Exercise 1 The coin-change problem consists of the following: Given a set of n coins $\{c_1, c_2, \ldots, c_n\}$, each of which is a positive integer, and an amount A, also a positive integer, find whether it is possible to get a change for A. Assume that $A \geq c_i$, $i = 1, \ldots, n$.

a) Consider the two following backtracking algorithms for this problem. Discuss the difference between the two approaches and write the first call.

Function $Coin1(A, i)$
  if $A = 0$ **then**
    return `true`
  if $A < 0$ or $i > n$ **then**
    return `false`
  if $Coin1(A - c_i, i + 1) =$ `true` **then**
    return `true`
  if $Coin1(A, i + 1) =$ `true` **then**
    return `true`
  return `false`

Function $Coin2(A, i)$
  if $A = 0$ **then**
    return `true`
  if $A < 0$ **then**
    return `false`
  for $j = i + 1, \ldots, n$ **do**
    if $Coin2(A - c_j, j) =$ `true` **then**
      return `true`
  return `false`

b) Draw the recursion call trees that describe the search process of the two algorithms above for the following input data: $c_1 = 3$, $c_2 = 5$, $c_3 = 7$ and $A = 12$; provide only information about the arguments of the recursion call at each node of the tree.

c) What is the best ordering of the coins with respect to the running time of both backtracking algorithms?

d) If you want to know the number of possible ways of making change, what needs to be modified in both algorithms?

e) If you want to know the least number of coins to make the change, what needs to be modified in both algorithms?

f) What is the time and space complexity of both approaches?

Exercise 2 Read the problem *Zé Manel is setting up a computer network* in EA2023_PL in Mooshak and solve them using a backtracking approach.