Tutorial

Programming & Data Structure: CS 11001

Section - 4/D

Department of Computer Science and Engineering

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Factorial Computation

```
#include <stdio.h>
int main(){ // fact1.c
   int n, i, fact=1;

   printf("Enter a non-ve integer: ");
   scanf("%d", &n);
   for(i=n; i>0; --i) fact *= i;
   printf("%d! = %d\n", n, fact);

   return 0;
}
```

Definition of Factorial Function

```
int factorial(int n){
    int i, fact = 1;

    for(i=n; i>0; --i) fact *= i ;

    return fact;
}
```

main() Function

```
int main() // fact2.c
{
    int n ;
    printf("Enter a non-ve integer: ");
    scanf("%d", &n) ;
    printf("%d! = %d\n", n, factorial(n)) ;
    return 0 ;
}
```

Invocation of factorial()

Computation of $sin(x)$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} \cdots$$

Finite number of terms of this infinite series may be used to compute an approximate value of $\sin(x)$, where x is in radian.

$$\begin{aligned}
\sin x &= x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} \cdots \\
&= \sum_{i \geq 0} (-1)^i \frac{x^{2i+1}}{(2i+1)!} \\
&= \sum_{i \geq 0} t_i, \text{ where } t_i = (-1)^i \frac{x^{2i+1}}{(2i+1)!}
\end{aligned}$$

Inductive Definition of $t_i(x)$

$$t_i = \begin{cases} x & \text{if } i = 0, \\ -t_{i-1}\dfrac{x^2}{2i(2i+1)} & \text{if } i > 0. \end{cases}$$

This is also called recurrence relation or recursive definition.

Approximation of $\sin(x)$

The sum up to the n^{th} term of the series, $S_n(x)$, gives an approximate value of $\sin(x)$. The inductive definition of S_n is

$$S_n = \begin{cases} t_0 & \text{if } n = 0, \\ s_{n-1} + t_n & \text{if } n > 0. \end{cases}$$

Tutorial IV.1

You have already written the code to compute $\sin x$. Write a C function `double mySin(double x)` that will take an angle `x` in radian as parameter and will return the approximate value of $\sin x$.

Tutorial IV.2

How do you handle the termination of the computation loop.

Tutorial IV.3

Write a C `main()` that will call the function `double mySin(double x)` and will print a table of $\sin\theta$ for angles $-90°$ to $90°$.