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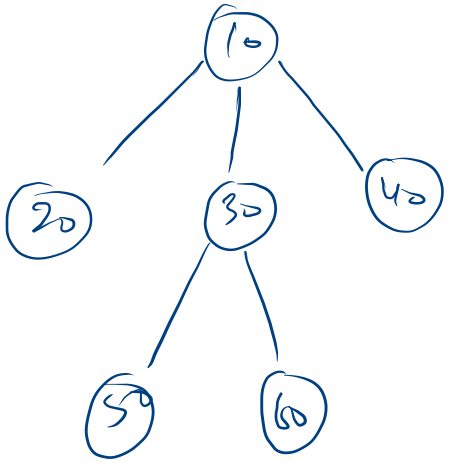
D C B A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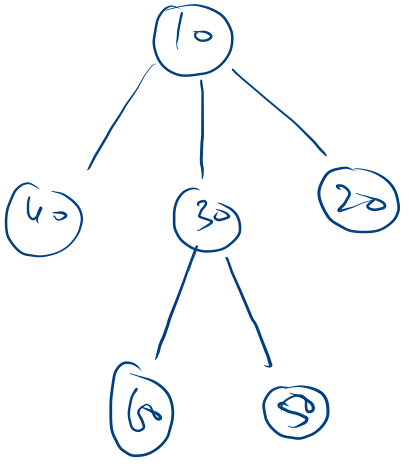
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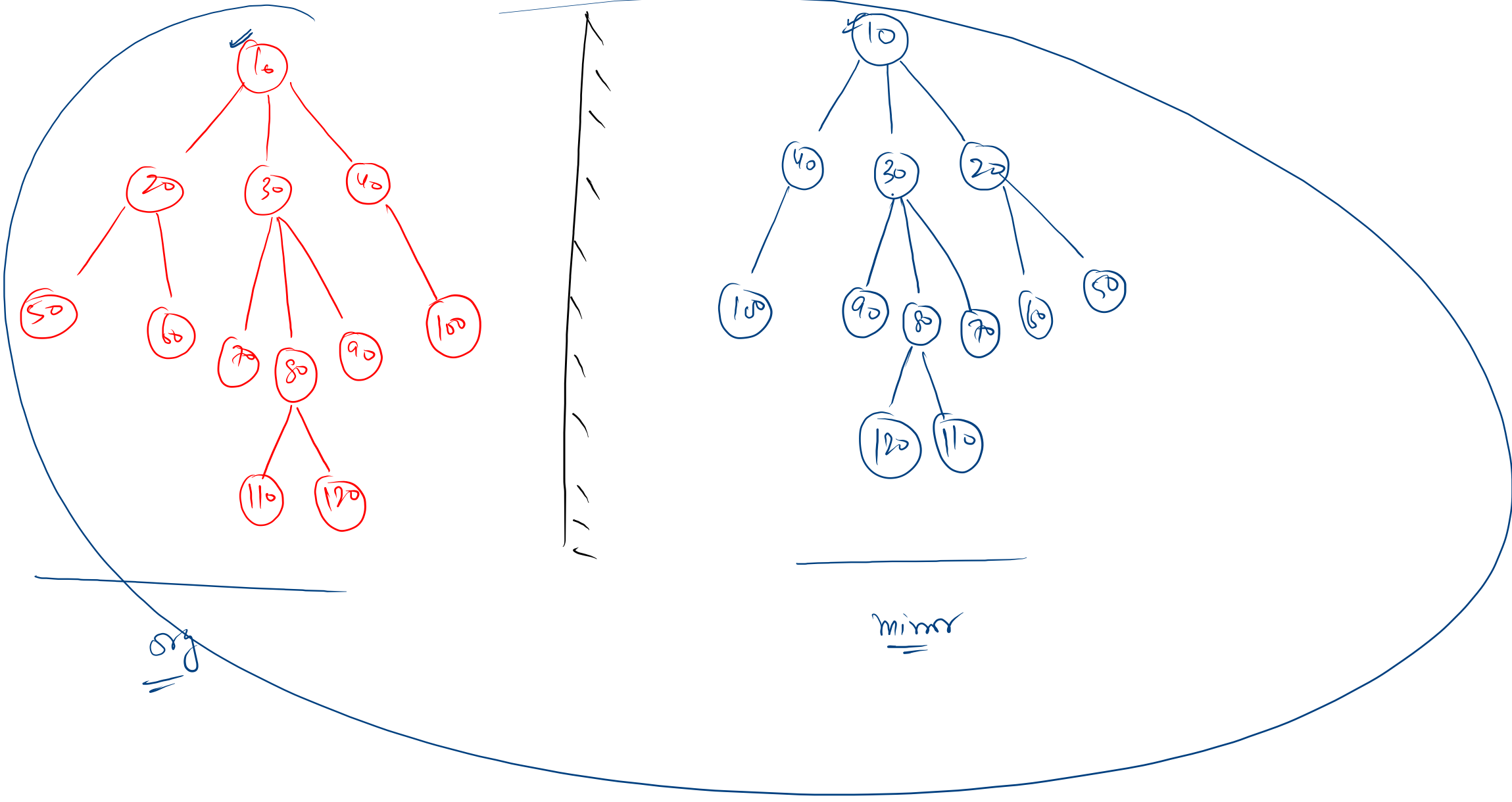
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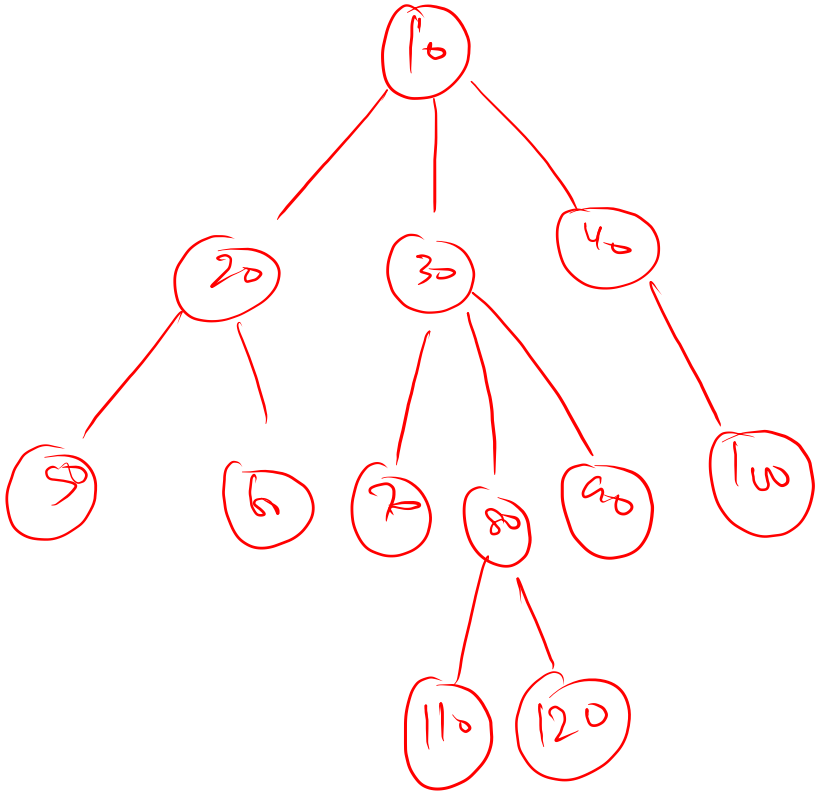
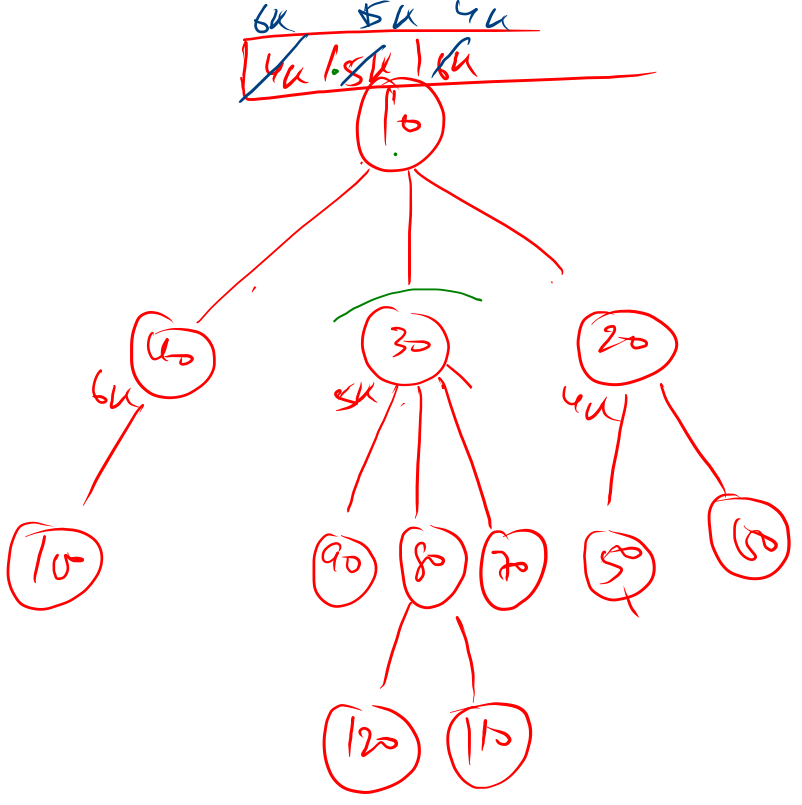
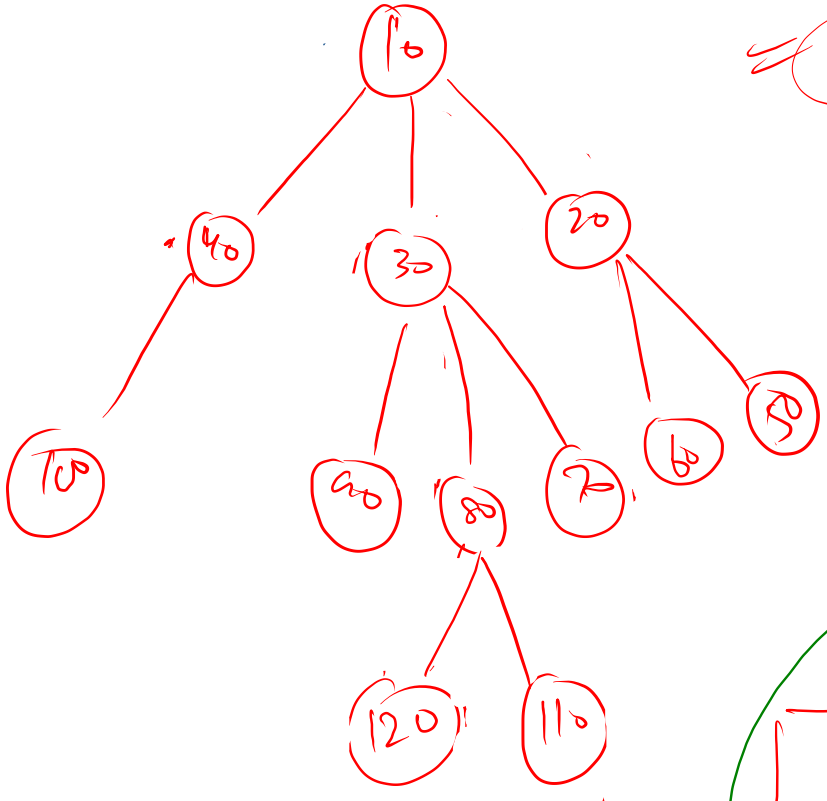


