

EE103 – INTRODUCTION TO PROGRAMMING – LAB 5

TAYLOR SERIES

Q-) Write a C code that calculates the $\cos(x)$ & $\sin(x)$ function by using Taylor Series:

$$y = \cos(x) = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n}$$

$$y = \sin(x) = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1}$$

✓ Write a **function** that can calculate **factorial** of a number (20p)

- `A = myfactorialfunction(5); >> A = 5! = 120`

Hint: Factorial function must return *double* because *integer* is not enough to store 9! and above.

✓ Write a **function** that can calculate **cos(x)** by using Taylor Series (30p)

- Function must take *precision* which will be taken from user in the main function and the value 'x'
- The approximated value of $\cos(x)$ will be computed by Taylor series until the criteria below achieved:

$$Precision > |y_n - y_{n-1}|$$

Hint: Unit of the value 'x' is radian

Hint: While calculating absolute of an double variable use the function 'fabs(x)' which is in the math.h

✓ Write a **function** that can calculate **sin(x)** by using Taylor Series (30p)

- Function must take *precision* which will be taken from user in the main function and the value 'x'
- The approximated value of $\sin(x)$ will be computed by Taylor series until the criteria below achieved:

$$Precision > |y_n - y_{n-1}|$$

Hint: Unit of the value 'x' is radian

Hint: While calculating absolute of an double variable use the function 'fabs(x)' which is in the math.h

✓ Write the main function (20p)

- Take the 'precision' from user
- Write a C program that calculates the sine and cosine at 30 degrees intervals between 0 and 360.
- Print these values on screen like the example below

Hint: You need to define π as 3.14159 to calculate x

```
Enter precision
0.005
Degree : 0    Radian : 0.000000    Cos(x) : 1.000000    Sin(x) : 0.000000    Precision : 0.005000
Degree : 30   Radian : 0.523598    Cos(x) : 0.866054    Sin(x) : 0.500002    Precision : 0.005000
Degree : 60   Radian : 1.047197    Cos(x) : 0.499965    Sin(x) : 0.866021    Precision : 0.005000
Degree : 90   Radian : 1.570795    Cos(x) : 0.000026    Sin(x) : 0.999843    Precision : 0.005000
Degree : 120  Radian : 2.094393    Cos(x) : -0.500013    Sin(x) : 0.866109    Precision : 0.005000
Degree : 150  Radian : 2.617992    Cos(x) : -0.866233    Sin(x) : 0.499960    Precision : 0.005000
Degree : 180  Radian : 3.141590    Cos(x) : -0.999900    Sin(x) : 0.000024    Precision : 0.005000
Degree : 210  Radian : 3.665188    Cos(x) : -0.866075    Sin(x) : -0.499787    Precision : 0.005000
Degree : 240  Radian : 4.188787    Cos(x) : -0.499980    Sin(x) : -0.866124    Precision : 0.005000
Degree : 270  Radian : 4.712385    Cos(x) : 0.000190    Sin(x) : -0.999952    Precision : 0.005000
Degree : 300  Radian : 5.235983    Cos(x) : 0.499903    Sin(x) : -0.865674    Precision : 0.005000
Degree : 330  Radian : 5.759582    Cos(x) : 0.866068    Sin(x) : -0.500175    Precision : 0.005000
Degree : 360  Radian : 6.283180    Cos(x) : 1.000301    Sin(x) : 0.000077    Precision : 0.005000
```