Binary Search Recursion

Assignment: 12

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Recurrence Relation:

binarySearch(arr,key,low,high) =

$$
\begin{cases}
-1 & \text{if(low > high)} \\
mid & \text{if(arr[mid]==key)} \\
\text{binarySearch(arr,key,mid+1,high)} & \text{if(arr[mid]<key)} \\
\text{binarySearch(arr,key,low,mid-1)} & \text{otherwise}
\end{cases}
$$

Program:

BinarySearch.java

```java
package com.kodnest.recursion;

import java.util.Scanner;

public class BinarySearch {
    public static void main(String[] args) {
        Scanner scan=new Scanner(System.in);
        System.out.println("Enter size of an array");
        int arr[] = new int[scan.nextInt()];
        System.out.println("Enter array elements in ascending order");
        for(int i=0;i<=arr.length-1;i++)
        {
            arr[i]=scan.nextInt();
        }
        System.out.println("Enter a key to search");
        int key = scan.nextInt();
        int result = binarySearch(arr, key, 0, arr.length - 1);
        if (result != -1)
        {
            System.out.println("Element found at index: " + result);
        }
```

BinarySearch.java

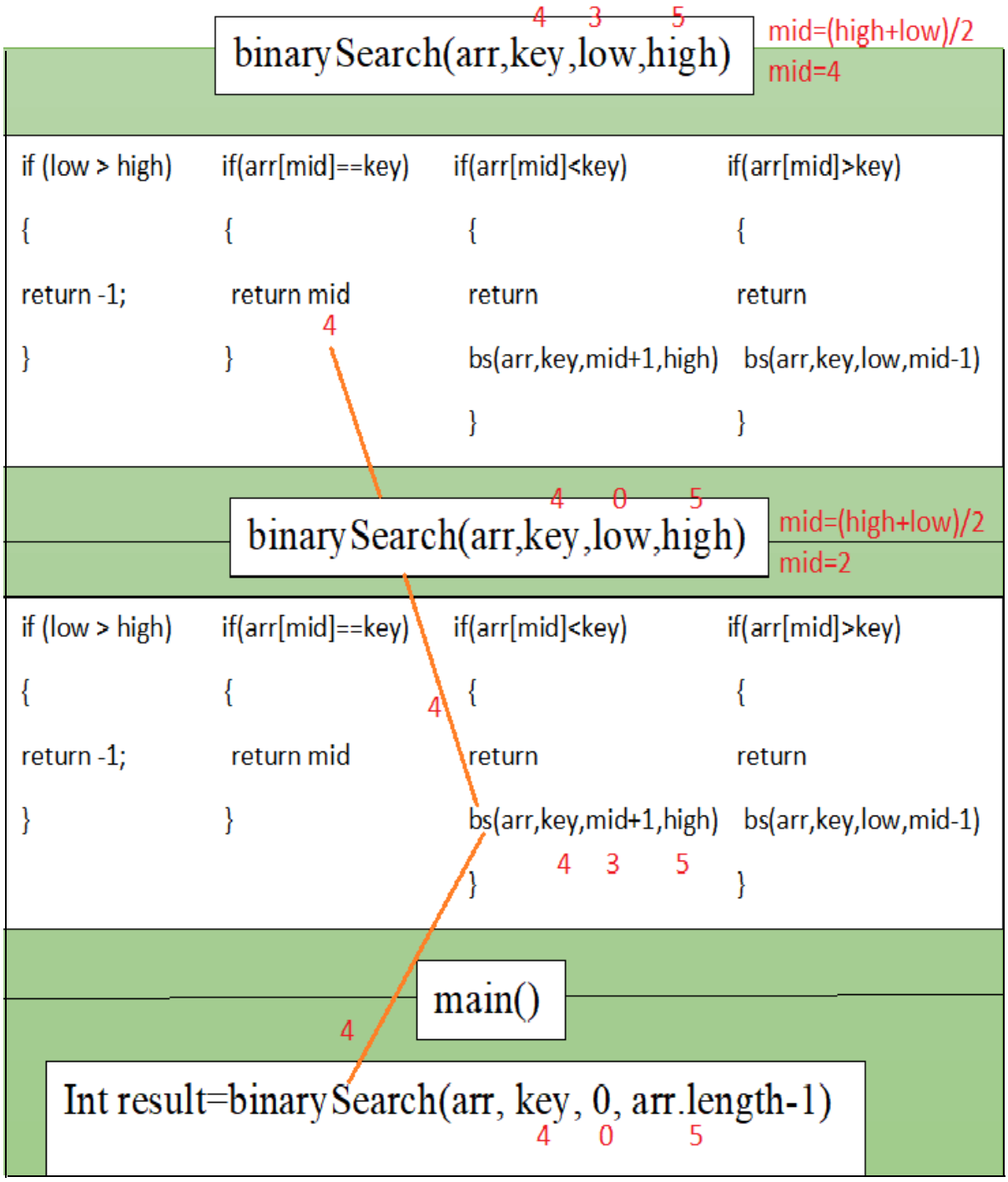
```java
        else
        {
            System.out.println("Element not found");
        }
    }

    public static int binarySearch(int[] arr, int key, int low, int high) {
            if (low > high)
            {
                return -1;
            }
            int mid =(low+high)/2;
            if (arr[mid] == key)
            {
                return mid;
            } else if (arr[mid] < key)
            {
                return binarySearch(arr, key, mid + 1, high);
            } else
            {
                return binarySearch(arr, key, low, mid - 1);
            } }
            }
```

Console

```
<terminated> BinarySearch (1) [Java Application] C:\Program Files\Java\jdk-17\bin\javaw.exe  (26-Oct-2023, 10:47:02 pm – 10:
Enter array elements in ascending order
0 1 2 3 4 5
Enter a key to search
4
Element found at index: 4
```

Memory map:



arr.length- 6

arr- 0,1,2,3,4,5

key- 4