

Python for data scientists SP1 2021/2022

Assignment 6

There are two problems in this assignment.

You can either submit:

- One Python file for Problem 1 (solutionA6_P1.py)
- One Python file for Problem 2 (solutionA6_P2.py)
- A PDF file for the explanation part (if any).

Or a Jupyter Notebook with clearly marked solutions for which problems/which tasks and any explanation.

Note: If you add any details or make any assumptions, please clearly describe in your submission.

Problem 1

Collaborative online editors are widely used now (Google Docs, Overleaf, Collab, Deepnote, CKEditor5). The function of merging trees is often behind such collaborative tools. Such function is often used to merge changes that are made by different users working with the same file from different devices and to show those changes to everyone working on that same file across all that different devices. For an example of a research paper describing the use of such function for collaborative coding, please look at [diffTree: Robust Collaborative Coding using Tree-Merge](#).

For this problem, you will implement a much-simplified tasks:

- merging k number of binary search trees into one with certain operation. Assume that the keys of the nodes are integers. The operations supported are those of simple arithmetic operations (addition and multiplication). The input trees are of the same shape.
- Join two red-black trees (given two trees $T1$ and $T2$ and a key x , we return a new tree $T = T1 \cup \{x\} \cup T2$, with n be the total number of nodes in $T1$ and $T2$).

Problem 2

Implement the functions needed to accomplished deletion of a node from a red-black tree in Python. You can see the explanation and the pseudo-code in Section 13.4 of the book Introduction to Algorithms. Show that the deletion functionality runs well for all intended cases when the functions are used as independent functions, as well as when the functions are used as methods of the class `RB_tree` (as defined in Lecture 11). To show that those functions/methods work, build a red-black tree, populate that with your own data, and use it to show that deletion works. Describe what you observed.

If you use any assumption or use different ways to build the trees etc. compared to what we discussed in the class, please clearly describe that. Creativity is encouraged here.

