NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

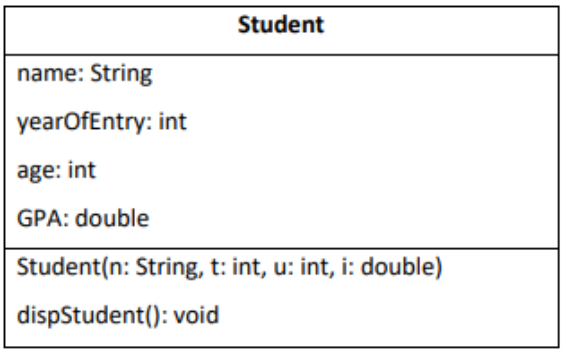
5.1 Purpose

After doing this lab, students are expected to be able to:

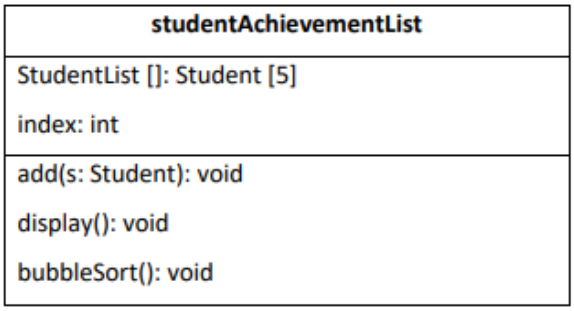
a. Students are able to make algorithms for searching bubble sort, selection sort and insertion sort
b. Students are able to implement the algorithm of searching bubble sort, selection sort and insertion sort to the program

5.2 Sorting Student Data Based on GPA Using Bubble Sort

Pay attention to the Student class diagram below! This class diagram will be made as a reference in making the Student class in java programming languange.



Based on the class diagram above, we will create a Student class whose function is to create a student object that will be included in an array. There is a parameterized constructor and also a display() method to display all the existing attributes.



Furthermore, the class diagram above is a representation of a class that functions to perform operations from student array objects, for example to add student objects, display all student data, and also to sort using the bubble sort technique based on student GPA scores.

5.2.1 Lab Unit 1

1. Create a new project with the name “bubble-selection-insertion”, then create new package with the name “week6”.
2. Ceate a class with the name Student00, replace 00 with your absent number
3. Adjust the Student00 class by looking at the class diagram above by adding attributes, constructors, and functions or methods. For more details, the class can be seen in the code snippet below:

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

```java
public class Student {
    String name;
    int yearOfEnty, age;
    double GPA;

    public Student(String n, int y, int a, double gpa ){
        name=n;
        yearOfEnty=y;
        age=a;
        GPA=gpa;
    }

    public void dispStudent(){
        System.out.println("Name : "+name);
        System.out.println("Year of Entry : "+yearOfEnty);
        System.out.println("Age : "+age);
        System.out.println("GPA : "+GPA);
    }

}
```

4. Create studentAchievementList00 class as follows!

```java
public class studentAchievementList {
    Student StudentList [] = new Student [5];
    int index;

    //create add() method

    //create display() method

    //create bubbleSort() method

}
```

5. Create add() method inside studentAchievementList00! The add() method is used to add an object from the Student class to the StudentList attribute.

```java
public void add(Student s){
    if (index<StudentList.length){
        StudentList[index]=s;
        index++;
    }else{
        System.out.println("Data is Full");
    }
}
```

6. Create display() method inside studentAchievementList00! display() method is used to display all the data of students in the class! Note the use of the for syntax which is somewhat different from the previously studied for, although it is conceptually similar.

