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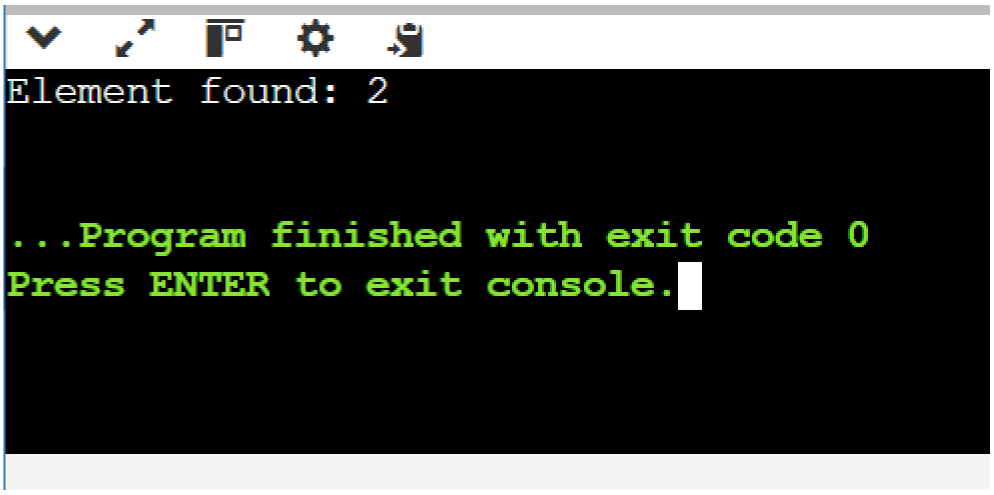
Section – 620-B

Q1. Implementation of linear search

Ans:

```
#include <iostream>
using namespace std;
int linearSearch(int arr[], int size, int t) {
   for (int i = 0; i < size; ++i) {
      if (arr[i] == t) {
         return i;
      }
   }
   return -1;
}
int main() {
   int arr[] = {1, 5, 14, 18, 25};
   int size = sizeof(arr) / sizeof(arr[0]);
   int t = 14;
   int result = linearSearch(arr, size, t);
   if (result != -1) {
      cout << "Element found: " << result << endl;
   } else {
      cout << "Element not found: " << endl;
   }
   return 0;
}
```

Output



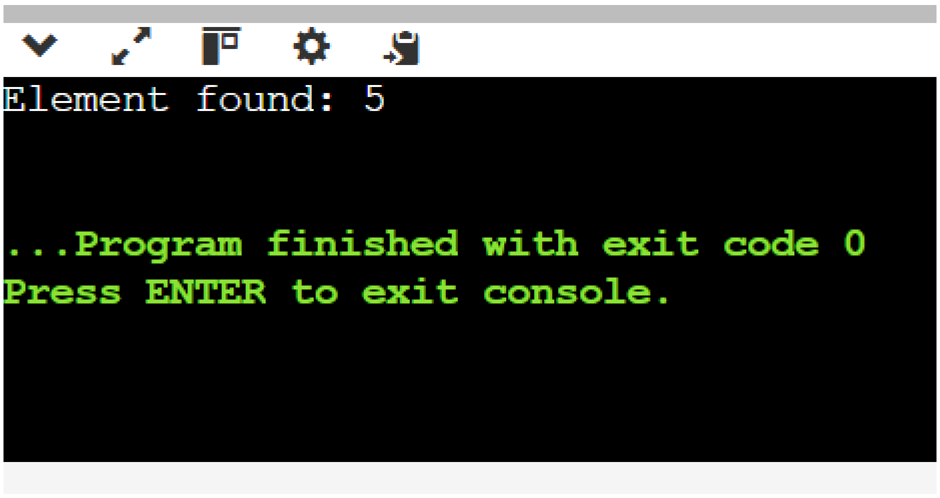
```
Element found: 2


...Program finished with exit code 0
Press ENTER to exit console.
```

