These are some review questions to test your understanding of the material. Some of these questions may appear on an exam.

1 Splay Tree

Please see the rules for splaying on page 1.

1.1 Define Splay tree.

1.2 Show the result of inserting 2, 1, 4, 5, 9, 3, 6, 7 into an empty Splay tree (show the tree at the end of each insertion).

1.3 Show the result of deleting a given node in the tree.

1.4 What does the following statement mean?

   “a splay tree has \( O(n \lg n) \) amortized performance over sequences of insert, remove, and find operations”

   In particular, what does ‘\( n \)’ mean?

1.5 Explain, in English, how to insert a new element in a splay tree. Be sure to cover the situation in which the element is already in the tree.

1.6 Explain, in English, how to remove an element from a splay tree. Be sure to cover the situation in which the element to be removed is not in the tree.

1.7 Explain, in English, how to find an element in a splay tree. Be sure to cover the situation in which the element is not in the tree.

Splaying Rules

To splay the node \( X \):

1. If \( X \) is root, do nothing.

2. If \( X \) has no grandparent (i.e., the parent of \( X \) is root), rotate \( X \) about its parent. This will make \( X \) be root.

3. If \( X \) has a grandparent:

   (a) If \( X \) and its parent are both left-children or both right-children, rotate the parent about the grandparent, then rotate \( X \) about its parent.

   (b) If \( X \) and its parent are opposite-type children (one is left, the other is right) rotate \( X \) about its parent, then rotate \( X \) about its new parent (i.e., its former grandparent).