EC4070: Data Structures and Algorithms

LAB 02

K.J.M.U.G.S.E. JAYASINGHE

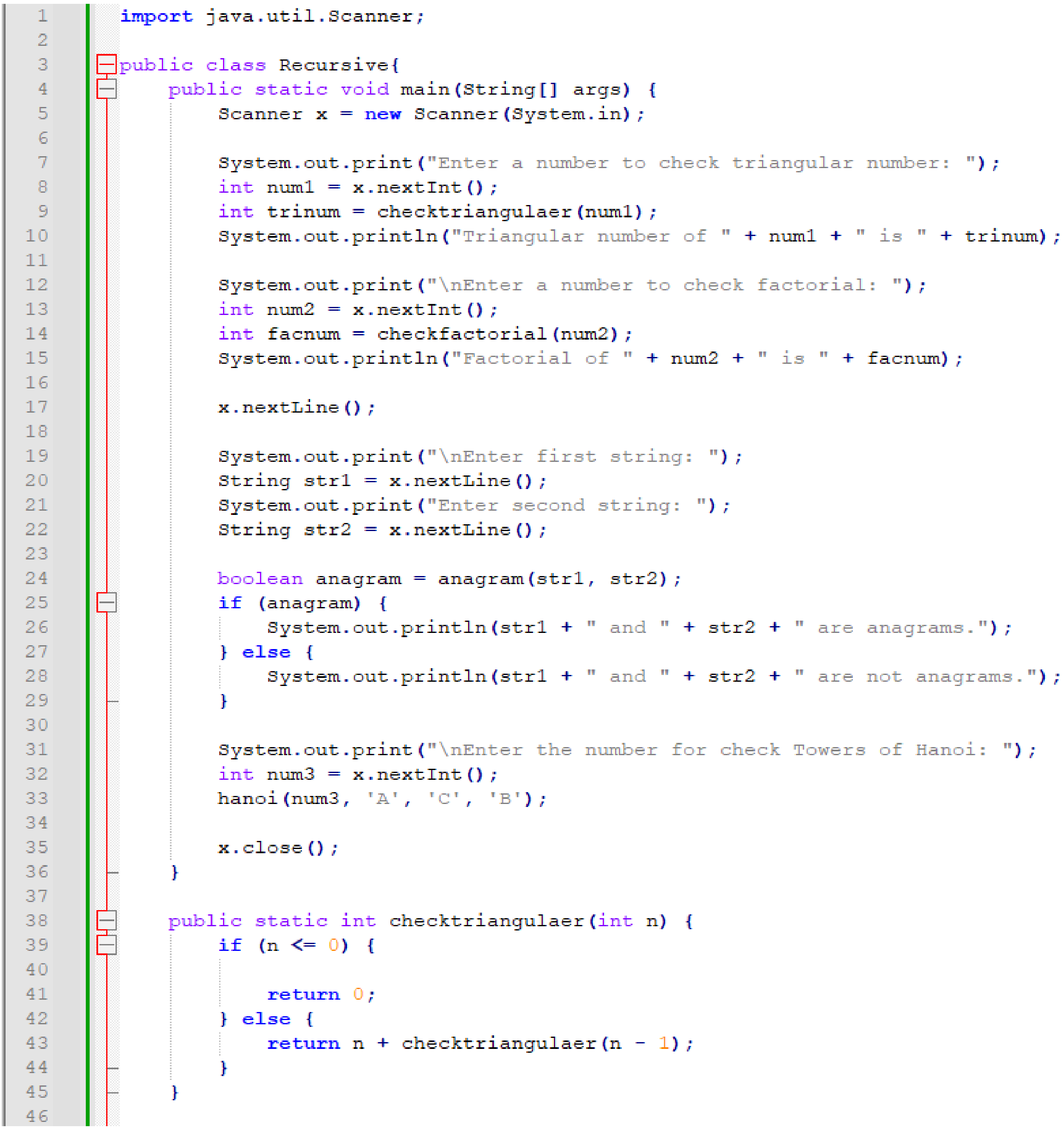
2021/E/075

SEMESTER 4

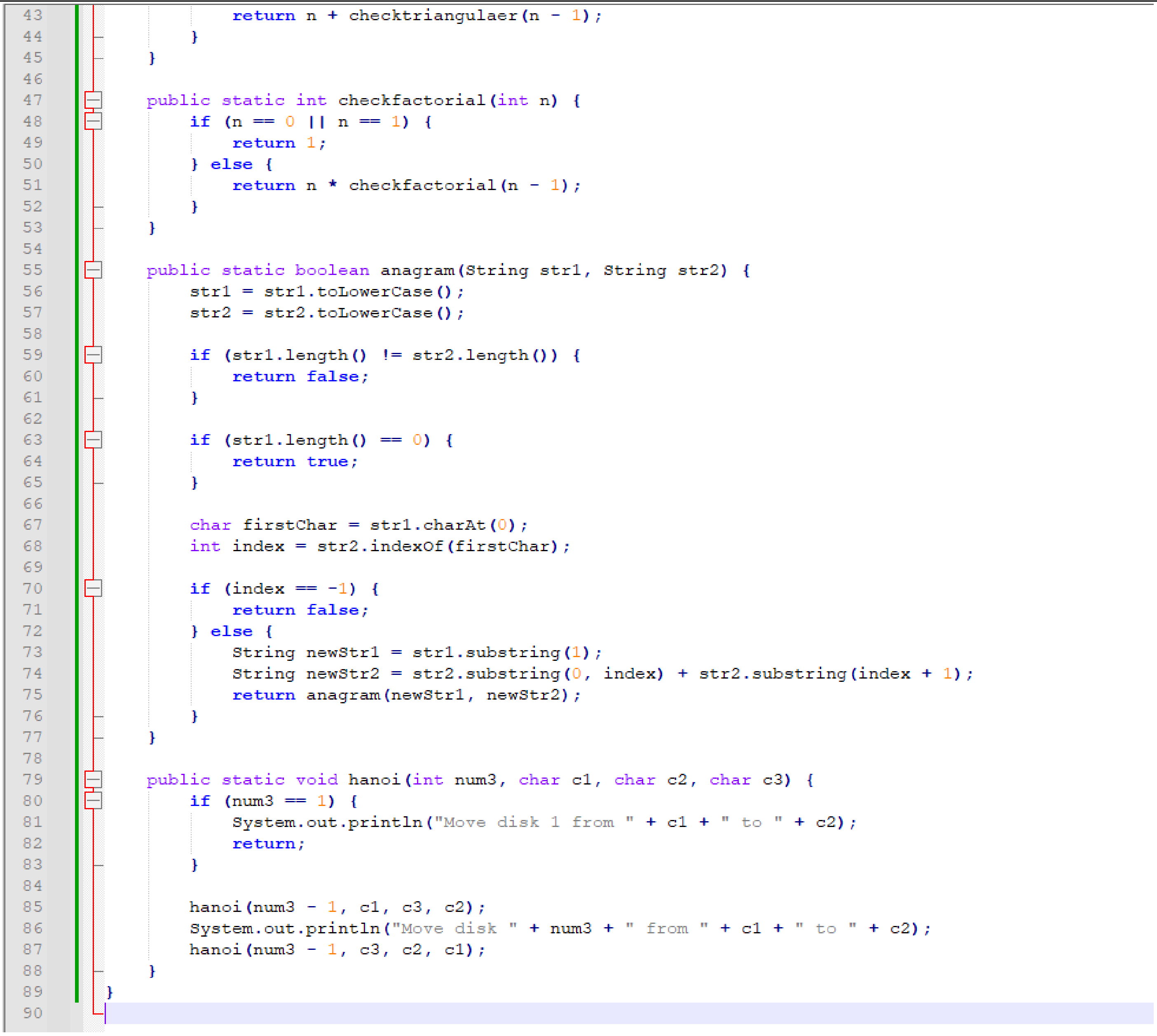
EC4070

04.10.2023

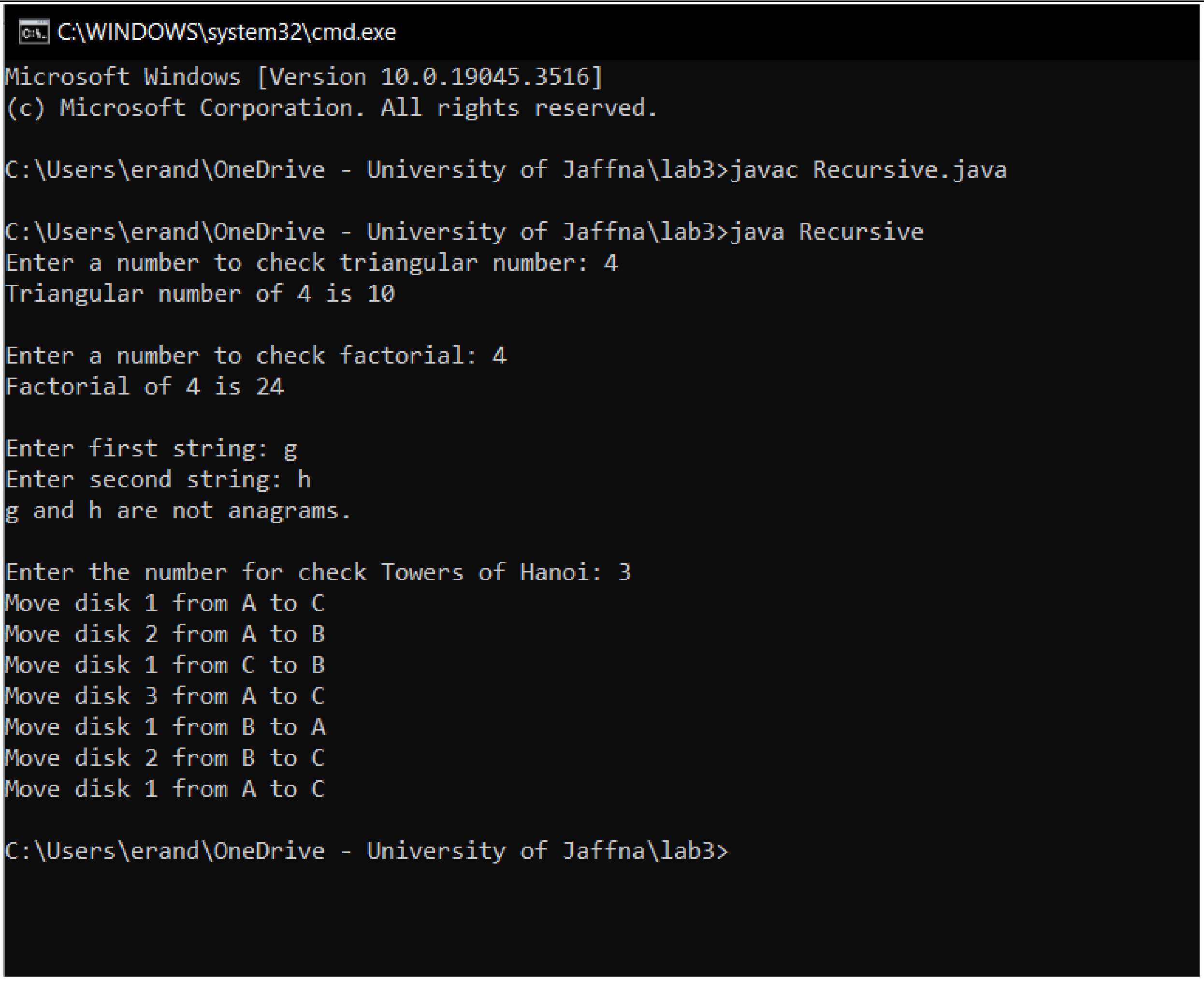
Q1.



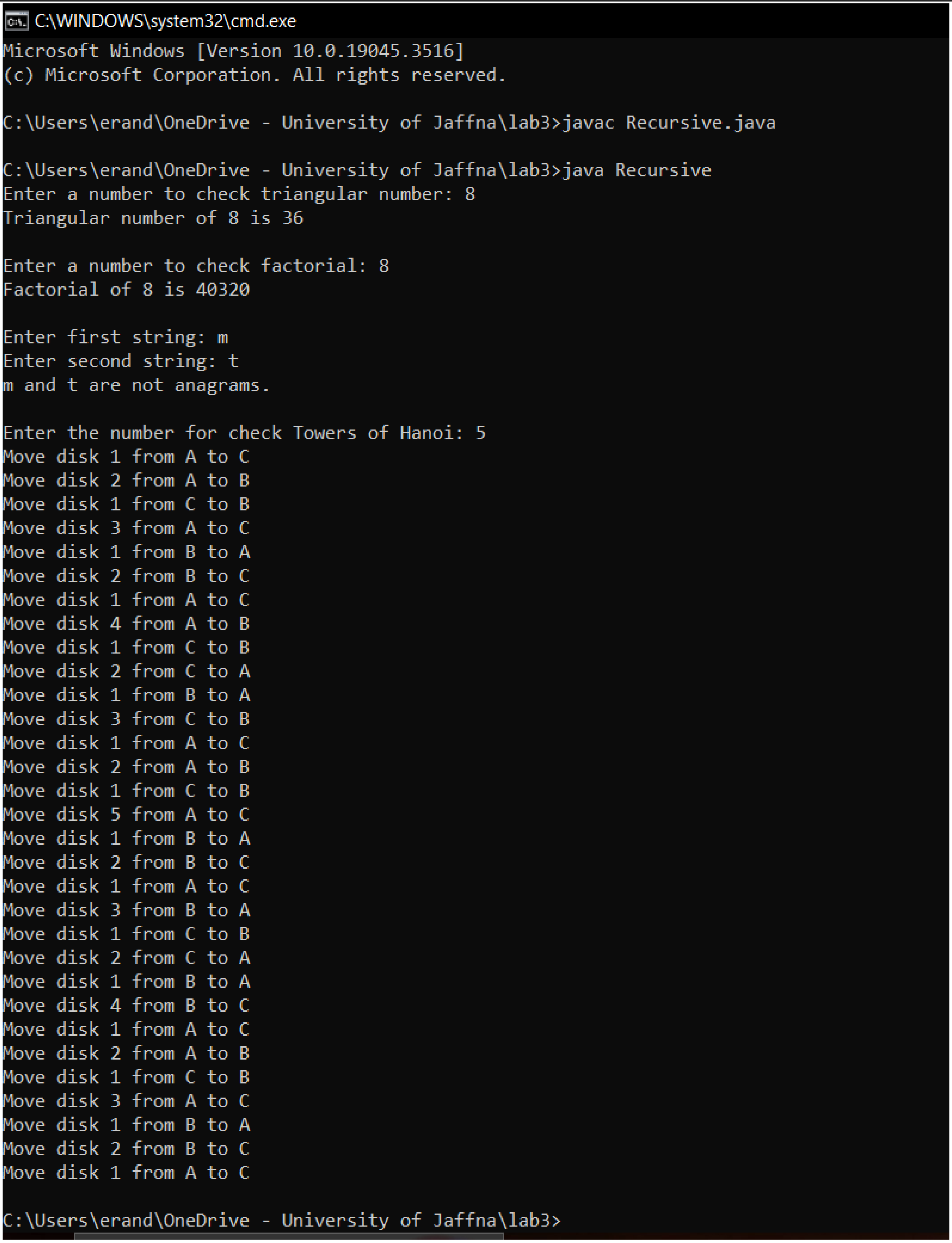
```java
import java.util.Scanner;

public class Recursive{
    public static void main(String[] args) {
        Scanner x = new Scanner(System.in);

        System.out.print("Enter a number to check triangular number: ");
        int num1 = x.nextInt();
        int trinum = checktriangulaer(num1);
        System.out.println("Triangular number of " + num1 + " is " + trinum);

        System.out.print("\nEnter a number to check factorial: ");
        int num2 = x.nextInt();
        int facnum = checkfactorial(num2);
        System.out.println("Factorial of " + num2 + " is " + facnum);

        x.nextLine();

        System.out.print("\nEnter first string: ");
        String str1 = x.nextLine();
        System.out.print("Enter second string: ");
        String str2 = x.nextLine();

        boolean anagram = anagram(str1, str2);
        if (anagram) {
            System.out.println(str1 + " and " + str2 + " are anagrams.");
        } else {
            System.out.println(str1 + " and " + str2 + " are not anagrams.");
        }

        System.out.print("\nEnter the number for check Towers of Hanoi: ");
        int num3 = x.nextInt();
        hanoi(num3, 'A', 'C', 'B');

        x.close();
    }

    public static int checktriangulaer(int n) {
        if (n <= 0) {

            return 0;
        } else {
            return n + checktriangulaer(n - 1);
        }
    }

