)   execution time : 5.143 s
Press any key to continue.
```

A mouse cursor is visible near the bottom of the window.

### Q11. Sum of Digits

```
#include <stdio.h>
#include <stdlib.h>

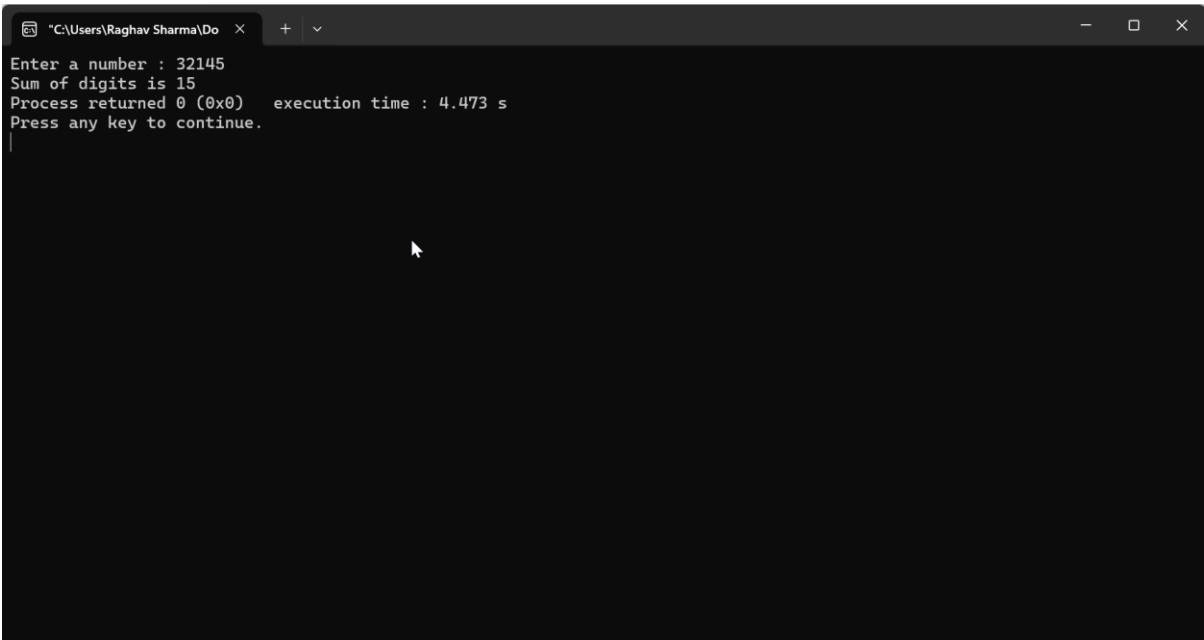
int main()
{
    int num;
    int sum = 0;
    int digit;

    printf("Enter a number : ");
    scanf("%d", &num);

    while(num>0){
        digit = num%10;
        sum = sum + digit;
        num = num/10;
    }

    printf("Sum of digits is %d", sum);