Q2. Implementation of binary search to find index value

Ans:

```
#include <iostream>

using namespace std;

int binarySearch(int arr[], int size, int t) {

    int l = 0, r = size - 1;

    while (l <= r) {

        int mid = l + (r - l) / 2;

        if (arr[mid] == t) {

            return mid;

        } else if (arr[mid] < t) {

            l = mid + 1;

        } else {

            r = mid - 1;

        }

    }

    return -1;
}
int main() {
    int arr[] = {1, 4, 14, 25, 4, 18};
    int size = sizeof(arr) / sizeof(arr[0]);
    int t = 18 ;
    int result = binarySearch(arr, size, t);
    if (result != -1) {
        cout << "Element found: " << result << endl;
    } else {
        cout << "Element not found:" << endl;
    }
    return 0;
}
```

Output



```
Element found: 5


...Program finished with exit code 0
Press ENTER to exit console.
```

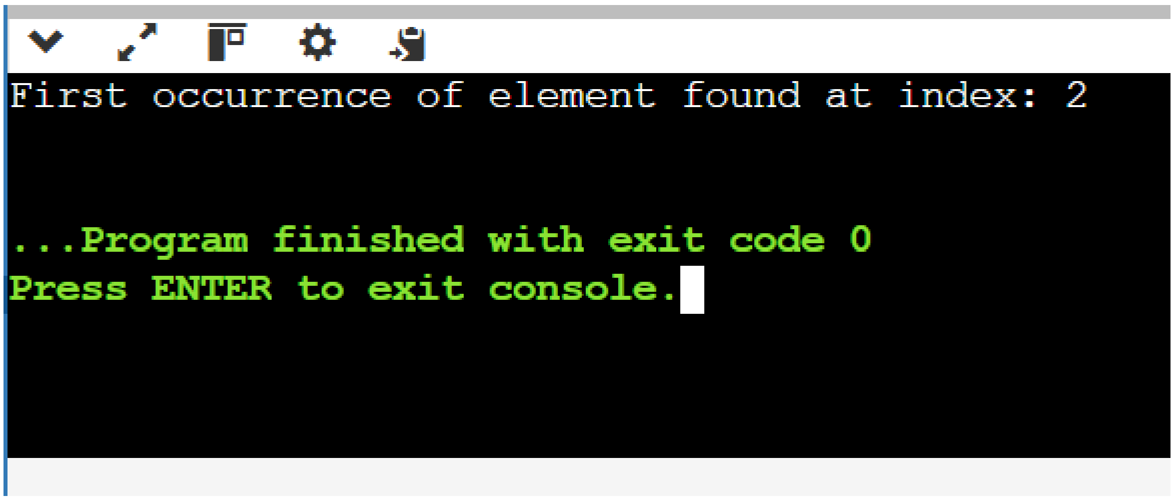
Q3. Binary search to find first occurance of target value in sorted array

Ans:

```
#include <iostream>
```

```
using namespace std;
int firstOccurrenceBinarySearch(int arr[], int size, int t) {
    int l = 0, r = size - 1;
    int result = -1;
    while (l <= r) {
        int mid = l + (r - l) / 2;
        if (arr[mid] == t) {
            result = mid;
            r = mid - 1;
        } else if (arr[mid] < t) {
            l = mid + 1;
        } else {
            r = mid - 1;
        }
    }

    return result;
}
int main() {
    int arr[] = {5, 10, 15, 20, 25, 30};
    int size = sizeof(arr) / sizeof(arr[0]);
    int t = 12;
    int result = firstOccurrenceBinarySearch(arr, size, t);
    if (result != -1) {
        cout << "First occurrence of element found at index: " << result << endl; // Output: 2
    } else {
        cout << "Element not found:" << endl;
    }
    return 0;
}
```

