Design And Analysis Of Algorithms

Practical

Objective:- Implement and analyze the complexity of Quick And Merge Sort.

Code:-

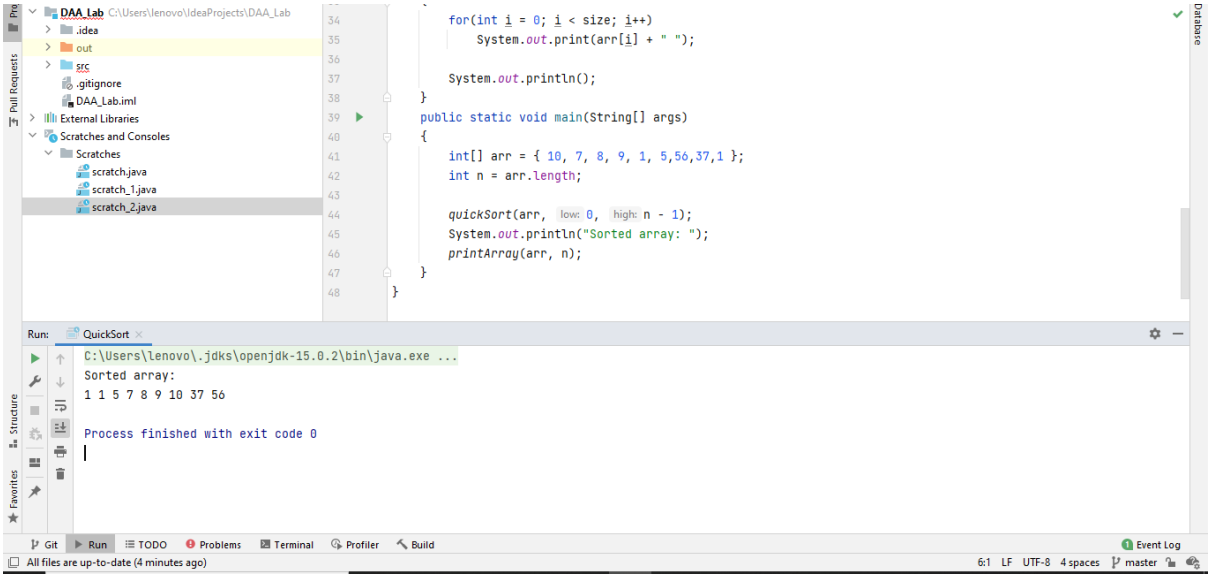
```
class QuickSort{
   static void swap(int[] arr, int i, int j)
   {
       int temp = arr[i];
       arr[i] = arr[j];
       arr[j] = temp;
   }
   static int partition(int[] arr, int low, int high)
   {
       int pivot = arr[high];
       int i = (low - 1);
       for(int j = low; j <= high - 1; j++)
       {
           if (arr[j] < pivot)
           {
               i++;
               swap(arr, i, j);
           }
       }
       swap(arr, i + 1, high);
       return (i + 1);
   }
   static void quickSort(int[] arr, int low, int high)
   {
       if (low < high)
       {
           int pi = partition(arr, low, high);
           quickSort(arr, low, pi - 1);
           quickSort(arr, pi + 1, high);
       }
   }
   static void printArray(int[] arr, int size)
   {
       for(int i = 0; i < size; i++)
           System.out.print(arr[i] + " ");

       System.out.println();
   }
   public static void main(String[] args)
   {
       int[] arr = { 10, 7, 8, 9, 1, 5,56,37,1 };
       int n = arr.length;

       quickSort(arr, 0, n - 1);
       System.out.println("Sorted array: ");
       printArray(arr, n);
   }
```

}

Output:-



Analyze:-Best Time Complexity : O(nlogn) Average Time Complexity : O(nlogn) Worst Time Complexity : O(n^2)

