Lab Report-01

(Linear_Search)

CSE-2212 (Design and Analysis of Algorithms Lab)

Submitted By:

Name: Eyasir Ahamed
Exam Roll: 413
Class Roll: 15
Registration No: 202004017

Submitted To:

Sharad Hasan
Ex. Lecturer
Dept. of CSE
Sheikh Hasina University, Netrokona

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SHEIKH HASINA UNIVERSITY
NETROKONA, BANGLADESH

#1_Linear Search

Problem Definition

Given an array of integers arr[] of size n and a key integer key, the problem is to find the index of the first occurrence of key in the array arr[]. If the key is not present, return -1.

Formal Statement of the Algorithm

- Start from the first element of the array (arr[0]).
- Iterate through each element of the array from index 0 to n-1.
- For each element arr[i], check if it is equal to the key.
- If arr[i] equals the key, return the index i.
- If the key is not found after iterating through the entire array, return -1.

Complexity Analysis of the Algorithm

- Time Complexity:
  - Best case: O(1) (when the key is found at the first index).
  - Average and Worst case: O(n) (when the key is not present in the array or found at the last index).

- Space Complexity: O(1) (constant space, as no extra space is used apart from a few variables).

Actual Code

```cpp
#include <bits/stdc++.h>
using namespace std;

int linear_search(int arr[], int n, int key)
{
    for (int i = 0; i < n; i++)
    {
        if (arr[i] == key)
        {
            return i;
        }
    }
    return -1;
}
int main()
{
    int arr[] = {2, 6, 3, 0, 9};
    int n = sizeof(arr) / sizeof(int);
    int k = linear_search(arr, n, arr[1]);
    cout << "at index : " << k;
    return 0;
}
```

Output

```
eyasir@eyasirUPC:~/Documents/GitHub/DSA/Searching$ cd "/home/eyasir/Documents/GitHub/DSA/Searching/" && g++ linear_search.cpp -o linear_search && "/home/eyasir/Documents/GitHub/DSA/Searching/"linear_search
at index : 1
```