EC4070: Data Structures and Algorithms

LAB 02

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

2021/E/075

SEMESTER 4

EC4070

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Q1

```
import java.util.Scanner;


public class Array{


 public static void main (String[] args){


                int[] arr;
                arr = new int[20];


                Scanner sc =new Scanner(System.in);
                for(int a=0;a<20;a++)
                {
                        System.out.print("enter the element:   ");
                        arr[a] = sc.nextInt();


                }
                 System.out.print("The array: ");
                 for(int b=0;b<20;b++)
                 {
                         System.out.print(arr[b]+" " );


                 }


                 System.out.print("\n");



                 System.out.print("Enter the number to swap: ");
                 int i = sc.nextInt();
                 System.out.print("Enter the second number to swap: ");
                 int j = sc.nextInt();


                 int temp = arr[i-1];
```

```
arr[i-1]=arr[j-1];
arr[j-1] =temp;

System.out.print("The array after swap: ");
for(int c=0;c<20;c++)
{
	System.out.print(arr[c]+" ");
}
System.out.print("\n");



System.out.print("Enter k th element: ");
int k= sc.nextInt();
System.out.println("The k th element is: "+arr[k-1]);



int[] arr1 = new int[19];
for(int d=0,f=0; d<20&&f<19;d++)
{
	if(d==k-1)
	{
		continue;
	}
	arr1[f++]=arr[d];
}

System.out.print("The array after deletion : ");
for(int e=0; e<19 ;e++)
{
	System.out.print(arr1[e]+" ");
}
System.out.print("\n");
```

```
int[] arr2= new int[20];
System.out.print("Enter new element: ");
int n=sc.nextInt();

for (int d=0,h=0;d<19 && h<20;d++)
{
   arr2[h++]=arr1[d];
}
arr2[19]=n;
System.out.print("after the insertion: ");

for (int p=0;p<20;p++)
{
   System.out.print(arr2[p]+" ");
}
                System.out.print("\n");


System.out.print("Enter the element: ");
int ele = sc.nextInt();

int index=20 ;
for (int x=0;x<20;x++)
{
   if(arr2[x]==ele)
   {
      index =x;
   }
}
if(index==20)
```

```
{
   System.out.println("Element is not found in this array");
}
else
{
   System.out.println("Element is in the array");
} }}
```

```java
import java.util.Scanner;

public class Array{

 public static void main (String[] args){

        int[] arr;
        arr = new int[20];

        Scanner sc =new Scanner(System.in);
        for(int a=0;a<20;a++)
        {
            System.out.print("enter the element:    ");
            arr[a] = sc.nextInt();

        }
         System.out.print("The array: ");
         for(int b=0;b<20;b++)
         {
             System.out.print(arr[b]+" " );

         }

         System.out.print("\n");


         System.out.print("Enter the number to swap: ");
         int i = sc.nextInt();
         System.out.print("Enter the second number to swap: ");
         int j = sc.nextInt();

         int temp = arr[i-1];
         arr[i-1]=arr[j-1];
         arr[j-1] =temp;

         System.out.print("The array after swap: ");
         for(int c=0;c<20;c++)
         {
             System.out.print(arr[c]+" ");
         }
         System.out.print("\n");


         System.out.print("Enter k th element: ");
         int k= sc.nextInt();
         System.out.println("The k th element is: "+arr[k-1]);


         int[] arr1 = new int[19];
```

```
        int[] arr1 = new int[19];
        for(int d=0,f=0; d<20&&f<19;d++)
        {
            if(d==k-1)
            {
                continue;
            }
            arr1[f++]=arr[d];
        }

        System.out.print("The array after deletion : ");
        for(int e=0; e<19 ;e++)
        {
            System.out.print(arr1[e]+" ");
        }
        System.out.print("\n");



        int[] arr2= new int[20];
        System.out.print("Enter new element: ");
        int n=sc.nextInt();

        for (int d=0,h=0;d<19 && h<20;d++)
        {
            arr2[h++]=arr1[d];
        }
        arr2[19]=n;
        System.out.print("after the insertion: ");

        for (int p=0;p<20;p++)
        {
            System.out.print(arr2[p]+" ");
        }
        System.out.print("\n");


        System.out.print("Enter the element: ");
        int ele = sc.nextInt();

        int index=20 ;
        for (int x=0;x<20;x++)
        {
            if(arr2[x]==ele)
            {
                index =x;
            }
        }
```

```
            }
        }
        if(index==20)
        {
            System.out.println("Element is not found in this array");
        }
        else
        {
            System.out.println("Element is in the array");
        }


    }


}
```

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.19045.3448]
(c) Microsoft Corporation. All rights reserved.

