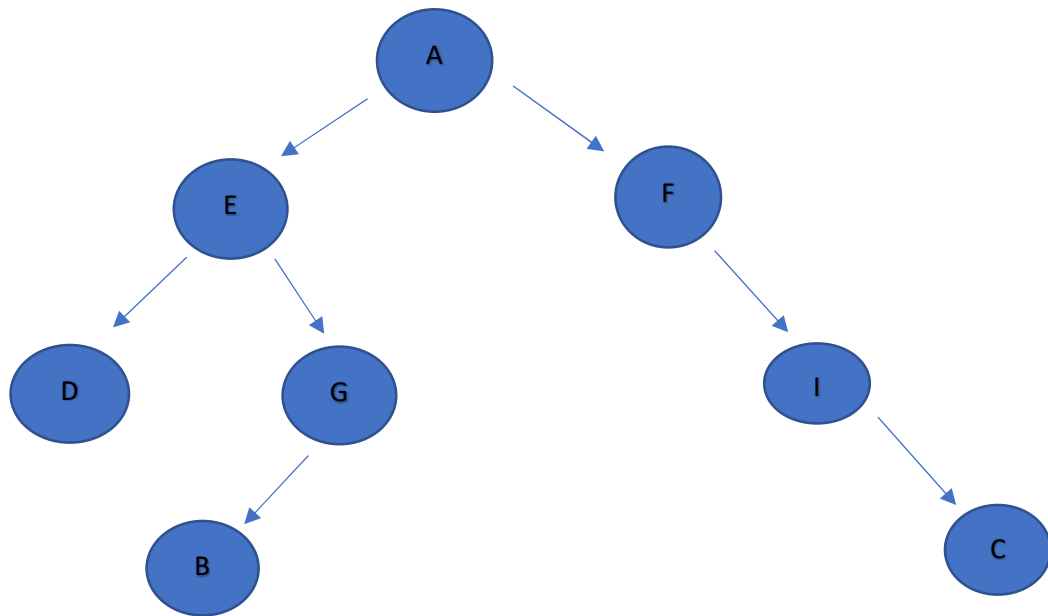Natnael Tsige

Homework 2

CPT – S 233

10/20/2020

1.

2. Step 1:

Empty node:
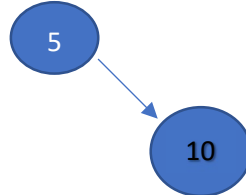
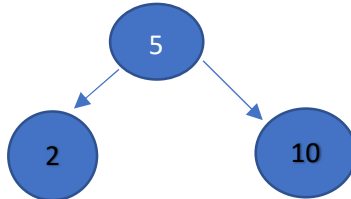Step 2:   Insert 5:   5

Step 3:   Insert 10: 10 > 5, thus 10 goes to the right child node
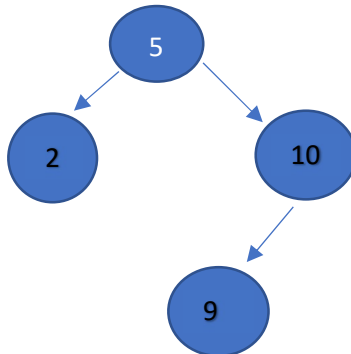

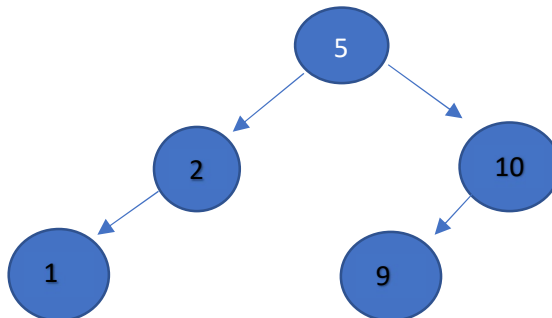Step 4:   Insert 2: 2 < 5, thus 2 goes to the left child node.

