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DOMAIN WINTER WINNING CAMP-Day(5)

1) Search No.

Code:

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

int searchNumber(vector<int>& arr, int k) {
    for (int i = 0; i < arr.size(); i++) {
        if (arr[i] == k) return i + 1; // 1-based indexing
    }
    return -1;
}

int main() {
    int n, k;
    cout << "Enter the size of the array: ";
    cin >> n;
    vector<int> arr(n);
    cout << "Enter elements of the array: ";
    for (int& num : arr) cin >> num;
    cout << "Enter the number to search: ";
    cin >> k;

    int result = searchNumber(arr, k);
    if (result != -1)
        cout << "First occurrence at position: " << result << endl;
    else
        cout << "Number not found in the array." << endl;

    return 0;
}
```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code defines a function 'searchNumber' that iterates through a vector to find a target value. The main function prompts the user for the array size, elements, and the search value. The output window shows the user input and the result: 'First occurrence at position: 2'.

```
main.cpp
1 #include <iostream>
2 #include <vector>
3 using namespace std;
4
5 int searchNumber(vector<int>& arr, int k) {
6     for (int i = 0; i < arr.size(); i++) {
7         if (arr[i] == k) return i + 1; // 1-based indexing
8     }
9     return -1;
10 }
11
12 int main() {
13     int n, k;
14     cout << "Enter the size of the array: ";
15     cin >> n;
```

Output

```
Enter the size of the array: 5
Enter elements of the array: 1 5 2 9 0
Enter the number to search: 5
First occurrence at position: 2

=== Code Execution Successful ===
```

2) Sorted Array Search

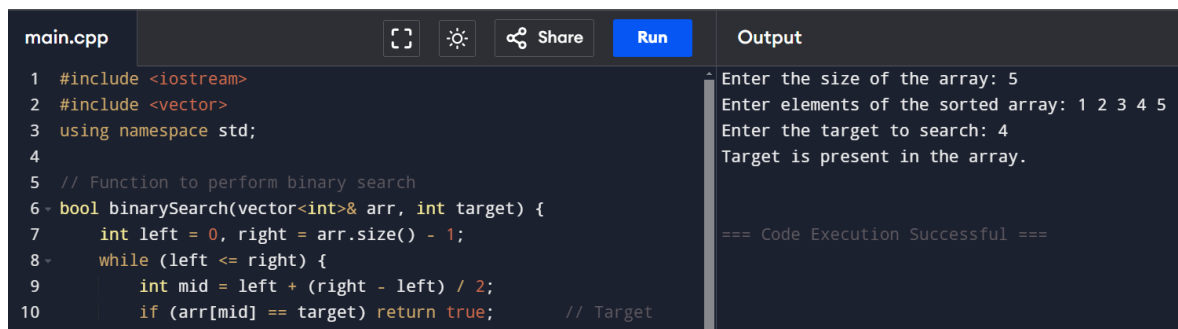
```
#include <iostream>
#include <iostream>
#include <vector>
using namespace std;
```

```
// Function to
perform binary
search
bool
binarySearch(vector<
int>& arr, int target) {
    int left = 0, right =
arr.size() - 1;
    while (left <= right)
    {
        int mid = left +
(right - left) / 2;
        if (arr[mid] ==
target) return true;
// Target found
        else if (arr[mid] <
target) left = mid + 1;
// Search in the right
half
        else right = mid -
1;
//
Search in the left half
    }
    return false; //
```

```
Target not found  
}
```

```
int main() {  
    int n, target;  
    cout << "Enter the  
size of the array: ";  
    cin >> n;  
  
    vector<int> arr(n);  
    cout << "Enter  
elements of the  
sorted array: ";  
    for (int& num : arr)  
        cin >> num;  
  
    cout << "Enter the  
target to search: ";  
    cin >> target;  
  
    if  
(binarySearch(arr,  
target))  
        cout << "Target  
is present in the  
array." << endl;  
    else  
        cout << "Target  
is not present in the  
array." << endl;  
  
    return 0;  
}
```

Output:



The screenshot shows a C++ IDE with a file named `main.cpp`. The code implements a binary search function. The output window shows the following text:

```
Enter the size of the array: 5
Enter elements of the sorted array: 1 2 3 4 5
Enter the target to search: 4
Target is present in the array.

