Mohammad Ali Jinnah University

Chartered by Government of Sindh - Recognized by HEC

Lab Task 5

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Id: FA19-BSSE-0014

Subject: Data Structures and Algorithms Lab (CS 2511)

Lab Title: Merge & Quick Sort

Section: AM

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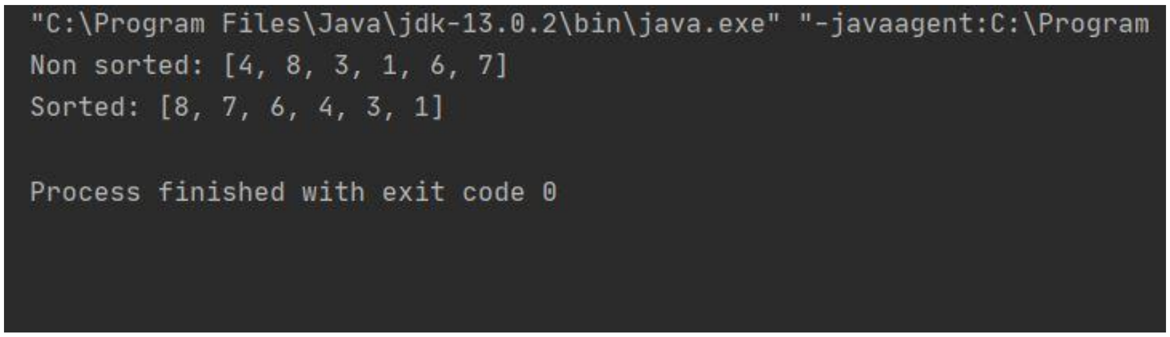
Date: Sunday, November 15, 2020

1. **Customize the given code of Merge Sort for descending order sorting.**
   Code:

```java
import java.util.Arrays;

public class mergesort {
    static void merge(int A[ ] , int start, int mid, int end) {
        int low = start, middle = mid+1, count=0;
        int temp[] = new int[(end-start)+1];

        while (low<=mid&&middle<=end){
           if (A[low] > A[middle])
               temp[count] = A[low++];

            else
                temp[count] = A[middle++];

            count++;
        }

        while(low<=mid){
            temp[count] = A[low];
            count++;
            low++;
        }

        while(middle<=end){
            temp[count] = A[middle];
            count++;
            middle++;
        }

        for (int i = 0; i<count; i++,start++) {
              A[start] = temp[i];
        }
    }

    static void sort(int arr[],int low,int high){
        int mid;
        if(low < high){
            mid=(low+high)/2;

            sort(arr,low,mid);
            sort(arr,mid+1,high);

            merge(arr,low,mid,high);
        }
    }

    public static void main(String[] args) {
        int[] arr={4,8,3,1,6,7};
        int low = 0;
        int high = arr.length-1;
        System.out.println("Non sorted: "+Arrays.toString(arr));
        sort(arr,low,high);

        System.out.println("Sorted: "+Arrays.toString(arr));
    }
}
```

Output:



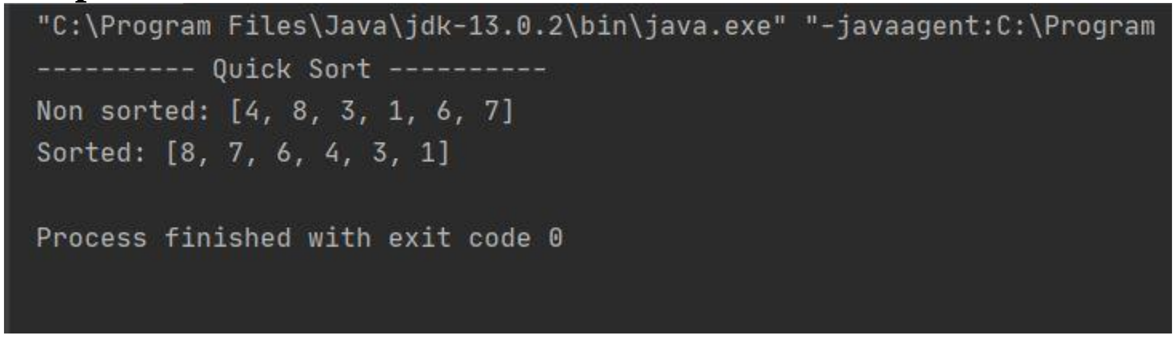
```
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" "-javaagent:C:\Program
Non sorted: [4, 8, 3, 1, 6, 7]
Sorted: [8, 7, 6, 4, 3, 1]

Process finished with exit code 0
```

