

“Data Structures (IS33)”

A report submitted on Leetcode questions.

In

Third Semester

By

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STACK —

Problem 3174 – Clear Digits (Easy)

You are given a string s .

Your task is to remove **all** digits by doing this operation repeatedly:

- Delete the *first* digit and the **closest non-digit** character to its *left*.

Return the resulting string after removing all digits.

Example:

Input: $s = \text{"cb34"}$

Output: ""

Explanation:

First, we apply the operation on $s[2]$, and s becomes "c4" .

Then we apply the operation on $s[1]$, and s becomes "" .

Constraints:

- $1 \leq s.length \leq 100$
- s consists only of lowercase English letters and digits.
- The input is generated such that it is possible to delete all digits.

The screenshot displays a coding platform interface with the following components:

- Problem Status:** "Accepted" with 688 / 688 testcases passed. Submitted by Atharv on Jan 06, 2025 16:24.
- Performance Metrics:**
 - Runtime: 0 ms, Beats 100.00%
 - Memory: 8.38 MB, Beats 79.71%
- Bar Chart:** A chart showing the distribution of runtime performance across different percentiles.
- Code Editor:** Contains the following C++ code:

```
1 class Solution {
2 public:
3     string clearDigits(string s) {
4         int j = 0;
5         for (int i = 0; i < s.length(); i++){
6             if (isdigit(s[i]))
7                 j--;
8             else
9                 s[j++] = s[i];
10        }
11        return s.substr(0, j);
12    }
13 }
```
- Testcase:** Case 1 shows input $s = \text{"abc"}$.
- Navigation:** Buttons for Description, Editorial, Solutions, and Submissions are visible at the bottom.

Problem 678 – Valid Parenthesis String (Medium)

Given a string s containing only three types of characters: '(', ')' and '*', return true *if s is valid*.

The following rules define a **valid** string:

- Any left parenthesis '(' must have a corresponding right parenthesis ')'.
- Any right parenthesis ')' must have a corresponding left parenthesis '('.
- Left parenthesis '(' must go before the corresponding right parenthesis ')'.
- '*' could be treated as a single right parenthesis ')' or a single left parenthesis '(' or an empty string "".

Example 1:

Input: $s = "(*)"$

Output: true

Example 2:

Input: $s = "(*))"$

Output: true

Constraints:

- $1 \leq s.length \leq 100$
- $s[i]$ is '(', ')' or '*'.

The screenshot shows the LeetCode submission interface for Problem 678. The submission is marked as 'Accepted' with 83/83 test cases passed. The performance metrics are 0ms runtime, 100.00% beats, 8.18 MB memory, and 39.47% beats. A bar chart shows the runtime performance across all test cases. The code editor displays a C++ solution using a stack to validate the string. The test case input is '()' and the output is true.

```
class Solution {
public:
    bool checkValidString(string s) {
        stack<int> open_star;
        for(int i=0; i<s.length(); i++){
            if(s[i]=='('){
                if(open_star.empty()) return false;
                else star.pop();
            }
            else if(s[i]=='*'){
                // ...
            }
        }
    }
};
```

QUEUE –

Problem 1700 – Number of Students Unable to Eat Lunch (Easy)

The school cafeteria offers circular and square sandwiches at lunch break, referred to by numbers 0 and 1 respectively. All students stand in a queue. Each student either prefers square or circular sandwiches.

The number of sandwiches in the cafeteria is equal to the number of students. The sandwiches are placed in a **stack**. At each step:

- If the student at the front of the queue **prefers** the sandwich on the top of the stack, they will **take it** and leave the queue.
- Otherwise, they will **leave it** and go to the queue's end.

This continues until none of the queue students want to take the top sandwich and are thus unable to eat.

You are given two integer arrays `students` and `sandwiches` where `sandwiches[i]` is the type of the i^{th} sandwich in the stack ($i = 0$ is the top of the stack) and `students[j]` is the preference of the j^{th} student in the initial queue ($j = 0$ is the front of the queue). Return *the number of students that are unable to eat*.

Example 1:

Input: `students = [1,1,0,0]`, `sandwiches = [0,1,0,1]`

Output: 0

Explanation:

- Front student leaves the top sandwich and returns to the end of the line making `students = [1,0,0,1]`.
- Front student leaves the top sandwich and returns to the end of the line making `students = [0,0,1,1]`.
- Front student takes the top sandwich and leaves the line making `students = [0,1,1]` and `sandwiches = [1,0,1]`.
- Front student leaves the top sandwich and returns to the end of the line making `students = [1,1,0]`.

