DATA STRUCTURES & ALGORITHMS

CS106.3

Coursework 2023/2024

Name	**J M S V JAYAWEERA**
Index	**29008**
Degree	**BSc (Hons) Software Engineering**

Coursework

Use recursive approach to solve the Binary Search:

1. Write a proper pseudocode
2. Convert in to a program
3. Test the program with [2, 8, 9, 11, 15, 45, 58, 78, 99] array locating 2.

---------- [Answer Below] ----------

1. The Pseudocode

```
function binarySearch(arr, low, high, target):
  if low <= high:
    mid = (low + high) / 2

    if arr[mid] == target:
      return mid
    else if arr[mid] < target:
      return binarySearch(arr, mid + 1, high, target)
    else:
      return binarySearch(arr, low, mid - 1, target)
  else:
    return -1
```

2. I have written the program in both Java and C to understand and practice the concept.

   - Java

```
public class RecursiveBinarySearch {

  public static int binarySearch(int[] arr, int low, int high, int target) {
    if (low <= high) {
      int mid = (low + high) / 2;
```

```
        if (arr[mid] == target) {
            return mid;
        } else if (arr[mid] < target) {
            return binarySearch(arr, mid + 1, high, target);
        } else {
            return binarySearch(arr, low, mid - 1, target);
        }
    } else {
        return -1;
    }
}
```

- C

```
#include <stdio.h>
int binarySearch(int arr[], int low, int high, int target) {
    if (low <= high) {
        int mid = (low + high) / 2;

        if (arr[mid] == target) {
            return mid;
        } else if (arr[mid] < target) {
            return binarySearch(arr, mid + 1, high, target);
        } else {
            return binarySearch(arr, low, mid - 1, target);
        }
    } else {
        return -1;
    }
}
```

3. I Have Tried recursive method to Solve Binary Search using the Both Languages C and Java.

- **Java Code**

```
// This is a code that i wrote to solve Binary search using recursive method

public class RecursiveBinarySearch {

    public static int binarySearch(int[] arr, int low, int high, int target) {
        if (low <= high) {
            int mid = (low + high) / 2;
```

```
            if (arr[mid] == target) {
                return mid;
            } else if (arr[mid] < target) {
                return binarySearch(arr, mid + 1, high, target);
            } else {
                return binarySearch(arr, low, mid - 1, target);
            }
        } else {
            return -1;
        }
    }

    public static void main(String[] args) {
        int[] arr = {2, 8, 9, 11, 15, 45, 58, 78, 99};
        int target = 2;
        int result = binarySearch(arr, 0, arr.length - 1, target);

        if (result != -1) {
            System.out.println("Element " + target + " is found at index " + result +
".");
        } else {
            System.out.println("Element " + target + " is not present in the
array.");
        }
    }
}
```

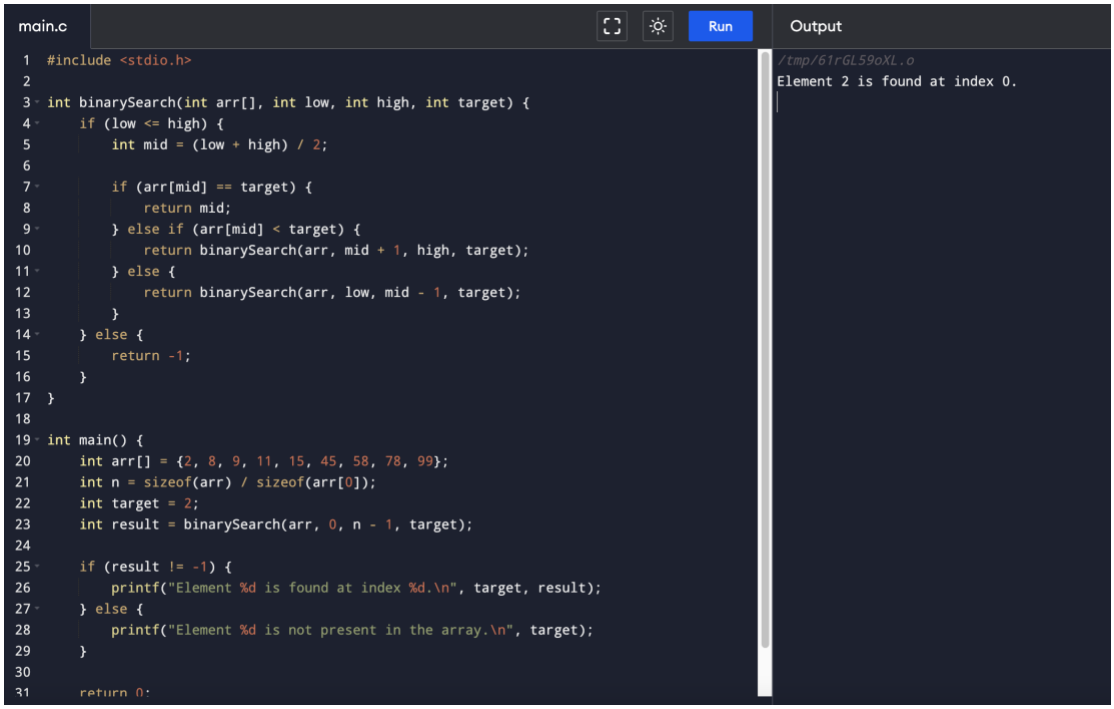
- **C Code**

```
// This is a code that i wrote to solve Binary search using recursive
method
#include <stdio.h>

int binarySearch(int arr[], int low, int high, int target) {
    if (low <= high) {
        int mid = (low + high) / 2;

        if (arr[mid] == target) {
            return mid;
        } else if (arr[mid] < target) {
            return binarySearch(arr, mid + 1, high, target);
        } else {
            return binarySearch(arr, low, mid - 1, target);
        }
```

```
    } else {
        return -1;
    }
}

int main() {
    int arr[] = {2, 8, 9, 11, 15, 45, 58, 78, 99};
    int n = sizeof(arr) / sizeof(arr[0]);
    int target = 2;
    int result = binarySearch(arr, 0, n - 1, target);

    if (result != -1) {
        printf("Element %d is found at index %d.\n", target, result);
    } else {
        printf("Element %d is not present in the array.\n", target);
    }

    return 0;
}
```

- The Output

The output using C



The Output Using Java

```java
public class RecursiveBinarySearch {
    3 usages
    public static int binarySearch(int[] arr, int low, int high, int target)
    {
        if (low <= high) {
            int mid = (low + high) / 2;

            if (arr[mid] == target) {
                return mid;
            } else if (arr[mid] < target) {
                return binarySearch(arr, low: mid + 1, high, target);
            } else {
                return binarySearch(arr, low, high: mid - 1, target);
            }
        } else {
            return -1;
        }
    }


    public static void main(String[] args) {
        int[] arr = {2, 8, 9, 11, 15, 45, 58, 78, 99};
        int target = 2;
        int result = binarySearch(arr, low: 0, high: arr.length - 1, target);

        if (result != -1) {
            System.out.println("Element " + target + " is found at index " + result + ".");
        } else {
            System.out.println("Element " + target + " is not present in the array.");
        }
    }
}
```

```
un:  RecursiveBinarySearch
/Users/macboookpro/Library/Java/JavaVirtualMachines/openjdk-20.0.1/Contents/Home/bin/java -javaagent:/Applications/Intel
Element 2 is found at index 0.

Process finished with exit code 0
```