```



```
            return n + checktriangulaer(n - 1);
        }
    }

    public static int checkfactorial(int n) {
        if (n == 0 || n == 1) {
            return 1;
        } else {
            return n * checkfactorial(n - 1);
        }
    }

    public static boolean anagram(String str1, String str2) {
        str1 = str1.toLowerCase();
        str2 = str2.toLowerCase();

        if (str1.length() != str2.length()) {
            return false;
        }

        if (str1.length() == 0) {
            return true;
        }

        char firstChar = str1.charAt(0);
        int index = str2.indexOf(firstChar);

        if (index == -1) {
            return false;
        } else {
            String newStr1 = str1.substring(1);
            String newStr2 = str2.substring(0, index) + str2.substring(index + 1);
            return anagram(newStr1, newStr2);
        }
    }

    public static void hanoi(int num3, char c1, char c2, char c3) {
        if (num3 == 1) {
            System.out.println("Move disk 1 from " + c1 + " to " + c2);
            return;
        }

        hanoi(num3 - 1, c1, c3, c2);
        System.out.println("Move disk " + num3 + " from " + c1 + " to " + c2);
        hanoi(num3 - 1, c3, c2, c1);
    }
}
```



```
Microsoft Windows [Version 10.0.19045.3516]
(c) Microsoft Corporation. All rights reserved.

C:\Users\erand\OneDrive - University of Jaffna\lab3>javac Recursive.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java Recursive
Enter a number to check triangular number: 4
Triangular number of 4 is 10

Enter a number to check factorial: 4
Factorial of 4 is 24

Enter first string: g
Enter second string: h
g and h are not anagrams.

Enter the number for check Towers of Hanoi: 3
Move disk 1 from A to C
Move disk 2 from A to B
Move disk 1 from C to B
Move disk 3 from A to C
Move disk 1 from B to A
Move disk 2 from B to C
Move disk 1 from A to C

C:\Users\erand\OneDrive - University of Jaffna\lab3>
```



```
Microsoft Windows [Version 10.0.19045.3516]
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C:\Users\erand\OneDrive - University of Jaffna\lab3>javac Recursive.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java Recursive
Enter a number to check triangular number: 8
Triangular number of 8 is 36

Enter a number to check factorial: 8
Factorial of 8 is 40320

Enter first string: m
Enter second string: t
m and t are not anagrams.

Enter the number for check Towers of Hanoi: 5
Move disk 1 from A to C
Move disk 2 from A to B
Move disk 1 from C to B
Move disk 3 from A to C
Move disk 1 from B to A
Move disk 2 from B to C
Move disk 1 from A to C
Move disk 4 from A to B
Move disk 1 from C to B
Move disk 2 from C to A
Move disk 1 from B to A
Move disk 3 from C to B
Move disk 1 from A to C
Move disk 2 from A to B
Move disk 1 from C to B
Move disk 5 from A to C
Move disk 1 from B to A
Move disk 2 from B to C
Move disk 1 from A to C
Move disk 3 from B to A
Move disk 1 from C to B
Move disk 2 from C to A
Move disk 1 from B to A
Move disk 4 from B to C
Move disk 1 from A to C
Move disk 2 from A to B
Move disk 1 from C to B
Move disk 3 from A to C
Move disk 1 from B to A
Move disk 2 from B to C
Move disk 1 from A to C

C:\Users\erand\OneDrive - University of Jaffna\lab3>
```
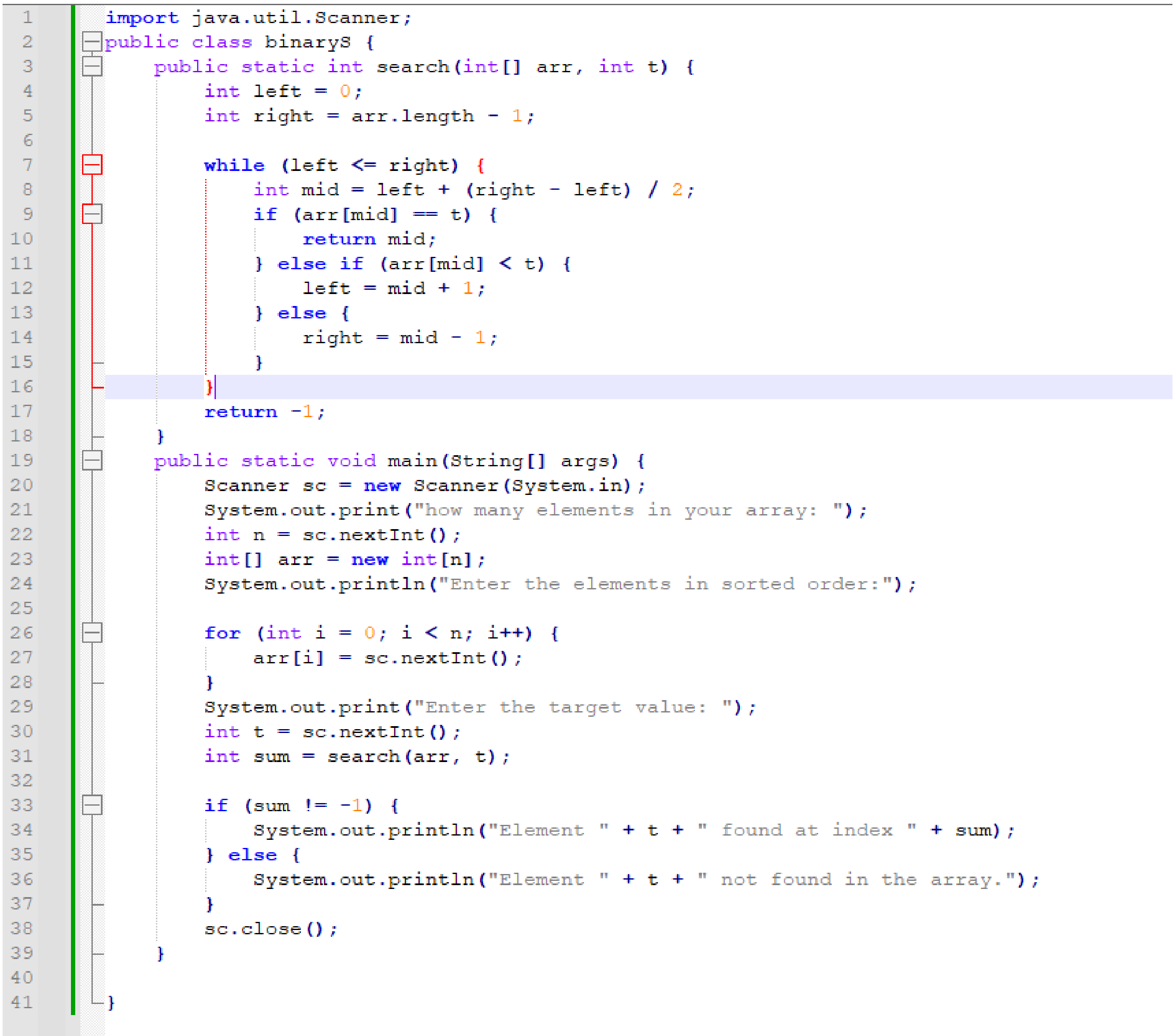
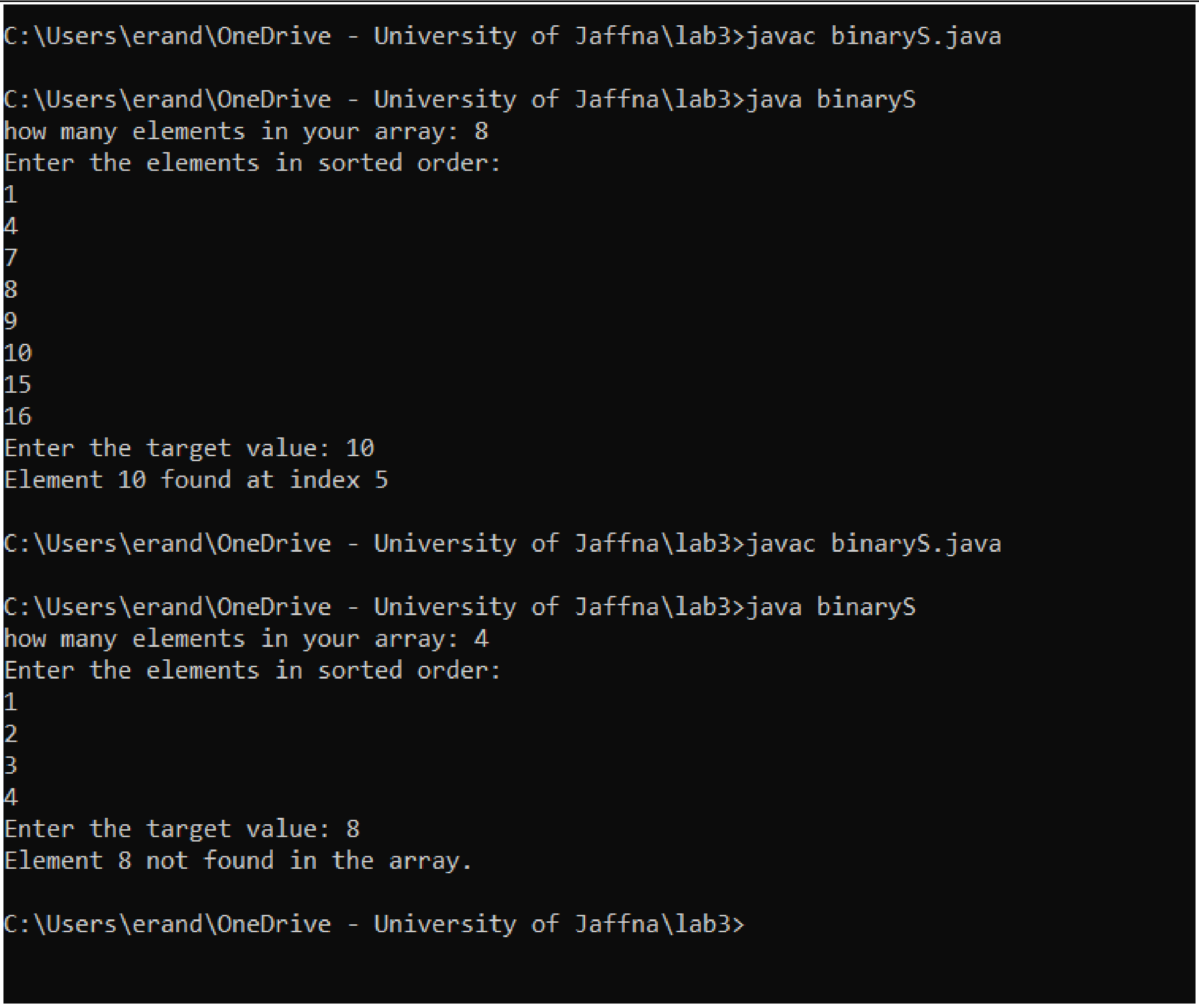

