Red Black Tree Deletion (cont)

Terminal Cases - Case 1

1. Double black node is a root node

![Diagram showing red black tree before and after deletion]
Red Black Tree Deletion (cont)

Terminal Cases - Case 2

1. Sibling is black node
2. Sibling children are black nodes
3. Parent is red node

![Diagram of red black tree deletion case 2]
Red Black Tree Deletion (cont)

Terminal Cases - Case 3

1. Sibling is black node
2. Sibling right child is red node
3. Parent is black node
Red Black Tree Deletion (cont)

Non Terminal Cases - Case 4

1. Sibling is red node
2. Sibling children are black nodes
3. Parent is black node
Red Black Tree Deletion (cont)

Non Terminal Cases - Case 5

1. Sibling is black node
2. Sibling children are black nodes
3. Parent is black node
Red Black Tree Deletion (cont)

Non Terminal Cases - Case 6

1. Sibling is black node
2. Sibling left child is red node
3. Parent is black node
Red Black Tree Deletion (cont)

Case 3 Vs Case 6 conflict

If a) Sibling is black node
b) Sibling both children are red node
c) Parent is black node

then do we need to choose Case 3 or Case 6?

Choose Case 3, as it is terminal case by ignoring left child’s color. Look at example 2.
Example 1: Delete the node 10 from the given tree

Given Tree:
Red Black Tree Deletion (cont)

Example 1: Delete the node 10 from the given tree

Apply BST deletion principle from the base case:
Example 1: Delete the node 10 from the given tree

Apply Case 2 Fix:
Red Black Tree Deletion (cont)

Example 2: Delete the node 5 from the given tree

Given Tree:
Red Black Tree Deletion (cont)

Example 2: Delete the node 5 from the given tree

Apply BST deletion principle from the base case:
Red Black Tree Deletion (cont)

Example 2: Delete the node 5 from the given tree

Apply Case 3 fix:
Red Black Tree Deletion (cont)

Example 3: Delete the node 5 from the given tree

Given Tree:
Example 3: Delete the node 5 from the given tree

Apply BST deletion principle from the base case:
Example 3: Delete the node 5 from the given tree

Apply Case 5 fix:
Red Black Tree Deletion (cont)

Example 3: Delete the node 5 from the given tree

Apply Case 1 fix:
Red Black Tree Deletion (cont)

Example 4: Delete the node 3 from the given tree

Given Tree:
Red Black Tree Deletion (cont)

Example 4: Delete the node 3 from the given tree

Apply BST deletion principle from the base case:
Red Black Tree Deletion (cont)

Example 4: Delete the node 3 from the given tree

Apply Case 5 fix:
Red Black Tree Deletion (cont)

Example 4: Delete the node 3 from the given tree

Apply Case 6 fix:
Red Black Tree Deletion (cont)

Example 4: Delete the node 3 from the given tree

Apply Case 3 fix:
Red Black Tree Deletion (cont)

Example 5: Delete the node 10 from the given tree

Given Tree:
Red Black Tree Deletion (cont)

Example 5: Delete the node 10 from the given tree

Apply BST deletion principle from the base case:
Red Black Tree Deletion (cont)

Example 5: Delete the node 10 from the given tree

Apply Case 4 fix:
Red Black Tree Deletion (cont)

Example 5: Delete the node 10 from the given tree

Apply Case 2 fix:
Class activity: Post your solution in slack to get attendance points

1. Delete all the node in ascending order from the original tree given to you in Example 5
2. Delete all the node in descending order from the original tree given to you in Example 5