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter a number : 32145
Sum of digits is 15
Process returned 0 (0x0)   execution time : 4.473 s
Press any key to continue.
```

The window title bar indicates the file path "C:\Users\Raghav Sharma\Do" and standard window controls (minimize, maximize, close). The output shows the program successfully calculated the sum of digits for the input 32145, resulting in 15.

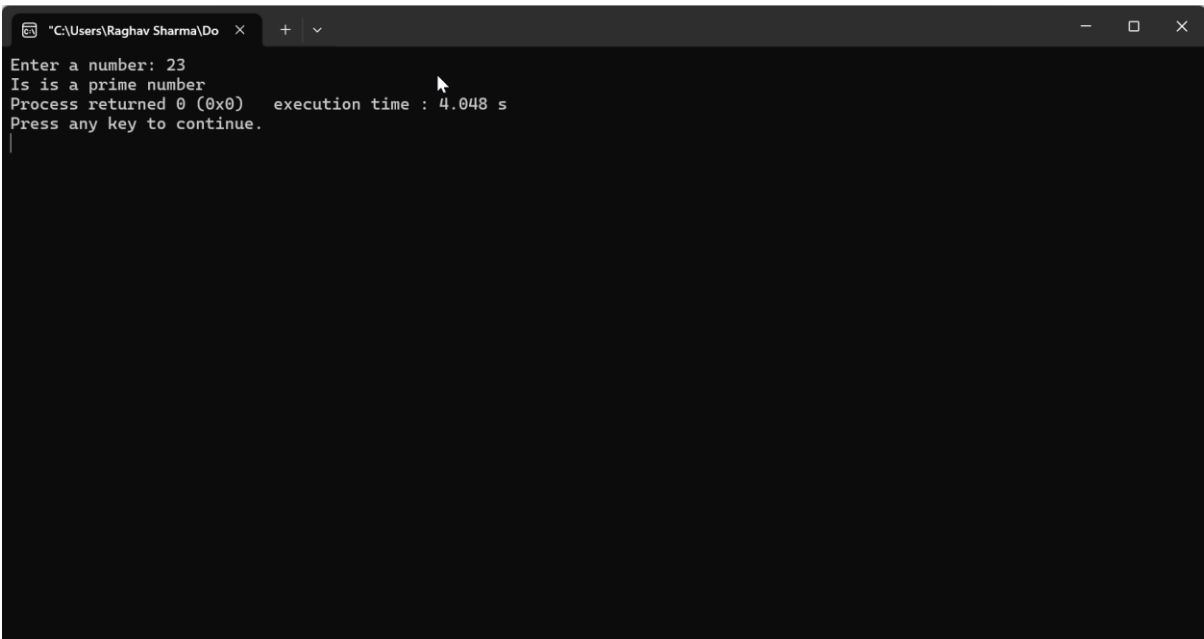
## Q12. Check Prime Number

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int num;
    int isPrime = 1;
    printf("Enter a number: ");
    scanf("%d", &num);

    for(int i = 2; i*i<num; i++){
        if(num%i == 0){
            isPrime = 0;
            break;
        }
    }

    if(isPrime){
        printf("Is is a prime number");
    }
    else{
        printf("Not a Prime Number");
    }
    return 0;
}
```



The screenshot shows a Windows command prompt window with the title bar "C:\Users\Raghav Sharma\Do". The window contains the following text:

```
Enter a number: 23
Is is a prime number
Process returned 0 (0x0)   execution time : 4.048 s
Press any key to continue.
```

A mouse cursor is visible over the text "execution time : 4.048 s".