Step 5:   Insert 2: 9< 5, thus 9 first go to the right child node of the root (5) then since 9 < 10, 9 then go to the left child node of 10.
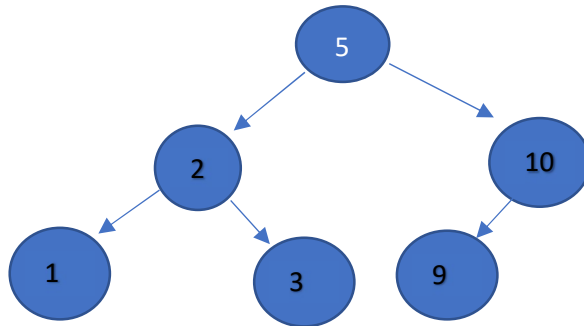

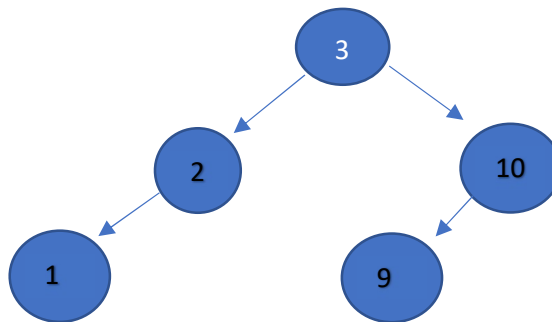Step 6:   Insert 1: since 1 > 5, 1 frist go to the lfet child of the root, then because 1 < 2, 2 will then go to the lfet child node of 2.

Step 7:   Insert 3:since 3 < 5, 3 first will go to the left node of the root,
                 because 3 > 2, 2 then will go to the right child of node 2.
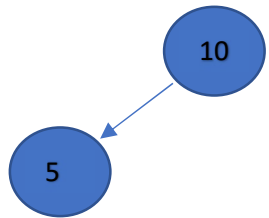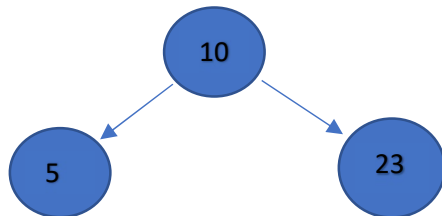

Step 8:   Remove 5:
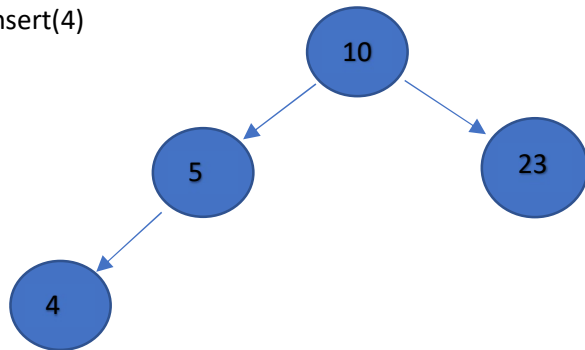
3. Step 1: empty node.
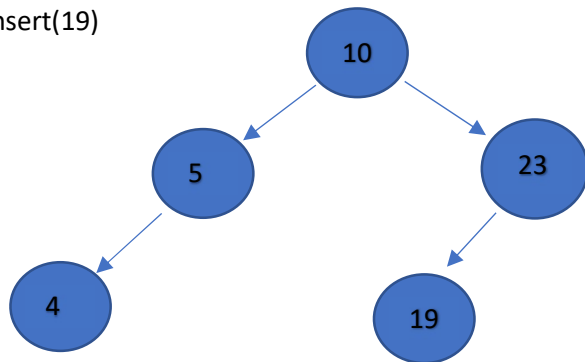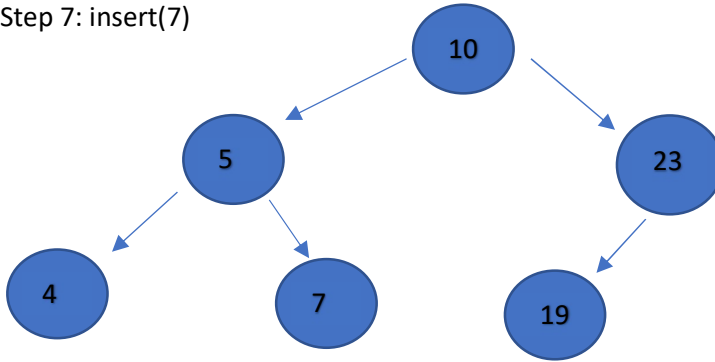
Step 2: Insert(10)
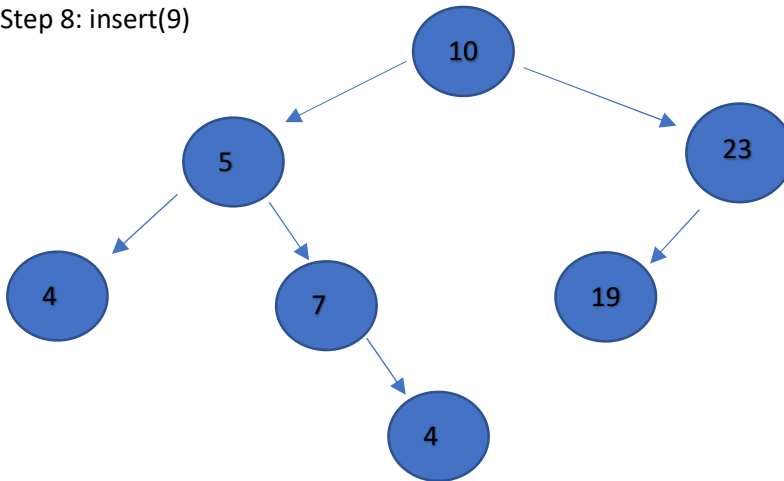
Step 3: insert(5)

