Homework 2.
Due: Thursday, January 24, 2019 before 8am EDT.

Suplementary material: watch lectures of prof. Vigoda (the link is available on Canvas) DC1, DC2 and DC3.

Suggested reading: Chapter 2 of the book. Check the **Master Theorem** in page 54. We assume you know the content of section 2.3.

DC Homework

Problem 1 (Maximum sum)

Let $A = \{a_1, a_2, \ldots, a_n\}$ be a sequence of integer numbers.

(a) Give an algorithm to find the maximum integer in A.

(b) Give an algorithm to find the two consecutive elements on A with maximum sum.

(c) Given a natural number $k \leq n$, design an $O(n)$ algorithm to find k consecutive elements in A with maximum sum.

Problem 2 (2.16 in DPV: finding x in an infinite array)

You are given an infinite array $A[.]$ in which the first n entries contain different integers in sorted order and the rest are filled with ∞. You are not given the value of n. Describe an algorithm that takes as an input an integer x and finds a position in the array containing x, if such position exists, in $O(\log(n))$ time.

Problem 3 (Finding the k^{th} smallest element in the union of two sorted lists)

Describe an algorithm that takes as input two sorted lists of length n and m and an integer k and outputs the k^{th} smallest element in their union. You can assume both lists contain integers and all entries are different.

Problem 4 (2.17 in DPV: fixed point)

Given a sorted array of integers $A = \{a_1, a_2, \ldots, a_n\}$, you want to find out whether there is an index i for which $a_i = i$. Give a divide and conquer algorithm to solve this problems that runs in time $O(\log(n))$.