JOBSHEET VI
SEARCHING

1.1. Learning Objective

After learning this practicum course, students will be able to:

1. Define Searching algorithm
2. Create and declare searching algorithm structure
3. Implement searching algorithm

1.2. Sequential Search Method

Take a look on following class diagram! Use this class diagram as blueprint of program code in **Students** class

Students
Nim: int name: String age: int gpa: double
Students(ni:int, nm: String, age: int, gpa: double) display(): void

Create a **Students** class to make instantiation process of **Students** class which will be added in an array. There is a constructor with parameter and display() method to print all attributes available in Students class

SearchStudent
listStd: Student[5] idx: int
add(mhs: Mahasiswa): void display(): void FindSeqSearch(int cari): int showPosition(int x,int pos): void showData(int x,int pos) :void

Next, above class diagram will represents a class to manipulate array of objects instantiated from **Students** class. For example, to add a student, display all student's information, to search by NIM, and to display searched student's data later on

1.2.1. Steps

1. Create a new project in NetBeans called **TestSearching**
2. Then, create a new package **week7.**
3. Create new **Students** class, then declare following attributes:

```java
public class Students {
    int nim, age;
    String name;
    double gpa;
```

4. Create a constructor in **Students** class with parameters (int ni, String nm, int age, double gpa). Convert it to program code as follows:

```java
public Students(int nim, int age, String name, double gpa) {
    this.nim = nim;
    this.age = age;
    this.name = name;
    this.gpa = gpa;
}
```

5. Create display() method with void as its return type

```java
public void display(){
    System.out.println("NIM = " + nim);
    System.out.println("Name = " + name);
    System.out.println("Age = " + age);
    System.out.println("GPA= " + gpa);
}
```

6. Create a new **SearchStudent** class as follows.

```java
public class SearchStudent {
    Students[] listStd = new Students[5];
    int idx;
```

7. Create method **add()** at that class! This will be used for adding objects from **Students** class to listStd attribute

```java
public void add(Students std){
    if(idx < listStd.length){
        listStd[idx] = std;
        idx++;
    }else{
        System.out.println("Data is already full");
    }
}
```

8. Create method **display()** in class **SearchStudent!** This display() method will be used to print all students data available in this class. Pay attention on how we use **for loops** differently. Even so, the concepts is still the same

```java
public void display(){
    for (Students students : listStd) {
        students.display();
        System.out.println("-----------------------------");
    }
}
```

9. Create method **FindSeqSearch** with integer as its return type. Then fill in the function with sequential search algorithm.

```java
public int findSeqSearch(int search){
    int position = -1;
    for (int i = 0; i < listStd.length; i++) {
        if(listStd[i].nim == search){
            position = i;
            break;
        }
    }
    return position;
}
```

10. Create method **displayPosition** with void as its return type. And write these following code as follows

```java
public void showPosition(int x, int pos){
    if(pos != -1){
        System.out.println("Data : "+ x + " is found in index-"+pos);
    }else{
        System.out.println("Data : " + x + " is not found");
    }
}
```

11. Create method **displayData** with void as its return type. And write these following code as follows

```java
public void showData(int x, int pos){
    if(pos != -1){
        System.out.println("NIM \t : " + x);
        System.out.println("Name \t : " + listStd[pos].name);
        System.out.println("Age \t : " + listStd[pos].age);
        System.out.println("IPK \t : " + listStd[pos].gpa);
    }else{
        System.out.println("Data " + x + " is not found");
    }
}
```

12. Create a main class named **StudentsMain** and add main method as follows

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

    }
}
```

13. In main method, instantiate an object in **SearchStudent** that consist of 5 **Students,** then add all students object by calling **add** function in object **SearchStudent**

```
Scanner s = new Scanner(System.in);
Scanner s1 = new Scanner(System.in);

SearchStudent data = new SearchStudent();
int amountStudent = 5;