Step 4: insert(23)

Step 5: insert(4)

Step 6: insert(19)

Step 7: insert(7)

```
                    10
                   /  \
                  5    23
                 / \     \
                4   7    19
```

Step 8: insert(9)

```
                    10
                   /  \
                  5    23
                 / \     \
                4   7    19
                     \
                      4
```

Step 9: insert(6)

```
                    10
                   /  \
                  5    23
                 / \     \
                4   7    19
                   / \
                  6   9
```
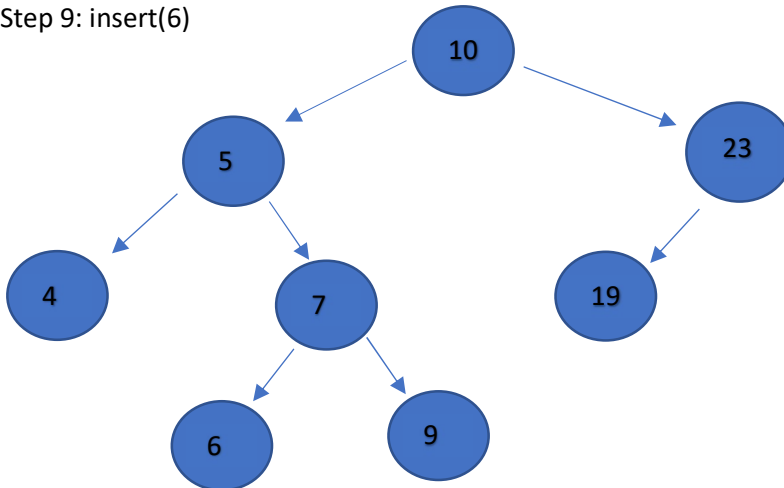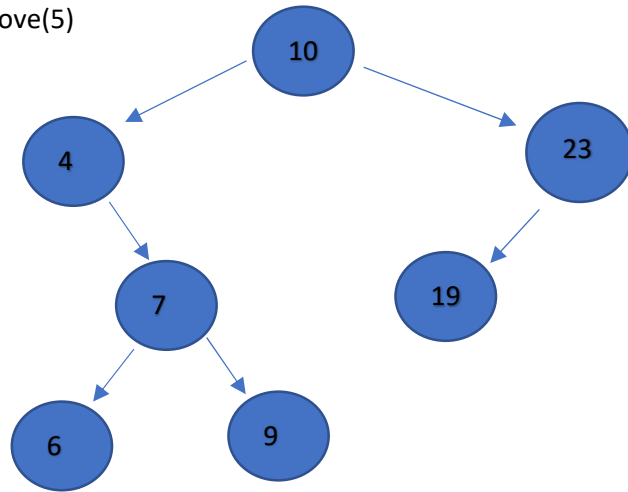
Step 10: Remove(5)

4. A) The height of the tree is the longest path from the root node to a leaf node.
Thus the heigh of the tree is the path from the root node (0100) to the leaf node (0083) or (0099).
Path one: 0100 → 0050 → 0080 → 0090 → 0083. 4
Pathe two: 0100 → 0050 → 0080 → 0090 → 0099. 4
Thus the height of the tree is 4.

