CS19003 Programming and Data Structures Lab

Assignment Set 3 **March 28, 2023**

INSTRUCTIONS

1. There are three assignments in this Lab. You need to submit each of the three assignments separately. It is advisable to submit each assignment as you complete it, rather than wait for the end to submit everything.
2. Your source program files must be named exactly as indicated (note that names are case sensitive)
3. Please write a header as indicated in the previous assignment

---

1. **[Filename: set3asg1.c]**

   Drawing Patterns. Consider the following patterns and their relation with the number N.

```
====
|<>|
====
```

Pattern for N = 1

```
========
|  <>  |
|<---->|
|  <>  |
========
```

Pattern for N = 2

```
============
|    <>    |
|  <---->  |
|<-------->|
|  <---->  |
|    <>    |
============
```

Pattern for N = 3

   Write a C program that reads a positive integer N (assume N < 20) and prints the corresponding pattern.

2. **[Filename: set3asg2.c]**

   Krishnamurthy Number. A Krishnamoorthy number is a number whose sum of the factorial of digits is equal to the number itself. For example, the number N = 145 is a Krishnamurthy number because the sum of the factorial of it's digits, 1! + 4! + 5! = 1 + 24 + 120 = 145, which is the same as N. Write a C program to read an integer N and print whether it is a Krishnamurthy number.

3. **[Filename: set3asg3.c]**

Series Summation. Computers often use Taylor series expansions for computing the values of mathematical functions. For example, consider the following Taylor series expansion:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} \ldots$$

Let us consider the n^{th} term: $\frac{x^n}{n!}$ in this series. It is not a good idea to compute x^n and $n!$ separately because both of these can be VERY large for large values of n (and computers can store numbers of a limited size). Instead, we can compute the n^{th} term in terms of the $(n-1)^{th}$ term as follows:

$$t_n = \frac{x^n}{n!} = \left(\frac{x}{n}\right)\frac{x^{n-1}}{(n-1)!} = \left(\frac{x}{n}\right) t_{n-1}$$

Write a C program which uses the same approach for finding the values of $sin\,(x)$ and $cos\,(x)$. Your program must read the value of x and k from the user. Then it must compute the values of these functions up to the k^{th} term and print the values computed using this method. For comparison, you must also print the values returned by the math library functions `sin()` and `cos()` for the same value of x.

The Taylor series expansions are given below:

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} \ldots$$

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} \ldots$$