=== Code Execution Successful ===
```

3) Find First and Last Position of Element

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

```
// Function to find the first occurrence of the target
int findFirst(vector<int>& arr, int target) {
    int left = 0, right = arr.size() - 1, result = -1;
    while (left <= right) {
        int mid = left + (right - left) / 2;
        if (arr[mid] == target) {
            result = mid;
            right = mid - 1; // Search in the left half for earlier occurrences
        } else if (arr[mid] < target) {
            left = mid + 1;
        } else {
            right = mid - 1;
        }
    }
    return result;
}
```

```
// Function to find the last occurrence of the target
int findLast(vector<int>& arr, int target) {
    int left = 0, right = arr.size() - 1, result = -1;
    while (left <= right) {
        int mid = left + (right - left) / 2;
        if (arr[mid] == target) {
            result = mid;
            left = mid + 1; // Search in the right half for later occurrences
        } else if (arr[mid] < target) {
            left = mid + 1;
        } else {
            right = mid - 1;
        }
    }
}
```

```

    return result;
}

int main() {
    int n, target;
    cout << "Enter the size of the array: ";
    cin >> n;

    vector<int> arr(n);
    cout << "Enter elements of the sorted array: ";
    for (int& num : arr) cin >> num;

    cout << "Enter the target to find: ";
    cin >> target;

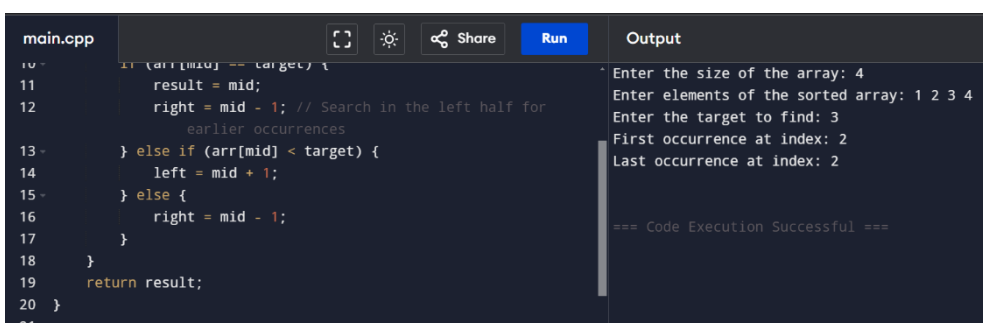
    int first = findFirst(arr, target);
    int last = findLast(arr, target);

    if (first != -1 && last != -1) {
        cout << "First occurrence at index: " << first << endl;
        cout << "Last occurrence at index: " << last << endl;
    } else {
        cout << "Target not found in the array." << endl;
    }

    return 0;
}

```

Output:



The screenshot shows a code editor with a file named 'main.cpp'. The code implements a binary search algorithm to find the first and last occurrence of a target in a sorted array. The output window on the right shows the program's execution with the following input and output:

```

Enter the size of the array: 4
Enter elements of the sorted array: 1 2 3 4
Enter the target to find: 3
First occurrence at index: 2
Last occurrence at index: 2

=== Code Execution Successful ===

```

4) Squares of a Sorted Array

```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;