B) The length of path fron node 0090 to the root node is 3, Thus the depth of node 90 is 3.

C) The height of a node is the longet path from the node itslfe to a leaf node, thus given we have only the child nodes which are also the leaf (0083 and 0099) the height of node 90 is 1.

D)
Pre – order (Root, Left, Right):
0100,0050,0003,0001,0020,0080,0052,0090,0083,0099,0150,0125,0152
In – order (left, root, right):
0001,0003,0020,0050,0052,0080,0083,0090,0099,0100,0125,0150,0152
Post – order (Left, right, root):
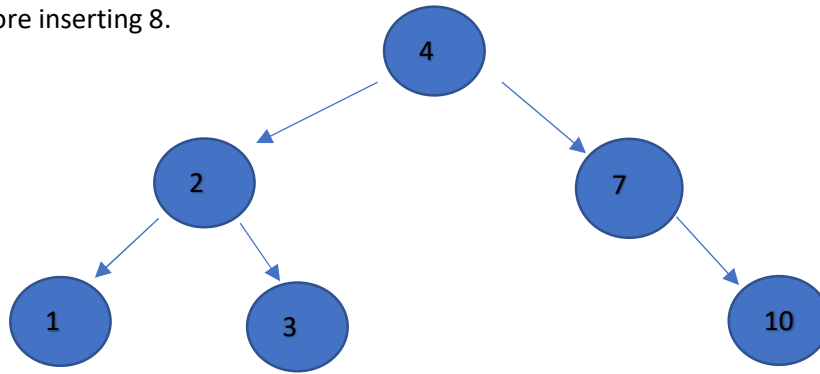0001,0020,0003,0052,0083,0099,0090,0080,0050,0125,0152,0150,0100
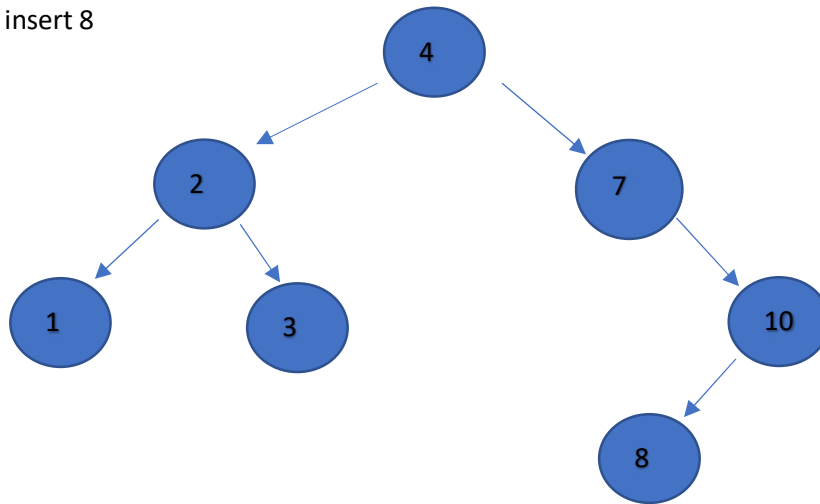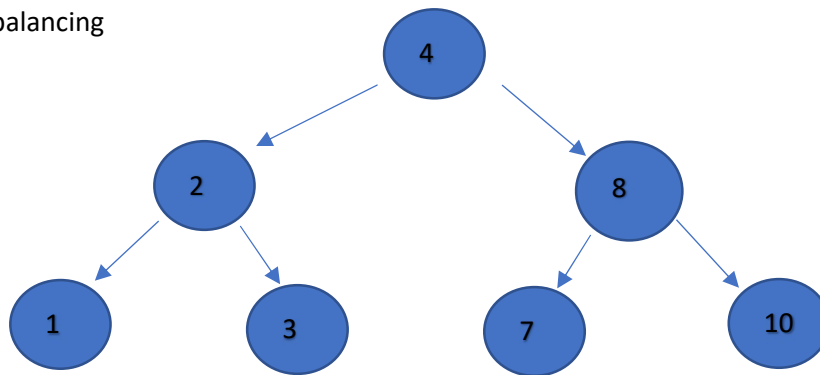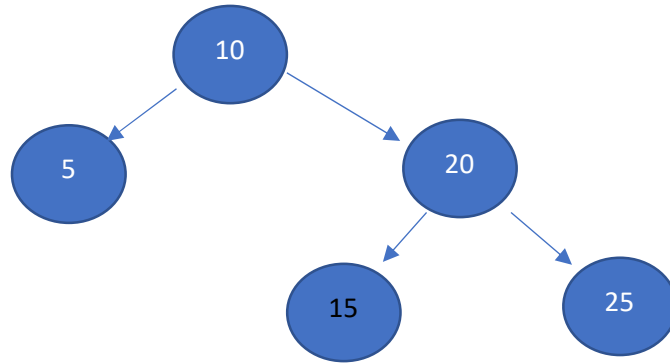
5. Orignaly
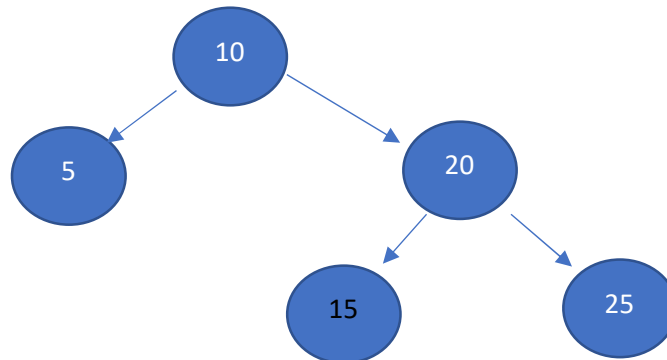
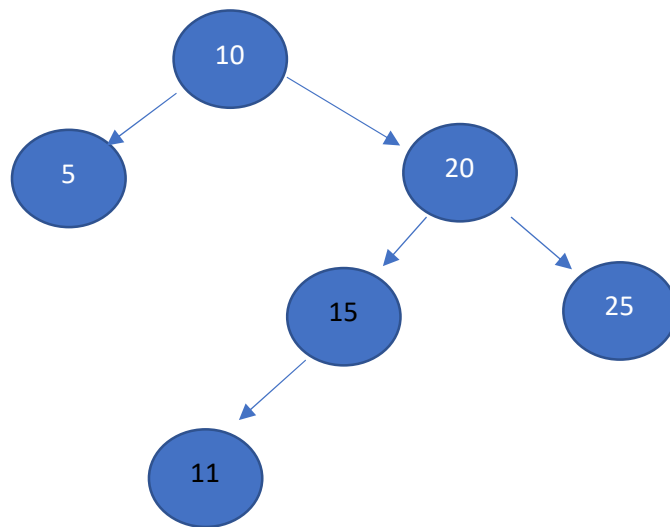After 5 is removed.
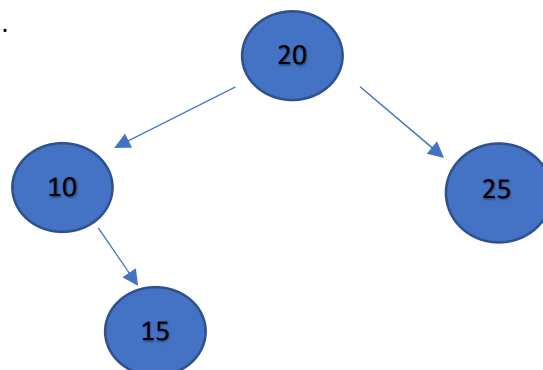
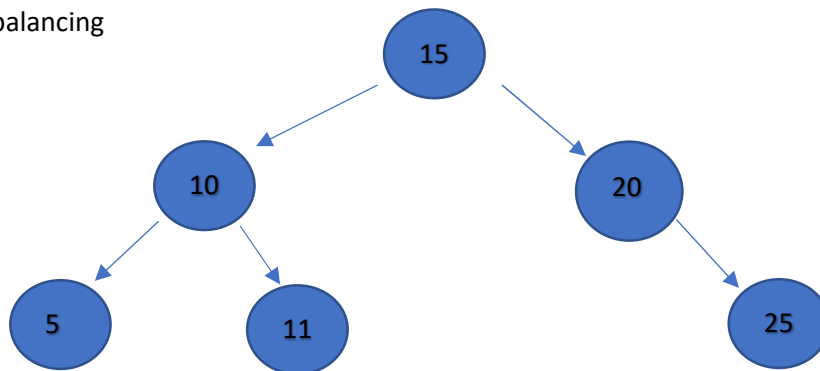6. Before inserting 8.

