A screenshot of a computer

AI-generated content may be incorrect.**Assignment: Drawing and Analyzing Operations on Leftist Trees**

A diagram of a diagram

AI-generated content may be incorrect.Start off with an empty left heap tree.

With every sequential insert, it almost acts like the node is a “new tree” and you want to merge it with the existing tree.

A screenshot of a graph

AI-generated content may be incorrect.When inserting (10), since it is the node with the lesser key, the (15) will become its left child.

When inserting (20), it just becomes the root’s (10) right child

When inserting (8), since it is the lesser key of both “root” nodes. The (10) is becomes the (8)’s right child, but to meet the leftist tree property, we need to swap the (10) from the right to the left child

A diagram of a diagram

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With inserting the (12), there is no right child, so we can just insert it in there.

A diagram of a diagram

AI-generated content may be incorrect.When inserting (17), we take the right sub-tree of (8) and merge it with (17). This makes a subtree of (12) with a left child of (17).

That subtree will become the new right subtree of (8)

A diagram of a diagram

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Inserting (25), we take the right subtree of (8) and to a recursive merge.

Taking the subtree, we can just insert (25) into the right child of (12).

From there, we can take the merged subtree, and append it to the right child of the root (8).

A screenshot of a computer

AI-generated content may be incorrect.When deleting the root, we take both right and left subtrees and merge those 2 together.

A diagram of a game

AI-generated content may be incorrect.

When merging two trees, we take the right subtree of the tree with the lesser key value (8) and merge that with the 2nd tree.

Since the (10) tree has the smaller key value, that will be the root of the new tree.

Thus we, merge (20) with the tree of root (12). Which we merge (20) with the right subtree of (12).

We bring all those merges back and reassess the level.

A diagram of a diagram

AI-generated content may be incorrect.

Everything looks fine until we append the right subtree back to the main tree. Since the levels are off, we need to switch the right and left child to maintain a leftist tree.

A diagram of a diagram

AI-generated content may be incorrect.

Deleting the root a second time is much simpler than the first time.

We take the right subtree of (12) and merge it with (15).

Since (15) is the lesser key value, we make the (20) the left child of (15)

Assessing the levels, there is no issue, so we can move to the 3rd deletion.

A diagram of a game

AI-generated content may be incorrect.

The 3rd deletion is the simplest, as (15) is the lesser key value and has an open right child, we can just append (17) to the right child of (15)

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A diagram of a diagram

AI-generated content may be incorrect.When merging 2 trees, we need to assess which one will be the new root, and that new root will be the tree with (8). We need to merge the right subtree of (8) tree with the 2nd tree.

A diagram of a root system

AI-generated content may be incorrect.We need to recursively merge as the root of the 2nd tree is smaller than (17). We merge the (17) with the right child of (10).

Bringing it back, we need to append the (17) as the right child, and everything still seems balanced, so no extra actions needed.

Once, we append the merged right subtree back to the main tree, there are issues with balance, so we do need to swap the left and right child to restore leftist tree property.

The structure and height of the tree really change with insertions, deletions, and merging for a leftist tree. There are very specific rules, and technically it is all “merging” operations. There will definitely be more time complexity with leftist trees as there are more technical operations needed to keep a leftist balance after every operation. Especially with merging recursions.

A diagram of a group of circles with arrows and arrows

AI-generated content may be incorrect.