C:\games\2021_E_073_lab_02>javac Array.java

C:\games\2021_E_073_lab_02>java Array
enter the element:   1
enter the element:   2
enter the element:   3
enter the element:   4
enter the element:   5
enter the element:   6
enter the element:   7
enter the element:   8
enter the element:   9
enter the element:   10
enter the element:   11
enter the element:   12
enter the element:   13
enter the element:   14
enter the element:   15
enter the element:   16
enter the element:   17
enter the element:   18
enter the element:   19
enter the element:   20
The array: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Enter the number to swap: 1
Enter the second number to swap: 20
The array after swap: 20 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 1
Enter k th element: 5
The k th element is: 5
The array after deletion : 20 2 3 4 6 7 8 9 10 11 12 13 14 15 16 17 18 19 1
Enter new element: 100
after the insertion: 20 2 3 4 6 7 8 9 10 11 12 13 14 15 16 17 18 19 1 100
Enter the element: 45
Element is not found in this array

C:\games\2021_E_073_lab_02>
```

Q2

```
import java.util.Scanner;

public class array{

	int[] arr = new int[20];

	int
num1,num2,temp,numDisplay,numDelete,numAdd,elementAdd,indexAdd,x,y,numSearch;


	public void arrRead(){

		Scanner scanner = new Scanner(System.in);

		for(int i=0; i<20; i++){

			System.out.print("Enter a Number : ");

			arr[i] = scanner.nextInt();

		}

	}


	public void arrPrint(){

		for(int i=0; i<20; i++){

			System.out.print(arr[i] + "  ");

		}

		System.out.print("\n");

	}


	public void arrSwap(){

		Scanner scanner = new Scanner(System.in);

		System.out.print("\nEnter first number to Swap : ");

		num1 = scanner.nextInt();

		System.out.print("Enter second number to Swap : ");

		num2 = scanner.nextInt();
```

```
            temp = arr[num1-1];
            arr[num1-1] = arr[num2-1];
            arr[num2-1] = temp;
            System.out.print("\n");

            for(int i=0; i<20; i++){
                    System.out.print(arr[i] + "  ");
            }
            System.out.print("\n");
    }

    public void printElement(){
            Scanner scanner = new Scanner(System.in);
            System.out.print("Enter the number if you want to Display : ");
            numDisplay = scanner.nextInt();
            System.out.print("The number is " + arr[numDisplay-1]);
            System.out.print("\n");



    }

    public void deleteElement(){
            Scanner scanner = new Scanner(System.in);
            System.out.print("Enter the number want to Delete : ");
            numDelete = scanner.nextInt();
            for (int j=(numDelete-1); j<19; j++){
                    arr[j] = arr[j+1];
            }
            System.out.print("\n");
```

```
        for(int i=0; i<20; i++){
                System.out.print(arr[i] + "  ");
        }
        System.out.print("\n");
}

public void addElement(){
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the Number to add the arry : ");
        numAdd = scanner.nextInt();
        System.out.print("Enter the place in the arry : ");
        elementAdd = scanner.nextInt();
        indexAdd = elementAdd - 1;
        for (int i=19; i>indexAdd; i--){
                arr[i] = arr[i-1];
        }
        arr[elementAdd] = numAdd;
        System.out.print("\n");

        for(int i=0; i<20; i++){
                System.out.print(arr[i] + "  ");
        }
        System.out.print("\n");
}

public void elementSearch(){
        Scanner scanner = new Scanner(System.in);
        x = 1;
        y = 0;
        while (x<3){
```

