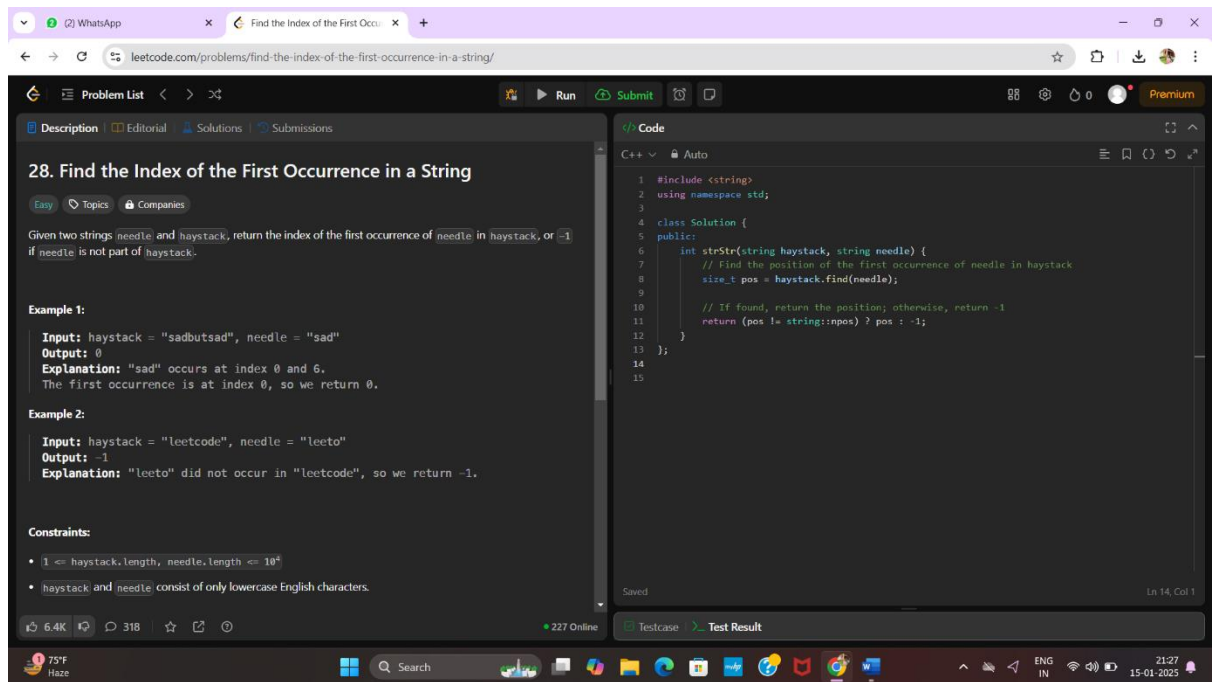


DAA HOLIDAY ASSIGNMENT

1) find-the-index-of-the-first-occurrence-in-a-string

<https://leetcode.com/problems/find-the-index-of-the-first-occurrence-in-a-string/>



28. Find the Index of the First Occurrence in a String

Easy Topics Companies

Given two strings `needle` and `haystack`, return the index of the first occurrence of `needle` in `haystack`, or `-1` if `needle` is not part of `haystack`.

Example 1:

Input: `haystack = "sadbutsad"`, `needle = "sad"`
Output: `0`
Explanation: "sad" occurs at index 0 and 6. The first occurrence is at index 0, so we return 0.

Example 2:

Input: `haystack = "leetcode"`, `needle = "leeto"`
Output: `-1`
Explanation: "leeto" did not occur in "leetcode", so we return -1.