Output



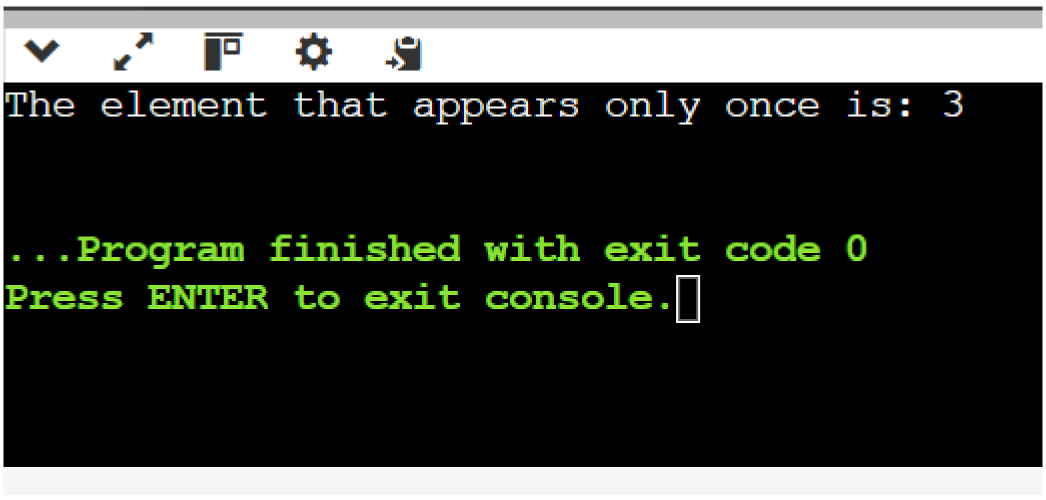
```
First occurrence of element found at index: 2


...Program finished with exit code 0
Press ENTER to exit console.
```

Q4. appears only once in sorted array (bs)

Ans:

```
#include <iostream>
using namespace std;
int singleNonDuplicate(int arr[], int size) {
    int left = 0, right = size - 1;
    while (left < right) {
        int mid = left + (right - left) / 2;
        if (mid % 2 == 1) {
            mid--;
        }
        if (arr[mid] == arr[mid + 1]) {
            left = mid + 2;
        } else {
            right = mid;
        }
    }
    return arr[left];
}
int main() {
    int arr[] = {1,1,2,2,3,4,4,5,5};
    int size = sizeof(arr) / sizeof(arr[0]);
    int result = singleNonDuplicate(arr, size);
    cout << "The element that appears only once is: " << result << endl;
    return 0;
}
```

Output



```
The element that appears only once is: 3


...Program finished with exit code 0
Press ENTER to exit console.
```

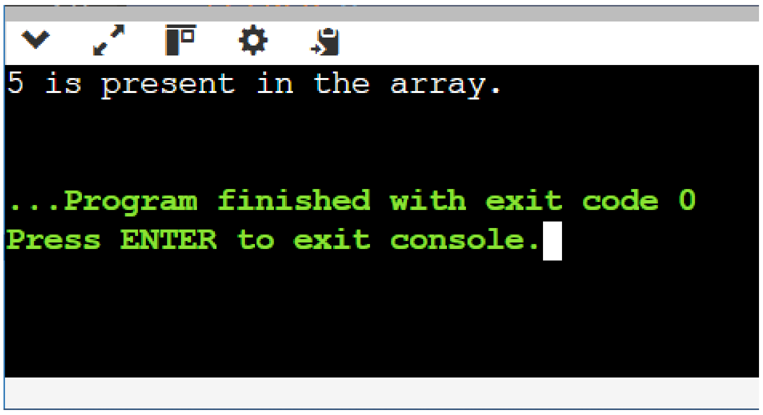
Q5. given an array sorted in ascending order and an integer k return true if k is present in the array otherwise false

Ans:

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

```
int binarySearch(int arr[], int size, int k) {
    int left = 0, right = size - 1;
    while (left <= right) {
        int mid = left + (right - left) / 2;
        if (arr[mid] == k) {
            return true;
        } else if (arr[mid] < k) {
            left = mid + 1;
        } else {
            right = mid - 1;
        }
    }
    return false;
}
int main() {
    int arr[] = {1, 3, 5, 7, 9, 11, 13};
    int size = sizeof(arr) / sizeof(arr[0]);
    int k = 5;
    if (binarySearch(arr, size, k)) {
        cout << k << " is present in the array." << endl;
    } else {
        cout << k << " is not present in the array." << endl;
    }
    return 0;
}
```

Output



```
5 is present in the array.


...Program finished with exit code 0
Press ENTER to exit console.
```

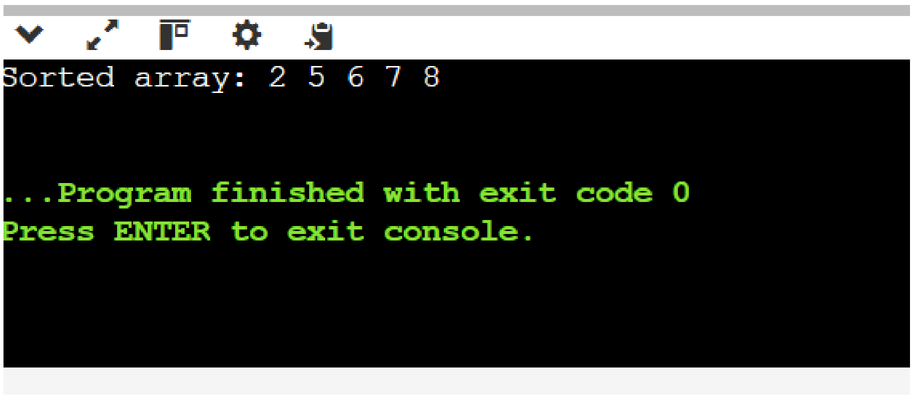
Q6. Bubble sort

Ans:

```
#include <iostream>

using namespace std;

void bubbleSort(int arr[], int n) {

   for (int i = 0; i < n - 1; ++i) {

      for (int j = 0; j < n - i - 1; ++j) {

         if (arr[j] > arr[j + 1]) {

            int temp = arr[j];

            arr[j] = arr[j + 1];

            arr[j + 1] = temp;

         }

      }

   }

}

int main() {

   int arr[] = {8, 5, 7, 6, 2};

   int n = sizeof(arr) / sizeof(arr[0]);

   bubbleSort(arr, n);
```

```
    cout << "Sorted array: ";
    for (int i = 0; i < n; ++i) {
        cout << arr[i] << " ";
    }
    cout << endl;
    return 0;
}
```

Output



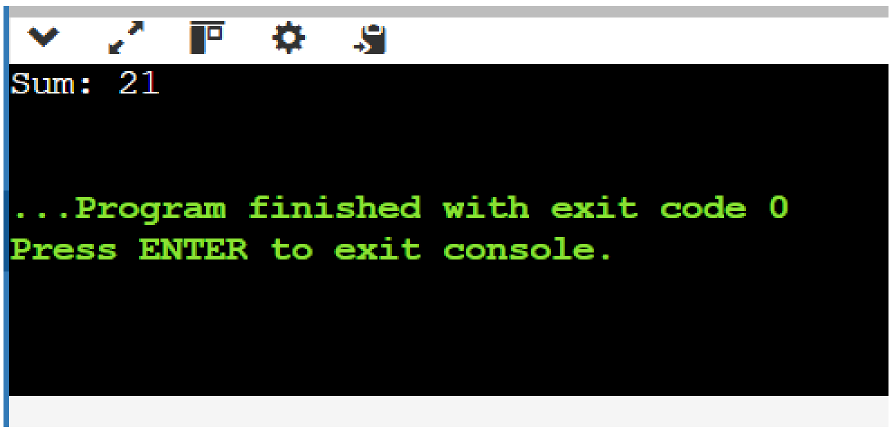
```
Sorted array: 2 5 6 7 8


...Program finished with exit code 0
Press ENTER to exit console.
```