Q2.

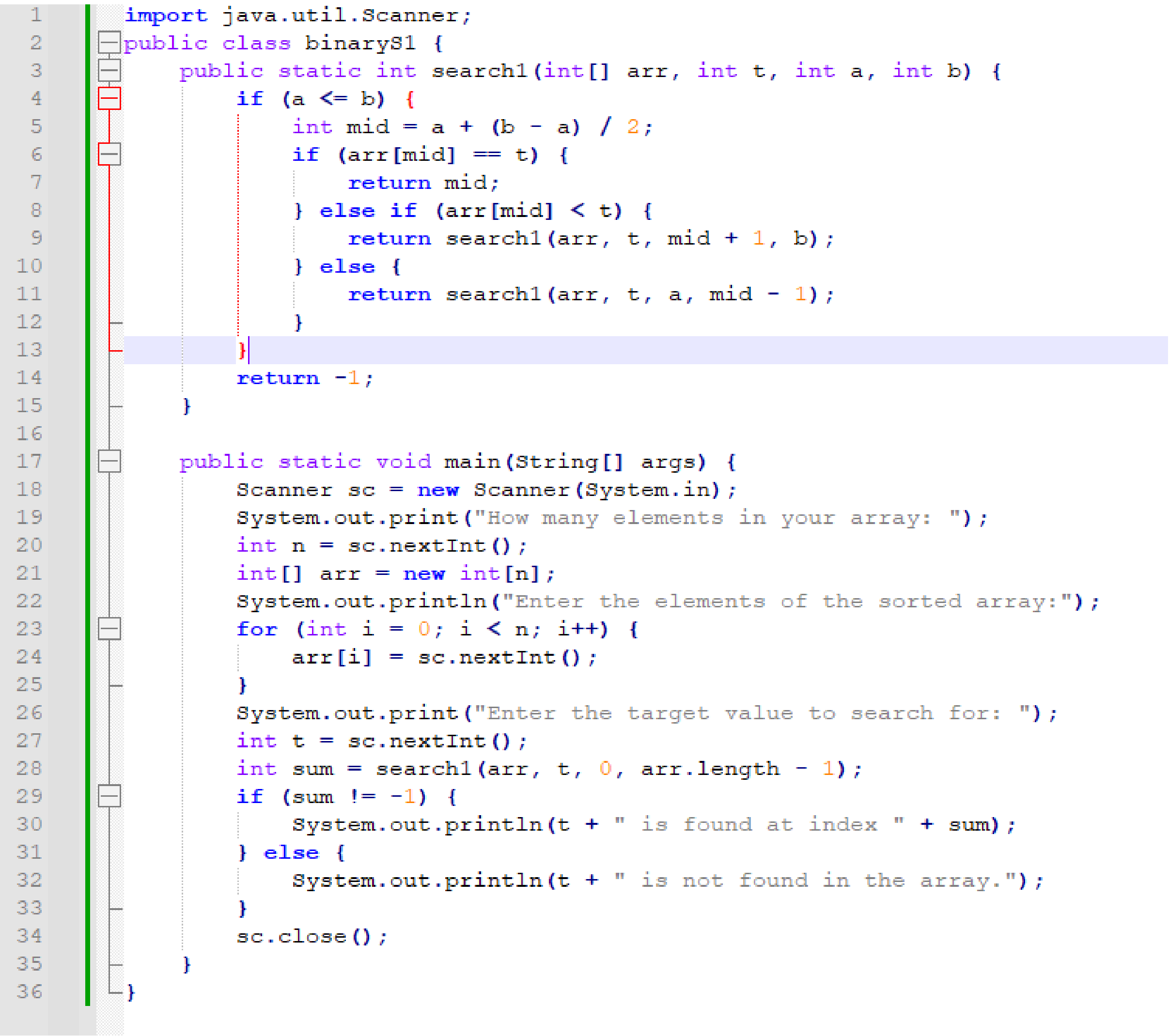


```java
import java.util.Scanner;
public class binaryS {
    public static int search(int[] arr, int t) {
        int left = 0;
        int right = arr.length - 1;

        while (left <= right) {
            int mid = left + (right - left) / 2;
            if (arr[mid] == t) {
                return mid;
            } else if (arr[mid] < t) {
                left = mid + 1;
            } else {
                right = mid - 1;
            }
        }
        return -1;
    }
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("how many elements in your array: ");
        int n = sc.nextInt();
        int[] arr = new int[n];
        System.out.println("Enter the elements in sorted order:");

        for (int i = 0; i < n; i++) {
            arr[i] = sc.nextInt();
        }
        System.out.print("Enter the target value: ");
        int t = sc.nextInt();
        int sum = search(arr, t);

        if (sum != -1) {
            System.out.println("Element " + t + " found at index " + sum);
        } else {
            System.out.println("Element " + t + " not found in the array.");
        }
        sc.close();
    }

}
```

