1. (5 points)
Write a recursive function to count the number of nodes in a binary tree $T$. You can assume that each node in the tree has the following structure:

```cpp
class Node {
    Node *left;
    Node *right;
}
```

Pointer $T$ points to the root of the binary tree. The function should have the interface:

```cpp
int CountNodes(Nodes *T)
```

Your answer can be in C++ syntax or in the form of a generic pseudocode.

2. (5 points)
Evaluate the series: $\sum_{i=0}^{\infty} \frac{1}{4^i} = ?$
Show all the steps while deriving the answer. Use the technique in section 1.2.3 (page 4, Weiss).

3. (5 points)
Use induction to prove:

$$\sum_{i=1}^{N} (2i - 1) = N^2$$

4. (5 points)
A ternary or 3-ary tree is one in which each internal node contains exactly three children. Prove that the number of the nodes in a complete ternary tree of level $D$ is:

$$\frac{3^{D+1} - 1}{2}.$$  

You can either use induction or provide a constructive proof by deriving the expression. (Recall that a $D$-level tree has exactly $D$ levels under the root.)

5. (6 points)
Rewrite the Tower of Hanoi algorithm presented in class WITHOUT tail recursion.