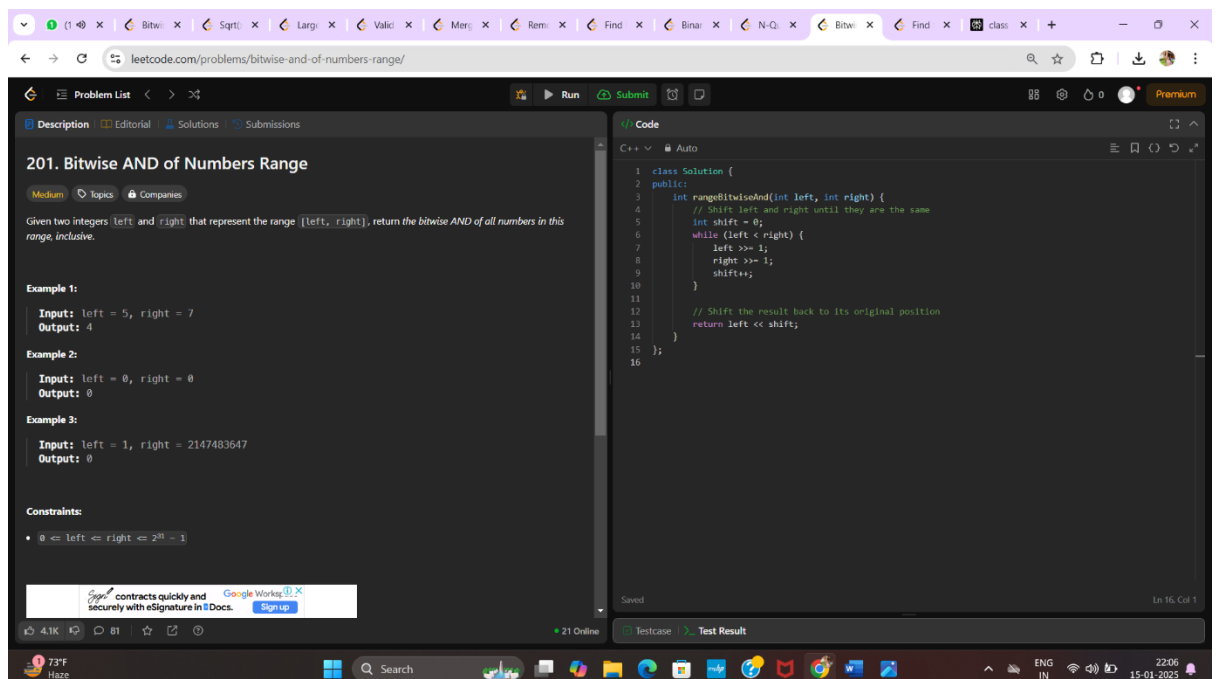
Constraints:

- $1 \leq \text{haystack.length}, \text{needle.length} \leq 10^4$
- `haystack` and `needle` consist of only lowercase English characters.

```
1 #include <string>
2 using namespace std;
3
4 class Solution {
5 public:
6     int strStr(string haystack, string needle) {
7         // Find the position of the first occurrence of needle in haystack
8         size_t pos = haystack.find(needle);
9
10        // If found, return the position; otherwise, return -1
11        return (pos != string::npos) ? pos : -1;
12    }
13 };
14
15
```

2) Bitwise AND of numberrange

<https://leetcode.com/problems/bitwise-and-of-numbers-range/description/>



201. Bitwise AND of Numbers Range

Medium Topics Companies

Given two integers `left` and `right` that represent the range `[left, right]`, return the *bitwise AND* of all numbers in this range, inclusive.

Example 1:

Input: `left = 5`, `right = 7`
Output: `4`

Example 2:

Input: `left = 0`, `right = 0`
Output: `0`

Example 3:

Input: `left = 1`, `right = 2147483647`
Output: `0`

Constraints:

- $0 \leq \text{left} \leq \text{right} \leq 2^{31} - 1$

```
1 class Solution {
2 public:
3     int rangeBitwiseAnd(int left, int right) {
4         // Shift left and right until they are the same
5         int shift = 0;
6         while (left < right) {
7             left >>= 1;
8             right >>= 1;
9             shift++;
10        }
11
12        // Shift the result back to its original position
13        return left << shift;
14    }
15 };
16
```

3)SQRT(X)

