University of Abdelhamid Mehri - Constantine 2

NTIC Faculty – First Year State Engineer, 2023–2024

# Algorithms and Data Structures (ADS1)

## Mini Project: Calculator with Taylor Series

**Due by 11 November 2023**


### Overview

In this project, the students will create an advanced calculator program in C. The objectives are to:

- Implement a user-friendly menu system with multiple options.
- Perform basic arithmetic operations and additional mathematical functions.
- Handle errors.

### Detailed description

- **Menu system**

  The calculator uses a menu system that offers the following options:

  ✓ Basic arithmetic operations: addition, subtraction, multiplication and division.

  ✓ Mathematical functions: power, factorial, sin and cos.

  ✓ Exit the program.

  This menu will be shown as long as the user does not choose to exit the program.

- **Operation/function implementation**

  ✓ The student should implement each operation/function without using predefined functions.

  ✓ To calculate sin(x) and cos(x), the students will use the following Taylor series approximation formulas:

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

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

  **Hint:** for the functions sin and cos, the user enters two numbers:

  * **x:** the number for which he wants to calculate the approximation of the function.
  * **N:** the number of terms in the approximation.

- **Error Handling**

  If the user enters invalid inputs, a clear warning message should be shown. For example, if he requests a division by zero, a possible error message is *"Error: Division by zero is not allowed"*.

**Project Submission**

- It is requested to create a folder named *FirstName_LastName_Group* including:

  ✓ A Microsoft Word file named 'Report' containing:

  * An algorithm for each mathematical function.
  * A flowchart for each mathematical function.
  * A study on the influence of the number of selected terms in the series on the accuracy of the approximation.

  ✓ A single C program, named 'calculator.c' allowing the user to choose an arithmetic operation or a mathematical function to calculate and providing the requested calculation result.

- Only the Google Drive link to this prepared folder should be submitted by sending an email to **ing.ads1.ntic@gmail.com**.