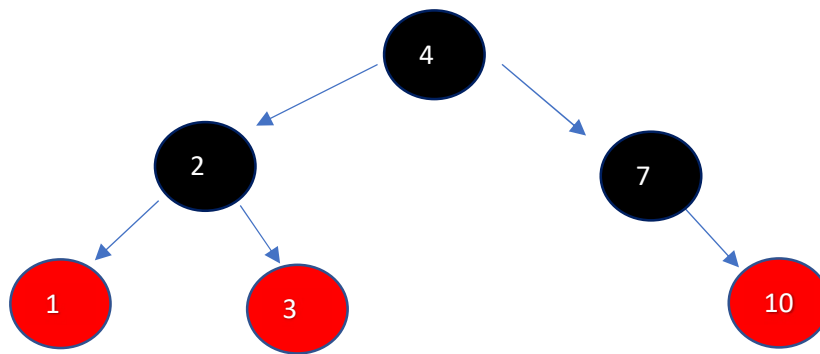
Step 1 insert 8
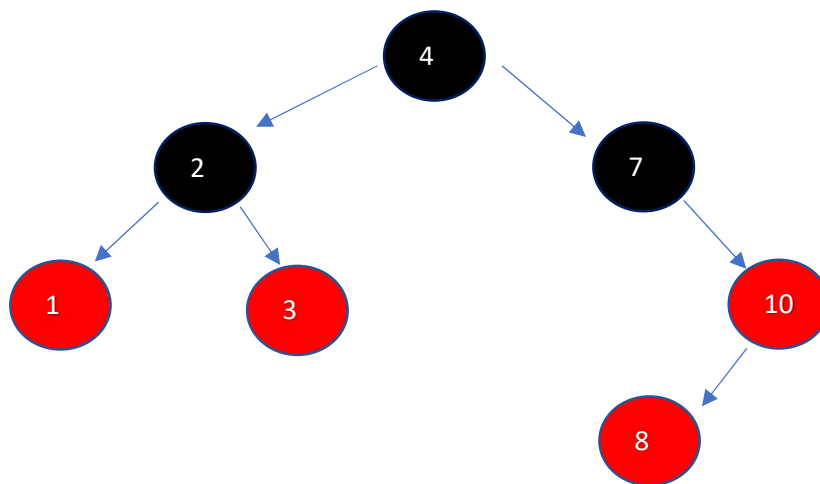

