QUESTION #11

RED - BLACK TREE

How to insert a value in a red - black tree.

TREES

Solution

If Tree is a non-empty tree :

1. Use the BST insert algorithm to add K to the tree
2. Color the node containing K red
3. Restore red-black tree properties(if necessary)

To restore the violated property, we use:

- 3.1. Recolouring
- 3.2. Rotation(Left, Right, Double)

Two cases based on color of Uncle(sibling of parent node)

- 3.3.1. If Uncle is red, we do recoloring
- 3.3.2. If Uncle is black, we do rotation and/or recoloring

Solution

Now, Let x be the newly inserted node

If x's Uncle is red and x's parent is not black

1.Change the color of the parent and uncle as black
2.Change color of grandparent as red
3. Make x's grandparent as the new x.
4. Repeat above steps on new x.

NERVING INTO
DATA STRUCTURES

Solution

If x's uncle is black and x's parent is not black then there can be four configurations for x

1. Left Left Case(parent is left child of grand parent and x is left child of parent)
   1.1 Right rotate grandparent
   1.2 Swap colors of parent and grandparent
2. Left Right Case(parent is left child of grandparent and x is right child of parent)
   2.1 Left rotate parent
   2.2 Apply Left Left Case(1)
3. Right Right Case (parent is right child of grand parent and x is right child of parent)
   3.1 Left rotate grandparent
   3.2 Swap colors of parent and grandparent
4. Right Left Case (parent is right child of grand parent and x is left child of parent)
   4.1 Right rotate parent
   4.2 Apply Right Right Case(3)

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