Algorithms and Data Structures

Summer Semester 2025

For discussion on Wednesday, May 21

1. (GTG Exercise R-4.8) Isabel has an interesting way of summing up the values in a sequence A of n integers, where n is a power of two. She creates a new sequence B of half the size of A and sets $B[i] = A[2i] + A[2i + 1]$, for $i = 0, 1, \ldots, (n/2) - 1$. If B has size 1, then she outputs $B[0]$. Otherwise, she replaces A with B, and repeats the process. What is the running time of her algorithm?

2. (GTG Exercise C-4.12) Give a recursive algorithm to compute the product of two positive integers, m and n, using only addition and subtraction.

3. Write a recursive function which solves the "Tower of Hanoi"-Puzzle.

   Hint: The input should be in the form of three lists, one for the source peg, one for the helper peg, and one for the destination peg, e.g.

   ```
   s = [4, 3, 2, 1]
   h = []
   d = []
   ```

   At the end of the puzzle, all the "disks", i.e., the numbers in the list, should have moved from the source peg to the destination peg.

   The move of a single "disk" from source to destination can be done via the following line of Python code:

   ```
   d.append(s.pop())
   ```