

EC4070: Data Structures and Algorithms

LAB 02

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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");  
} }
```

```
1  import java.util.Scanner;
2
3  public class Array{
4
5  public static void main (String[] args){
6
7      int[] arr;
8      arr = new int[20];
9
10     Scanner sc =new Scanner(System.in);
11     for(int a=0;a<20;a++)
12     {
13         System.out.print("enter the element: ");
14         arr[a] = sc.nextInt();
15     }
16     System.out.print("The array: ");
17     for(int b=0;b<20;b++)
18     {
19         System.out.print(arr[b]+" ");
20     }
21     System.out.print("\n");
22
23     System.out.print("Enter the number to swap: ");
24     int i = sc.nextInt();
25     System.out.print("Enter the second number to swap: ");
26     int j = sc.nextInt();
27
28     int temp = arr[i-1];
29     arr[i-1]=arr[j-1];
30     arr[j-1] =temp;
31
32     System.out.print("The array after swap: ");
33     for(int c=0;c<20;c++)
34     {
35         System.out.print(arr[c]+" ");
36     }
37     System.out.print("\n");
38
39     System.out.print("Enter k th element: ");
40     int k= sc.nextInt();
41     System.out.println("The k th element is: "+arr[k-1]);
42
43     int[] arr1 = new int[19];
```

```

49 int[] arr1 = new int[19];
50 for(int d=0,f=0; d<20&&f<19;d++)
51 {
52     if(d==k-1)
53     {
54         continue;
55     }
56     arr1[f++]=arr[d];
57 }
58
59 System.out.print("The array after deletion : ");
60 for(int e=0; e<19 ;e++)
61 {
62     System.out.print(arr1[e]+" ");
63 }
64 System.out.print("\n");
65
66
67
68
69 int[] arr2= new int[20];
70 System.out.print("Enter new element: ");
71 int n=sc.nextInt();
72
73 for (int d=0,h=0;d<19 && h<20;d++)
74 {
75     arr2[h++]=arr1[d];
76 }
77 arr2[19]=n;
78 System.out.print("after the insertion: ");
79
80 for (int p=0;p<20;p++)
81 {
82     System.out.print(arr2[p]+" ");
83 }
84 System.out.print("\n");
85
86
87 System.out.print("Enter the element: ");
88 int ele = sc.nextInt();
89
90 int index=20 ;
91 for (int x=0;x<20;x++)
92 {
93     if(arr2[x]==ele)
94     {
95         index =x;
96     }
97 }

```

```

96     }
97 }
98 if(index==20)
99 {
100     System.out.println("Element is not found in this array");
101 }
102 else
103 {
104     System.out.println("Element is in the array");
105 }
106
107
108 }
109
110
111 }

```

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 array : ");
        numAdd = scanner.nextInt();
        System.out.print("Enter the place in the array : ");
        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();

}

}

```

```
1  import java.util.Scanner;
2  public class array{
3      int[] arr = new int[20];
4      int num1,num2,temp,numDisplay,numDelete,numAdd,elementAdd,indexAdd,x,y,numSearch;
5
6  public void arrRead(){
7      Scanner scanner = new Scanner(System.in);
8      for(int i=0; i<20; i++){
9          System.out.print("Enter a Number : ");
10         arr[i] = scanner.nextInt();
11     }
12 }
13
14 public void arrPrint(){
15     for(int i=0; i<20; i++){
16         System.out.print(arr[i] + " ");
17     }
18     System.out.print("\n");
19 }
20
21 public void arrSwap(){
22     Scanner scanner = new Scanner(System.in);
23     System.out.print("\nEnter first number to Swap : ");
24     num1 = scanner.nextInt();
25     System.out.print("Enter second number to Swap : ");
26     num2 = scanner.nextInt();
27
28     temp = arr[num1-1];
29     arr[num1-1] = arr[num2-1];
30     arr[num2-1] = temp;
31     System.out.print("\n");
32
33     for(int i=0; i<20; i++){
34         System.out.print(arr[i] + " ");
35     }
36     System.out.print("\n");
37 }
38
39 public void printElement(){
40     Scanner scanner = new Scanner(System.in);
41     System.out.print("Enter the number if you want to Display : ");
42     numDisplay = scanner.nextInt();
43     System.out.print("The number is " + arr[numDisplay-1]);
44     System.out.print("\n");
45 }
46
47 }
48
```

```

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 array : ");
67         numAdd = scanner.nextInt();
68         System.out.print("Enter the place in the array : ");
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 array : 100
```

```
Enter the place in the array : 14
```

