	Marwari University
Marwadi University	**Faculty of Technology** **Department of Information and Communication Technology**
Subject: Design and Analysis of Algorithms (01CT0512)	**Aim:** Implementing the Searching Algorithms and understanding the time and space complexities
Experimrnt 2	**Date: 03-08-2025** **Enrollment No: 92301733054**

❖ Linear Serch

Code:

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

int Linear_Search(vector<int> Array, int key)
{
  for (int i = 0; i < Array.size(); i++)
  {
    if (Array[i] == key)
    {
      return i;
    }
  }
  return -1;
}

void Print_Array(vector<int> Array)
{
  for (int i = 0; i < Array.size(); i++)
  {
    cout << Array[i] << " ";
  }
  cout << endl;
}
void Input_Array(vector<int> &Array)
{
  for (int i = 0; i < Array.size(); i++)
  {
    cout << "Enter Element at index " << i << " : ";
    cin >> Array[i];
  }
}
int main()
{
  int size;
```

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```cpp
    int key;
    while (true)
    {
        cout << "Enter The Size of the Array :- " << endl;
        cin >> size;
        if (size >= 1)
        {
            break;
        }
        cout << "Invalid Size. Size must be a Positive Integer." << endl;
    }
    vector<int> Array(size, 0);
    cout << "Enter The Element for the Array:- " << endl;
    Input_Array(Array);
    cout << "Your Input Array Is :- " << endl;
    Print_Array(Array);
    cout << "Enter the Key to Search In Array :- ";
    cin >> key;
    int ans = Linear_Search(Array, key);
    if (ans != -1)
    {
        cout << key << " Found at Index - " << ans << " of Array." << endl;
    }
    else
    {
        cout << "Key is not exists in Array.";
    }
    return 0;
}
```

Output:

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Time Complexity: O(n)
Space Complexity: O(1)

❖ Binary Search
Code:

```cpp
#include <iostream>
#include <vector>
#include <algorithm>
using namespace std;
int Binary_Search(vector<int> Array, int left, int right, int key)
{
    while (left <= right){
        int mid = left + (right - left) / 2;
        if (key == Array[mid]){
            return mid;
        }
        if (key < Array[mid]){
            right = mid - 1;
        }
        else
        {
            left = mid + 1;
        }
    }
    return -1;
}
void Print_Array(vector<int> Array)
{
    for (int i = 0; i < Array.size(); i++)
    {
        cout << Array[i] << " ";
    }
    cout << endl;
}

void Input_Array(vector<int> &Array)
{
    for (int i = 0; i < Array.size(); i++)
```

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```cpp
    {
      cout << "Enter Element at index " << i << " : ";
      cin >> Array[i];
    }
}
int main()
{
    int size;
    int key;

    while (true)
    {
      cout << "Enter The Size of the Array :- " << endl;
      cin >> size;
      if (size >= 1)
      {
          break;
      }
      cout << "Invalid Size. Size must be a Positive Integer." << endl;
    }
    vector<int> Array(size, 0);
    cout << "Enter The Element for the Array:- " << endl;
    Input_Array(Array);
    sort(Array.begin(), Array.end());
    cout << "Your Input Array Is :- " << endl;
    Print_Array(Array);
    cout << "Enter the Key to Search In Array :- ";
    cin >> key;
    int ans = Binary_Search(Array, 0, size, key);
    if (ans != -1)
    {
      cout << key << " Found at Index - " << ans << " of Array." << endl;
    }
    else
    {
      cout << "Key is not exists in Array.";
    }
    return 0;
}
```

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Output:

```
PROBLEMS   SPELL CHECKER   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS   GITLENS                        Code + ∨ ⬚ 🗑 ⋯ ⌄

cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 2/" && g++ Binary_Search.cpp -o Binary_Search && "/Users/nikhilbhanderi/Documents/Seme
ster 5/DAA/Lab - Manual/Experiment - 2/"Binary_Search
● nikhilbhanderi@Nikhils-MacBook-Air Experiment - 2 % cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 2/" && g++ Binary_Search.cpp -o Bi
nary_Search && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 2/"Binary_Search
Enter The Size of the Array :-
6
Enter The Element for the Array:-
Enter Element at index 0 : 2
Enter Element at index 1 : 4
Enter Element at index 2 : 6
Enter Element at index 3 : 2
Enter Element at index 4 : 7
Enter Element at index 5 : 2
Your Input Array Is :-
2 2 2 4 6 7
Enter the Key to Search In Array :- 4
4 Found at Index - 3 of Array.
○ nikhilbhanderi@Nikhils-MacBook-Air Experiment - 2 % █
```

Time Complexity: $O(\log n)$
Space Complexity: $O(1)$