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

```
public void display(){
    for (Student s : StudentList){
        s.dispStudent();
        System.out.println("========================");
    }
}
```

7. Create bubbleSort() method inside studentAchievementList00!

```
public void bubbleSort(){
    for (int i=0; i<StudentList.length-1;i++){
        for(int j=0;j<StudentList.length-i-1;j++){
            if(StudentList[j].GPA > StudentList[j+1].GPA){
                //Swapping process
                Student tmp = StudentList[j];
                StudentList[j]=StudentList[j+1];
                StudentList[j+1]=tmp;
            }
        }
    }
}
```

8. Create MainStudent00 class, then create main() method inside that class!

```
public class StudentMain {
    public static void main(String[] args) {

    }

}
```

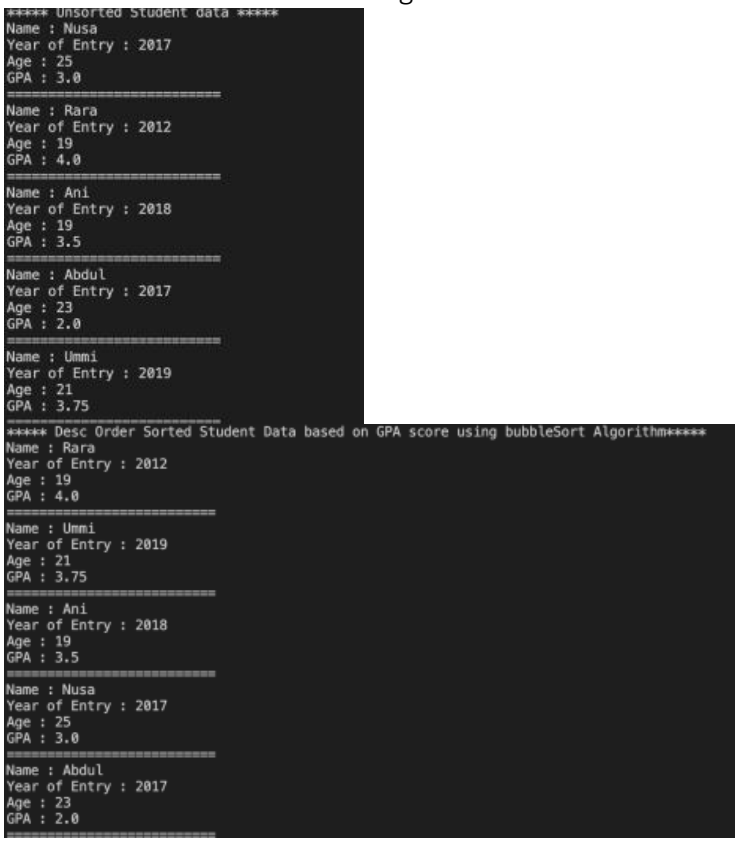
9. Inside main() method, create an studentAchievementList00 object and create 5 Student00 objects then add all the student objects by calling the add() method on the studentAchievementList00 object. Please call the display() method to see all the data that has been entered, sort the data by calling the bubbleSort() method and finally call the display() method again.

```
studentAchievementList list = new studentAchievementList();
Student s1 = new Student("Nusa", 2017, 25, 3);
Student s2 = new Student("Rara", 2012, 19, 4);
Student s3 = new Student("Ani", 2018, 19, 3.5);
Student s4 = new Student("Abdul", 2017, 23, 2);
Student s5 = new Student("Ummi", 2019, 21, 3.75);

list.add(s1);
list.add(s2);
list.add(s3);
list.add(s4);
list.add(s5);

System.out.println("***** Unsorted Student data *****");
list.display();

System.out.println("***** Sorted Student Data based on GPA score *****");
list.bubbleSort();
list.display();
```

NAME	:	FARICHA AULIA
NIM	:	2141720155
ABSENT	:	08
CLASS	:	1I - IT
TOPIC	:	JOBSHEET 5 - SORTING

5.2.2 Verification

Match the results with the image below



Answer Program Lab Unit 1

src > week6 > Student08.java > Student08

```java
package week6;

public class Student08 {
    String name;
    int yearOfEnty, age;
    double GPA;

    public Student08(String n, int y, int a, double gpa){
        name=n;
        yearOfEnty=y;
        age=a;
        GPA=gpa;
    }

    public void dispStudent(){
        System.out.println("Name            : " +name);
        System.out.println("Year of Entry   : " +yearOfEnty);
        System.out.println("Age             : " +age);
        System.out.println("GPA             : " +GPA);
    }
}
```

