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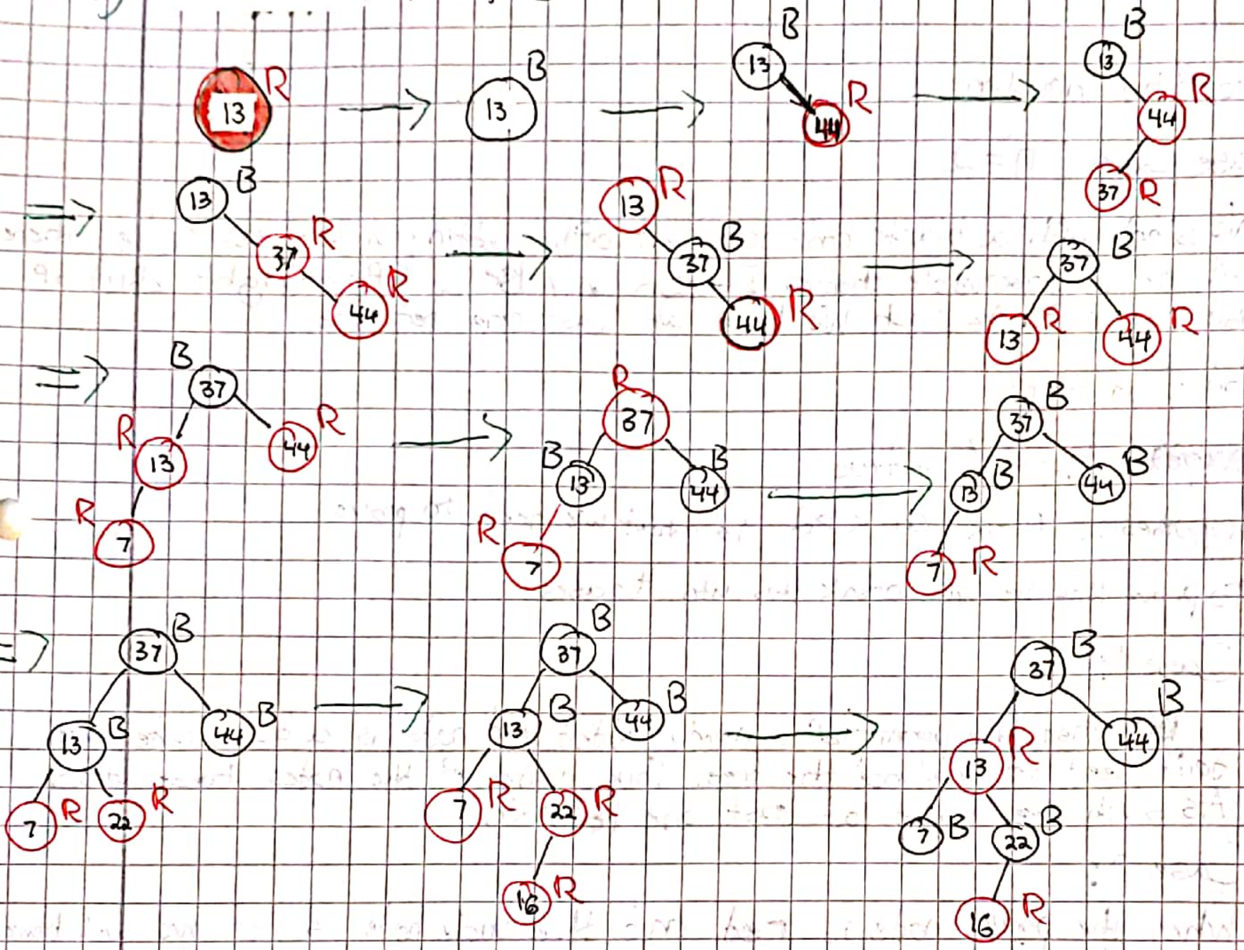
Mat # 30001249

Algorithms & Data Structures
Assignment #8

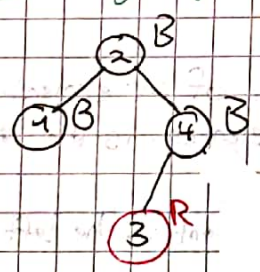
Problem 8.1)

A) [13, 44, 37, 7, 22, 16]

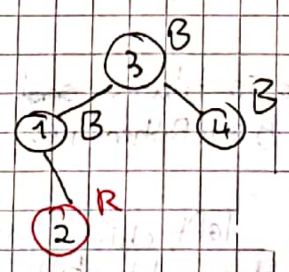


B) [1, 2, 3, 4]

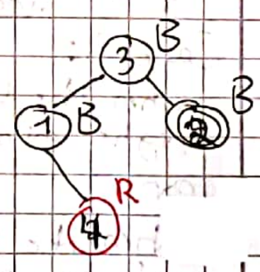
1) [2, 1, 4, 3]



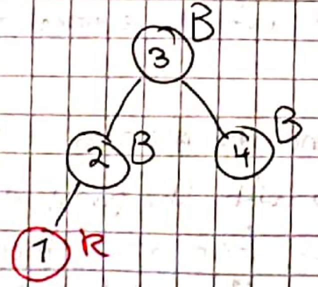
2) [3, 1, 4, 2]



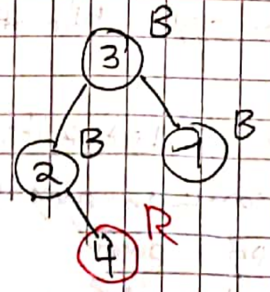
3) [3, 1, 2, 4]



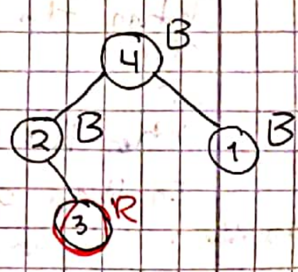
4) [3, 2, 4, 1]



5) [3, 2, 1, 4]



6) [4, 2, 1, 3]



c) Prove that if $n > 1$, the tree contains at least one red node

So by default according to property 2 the root will always be black. So 1 noded Red Black Tree is always black. But when $n > 1$, after we add a new node it will be inserted as Red no matter which side. If we add a new node to this; when added to the empty side nothing changes, however, when added to the same side. we violate a few properties. Property 4 will have been violated, and if we change it to black we violate Property 5. Thus we must change the nodes positions. After this change we are violating property 2, so we must change colors too. Thus the root is Black once again and the leaves return to red.

After adding more nodes (below this level) it will be identical to the above case. With the only exception being that they are in a different subtree.

When assigned to the left, the lowest level on the right won't change from red. When we assign to the right it works the same on the left.

Thus, proven □