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**DOMAIN WINTER WINNING CAMP-Day(5)**

**1) Search No.**

**Code:**

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

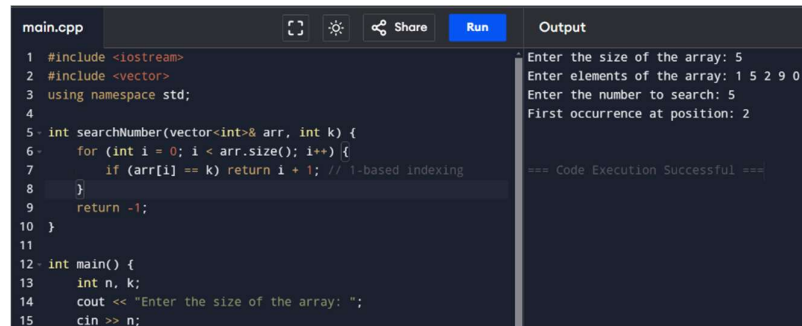
int searchNumber(vector<int>& arr, int k) {
    for (int i = 0; i < arr.size(); i++) {
        if (arr[i] == k) return i + 1; // 1-based indexing
    }
    return -1;
}

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 takes a vector of integers and a target integer, returning the index of the first occurrence or -1. The 'main' function prompts the user to enter the size of the array (5), the elements (1 5 2 9 0), and the number to search (5). The output window shows the user's input and the result: 'First occurrence at position: 2'. A status message at the bottom of the output window says '=== Code Execution Successful ==='.

```
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:

main.cpp	Output
<pre>1 #include &lt;iostream&gt; 2 #include &lt;vector&gt; 3 using namespace std; 4 5 // Function to perform binary search 6 bool binarySearch(vector&lt;int&gt;&amp; arr, int target) { 7     int left = 0, right = arr.size() - 1; 8     while (left &lt;= right) { 9         int mid = left + (right - left) / 2; 10        if (arr[mid] == target) return true;    // Target</pre>	<pre>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 ===</pre>

### 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 C++ IDE 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 shows the following interaction:

```

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 vector of their squares, sorted in ascending order. The `main` function prompts the user to enter the size of the array (5) and the elements (1 5 2 9 0). The output shows the sorted squares: 0 1 4 25 81. The code execution is successful.

```
main.cpp
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
```

Output

```
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 &lt;iostream&gt; 2  #include &lt;vector&gt; 3  using namespace std; 4 5  bool searchMatrix(vector&lt;vector&lt;int&gt;&gt;&amp; matrix, int target) { 6      int rows = matrix.size(), cols = matrix[0].size(); 7      int left = 0, right = rows * cols - 1; 8 9      while (left &lt;= 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 &lt; 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 :

main.cpp



ShareRun

```
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];
}
```

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 &lt;iostream&gt; 2 #include &lt;queue&gt; 3 #include &lt;vector&gt; 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-&gt;val &gt; b-&gt;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;

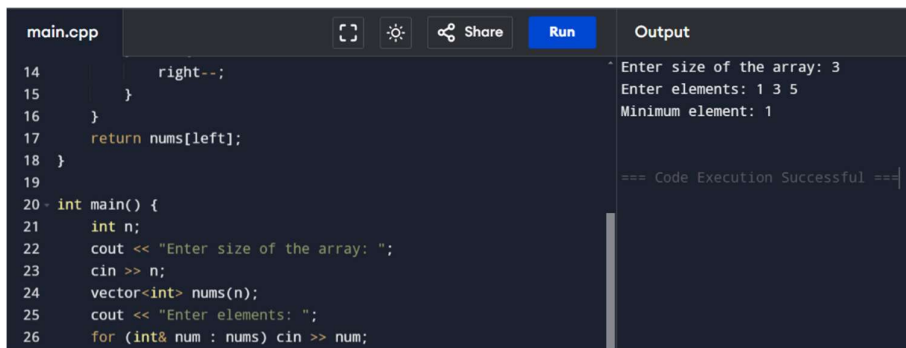
int findMin(vector<int>& nums) {
    int left = 0, right = nums.size() - 1;
    while (left < right) {
        int mid = left + (right - left) / 2;
        if (nums[mid] > nums[right]) {
            left = mid + 1;
        } else if (nums[mid] < nums[right]) {
            right = mid;
        } else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

A screenshot of a C++ IDE. The left pane shows a file named 'main.cpp' with C++ code. The right pane shows the 'Output' window. The code in 'main.cpp' includes a recursive function 'right--' and a 'main' function that prompts the user for array size and elements. The output window shows the user input: 'Enter size of the array: 3', 'Enter elements: 1 3 5', and 'Minimum element: 1'. It also shows '=== Code Execution Successful ==='.

```
main.cpp
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;
```

```
Output
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;
```

```

vector<int> result = sortEvenOdd(nums);
cout << "Sorted array: ";
for (int num : result) cout << num << " ";
cout << endl;

return 0;
}

```

**Output :**

The screenshot shows a C++ IDE with a file named 'main.cpp'. The code defines a function 'sortEvenOdd' that takes a vector of integers and returns a new vector. It separates the input vector into two: 'even' (containing elements at even indices) and 'odd' (containing elements at odd indices). Both 'even' and 'odd' are sorted in ascending order. The function then concatenates the sorted 'even' vector followed by the sorted 'odd' vector. The main function prompts the user for the size of the array (5) and the elements (1 5 2 9 0). It then calls 'sortEvenOdd' and prints the sorted array: 0 9 1 5 2.

```

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());

```

Output

```

Enter size of the array: 5
Enter elements: 1 5 2 9 0
Sorted array: 0 9 1 5 2

=== Code Execution Successful ===

```

## 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 :

```

main.cpp
1 #include <iostream>
2 #include <vector>
3 #include <algorithm>
4 #include <numeric>
5 using namespace std;
6
7 // Function to calculate all GCD pairs and sort them
8 vector<int> calculateSortedGCDPairs(vector<int>& nums) {
9     vector<int> gcdPairs;
10    int n = nums.size();
11
12    // Calculate GCD for all pairs (nums[i], nums[j]) where i < j
13    for (int i = 0; i < n; ++i) {
14        for (int j = i + 1; j < n; ++j) {

```

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

=== Code Execution Successful ===