NAME	:	FARICHA AULIA
NIM	:	2141720155
ABSENT	:	08
CLASS	:	1I - IT
TOPIC	:	JOBSHEET 5 - SORTING

src > week6 > studentAchievList08.java > studentAchievList08 > insertionSort()

```java
package week6;

public class studentAchievList08 {
    Student08 StudentList [] = new Student08 [5];
    int index;

    public void add(Student08 s){
        if (index<StudentList.length){
            StudentList[index]=s;
            index++;
        }
        else{
            System.out.println("Data is Full");
        }
    }
    public void display(){
        for (Student08 s : StudentList){
            s.dispStudent();
            System.out.println("=========================");
        }
    }
    public void bubbleSort(){
        for (int i=0; i<StudentList.length-1; i++){
            for(int j=0; j<StudentList.length-i-1;j++){
                if(StudentList[j].GPA<StudentList[j+1].GPA){
                    //Swapping Process
                    Student08 tmp = StudentList[j];
                    StudentList[j] = StudentList[j+1];
                    StudentList[j+1]=tmp;
                }
            }
        }
    }
```

src > week6 > MainStudent08.java > ...

```java
package week6;

public class MainStudent08 {
    Run | Debug
    public static void main(String[] args) {
        studentAchievList08 list = new studentAchievList08();
        Student08 s1 = new Student08 ("Nusa", 2017, 25, 3);
        Student08 s2 = new Student08 ("Rara", 2012, 19, 4);
        Student08 s3 = new Student08 ("Ani", 2018, 19, 3.5);
        Student08 s4 = new Student08 ("Abdul", 2017, 23, 2);
        Student08 s5 = new Student08 ("Ummi", 2019, 21, 3.75);

        list.add(s1);
        list.add(s2);
        list.add(s3);
        list.add(s4);
        list.add(s5);

        System.out.println("***** Unsorted Student08 Data *****");
        list.display();

        System.out.println("***** Sorted Student Data based on GPA score *****");
        list.bubbleSort();
        list.display();
    }
}
```

Result of Running Program Lab Unit 1

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

```
***** Unsorted Student08 Data *****
Name            : Nusa
Year of Entry   : 2017
Age             : 25
GPA             : 3.0
=========================
Name            : Rara
Year of Entry   : 2012
Age             : 19
GPA             : 4.0
=========================
Name            : Ani
Year of Entry   : 2018
Age             : 19
GPA             : 3.5
=========================
Name            : Abdul
Year of Entry   : 2017
Age             : 23
GPA             : 2.0
=========================
Name            : Ummi
Year of Entry   : 2019
Age             : 21
GPA             : 3.75
=========================
```

```
***** Sorted Student Data based on GPA score *****
Name            : Rara
Year of Entry   : 2012
Age             : 19
GPA             : 4.0
=========================
Name            : Ummi
Year of Entry   : 2019
Age             : 21
GPA             : 3.75
=========================
Name            : Ani
Year of Entry   : 2018
Age             : 19
GPA             : 3.5
=========================
Name            : Nusa
Year of Entry   : 2017
Age             : 25
GPA             : 3.0
=========================
Name            : Abdul
Year of Entry   : 2017
Age             : 23
GPA             : 2.0
=========================
```