System.out.println("--------------------------------");
System.out.println("Input student data accordingly from smallest NIM")
for (int i = 0; i < amountStudent; i++) {
    System.out.println("----------");
    System.out.print("NIM\t:");
    int nim = s.nextInt();
    System.out.print("Name\t:");
    String name = s1.nextLine();
    System.out.print("Age\t:");
    int age = s.nextInt();
    System.out.print("GPA\t:");
    double gpa = s.nextDouble();

    Students std = new Students(nim, age, name, gpa);
    data.add(std);
}
```

14. Add method **display** to print all inserted data

```
System.out.println("---------------------------");
System.out.println("Entire Student Data");
data.display();
```

15. To search students by their NIM, create a **search** variable to hold input from user. Then call method **FindSeqSearch** with its parameter is the search variable we've declared before

```
System.out.println("---------------------------");
System.out.println("Entire Student Data");
data.display();
```

16. Call method **displayPosition** from class **SearchStudent.**

```
System.out.println("______________________");
System.out.println("______________________");
System.out.print("Search student by NIM: ");
int search = s.nextInt();
System.out.println("Using Sequential Search");
int position = data.findSeqSearch(search);
```

17. Call method **displayData** from class **SearchStudent**

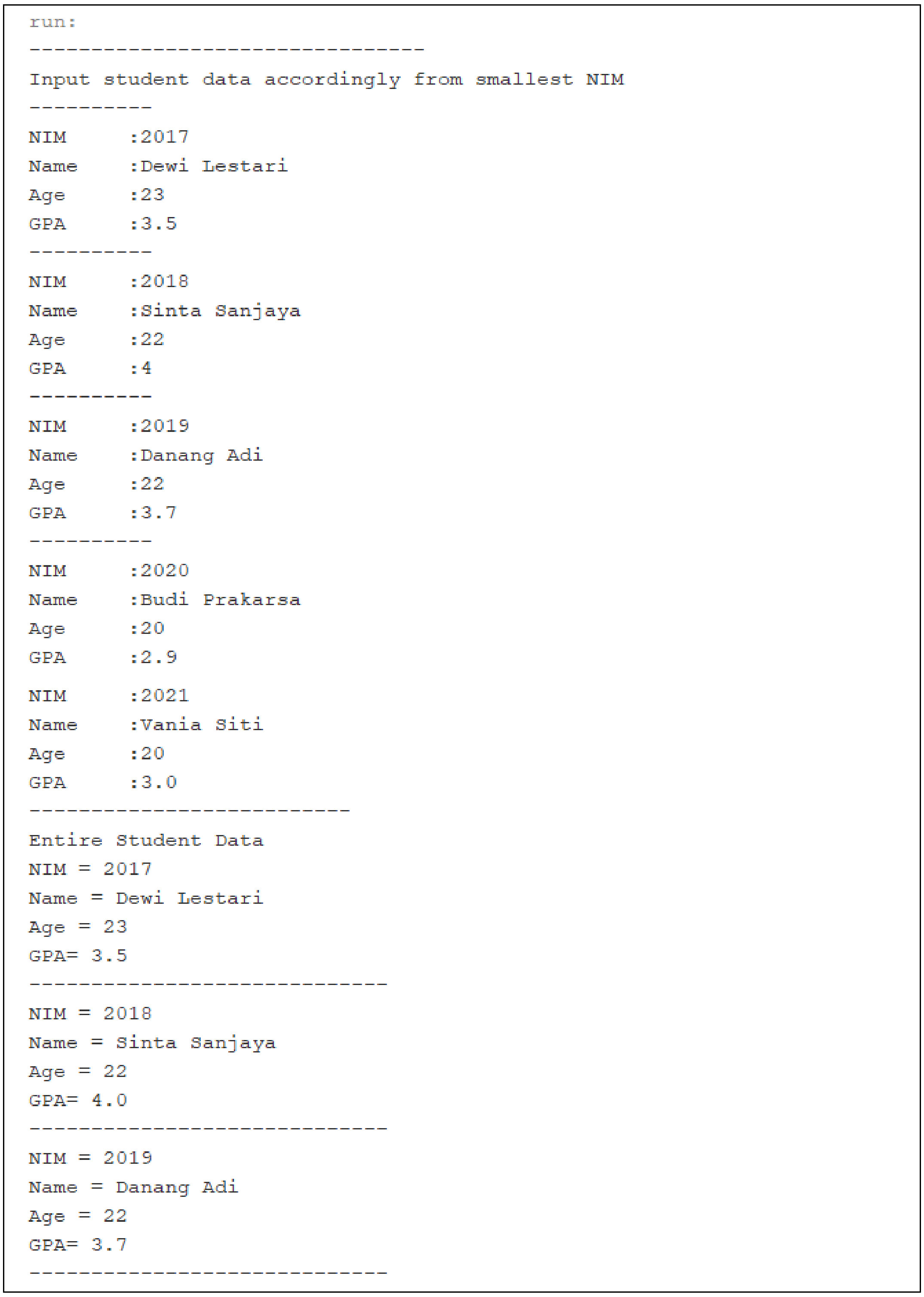
```
data.showPosition(search, position);
```

18. Run the program and see the result

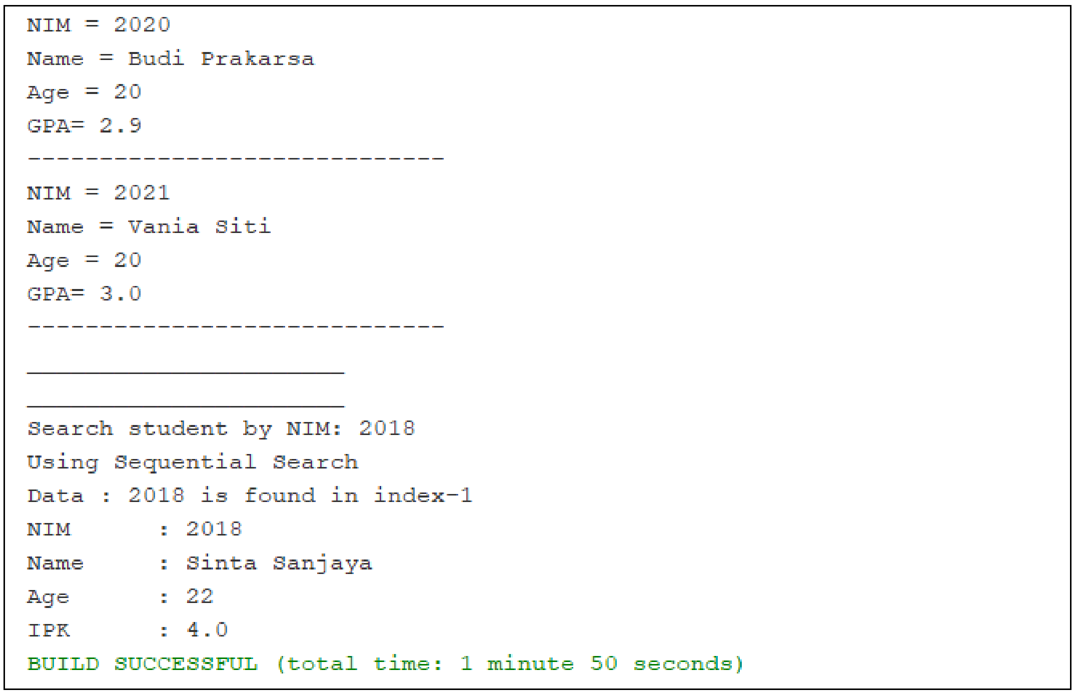
```
data.showData(search, position);
```

1.2.2. Result

Match the output of your program code with following image