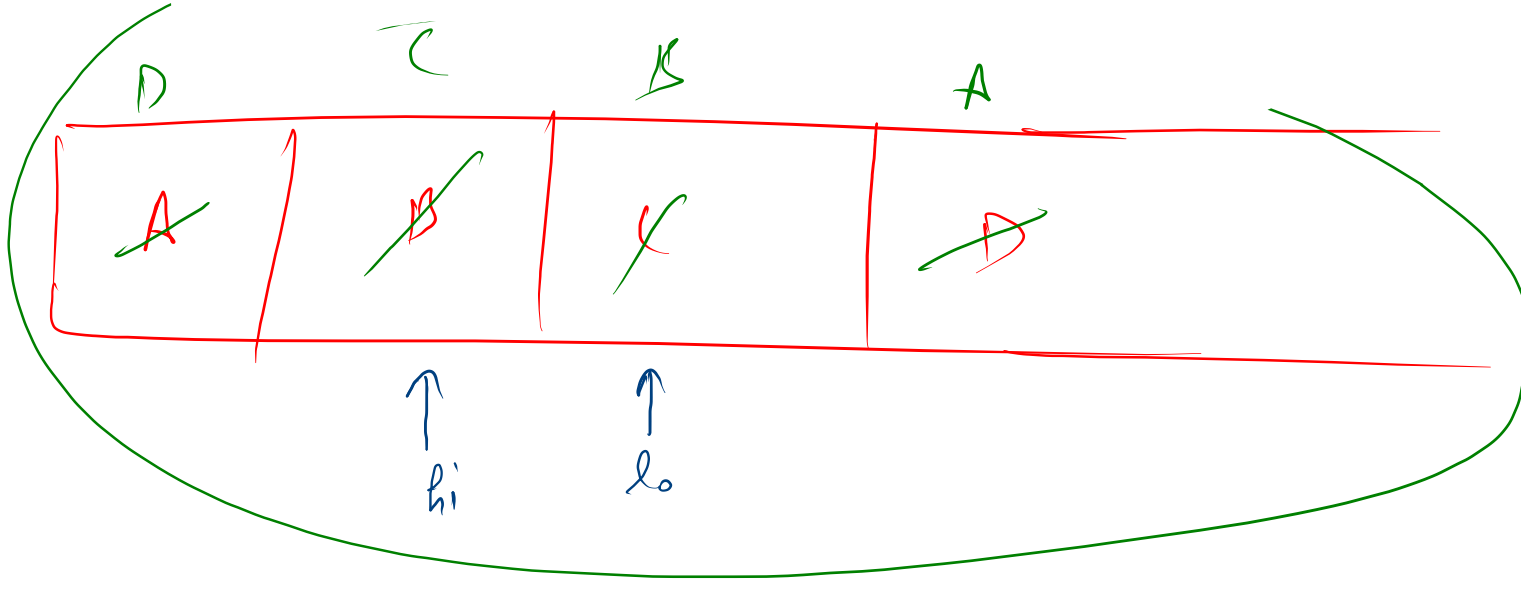


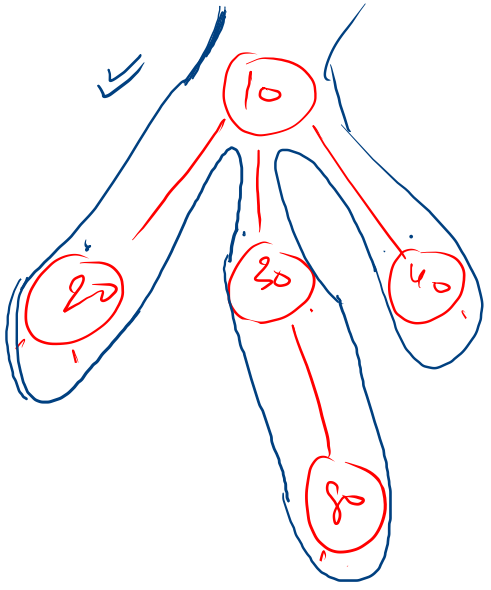

```java
public static void mirror(Node node){

  for(Node child : node.children){
      mirror(child);
  }

  Collections.reverse(node.children);
}
```

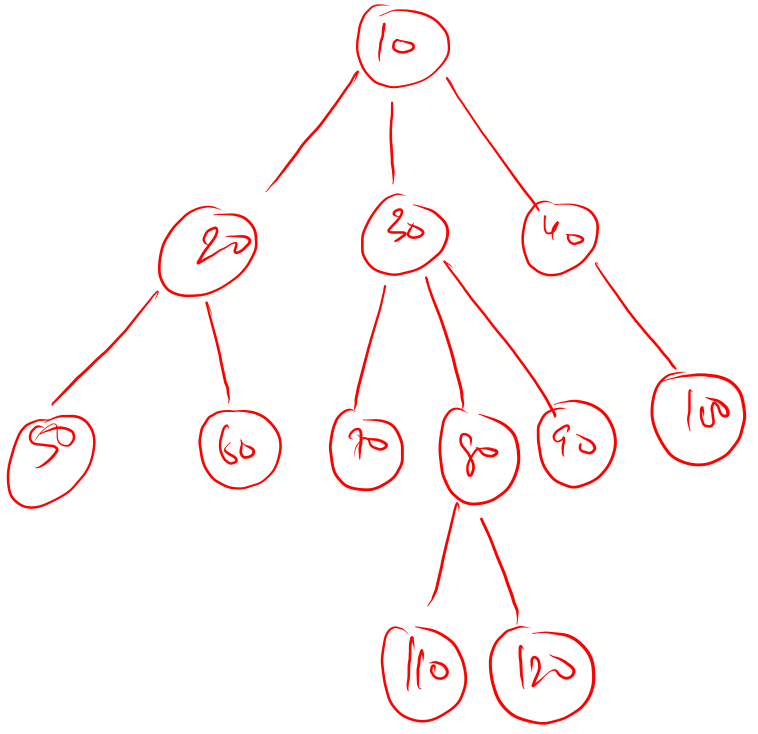


n^2

```
public static void mirror(Node node){

   for(Node child : node.children){
       mirror(child);
   }

   Collections.reverse(node.children);
}
```

