Computational Thinking (CO2412): Tutorial – Calendar Week 44

Algorithm Design

M. Horsch, O. Kerr, School of Psychology and Computer Science

2.1. Maximum sublist product problem

In the lecture, we discussed the maximum sublist sum problem.[1] Now consider the maximum sublist *product* problem, defined in the same way, but aiming at the sublist with the maximum possible product of its elements:

The input (argument) consists of a list $\mathbf{x} = [x_0, x_1, \ldots, x_{n-1}]$ of floating-point numbers x_k with $0 \leq k < n$. The output (return value) is the sublist $\mathbf{x}[i:j]$, with $0 \leq i \leq j \leq n$, for which the product $x_i \cdot x_{i+1} \cdot \ldots \cdot x_{j-1}$ becomes as large as possible.

a) Develop and implement an algorithm solving this problem.
b) Did you use any of the design strategies[2] from the lecture?
c) Validate your code by applying it to test cases that you can also solve by hand.[3]
d) What asymptotic time efficiency do you obtain by analysing the algorithm?

Remark: The product over the empty sublist $\mathbf{x}[0:0]$, or generally $\mathbf{x}[i:i]$, is here defined to be 1. Therefore, it is never correct to return a sublist with a product smaller than one; instead, an empty sublist should be returned.

Submission deadline: 20th November 2021; discussion planned for 2nd December 2021. Group work by up to four people is welcome.

[1] See also `https://home.bawue.de/~horsch/teaching/co2412/material/maximum-sublist.ipynb`.
[2] "No" is perfectly good if you did not.
[3] For example, with $\mathbf{x} = [1.5, -2, -2, -3, 0.5, 3, -0.25]$, the sublist $\mathbf{x}[2:6] = [-2, -3, 0.5, 3]$ should be returned, since the product of its elements is 9, greater than that of any other sublist of $\mathbf{x}$.