Lesson 04 Demo 05

Implementing Quick Sort Algorithm

Objective: To demonstrate the quick sort algorithm and explain its time and space complexity using JavaScript

Tools required: Visual Studio Code and Node.js

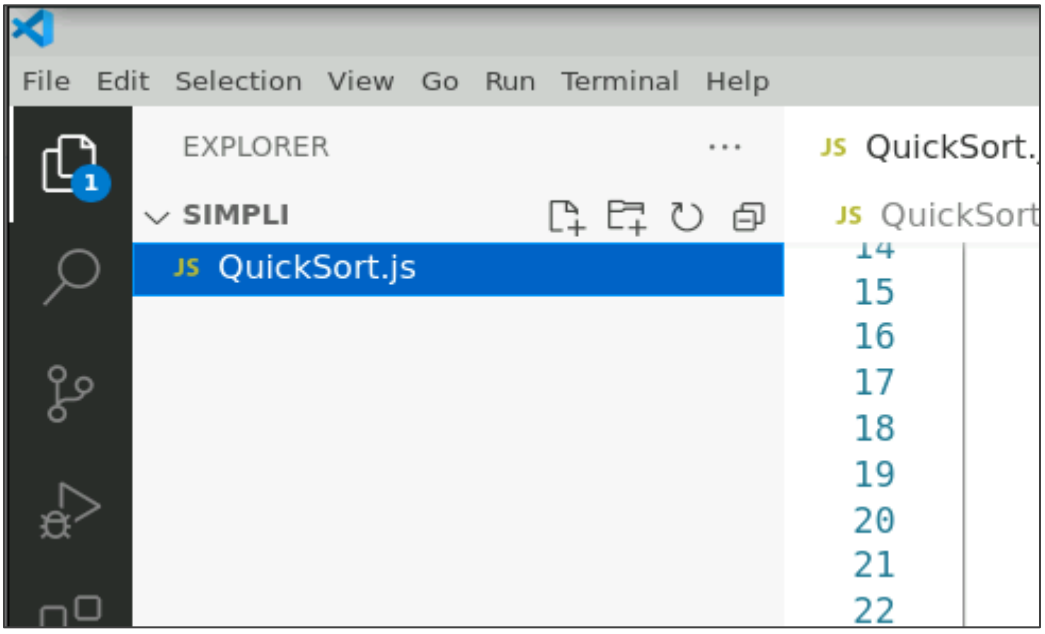
Prerequisites: Basic understanding of arrays and loops in JavaScript

Steps to be followed:

1. Create and execute the JS file

Step 1: Create and execute the JS file

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



1.2 Write the code given below in the **QuickSort.js** file:

```
function quickSort(array, low, high) {
  if (low < high) {
    const pivotIndex = partition(array, low, high);
    // Recursive call for the left part of the array
    quickSort(array, low, pivotIndex - 1);
    // Recursive call for the right part of the array
    quickSort(array, pivotIndex + 1, high);
  }
}
// Time Complexity: Average and Best - O(n log n), Worst - O(n^2)
// Space Complexity: O(log n)

function partition(array, low, high) {
  const pivot = array[high];
  let i = low - 1;

  for (let j = low; j < high; j++) {
    if (array[j] < pivot) {
      i++;
      [array[i], array[j]] = [array[j], array[i]]; // Swap elements
    }
  }

  [array[i + 1], array[high]] = [array[high], array[i + 1]]; // Swap pivot
  return i + 1; // Return the pivot index
}

const unsortedArray = [5, 2, 4, 1, 3];
console.time("quickSort");
quickSort(unsortedArray, 0, unsortedArray.length - 1);
console.timeEnd("quickSort"); // Measures and logs the time taken for sorting
console.log(unsortedArray); // Output: [1, 2, 3, 4, 5]
```

```javascript
function quickSort(array, low, high) {
    if (low < high) {
      const pivotIndex = partition(array, low, high);
      // Recursive call for the left part of the array
      quickSort(array, low, pivotIndex - 1);
      // Recursive call for the right part of the array
      quickSort(array, pivotIndex + 1, high);
    }
  }
  // Time Complexity: Average and Best - O(n log n), Worst - O(n^2)
  // Space Complexity: O(log n)

  function partition(array, low, high) {
    const pivot = array[high];
    let i = low - 1;

    for (let j = low; j < high; j++) {
      if (array[j] < pivot) {
        i++;
        [array[i], array[j]] = [array[j], array[i]]; // Swap elements
      }
    }

    [array[i + 1], array[high]] = [array[high], array[i + 1]]; // Swap pivot
    return i + 1; // Return the pivot index
  }

  const unsortedArray = [5, 2, 4, 1, 3];
  console.time("quickSort");
  quickSort(unsortedArray, 0, unsortedArray.length - 1);
  console.timeEnd("quickSort"); // Measures and logs the time taken for sorting
  console.log(unsortedArray); // Output: [1, 2, 3, 4, 5]
```

1.3 Save the file and execute it in the terminal using the following command:
node QuickSort.js

```
    // Recursive call for the right part of the array
    quickSort(array, pivotIndex + 1, high);
  }
}
// Time Complexity: Average and Best - O(n log n), Worst - O(n^2)
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
priyanshurajsim@ip-172-31-40-74:~/Downloads/Simpli$ ls
QuickSort.js
priyanshurajsim@ip-172-31-40-74:~/Downloads/Simpli$ node QuickSort.js
quickSort: 0.127ms
[ 1, 2, 3, 4, 5 ]
priyanshurajsim@ip-172-31-40-74:~/Downloads/Simpli$
```

In our example, we used the quick sort algorithm in JavaScript to arrange the items in an array. It has a time complexity of O(n^2) and a space complexity of O(log n).

By following these steps, you have successfully implemented and executed the quick sort algorithm in JavaScript, including measuring its execution time.