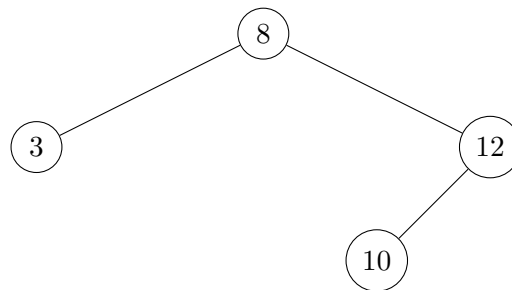


Algorithms and Data Structures Summer Term 2021 Exercise Sheet 6

Exercise 1: Binary Search Trees I

Consider the following binary search tree.



1. Give all sequences of `insert(key)` operations that generate the tree.
2. Draw the tree after the following sequence of operations: `insert(6)`, `insert(5)`, `remove(3)`.

Exercise 2: Binary Search Trees II

- (a) Describe a function that takes a binary search tree B and a key x as input and generates the following output:
- If there is an element v in B with $v.key = x$, return v .
 - Otherwise, return the pair (u, w) where u is the tree element with the next smaller key and w is the element with the next larger key. It should be $u = \text{None}$ if x is smaller than any key in the tree and $w = \text{None}$ if x is larger than any key in the tree.

For your description you can use pseudo code or a sufficiently detailed description in English.
Analyze the runtime of your function.

- (b) Describe a function which returns the depth of a binary search tree and analyze the runtime.
- (c) Describe a function that for a given binary search tree with n nodes and a given $k \leq n$ returns a list with the k smallest keys from the tree. Analyze the runtime.