```
run:
--------------------------------
Input student data accordingly from smallest NIM
----------
NIM     :2017
Name    :Dewi Lestari
Age     :23
GPA     :3.5
----------
NIM     :2018
Name    :Sinta Sanjaya
Age     :22
GPA     :4
----------
NIM     :2019
Name    :Danang Adi
Age     :22
GPA     :3.7
----------
NIM     :2020
Name    :Budi Prakarsa
Age     :20
GPA     :2.9
NIM     :2021
Name    :Vania Siti
Age     :20
GPA     :3.0
--------------------------
Entire Student Data
NIM = 2017
Name = Dewi Lestari
Age = 23
GPA= 3.5
-----------------------------
NIM = 2018
Name = Sinta Sanjaya
Age = 22
GPA= 4.0
-----------------------------
NIM = 2019
Name = Danang Adi
Age = 22
GPA= 3.7
-----------------------------
```

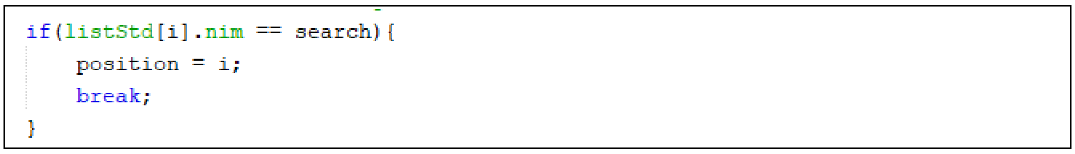


```
NIM = 2020
Name = Budi Prakarsa
Age = 20
GPA= 2.9
-----------------------------
NIM = 2021
Name = Vania Siti
Age = 20
GPA= 3.0
-----------------------------

______________________
______________________
Search student by NIM: 2018
Using Sequential Search
Data : 2018 is found in index-1
NIM      : 2018
Name     : Sinta Sanjaya
Age      : 22
IPK      : 4.0
BUILD SUCCESSFUL (total time: 1 minute 50 seconds)
```

1.2.3. Question

1. What is the difference of method **displayData** and **displayPosition** in **StudentSearch** class?
2. What is the function of break in this following program code?



```
if(listStd[i].nim == search){
    position = i;
    break;
}
```

3. If inserted NIM data is not sorted from smallest to biggest value, will the program encounter an error? Is the result still correct? Why is that?

1.3. Binary Search Method

1.3.1. Steps

1. in step 1.2.1 (Sequential search), create method **FindBinarySearch** with integer as its data type in class **SearchStudent.** Then declare the content of method **FindBinarySearch** with using binary search as its searching algorithm

