Data Structure and Algorithm Practicum
Array of Objects

Name
Muhammad Baihaqi Aulia Asy'ari

NIM
2241720145

Class
1I

Department
Information Technology

Study Program
D4 Informatics Engineering

1.2 Create, insert, and display Array of Object

1.2.1 Steps

1. ```
   package ArrayOfObjects;

   public class Rectangle {
       public int length;
       public int width;
   }
   ```

2. ```
   package ArrayOfObjects;

   public class ArrayOfObjects {
   public static void main(String[] args) {
       Rectangle[] rectangleArray = new Rectangle[3];

       rectangleArray[0] = new Rectangle();
       rectangleArray[0].length = 110
       rectangleArray[0].width = 30

       rectangleArray[1] = new Rectangle();
       rectangleArray[1].length = 80
       rectangleArray[1].width = 40

       rectangleArray[2] = new Rectangle();
       rectangleArray[2].length = 100
       rectangleArray[2].width = 20

       System.out.println("First Rectangle, width: " +
        ↪  rectangleArray[0].width + ", length: " +
        ↪  rectangleArray[0].length);
       System.out.println("First Rectangle, width: " +
        ↪  rectangleArray[1].width + ", length: " +
        ↪  rectangleArray[1].length);
       System.out.println("First Rectangle, width: " +
        ↪  rectangleArray[2].width + ", length: " +
        ↪  rectangleArray[2].length);
       }
   }
   ```

1.2.2 Result

```
"C:\Program Files\Java\jdk-18.0.2.1\bin\java.exe" -
↪ javaagent:C:\Users\ASUS\AppData\Local\JetBrains\Toolbox\apps\
↪ IDEA-C\ch-0\223.8617.56\lib\idea_rt.jar=53329:C:\Users\ASUS\
↪ AppData\Local\JetBrains\Toolbox\apps\IDEA-C\ch-0\223.8617.56\bin
↪ -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8
↪ -Dsun.stderr.encoding=UTF-8 -classpath "D:\Kuliah Smt 2\Algoritma
↪ dan Struktur Data\Praktikum Week
↪ 3\codes\ArrayOfObjects\target\classes"
↪ ArrayOfObjects.ArrayOfObjects
First Rectangle, width: 30, length: 110
Second Rectangle, width: 40, length: 80
Third Rectangle, width: 20, length: 100

Process finished with exit code 0

```

1.2.3 Questions

1. Based on practicum 1.2, does the class that are going to be used as an array of object must have attributes and methods? Please explain
2. Does class **Rectangle** have constructor? If not, why we instantiate the object as follows?

   ```
   rectangleArray[1] = new Rectangle();
   ```

3. What's the meaning of this line of code?

   ```
   Rectangle[] rectangleArray = new Rectangle[3];
   ```

4. Whats the meaning of these lines of code?

   ```
   rectangleArray[1] = new Rectangle();
   rectangleArray[1].length = 80;
   rectangleArray[1].width = 40;
   ```

5. Why **ArrayOfObject** class and **Rectangle** class should be differentiated?

1.3 Get input in Array of Objects using Loops

1.3.1 Steps

```
package ArrayOfObjects;

import java.util.Scanner;

public class ArrayOfObjects {
    public static void main(String[] args) {
        Rectangle[] rectangleArray = new Rectangle[3];
        Scanner sc = new Scanner(System.in);

        // Assign the values for each attributes in objects
        for (int i = 0; i < 3; i++) {
            rectangleArray[i] = new Rectangle();
            System.out.println("Rectangle " + i);

            System.out.print("Input length : ");
            rectangleArray[i].length = sc.nextInt();

            System.out.print("Input width : ");
            rectangleArray[i].width = sc.nextInt();
        }

        // Display the result in console
        for (int i = 0; i < 10; i++) {
            System.out.println("Rectangle " + i);
            System.out.println("width: " + rectangleArray[0].width +
            ↪  ", length: " + rectangleArray[0].length);
        }
    }
}
```

1.3.2 Result

```
"C:\Program Files\Java\jdk-18.0.2.1\bin\java.exe" -
↪ javaagent:C:\Users\ASUS\AppData\Local\JetBrains\Toolbox\apps\
↪ IDEA-C\ch-0\223.8617.56\lib\idea_rt.jar=53329:C:\Users\ASUS\
↪ AppData\Local\JetBrains\Toolbox\apps\IDEA-C\ch-0\223.8617.56\bin
↪ -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8
↪ -Dsun.stderr.encoding=UTF-8 -classpath "D:\Kuliah Smt 2\Algoritma
↪ dan Struktur Data\Praktikum Week
↪ 3\codes\ArrayOfObjects\target\classes"
↪ ArrayOfObjects.ArrayOfObjects
Rectangle 0
Input length : 5
Input width : 6
Rectangle 1
Input length : 5
Input width : 6
Rectangle 2
Input length : 5
Input width : 6
Rectangle 0
width: 6, length: 5
Rectangle 1
width: 6, length: 5
Rectangle 2
width: 6, length: 5
Rectangle 3
width: 6, length: 5
Rectangle 4
width: 6, length: 5
Rectangle 5
width: 6, length: 5
Rectangle 6
width: 6, length: 5
Rectangle 7
width: 6, length: 5
Rectangle 8
width: 6, length: 5
Rectangle 9
width: 6, length: 5

Process finished with exit code 0

```

1.3.3 Questions

1. Does array of object can be implemented on 2D array?
2. If yes, then please give an example. Otherwise, please explain?
3. There is a **Square** class that has an attribute **side** with integer as its data type. There will be an error when we run this code, why?