```
                x++;
                System.out.print("\nEnter the Number search : ");
                numSearch = scanner.nextInt();
                for (int k=0; k<20; k++){
                        if (arr[k] == numSearch){
                                System.out.print("Number that you search is  Element of
the array.");
                                y++;
                        }
                        else if(arr[k] != numSearch && k==19 && y==0){
                                System.out.print("Number that you search is not in the
array.");
                        }
                }
                y = 0;
        }
    }

    public static void main(String[] args){
        array obj1 = new array();
        obj1.arrRead();
        obj1.arrPrint();
        obj1.arrSwap();
        obj1.printElement();
        obj1.deleteElement();
        obj1.addElement();
        obj1.elementSearch();
    }
}
```

```java
import java.util.Scanner;
public class array{
    int[] arr = new int[20];
    int num1,num2,temp,numDisplay,numDelete,numAdd,elementAdd,indexAdd,x,y,numSearch;

    public void arrRead(){
        Scanner scanner = new Scanner(System.in);
        for(int i=0; i<20; i++){
            System.out.print("Enter a Number : ");
            arr[i] = scanner.nextInt();
        }
    }

    public void arrPrint(){
        for(int i=0; i<20; i++){
            System.out.print(arr[i] + "  ");
        }
        System.out.print("\n");
    }

    public void arrSwap(){
        Scanner scanner = new Scanner(System.in);
        System.out.print("\nEnter first number to Swap : ");
        num1 = scanner.nextInt();
        System.out.print("Enter second number to Swap : ");
        num2 = scanner.nextInt();

        temp = arr[num1-1];
        arr[num1-1] = arr[num2-1];
        arr[num2-1] = temp;
        System.out.print("\n");

        for(int i=0; i<20; i++){
            System.out.print(arr[i] + "  ");
        }
        System.out.print("\n");
    }

    public void printElement(){
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter the number if you want to Display : ");
        numDisplay = scanner.nextInt();
        System.out.print("The number is " + arr[numDisplay-1]);
        System.out.print("\n");


    }

```

```
46
47      }
48
49      public void deleteElement(){
50          Scanner scanner = new Scanner(System.in);
51          System.out.print("Enter the number want to Delete : ");
52          numDelete = scanner.nextInt();
53          for (int j=(numDelete-1); j<19; j++){
54              arr[j] = arr[j+1];
55          }
56          System.out.print("\n");
57
58          for(int i=0; i<20; i++){
59              System.out.print(arr[i] + "  ");
60          }
61          System.out.print("\n");
62      }
63
64      public void addElement(){
65          Scanner scanner = new Scanner(System.in);
66          System.out.print("Enter the Number to add the arry : ");
67          numAdd = scanner.nextInt();
68          System.out.print("Enter the place in the arry : ");
69          elementAdd = scanner.nextInt();
70          indexAdd = elementAdd - 1;
71          for (int i=19; i>indexAdd; i--){
72              arr[i] = arr[i-1];
73          }
74          arr[elementAdd] = numAdd;
75          System.out.print("\n");
76
77          for(int i=0; i<20; i++){
78              System.out.print(arr[i] + "  ");
79          }
80          System.out.print("\n");
81      }
82
83      public void elementSearch(){
84          Scanner scanner = new Scanner(System.in);
85          x = 1;
86          y = 0;
87          while (x<3){
88              x++;
89              System.out.print("\nEnter the Number search : ");
90              numSearch = scanner.nextInt();
91              for (int k=0; k<20; k++){
92                  if (arr[k] == numSearch){
93                      System.out.print("Number that you search is  Element of the array.");
94                      y++;
```

```
83      public void elementSearch(){
84          Scanner scanner = new Scanner(System.in);
85          x = 1;
86          y = 0;
87          while (x<3){
88              x++;
89              System.out.print("\nEnter the Number search : ");
90              numSearch = scanner.nextInt();
91              for (int k=0; k<20; k++){
92                  if (arr[k] == numSearch){
93                      System.out.print("Number that you search is  Element of the array.");
94                      y++;
95                  }
96                  else if(arr[k] != numSearch && k==19 && y==0){
97                      System.out.print("Number that you search is not in the array.");
98                  }
99              }
100             y = 0;
101         }
102     }
103
104     public static void main(String[] args){
105         array obj1 = new array();
106         obj1.arrRead();
107         obj1.arrPrint();
108         obj1.arrSwap();
109         obj1.printElement();
110         obj1.deleteElement();
111         obj1.addElement();
112         obj1.elementSearch();
113     }
114 }
```