- Front student takes the top sandwich and leaves the line making students = [1,0] and sandwiches = [0,1].
- Front student leaves the top sandwich and returns to the end of the line making students = [0,1].
- Front student takes the top sandwich and leaves the line making students = [1] and sandwiches = [1].
- Front student takes the top sandwich and leaves the line making students = [] and sandwiches = [].

Hence all students are able to eat.

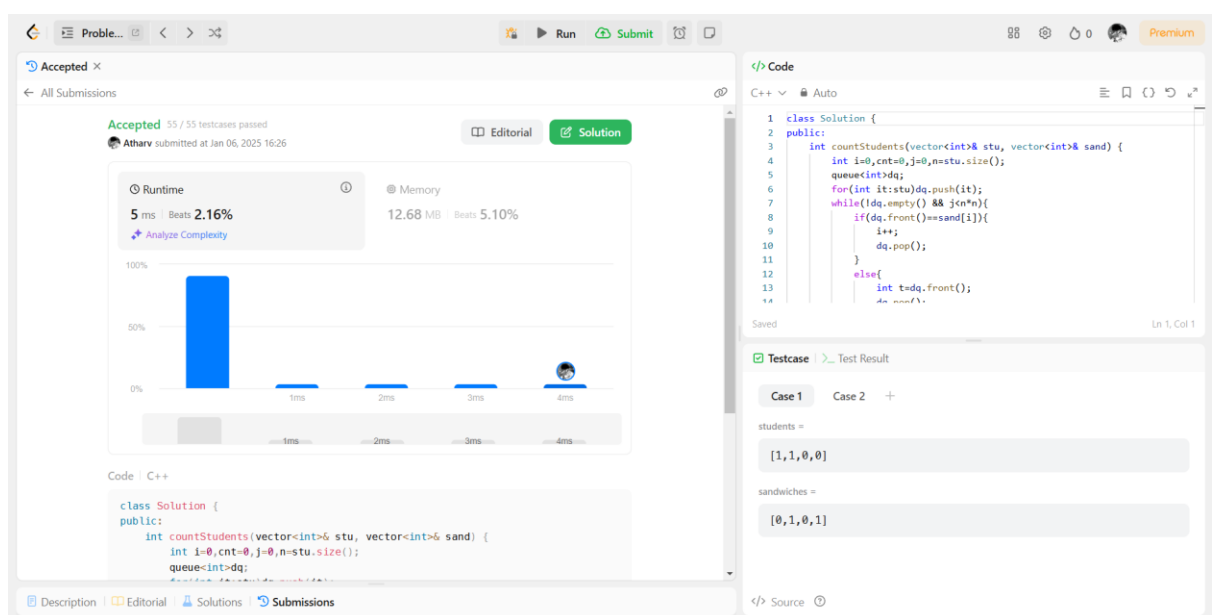
Example 2:

Input: students = [1,1,1,0,0,1], sandwiches = [1,0,0,0,1,1]

Output: 3

Constraints:

- $1 \leq \text{students.length}, \text{sandwiches.length} \leq 100$
- $\text{students.length} == \text{sandwiches.length}$
- $\text{sandwiches}[i]$ is 0 or 1.
- $\text{students}[i]$ is 0 or 1.



Problem 341- Flatten Nested List Iterator (Medium)

You are given a nested list of integers `nestedList`. Each element is either an integer or a list whose elements may also be integers or other lists. Implement an iterator to flatten it.

Implement the `NestedIterator` class:

- `NestedIterator(List<NestedInteger> nestedList)` Initializes the iterator with the nested list `nestedList`.
- `int next()` Returns the next integer in the nested list.
- `boolean hasNext()` Returns true if there are still some integers in the nested list and false otherwise.

Your code will be tested with the following pseudocode:

```
initialize iterator with nestedList
```

```
res = []
```

```
while iterator.hasNext()
```

```
    append iterator.next() to the end of res
```

```
return res
```

If `res` matches the expected flattened list, then your code will be judged as correct.

Example 1:

Input: `nestedList = [[1,1],2,[1,1]]`

Output: `[1,1,2,1,1]`

Explanation: By calling `next` repeatedly until `hasNext` returns false, the order of elements returned by `next` should be: `[1,1,2,1,1]`.

