

Sanjeer Kumar Singh  
Lab 8 - Prgm 7  
BS

13M18CS013  
classmate

Date \_\_\_\_\_  
Page \_\_\_\_\_

191

## Red Black Tree

### Insertion

```
Node * BSTinsert (Node * root, Node * pt) {  
    if (root == NULL)  
        return pt;  
    if (pt->data < root->data) {  
        root->left = BSTinsert (root->left, pt);  
        root->left->parent = root;  
    }  
    else if (pt->data > root->data) {  
        root->right = BSTinsert (root->right, pt);  
        root->right->parent = root;  
    }  
    return root;  
}
```

```
void RBTree :: fix_violation (Node * &root, Node * &pt)  
{  
    Node * parent-pt = NULL;  
    Node * grand-parent-pt = NULL;  
    while ( (pt != root) && (pt->Color != Black) &&  
            (pt->parent->Color == Red) ) {  
        parent-pt = pt->parent;  
        grand-parent-pt = pt->parent->parent;  
        if (parent-pt == grand-parent-pt->left) {  
            Node * uncle-pt uncle-pt = grand-parent-pt->right;  
            if (uncle-pt != NULL && uncle-pt->Color == Red)  
                grand-parent-pt->Color = Red;  
        }  
    }
```

18-11-20

Sangeet Kumar Singh  
13M18CS093  
BS

Pg 2

classmate

Date

Page

```
parent-pt → Color = Black;
uncle-pt → Color = black;
pt = grand-parent-pt; }
else {
    if (pt == parent-pt → right) {
        rotateLeft (root, parent-pt);
        pt = parent-pt;
        parent-pt = pt → parent; }
    rotateRight (root, grandparent-pt);
    Swap (parent-pt → Color, grand-parent-pt → Color);
    pt = parent-pt; } }
else {
    node * uncle-pt = grand-parent-pt → left;
    if ((uncle-pt != null) && (uncle-pt → Color == Red))
    {
        grand-parent-pt → Color = Red;
        parent-pt → Color = Black;
        uncle-pt → Color = Black;
        pt = grand-parent-pt; }
    else {
        if (pt == parent-pt → left) {
            rotateRight (root, parent-pt);
            pt = parent-pt;
            parent-pt = pt → parent; }
        rotateLeft (root, grand-parent-pt);
        Swap (parent-pt → Color, grand-parent-pt → Color);
        pt = parent-pt; } }
    root → Color = Black;
}
```