
Exercise 1

Exercise 1 a)

Read about *Dynamic Programming*. I recommend the book Algorithms by Dasgupta, Papadimitriou and Vazirani. If you follow my recommendation, you should read at least until the end of chapter 6.3, edit distance.

Exercise 1 b)

Walking up the stairs. How many steps can you take at a time? Let's say up to three! Then how many ways are there to walk up a staircase with n steps? Use dynamic programming to answer this question!

Exercise 1 c)

What conditions must be satisfied in order for dynamic programming to be applicable?

Exercise 1 d)

What conditions must be satisfied when enumerating plan alternatives using dynamic programming?

Exercise 2

The number of full binary rooted trees with $n+1$ leaf nodes is given by the n -th Catalan number

$$C_n = \sum_{k=0}^{n-1} C_k * C_{n-k-1}$$

where $C_0 = 1$ is the base case.

However, why is that? Find a proof-style explanation for the above recurrence relation!

Remarks:

- Full binary tree means each node has either 0 or 2 children.
- Rooted tree means there is a vertex that serves as the root.