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SUBJECT : DSA LAB

Binary Search Implementation

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

int 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 mid; // Target found
        else if (arr[mid] < target)
            left = mid + 1;
        else
            right = mid - 1;
    }
    return -1; // Target not found
}

int main() {
    vector<int> arr = {2, 3, 4, 10, 40};
    int target = 10;

    int result = binarySearch(arr, target);
    if (result != -1)
        cout << "Binary Search: Target found at index " << result << endl;
    else
```

```cpp
        cout << "Binary Search: Target not found." << endl;


    return 0;
}
```

Linear Search Implementation

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

int linearSearch(vector<int> arr, int target) {
    for (int i = 0; i < arr.size(); i++) {
        if (arr[i] == target)
            return i; // Target found
    }
    return -1; // Target not found
}

int main() {
    vector<int> arr = {2, 3, 4, 10, 40};
    int target = 10;

    int result = linearSearch(arr, target);
    if (result != -1)
```

```
        cout << "Linear Search: Target found at index " << result << endl;
    else
        cout << "Linear Search: Target not found." << endl;


    return 0;
}
```

How to Run the Program in Dev-C++

1. Open Dev-C++: Launch the Dev-C++ IDE on your system.

2. Create Separate Files:

Create a new file for Binary Search (binary_search.cpp):

Go to File > New > Source File.

Paste the Binary Search code into the editor.

Save the file as binary_search.cpp.

Repeat the same steps for Linear Search (linear_search.cpp).

3. Compile the Program:

Open the desired file (e.g., binary_search.cpp) in Dev-C++.

Click on Execute > Compile and Run or press F11.

This will compile the code and execute it directly within the IDE.

4. View Output:

After running, the output will appear in the console window at the bottom of Dev-C++.

5. Repeat for Other Program:

Close the current file and open linear_search.cpp in Dev-C++.

Compile and run it to view the Linear Search program output.

Purpose of the Code

This project implements two fundamental searching algorithms:

1. Binary Search: Efficiently finds the position of a target element in a sorted list.

2. Linear Search: Iterates through the list to find the target element.

Time Complexity

Binary Search:

Best Case: $O(1)$

Worst Case: $O(\log_n)$

Linear Search:

Best Case: $O(1)$

Worst Case: $O(n)$