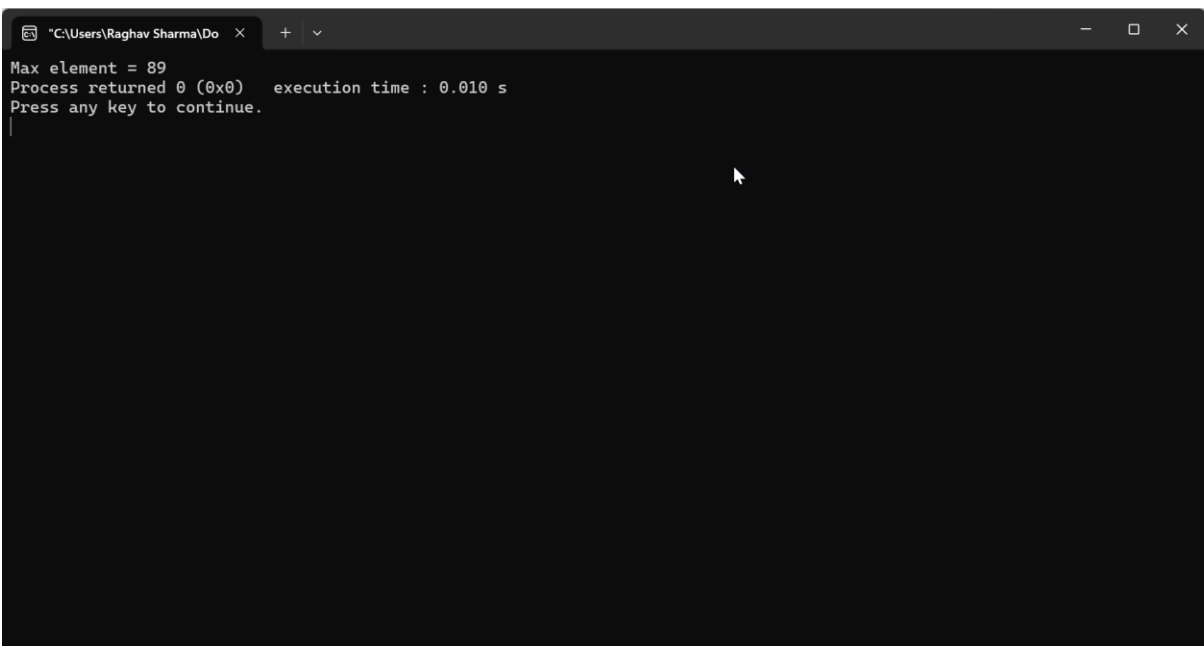
### Q13. Array – Find Maximum Element

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int a[8] = {1,3,43,12,54,89,56,79};
    int max = a[0];
    int i;
    int size = sizeof(a)/sizeof(a[0]);

    for(i=0;i<size;i++){
        if(a[i]>max){
            max = a[i];
        }
    }

    printf("Max element = %d", max);
    return 0;
}
```



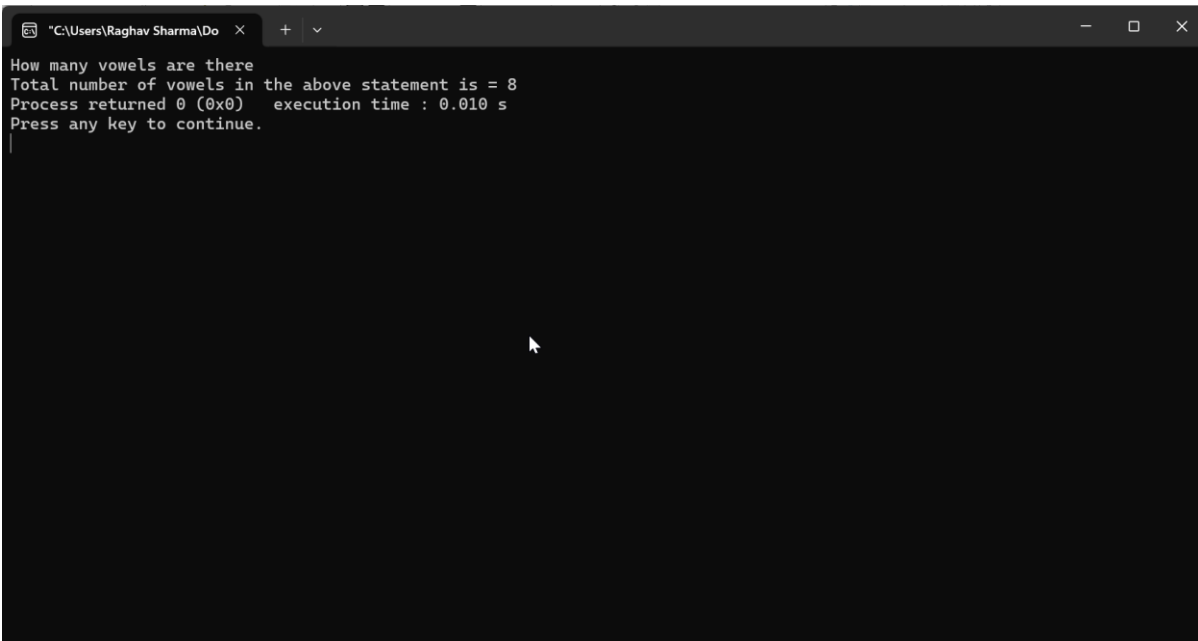
```
"C:\Users\Raghav Sharma\Do" x + v - □ x
Max element = 89
Process returned 0 (0x0)   execution time : 0.010 s
Press any key to continue.
```

#### Q14. String – Count Vowels

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    char s[50] = "How many vowels are there";
    int count = 0;
    int i = 0;

    while(s[i] != '\0'){
        if (s[i] == 'A' || s[i] == 'E' || s[i] == 'I' || s[i] == 'O' || s[i] == 'U' || s[i] == 'a' || s[i] == 'e' || s[i] == 'i' ||
s[i] == 'o' || s[i] == 'u')
        {
            count++;
        }
        i++;
    }
    printf(s);
    printf("\nTotal number of vowels in the above statement is = %d", count);
    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do x + v
How many vowels are there
Total number of vowels in the above statement is = 8
Process returned 0 (0x0) execution time : 0.010 s
Press any key to continue.
```

