Lab Assignment 3

CS 302 – Advanced Data Structures and File Processing

Spring 2020

This lab is supposed to be a lab for two weeks. That is due to the amount of work needed to properly implement it. Please take this into account when planning your time.

Problem

You are given an array of non-negative integers, where different integers may have different numbers of digits, but the total number of digits over all the integers in the array is n. Show how to sort the array in $\mathcal{O}(n)$ time[1].

To implement this problem, we represent a single integer as array of bytes. Each byte represents a digit (base 128). The byte with index 0 in the array represents the least significant byte. That is, if A has length 3, $A[0] = 6$, $A[1] = 7$, and $A[2] = 8$, then A represents the number $6 \cdot 128^0 + 7 \cdot 128^1 + 8 \cdot 128^2$.

Implementation

You are given a file *Lab3.java* (which you can download from canvas). The file contains a class `Lab3` with a function `problem`. Implement your solutions in this function. **Do not make any changes outside of that function (e. g. by adding helper functions); such changes will be undone.** Do not output anything to the terminal.

The program already implemented in the file `Lab3.java` randomly generates test cases. The seed of the random number generator is set to ensure the same test cases whenever to program is executed. Note that the purpose of the tests is for you to avoid major mistakes. **Passing all given tests *does not* imply that your algorithm is correct, especially that is has the expected runtime.**

Submission

For your submission, upload the file *Lab3.java* with your implement to canvas.

This is an individual assignment. Therefore, a submission is required from each student.

Deadline: Sunday, May 10, 11:59 p.m.

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[1] The algorithm you are expected to implement, strictly speaking, runs in $\mathcal{O}(b \cdot n)$ time, where b is the base for counting sort. However, since we set $b = 128$, b is a constant and the runtime is therefore $\mathcal{O}(n)$.