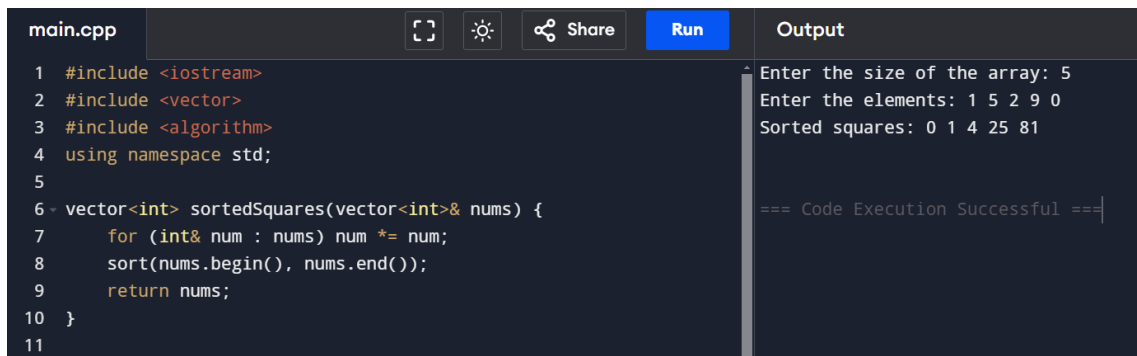
vector<int> sortedSquares(vector<int>& nums) {
    for (int& num : nums) num *= num;
    sort(nums.begin(), nums.end());
    return nums;
}

int main() {
    int n;
    cout << "Enter the size of the array: ";
    cin >> n;
    vector<int> nums(n);
    cout << "Enter the elements: ";
    for (int& num : nums) cin >> num;

    vector<int> result = sortedSquares(nums);
    cout << "Sorted squares: ";
    for (int val : result) cout << val << " ";
    cout << endl;

    return 0;
}
```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code defines a function 'sortedSquares' that takes a vector of integers and returns a new vector containing the squares of the elements, sorted in ascending order. The output window shows the program's execution: it prompts for the size of the array (5), then for the elements (1 5 2 9 0), and finally displays the sorted squares (0 1 4 25 81). The execution is successful.

```
main.cpp  [Icons]  Run  Output

1  #include <iostream>
2  #include <vector>
3  #include <algorithm>
4  using namespace std;
5
6  vector<int> sortedSquares(vector<int>& nums) {
7      for (int& num : nums) num *= num;
8      sort(nums.begin(), nums.end());
9      return nums;
10 }
11
```

Enter the size of the array: 5
Enter the elements: 1 5 2 9 0
Sorted squares: 0 1 4 25 81

=== Code Execution Successful ===

5) Search in a 2D Matrix

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

```
bool searchMatrix(vector<vector<int>>& matrix, int target) {
    int rows = matrix.size(), cols = matrix[0].size();
    int left = 0, right = rows * cols - 1;

    while (left <= right) {
        int mid = left + (right - left) / 2;
        int midVal = matrix[mid / cols][mid % cols];
        if (midVal == target) return true;
        else if (midVal < target) left = mid + 1;
        else right = mid - 1;
    }
    return false;
}
```

```
int main() {
    int rows, cols, target;
    cout << "Enter rows and columns: ";
    cin >> rows >> cols;

    vector<vector<int>> matrix(rows, vector<int>(cols));
    cout << "Enter elements row by row:\n";
    for (auto& row : matrix) {
        for (int& val : row) cin >> val;
```

```

}

cout << "Enter the target: ";
cin >> target;

if (searchMatrix(matrix, target)) cout << "Target found.\n";
else cout << "Target not found.\n";

return 0;
}

```

Output:

main.cpp	Output
<pre> 1 #include <iostream> 2 #include <vector> 3 using namespace std; 4 5 bool searchMatrix(vector<vector<int>>& matrix, int target) { 6 int rows = matrix.size(), cols = matrix[0].size(); 7 int left = 0, right = rows * cols - 1; 8 9 while (left <= right) { 10 int mid = left + (right - left) / 2; 11 int midVal = matrix[mid / cols][mid % cols]; 12 if (midVal == target) return true; 13 else if (midVal < target) left = mid + 1; 14 else right = mid - 1; </pre>	<pre> Enter rows and columns: 3 4 Enter elements row by row: 1 3 5 7 10 11 16 20 23 30 34 60 Enter the target: 3 Target found. === Code Execution Successful === </pre>

6) Median of Two Sorted Arrays