Q7. Sum of binary tree nodes

Ans:

```
#include <iostream>
using namespace std;
struct TreeNode {
    int val;
    TreeNode* left;
    TreeNode* right;
    TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}
};
int sumOfNodes(TreeNode* root) {
    if (root == nullptr) {
        return 0;
    }
    return root->val + sumOfNodes(root->left) + sumOfNodes(root->right);
}
TreeNode* createExampleTree() {
    TreeNode* root = new TreeNode(1);
    root->left = new TreeNode(2);
    root->right = new TreeNode(3);
    root->left->left = new TreeNode(4);
    root->left->right = new TreeNode(5);
    root->right->right = new TreeNode(6);
    return root;
}
int main() {
    TreeNode* root = createExampleTree();
    int sum = sumOfNodes(root);
    cout << "Sum: " << sum << endl;
    return 0;
}
```

Output



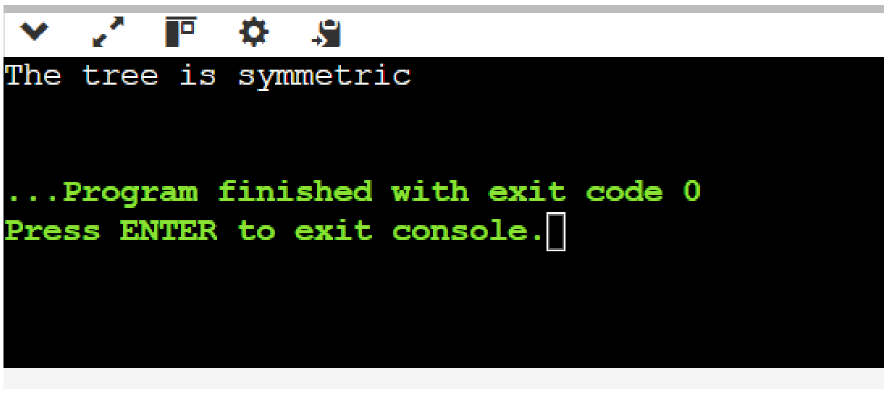
```
Sum: 21


...Program finished with exit code 0
Press ENTER to exit console.
```

Q8. Find the tree is symmetric or not .Input – [1,2,2,3,4,4,3]

Ans:

```
#include <iostream>

using namespace std;

struct TreeNode {

    int val;

    TreeNode* left;

    TreeNode* right;

    TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}

};

int isMirror(TreeNode* left, TreeNode* right) {

    if (left == nullptr && right == nullptr) {

        return true;

    }

    if (left == nullptr || right == nullptr) {

        return false;

    }

    return (left->val == right->val) && isMirror(left->left, right->right) && isMirror(left->right,
right->left);

}

int isSymmetric(TreeNode* root) {

    if (root == nullptr) {

        return true;

    }

    return isMirror(root->left, root->right);

}

TreeNode* createExampleTree() {
    TreeNode* root = new TreeNode(1);

    root->left = new TreeNode(2);

    root->right = new TreeNode(2);

    root->left->left = new TreeNode(3);

    root->left->right = new TreeNode(4);

    root->right->left = new TreeNode(4);

    root->right->right = new TreeNode(3);

    return root;

}

int main() {

    TreeNode* root = createExampleTree();

    bool symmetric = isSymmetric(root);

    cout << "The tree is " << (symmetric ? "symmetric" : "not symmetric") << endl;

    return 0;

}
```

Output



```
The tree is symmetric


...Program finished with exit code 0
Press ENTER to exit console.
```