After balancing
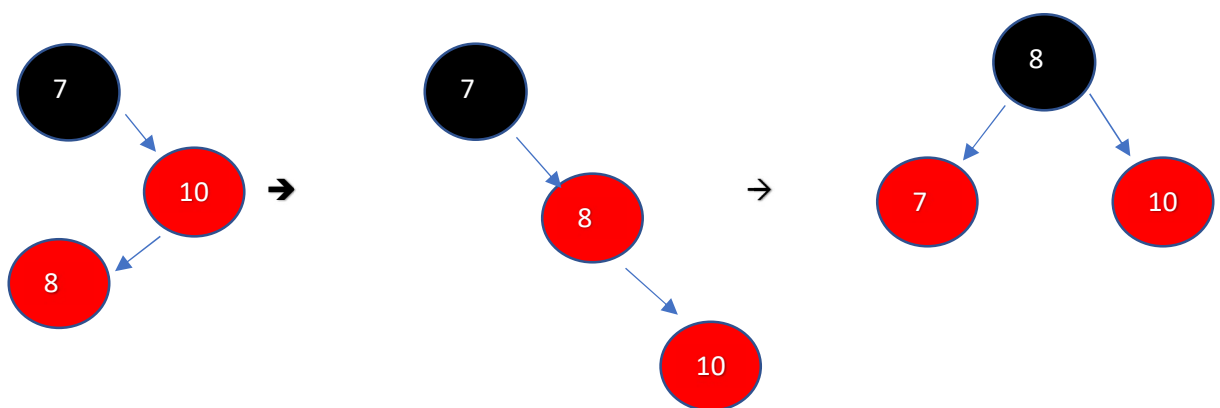
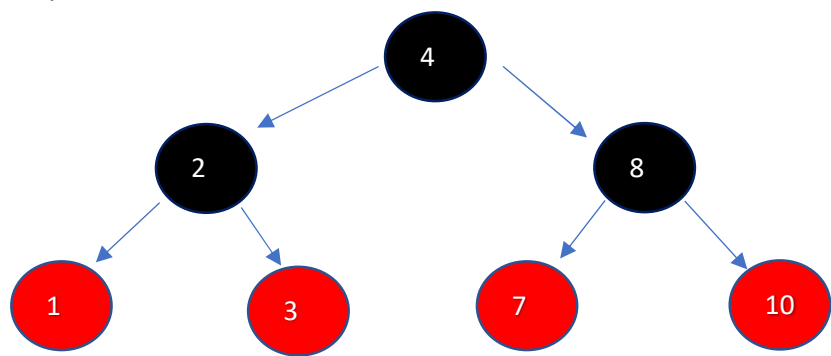**7.** Orignaly