```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;

double findMedianSortedArrays(vector<int>& nums1, vector<int>& nums2) {
    vector<int> merged(nums1.begin(), nums1.end());
    merged.insert(merged.end(), nums2.begin(), nums2.end());
    sort(merged.begin(), merged.end());
    int n = merged.size();
    if (n % 2 == 0) return (merged[n / 2 - 1] + merged[n / 2]) / 2.0;
    else return merged[n / 2];
}


int main() {
    int n1, n2;
    cout << "Enter size of first array: ";
    cin >> n1;
    vector<int> nums1(n1);
    cout << "Enter first array: ";
    for (int& num : nums1) cin >> num;

    cout << "Enter size of second array: ";
    cin >> n2;
    vector<int> nums2(n2);
    cout << "Enter second array: ";
    for (int& num : nums2) cin >> num;

    cout << "Median: " << findMedianSortedArrays(nums1, nums2) << endl;

    return 0;
}
```

Output :



The screenshot shows a C++ IDE with a file named `main.cpp`. The code defines a function `findMedianSortedArrays` that takes two sorted arrays and returns their median. The output window shows the program's execution with user input for array sizes and elements, resulting in a median of 3.5.

```
main.cpp
1 #include <iostream>
2 #include <vector>
3 #include <algorithm>
4 using namespace std;
5
6 double findMedianSortedArrays(vector<int>& nums1, vector<int>&
  nums2) {
7     vector<int> merged(nums1.begin(), nums1.end());
8     merged.insert(merged.end(), nums2.begin(), nums2.end());
9     sort(merged.begin(), merged.end());
10    int n = merged.size();
11    if (n % 2 == 0) return (merged[n / 2 - 1] + merged[n / 2])
      / 2.0;
12    else return merged[n / 2];
}
```

Output

```
Enter size of first array: 5
Enter first array: 1 5 2 9 0
Enter size of second array: 5
Enter second array: 1 5 2 7 6
Median: 3.5

=== Code Execution Successful ===
```

7) Merge K Sorted Lists

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

```
struct ListNode {
    int val;
    ListNode* next;
    ListNode(int x) : val(x), next(nullptr) {}
};
```

```
struct Compare {
    bool operator()(ListNode* a, ListNode* b) {
        return a->val > b->val;
    }
};
```

```
ListNode* mergeKLists(vector<ListNode*>& lists) {
    priority_queue<ListNode*, vector<ListNode*>, Compare> pq;
    for (auto node : lists) {
        if (node) pq.push(node);
    }
```

```
ListNode* dummy = new ListNode(0);
ListNode* tail = dummy;
```

```

while (!pq.empty()) {
    ListNode* curr = pq.top();
    pq.pop();
    tail->next = curr;
    tail = tail->next;
    if (curr->next) pq.push(curr->next);
}
return dummy->next;
}

```

// Helper functions to create and print a linked list

```

ListNode* createList(vector<int>& nums) {
    ListNode* head = nullptr, *tail = nullptr;
    for (int num : nums) {
        ListNode* newNode = new ListNode(num);
        if (!head) head = tail = newNode;
        else {
            tail->next = newNode;
            tail = newNode;
        }
    }
    return head;
}

```

```

void printList(ListNode* head) {
    while (head) {
        cout << head->val << " ";
        head = head->next;
    }
    cout << endl;
}

```

```

int main() {
    int k;
    cout << "Enter the number of linked lists: ";
    cin >> k;

    vector<ListNode*> lists(k);
    for (int i = 0; i < k; ++i) {
        int n;
        cout << "Enter size of list " << i + 1 << ": ";
        cin >> n;
        vector<int> nums(n);
        cout << "Enter elements: ";
    }
}

```