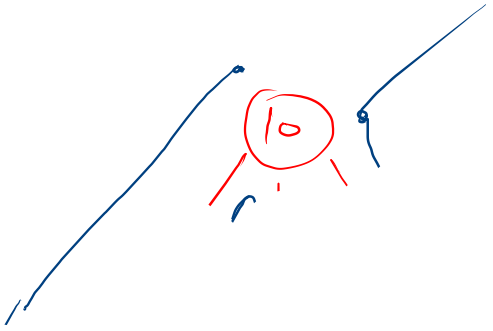




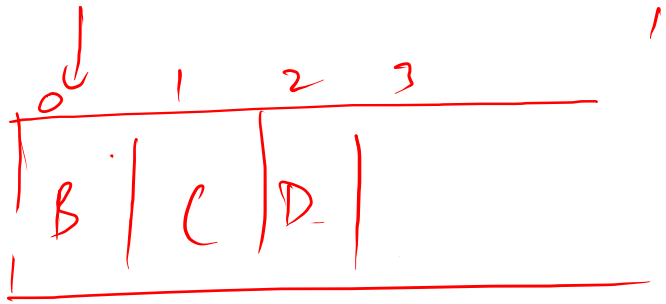


node.children.size() == 0

↳ leaf node

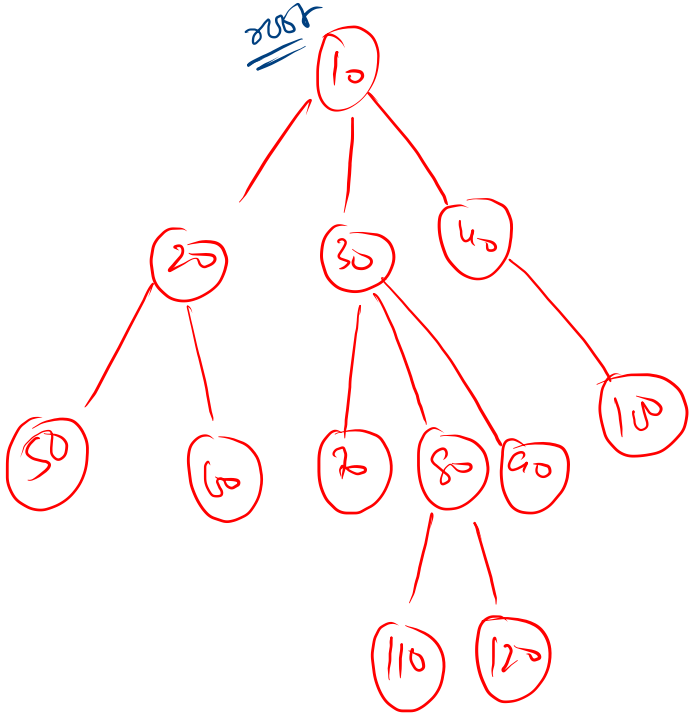


```java
public static void removeLeaves(Node node) {


  for(Node child : node.children){
      removeLeaves(child);
  }

  for(int idx = node.children.size()-1 ; idx >= 0 ; idx--){
      Node child = node.children.get(idx);
      if(child.children.size() == 0){
          // leaf node
          node.children.remove(idx);
      }
  }
}
```



idx=0

```
for (int i=0 ; i< n; i++) {

}
```


root
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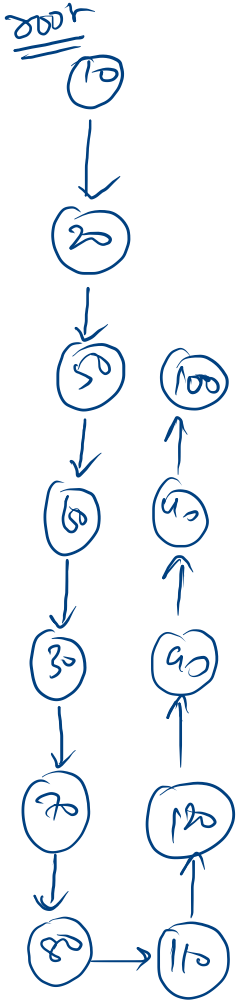
root
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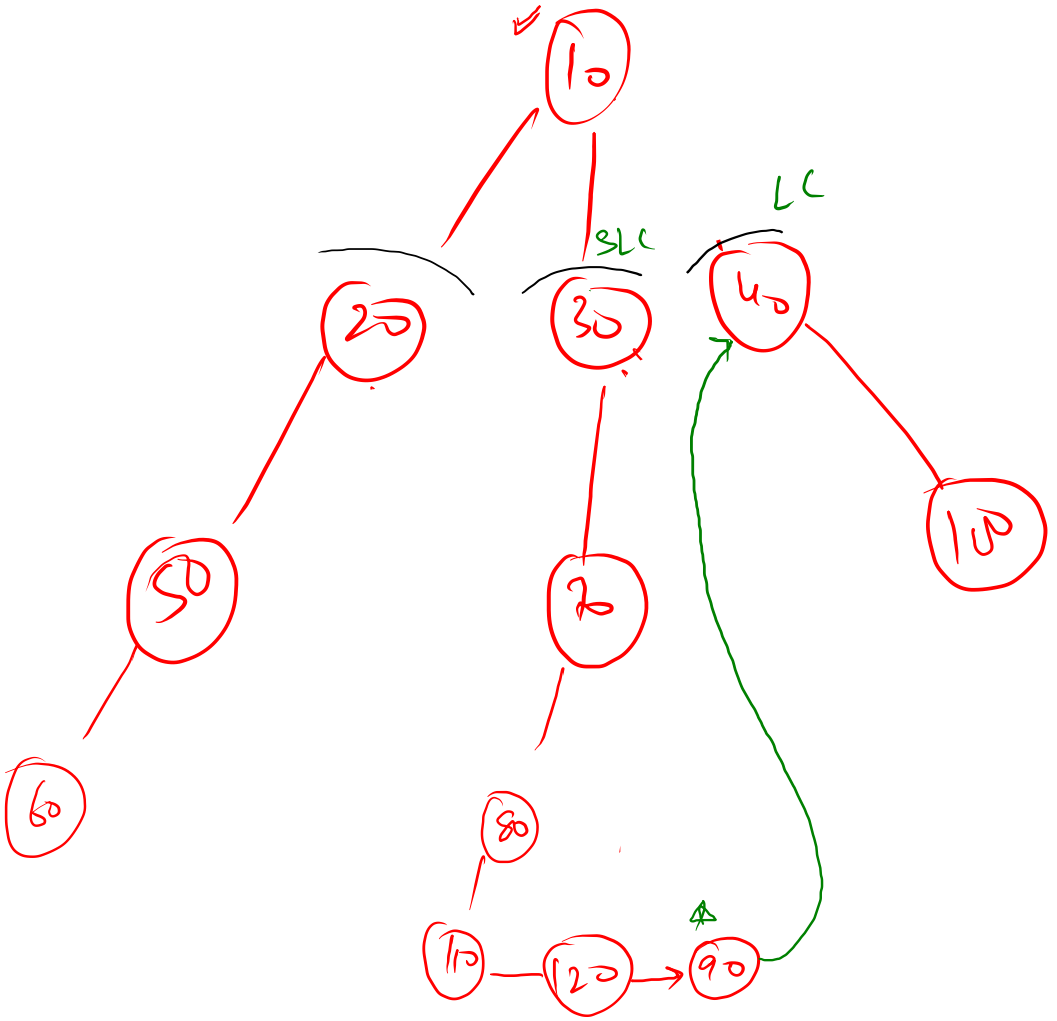
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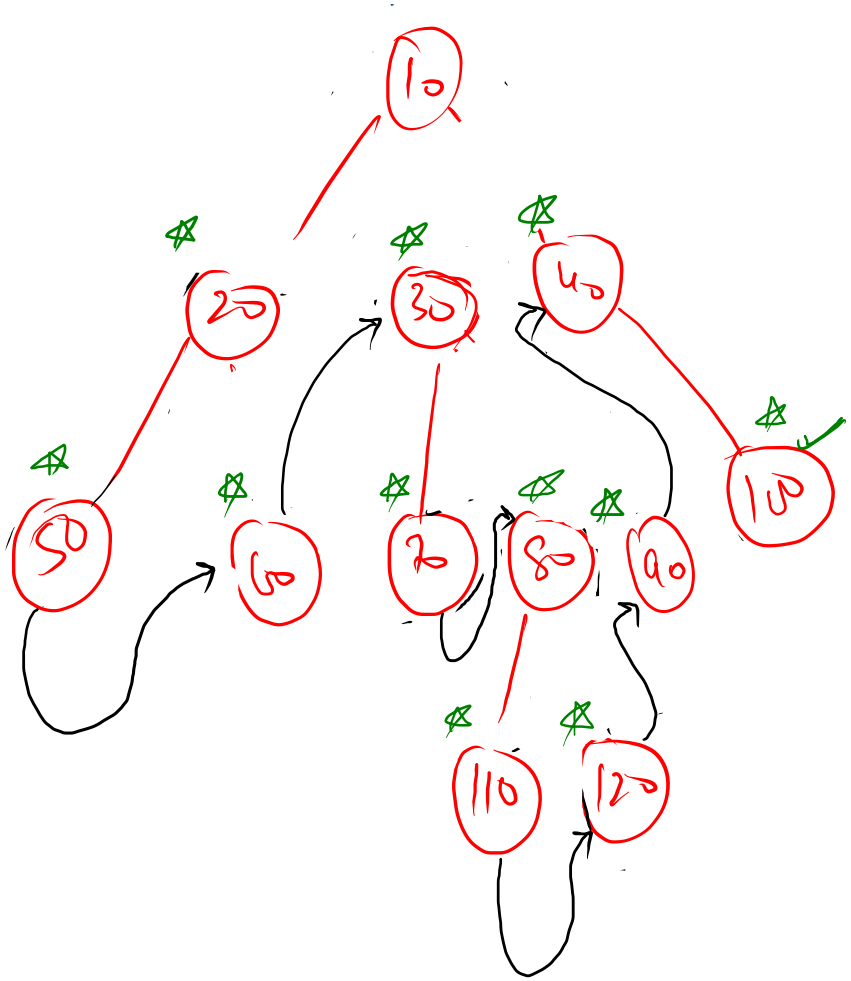
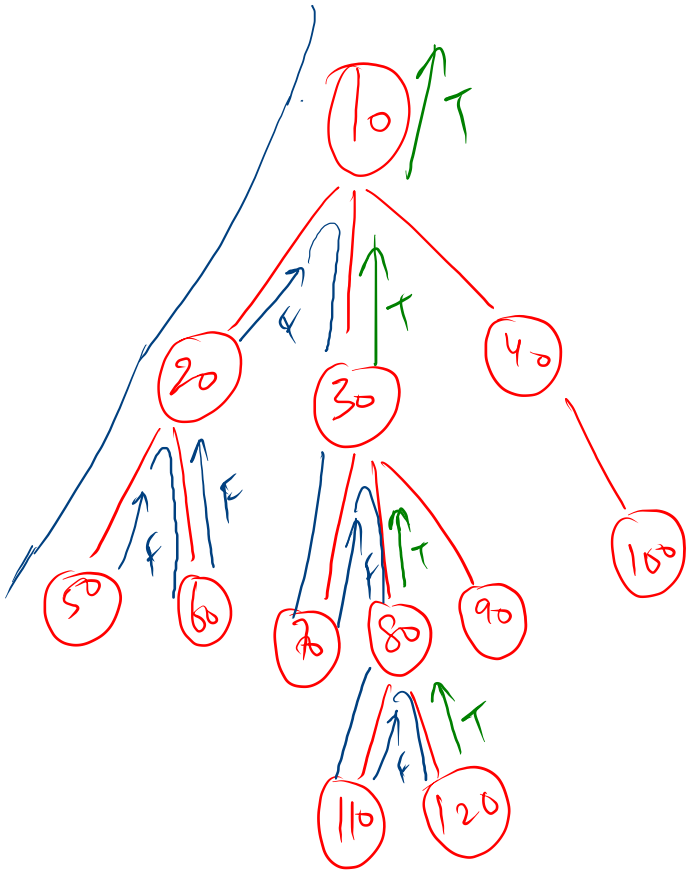