Example 2:

Input: `nestedList = [1,[4,[6]]]`

Output: `[1,4,6]`

Explanation: By calling `next` repeatedly until `hasNext` returns false, the order of elements returned by `next` should be: `[1,4,6]`.

Constraints:

- $1 \leq \text{nestedList.length} \leq 500$
- The values of the integers in the nested list is in the range $[-10^6, 10^6]$.

The screenshot displays a LeetCode submission interface. On the left, the 'Accepted' status is shown with 43/43 test cases passed. The runtime is 7ms, beating 53.59% of solutions, and the memory usage is 17.96 MB, beating 58.34%. A bar chart illustrates the runtime distribution across different time intervals. The right side of the image shows the C++ code for a 'NestedIterator' class, which uses a queue to traverse a nested list of integers. Below the code, a test case is provided with the input `[[1,1],2,[1,1]]`.

Runtime Performance:

Runtime (ms)	Percentage
0-1	~8%
1-2	~1%
2-3	~18%
3-4	~12%
4-5	~5%
5-6	~4%
6-7	~15%
7-8	~12%
8-9	~5%
9-10	~4%
10-11	~6%
11-12	~4%

C++ Code:

```
19 class NestedIterator {
20 public:
21     queue<int> q;
22
23     void f(const vector<NestedInteger> &nestedList){
24         for(auto& L: nestedList){
25             if (L.isInteger()) q.push(L.getInteger());
26             else f(L.getList());
27         }
28     }
29
30     NestedIterator(vector<NestedInteger> &nestedList) {
31         f(nestedList);
32     }
33 }
```

Testcase:

Case 1 Case 2 +

nestedList =

```
[[1,1],2,[1,1]]
```


LINKED LIST –

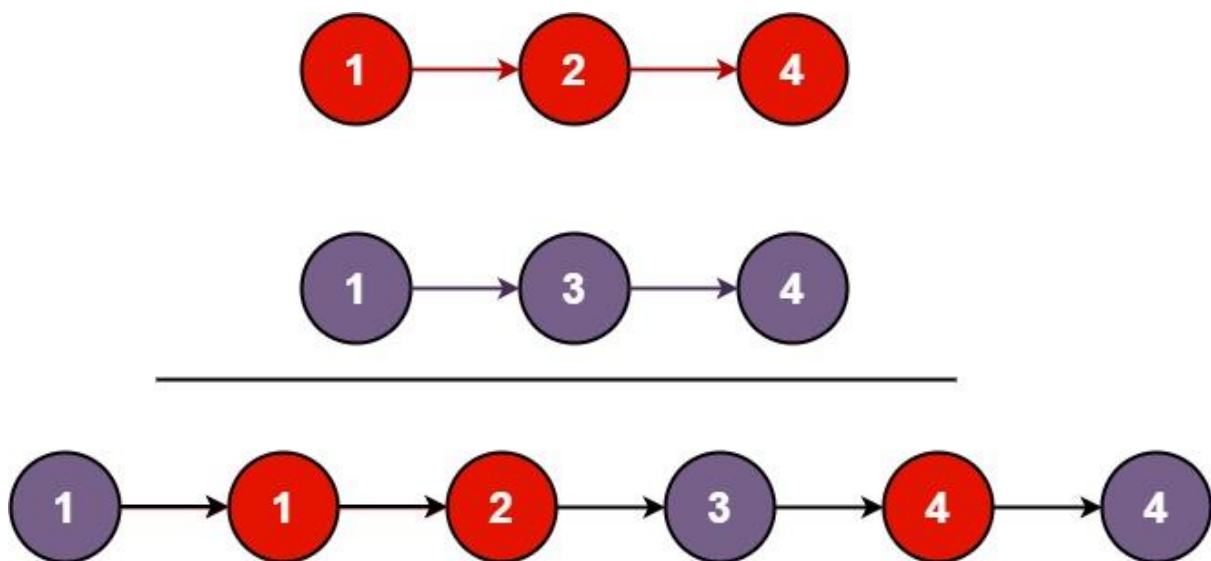
Problem 21– Merge Two Sorted Lists (Easy)

You are given the heads of two sorted linked lists list1 and list2.

Merge the two lists into one **sorted** list. The list should be made by splicing together the nodes of the first two lists.