```
C:\Users\erand\OneDrive\Desktop>javac array.java

C:\Users\erand\OneDrive\Desktop>java array
Enter a Number : 1
Enter a Number : 2
Enter a Number : 3
Enter a Number : 4
Enter a Number : 5
Enter a Number : 6
Enter a Number : 7
Enter a Number : 8
Enter a Number : 9
Enter a Number : 10
Enter a Number : 11
Enter a Number : 12
Enter a Number : 13
Enter a Number : 14
Enter a Number : 15
Enter a Number : 16
Enter a Number : 17
Enter a Number : 18
Enter a Number : 19
Enter a Number : 20
1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20
```

```
Enter first number to Swap : 1
Enter second number to Swap : 20

20  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  1
Enter the number if you want to Display : 10
The number is 10
Enter the number want to Delete : 6

20  2  3  4  5  7  8  9  10  11  12  13  14  15  16  17  18  19  1  1
Enter the Number to add the arry : 100
Enter the place in the arry : 14

20  2  3  4  5  7  8  9  10  11  12  13  14  15  100  16  17  18  19  1

Enter the Number search : 10
Number that you search is  Element of the array.
Enter the Number search : 57
Number that you search is not in the array.
C:\Users\erand\OneDrive\Desktop>
```

Q3

```
import java.util.Scanner;


public class Sorting {
   private int[] arr;


   public Sorting(int[] arr) {
      this.arr = arr;
   }


   public int linearSearch(int t) {
      for (int i = 0; i < arr.length; i++) {
         if (arr[i] == t) {
            return i;
         }
      }
      return -1;
   }


   public void bubbleSort() {
      int n = arr.length;
      boolean swapped;


      for (int i = 0; i < n - 1; i++) {
         swapped = false;


         for (int j = 0; j < n - i - 1; j++) {
            if (arr[j] > arr[j + 1]) {
               int temp = arr[j];
               arr[j] = arr[j + 1];
               arr[j + 1] = temp;
               swapped = true;
            }
```

```
        }

        if (!swapped) {
            break;
        }
    }
}

public void insertionSort() {
    int n = arr.length;

    for (int i = 1; i < n; i++) {
        int k = arr[i];
        int j = i - 1;

        while (j >= 0 && arr[j] > k) {
            arr[j + 1] = arr[j];
            j = j - 1;
        }
        arr[j + 1] = k;
    }
}

public void selectionSort() {
    int n = arr.length;

    for (int i = 0; i < n - 1; i++) {
        int m = i;

        for (int j = i + 1; j < n; j++) {
            if (arr[j] < arr[m]) {
                m = j;
            }
```

```
        }

        int temp = arr[m];
        arr[m] = arr[i];
        arr[i] = temp;
    }
}

public void printarr() {
    System.out.print("arr: ");
    for (int num : arr) {
        System.out.print(num + " ");
    }
    System.out.println();
}

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    int[] arr = new int[20];

    System.out.println("Enter 20 elements for the arr:");

    for (int i = 0; i < 20; i++) {
        System.out.print("Enter element : ");
        arr[i] = scanner.nextInt();
    }

    Sorting sorting = new Sorting(arr);

    System.out.println("Original arr:");
    sorting.printarr();

