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Section: 22BCS_IOT_620-A **Date:** 26-12-24

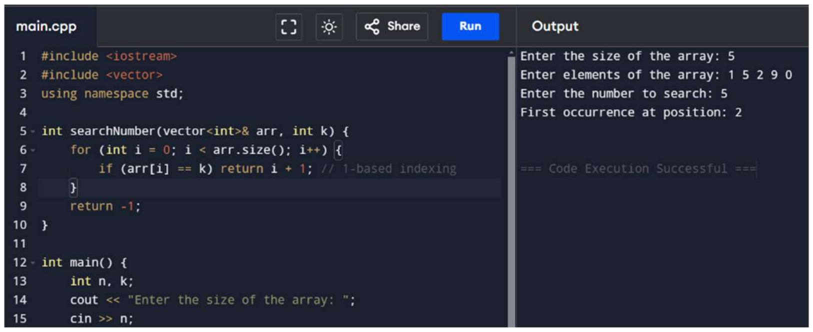
DOMAIN WINTER WINNING CAMP-Day(5)

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:



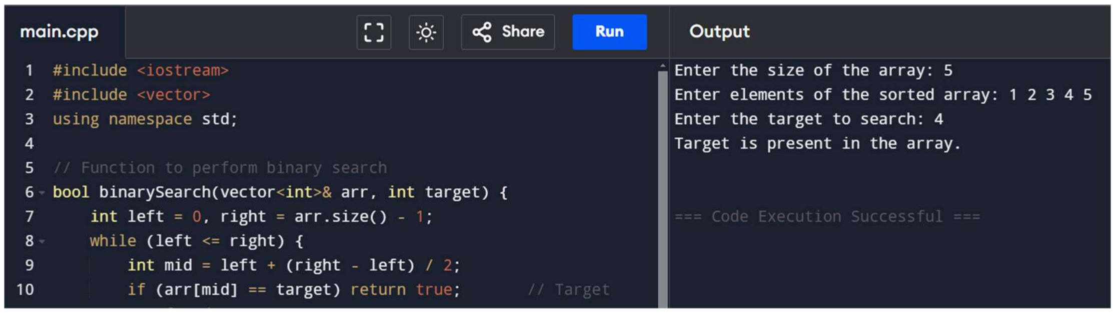
```cpp
#include <iostream>
#include <vector>
using namespace std;

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;
```

```
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:



```
#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
```

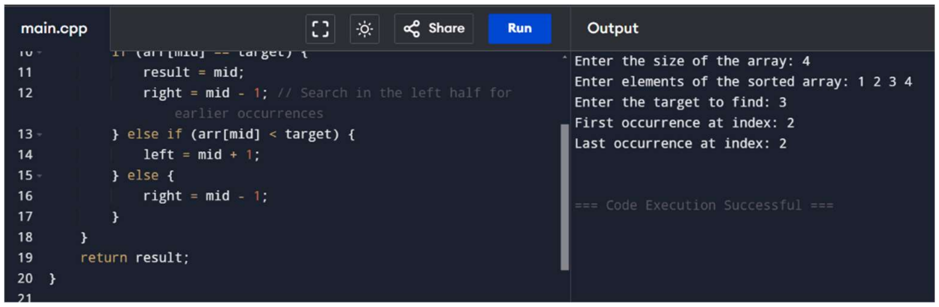
```
Enter the size of the array: 5
Enter elements of the sorted array: 1 2 3 4 5
Enter the target to search: 4
Target is present in the array.


=== 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:



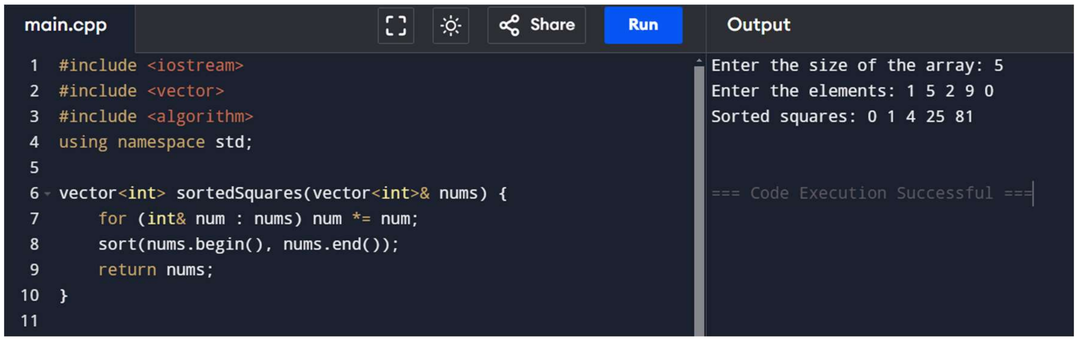
```
        if (arr[mid] == target) {
            result = mid;
            right = mid - 1; // Search in the left half for
                earlier occurrences
        } else if (arr[mid] < target) {
            left = mid + 1;
        } else {
            right = mid - 1;
        }
    }
    return result;
}
```

```
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:



```
#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;
}

```

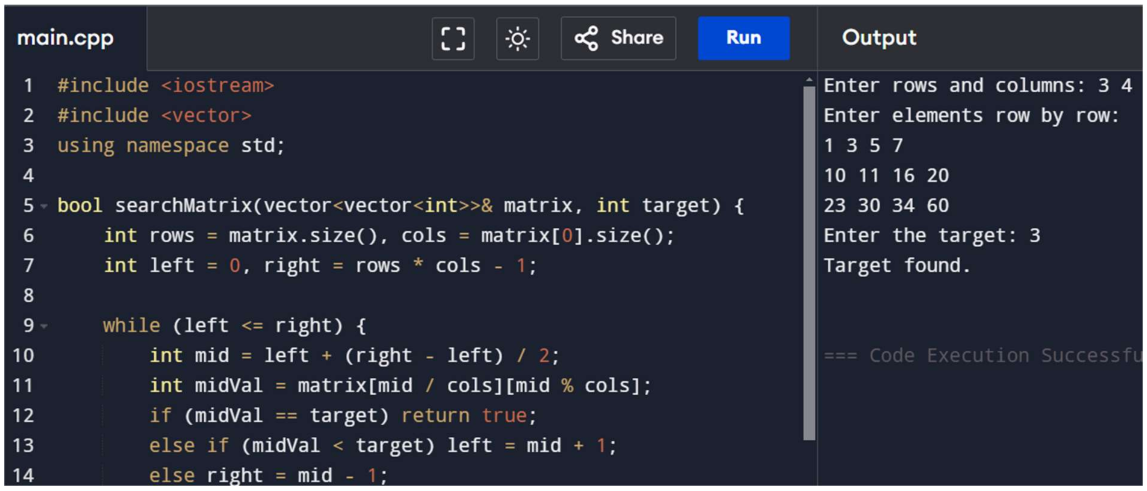
```
Enter the size of the array: 5
Enter the elements: 1 5 2 9 0
Sorted squares: 0 1 4 25 81


=== 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:



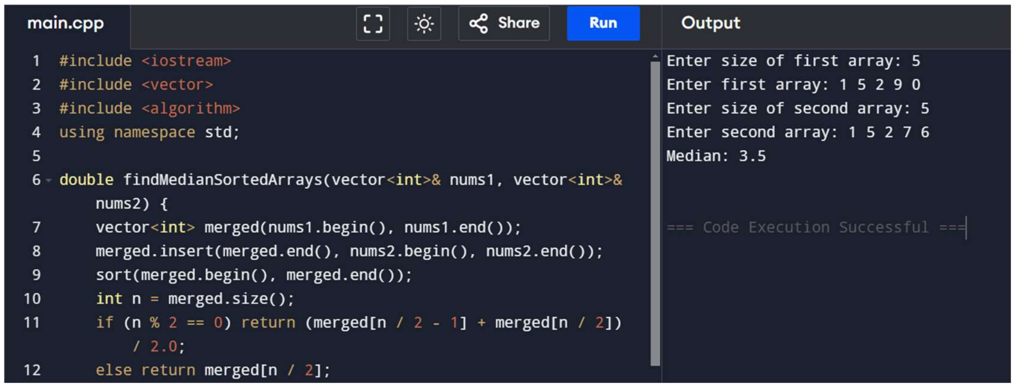
```
#include <iostream>
#include <vector>
using namespace std;

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;
```

```
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 Successfu
```

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 :