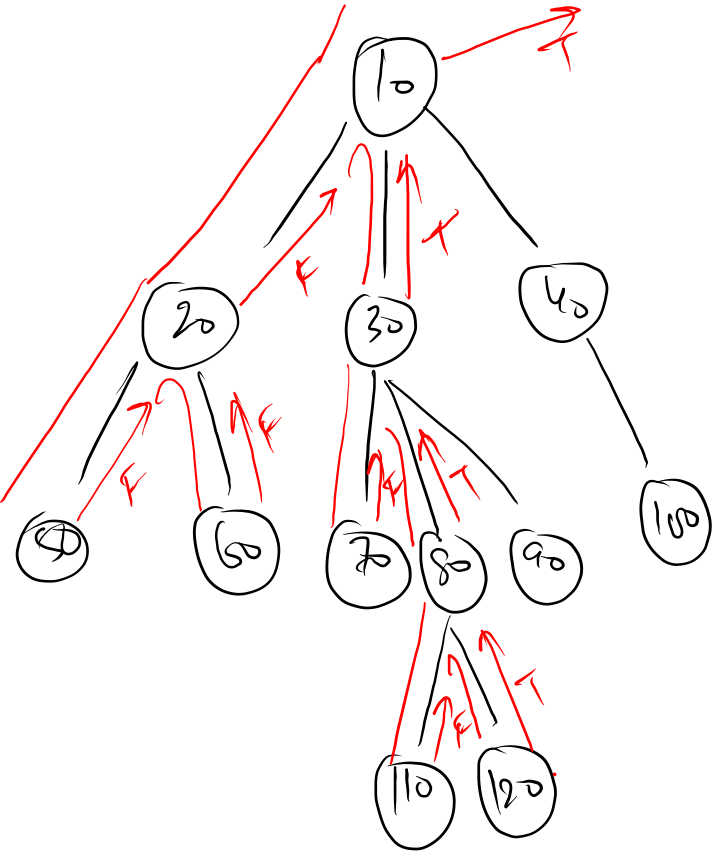

```java
public static Node getTail(Node node){
    while(node.children.size() == 1){
        node = node.children.get(0);
    }

    return node;
}
```

```java
public static void linearize(Node node){
  for(Node child : node.children){
      linearize(child);
  }

  while(node.children.size() > 1){
      Node lc = node.children.remove(node.children.size()-1);
      Node slc = node.children.get(node.children.size()-1);

      Node tail = getTail(slc);

      tail.children.add(lc);
  }
}
```

X = 120 ?

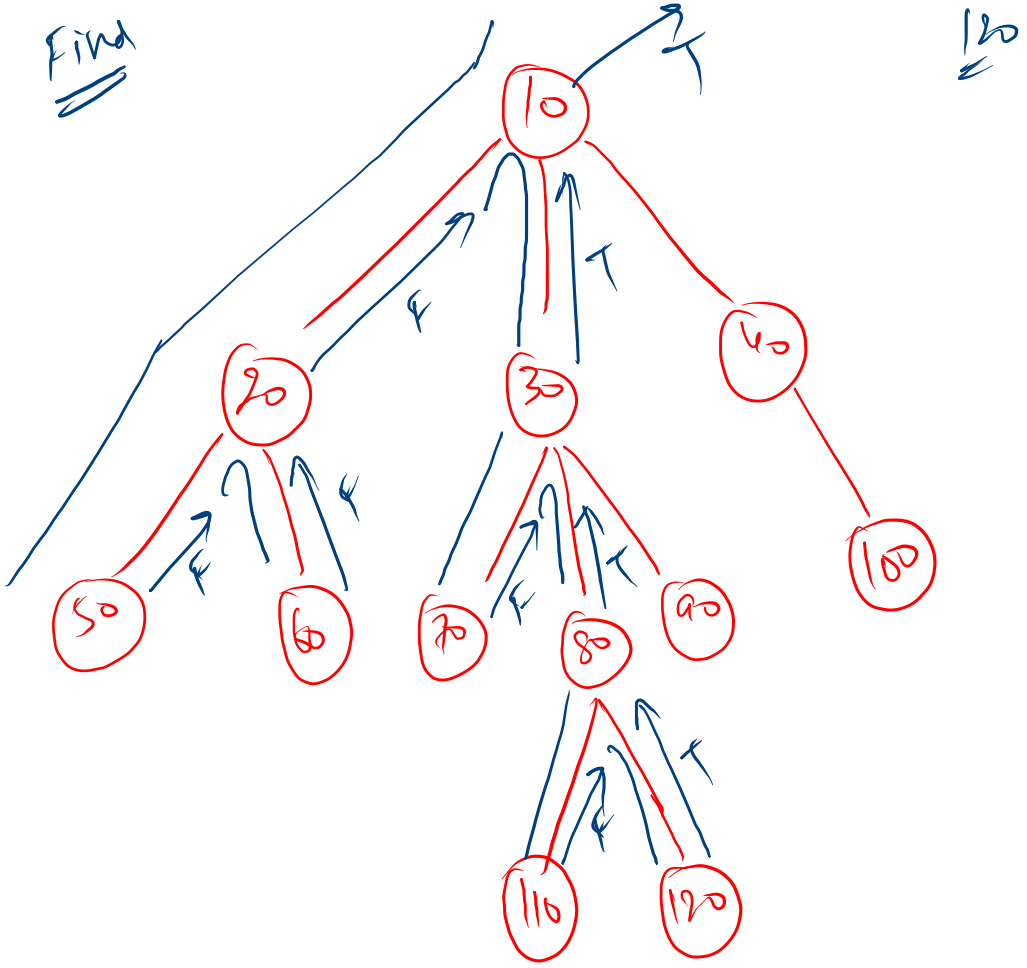


Edge Post



x: 120

```java
public static boolean find(Node node, int data) {
    if(node.data == data){
        return true;
    }

    for(Node child : node.children){
        boolean res = find(child,data);
        if(res){
            return true;
        }
    }

    return false;
}
```