Return *the head of the merged linked list*.

Example 1:



Input: list1 = [1,2,4], list2 = [1,3,4]

Output: [1,1,2,3,4,4]

Example 2:

Input: list1 = [], list2 = []

Output: []

Example 3:

Input: list1 = [], list2 = [0]

Output: [0]

Constraints:

- The number of nodes in both lists is in the range [0, 50].
- $-100 \leq \text{Node.val} \leq 100$
- Both list1 and list2 are sorted in **non-decreasing** order.

The screenshot shows a LeetCode submission interface. On the left, the submission status is 'Accepted' with a message '208 / 208 testcases passed' and 'Atharv submitted at Jan 06, 2025 16:28'. Below this, a bar chart shows the runtime performance, with the user's submission at 0ms, beating 100.00% of other submissions. The memory usage is 19.44 MB, beating 75.48% of other submissions. The code is written in C++ and implements a function to merge two sorted linked lists. The code is as follows:

```
11 class Solution {
12 public:
13     ListNode* mergeTwoLists(ListNode* list1, ListNode* list2) {
14         if(list1 == NULL) return list2;
15         if(list2 == NULL) return list1;
16         if(list1->val > list2->val) std::swap(list1, list2);
17         ListNode* result = list1;
18         while(list1 != NULL && list2 != NULL){
19             ListNode* temp = NULL;
20             while(list1 != NULL && list1->val <= list2->val){
21                 temp = list1;
22                 list1 = list1->next;
23             }
24             temp->next = list2;
25         }
26         return result;
27     }
28 }
```

The test case shows two input lists: list1 = [1, 2, 4] and list2 = [1, 3, 4]. The output is the merged list: [1, 1, 2, 3, 4, 4].

Problem 706 – Design Hashmap (Easy)

Design a HashMap without using any built-in hash table libraries.

Implement the MyHashMap class:

- MyHashMap() initializes the object with an empty map.
- void put(int key, int value) inserts a (key, value) pair into the HashMap. If the key already exists in the map, update the corresponding value.
- int get(int key) returns the value to which the specified key is mapped, or -1 if this map contains no mapping for the key.
- void remove(key) removes the key and its corresponding value if the map contains the mapping for the key.

Example 1:

Input

["MyHashMap", "put", "put", "get", "get", "put", "get", "remove", "get"]

[[], [1, 1], [2, 2], [1], [3], [2, 1], [2], [2], [2]]

Output

[null, null, null, 1, -1, null, 1, null, -1]

Explanation

```
MyHashMap myHashMap = new MyHashMap();
```

```
myHashMap.put(1, 1); // The map is now [[1,1]]
```

```
myHashMap.put(2, 2); // The map is now [[1,1], [2,2]]
```

```
myHashMap.get(1); // return 1, The map is now [[1,1], [2,2]]
```

```
myHashMap.get(3); // return -1 (i.e., not found), The map is now [[1,1], [2,2]]
```

```
myHashMap.put(2, 1); // The map is now [[1,1], [2,1]] (i.e., update the existing value)
```

```
myHashMap.get(2); // return 1, The map is now [[1,1], [2,1]]
```

```
myHashMap.remove(2); // remove the mapping for 2, The map is now [[1,1]]
```

myHashMap.get(2); // return -1 (i.e., not found), The map is now [[1,1]]

Constraints:

- $0 \leq \text{key}, \text{value} \leq 10^6$
- At most 10^4 calls will be made to put, get, and remove.

The screenshot shows a LeetCode submission interface. On the left, the 'Accepted' status is confirmed with 37/37 testcases passed. The submission was made by 'Atharv' on Jan 06, 2025 at 16:28. Performance metrics show a runtime of 49 ms (beats 42.75%) and memory usage of 220.38 MB (beats 15.91%). A bar chart visualizes the runtime distribution across various time intervals. Below the chart, the C++ code for the 'MyHashMap' class is displayed. On the right, the 'Code' editor shows the same C++ code. Below the code, the 'Testcase' section shows 'Case 1' with a sequence of operations: ["MyHashMap", "put", "put", "get", "get", "put", "get", "remove", "get"] and the corresponding input/output pairs: [[], [1,1], [2,2], [1], [3], [2,1], [2], [2], [2]].