The window title bar shows the file path "C:\Users\Raghav Sharma\Do" and standard Windows window controls (minimize, maximize, close). The output of the program is displayed in the command prompt, showing the string "How many vowels are there", the count of vowels (8), and the execution time (0.010 s).

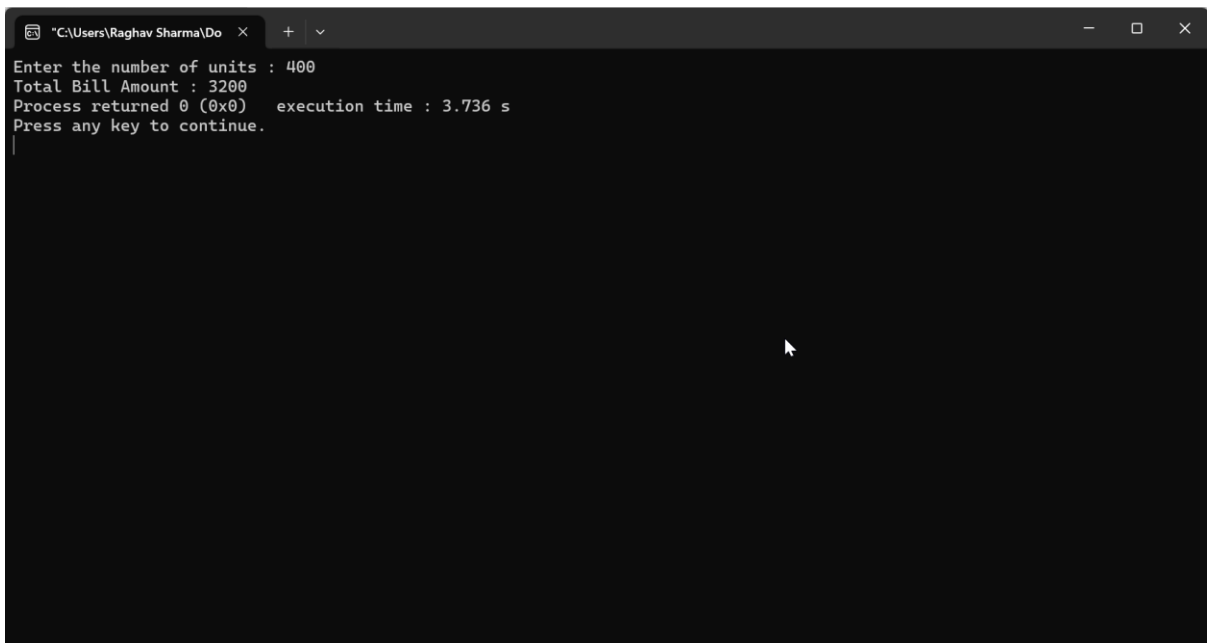
### Q15. Scenario – Electricity Bill Calculation