<https://leetcode.com/problems/sqrtx>

The screenshot shows the LeetCode interface for problem 69, 'Sqrt(x)'. The problem description states: 'Given a non-negative integer x, return the square root of x rounded down to the nearest integer. The returned integer should be non-negative as well. You must not use any built-in exponent function or operator. For example, do not use pow(x, 0.5) in c++ or x ** 0.5 in python.' Example 1: Input: x = 4, Output: 2. Example 2: Input: x = 8, Output: 2. The constraints are: 0 ≤ x ≤ 2³¹ - 1. The code editor shows a C++ solution using binary search.

```
1 #include <iostream>
2 using namespace std;
3
4 class Solution {
5 public:
6     int mySqrt(int x) {
7         if (x == 0 || x == 1) return x; // Handle edge cases
8
9         int left = 0, right = x, result = 0;
10
11         while (left <= right) {
12             long long mid = left + (right - left) / 2; // Use long long to avoid overflow
13             long long square = mid * mid;
14
15             if (square == x) {
16                 return mid; // Perfect square
17             } else if (square < x) {
18                 result = mid; // Update result
19                 left = mid + 1; // Search in the right half
20             } else {
21                 right = mid - 1; // Search in the left half
22             }
23         }
24
25         return result; // Return the largest integer whose square <= x
26     };
27 };
28
```

4)Largest Number

<https://leetcode.com/problems/largest-number/description/>

The screenshot shows the LeetCode interface for problem 179, 'Largest Number'. The problem description states: 'Given a list of non-negative integers nums, arrange them such that they form the largest number and return it. Since the result may be very large, so you need to return a string instead of an integer.' Example 1: Input: nums = [10,2], Output: "210". Example 2: Input: nums = [3,30,34,5,9], Output: "9534330". The constraints are: 1 ≤ nums.length ≤ 100, 0 ≤ nums[i] ≤ 10⁹. The code editor shows a C++ solution using a custom comparator and sorting.

```
1
2
3 class Solution {
4 public:
5     string largestNumber(vector<int>& nums) {
6         vector<string> strNums;
7         for (int num : nums) {
8             strNums.push_back(to_string(num));
9         }
10
11         auto compare = [](const string& a, const string& b) {
12             return a + b > b + a;
13         };
14
15         sort(strNums.begin(), strNums.end(), compare);
16
17         string result;
18         for (const string& str : strNums) {
19             result += str;
20         }
21
22         if (result[0] == '0') {
23             return "0";
24         }
25
26         return result;
27     };
28 };
29
30
```

5)Valid Parenthesis

<https://leetcode.com/problems/valid-parentheses/>

20. Valid Parentheses

Given a string `s` containing just the characters `'('`, `')'`, `'{'`, `'}'`, `'['`, and `']'`, determine if the input string is valid.

An input string is valid if:

- Open brackets must be closed by the same type of brackets.
- Open brackets must be closed in the correct order.
- Every close bracket has a corresponding open bracket of the same type.

Example 1:

Input: `s = "()"`
Output: `true`

Example 2:

Input: `s = "([)]"`
Output: `false`

Example 3:

Input: `s = "{[]}"`
Output: `true`

Example 4:

Input: `s = "([)]"`
Output: `false`

Code:

```
1 #include <iostream>
2 #include <stack>
3 #include <string>
4 using namespace std;
5
6 class Solution {
7 public:
8     bool isValid(string s) {
9         stack<char> stack;
10
11         for (char c : s) {
12             // If the character is an opening bracket, push it onto the stack
13             if (c == '(' || c == '[' || c == '{') {
14                 stack.push(c);
15             }
16             // If the character is a closing bracket, check if it matches the top of the stack
17             else if (c == ')' || c == ']' || c == '}') {
18                 if (stack.empty()) {
19                     return false; // No opening bracket to match with
20                 }
21                 char top = stack.top();
22                 stack.pop();
23
24                 // Check if the top of the stack matches the corresponding opening bracket
25                 if ((c == ')' && top != '(') || (c == ']' && top != '[') || (c == '}' && top != '{')) {
26                     return false;
27                 }
28             }
29         }
30
31         // If the stack is empty, all brackets were matched, otherwise return false
32         return stack.empty();
33     }
34 };
35
```