5.2.3 Question

1. What is the name of the method that has a bubble sort process?
   Answer: Simple sorting, The method that has the sorting process gradually moves to the right position
2. What is the swap process? Explain the program snippet to perform the swap process!
   Answer: Swap means exchanging elements if a certain condition is certain, then proceed to the next exchange. on bubbleSort by comparing the first 2 elements, if the first element is greater than the second element, then an exchange is performed. done continuously. If there is no more exchange of elements, then the list of elements is already sorted.
3. Inside bubbleSort() method, there is a line of program code as below:

```
if(StudentList[j].GPA > StudentList[j+1].GPA){
    //Swapping process
    Student tmp = StudentList[j];
    StudentList[j]=StudentList[j+1];
    StudentList[j+1]=tmp;
}
```

   What is the process for?
   Answer: to temporarily hold the value, and replace the current value with the next value
4. Pay attention to oop inside the bubble Sort() below:

```
for (int i=0; i<StudentList.length-1;i++){
    for(int j=0;j<StudentList.length-i-1;j++){
```

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

a. What is the difference between the use of an i loop and a j loop?
   Answer:
   - i to access the value on each element
   - j to access another iteration

b. Why is the condition of the loop i : i<listMhs.length-1
   Answer: to access elements of variable length studentList and loop until a certain condition

c. Why is the condition of the loop i : j<listMhs.length-i-1
   Answer: .to access iteration switching and value on loop

d. If there are 50 data in the StudentList, then how many iterations of i are there? And how many bubble sort stages are there?
   Answer: 51 iterations and bubble sort stages carried out until the conditions are suitable

5.3 Sorting Student Data Based on GPA Using Selection Sort

In the previous practicum, we have sorted student data based on GPA using Bubble Sort in descending order, this time we will try to add a sorting function using Selection Sort.

5.3.1. Lab unit -2

1. Create selectionSort() method inside studentAchievementList00 class! This method will perform the ascending sorting process, but uses a selection sort algorithm

```
public void selectionSort(){
    for (int i=0; i<StudentList.length-1;i++){
        int indexMin=i;
        for(int j=i+1; j<StudentList.length;j++){
            if(StudentList[j].GPA<StudentList[indexMin].GPA){
                indexMin=j;
            }
        }
        //Swapping process
        Student tmp = StudentList[indexMin];
        StudentList[indexMin]=StudentList[i];
        StudentList[i]=tmp;
    }
}
```

2. Inside main() method in the MainStudent00 Class, add a program line to call the selectionSort() method!

```
System.out.println("***** ASC Order Sorted Student Data based on GPA score using SelectionSort Algorithm*****");
list.selectionSort();
list.display();
```

Try running the Main class again, and observe the results! Has the student data now appeared in ascending order based on GPA?

5.3.2. Verification

NAME	:	FARICHA AULIA
NIM	:	2141720155
ABSENT	:	08
CLASS	:	1I - IT
TOPIC	:	JOBSHEET 5 - SORTING

Match the results with the image below

```
***** ASC Order Sorted Student Data based on GPA score using SelectionSort Algorithm*****
Name : Abdul
Year of Entry : 2017
Age : 23
GPA : 2.0
=========================
Name : Nusa
Year of Entry : 2017
Age : 25
GPA : 3.0
=========================
Name : Ani
Year of Entry : 2018
Age : 19
GPA : 3.5
=========================
Name : Ummi
Year of Entry : 2019
Age : 21
GPA : 3.75
=========================
Name : Rara
Year of Entry : 2012
Age : 19
GPA : 4.0
=========================
```

