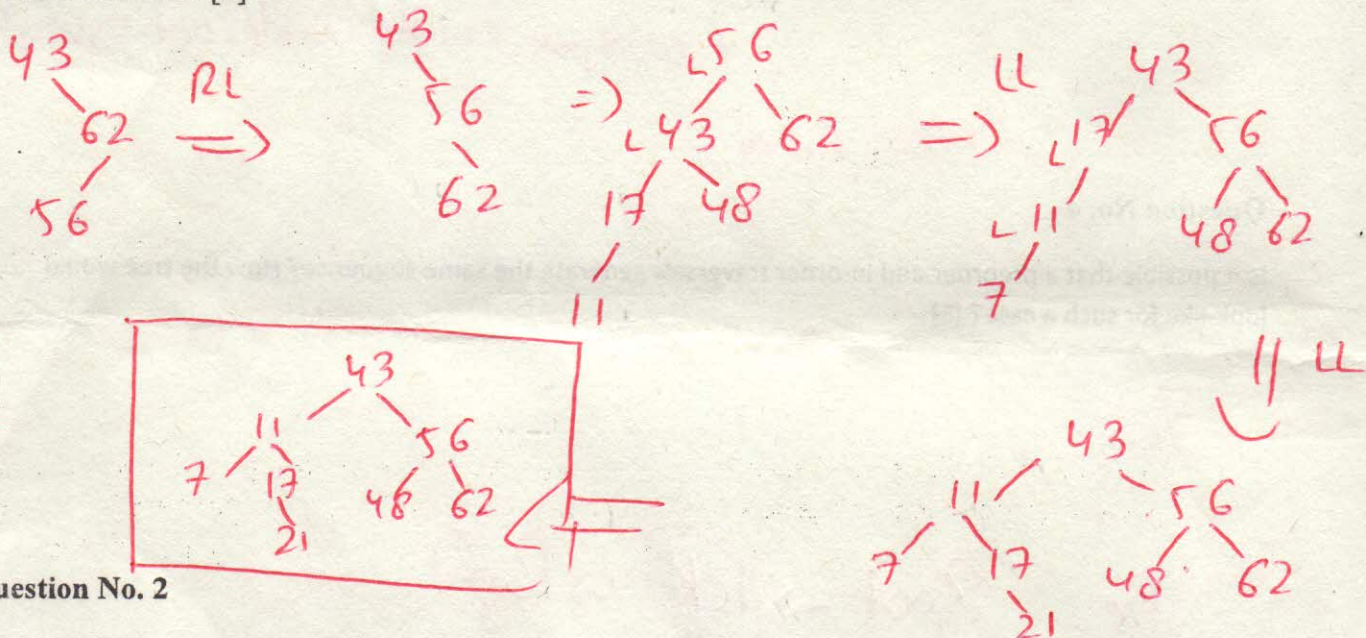


National University of Computer & Emerging Sciences
FAST-Karachi Campus
CS218- Data Structures (Fall 2019)
Grand Quiz

Std-ID: _____ Marks: 20

Consider the following sequence of values that you need to insert into an initially empty AVL Tree, AVLTree<int>: 43, 62, 56, 48, 17, 11, 7, 21 Draw step-wise and mentioned where you perform rotations. [5]



Given the following signature of the function. Write the code to give the next Higer value than the given x for the tree given by the pointer root. [5]

```

T& BSTree<T>::NextHigher(BSTree<T> * root, T & x) {
    node *successor = null;
    nexthigher(node *root, node *successor, int x) {
        if (root == null) {
            successor = null;
            return;
        }
        if (root->data == x) {
            if (root->right != null) {
                successor = findmin(root->right);
            }
        }
        else if (root->data < x) {
            nexthigher(root->right, successor, x);
        }
        else {
            successor = root;
            nexthigher(root->left, successor, x);
        }
    }
}

```

OR
Inorder traversal
next value after
x;

Question No. 3

Given a BST root, you need to count all nodes that have both the children. [5]

```
unsigned int BSTree<T>:: CountParentWith2Child (BSTree<T> * root)
```

```
    int count = 0;
```

```
    if (root == NULL) {  
        return 0;
```

```
    if (root->left && root->right) {  
        count++;
```

```
    }  
    ← count += countParentWith2Child (root->left)  
    + countParentWith2Child (root->right);
```

```
    return count;
```

Question No. 4

Is it possible that a preorder and in-order traversals generate the same sequence? How the tree would look-like for such a case? [5]

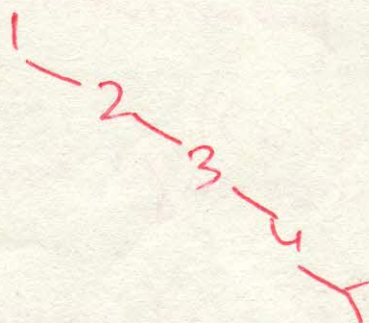
Yes

Pre = Root → ~~Left~~ → Right.