2. **Customize the given code of Quick Sort for descending order sorting.**

Code:

```
package com.company.Sorting;

import java.util.Arrays;

public class QuickSort {
    public static void main(String[] args) {
        int[] arr={4,8,3,1,6,7};
        int low = 0;
        int high = arr.length-1;

        System.out.println("---------- Quick Sort ----------");
        System.out.println("Non sorted: "+ Arrays.toString(arr));

        sort(arr,low,high);

        System.out.println("Sorted: "+Arrays.toString(arr));
    }

    static void sort(int arr[], int low, int high){
        if (low < high){
            int pi = partition(arr, low, high);

            sort(arr, low, pi-1);
            sort(arr, pi+1, high);
        }
    }

    static int partition(int arr[], int low, int high){
        int pivot = arr[high];
        int i = (low-1); // index of smaller element

        for (int j=low; j<high; j++)
            if (arr[j] > pivot)
                i += swap(arr,i+1,j);

        return (i+swap(arr,i+1,high));
    }

    public static int swap(int arr[], int i, int j) {
        int temp = arr[i];
        arr[i] = arr[j];
        arr[j] = temp;

        return 1;
    }
}
```

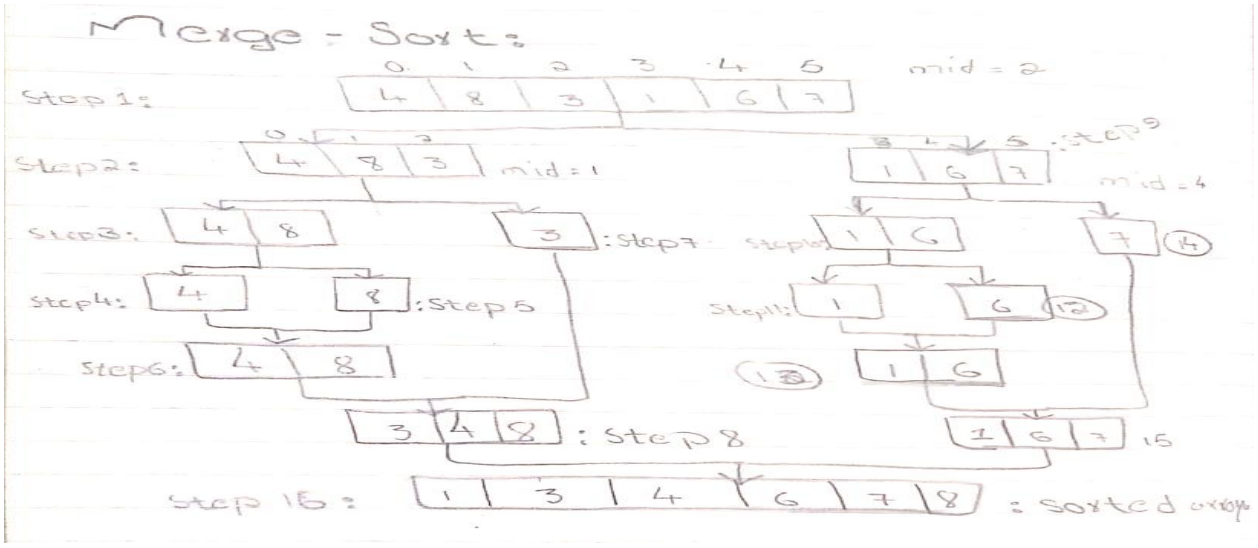
Output:



```
"C:\Program Files\Java\jdk-13.0.2\bin\java.exe" "-javaagent:C:\Program
---------- Quick Sort ----------
Non sorted: [4, 8, 3, 1, 6, 7]
Sorted: [8, 7, 6, 4, 3, 1]

Process finished with exit code 0
```