Answer Program Lab Unit 2

```java
    public void selectionSort(){
        for (int i=0; i<StudentList.length-1;i++){
            int indexMin=i;
            for(int j=i+1; j<StudentList.length; j++){
                if(StudentList[j].GPA<StudentList[indexMin].GPA){
                    indexMin=j;
                }
            }
            //Swapping process
            Student08 tmp = StudentList[indexMin];
            StudentList[indexMin] = StudentList[i];
            StudentList[i]=tmp;
        }
    }
}
```

```java
c > week6 > MainStudent08.java > MainStudent08
package week6;

public class MainStudent08 {
    Run | Debug
    public static void main(String[] args) {
        studentAchievList08 list = new studentAchievList08();
        Student08 s1 = new Student08 ("Nusa", 2017, 25, 3);
        Student08 s2 = new Student08 ("Rara", 2012, 19, 4);
        Student08 s3 = new Student08 ("Ani", 2018, 19, 3.5);
        Student08 s4 = new Student08 ("Abdul", 2017, 23, 2);
        Student08 s5 = new Student08 ("Ummi", 2019, 21, 3.75);

        list.add(s1);
        list.add(s2);
        list.add(s3);
        list.add(s4);
        list.add(s5);

        System.out.println("***** Unsorted Student08 Data *****");
        list.display();

        System.out.println("***** Sorted Student Data based on GPA score *****");
        list.bubbleSort();
        list.display();

        System.out.println("***** ASC Order Sorted Student Data based \n on GPA score using selectionSort Algorithm *****");
        list.selectionSort();
        list.display();
    }
}
```

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

Result of Running Program Lab Unit 2

```
***** ASC Order Sorted Student Data based on GPA score using SelectionSort Algorithm *****
Name            : Abdul
Year of Entry   : 2017
Age             : 23
GPA             : 2.0
=========================
Name            : Nusa
Year of Entry   : 2017
Age             : 25
GPA             : 3.0
=========================
Name            : Ani
Year of Entry   : 2018
Age             : 19
GPA             : 3.5
=========================
Name            : Ummi
Year of Entry   : 2019
Age             : 21
GPA             : 3.75
=========================
Name            : Rara
Year of Entry   : 2012
Age             : 19
GPA             : 4.0
=========================
```

5.3.3. Question

Inside selectionSort() method, there is a line of program code as below:

```
int indexMin=i;
for(int j=i+1; j<StudentList.length;j++){
    if(StudentList[j].GPA<StudentList[indexMin].GPA){
        indexMin=j;
    }
}
```

What is the process for, please explain!

Answer: Serves as a condition or preferred sorting algorithm to perform the sorting process

5.4 Sorting Student Data Based on GPA Using Insertion Sort

Finally, the sorting technique using Insertion Sort will be implemented, sorting students' GPAs in ascending order.

5.4.1 Lab unit 3

1. Create method insertionSort() method inside studentAchievementList00 class. This method will perform the ascending sorting process using Insertion Sort.

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

```
public void insertionSort(){
    for(int i=1; i<StudentList.length;i++){
        Student temp=StudentList[i];
        int j =i;
        while(j>0 && StudentList[j-1].GPA>temp.GPA){
            StudentList[j]=StudentList[j-1];
            j--;
        }
        StudentList[j]=temp;

    }
}
```

2. Inside main() method in the MainStudent00 Class, add a program line to call insertionSort() method! Try running the Main class again, and observe the results! Has the student data now appeared in ascending order based on GPA?

```
System.out.println("***** ASC Order Sorted Student Data based on GPA score using InsertionSort Algorithm******");
list.insertionSort();
list.display();
```

5.4.2 Verification

Match the results with the image below.

```
***** ASC Order Sorted Student Data based on GPA score using InsertionSort Algori
hm******
Name : Abdul
Year of Entry : 2017
Age : 23
GPA : 2.0
==========================
Name : Nusa
Year of Entry : 2017
Age : 25
GPA : 3.0
==========================
Name : Ani
Year of Entry : 2018
Age : 19
GPA : 3.5
==========================
Name : Ummi
Year of Entry : 2019
Age : 21
GPA : 3.75
==========================
Name : Rara
Year of Entry : 2012
Age : 19
GPA : 4.0
==========================
```