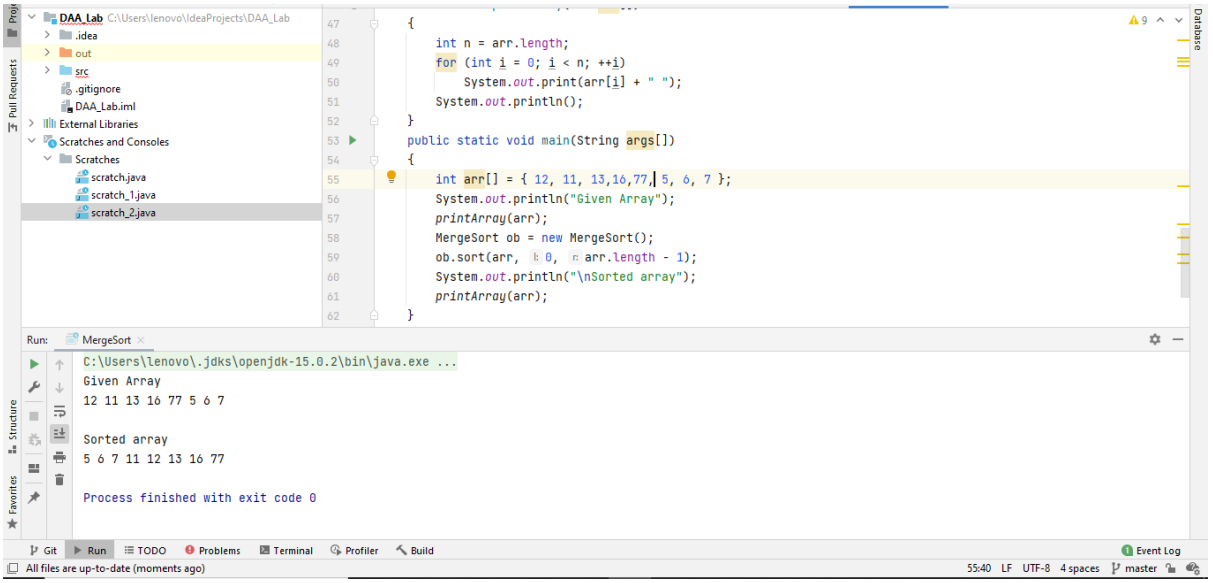
Objective:- Merge Sort

Code:-

```
class MergeSort
{
    void merge(int arr[], int l, int m, int r)
    {
        int n1 = m - l + 1;
        int n2 = r - m;
        int L[] = new int[n1];
        int R[] = new int[n2];
        for (int i = 0; i < n1; ++i)
            L[i] = arr[l + i];
        for (int j = 0; j < n2; ++j)
            R[j] = arr[m + 1 + j];
        int i = 0, j = 0;
        int k = l;
        while (i < n1 && j < n2) {
            if (L[i] <= R[j]) {
                arr[k] = L[i];
                i++;
            }
            else {
                arr[k] = R[j];
                j++;
```

```
            }
            k++;
        }
        while (i < n1) {
            arr[k] = L[i];
            i++;
            k++;
        }
        while (j < n2) {
            arr[k] = R[j];
            j++;
            k++;
        }
    }
    void sort(int arr[], int l, int r)
    {
        if (l < r) {
            int m =l+ (r-l)/2;
            sort(arr, l, m);
            sort(arr, m + 1, r);
            merge(arr, l, m, r);
        }
    }
    static void printArray(int arr[])
    {
        int n = arr.length;
        for (int i = 0; i < n; ++i)
            System.out.print(arr[i] + " ");
        System.out.println();
    }
    public static void main(String args[])
    {
        int arr[] = { 12, 11, 13, 5, 6, 7 };
        System.out.println("Given Array");
        printArray(arr);
        MergeSort ob = new MergeSort();
        ob.sort(arr, 0, arr.length - 1);
        System.out.println("\nSorted array");
        printArray(arr);
    }
}
```

Output:-



Analyze:-

The time complexity of MergeSort is **O(n*Log n)** in all the 3 cases (worst, average and best) as the mergesort always divides the array into two halves and takes linear time to merge two halves.