6)Merge Two Sorted Lists

<https://leetcode.com/problems/merge-two-sorted-lists/>

21. Merge Two Sorted Lists

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 = [0]`, `list2 = [0]`
Output: `[0]`

Code:

```
1 #include <iostream>
2 #include <vector>
3 // Include the ListNode header
4 using namespace std;
5
6 class Solution {
7 public:
8     ListNode* mergeTwoLists(ListNode* list1, ListNode* list2) {
9         ListNode* dummy = new ListNode(0); // Create a dummy node to start the merged list
10         ListNode* current = dummy; // Pointer to build the new list
11
12         // Traverse both lists
13         while (list1 != nullptr && list2 != nullptr) {
14             if (list1->val < list2->val) {
15                 current->next = list1; // Attach list1 node to merged list
16                 list1 = list1->next; // Move the list1 pointer forward
17             } else {
18                 current->next = list2; // Attach list2 node to merged list
19                 list2 = list2->next; // Move the list2 pointer forward
20             }
21             current = current->next; // Move the current pointer forward in the merged list
22         }
23
24         // If there are remaining nodes in list1 or list2, attach them
25         if (list1 != nullptr) {
26             current->next = list1;
27         } else if (list2 != nullptr) {
28             current->next = list2;
29         }
30
31         return dummy->next; // Return the merged list starting from the first node
32     }
33 };
34
35 // Helper function to create a linked list from a vector
36 ListNode* createList(const vector<int>& nums) {
37     ListNode* head = nullptr;
38     ListNode* current = nullptr;
39     for (int num : nums) {
40         if (head == nullptr) {
41             head = new ListNode(num);
42             current = head;
43         } else {
44             current->next = new ListNode(num);
45             current = current->next;
46         }
47     }
48     return head;
49 }
50
```

7) Remove Duplicates from sorted list

<https://leetcode.com/problems/remove-duplicates-from-sorted-list/>

83. Remove Duplicates from Sorted List

Given the head of a sorted linked list, delete all duplicates such that each element appears only once. Return the linked list sorted as well.

Example 1:

Input: head = [1,1,2]
Output: [1,2]

Example 2:

Input: head = [1,1,2,3,3]
Output: [1,2,3]

```
1 #include <iostream>
2 using namespace std;
3
4 // Assume ListNode structure is already defined and precompiled.
5
6 class Solution {
7 public:
8     ListNode* deleteDuplicates(ListNode* head) {
9         ListNode* current = head;
10        while (current != nullptr && current->next != nullptr) {
11            if (current->val == current->next->val) {
12                // Skip the duplicate node
13                current->next = current->next->next;
14            } else {
15                // Move to the next node
16                current = current->next;
17            }
18        }
19        return head;
20    }
21 };
22
23 // Helper function to print the linked list
24 void printList(ListNode* head) {
25     while (head != nullptr) {
26         cout << head->val << " ";
27         head = head->next;
28     }
29     cout << endl;
30 }
```

8) Find peak Element

<https://leetcode.com/problems/find-peak-element/>

162. Find Peak Element

A peak element is an element that is strictly greater than its neighbors.

Given a 0-indexed integer array `nums`, find a peak element, and return its index. If the array contains multiple peaks, return the index to **any** of the peaks.

You may imagine that `nums[-1] = nums[n] = -∞`. In other words, an element is always considered to be strictly greater than a neighbor that is outside the array.

You must write an algorithm that runs in $O(\log n)$ time.

Example 1:

Input: `nums = [1,2,3,1]`
Output: `2`
Explanation: 3 is a peak element and your function should return the index number 2.

Example 2:

Input: `nums = [1,2,1,3,5,6,4]`
Output: `5`
Explanation: Your function can return either index number 1 where the peak element is 2, or index number 5 where the peak element is 6.