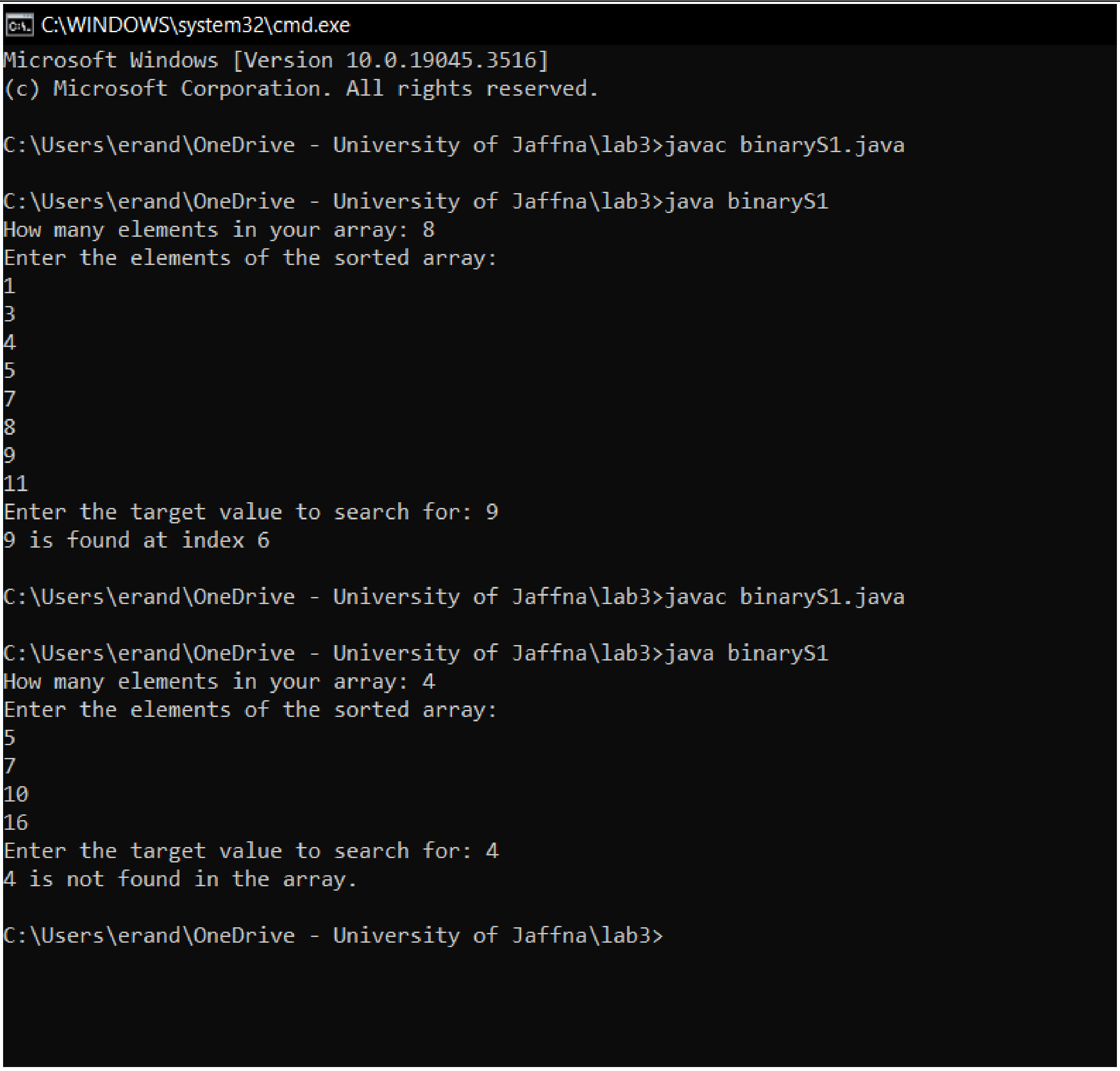


```
C:\Users\erand\OneDrive - University of Jaffna\lab3>javac binaryS.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java binaryS
how many elements in your array: 8
Enter the elements in sorted order:
1
4
7
8
9
10
15
16
Enter the target value: 10
Element 10 found at index 5

C:\Users\erand\OneDrive - University of Jaffna\lab3>javac binaryS.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java binaryS
how many elements in your array: 4
Enter the elements in sorted order:
1
2
3
4
Enter the target value: 8
Element 8 not found in the array.

C:\Users\erand\OneDrive - University of Jaffna\lab3>
```

