Homework Assignment 7

Due Date: April 15, 2022, 23:59

Exercise 1.

(i) Describe how to determine the minimum and the maximum of the elements in an AVL tree.

(ii) Given a binary tree with labelled vertices describe how to check, if the tree is an AVL tree.

total points: 8

Exercise 2. Consider the following retrieval operations on AVL trees.

(i) Describe an operator that exploits a *depth-first search* through the tree and returns the elements in the order of this search.

(ii) Define an operator that exploits a *breadth-first search* through the tree and returns the elements in the order of this search.

(iii) Describe how to determine the median of the elements in an AVL tree.

(iv) Use one of the operators in (i) or (ii) to define a function *range* on AVL trees, which for arguments x and y returns those elements in the tree that satisfy $x \leq e \leq y$.

total points: 10

Exercise 3.

(i) Prove that the total number of comparisons in a search in an (a, b)-tree with n nodes is bounded by $\lceil \log b \rceil (2 + \log_a((n-1)/2))$.

(ii) Assuming $b \leq 2a$ show that the number in (i) is in $O(\log b) + O(\log n)$.

total points: 12

Exercise 4.

(i) Implement a TRIE data structure. To test your implementation take a text of your choice with a length of around one page and build a dictionary with the words in the text.

(ii) Implement a procedure, which in case that a search for a word in the dictionary fails return suggested alternatives:

(a) Return words from the dictionary that extend the given word (not found in the dictionary) by one symbol.

(b) Return words from the dictionary that are prefixes of the given word (not found in the dictionary) with one or two symbols less.

(c) Return words from the dictionary that differ from the given word (not found in the dictionary) by exactly one symbol.

total points: 20