Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Department of Electronics & Telecommunication Engineering

Data Structures & Algorithms Lab (DJ19ECSBL1)

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Aim: Write a program to implement Binary Search

Programming Language: C/C++/Java

Theory: Binary Search is a searching algorithm used in a sorted array by repeatedly dividing the search interval in half. The idea of binary search is to use the information that the array is sorted and reduce the time complexity to O(log n).

The basic steps to perform Binary Search are:

- Begin with the mid element of the whole array as a search key.
- If the value of the search key is equal to the item then return an index of the search key.
- Else if the value of the search key is less than the item in the middle of the interval, narrow the interval to the lower half.
- Otherwise, narrow it to the upper half.
- Repeatedly check from the second point until the value is found or the interval is empty.

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Code and Implementation:

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

int binarySearch(int arr[], int n, int k)
{
    int l = 0;
    int r = n - 1;
    while (l <= r)
    {
        int mid = (l + r) / 2;
        if (arr[mid] == k)
        {
            return mid;
        }
        else if (arr[mid] < k)
        {
            l = mid + 1;
        }
        else
        {
            r = mid - 1;
        }
    }
    return -1;
}

int main()
{
    int arr[] = {1, 2, 3, 4, 5, 6};
    int a = binarySearch(arr, 6, 4);
    if (a == -1)
    {
        cout << "Element is not in given array." << endl;
    }
    else
    {
        cout << "Position of element " << 4 << " in array is: " << a << endl;
    }
}
```

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Output:

```
PS G:\programming\College_DSA> cd "g:\programming\College_DSA\searching\" ; if ($?) { g++ binarySearch.cpp -o binarySearch } ; if ($?) { .\binarySearch }
Position of element 4 in array is: 3
PS G:\programming\College_DSA\searching>
```

Result:

1) If element is present in array it will prints the index by binary search in array.
2) If element is not present in array then it will print -1.

Conclusion:

1) First condition for binary search is array should be in sorted order.
2) Time complexity of binary search is log(n).
3) It is faster than linear search.
4) Binary search was implemented using c++.