CSCI2100: Special Exercise Set 10

Prepared by Yufei Tao

**Problem 1.** Consider the AVL-tree below:

```
   30
  /  /
15  40
/  /  \
10 20 35
/   /   \
3   32 60
     /   \
    36   73
```

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.** 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.