

TA Lab Week 1 – Fundamentals

The goal of this lab is to get familiar with algorithmic problem solving. Therefore, the first lab is focussed on “classics”, such as the coin change problem, the Fibonacci sequence and a balanced parenthesis checker.

Exercise 1 – Coin change

Given an array of integer numbers that represent the values of each coin, and given a target amount, determine the minimum number of coins needed to create this amount. At first, try to solve this problem with regular coins (i.e., 1,5,10,20,50), then try with different irregular coin values (e.g., 1,7,12, 38).

Example 1

Given coin values (1, 2, 5,10,20,50), with
Target amount = 7; solution = 2 coins (5,2)
Target amount = 150; solution = 3 coins (50,50,50)
Target amount = 28; solution = 4 coins (20,5,2,1)

Example 2

Given coin values (1,4,6), with:
Target amount = 7; solution = 2 coins (6,1)
Target amount = 9; solution = 3 coins (4,4,1)

Only the number of coins is required, the coins used are not important for this exercise.

Hint

Which amounts require the fewest coins?

Exercise 2 – Fibonacci Sequence

Given an integer number n , write two functions (one recursively and another iteratively) that output the n^{th} Fibonacci number. A Fibonacci sequence is a series of numbers which starts from 0 and 1 and continues with each number (*Fibonacci number*) being the sum of the two preceding numbers. What's the difference in space complexity between the iterative and recursive method?

Examples:

- Fibonacci(5) = 3
- Fibonacci(10) = 34

0	1	1	2	3	5	8	13	21	34	55
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1	2	3	4	5	6	7	8	9	10	11

Exercise 3 – Balanced parenthesis

Write an algorithm to check whether, given an input sequence of characters, the sequence contains balanced parenthesis. For example:

$((x*2)+(x-2)) - a[3] / a[10]$ is balanced
 $(((x*2)+(x-2)) - a[3] / a[10])$ is not balanced

Hint

Use a stack to keep track of relevant information.