Informatics II, Spring 2023, Exercise 2

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Task 1: Code analysis

1.1 Analyse the algorithm `RecursiveAlgo` in the program `WhatdoIdo`. Explain what the algorithm does and what it returns if it is executed.

1.2 What is the time complexity of the algorithm. Assume that the input has length n.

Program: WhatDoIdo

```
RecursiveAlgo(str, s, e){
  if s==e then
  ⌞ return true
  if str[s] != str[e] then
  ⌞ return false
  if s < e + 1 then
  ⌊ return RecursiveAlgo(str, s + 1, e - 1)
  return true
}

main() {
  str = "racecar"
  n = strlen(str)
  res = false
  if n > 0 then
  ⌊   res = RecursiveAlgo(str, 0, n - 1)
  printf("%s", res?"true":"false")
}
```

Recursion

Task 2:

Analyse the function `printRec(int n)` and answer the following questions.

```
1 void printRec(int n)
2 {
3   if (n == 0)
4     return;
5
6   printf("%d", n%2);
7
8   printRec(n/2);
9 }
```

2.1 What is the output of the function call `printRec(20)`?

2.2 Write down the sequence of recursive function calls and the respective arguments for the call to `printRec(20)`?

2.3 To get the output `01010` for $n = 20$ using the function `printRec(n)`, which changes would you made in the function `printRec(n)`?

Task 3

The Tower of Hanoi is a game consisting of three pegs and a number of disks that can be placed on any of the pegs. No two disks have the same size. At the beginning all disks are stacked on the first peg in order of decreasing size (the smallest disk at the top). The goal of the game is to move all disks to the second peg. In each step only the top-most disk from a peg can be moved to the top of another peg. A large disk may never be placed on top of a smaller disk. The picture below illustrates the stacks for a game with seven disks after 4 moves.

```
Tower of Hanoi pegs after 4 moves:



    *******
   *********
  ***********                      *
 *************       *****        ***
```

Implement the solution of the Tower of Hanoi game with up to nine disks in C. It shall be possible to choose the number of disks and to display the stacks in a terminal after a given number of moves. Display the stacks for 8 disks after 213 moves.

Task 4

Write a recursive function that takes in an integer array of length n and recursively reduces the array by adding two neighbouring numbers. Each new array array is stacked on top of the previous array.

Thus, the output is a pyramid in which each element i is the sum of the left and right child of the element i in the level below as depicted below for the case $A = [5, 4, 6, 1, 3]$.