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Homework 04
METU CENG310 Fall 2021-2022
Data Structures and Algorithms with Python

Start Date: November 26th, 2021
Due Date: December 5th, 2021

1 Finding the Peak

Task-1: In this exercise, you are expected to develop a pseudo code[1] that uses recursion for the problem described below, and determine the complexity of your algorithm. Your algorithm has to be efficient, solutions with growth rate function other than $O(nlogn)$ will not be accepted.

Suppose you are given a sequence (i.e., array) of size n with each entry holding a *distinct* number. For some index value p between 0 and $n - 1$, the values in the array entries increase up to position p and then decrease on the remainder of the way until position $n - 1$.

An example of such array would be [12,17,38,54,55,69,68,44,39,19,14,7] where p and n could be 5 and 12, respectively.

Develop an algorithm to find the peak entry p without having to read the entire array. The algorithm should read as few entries of the array as possible. Also note that p could be 0 or $n - 1$, so your algorithm should be able to handle these corner cases as well.

Hint: There will two slopes (trends) of the array values: An increasing one followed by another decreasing one. Each of these trends can be considered as monotonically increasing or decreasing functions. So when we pick up value in the array, we can easily understand on which trend that value resides by checking whether the previous and next values are larger or smaller than the picked-up value. Depending on which trend the picked-up value is on, the direction of the search can be determined: Left or right half of the search input. The base condition would be met when both previous and next items on the array are smaller than the picked-up value (i.e., when we picked up the peak value.)

2 Instructions

Pertaining to the answers of this homework, **correct typing** of superscripts (e.g., n^2) and subscripts (e.g., n_0) **matters**. Due to this reason, this homework may be done on paper and **returned as a PDF** file containing the answer sheet captures (photos, scanned files). If you would like you can use MS Word or Latex, but your deliverable has to be a **single** PDF file. PDF file should be created so that the answers appears in the same order as the questions shown in the homework assignment document.

A Homework-04 page will be generated soon after the start date of this homework. All deliveries should be done over METUClass. Please also be aware of the late penalties (Please check the Announcements – Homework and Assignment Policy in METUClass if you have not already done so.). Should you have any questions pertaining to homework tasks, please ask them in advance (not on the due date) for your own convenience.

If the questions that are marked as **Bonus** are answered, they are accounted as additional score to your homework grading. So that, by answering these questions, taken into account that all other questions are answered correctly, you can get scores higher than full score. No matter how much bonus score you get throughout the semester, the total grade point that you will get from homework assignments cannot exceed 15% of your total grade (please recall that homework assignments comprise 15% of your total grade).

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[1] https://users.csc.calpoly.edu/~jdalbey/SWE/pdl_std.html