Homework 4

Strukture podataka i algoritmi I - I053

Homework instructions

The submission deadline is **November 15, 2023** at 9:00. You can type the tasks in LaTeX or write them by hand and scan them. Programming tasks should be submitted as .cpp files. All files need to be submitted to Teams. You can achieve a maximum of 100 points.

Task 1 (35 pts.)**.** Implement the Radix sort algorithm. What are the time and space complexities of this algorithm? Give an example where the algorithm is slow.

Task 2 (35 pts.)**.** Implement the Counting sort algorithm. What are the time and space complexities of this algorithm? Give an example where the algorithm is slow.

Task 3 (10 + 10 + 10 pts.)**.** Read chapter 4.3 of CLRS [1] to get an intuition for solving recurrences using the substitution method.
Use the substitution method to solve the following recurrences:

a) Show that the solution to $T(n) = T(n-1) + n$ is $O(n^2)$.

b) Show that the solution to $T(n) = T(n-1) + T(n-2) + c$ is $O(2^n)$, for some $c > 0$.

c) Show that the solution to $T(n) = T\left(\lceil \frac{n}{2} \rceil\right) + 1$ is $O(\log n)$.

Literatura

[1] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*. MIT Press, 3 edition, 2009.