Accepted 37 / 37 testcases passed
Atharv submitted at Jan 06, 2025 16:28

Runtime: 49 ms | Beats: 42.75%
Memory: 220.38 MB | Beats: 15.91%

Code

```
1 class MyHashMap {
2 public:
3     int mp[1000001];
4
5     MyHashMap() {
6         for (int i = 0; i < 1000001; ++i) {
7             mp[i] = -1;
8         }
9     }
10
11     void put(int key, int value) {
12         mp[key] = value;
13     }
14 }
```

Testcase Case 1

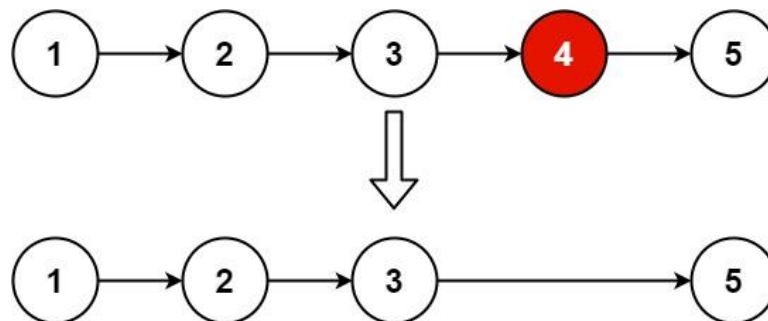
["MyHashMap", "put", "put", "get", "get", "put", "get", "remove", "get"]

[[], [1,1], [2,2], [1], [3], [2,1], [2], [2], [2]]

Problem 19- Remove Nth Node from End of List (Medium)

Given the head of a linked list, remove the n^{th} node from the end of the list and return its head.

Example 1:



Input: head = [1,2,3,4,5], n = 2

Output: [1,2,3,5]

Example 2:

Input: head = [1], n = 1

Output: []

Constraints:

- The number of nodes in the list is sz.
- $1 \leq sz \leq 30$
- $0 \leq \text{Node.val} \leq 100$

Accepted 208 / 208 testcases passed
Atharv submitted at Jan 06, 2025 16:28

Runtime: 0 ms | Beats 100.00%
Memory: 14.93 MB | Beats 39.60%

```
/**
 * Definition for singly-linked list.
 * struct ListNode {
 *     int val;
 *     ListNode *next;
 * };
 */
class Solution {
public:
    ListNode* removeNthFromEnd(ListNode* head, int n) {
        // ...
    }
};
```

Testcase 1: head = [1,2,3,4,5], n = 2

Problem 23- Merge k Sorted Lists (Hard)

You are given an array of k linked-lists lists, each linked-list is sorted in ascending order.

Merge all the linked-lists into one sorted linked-list and return it.

Example 1:

Input: lists = [[1,4,5],[1,3,4],[2,6]]

Output: [1,1,2,3,4,4,5,6]

Explanation: The linked-lists are:

[
1->4->5,
1->3->4,
2->6
]

merging them into one sorted list:

1->1->2->3->4->4->5->6

Constraints:

- $k == \text{lists.length}$
- $0 \leq k \leq 10^4$
- $0 \leq \text{lists}[i].\text{length} \leq 500$
- $-10^4 \leq \text{lists}[i][j] \leq 10^4$
- $\text{lists}[i]$ is sorted in **ascending order**.

The screenshot displays a coding platform interface with a problem list on the left and a code editor on the right. The problem is 'Merge k Sorted Lists' (Problem 23). The solution is accepted, with a runtime of 7 ms (beats 33.67%) and memory usage of 18.30 MB (beats 87.83%). The code is written in C++ and uses a min-heap to merge the k sorted linked lists. The test case input is lists = [[1,4,5],[1,3,4],[2,6]] and the expected output is [1,1,2,3,4,4,5,6].

Accepted 134 / 134 testcases passed
Atharv submitted at Jan 06, 2025 16:29

Runtime 7 ms | Beats 33.67%
Memory 18.30 MB | Beats 87.83%

Code C++

```
/**
 * Definition for singly-linked list.
 * struct ListNode {
 *     int val;
 *     ListNode *next;
 * };
 */
class Solution {
public:
    ListNode* mergeKLists(std::vector<ListNode*> lists) {
        if (lists.empty())
            return nullptr;
        auto cmp = [](ListNode* a, ListNode* b) {
            return a->val > b->val; // Min-heap based on node value
        };
        std::priority_queue<ListNode*, std::vector<ListNode*>, decltype(cmp)> minHeap(cmp);
    }
};
```