Insert 11
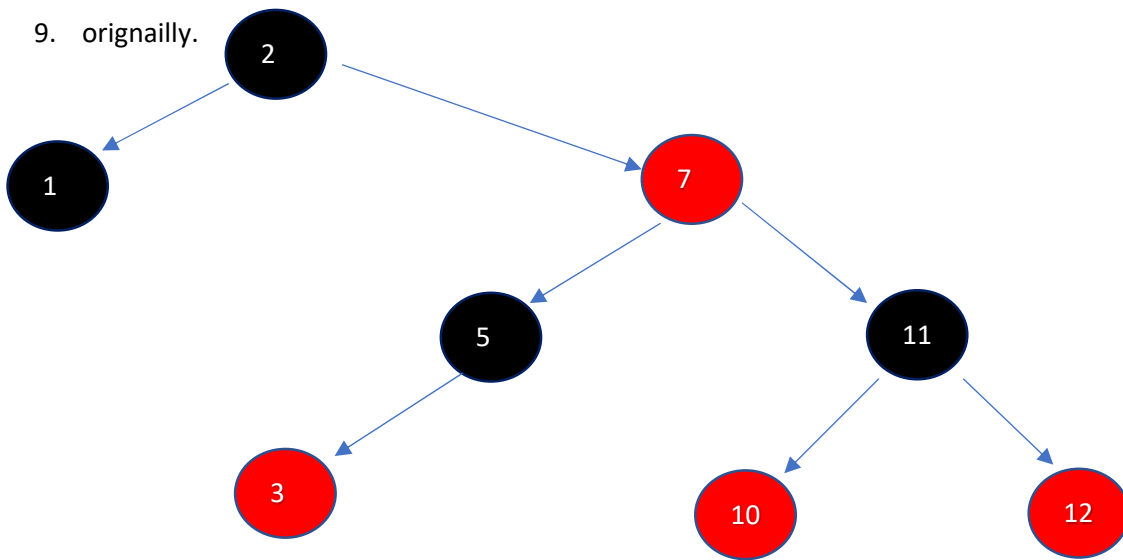

After balancing

8. Preinsertion

Insert 8

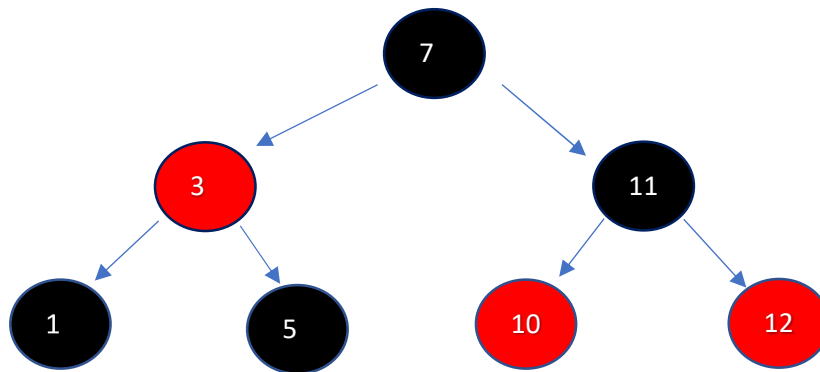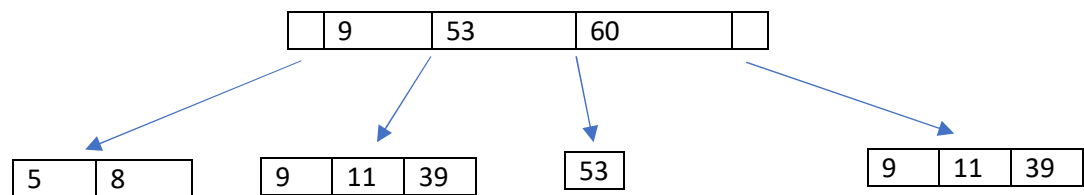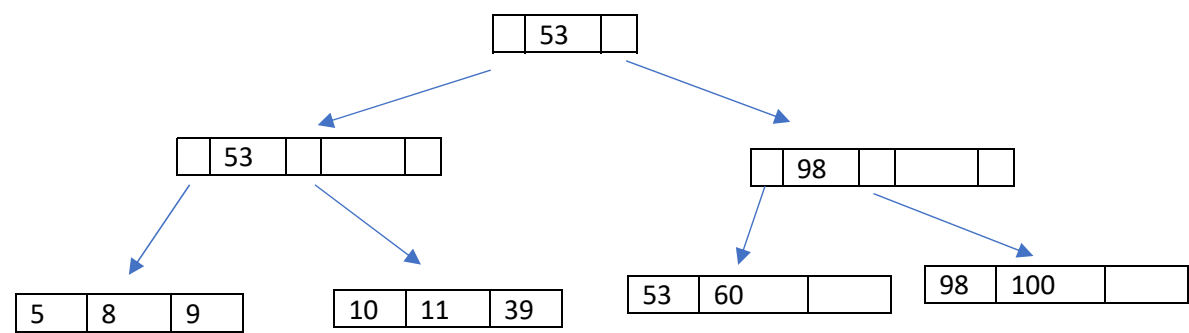Because the node 8 and the parent node 10 bot are red we rotate.

Finally

9. orignailly.

After removing the root node we roate

10. Insert 60

```
                        ┌──┬────┬──┐
                        │  │ 53 │  │
                        └──┴────┴──┘
              ┌───────────┘         └───────────┐
  ┌──┬────┬──┬──┬──┐                  ┌──┬────┬──┬──┬──┐
  │  │ 53 │  │  │  │                  │  │ 98 │  │  │  │
  └──┴────┴──┴──┴──┘                  └──┴────┴──┴──┴──┘
    ┌──────┘    └──────┐          ┌──────┘         └──────┐
┌───┬───┬───┐   ┌────┬────┬────┐  ┌────┬────┬──┐   ┌────┬─────┬──┐
│ 5 │ 8 │ 9 │   │ 10 │ 11 │ 39 │  │ 53 │ 60 │  │   │ 98 │ 100 │  │
└───┴───┴───┘   └────┴────┴────┘  └────┴────┴──┘   └────┴─────┴──┘
```

```
          ┌──┬───┬────┬────┬──┐
          │  │ 9 │ 53 │ 60 │  │
          └──┴───┴────┴────┴──┘
     ┌──────┘   ┌────┘    └────┐          └──────────┐
  ┌───┬───┐  ┌───┬────┬────┐  ┌────┐          ┌───┬────┬────┐
  │ 5 │ 8 │  │ 9 │ 11 │ 39 │  │ 53 │          │ 9 │ 11 │ 39 │
  └───┴───┘  └───┴────┴────┘  └────┘          └───┴────┴────┘
```

11.
- A) The internal size of the internal node (m) of the B-Tree is 3.
- B) The size of B-tree Leaf node (L) is 6.
- C)
- D)
- E)