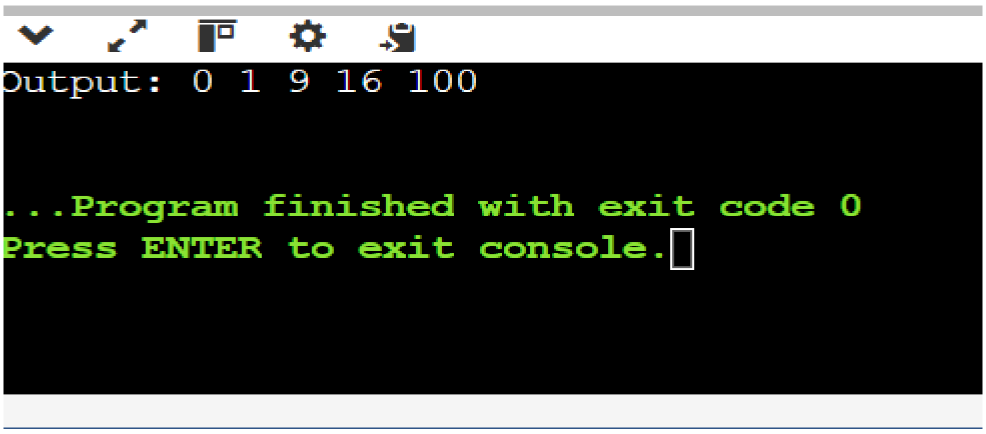
Q9. **Squares of a Sorted Array**

Ans:

```
#include <iostream>
```

```
#include <vector>

#include <algorithm>

using namespace std;

vector<int> sortedSquares(vector<int>& nums) {

    int n = nums.size();

    vector<int> result(n);

    int left = 0, right = n - 1;

    int pos = n - 1;

    while (left <= right) {

        if (abs(nums[left]) > abs(nums[right])) {

            result[pos] = nums[left] * nums[left];

            left++;

        } else {

            result[pos] = nums[right] * nums[right];

            right--;

        }

        pos--;

    }

    return result;

}

int main() {

    vector<int> nums = {-4, -1, 0, 3, 10};

    vector<int> result = sortedSquares(nums);


    cout << "Output: ";

    for (int x : result) {

        cout << x << " ";
    }
    cout << endl;
    return 0;
}
```

Output



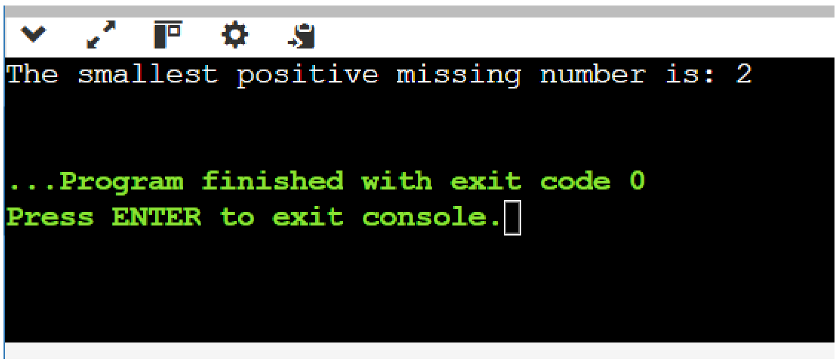
```
Output: 0 1 9 16 100


...Program finished with exit code 0
Press ENTER to exit console.
```

Q10. Smallest positive missing number.

Ans:

```
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;
int smallestMissingPositive(vector<int>& arr) {
    int n = arr.size();
    int j = 0;
    for (int i = 0; i < n; i++) {
        if (arr[i] <= 0) {
            swap(arr[i], arr[j]);
            j++;
        }
    }
    for (int i = j; i < n; i++) {
        int val = abs(arr[i]);
        if (val - 1 + j < n && arr[val - 1 + j] > 0) {
            arr[val - 1 + j] = -arr[val - 1 + j];
        }
    }
    for (int i = j; i < n; i++) {
        if (arr[i] > 0) {
            return i - j + 1;
        }
    }
    return n - j + 1;
}
int main() {
    vector<int> arr = {3, 4, -1, 1};

    int result = smallestMissingPositive(arr);
    cout << "The smallest positive missing number is: " << result << endl;

    return 0;
}
```

Output



```
The smallest positive missing number is: 2


...Program finished with exit code 0
Press ENTER to exit console.
```