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Section – 620-B

Q1. Implementation of linear search

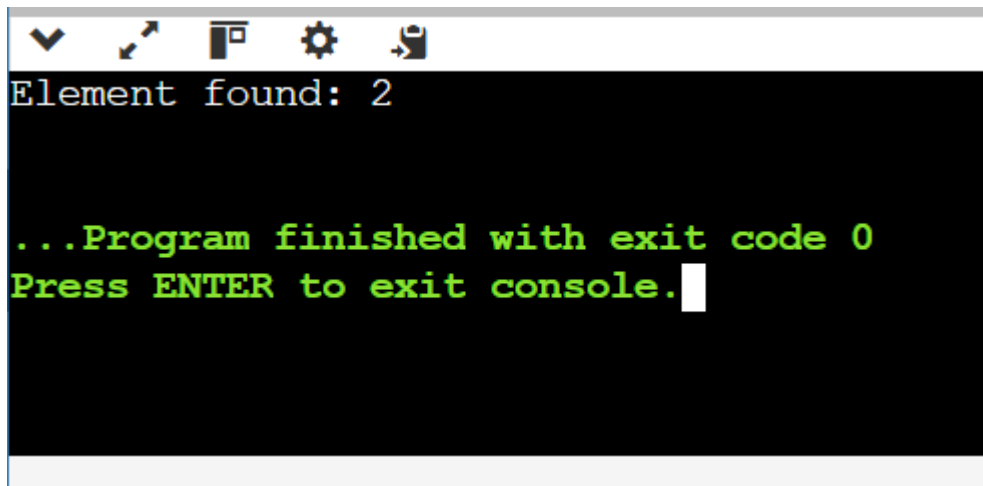
```
#include <iostream>

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

```
#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 ;

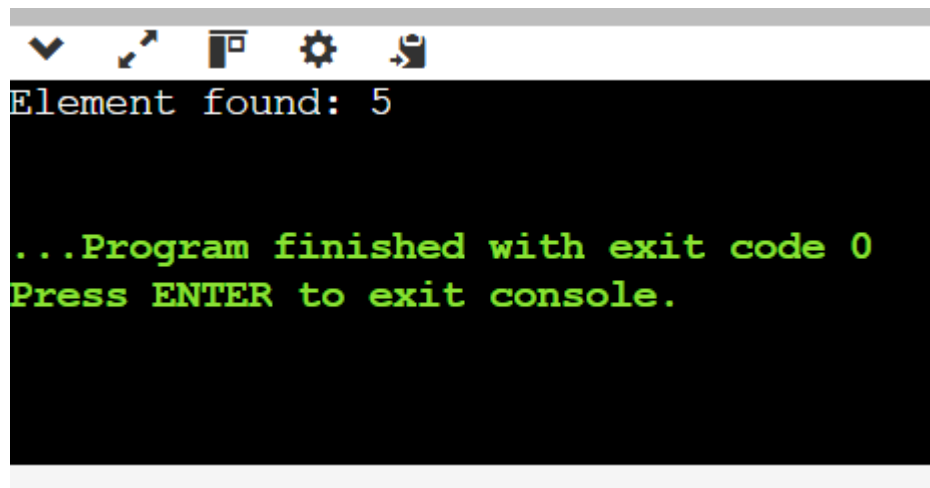
int result = binarySearch(arr, size, t);

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 occurrence of target value in sorted array

```

#include <iostream>

using namespace std;

int firstOccurrenceBinarySearch(int arr[], int size, int t) {
    int l = 0, r = size - 1;

```

```

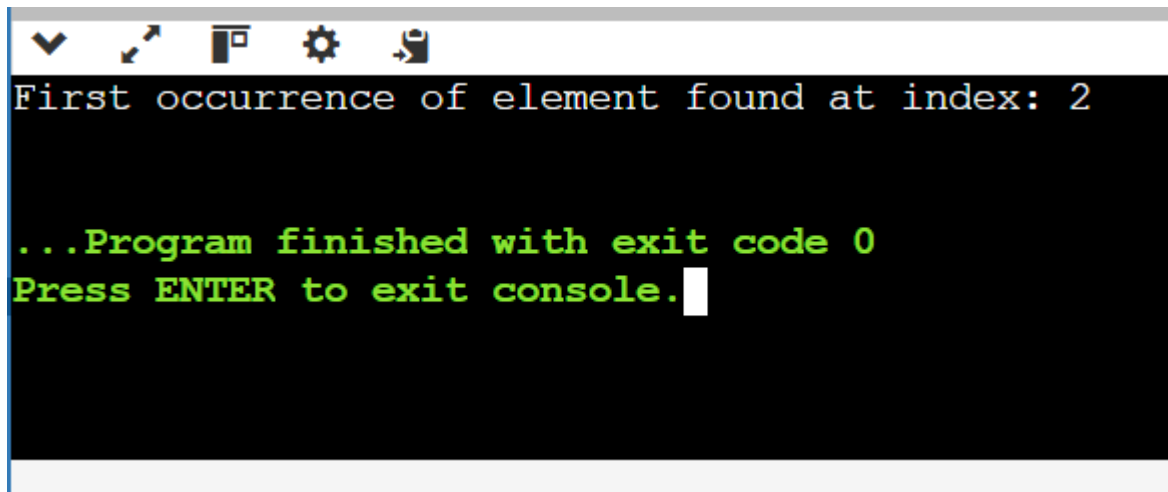
int result = -1;
while (l <= r) {
    int mid = l + (r - l) / 2;
    if (arr[mid] == t) {
        result = mid;
        r = mid - 1;
    } else if (arr[mid] < t) {
        l = mid + 1;
    } else {
        r = mid - 1;
    }
}

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

A screenshot of a console window with a dark background. The text is displayed in a monospaced font. The first line is "First occurrence of element found at index: 2" in a light blue color. The second line is "...Program finished with exit code 0" in a light green color. The third line is "Press ENTER to exit console." in the same light green color, followed by a white cursor block.

