

Lesson 04 Demo 10

Implementing the Binary Search Algorithm

Objective: To use binary search in JavaScript for quickly finding values in sorted data like product catalogs

Tools required: Visual Studio Code and Node.js

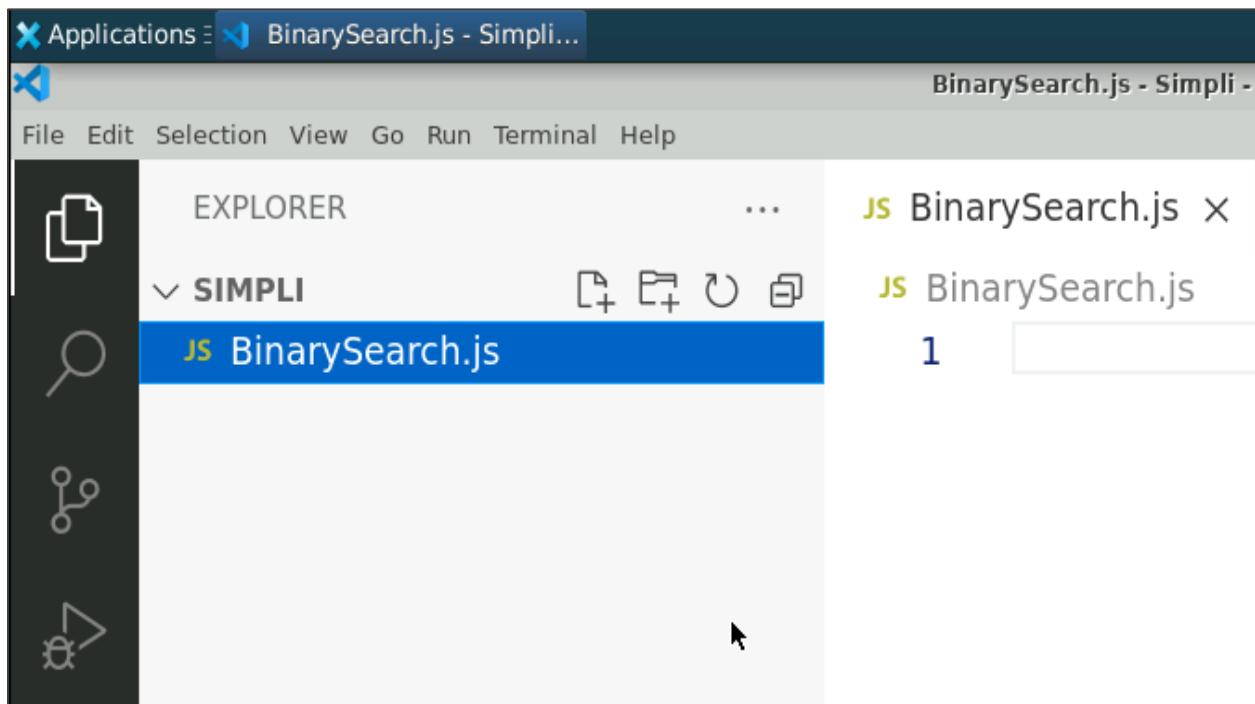
Prerequisites: A basic understanding of arrays and loops in JavaScript

Steps to be followed:

1. Create a JavaScript file and execute it

Step 1: Create a JavaScript file and execute it

- 1.1 Open the Visual Studio Code editor and create a JavaScript file named **BinarySearch.js**



1.2 Add the following code to the file:

```
// Binary search function to find the index of the target in a sorted array
function binarySearch(arr, target) {
    let left = 0;
    let right = arr.length - 1;

    // Time Complexity: O(log n)
    // The while loop divides the search space in half with each iteration,
    // leading to a logarithmic time complexity when the array is sorted.
    while (left <= right) {
        const mid = Math.floor((left + right) / 2);

        if (arr[mid] === target) {
            return mid; // Element found
        }
        if (arr[mid] < target) {
            left = mid + 1; // Search in the right half
        } else {
            right = mid - 1; // Search in the left half
        }
    }
    return -1; // Element not found
}

// Example usage
const arr = [1, 3, 5, 7, 9, 11, 13, 15];
const target = 9;

// Measure the execution time of the binarySearch function
console.time("binarySearch");
const result = binarySearch(arr, target);
console.timeEnd("binarySearch");

if (result !== -1) {
    console.log(`Element found at index: ${result}`);
} else {
    console.log('Element not found in the array');
}
```

```
js BinarySearch.js > ...
1 // Binary search function to find the index of the target in a sorted array
2 function binarySearch(arr, target) {
3     let left = 0;
4     let right = arr.length - 1;
5
6     // Time Complexity: O(log n)
7     // The while loop divides the search space in half with each iteration,
8     // leading to a logarithmic time complexity when the array is sorted.
9     while (left <= right) {
10         const mid = Math.floor((left + right) / 2);
11
12         if (arr[mid] === target) {
13             return mid; // Element found
14         }
15
16         if (arr[mid] < target) {
17             left = mid + 1; // Search in the right half
18         } else {
19             right = mid - 1; // Search in the left half
20         }
21     }
22
23     return -1; // Element not found
24 }
25
```

```
26 // Example usage
27 const arr = [1, 3, 5, 7, 9, 11, 13, 15];
28 const target = 9;
29
30 // Measure the execution time of the binarySearch function
31 console.time("binarySearch");
32 const result = binarySearch(arr, target);
33 console.timeEnd("binarySearch");
34
35 if (result !== -1) {    [
36     console.log(`Element found at index: ${result}`);
37 } else {
38     console.log('Element not found in the array');
39 }
```

1.3 Press **Ctrl + S** to save the file and then execute it in the **TERMINAL** using the commands given below:

```
ls  
node BinarySearch.js
```

```
30 // Measure the execution time of the binarySearch function  
31 console.time("binarySearch");  
32 const result = binarySearch(arr, target);  
33 console.timeEnd("binarySearch");  
34
```

The screenshot shows a terminal window with the following interface elements at the top: PROBLEMS, OUTPUT, DEBUG CONSOLE, TERMINAL (which is highlighted with a red box), and a bash tab. The terminal area contains the following text:

```
priyanshurajsim@ip-172-31-65-5:~/Downloads/Simpli$ ls  
BinarySearch.js  
priyanshurajsim@ip-172-31-65-5:~/Downloads/Simpli$ node BinarySearch.js  
binarySearch: 0.09ms  
Element found at index: 4  
priyanshurajsim@ip-172-31-65-5:~/Downloads/Simpli$ █
```

By following these steps, you have successfully used the binary search algorithm in JavaScript to efficiently find items in sorted data such as product catalogs, and learned that it has a time complexity of $O(\log n)$ and space complexity of $O(1)$.