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int units;
    int bill = 0;
    printf("Enter the number of units : ");
    scanf("%d",&units);

    if(units <= 100){
        bill = units * 5;
    }
    else if(units <= 200){
        bill = 100*5 + (units-100)*7;
    }
    else{
        bill = 100*5 + 100*7 + (units-200)*10;
    }

    printf("Total Bill Amount : %d", bill);
    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" X + v - □ X
Enter the number of units : 400
Total Bill Amount : 3200
Process returned 0 (0x0)   execution time : 3.736 s
Press any key to continue.
```

The window title bar indicates the file path "C:\Users\Raghav Sharma\Do" and standard Windows window controls (minimize, maximize, close). The output shows that the program successfully calculated the bill for 400 units as 3200.

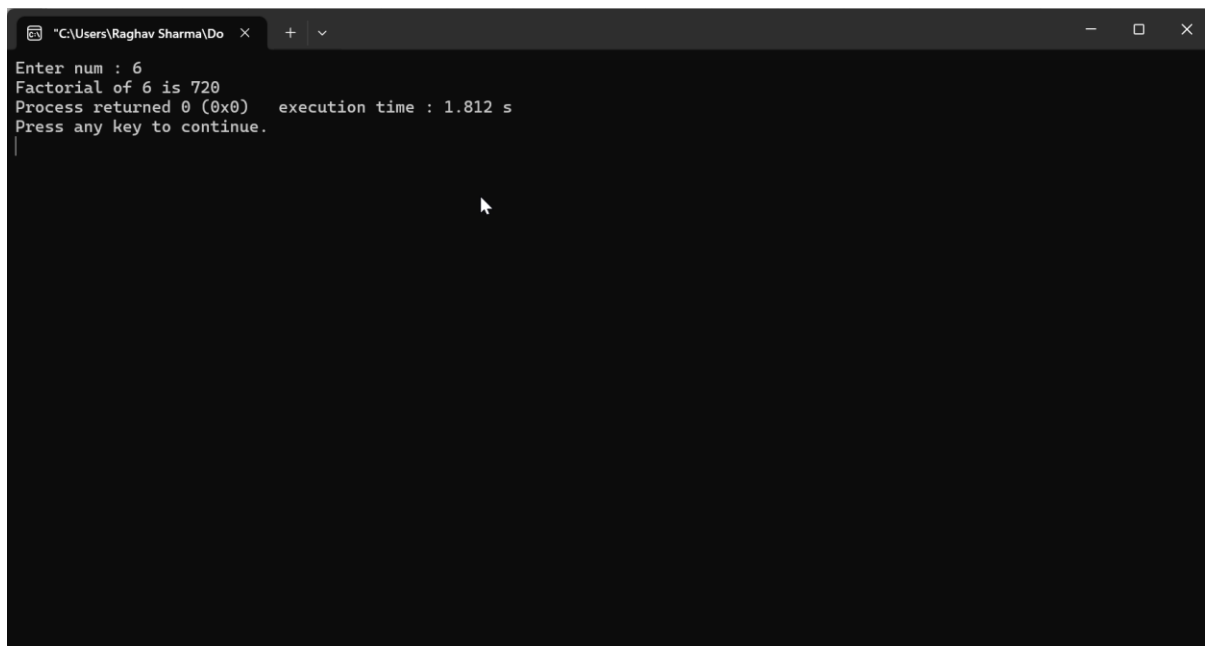
### Q16. Factorial using Recursion