In = ~~Left~~ → Root → Right

If left tree doesn't exist at all
then yes.

eg



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Dated: November 28, 2019
Time: 40 min.

Std-ID: 1 Marks: 20

Question No. 1

Draw the contents of the hash table in the boxes given the following conditions: The size of the hash table is 13. Open addressing and double hashing is used to resolve collisions. The hash function used is $H(k) = k \bmod 12$. The second hash function is: $G(k) = 11 - (k \bmod 11)$. What values will be in the hash table after the following sequence of insertions? Show complete working. [5]

33, 10, 9, 13, 12, 45, 26, 17

0	12
1	13
2	26
3	
4	
5	17
6	
7	45
8	
9	33
10	10
11	9
12	

$$12 \bmod 12 = 0$$

Question No. 2

Given the following signature of the function. Write the code to give the next Lower value than the given x for the tree given by the pointer root. [5]

```
T& BSTree<T>::NextLower(BSTree<T> * root, T & x)
```

```

node *predes = NULL;
nextlower (root, predes, x) {
    if (root == NULL) {
        return predes = NULL;
    }
    if (root->data == x) {
        if (root->left) {
            predes = findmax (root->left);
        }
        else {
            cout << "no lower value";
        }
    }
    else if (x < root->data) {
        nextlower (root->left, predes, x);
    }
    else {
        predes = root;
        nextlower (root->right, predes, x);
    }
}

```

Option 1
Inorder traversal
value just before
 x

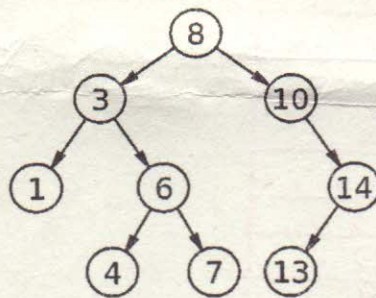
Question No. 3

Given an array of integer, write a routine to check if it is satisfying MinHeap condition or not. [5]

```
for (int i = n/2 - 1; i >= 0; i--) {  
    if (arr[i] < arr[2i+1] & & arr[i] < arr[2i+2])  
        continue;  
    else  
        cout << "no min heap";  
        break;  
}
```

Question No. 4

Given the following tree give the sequence of node in (1) Pre-Order (2) Post-Order



Pre-order => 8 | 3 | 1 | 6 | 4 | 7 | 10 | 14 | 13

Post-order => 1 | 4 | 7 | 6 | 3 | 13 | 14 | 10 | 8

AA

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7-26 mod 7
7-5=2
26+21
25 mod 2

Dated: November 28, 2019
Time: 40 min.

Marks: 20

Std-ID: _____

Question No. 1

Draw the contents of the hash table in the boxes given the following conditions: The size of the hash table is 12. Open addressing and double hashing is used to resolve collisions. The hash function used is $H(k) = k \bmod 12$ The second hash function is: $G(k) = 7 - (k \bmod 7)$. What values will be in the hash table after the following sequence of insertions? Show complete working. [5]

33, 10, 9, 13, 12, 45, 26, 17

0	12
1	13
2	9
3	
4	26
5	45
6	
7	
8	
9	33
10	10
11	

17 not possible

$9 + \frac{1(4)}{2(4)} \cdot 12$
 $2(4)$
 $2(12)$

Question No. 2

Write a function that takes two Binary Search Trees (BST) pointers and check if the two BST are structural identical or not. With different values in nodes two tree can have same structures.

bool IsStructuralIdenticals(BTNode<T> *T1, BTNode<T> * T2) [5]

```

if (T1 == NULL && T2 == NULL) {
    return true;
}

if (T1 != NULL && T2 != NULL) {
    return (
        isStructuralIdentical(T1->left, T2->left) &&
        isStructuralIdentical(T1->right, T2->right)
    );
}

else {
    return false;
}
    
```


Question No. 3

Given an array of integer, write a routine to check if it is satisfying MaxHeap condition or not. [5]

*for (int i = n/2 - 1 ; i ≥ 0 ; i--) { // each parent checked
if (arr[i] > arr[2i+1] && arr[i] > arr[2i+2])
continue;*

*else
return << "not maxheap";
break;*

Question No. 4

Given the following two order sequence of a BST. Produce a single distinct BST from these sequences.

In Order sequence of BST: 21,29,31,39,57,61,64

Preorder sequence of BST: 39,21,29,31,57,61,64