Find
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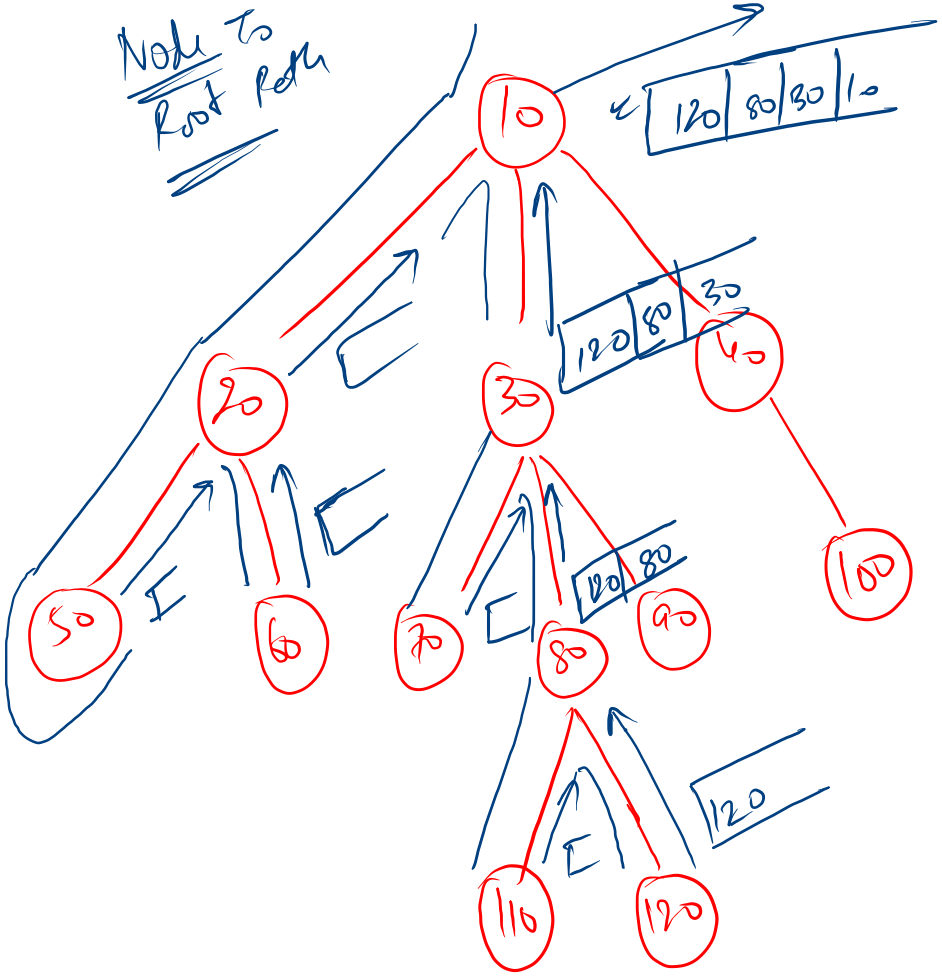
Node to Root path
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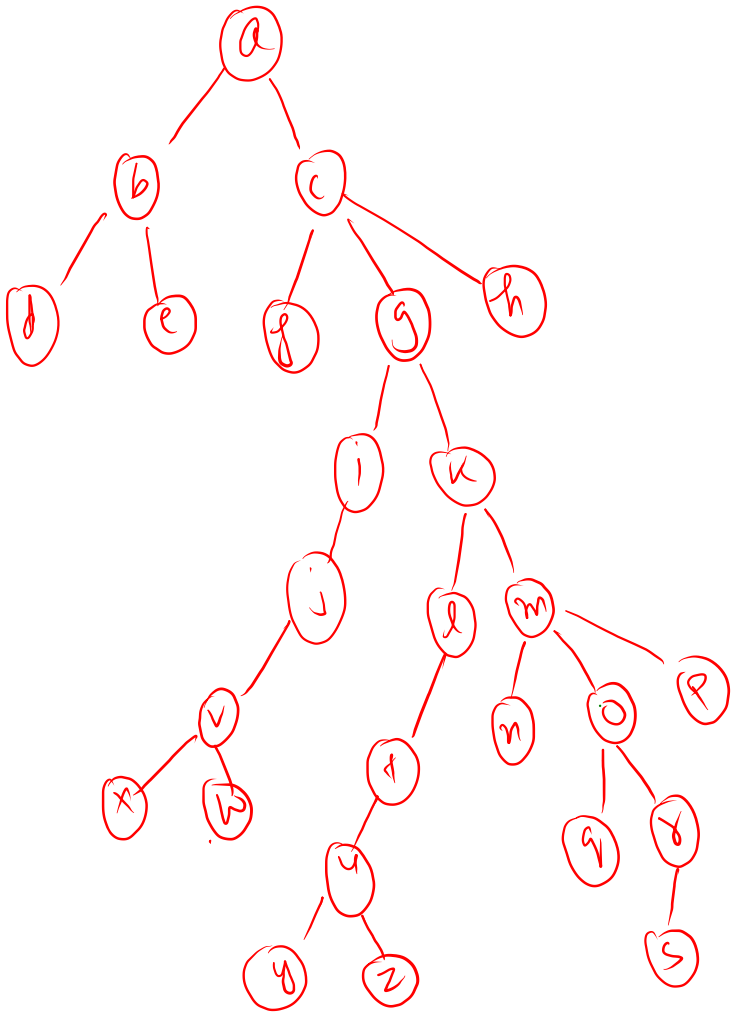
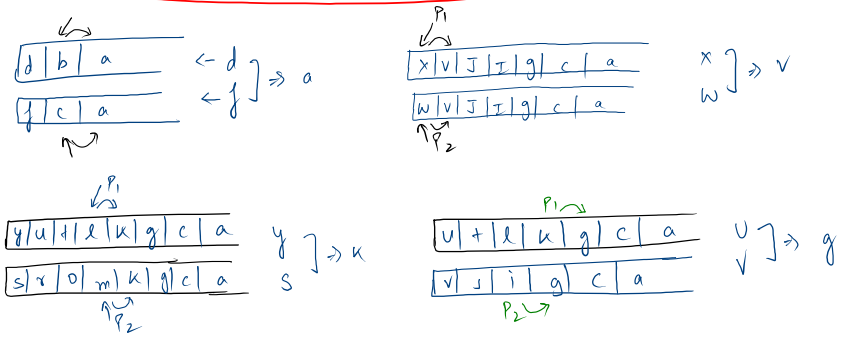
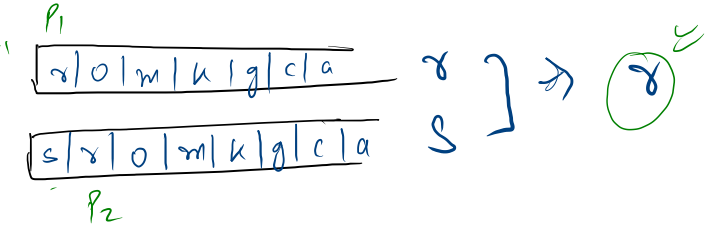
120 80 30 10
120 80 30
120 80
120

