**Assignment -1**

1. Write a program of finding terms of Fibonacci series by iteration and recursion and do the data analysis of program.

# include <stdio.h>

# include <sys/time.h>

int fiboRec(int);

int fiboInteration(int);

int main()

{

    struct timeval v1,v2;

    struct timezone z1,z2;

    gettimeofday(&v1,&z1);

    //printf("\nFibonacci : %d",fiboRec(30));

    printf("\nFibonacci : %d",fiboInteration(30));

    gettimeofday(&v2,&z2);

    printf("\nTime Difference : %d",(v2.tv\_usec-v1.tv\_usec));

    return 0;

}

int fiboRec(int n)

{

    if(n==1)

    {

        return 0;

    }

    else if(n==2)

    {

        return 1;

    }

    else

    {

        return fiboRec(n-1)+fiboRec(n-2);

    }

}

int fiboInteration(int n)

{

    if(n==1)

    {

        return 0;

    }

    else if(n==2)

    {

        return 1;

    }

    else

    {

        int a=0,b=1,c;

        for(int i=2; i<n; i++)

        {

            c=a+b;

            a=b;

            b=c;

        }

        return c;

    }

}

Output :-

Fibonacci : 46368

Time Difference : 22

Fibonacci : 46368

Time Difference : 37

Fibonacci : 46368

Time Difference : 53

Fibonacci : 46368

Time Difference : 54

Fibonacci : 46368

Time Difference : 599

Fibonacci : 46368

Time Difference : 359

Fibonacci : 46368

Time Difference : 534

Fibonacci : 46368

Time Difference : 390

Fibonacci : 514229

Time Difference : 29

Fibonacci : 514229

Time Difference : 44

Fibonacci : 514229

Time Difference : 39

Fibonacci : 514229

Time Difference : 73

Fibonacci : 514229

Time Difference : 3502

Fibonacci : 514229

Time Difference : 5150

Fibonacci : 514229

Time Difference : 5147

Fibonacci : 514229

Time Difference : 3146

Fibonacci : 5702887

Time Difference : 28

Fibonacci : 5702887

Time Difference : 31

Fibonacci : 5702887

Time Difference : 29

Fibonacci : 5702887

Time Difference : 32

Fibonacci : 5702887

Time Difference : 53797

Fibonacci : 5702887

Time Difference : 61970

Fibonacci : 5702887

Time Difference : 46489

Fibonacci : 5702887

Time Difference : 42319

Analysis :-

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iterative | Recursive | First | | Second | | Third | | Fourth | | Average | |
| 25 | | 22 | 599 | 37 | 359 | 53 | 534 | 54 | 390 | 41.5 | 470.5 |
| 30 | | 29 | 3502 | 44 | 5150 | 39 | 5147 | 73 | 3146 | 46.25 | 4236.25 |
| 35 | | 28 | 53797 | 31 | 61970 | 29 | 46489 | 32 | 42319 | 31 | 51143.75 |

* Here we can see that time taken by iterative method in all cases is lower than recursive method.
* We can also notice that time difference between iterative and recursive method increases drastically with increase in the nth term of Fibonacci series.
* Time taken by recursive method increases by 10 times as we increase value of nth term by 5 terms.
* We can also notice that time taken by iterative method is almost constant for different input.
* Hence we can say that graph of iterative method will be approximetly linear.
* And graph of recursive method will be a increasing curve.

Conclusion :-

We can conclude that recursive method is faster than iterative method when value of number of terms in Fibonacci series is small.

And iterative method is more faster than recursive method when number of terms in Fibonacci series is high.

Over All we can conclude that iterative method is better than recursive method.

2. Write a program of finding terms of Fibonacci series by iteration and recursion and do the data analysis of program.

# include <stdio.h>

# include <sys/time.h>

long factRec(int);

long factIteration(int);

int main()

{

    struct timeval v1,v2;

    struct timezone z1,z2;

    gettimeofday(&v1,&z1);

    printf("\nFactorial : %d", factRec(10));

    //printf("\nFactorial : %d", factIteration(10));

    gettimeofday(&v2,&z2);

    printf("\nTime Difference : %d",(v2.tv\_usec-v1.tv\_usec));

    return 0;

}

long factIteration(int n)

{

    long fact=1;

    while(n!=0)

    {

        fact\*=n;

        n--;

    }

    return fact;

}

long factRec(int n)

{

    if(n==0)

    {

        return 1;

    }

    else

    {

        return n\*factRec(n-1);

    }

}

Output :-

Factorial : 120

Time Difference : 79

Factorial : 120

Time Difference : 27

Factorial : 120

Time Difference : 39

Factorial : 120

Time Difference : 41

Factorial : 120

Time Difference : 24

Factorial : 120

Time Difference : 38

Factorial : 120

Time Difference : 35

Factorial : 120

Time Difference : 25

Factorial : 3628800

Time Difference : 33

Factorial : 3628800

Time Difference : 27

Factorial : 3628800

Time Difference : 33

Factorial : 3628800

Time Difference : 32

Factorial : 3628800

Time Difference : 34

Factorial : 3628800

Time Difference : 205

Factorial : 3628800

Time Difference : 41

Factorial : 3628800

Time Difference : 58

Factorial : 3628800

Time Difference : 23

Factorial : 479001600

Time Difference : 31

Factorial : 479001600

Time Difference : 49

Factorial : 479001600

Time Difference : 532

Factorial : 479001600

Time Difference : 35

Factorial : 479001600

Time Difference : 36

Factorial : 479001600

Time Difference : 891

Factorial : 479001600

Time Difference : 73

**Factorial : 479001600**

**Time Difference : 523**

Analysis :-

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iterative | Recursive | First | | Second | | Third | | Fourth | | Average | |
| 5 | | 79 | 24 | 27 | 38 | 39 | 35 | 41 | 25 | 46.5 | 30.5 |
| 10 | | 33 | 34 | 27 | 205 | 33 | 41 | 32 | 58 | 31.25 | 84.5 |
| 12 | | 31 | 36 | 49 | 891 | 532 | 73 | 35 | 523 | 161.75 | 380.75 |

* Here we can see that time taken by iterative method in all cases is lower than recursive method except for factorial of 5.
* We can also notice that time difference between iterative and recursive method increases with increase in the n for the factorial.
* Time taken by recursive method increases by 3 times as we increase the value of n from 5 to 10.
* Time taken by recursive method increases by 5 times as we increase the value of n from 10 to 12.
* We can also notice that time taken by iterative method is almost constant for different input.
* Hence we can say that graph of iterative method will be approximetly linear.
* And graph of recursive method will be a increasing curve.

Conclusion :-

We can conclude that recursive method is faster than iterative method when value of n for the factorial is small.

And iterative method is more faster than recursive method when value of n for factorial is high.

Over All we can conclude that iterative method is better than recursive method to find factorial.