Q2.1



```java
import java.util.Scanner;
public class binaryS1 {
    public static int search1(int[] arr, int t, int a, int b) {
        if (a <= b) {
            int mid = a + (b - a) / 2;
            if (arr[mid] == t) {
                return mid;
            } else if (arr[mid] < t) {
                return search1(arr, t, mid + 1, b);
            } else {
                return search1(arr, t, a, mid - 1);
            }
        }
        return -1;
    }

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("How many elements in your array: ");
        int n = sc.nextInt();
        int[] arr = new int[n];
        System.out.println("Enter the elements of the sorted array:");
        for (int i = 0; i < n; i++) {
            arr[i] = sc.nextInt();
        }
        System.out.print("Enter the target value to search for: ");
        int t = sc.nextInt();
        int sum = search1(arr, t, 0, arr.length - 1);
        if (sum != -1) {
            System.out.println(t + " is found at index " + sum);
        } else {
            System.out.println(t + " is not found in the array.");
        }
        sc.close();
    }
}
```



```
Microsoft Windows [Version 10.0.19045.3516]
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C:\Users\erand\OneDrive - University of Jaffna\lab3>javac binaryS1.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java binaryS1
How many elements in your array: 8
Enter the elements of the sorted array:
1
3
4
5
7
8
9
11
Enter the target value to search for: 9
9 is found at index 6

C:\Users\erand\OneDrive - University of Jaffna\lab3>javac binaryS1.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java binaryS1
How many elements in your array: 4
Enter the elements of the sorted array:
5
7
10
16
Enter the target value to search for: 4
4 is not found in the array.

C:\Users\erand\OneDrive - University of Jaffna\lab3>
```
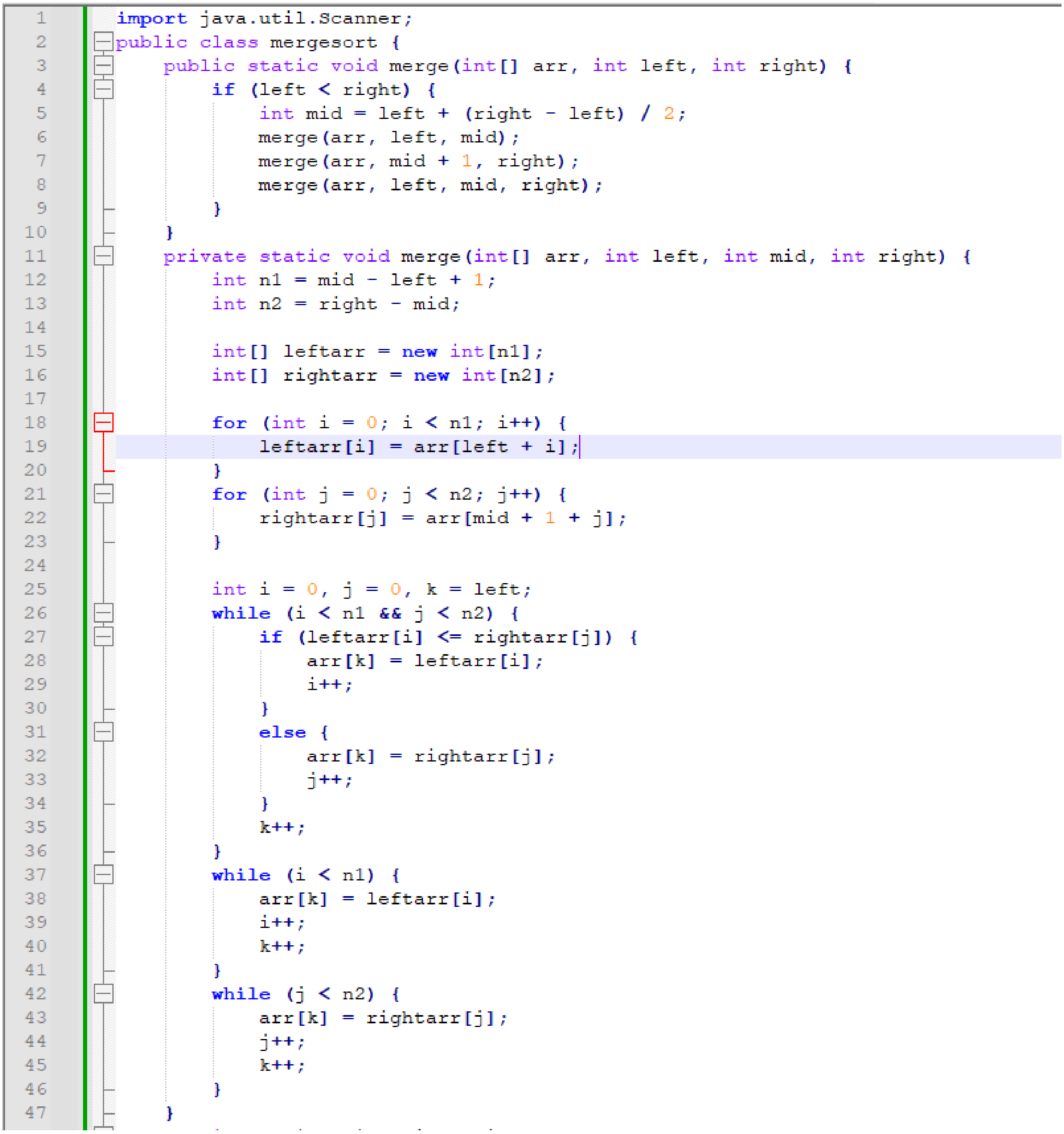
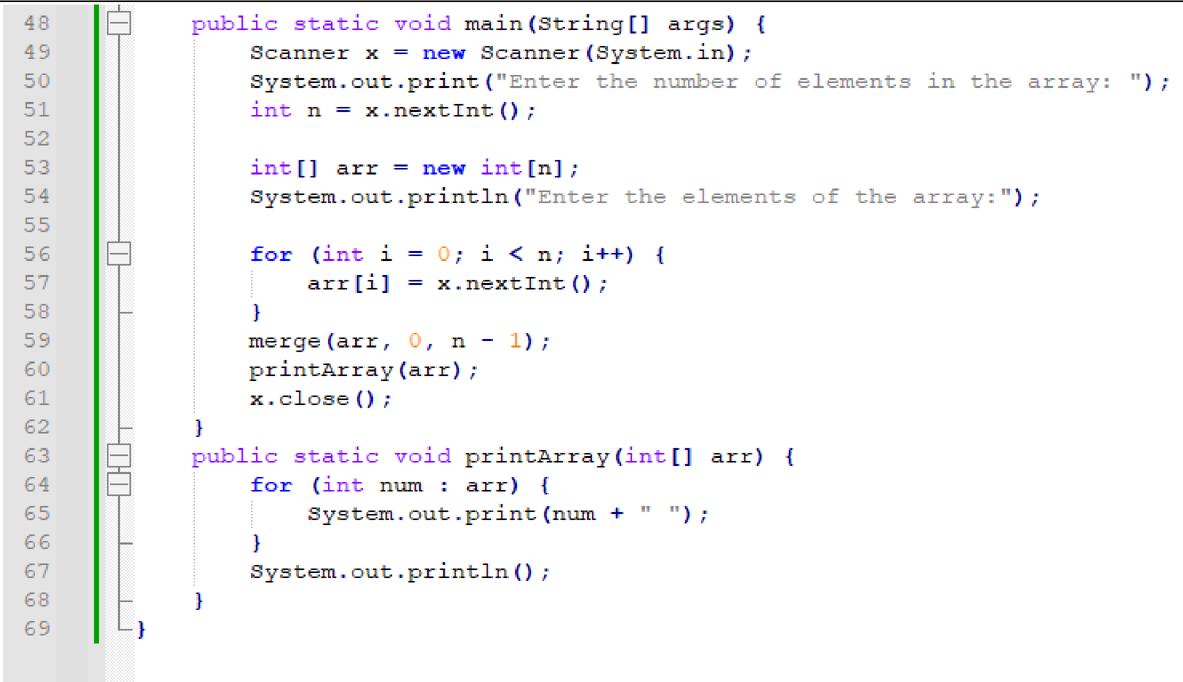
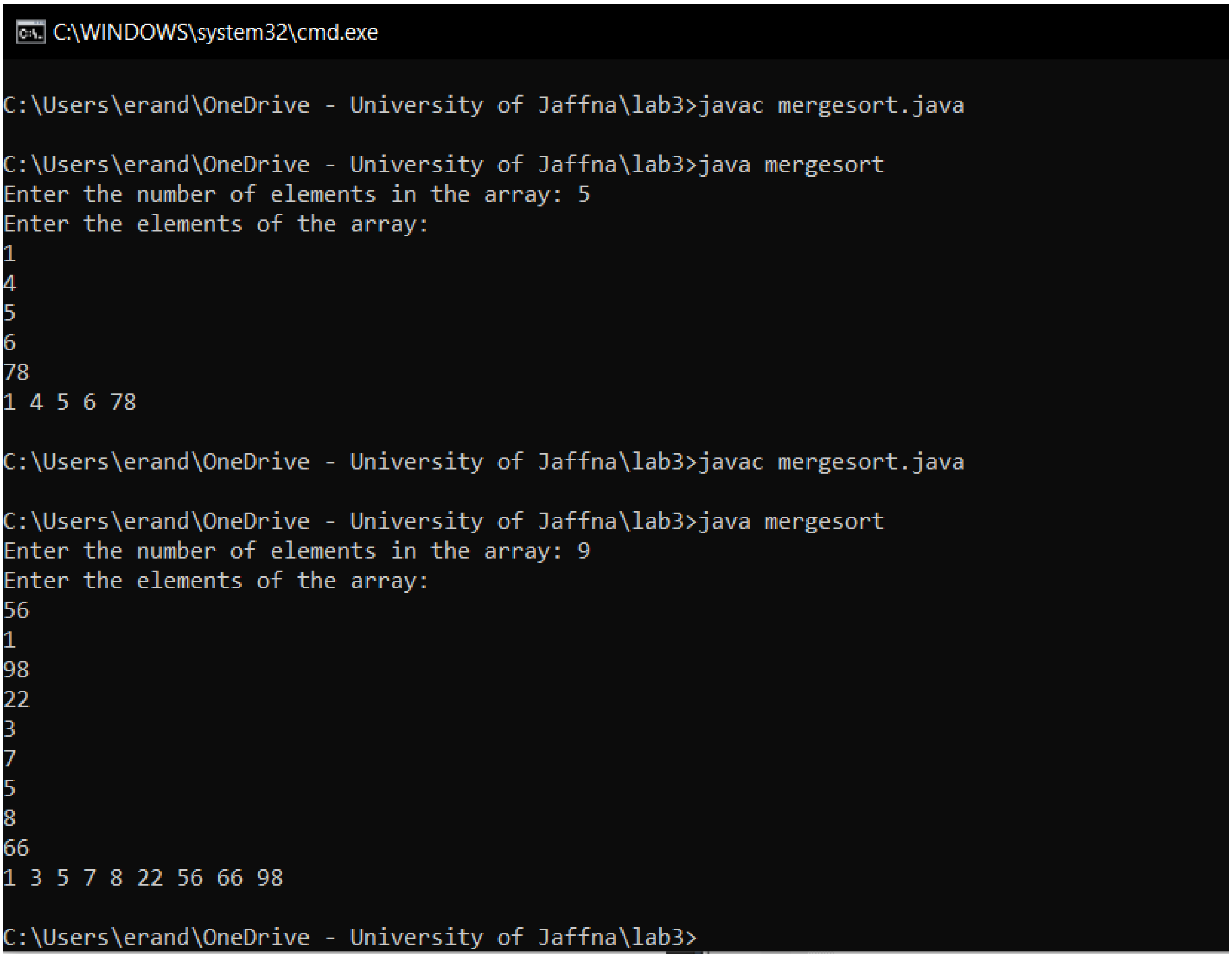

