# **Tutorial Sheet 4**

## **Exercise 1**

**Compare the stack frame usage between the iterative and recursive definitions of the factorial function in the following code:**

// Iterative function  
long fact(int n) {  
 long ans;  
 for (ans = 1; n > 1; n--)  
 ans \*= n;  
 return ans;  
}  
// Recursive function  
long rfact(int n) {  
 long ans;  
 if (n > 0)  
 ans = n \* rfact(n - 1);  
 else  
 ans = 1;  
 return ans;  
}

**Exercise 2**

**Implement iterative and recursive versions of the Fibonacci sequence, and compare:**

* **Readability of the implementation.**
* **Stack frame usage.**

The Fibonacci sequence is a series of numbers where each number is the sum of the two preceding ones. It starts with 0 and 1. Mathematically, it is defined as:

* **F(0) = 0**
* **F(1) = 1**
* **F(n) = F(n − 1) + F(n − 2)** for **n > 1**

## **Exercise 3**

**Repeat Exercise 2, but this time implement iterative and recursive versions to compute the greatest common divisor (GCD) of two integers where x > y, and compare:**

* **Readability of the implementation.**
* **Stack frame usage.**

The greatest common divisor (GCD) of two integers x and y is the largest positive integer that divides both numbers without leaving a remainder. It can be calculated using Euclid's algorithm:

* **If y == 0, then GCD(x, y) = x**
* **Else, GCD(x, y) = GCD(y, x % y)**

## **Exercise 4**

**Implement the following functions using recursion:**

1. **A function that converts a decimal number into its base 16 (hexadecimal) representation.**
2. **A function that reverses a character string.**

## **Exercise 5**

**Write a function that expects a string with no numeric characters as input (passed by reference), and outputs the:**

* **Input validity.**
* **Input length.**
* **Input's first character.**
* **Input's most frequent character.**

**Finally, test the function inside a program that accepts a sequence of strings from an input stream.**

*Hint: Refer to scanf() to see how strings are passed by reference.*

## **Exercise 6**

**Use functions from <math.h> to write two functions that transform the real number x in-place (pass-by-reference) to:**

* **ceil(x)**
* **floor(x)**

**In addition, also attempt the above without resorting to <math.h> functions.**

## **Exercise 7**

**Write a program that exposes all of this lab's functions within a user menu. Structure the program's source code across multiple files.**