```
#include <stdio.h>
#include <stdlib.h>

int fact(n){
    if(n==0 || n==1){
        return 1;
    }
    return n*fact(n-1);
}

int main()
{
    int num;
    printf("Enter num : ");
    scanf("%d", &num);

    printf("Factorial of %d is %d", num, fact(num));
    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter num : 6
Factorial of 6 is 720
Process returned 0 (0x0)   execution time : 1.812 s
Press any key to continue.
```

A mouse cursor is visible in the center of the window.



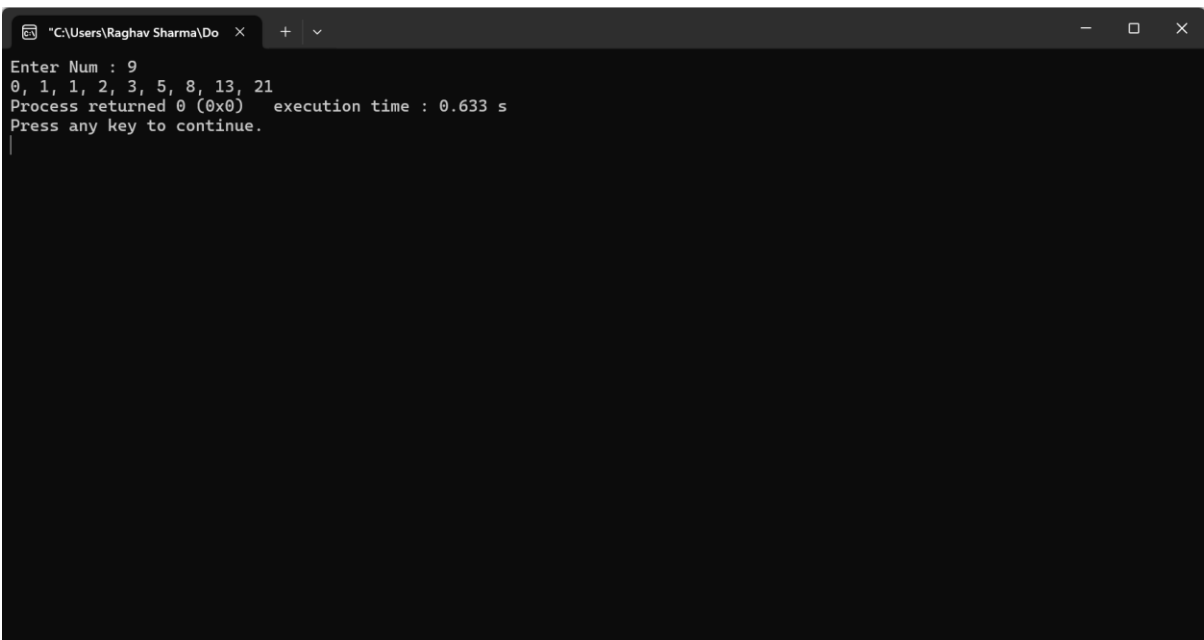
### Q17. Fibonacci Series using Recursion

```
#include <stdio.h>
#include <stdlib.h>

int fib(int n){
    if(n==0){
        return 0;
    }
    if(n==1){
        return 1;
    }
    return fib(n-1) + fib (n-2);
}

int main()
{
    int num;
    int i;
    printf("Enter Num : ");
    scanf("%d", &num);
    for(i=0; i<num; i++){
        printf("%d", fib(i));
        if(i<num-1){
            printf(", ");
        }
    }

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter Num : 9
0, 1, 1, 2, 3, 5, 8, 13, 21
Process returned 0 (0x0)   execution time : 0.633 s
Press any key to continue.
```

The output displays the Fibonacci sequence for the input 9: 0, 1, 1, 2, 3, 5, 8, 13, 21. The process returned 0 (0x0) and the execution time was 0.633 s.

### Q18. GCD (Greatest Common Divisor) using Recursion