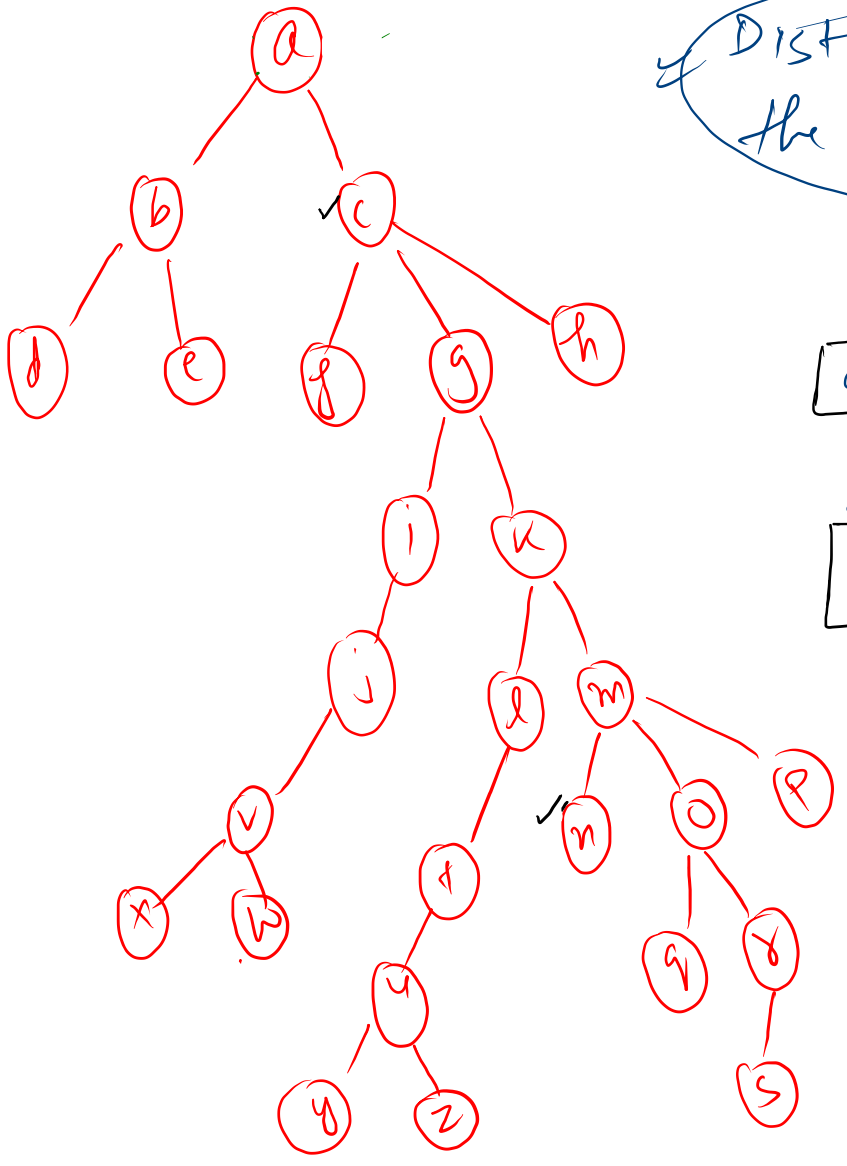


Lowest Common Ancestor




```java
public static int lca(Node node, int d1, int d2) {
    ArrayList<Integer> list1 = nodeToRootPath(node,d1);
    ArrayList<Integer> list2 = nodeToRootPath(node,d2);

    int p1 = list1.size()-1 , p2 = list2.size()-1;

    while(p1 >= 0 && p2 >= 0){
        if(list1.get(p1) == list2.get(p2)){
            p1--;
            p2--;
        }else{
            break;
        }
    }

    p1++;
    p2++;

    return list1.get(p1);
}
```





Distance b/w two nodes on the basis of edges

$p_1 \rightarrow$

0	1	2
d	b	a

← d $p_1 = 2$

0	1	2
f	c	a

$p_2 \rightarrow$

f $p_2 = 2$

distance = $p_1 + p_2$ →

$p_1 \rightarrow$ (-1)

0	1
c	a

← c $p_1 = 0$

0	1	2	3	4	5
n	m	k	g	c	a

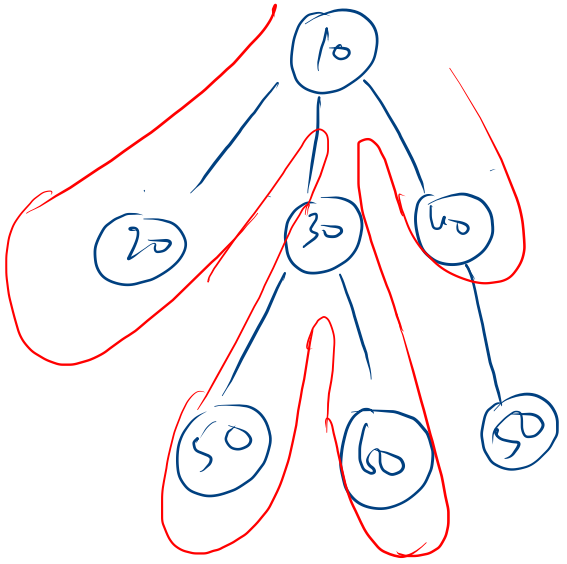
← n $p_2 = 4$

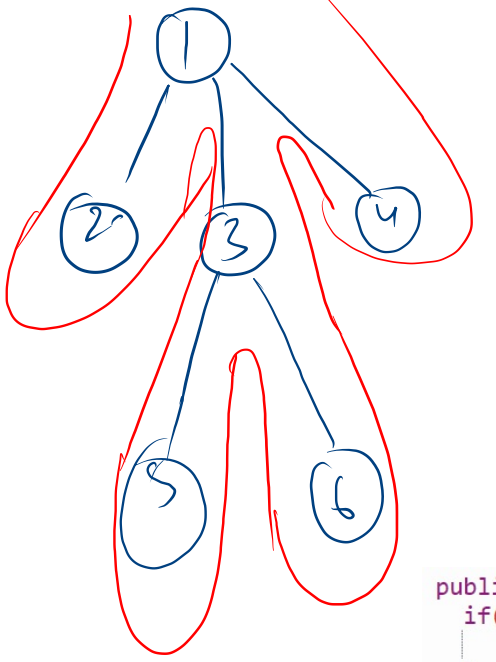
$p_2 \rightarrow$

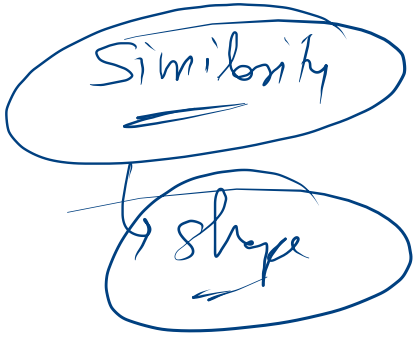
$p_1 + p_2 \rightarrow 0 + 4 =$

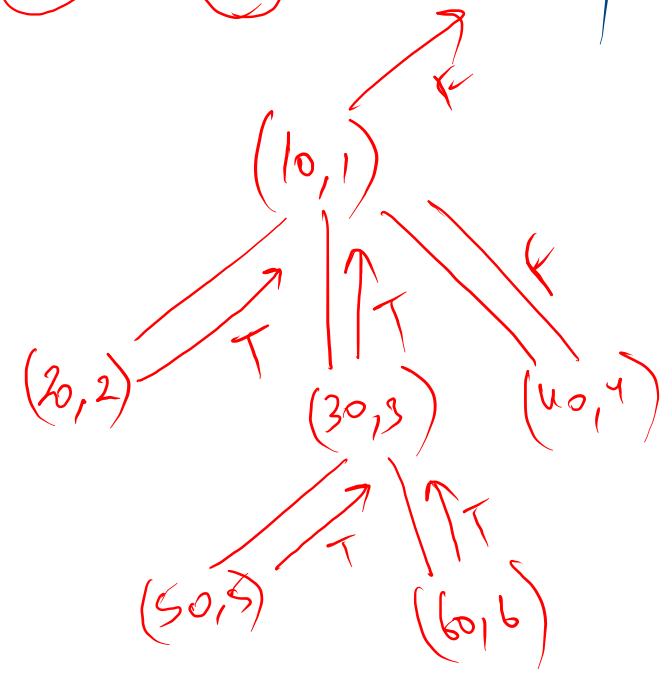
```java
public static int lca(Node node, int d1, int d2) {
  ArrayList<Integer> list1 = nodeToRootPath(node,d1);
  ArrayList<Integer> list2 = nodeToRootPath(node,d2);

  int p1 = list1.size()-1 , p2 = list2.size()-1;

  while(p1 >= 0 && p2 >= 0){
      if(list1.get(p1) == list2.get(p2)){
          p1--;
          p2--;
      }else{
          break;
      }
  }

  p1++;
  p2++;

  return list1.get(p1);
}
```

```java
public static int distanceBetweenNodes(Node node, int d1, int d2){
  ArrayList<Integer> list1 = nodeToRootPath(node,d1);
  ArrayList<Integer> list2 = nodeToRootPath(node,d2);

  int p1 = list1.size()-1 , p2 = list2.size()-1;

  while(p1 >= 0 && p2 >= 0){
      if(list1.get(p1) == list2.get(p2)){
          p1--;
          p2--;
      }else{
          break;
      }
  }

  p1++;
  p2++;

  return p1+p2;
}
```