NAME	:	FARICHA AULIA
NIM	:	2141720155
ABSENT	:	08
CLASS	:	1I - IT
TOPIC	:	JOBSHEET 5 - SORTING

Answer Program Lab Unit 3

```
48      public void insertionSort(){
49          for(int i=1; i<StudentList.length;i++){
50              Student08 temp=StudentList[i];
51              int j=i;
52              while(j>0 && StudentList[j-1].GPA>temp.GPA){
53                  StudentList[j]=StudentList[j-1];
54                  j--;
55              }
56              StudentList[j]=temp;
57          }
58      }
```

src > week6 > MainStudent08.java > ...

```
1   package week6;
2
3   public class MainStudent08 {
        Run | Debug
4       public static void main(String[] args) {
5           studentAchievList08 list = new studentAchievList08();
6           Student08 s1 = new Student08 ("Nusa", 2017, 25, 3);
7           Student08 s2 = new Student08 ("Rara", 2012, 19, 4);
8           Student08 s3 = new Student08 ("Ani", 2018, 19, 3.5);
9           Student08 s4 = new Student08 ("Abdul", 2017, 23, 2);
10          Student08 s5 = new Student08 ("Ummi", 2019, 21, 3.75);
11
12          list.add(s1);
13          list.add(s2);
14          list.add(s3);
15          list.add(s4);
16          list.add(s5);
17
18          System.out.println("***** Unsorted Student08 Data *****");
19          list.display();
20
21          System.out.println("***** Sorted Student Data based on GPA score *****");
22          list.bubbleSort();
23          list.display();
24
25          System.out.println("***** ASC Order Sorted Student Data based on GPA score using selectionSort Algorithm *****");
26          list.selectionSort();
27          list.display();
28
29          System.out.println("***** ASC Order Sorted Student Data based on GPA score using InsertionSort Algorithm *****");
30          list.insertionSort();
31          list.display();
32      }
33  }
```

Result of Running Program Lab Unit 3

```
***** ASC Order Sorted Student Data based on GPA score using InsertionSort Algorithm *****
Name            : Abdul
Year of Entry   : 2017
Age             : 23
GPA             : 2.0
========================
Name            : Nusa
Year of Entry   : 2017
Age             : 25
GPA             : 3.0
========================
Name            : Ani
Year of Entry   : 2018
Age             : 19
GPA             : 3.5
========================
Name            : Ummi
Year of Entry   : 2019
Age             : 21
GPA             : 3.75
========================
Name            : Rara
Year of Entry   : 2012
Age             : 19
GPA             : 4.0
========================
```

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

5.4.3 Question

modify InsertionSort method so that this function can carry out the sorting process in ascending or descending order, you can do this by adding parameter to this InsertionSort method.

```
public void insertionSort(boolean asc){
    for(int i=1; i<StudentList.length;i++){
        Student temp=StudentList[i];
        int j =i;
        if (asc){


        } else{

        }

    StudentList[j]=temp;
    }
}
```

Answer:

```
48      public void insertionSort(boolean asc){
49          for(int i=1; i<StudentList.length;i++){
50              Student08 temp=StudentList[i];
51              int j=i;
52              if(asc){
53                  while(j>0 && StudentList[j-1].GPA>temp.GPA){
54                      StudentList[j]=StudentList[j-1];
55                  }
56              }else{
57                  while(j>0 && StudentList[j-1].GPA>temp.GPA){
58                  StudentList[j]=StudentList[j-1];
59                  j--;
60                  }
61              }
62              StudentList[j]=temp;
63          }
64      }
65  }
```

5.5 Exercise

An airline ticket sales company is developing a backend for a ticket booking system, one of its features is to display a list of available tickets based on the filter options desired by the user. This ticket list must be able to be sorted by price starting from the lowest price to the highest price. Implement the following class diagram into the Java programming language and then make a data sorting process for ticket prices using bubble sort and selection sort algorithm

Ticket
+ companyAirlines : String + price : int + origin : String + destination : String
+ Ticket (String cA, int p, String o, String d) : void