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

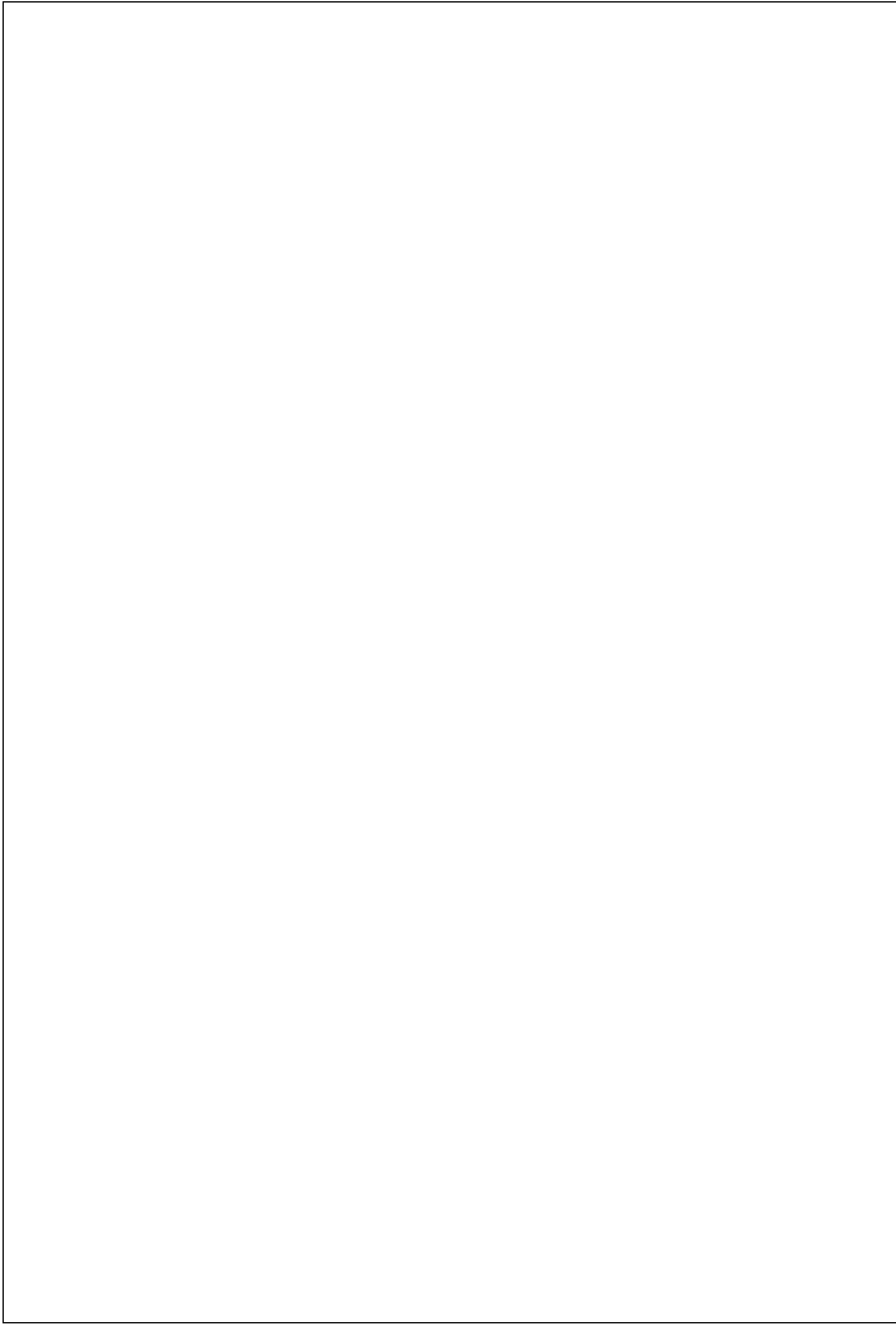
```
Enter the Number search : 10
```

```
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 x Sorting.java x
1  import java.util.Scanner;
2
3  public class Sorting {
4      private int[] arr;
5
6      public Sorting(int[] arr) {
7          this.arr = arr;
8      }
9
10     public int linearSearch(int t) {
11         for (int i = 0; i < arr.length; i++) {
12             if (arr[i] == t) {
13                 return i;
14             }
15         }
16         return -1;
17     }
18
19     public void bubbleSort() {
20         int n = arr.length;
21         boolean swapped;
22
23         for (int i = 0; i < n - 1; i++) {
24             swapped = false;
25
26             for (int j = 0; j < n - i - 1; j++) {
27                 if (arr[j] > arr[j + 1]) {
28                     int temp = arr[j];
29                     arr[j] = arr[j + 1];
30                     arr[j + 1] = temp;
31                     swapped = true;
32                 }
33             }
34
35             if (!swapped) {
36                 break;
37             }
38         }
39     }
40 }
```

```
40
41 public void insertionSort() {
42     int n = arr.length;
43
44     for (int i = 1; i < n; i++) {
45         int k = arr[i];
46         int j = i - 1;
47
48         while (j >= 0 && arr[j] > k) {
49             arr[j + 1] = arr[j];
50             j = j - 1;
51         }
52         arr[j + 1] = k;
53     }
54 }
55
56 public void selectionSort() {
57     int n = arr.length;
58
59     for (int i = 0; i < n - 1; i++) {
60         int m = i;
61
62         for (int j = i + 1; j < n; j++) {
63             if (arr[j] < arr[m]) {
64                 m = j;
65             }
66         }
67
68         int temp = arr[m];
69         arr[m] = arr[i];
70         arr[i] = temp;
71     }
72 }
73
74 public void printarr() {
75     System.out.print("arr: ");
76     for (int num : arr) {
77         System.out.print(num + " ");
78     }
79     System.out.println();
80 }
81
```

```

82 public static void main(String[] args) {
83     Scanner scanner = new Scanner(System.in);
84     int[] arr = new int[20];
85
86     System.out.println("Enter 20 elements for the arr:");
87
88     for (int i = 0; i < 20; i++) {
89         System.out.print("Enter element : ");
90         arr[i] = scanner.nextInt();
91     }
92
93     Sorting sorting = new Sorting(arr);
94
95     System.out.println("Original arr:");
96     sorting.printarr();
97
98     System.out.print("Enter a number to search for: ");
99     int t = scanner.nextInt();
100
101     int x = sorting.linearSearch(t);
102     if (x != -1) {
103         System.out.println("Linear Search: Found at index " + x);
104     } else {
105         System.out.println("Linear Search: Not found");
106     }
107
108     sorting.bubbleSort();
109     System.out.println("Bubble Sort:");
110     sorting.printarr();
111
112     sorting.insertionSort();
113     System.out.println("Insertion Sort:");
114     sorting.printarr();
115
116     sorting.selectionSort();
117     System.out.println("Selection Sort:");
118     sorting.printarr();
119
120     scanner.close();
121 }
122 }
123

```

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>
```