COMP3506/7505: Special Exercise Set 9

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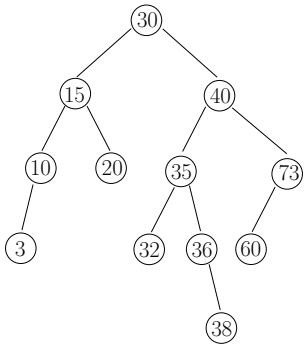
Problem 1. Consider the AVL-tree below:



Show the AVL-tree after inserting 37.

Problem 2. Show the AVL-tree after inserting 1 to the tree in Problem 1.

Problem 3. Show the AVL-tree after deleting 60 from the tree in Problem 1.

Problem 4. Show the AVL-tree after deleting 15 from the tree in Problem 1.

Problem 5. Recall that in the dictionary search problem, we want to preprocess a set S of n integers into a data structure to answer the following queries efficiently: given an integer q, determine whether $q \in S$. Describe a data structure that satisfies all the following requirements:

- It consumes $O(n)$ space.
- It answers each query in $O(1)$ expected time, and simultaneously, $O(\log n)$ worst-case time.

Problem 6. Let S be a dynamic set of integers. Let $n = |S|$. Describe a data structure on S to support the following operations on S with the required performance guarantees:

- Insert a new element to S in $O(\log n)$ time.
- Delete an element from S in $O(\log n)$ time.
- Report the k smallest elements of S in $O(k)$ time, for any k satisfying $1 \leq k \leq n$.

Your structure must consume $O(n)$ space at all times.