Q3



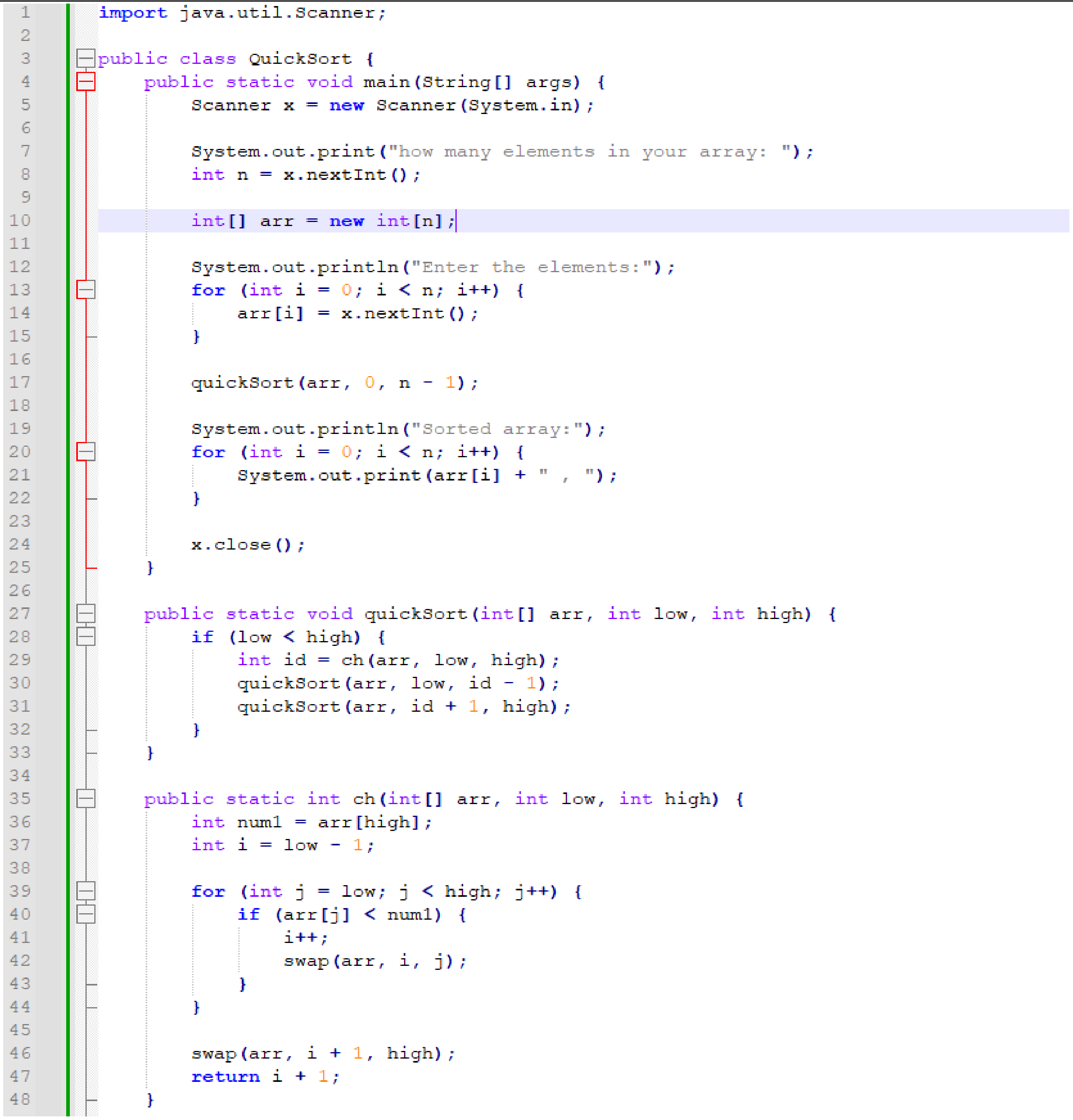
```java
import java.util.Scanner;
public class mergesort {
    public static void merge(int[] arr, int left, int right) {
        if (left < right) {
            int mid = left + (right - left) / 2;
            merge(arr, left, mid);
            merge(arr, mid + 1, right);
            merge(arr, left, mid, right);
        }
    }
    private static void merge(int[] arr, int left, int mid, int right) {
        int n1 = mid - left + 1;
        int n2 = right - mid;

        int[] leftarr = new int[n1];
        int[] rightarr = new int[n2];

        for (int i = 0; i < n1; i++) {
            leftarr[i] = arr[left + i];
        }
        for (int j = 0; j < n2; j++) {
            rightarr[j] = arr[mid + 1 + j];
        }

        int i = 0, j = 0, k = left;
        while (i < n1 && j < n2) {
            if (leftarr[i] <= rightarr[j]) {
                arr[k] = leftarr[i];
                i++;
            }
            else {
                arr[k] = rightarr[j];
                j++;
            }
            k++;
        }
        while (i < n1) {
            arr[k] = leftarr[i];
            i++;
            k++;
        }
        while (j < n2) {
            arr[k] = rightarr[j];
            j++;
            k++;
        }
    }
```



