Algorithms and Data Structures  
Summer Term 2019  
Sample Solution Exercise Sheet 7

Exercise 1: Binary Search Trees I

Consider the following binary search tree

```
8
 /   \
3     12
   /   \
  10
```

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)`.

Sample Solution

1. (i) `insert(8), insert(3), insert(12), insert(10)`
   (ii) `insert(8), insert(12), insert(3), insert(10)`
   (iii) `insert(8), insert(12), insert(10), insert(3)`

2. After `insert(6)` and `insert(5)`:

```
8
 /   \
3     12
   /   \
  10
   /   \
  6
 /   \
5
```

After `remove(3)`:
Exercise 2: Binary Search Trees II

Write an algorithm that takes as input a node of a binary search tree and outputs its successor in the tree (i.e., the node with the next larger key). What is the runtime of the algorithm?

Sample Solution

```python
if u.right ≠ None then
    current = u.right
    while current.left ≠ None do
        current = current.left
    return current
else
    current = u
    parent = current.parent
    while parent ≠ None and parent.left ≠ current do
        current = parent
        parent = current.parent
    return parent
```

Runtime: $O(\text{depth})$