```
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)

```
#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];

}
```

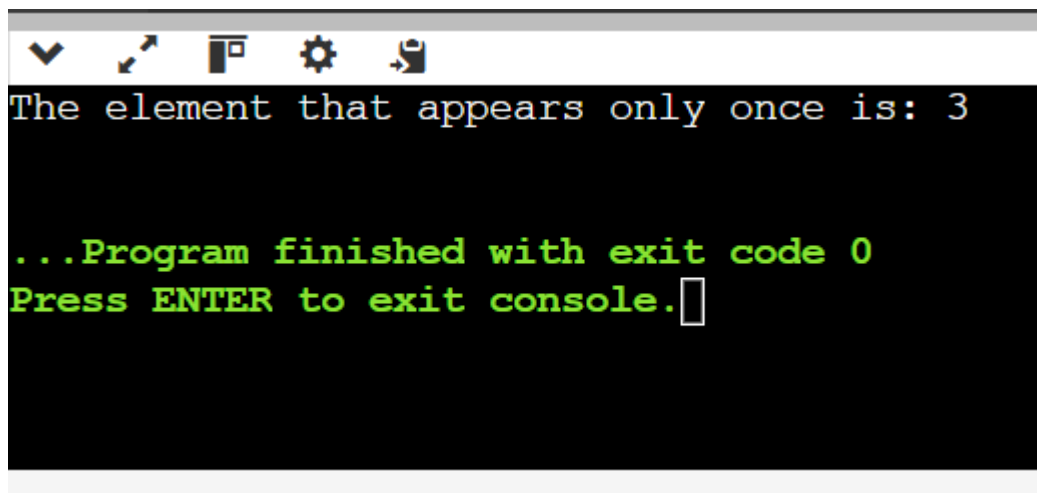
```

}

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 screenshot shows a console window with a dark background. At the top, there is a toolbar with icons for a dropdown menu, a window, a settings gear, and a file icon. The main text in the console is "The element that appears only once is: 3" in a light blue monospace font. Below this, in a green monospace font, it says "...Program finished with exit code 0" and "Press ENTER to exit console." followed by a small white cursor icon.

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

```

#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) {

```

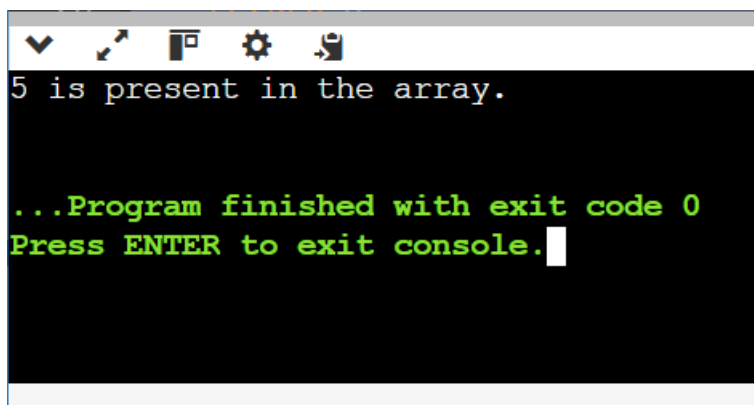
```

        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

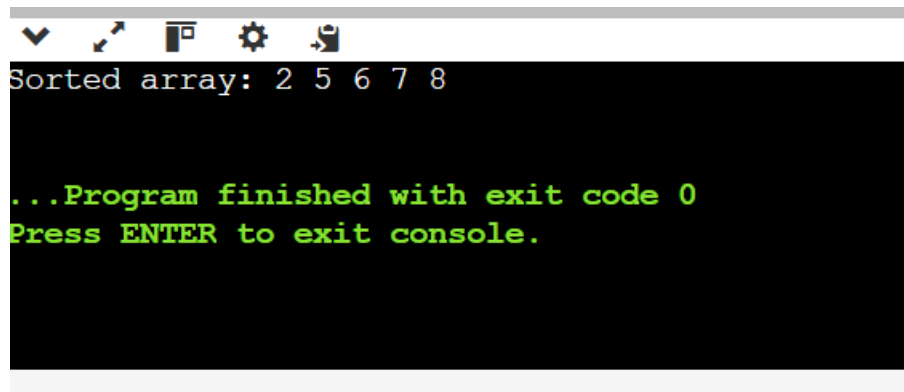
```
#include <iostream>

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

A screenshot of a terminal window with a dark background. The top bar shows standard window controls. The terminal text is as follows:

```
Sorted array: 2 5 6 7 8

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

Q7. Sum of binary tree nodes

```
#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]

```

#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;
}

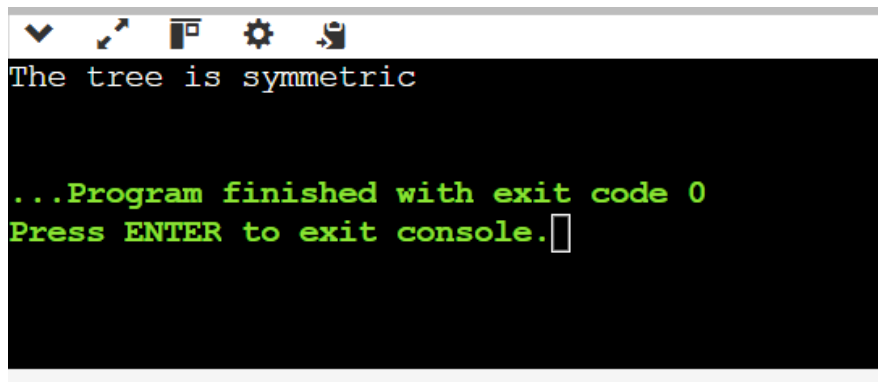
```

```

int main() {
    TreeNode* root = createExampleTree();
    bool symmetric = isSymmetric(root);
    cout << "The tree is " << (symmetric ? "symmetric" : "not symmetric") << endl;
    return 0;
}

```

Output



The screenshot shows a terminal window with a dark background. The output text is as follows:

```

The tree is symmetric

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

```

Q9. Squares of a Sorted Array

```

#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];

```

```

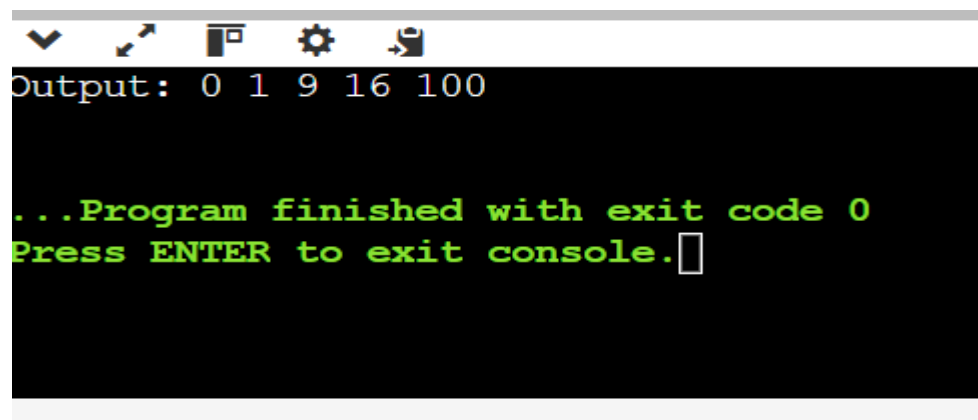
        left++;
    } else {
        result[pos] = nums[right] * nums[right];
        right--;
    }
    pos--;
}
return result;
}

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.

```
#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;

        }

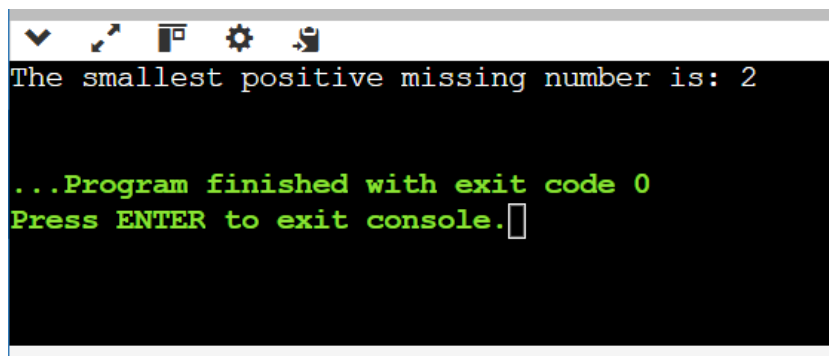
    }

    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

A screenshot of a console window with a black background and white text. The window has a title bar with standard Windows icons (minimize, maximize, close, settings, and a file icon). The output text is: "The smallest positive missing number is: 2" followed by a blank line. Then, in green text, it says "...Program finished with exit code 0" and "Press ENTER to exit console." followed by a cursor icon.

```
The smallest positive missing number is: 2  
  
...Program finished with exit code 0  
Press ENTER to exit console.
```