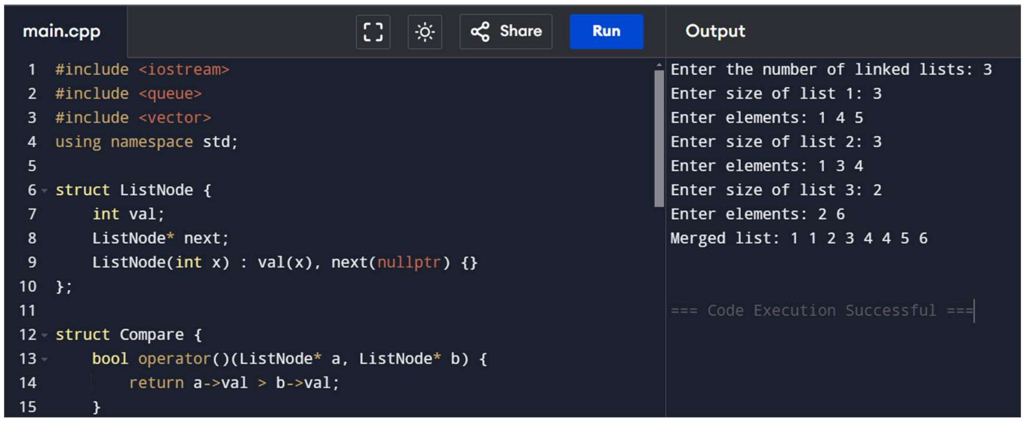
```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;

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];
```

```
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 :



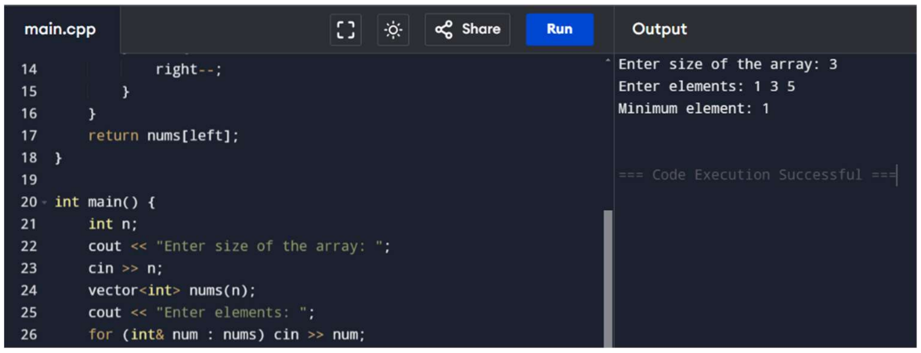
```
#include <iostream>
#include <queue>
#include <vector>
using namespace std;

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;
    }
```

```
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 ===
```

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:



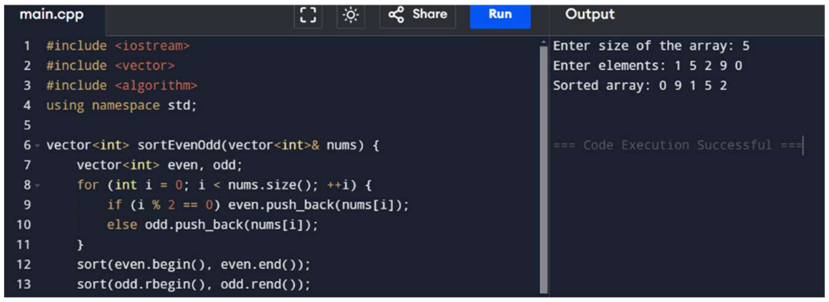
```
            right--;
        }
    }
    return nums[left];
}

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;
```

```
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 :



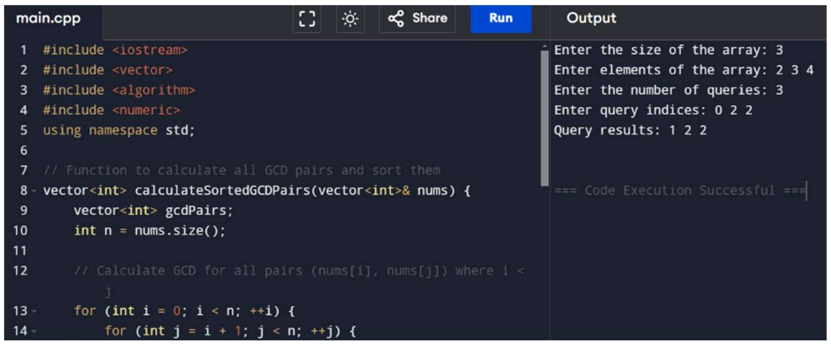
```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;

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());
```

```
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 :



```
#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) {
```

```
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 ===
```