Constraints:

- $1 \leq \text{nums.length} \leq 1000$

```
1 #include <iostream>
2 #include <vector>
3 using namespace std;
4
5 class Solution {
6 public:
7     int findPeakElement(vector<int>& nums) {
8         int left = 0, right = nums.size() - 1;
9
10        while (left < right) {
11            int mid = left + (right - left) / 2;
12
13            if (nums[mid] > nums[mid + 1]) {
14                right = mid;
15            } else {
16                left = mid + 1;
17            }
18        }
19        return left;
20    }
21 };
22
23
24
```

9) Binary Tree Inorder Traversal

<https://leetcode.com/problems/binary-tree-inorder-traversal/>

The screenshot shows the LeetCode interface for problem 94. The description states: "Given the *root* of a binary tree, return the *inorder traversal* of its nodes' values." Example 1 shows an input tree with root 1, left child 3, and right child 2, resulting in an output of [1, 3, 2]. The code editor on the right contains a C++ solution using a recursive helper function to perform the inorder traversal.

```
1 #include <iostream>
2 #include <vector>
3
4 using namespace std;
5
6 class Solution {
7 public:
8     void inorderTraversalHelper(TreeNode* root, vector<int>& result) {
9         if (root == nullptr) {
10             return;
11         }
12         // Traverse left subtree
13         inorderTraversalHelper(root->left, result);
14         // Visit the root node
15         result.push_back(root->val);
16         // Traverse right subtree
17         inorderTraversalHelper(root->right, result);
18     }
19
20     vector<int> inorderTraversal(TreeNode* root) {
21         vector<int> result;
22         inorderTraversalHelper(root, result);
23         return result;
24     }
25 };
26
27 // Testcase
28 // Test Result
```

10) N-Queens

<https://leetcode.com/problems/n-queens/>

The screenshot shows the LeetCode interface for problem 51. The description states: "The *n-queens* puzzle is the problem of placing *n* queens on an *n* x *n* chessboard such that no two queens attack each other. Given an integer *n*, return all distinct solutions to the *n-queens* puzzle. You may return the answer in any order. Each solution contains a distinct board configuration of the *n-queens* placement, where 'Q' and '.' both indicate a queen and an empty space, respectively." Example 1 shows a 4x4 chessboard with two solutions. The code editor on the right contains a C++ solution using a backtracking algorithm to find all valid configurations.

```
1 #include <vector>
2 #include <string>
3 using namespace std;
4
5 class Solution {
6 public:
7     vector<vector<string>> solveNQueens(int n) {
8         vector<vector<string>> solutions;
9         vector<string> board(n, string(n, '.')); // Initialize an empty n x n board
10         vector<int> leftRow(n, 0), upperDiag(2 * n - 1, 0), lowerDiag(2 * n - 1, 0);
11         backtrack(0, n, board, solutions, leftRow, upperDiag, lowerDiag);
12         return solutions;
13     }
14
15 private:
16     void backtrack(int col, int n, vector<string>& board, vector<vector<string>>& solutions,
17                     vector<int>& leftRow, vector<int>& upperDiag, vector<int>& lowerDiag) {
18         if (col == n) {
19             solutions.push_back(board);
20             return;
21         }
22
23         for (int row = 0; row < n; ++row) {
24             if (leftRow[row] == 0 && upperDiag[row + col] == 0 && lowerDiag[row - col + n - 1] == 0) {
25                 board[row][col] = 'Q';
26                 leftRow[row] = upperDiag[row + col] = lowerDiag[row - col + n - 1] = 1;
27
28                 backtrack(col + 1, n, board, solutions, leftRow, upperDiag, lowerDiag);
29
30                 // Undo the current placement
31                 board[row][col] = '.';
32                 leftRow[row] = upperDiag[row + col] = lowerDiag[row - col + n - 1] = 0;
33             }
34         }
35     }
36 };
37
38 // Testcase
39 // Test Result
```

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