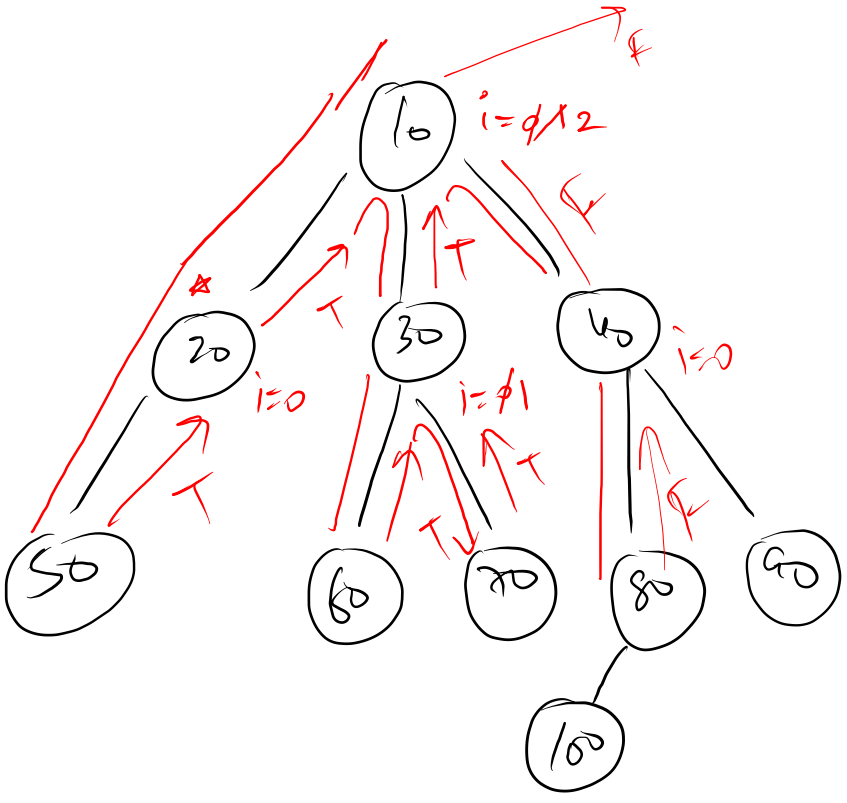


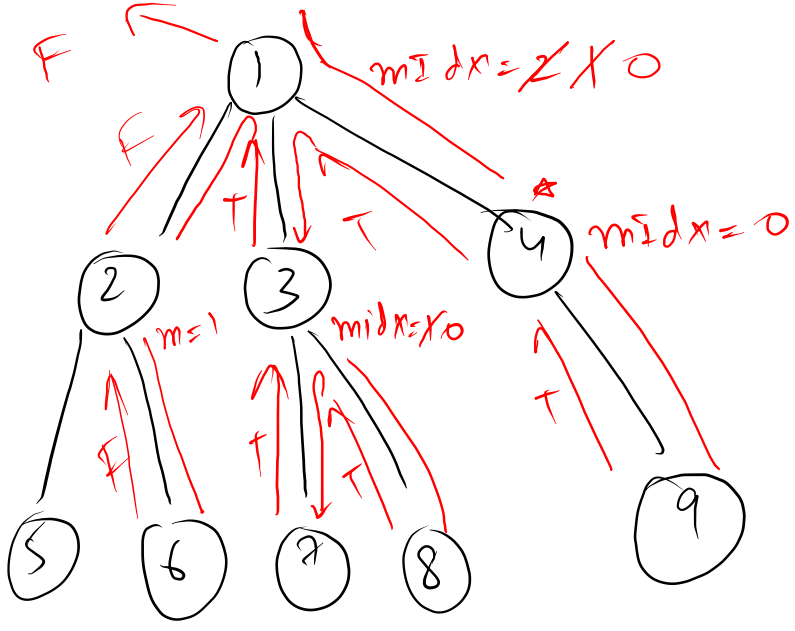




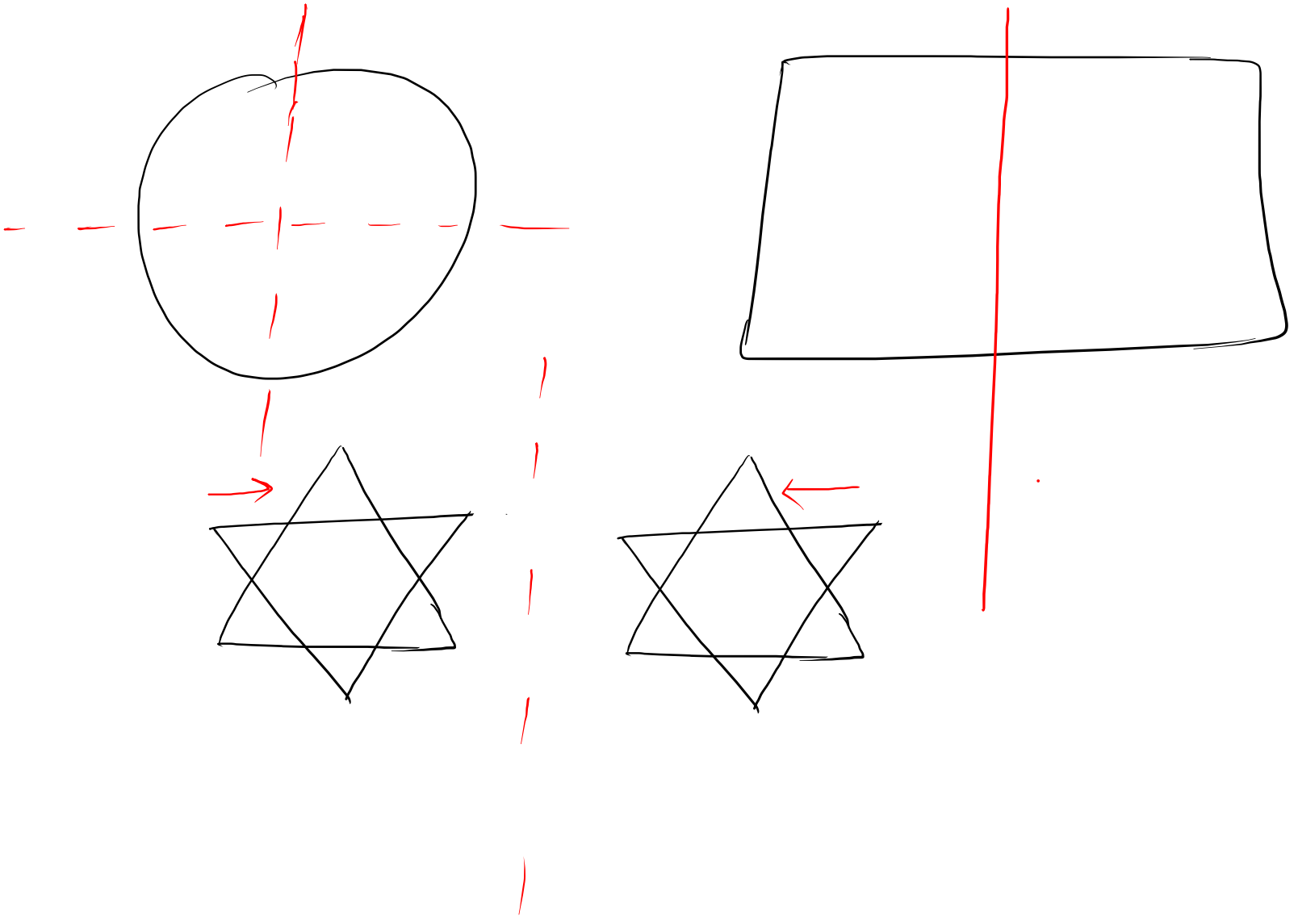


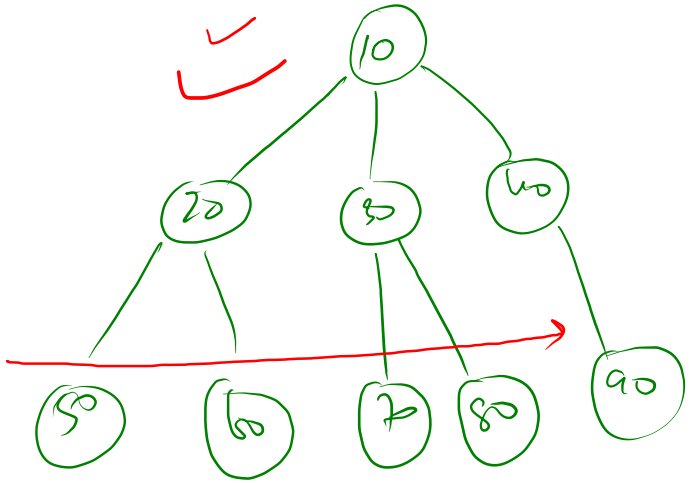

```java
public static boolean areSimilar(Node n1, Node n2) {
  if(n1.children.size() != n2.children.size()){
      return false;
  }

  for(int i = 0 ; i < n1.children.size() ; i++){
      Node child1 = n1.children.get(i);
      Node child2 = n2.children.get(i);

      boolean res = areSimilar(child1,child2);

      if(res == false){
          return false;
      }
  }

  return true;
}
```





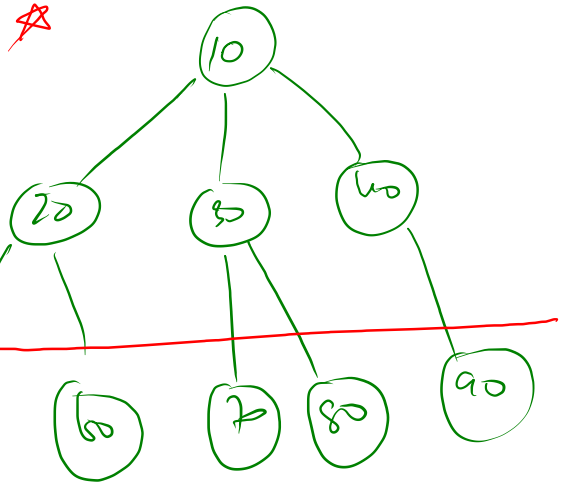

```java
public static boolean areMirror(Node n1, Node n2) {
    if(n1.children.size() != n2.children.size()){
        return false;
    }

    for(int i = 0 ; i < n1.children.size() ; i++){
        Node c1 = n1.children.get(i);
        int mIdx = n2.children.size()-1-i;
        Node c2 = n2.children.get(mIdx);

        boolean res = areMirror(c1,c2);
        if(res == false){
            return false;
        }
    }

    return true;
}
```