```

        for (int& num : nums) cin >> num;
        lists[i] = createList(nums);
    }

    ListNode* merged = mergeKLists(lists);
    cout << "Merged list: ";
    printList(merged);

    return 0;
}

```

Output :

main.cpp	Output
<pre> 1 #include <iostream> 2 #include <queue> 3 #include <vector> 4 using namespace std; 5 6 struct ListNode { 7 int val; 8 ListNode* next; 9 ListNode(int x) : val(x), next(nullptr) {} 10 }; 11 12 struct Compare { 13 bool operator()(ListNode* a, ListNode* b) { 14 return a->val > b->val; 15 } </pre>	<pre> Enter the number of linked lists: 3 Enter size of list 1: 3 Enter elements: 1 4 5 Enter size of list 2: 3 Enter elements: 1 3 4 Enter size of list 3: 2 Enter elements: 2 6 Merged list: 1 1 2 3 4 4 5 6 === Code Execution Successful === </pre>

8) Find Minimum in Rotated Sorted Array II

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

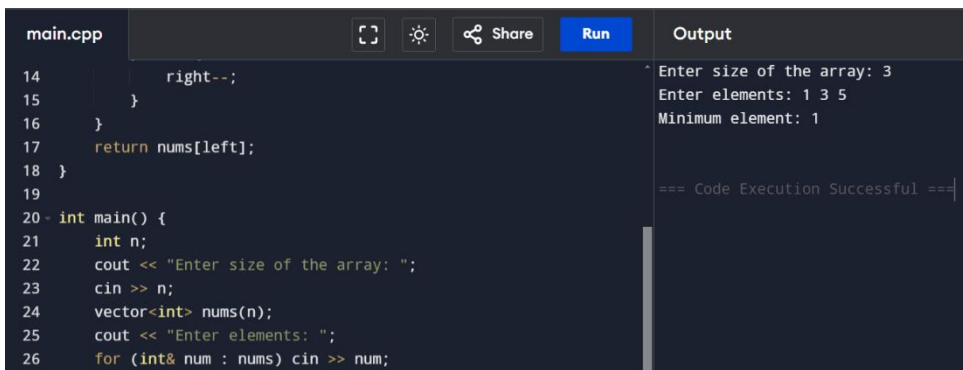
int findMin(vector<int>& nums) {
    int left = 0, right = nums.size() - 1;
    while (left < right) {
        int mid = left + (right - left) / 2;
        if (nums[mid] > nums[right]) {
            left = mid + 1;
        } else if (nums[mid] < nums[right]) {
            right = mid;
        } else {
            right--;
        }
    }
    return nums[left];
}

int main() {
    int n;
    cout << "Enter size of the array: ";
    cin >> n;
    vector<int> nums(n);
    cout << "Enter elements: ";
    for (int& num : nums) cin >> num;

    cout << "Minimum element: " << findMin(nums) << endl;

    return 0;
}
```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code in the editor is as follows:

```
14     right--;  
15 }  
16 }  
17 return nums[left];  
18 }  
19  
20 int main() {  
21     int n;  
22     cout << "Enter size of the array: ";  
23     cin >> n;  
24     vector<int> nums(n);  
25     cout << "Enter elements: ";  
26     for (int& num : nums) cin >> num;
```

The output panel on the right shows the following text:

```
Enter size of the array: 3  
Enter elements: 1 3 5  
Minimum element: 1  
  
=== Code Execution Successful ===
```

9) Sort Even and Odd Indices Independently

```
#include <iostream>  
#include <vector>  
#include <algorithm>  
using namespace std;
```

```
vector<int> sortEvenOdd(vector<int>& nums) {  
    vector<int> even, odd;  
    for (int i = 0; i < nums.size(); ++i) {  
        if (i % 2 == 0) even.push_back(nums[i]);  
        else odd.push_back(nums[i]);  
    }  
    sort(even.begin(), even.end());  
    sort(odd.rbegin(), odd.rend());  
  
    vector<int> result(nums.size());  
    for (int i = 0, e = 0, o = 0; i < nums.size(); ++i) {  
        result[i] = (i % 2 == 0) ? even[e++] : odd[o++];  
    }  
    return result;  
}
```

```
int main() {  
    int n;  
    cout << "Enter size of the array: ";  
    cin >> n;  
    vector<int> nums(n);  
    cout << "Enter elements: ";  
    for (int& num : nums) cin >> num;
```