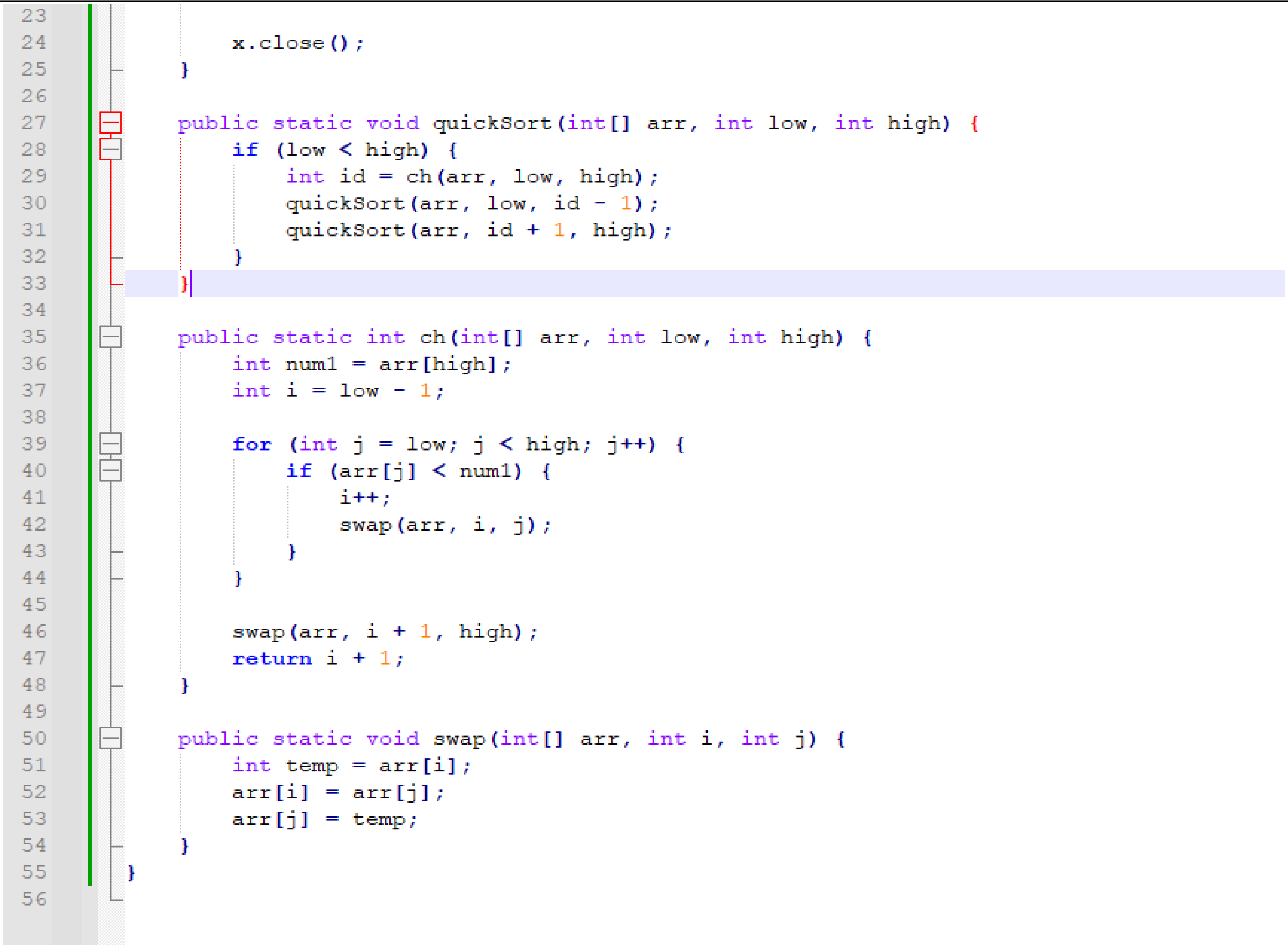
```java
    public static void main(String[] args) {
        Scanner x = new Scanner(System.in);
        System.out.print("Enter the number of elements in the array: ");
        int n = x.nextInt();

        int[] arr = new int[n];
        System.out.println("Enter the elements of the array:");

        for (int i = 0; i < n; i++) {
            arr[i] = x.nextInt();
        }
        merge(arr, 0, n - 1);
        printArray(arr);
        x.close();
    }
    public static void printArray(int[] arr) {
        for (int num : arr) {
            System.out.print(num + " ");
        }
        System.out.println();
    }
}
```



```
C:\Users\erand\OneDrive - University of Jaffna\lab3>javac mergesort.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java mergesort
Enter the number of elements in the array: 5
Enter the elements of the array:
1
4
5
6
78
1 4 5 6 78

C:\Users\erand\OneDrive - University of Jaffna\lab3>javac mergesort.java

C:\Users\erand\OneDrive - University of Jaffna\lab3>java mergesort
Enter the number of elements in the array: 9
Enter the elements of the array:
56
1
98
22
3
7
5
8
66
1 3 5 7 8 22 56 66 98

C:\Users\erand\OneDrive - University of Jaffna\lab3>
```



```java
import java.util.Scanner;

public class QuickSort {
    public static void main(String[] args) {
        Scanner x = new Scanner(System.in);

        System.out.print("how many elements in your array: ");
        int n = x.nextInt();

        int[] arr = new int[n];

        System.out.println("Enter the elements:");
        for (int i = 0; i < n; i++) {
            arr[i] = x.nextInt();
        }

        quickSort(arr, 0, n - 1);

        System.out.println("Sorted array:");
        for (int i = 0; i < n; i++) {
            System.out.print(arr[i] + " , ");
        }

        x.close();
    }

    public static void quickSort(int[] arr, int low, int high) {
        if (low < high) {
            int id = ch(arr, low, high);
            quickSort(arr, low, id - 1);
            quickSort(arr, id + 1, high);
        }
    }

    public static int ch(int[] arr, int low, int high) {
        int num1 = arr[high];
        int i = low - 1;

        for (int j = low; j < high; j++) {
            if (arr[j] < num1) {
                i++;
                swap(arr, i, j);
            }
        }

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



```java
        x.close();
    }

    public static void quickSort(int[] arr, int low, int high) {
        if (low < high) {
            int id = ch(arr, low, high);
            quickSort(arr, low, id - 1);
            quickSort(arr, id + 1, high);
        }
    }

    public static int ch(int[] arr, int low, int high) {
        int num1 = arr[high];
        int i = low - 1;

        for (int j = low; j < high; j++) {
            if (arr[j] < num1) {
                i++;
                swap(arr, i, j);
            }
        }

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

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