CS3345.004 Programing Assignment 1 (10%)

Due 11:59pm, March 23, 2023

Implementation of Splay Trees

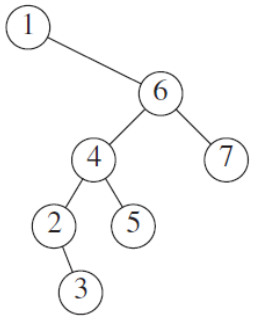
A. (**100%**) Write a program to implement Splay Tree data structure that uses bottom-up splaying as described in the class.

a. With input *N* (an integer), inserting nodes 1, 2, 3, …, *N* into an initially empty tree.

b. Implement insertion, deletion, and search operations. For each operation, with input *k* (an integer), your program completes the operation (insert *k*, delete *k*, or search *k*) accordingly.

c. After each operation, print out each node (an integer) of the Splay Tree in a preorder traversal. For a node *k*, print out *k*L if k is the left child of its parent or *k*R if *k* is the right child of its parent. If *k* is the root, print out *k*RT.

E.g., for the following Splay Tree, the preorder traversal is 1RT, 6R, 4L, 2L, 3R, 5R, 7R.



Perform experimental studies with different *N* followed by a series of operations (insert, delete, or search).

B. (**Extra 15%)** The standard splaying (implemented in A.) requires two passes, one downward pass to find the node *k* to splay, followed by an upward pass to splay the node *k*. Design an algorithm (pseudocode) for splaying and searching for *k* in one downward pass. Describe how to perform the zig-zig, zig-zag, and zig steps.

Programming assignments grading:

Code Development 30% (compile w/o error)
Program Execution 20% (run successfully)
Program Design 25% (conform to spec)
Documentation 15% (program, comments)
Coding Style 10% (clear, efficient)

SUBMISSION:

1. A copy of the final working source code with comments and documentation.
2. A screenshot showing multiple keyboard inputs and displayed outputs from the console.
3. Submit your answers, clearly marked with your name, through eLearning by the due date.
4. Plagiarizing assignment answers obtained from the internet or AI chatbots is not permitted.
5. **No late assignment submission will be accepted!**

Yi Zhao