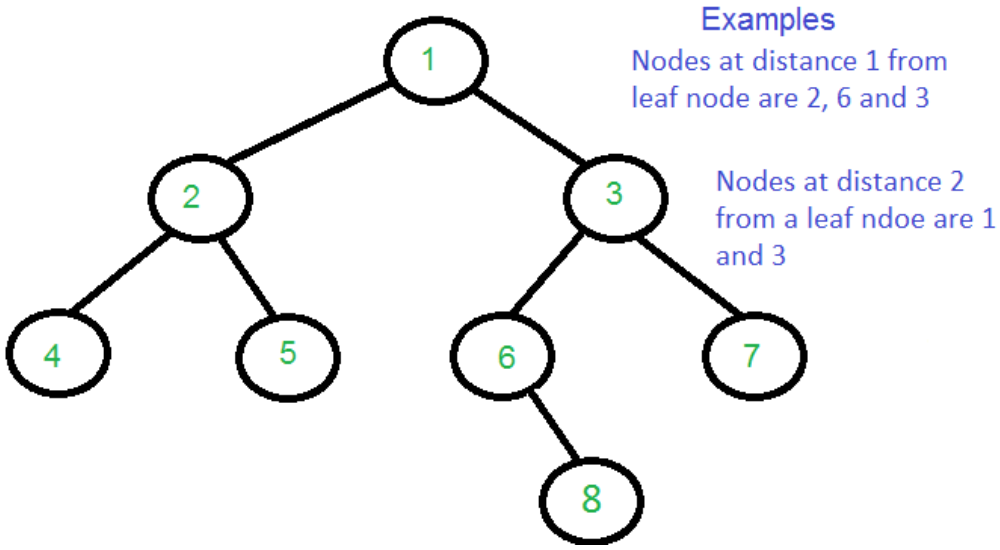
Print all nodes that are at distance k from a leaf node

Given a Binary Tree and a positive integer k, print all nodes that are distance k from a leaf node.

Here the meaning of distance is different from previous post. Here k distance from a leaf means k levels higher than a leaf node. For example if k is more than height of Binary Tree, then nothing should be printed. Expected time complexity is O(n) where n is the number nodes in the given Binary Tree.



We strongly recommend to minimize the browser and try this yourself first.

The idea is to traverse the tree. Keep storing all ancestors till we hit a leaf node. When we reach a leaf node, we print the ancestor at distance k. We also need to keep track of nodes that are already printed as output. For that we use a boolean array visited[].

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```
/* Program to print all nodes which are at distance k from a leaf */
#include <iostream>
using namespace std;
#define MAX_HEIGHT 10000

struct Node
{
    int key;
    Node *left, *right;
};

/* utility that allocates a new Node with the given key  */
Node* newNode(int key)
{
    Node* node = new Node;
    node->key = key;
    node->left = node->right = NULL;
    return (node);
}
```

```
/* This function prints all nodes that are distance k from a leaf node
   path[] --> Store ancestors of a node
   visited[] --> Stores true if a node is printed as output.  A node m
                 distance away from many leaves, we want to print it o
void kDistantFromLeafUtil(Node* node, int path[], bool visited[],
                          int pathLen, int k)
{
    // Base case
    if (node==NULL) return;

    /* append this Node to the path array */
    path[pathLen] = node->key;
    visited[pathLen] = false;
    pathLen++;

    /* it's a leaf, so print the ancestor at distance k only
       if the ancestor is not already printed  */
    if (node->left == NULL && node->right == NULL &&
        pathLen-k-1 >= 0 && visited[pathLen-k-1] == false)
    {
        cout << path[pathLen-k-1] << " ";
        visited[pathLen-k-1] = true;
        return;
    }

    /* If not leaf node, recur for left and right subtrees */
    kDistantFromLeafUtil(node->left, path, visited, pathLen, k);
```


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```
    kDistantFromLeafUtil(node->right, path, visited, pathLen, k);
}

/* Given a binary tree and a nuber k, print all nodes that are k
   distant from a leaf*/
void printKDistantfromLeaf(Node* node, int k)
{
    int path[MAX_HEIGHT];
    bool visited[MAX_HEIGHT] = {false};
    kDistantFromLeafUtil(node, path, visited, 0, k);
}

/* Driver program to test above functions*/
int main()
{
    // Let us create binary tree given in the above example
    Node * root = newNode(1);
    root->left = newNode(2);
    root->right = newNode(3);
    root->left->left = newNode(4);
    root->left->right = newNode(5);
    root->right->left = newNode(6);
    root->right->right = newNode(7);
    root->right->left->right = newNode(8);

    cout << "Nodes at distance 2 are: ";
    printKDistantfromLeaf(root, 2);

    return 0;
}
```

Output:

```
Nodes at distance 2 are: 3 1
```

Time Complexity: Time Complexity of above code is O(n) as the code does a simple tree traversal.

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