Testcase Case 1 Case 2 Case 3 +

lists =
[[1,4,5],[1,3,4],[2,6]]

TREES –

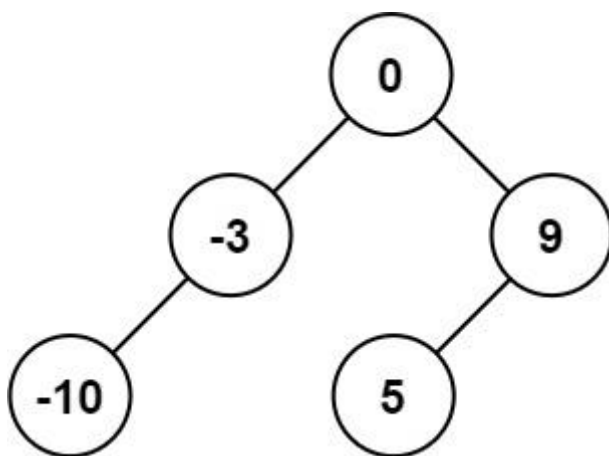
Problem 108– Covert Sorted Array to Binary Search Tree (Easy)

Given an integer array nums where the elements are sorted in **ascending order**, convert *it to a*

height-balanced

binary search tree.

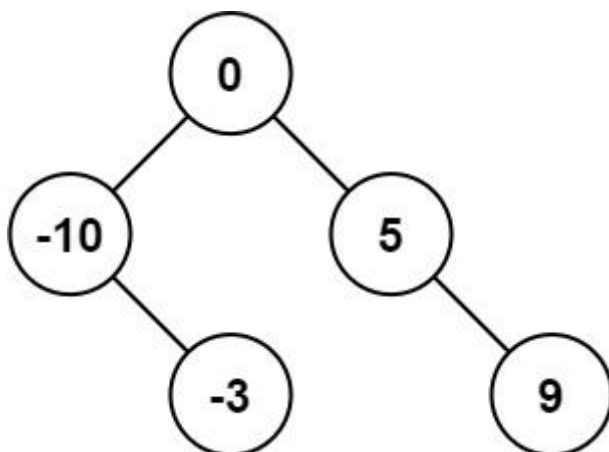
Example 1:



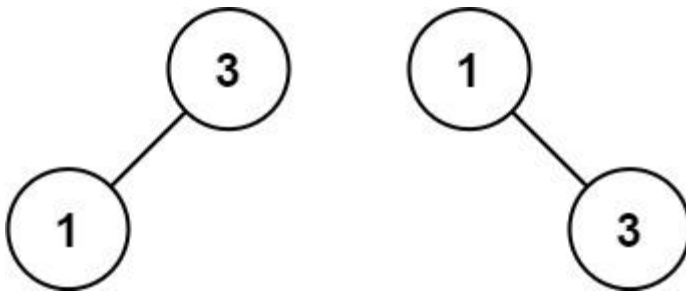
Input: nums = [-10,-3,0,5,9]

Output: [0,-3,9,-10,null,5]

Explanation: [0,-10,5,null,-3,null,9] is also accepted:



Example 2:



Input: nums = [1,3]

Output: [3,1]

Explanation: [1,null,3] and [3,1] are both height-balanced BSTs.

Constraints:

- $1 \leq \text{nums.length} \leq 10^4$
- $-10^4 \leq \text{nums}[i] \leq 10^4$
- nums is sorted in a **strictly increasing** order.

Accepted 31 / 31 testcases passed
Atharv submitted at Jan 06, 2025 16:29

Runtime: 3 ms | Beats: 58.52%
Memory: 22.98 MB | Beats: 41.91%

Code (C++)

```
class Solution {
public:
    TreeNode* func(vector<int>& nums, int i, int j){
        if (i > j) return NULL;
        int m = (i+j)/2;
        TreeNode* root = new TreeNode(nums[m]);
        root->left = func(nums,i,m-1);
        root->right = func(nums,m+1,j);
        return root;
    }
    TreeNode* sortedArrayToBST(vector<int>& nums) {
```

Testcase 1: Case 1 Case 2 +
nums = [-10,-3,0,5,9]

Problem 94– Binary Tree Inorder Traversal (Easy)

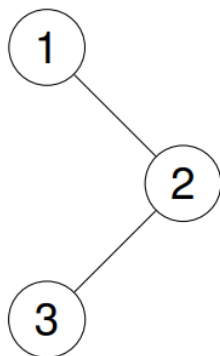
Given the root of a binary tree, return *the inorder traversal of its nodes' values*.