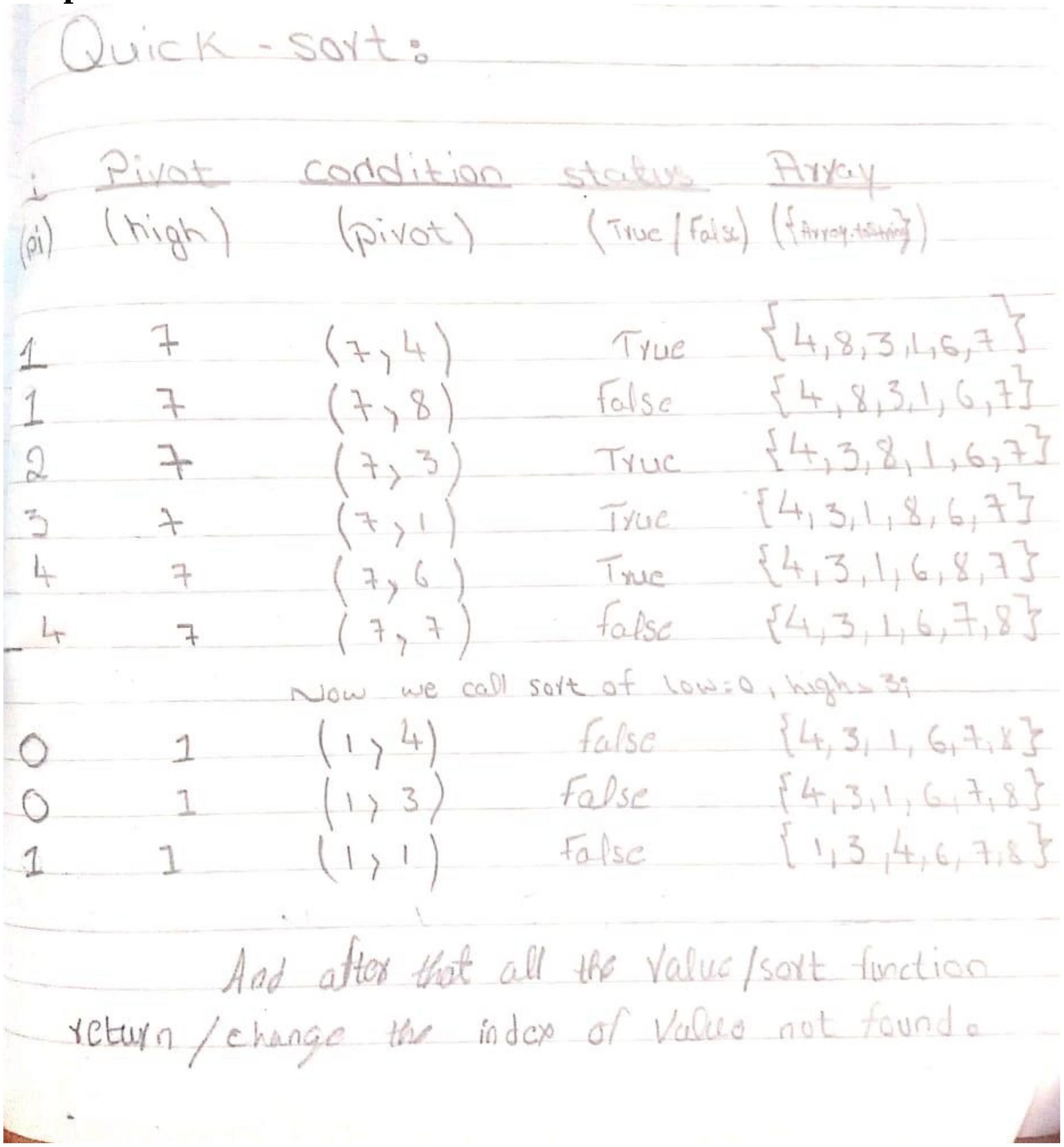
3. **Perform dry run of Merge sort on the following array: [4, 8, 3, 1, 6, 7].**

Output:



4. Perform dry run of Quick sort on the following array: [4, 8, 3, 1, 6, 7].

Output:



Quick-sort:

i (pi)	Pivot (high)	condition (pivot)	status (True / False)	Array ({Array.toString})
1	7	(7, 4)	True	{4,8,3,1,6,7}
1	7	(7, 8)	false	{4,8,3,1,6,7}
2	7	(7, 3)	True	{4,3,8,1,6,7}
3	7	(7, 1)	True	[4,3,1,8,6,7}
4	7	(7, 6)	True	{4,3,1,6,8,7}
4	7	(7, 7)	false	{4,3,1,6,7,8}
		Now we call sort of low=0, high=3;		
0	1	(1, 4)	false	{4,3,1,6,7,8}
0	1	(1, 3)	False	{4,3,1,6,7,8}
1	1	(1, 1)	False	[1,3,4,6,7,8}

And after that all the Value/sort function return/change the index of Value not found.