```java
public int FindBinarySearch(int cari, int left, int right) {
    int mid;
    if (right >= left) {
        mid = (left + right) / 2;
        if (cari == listMHs[mid].nim) {
            return (mid);
        } else if (listMHs[mid].nim > cari) {
            return FindBinarySearch(cari, left, mid - 1);
        } else {
            return FindBinarySearch(cari, mid + 1, right);
        }
    }
    return -1;
}
```

2. Call method **FindBinarySearch** from **SearchStudent** class in **StudentsMain**. Then call method **displayPosition** and **displayData**

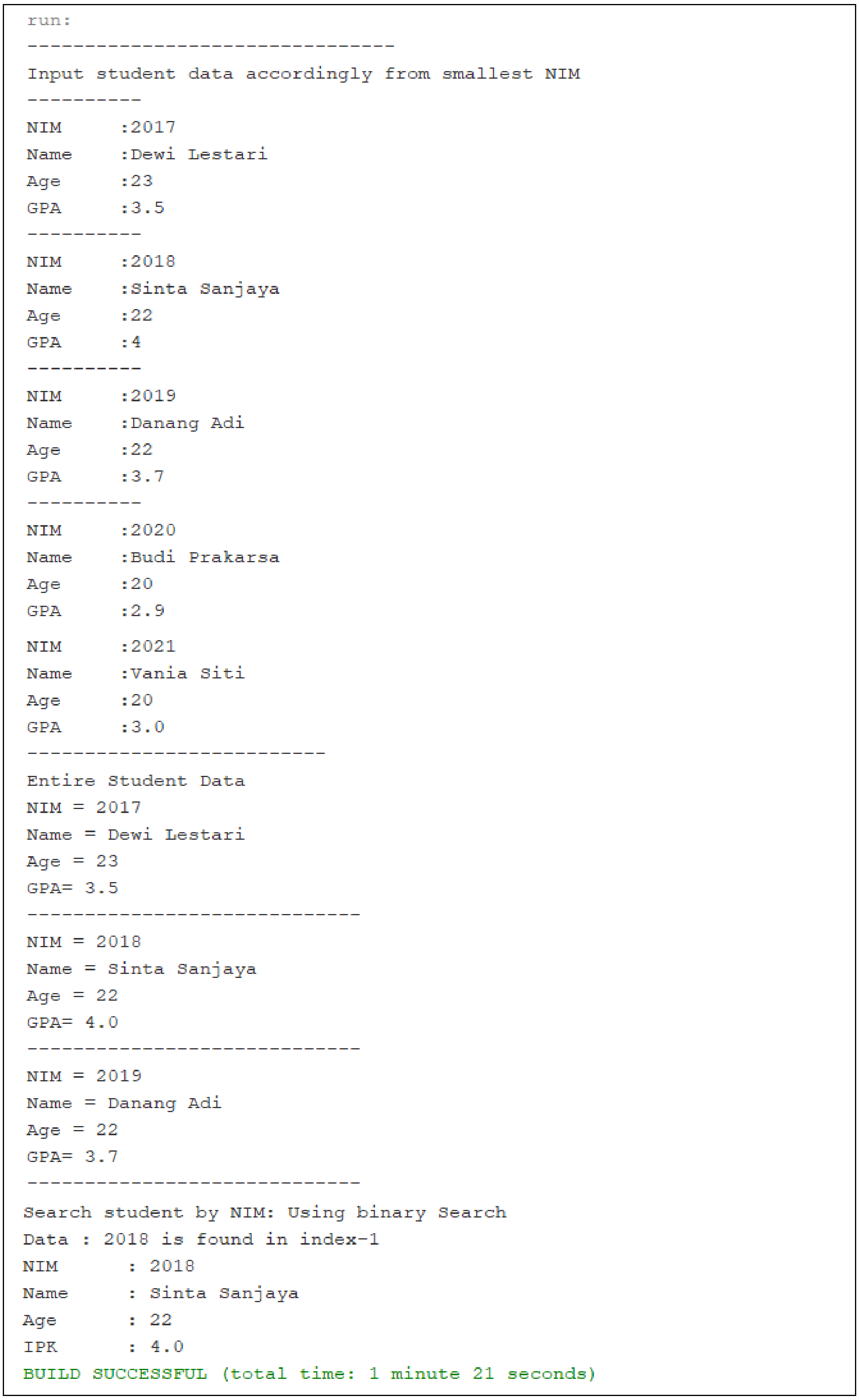
```java
System.out.println("======================");
System.out.print("Search student by NIM: ");
System.out.println("Using binary Search");
int position1 = data.findBinarySearch(search,0, amountStudent -1);

data.showPosition(search, position1);
data.showData(search, position1);
```

3. Run and see the result

1.3.2. Result

Match the output of your program code with following image



```
run:
--------------------------------
Input student data accordingly from smallest NIM
----------
NIM      :2017
Name     :Dewi Lestari
Age      :23
GPA      :3.5
----------
NIM      :2018
Name     :Sinta Sanjaya
Age      :22
GPA      :4
----------
NIM      :2019
Name     :Danang Adi
Age      :22
GPA      :3.7
----------
NIM      :2020
Name     :Budi Prakarsa
Age      :20
GPA      :2.9

