

## Node at distance K in C++

```
#include <iostream>
#include <queue>
using namespace std;

// Definition of a binary
tree node
struct Node {
    int data;
    Node* left;
    Node* right;

    Node(int item) {
        data = item;
        left = nullptr;
        right = nullptr;
    }
};

// Function declaration
void
printNodesDown(Node*
root, int k);

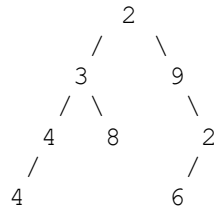
// Function to print nodes
at distance k from the
given node
int
nodesAtDistanceKWithRo
otDistance(Node* root, int
node, int k) {
    if (root == nullptr) {
        return -1;
    }

    // If the current node is
the target node, print
nodes at distance k from it
    if (root->data == node) {
        printNodesDown(root, k);
        return 0;
    }

    // Recursively search in
left subtree
    int leftHeight =
nodesAtDistanceKWithRo
otDistance(root->left,
node, k);
    if (leftHeight != -1) {
        // If the target node is
found in the left subtree
        if (leftHeight + 1 ==
k) {
            cout << root->data
<< endl;
        } else {
            // Print nodes at
distance k from the right
subtree

```

### Binary Tree Structure:



### Objective:

Print all nodes that are **exactly k=2 distance** away from node with value 3.

### Dry Run Table:

Step	Function Call	Current Node	Action	Output	Return Value
1	nodesAtDistanceK (root=2, node=3, k=2)	2	Call nodesAtDistanceKWithRootDistance		
2	nodesAtDistanceKWithRootDistance (root=2, node=3, k=2)	2	Not target → search left and right		
3	nodesAtDistanceKWithRootDistance (root=3, node=3, k=2)	3	🎯 Target found! Call printNodesDown (3, 2)		0
4	printNodesDown (root=3, k=2)	3	Go down to distance 2		
5	printNodesDown (root=4, k=1)	4	Recurse to left → node 4		
6	printNodesDown (root=4, k=0)	4 (leaf)	✓ Distance 0 → print 4	4	
7	printNodesDown (root=8, k=1)	8	No children		
8	Back to step 2, leftHeight = 0		Check if root (2) is at k=2? No → Call printNodesDown (right, k-2)		
9	printNodesDown (root=9, k=0)	9	✓ Distance 0 → print 9	9	
10	All done		Final output = 4, 9		

```

printNodesDown(root-
>right, k - leftHeight - 2);
    }
    return leftHeight + 1;
}

```

```

// Recursively search in
right subtree
int rightHeight =
nodesAtDistanceKWithRo
otDistance(root->right,
node, k);
if (rightHeight != -1) {
    // If the target node is
found in the right subtree
    if (rightHeight + 1 ==
k) {
        cout << root->data
<< endl;
    } else {
        // Print nodes at
distance k from the left
subtree

```

```

printNodesDown(root-
>left, k - rightHeight - 2);
    }
    return rightHeight +
1;
}

```

```

// If the target node is
not found in either subtree
return -1;
}

```

```

// Function to print nodes
at distance k from a given
node downwards
void
printNodesDown(Node*
root, int k) {
    if (root == nullptr || k
< 0) {
        return;
    }

```

```

// If reached the
required distance, print
the node
if (k == 0) {
    cout << root->data <<
endl;
    return;
}

```

```

// Recursively print
nodes at distance k in both
subtrees
printNodesDown(root-
>left, k - 1);

```

## ✓ Final Output:

4  
9

```

    printNodesDown(root->right, k - 1);
}

// Function to initiate
printing nodes at distance
k from a given node value
void
nodesAtDistanceK(Node*
root, int node, int k) {

nodesAtDistanceKWithRo
otDistance(root, node, k);
}

int main() {
    // Hardcoded tree
construction
    Node* root = new
Node(2);
    root->left = new
Node(3);
    root->left->left = new
Node(4);
    root->left->right = new
Node(8);
    root->left->left->left =
new Node(4);
    root->right = new
Node(9);
    root->right->right =
new Node(2);
    root->right->right->left
= new Node(6);

    // Call function to print
nodes at distance k from
node with value 3
    nodesAtDistanceK(root,
3, 2);

    // Clean up dynamically
allocated memory
    delete root->right->right->left;
    delete root->right->right;
    delete root->right;
    delete root->left->left->left;
    delete root->left->left;
    delete root->left->right;
    delete root->left;
    delete root;

    return 0;
}

```