

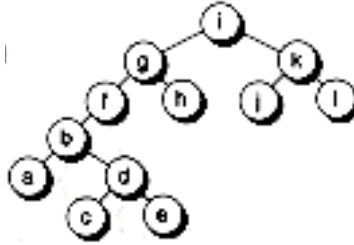
Data Structures

Fall 2019, Homework #3

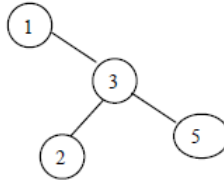
Date: Nov. 25, 2019

1. (25 pts) *Top down splay tree*

Draw the splay tree after a $find(c)$ operation is performed in a top-down splay tree. Show your work in detail.



2. (25 pts) Given a binary search tree T consisting of keys $1, 2, \dots, n$, let $splay(k)$ be an operation performing a splay on key k . Design a sequence of (bottom-up) splay operations on T so that the resulting tree is a chain of right children with 1 the root node, i.e., a right skewed binary tree with root 1. Apply your solution to the following example.



3. (25 pts) Consider a stack with operations $push$ and $multi-pop(k)$ as discussed in class. Use the potential method to show that starting from an empty stack, a sequence of n operations of push and $multi-pop(k)$ takes at most $2n$ time.
4. (25 pts) Let T and U be 2-4 trees storing n and m items, respectively, such that all the items in T have keys less than the keys of all the items in U . Describe an $O(\log n + \log m)$ time method for joining T and U into a single 2-4 tree that stores all the items in T and U (destroying the old versions of T and U). You must, of course, demonstrate that your method is correct.