NIM      :2021
Name     :Vania Siti
Age      :20
GPA      :3.0
--------------------------
Entire Student Data
NIM = 2017
Name = Dewi Lestari
Age = 23
GPA= 3.5
-----------------------------
NIM = 2018
Name = Sinta Sanjaya
Age = 22
GPA= 4.0
-----------------------------
NIM = 2019
Name = Danang Adi
Age = 22
GPA= 3.7
-----------------------------
Search student by NIM: Using binary Search
Data : 2018 is found in index-1
NIM       : 2018
Name      : Sinta Sanjaya
Age       : 22
IPK       : 4.0
BUILD SUCCESSFUL (total time: 1 minute 21 seconds)
```

1.3.3. Question

1. Show the program code in which runs the divide process
2. Show the program code in which runs the conquer process
3. If inserted NIM data is not sorted, will the program crash? Why?
   If inserted NIM data is sorted from largest to smallest value (e.g 20215, 20214 20212, 20211,20210) and element being searched is 20210. How is the result of binary search? does it return the correct one? if not, then change the code so that the binary search executed properly
4. Modify program above so that the students amount inserted is matched with user input

1.4. Review Divide and Conquer

1.4.1. Steps

1. Create a new package in NetBeans named **MergeSortTest**
2. Add class **MergeSorting** in this package
3. In this class, create method mergeSort that receives an array in its parameter

```
public void mergeSort(int[] data){

}
```

4. Create **merge** method to do data merging process from left side to the right

```
private void merge(int data[], int left, int mid, int right){

}
```

5. Implement **merge** process as follows:

```
public void merge(int data[], int left, int middle, int right) {
    int[] temp = new int[data.length];
    for (int i = left; i <= right; i++) {
        temp[i] = data[i];
    }
    int a = left;
    int b = middle + 1;
    int c = left;

      //membandingkan setiap bagian
      while (a <= middle && b <= right) {
          if (temp[a] <= temp[b]) {
              data[c] = temp[a];
              a++;
          } else {
              data[c] = temp[b];
              b++;
          }
          c++;
      }
      int s = middle - a;
      for (int i = 0; i <= s; i++) {
          data[c + i] = temp[a + i];
      }
  }
```

6. Create sort method

```
private void sort(int data[], int left, int right){

}
```

7. Implement these following codes in sort method

```
// DIvide into 2 parts and divide it again until no more thing to be divided
private void sort(int data[], int left, int right){
    if(left < right){
        int mid = (left + right) /2;
        sort(data,left,mid);
        sort(data, mid+1, right);
        merge(data, left, mid, right);
    }
}
```

8. In method **mergeSort**, call method sort with the data that wants to be sorted and initial data range as its parameter
9. Add method printArray

```
public void printArray(int arr[]){
    int n = arr.length;
    for (int i = 0; i < n; i++) {
        System.out.println(arr[i]+" ");
    }
    System.out.println();
}
```

10. Finally, declare the data to be sorted by using sorting process in **SortMain** class

1.4.2. Result

Match the output of your program code with following image

```
run:
Sorting with merge sort
Initial Data
10 40 30 50 70 20 100 90
Sorted Data
10 40 30 50 70 20 100 90
BUILD SUCCESSFUL (total time: 0 seconds)
```

1.5. Assignments

1. Modify the searching program above with these requirements:
   a. Before we search using binary search, we have to sort the data first. You can use whichever sorting algorithm that you are comfortable with
2. Modify the searching above with these requirements:
   - Search by student's name with Sequential Search algorithm
   - How is the output of the program if there is any duplicate name?

3. There is 2d array as follows:

Index	0	1	2	3	4
0	45	78	7	200	80
1	90	1	17	100	50
2	21	2	40	18	65

Based on data above, create a program to search data in 2d array, which the data to be searched is defined by user input (using sequential search)

4. There is a 1D array as follows:

5. 0	1	2	3	4	5	6	7	8	9
12	17	2	1	70	50	90	17	2	90

Create a program to sort the array, search & display the biggest value, and print the amount of biggest value available alongside with its position.