111-2 Data Structure

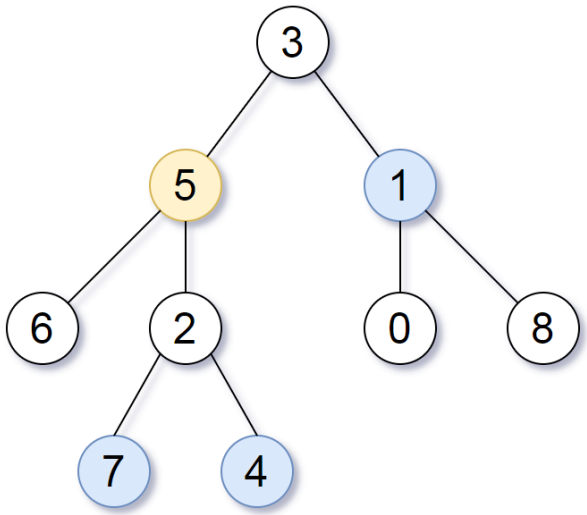
Homework 6 - Tree

Question 1 (80%)

You are an explorer on a quest to discover a hidden treasure in a vast jungle. You have a map that shows the location of various flags, each of which represents a node in a binary tree system. The distance between each flag is one kilometer, represented by one step. You start your journey from the current flag and have to find the target flag, which is k steps away from your current location.

Write a function that takes the number of nodes, the nodes in binary tree, the value of your current node, and an integer K as input, and returns an array of the values of all nodes that have a distance K from your current node. If there are no such nodes, return an empty array.

For example, given the binary tree with 11 nodes [3 5 1 6 2 0 8 -1 -1 7 4], your current node value of 5, and a distance K of 2. The function should return [7 4 1], as these are the nodes that are 2 steps away from your current flag with value 5. Note that the value -1 means null node. You may assume that the binary tree is non-empty, and the value of each node is unique.



NOTE:

The input format for the tree is an array where each element represents a node in the

tree. The tree is constructed in a level-order fashion, from left to right. Specifically, the root node is at index 0 of the array, its left child is at index 1, and its right child is at index 2. For any given node at index i, its left child is at index 2i + 1 and its right child is at index 2i + 2.

In the example input [3 5 1 6 2 0 8 -1 -1 7 4], the root node has value 3, so it is at index 0 of the array. Its left child has value 5 and is at index 1, and its right child has value 1 and is at index 2. The left child of the node with value 5 is at index 3 and has value 6, while its right child is at index 4 and has value 2. The left child of the node with value 1 is at index 5 and has value 0, while its right child is at index 6 and has value 8. Finally, the left child of the node with value 2 is at index 9 and has value 7, and its right child is at index 10 and has value 4.

Note that values -1 in the array represent missing nodes in the tree. In the example, the nodes with values 6 is a leaf node, so its children are represented as values -1 in the array. The two nodes with null values would not connect to each other.

Input format

- The first line of a test case is an integer *N*, the number of nodes.
- The second line of a test case are N integers representing the node of the binary tree system.
- The third line of a test case is the value of the target flag (a node in the binary tree system).
- The forth line of a test case is an integer representing the distance in steps from your current flag (node) to the other flags (nodes) that need to be returned.

Constraints

The number of nodes in the tree is in the range [1, 500]

$0 \leq \text{values of node} \leq 500$, -1 means null node

All the values of node are unique.

Current node is the value of one of the nodes in the tree.

$0 < \text{k} \leq 1000$

Output format

A list of integers representing the values of all nodes that have a distance of k steps from the target flag. The output should be sorted from large to small.

Sample input 1

11

3 5 1 6 2 0 8 -1 -1 7 4

5

2

Sample output 1

7 4 1

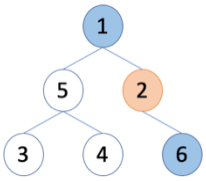
Sample input 2

7

1 5 2 3 4 -1 6

2

1



Sample output 2

6 1

Sample input 3

1

1

1

3

Sample output 3

Null

Question 2 (20%)

Continuing from Question 1, you start your journey from the current flag and have to find the target flag, which is the farthest step away from your current location.

Write a function that takes the number of nodes, the nodes in binary tree, the value of your current node, and returns an array of the values of all nodes that have the farthest distance from your current node.

For example, given the binary tree with 11 nodes [3 5 1 6 2 0 8 -1 -1 7 4], your current node value of 5. The function should return [8 0], as these are the nodes that are 3 steps away from your current flag with value 5. You may assume that the binary tree is non-empty, and the value of each node is unique.

Input format

- The first line of a test case is an integer *N*, the number of nodes.
- The second line of a test case are N integers representing the node of the binary tree system.
- The third line of a test case is the value of the target flag (a node in the binary tree system).

Constraints

The number of nodes in the tree is in the range [1, 500]

$0 \leq \text{values of node} \leq 500$, -1 means null node

All the values of node are unique.

Current node is the value of one of the nodes in the tree.

Output format

A list of integers representing the values of all nodes that have the farthest distance from the target flag. The output should be sorted from large to small.

Sample input 1

11

3 5 1 6 2 0 8 -1 -1 7 4

5

Sample output 1

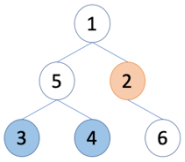
8 0

Sample input 2

7

1 5 2 3 4 -1 6

2



Sample output 2

4 3

Sample input 3

1

1

1

Sample output 3

1