```
#include <stdio.h>
#include <stdlib.h>

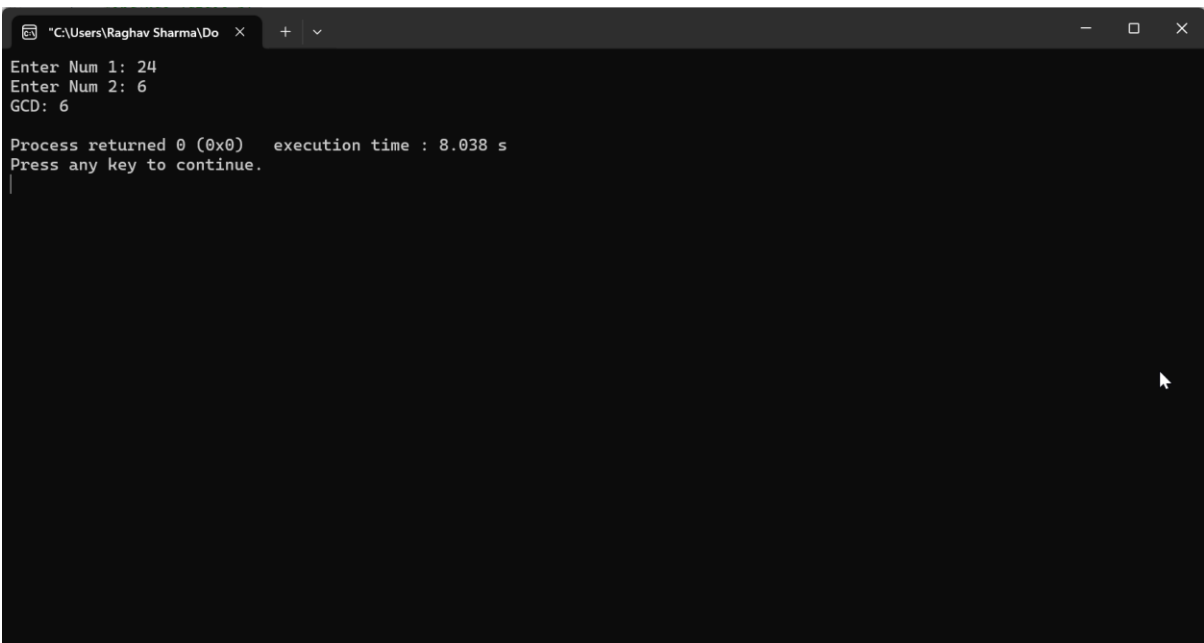
int gcd(int a, int b) {
    if (b == 0)
        return a;
    else
        return gcd(b, a % b);
}

int main() {
    int num1, num2;

    printf("Enter Num 1: ");
    scanf("%d", &num1);
    printf("Enter Num 2: ");
    scanf("%d", &num2);

    printf("GCD: %d\n", gcd(num1, num2));

    return 0;
}
```



The screenshot shows a Windows command prompt window with the following text:

```
"C:\Users\Raghav Sharma\Do" x + v
Enter Num 1: 24
Enter Num 2: 6
GCD: 6

Process returned 0 (0x0)   execution time : 8.038 s
Press any key to continue.
|
```

The window title bar indicates the file path "C:\Users\Raghav Sharma\Do". The output shows that the program successfully calculated the GCD of 24 and 6 as 6. The execution time was 8.038 seconds. The prompt is waiting for a key press to continue.

### Q19. Sum of Digits using Recursion

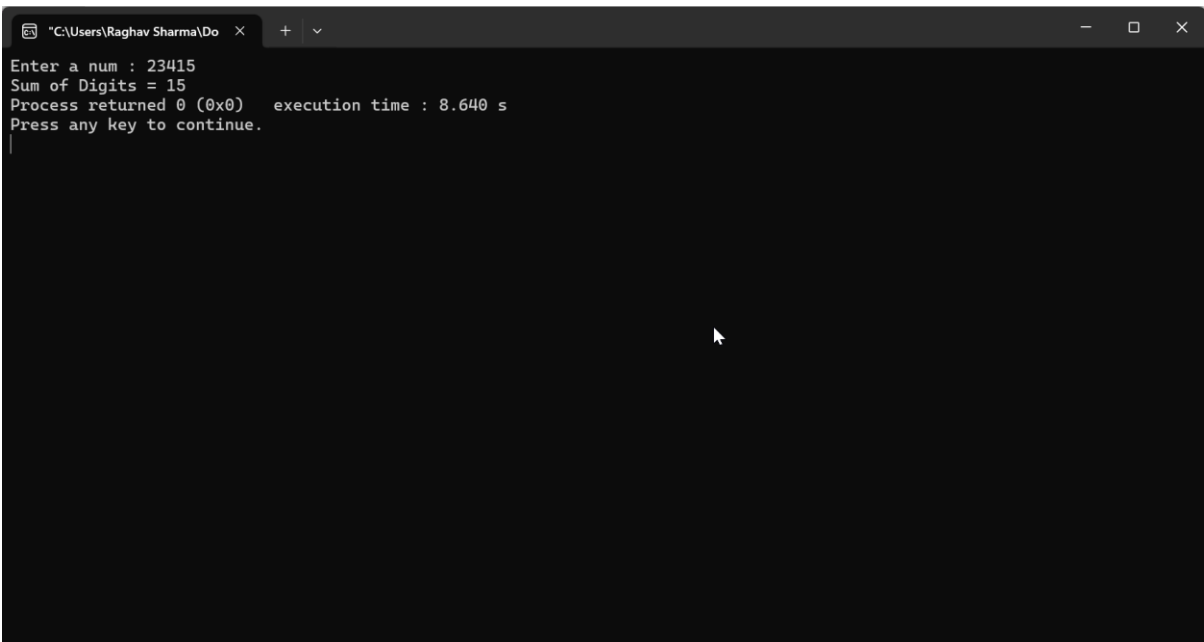
```
#include <stdio.h>
#include <stdlib.h>

int sumofnum(int n){
    if(n==0){
        return 0;
    }
    return n%10 + sumofnum(n/10);
}

int main()
{
    int num;
    printf("Enter a num : ");
    scanf("%d", &num);

    printf("Sum of Digits = %d", sumofnum(num));

    return 0;
}
```



```
"C:\Users\Raghav Sharma\Do" x + v
Enter a num : 23415
Sum of Digits = 15
Process returned 0 (0x0) execution time : 8.640 s
Press any key to continue.
```

## Q20. Recursive Binary Search

```
#include <stdio.h>
#include <stdlib.h>

int rbs(int arr[], int l, int h, int key) {

    if (l > h) {
        return -1;
    }

    int mid = (l + h) / 2;

    if (arr[mid] == key) {
        return mid;
    }

    else if (arr[mid] > key) {
        return rbs(arr, l, mid - 1, key);
    }
    else {
        return rbs(arr, mid + 1, h, key);
    }
}

int main() {

    int n = 10, key;
    int result;

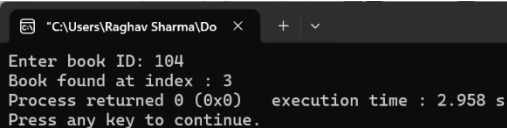
    int arr[10] = {101,102,103,104,105,106,107,108,109,110};

    printf("Enter book ID: ");
    scanf("%d", &key);

    result = rbs(arr, 0, n - 1, key);

    if (result == -1) {
        printf("Book not found", key);
    } else {
        printf("Book found at index : %d", result);
    }

    return 0;
}
```



```
"C:\Users\Raghav Sharma\Do" x + v
Enter book ID: 104
Book found at index : 3
Process returned 0 (0x0) execution time : 2.958 s
Press any key to continue.
|
```