**LAB # 13**

**Implementing Recursion**

The Tower of Hanoi or Towers of Hanoi is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape.

The objective of the puzzle is to move the entire stack to another rod, obeying the following rules:

* Only one disk may be moved at a time
* Each move consists of taking the upper disk from one of the rods and sliding it onto another rod, on top of the other disks that may already be present on that rod.
* No disk may be placed on top of a smaller disk.

*Fibonacci Series*

It is a simple numerical series that is the foundation for an incredible mathematical relationship behind phi.

Starting with 0 and 1, each new number in the series is simply the sum of the two before it. 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, . . .

The ratio of each successive pair of numbers in the series approximates phi (1.618. . .) , as 5 divided by 3 is 1.666..., and 8 divided by 5 is 1.60.

*Factorial*

The factorial is of a non-negative integer n, denoted by n!, is the product of all positive integers less than or equal to n.

For example,

The factorial operation is encountered in many different areas of mathematics, notably in combinatorics, algebra and mathematical analysis. Its most basic occurrence is the fact that there are n! ways to arrange n distinct objects into a sequence (i.e., permutations of a the set of objects).

# Time Boxing

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| **Activity Name** | **Activity Time** | **Total Time** |
| Login Systems + Setting up Visual Studio  Environment | 3 mints + 5 mints | 8 mints |
| Walk through Theory & Tasks | 60 mints | 60 mints |
| Implement Tasks | 80 mints | 80 mints |
| Evaluation Time | 30 mints | 30 mints |
|  | Total Duration | 178 mints |

# Objectives/Outcomes

This Lab exercise delivers the idea/concept of:

Creation and implementation of recursive methods

# Lab Tasks/Practical Work

1. Write a code which prints the following series:

2 4 8 16 - - - n

1. Write a program to calculate factorial of any given number using recursion.
2. Write a program to print Fibonacci series using recursion.