NAME : FARICHA AULIA
NIM : 2141720155
ABSENT : 08
CLASS : 1I - IT
TOPIC : JOBSHEET 5 - SORTING

TicketService
+ tikets : Ticket[]
+ add (Ticket t) : void + displayAll() : void + bubbleSort() : void + selectionSort() : void

MainTicket
+ Main(String[] args) :void

Answer Program Exercise

src > week6 > Ticket08.java > Ticket08

```java
package week6;

public class Ticket08 {
    String compAirlines;
    String origin;
    String destination;
    int price;

    public Ticket08(String cA, String o, String d, int p){
        compAirlines=cA;
        origin=o;
        destination=d;
        price=p;
    }

    public void dispTicket(){
        System.out.println("Company Airlines: "+compAirlines);
        System.out.println("Origin          : "+origin);
        System.out.println("Destination     : "+destination);
        System.out.println("Price           : "+price);
    }
}
```

src > week6 > TicketService08.java > TicketService08 > x

```java
package week6;
import java.util.Scanner;

public class TicketService08 {
    //Create a scanner object
    Scanner input = new Scanner(System.in);
    //Declaration Variable
    int x = input.nextInt();
    Ticket08 Ticket [] = new Ticket08 [x];
    int index;

    public void add(Ticket08 t){
        if (index<Ticket.length){
            Ticket[index]=t;
            index++;
        }
        else{
            System.out.println("Data is Full");
        }
    }
    public void display(){
        for (Ticket08 t : Ticket){
            t.dispTicket();
            System.out.println("========================");
        }
    }
```

NAME	:	FARICHA AULIA
NIM	:	2141720155
ABSENT	:	08
CLASS	:	1I - IT
TOPIC	:	JOBSHEET 5 - SORTING

```
27      public void bubbleSort(){
28          for (int i=0; i<Ticket.length-1; i++){
29              for(int j=0; j<Ticket.length-i-1;j++){
30                  if(Ticket[j].price<Ticket[j+1].price){
31                      //Swapping Process
32                      Ticket08 tmp = Ticket[j];
33                      Ticket[j] = Ticket[j+1];
34                      Ticket[j+1]=tmp;
35                  }
36              }
37          }
38      }
39      public void selectionSort(){
40          for (int i=0; i<Ticket.length-1;i++){
41              int indexMin=i;
42              for(int j=i+1; j<Ticket.length; j++){
43                  if(Ticket[j].price<Ticket[indexMin].price){
44                      indexMin=j;
45                  }
46              }
47              //Swapping process
48              Ticket08 tmp = Ticket[indexMin];
49              Ticket[indexMin] = Ticket[i];
50              Ticket[i]=tmp;
51          }
52      }
53  }
```

src > week6 > MainTicket08.java > ...

```
1   package week6;
2   import java.util.Scanner;
3
4   public class MainTicket08 {
        Run | Debug
5       public static void main(String[] args) {
6           //Create a scanner object
7           Scanner input = new Scanner(System.in);
8           TicketService08 data = new TicketService08();
9           System.out.print("Enter the amount of data : "); int y = input.nextInt();
10
11          Ticket08 total [] = new Ticket08 [y];
12
13          for(int i=0; i<total.length; i++){
14              String cA;
15              String o;
16              String d;
17              int p;
18              input.nextLine();
19              System.out.println("Airline Company  : "); cA=input.nextLine();
20              System.out.println("Origin          : "); o=input.nextLine();
21              System.out.println("Destination     : "); d=input.nextLine();
22              System.out.println("Ticket price    : "); p=input.nextInt();
23              total[i] = new Ticket08(cA, o, d, p);
24          }
25
26          System.out.println("***** Unsorted Ticket Data *****");
27          data.display();
28          System.out.println("***** Sorted Ticket Data using Bubble Sort *****");
29          data.bubbleSort();
30          data.display();
31          System.out.println("***** Sorted Ticket Data using Selection Sort *****");
32          data.selectionSort();
33          data.display();
34      }
35  }
```