    System.out.print("Enter a number to search for: ");
```

```
        int t = scanner.nextInt();

        int x = sorting.linearSearch(t);
        if (x != -1) {
            System.out.println("Linear Search: Found at index " + x);
        } else {
            System.out.println("Linear Search: Not found");
        }

        sorting.bubbleSort();
        System.out.println("Bubble Sort:");
        sorting.printarr();

        sorting.insertionSort();
        System.out.println("Insertion Sort:");
        sorting.printarr();

        sorting.selectionSort();
        System.out.println("Selection Sort:");
        sorting.printarr();

        scanner.close();
    }
}
```

array.java | Sorting.java

```java
import java.util.Scanner;

public class Sorting {
    private int[] arr;

    public Sorting(int[] arr) {
        this.arr = arr;
    }

    public int linearSearch(int t) {
        for (int i = 0; i < arr.length; i++) {
            if (arr[i] == t) {
                return i;
            }
        }
        return -1;
    }

    public void bubbleSort() {
        int n = arr.length;
        boolean swapped;

        for (int i = 0; i < n - 1; i++) {
            swapped = false;

            for (int j = 0; j < n - i - 1; j++) {
                if (arr[j] > arr[j + 1]) {
                    int temp = arr[j];
                    arr[j] = arr[j + 1];
                    arr[j + 1] = temp;
                    swapped = true;
                }
            }

            if (!swapped) {
                break;
            }
        }
    }
```

```java

    public void insertionSort() {
        int n = arr.length;

        for (int i = 1; i < n; i++) {
            int k = arr[i];
            int j = i - 1;

            while (j >= 0 && arr[j] > k) {
                arr[j + 1] = arr[j];
                j = j - 1;
            }
            arr[j + 1] = k;
        }
    }

    public void selectionSort() {
        int n = arr.length;

        for (int i = 0; i < n - 1; i++) {
            int m = i;

            for (int j = i + 1; j < n; j++) {
                if (arr[j] < arr[m]) {
                    m = j;
                }
            }

            int temp = arr[m];
            arr[m] = arr[i];
            arr[i] = temp;
        }
    }

    public void printarr() {
        System.out.print("arr: ");
        for (int num : arr) {
            System.out.print(num + " ");
        }
        System.out.println();
    }

```

```java
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        int[] arr = new int[20];

        System.out.println("Enter 20 elements for the arr:");

        for (int i = 0; i < 20; i++) {
            System.out.print("Enter element : ");
            arr[i] = scanner.nextInt();
        }

        Sorting sorting = new Sorting(arr);

        System.out.println("Original arr:");
        sorting.printarr();

        System.out.print("Enter a number to search for: ");
        int t = scanner.nextInt();

        int x = sorting.linearSearch(t);
        if (x != -1) {
            System.out.println("Linear Search: Found at index " + x);
        } else {
            System.out.println("Linear Search: Not found");
        }

        sorting.bubbleSort();
        System.out.println("Bubble Sort:");
        sorting.printarr();

        sorting.insertionSort();
        System.out.println("Insertion Sort:");
        sorting.printarr();

        sorting.selectionSort();
        System.out.println("Selection Sort:");
        sorting.printarr();

        scanner.close();
    }
}
```

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.22000.1455]
(c) Microsoft Corporation. All rights reserved.

C:\Users\2021E075\OneDrive - University of Jaffna\lab2>javac Sorting.java

C:\Users\2021E075\OneDrive - University of Jaffna\lab2>java Sorting
Enter 20 elements for the arr:
Enter element : 2
Enter element : 5
Enter element : 3
Enter element : 4
Enter element : 6
Enter element : 8
Enter element : 9
Enter element : 11
Enter element : 10
Enter element : 12
Enter element : 48
Enter element : 65
Enter element : 38
Enter element : 57
Enter element : 41
Enter element : 25
Enter element : 65
Enter element : 89
Enter element : 45
Enter element : 15
```

```
Original arr:
arr: 2 5 3 4 6 8 9 11 10 12 48 65 38 57 41 25 65 89 45 15
Enter a number to search for: 4
Linear Search: Found at index 3
Bubble Sort:
arr: 2 3 4 5 6 8 9 10 11 12 15 25 38 41 45 48 57 65 65 89
Insertion Sort:
arr: 2 3 4 5 6 8 9 10 11 12 15 25 38 41 45 48 57 65 65 89
Selection Sort:
arr: 2 3 4 5 6 8 9 10 11 12 15 25 38 41 45 48 57 65 65 89

C:\Users\2021E075\OneDrive - University of Jaffna\lab2>
```