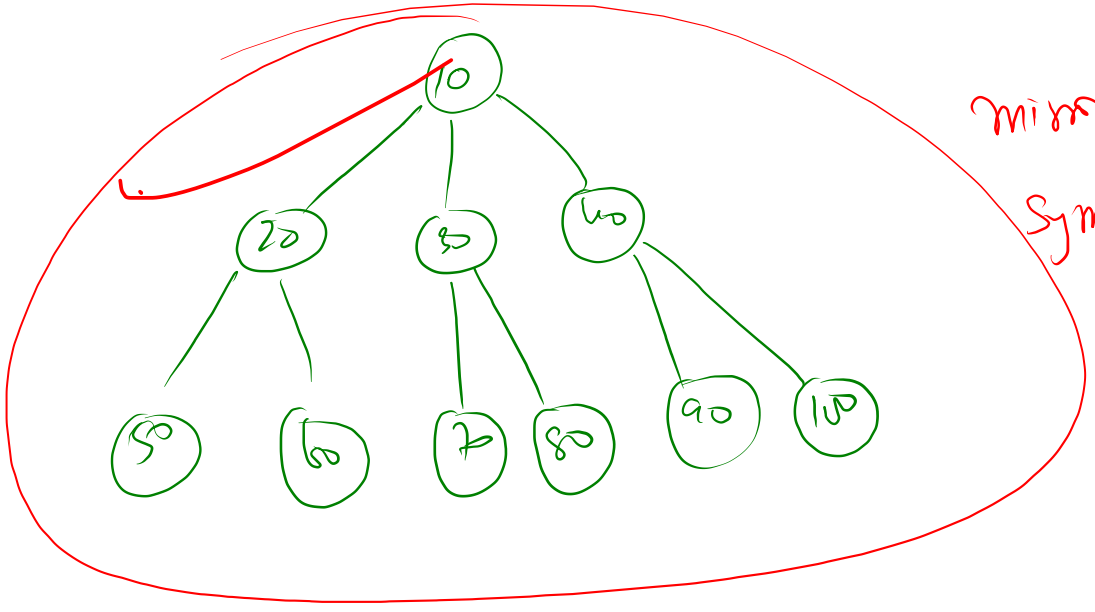




mirror → false

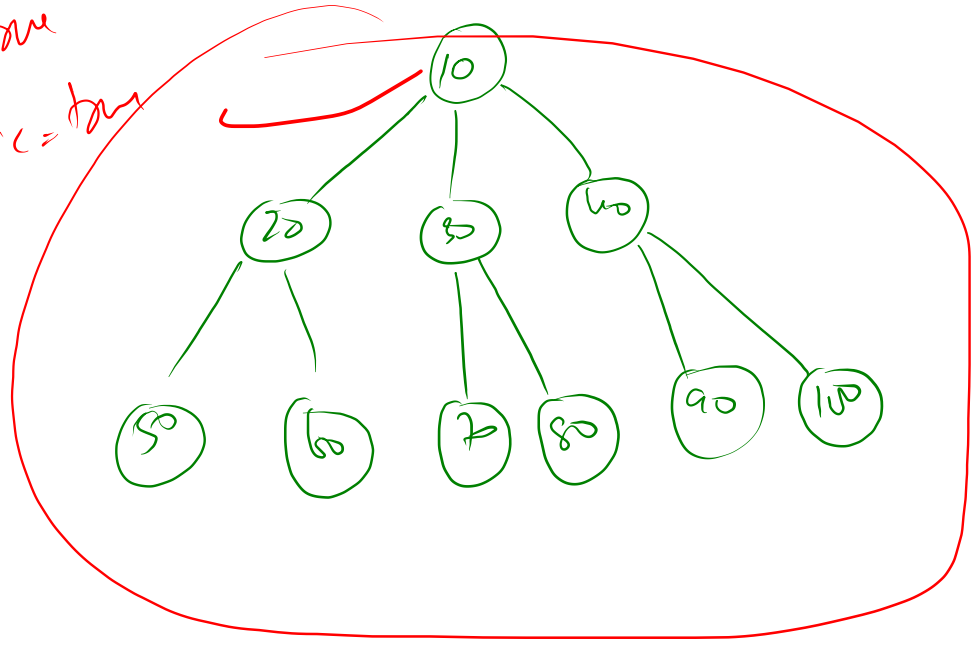
Symmetric → false





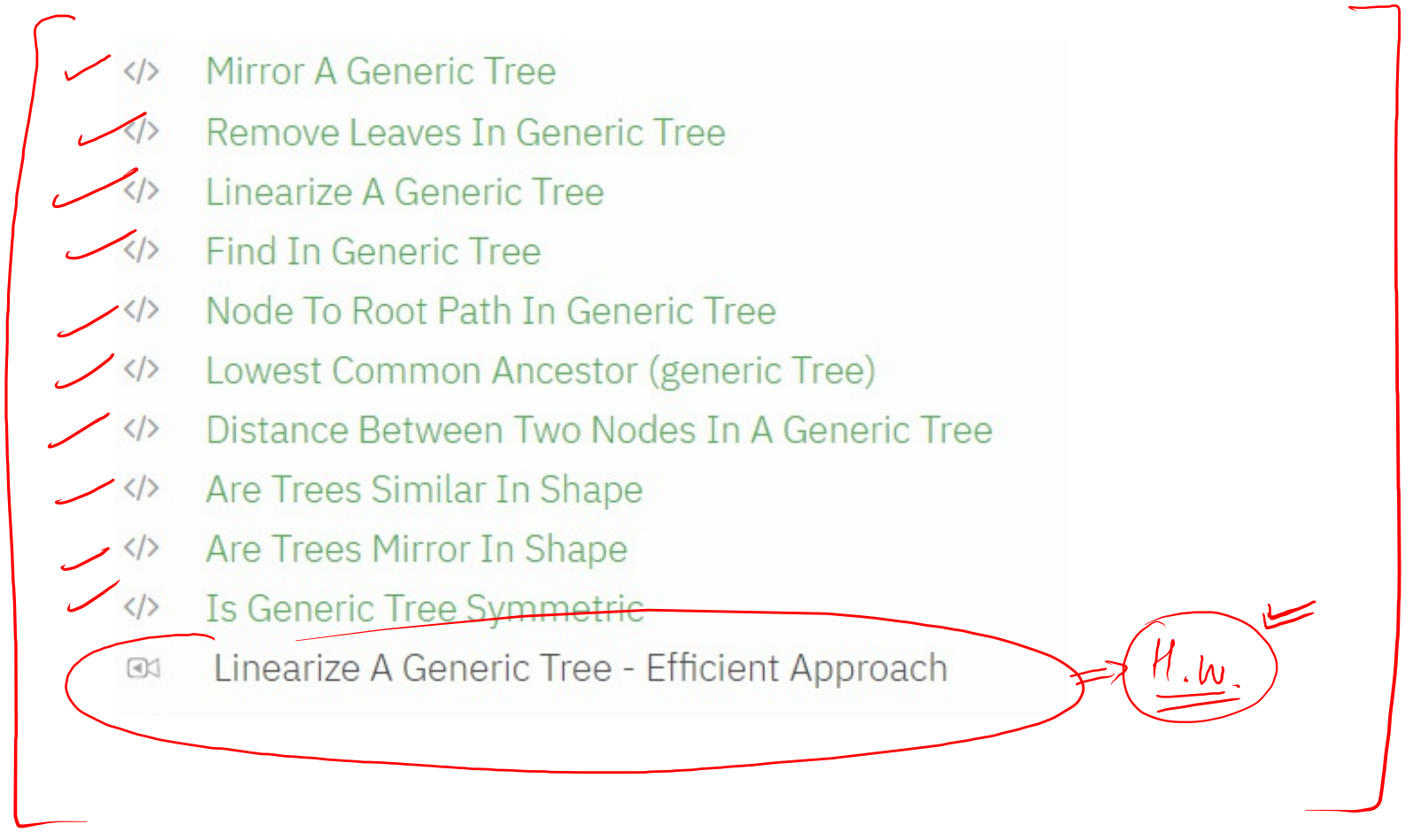
mirror → true

Symmetric = true



```java
public static boolean areSimilar(Node n1, Node n2) {
    if(n1.children.size() != n2.children.size()){
        return false;
    }

    for(int i = 0 ; i < n1.children.size() ; i++){
        Node child1 = n1.children.get(i);
        Node child2 = n2.children.get(i);

        boolean res = areSimilar(child1,child2);

        if(res == false){
            return false;
        }
    }

    return true;
}
```

```java
public static boolean areMirror(Node n1, Node n2) {
    if(n1.children.size() != n2.children.size()){
        return false;
    }

    for(int i = 0 ; i < n1.children.size() ; i++){
        Node c1 = n1.children.get(i);
        int mIdx = n2.children.size()-1-i;
        Node c2 = n2.children.get(mIdx);

        boolean res = areMirror(c1,c2);
        if(res == false){
            return false;
        }
    }

    return true;
}

public static boolean IsSymmetric(Node node) {
    return areMirror(node,node);
}
```


Mirror A Generic Tree
Remove Leaves In Generic Tree
Linearize A Generic Tree
Find In Generic Tree
Node To Root Path In Generic Tree
Lowest Common Ancestor (generic Tree)
Distance Between Two Nodes In A Generic Tree
Are Trees Similar In Shape
Are Trees Mirror In Shape
Is Generic Tree Symmetric
Linearize A Generic Tree - Efficient Approach
H.W.