Example 1:

Input: root = [1,null,2,3]

Output: [1,3,2]

Explanation:

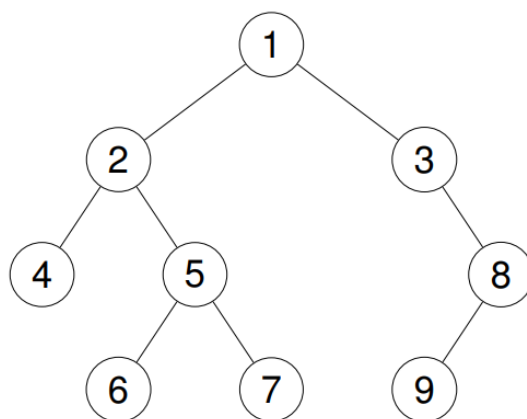


Example 2:

Input: root = [1,2,3,4,5,null,8,null,null,6,7,9]

Output: [4,2,6,5,7,1,3,9,8]

Explanation:



Example 3:

Input: root = []

Output: []

Example 4:

Input: root = [1]

Output: [1]

Constraints:

- The number of nodes in the tree is in the range [0, 100].
- $-100 \leq \text{Node.val} \leq 100$

The screenshot displays a LeetCode submission interface. On the left, the 'Accepted' status is confirmed with 71/71 test cases passed. The submission details show a runtime of 0ms (beating 100.00%) and a memory usage of 12.66 MB (beating 6.45%). A bar chart illustrates the performance relative to other submissions. The code editor on the right shows a C++ solution for the 'Binary Tree Inorder Traversal' problem, which uses a stack to simulate the recursive process. The test case input is `[1, null, 2, 3]`, and the output is a linked list structure: `1` → `2` → `3`.

```
class Solution {
public:
    vector<int> ans;
    vector<int> inorderTraversal(TreeNode* root) {
        if(!root) return {};
        inorderTraversal(root->left);
        ans.push_back(root->val);
        inorderTraversal(root->right);
        return ans;
    }
};
```

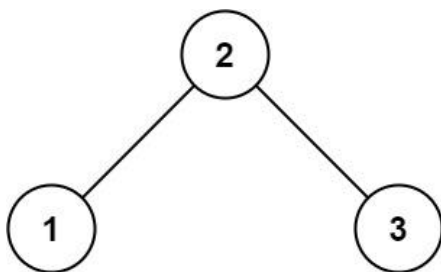
Problem 98- Validate Binary Search Tree (Medium)

Given the root of a binary tree, *determine if it is a valid binary search tree (BST)*.

A **valid BST** is defined as follows:

- The left subtree of a node contains only nodes with keys **less than** the node's key.
- The right subtree of a node contains only nodes with keys **greater than** the node's key.
- Both the left and right subtrees must also be binary search trees.

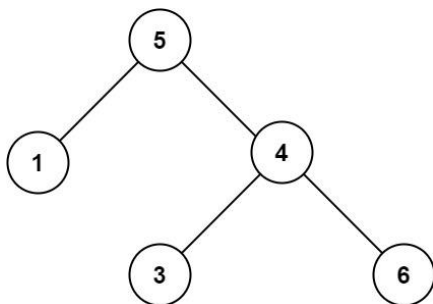
Example 1:



Input: root = [2,1,3]

Output: true

Example 2:



Input: root = [5,1,4,null,null,3,6]

Output: false

Explanation: The root node's value is 5 but its right child's value is 4.

Constraints:

- The number of nodes in the tree is in the range $[1, 10^4]$.
- $-2^{31} \leq \text{Node.val} \leq 2^{31} - 1$

Accepted 86 / 86 testcases passed
Atharv submitted at Jan 06, 2025 16:30

Runtime 0 ms | Beats 100.00%
Memory 22.14 MB | Beats 6.04%

Code | C++

```
// https://leetcode.com/problems/validate-binary-search-tree/description/  
  
// SOLUTION -
```

Testcase Test Result

Case 1 Case 2 +

root =

[2, 1, 3]

Diagram of a binary tree with root 2, left child 1, and right child 3.