}

Output :

```
main.cpp
1 #include <iostream>
2 #include <vector>
3 #include <algorithm>
4 using namespace std;
5
6 vector<int> sortEvenOdd(vector<int>& nums) {
7     vector<int> even, odd;
8     for (int i = 0; i < nums.size(); ++i) {
9         if (i % 2 == 0) even.push_back(nums[i]);
10        else odd.push_back(nums[i]);
11    }
12    sort(even.begin(), even.end());
13    sort(odd.rbegin(), odd.rend());
```

10) Sorted GCD Pair Queries

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <numeric>
using namespace std;

// Function to calculate all GCD pairs and sort them
vector<int> calculateSortedGCDPairs(vector<int>& nums) {
    vector<int> gcdPairs;
    int n = nums.size();

    // Calculate GCD for all pairs (nums[i], nums[j]) where i < j
    for (int i = 0; i < n; ++i) {
        for (int j = i + 1; j < n; ++j) {
            gcdPairs.push_back(gcd(nums[i], nums[j]));
        }
    }

    // Sort the GCD pairs
    sort(gcdPairs.begin(), gcdPairs.end());
    return gcdPairs;
}

// Function to handle the queries
vector<int> processQueries(vector<int>& gcdPairs, vector<int>& queries) {
    vector<int> results;
    for (int q : queries) {
        if (q >= 0 && q < gcdPairs.size()) {
            results.push_back(gcdPairs[q]);
        } else {
            results.push_back(-1); // Invalid query index
        }
    }
    return results;
}

int main() {
    int n, q;
    cout << "Enter the size of the array: ";
    cin >> n;

    vector<int> nums(n);
```



```

cout << "Enter elements of the array: ";
for (int& num : nums) cin >> num;

cout << "Enter the number of queries: ";
cin >> q;

vector<int> queries(q);
cout << "Enter query indices: ";
for (int& query : queries) cin >> query;

// Calculate sorted GCD pairs
vector<int> gcdPairs = calculateSortedGCDPairs(nums);

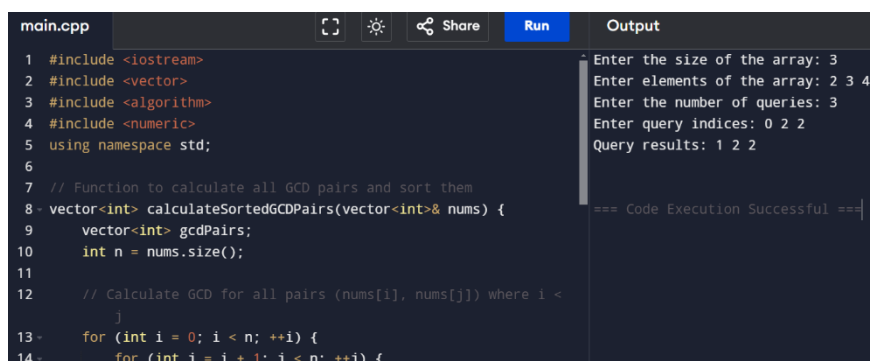
// Process the queries
vector<int> results = processQueries(gcdPairs, queries);

// Output the results
cout << "Query results: ";
for (int res : results) cout << res << " ";
cout << endl;

return 0;
}

```

Output :



The screenshot shows a code editor with a file named 'main.cpp'. The code is a C++ program that calculates sorted GCD pairs for an array and processes queries. The output window on the right shows the following text:

```

Enter the size of the array: 3
Enter elements of the array: 2 3 4
Enter the number of queries: 3
Enter query indices: 0 2 2
Query results: 1 2 2

```

Below the output, it says "=== Code Execution Successful ===".