   ```
   Square[] squareArray = new Square[100];
   squareArray[5].side = 20;
   ```

4. Modify the code on practicum 1.3 so that the length of the array will be defined from user input
5. Can we duplicate the instantiation process in array of objects? For example, we assign the object in **ppArray[i]** and **ppArray[0]**, the instantiation process of **ppArray[0]** will be done twice. What's the effect of this?

1.4 Mathematical operation in array of object's attribute

1.4.1 Steps

```
package ArrayBlock;

public class Blocks {
    public int width, length, height;

    public Blocks(int p, int l, int t) {
        length = p;
        width = l;
        height = t;
    }

    public int countVolume() {
        return length * width * height;
    }
}
```

```
package ArrayBlock;

public class ArrayBlocks {
    public static void main(String[] args) {
        Blocks[] blArray = new Blocks[3];

        blArray[0] = new Blocks(100, 30, 12);
        blArray[1] = new Blocks(128, 40, 15);
        blArray[2] = new Blocks(210, 50, 25);

        for (int i = 0; i < 3; i++) {
            System.out.println("Volume blocks - " + i + " : " +
            ↪  blArray[i].countVolume());
        }
    }
}
```

1.4.2 Result

```
"C:\Program Files\Java\jdk-18.0.2.1\bin\java.exe" -
↪ javaagent:C:\Users\ASUS\AppData\Local\JetBrains\Toolbox\apps\
↪ IDEA-C\ch-0\223.8617.56\lib\idea_rt.jar=53329:C:\Users\ASUS\
↪ AppData\Local\JetBrains\Toolbox\apps\IDEA-C\ch-0\223.8617.56\bin
↪ -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8
↪ -Dsun.stderr.encoding=UTF-8 -classpath "D:\Kuliah Smt 2\Algoritma
↪ dan Struktur Data\Praktikum Week
↪ 3\codes\ArrayOfObjects\target\classes" ArrayOfBlock.ArrayOfBlock
Volume blocks - 0 : 36000
Volume blocks - 1 : 76800
Volume blocks - 2 : 262500

Process finished with exit code 0

```

1.4.3 Questions

1. Can we have more than one constructor in one class? Please explain
2. Create a **Triangle** class as follows

   ```
   public class Triangle{
       public int base;
       public int height;
   }
   ```

   Add another constructor in this class that has parameter **int a, int t**. These represents its base and height.
3. Add method **countArea()** and **countPerimeter()** in class **Triangle**
4. In main function, instantiate array of **Triangle** objects. Assign the attributes values as follows:
   0^{th} `trArray` base: 10, height: 4
   1^{st} `trArray` base: 20, height: 10
   2^{nd} `trArray` base: 15, height: 6
   3^{rd} `trArray` base: 25, height: 10
5. Display the result of area and perimeter for each triangle by calling the method **countArea()** and **countPerimeter()**

1.5 Practice

1. Create a program that can count surface area and volume of some 3D Geometry object (Cube, blocks, cylinder, etc). Then, create one more class to instantiate the array of objects with its constructor to assign values of its attributes.

   Note: Create loop to get user input and assign it to the attributes of the objects, then display the surface area and volume of each 3rd geometry object in console

2. A company that handles land transaction needs a program to calculate land area. This program must receive user input to assign values of these:

   - How many lands?
   - Length and width of the land

   This program calculates the area of inputted land information as its output. Check this following program:

   ```
   How many lands: 3

   Land 1
   Length: 100
   Width : 40

   Land 2
   Length: 250
   Width : 100

   Land 3
   Length: 120
   Width : 100

   Land Area 1: 4000
   Land Area 2: 25000
   Land Area 3: 12000
   ```

3. Modify the program above so that it can display the widest area. (Additional note: create a different function to get the widest area)

   ```
   Land 1
   Length: 100
   ```

```
Width : 40

Land 2
Length: 250
Width : 100

Land 3
Length: 120
Width : 100

Land Area 1: 4000
Land Area 2: 25000
Land Area 3: 12000

The widest land is Land 2
```

4. A university needs a program to display student's information such as name, nim, gender, and GPA. This program should be able to receive input from all of those informations and display it to the user. Implement the program if there is 3 data sample, here is a reference of how you do it:

   Insert 1st student data
   Insert name :Rina
   Insert nim :1234567
   Insert gender :P
   Insert IPK :3.5

   Insert 2nd student data
   Insert name :Rio
   Insert nim :7654321
   Insert gender:L
   Insert IPK :4.0

   Insert 3rd student data
   Insert name :Reza
   Insert nim :8765398
   Insert gender:L
   Insert IPK :3.8

   ```
   Result
   ```

1st student data
name :Rina
nim :1234567
gender :P
IPK :3.5

2nd student data
name :Rio
nim :7654321
gender:L
IPK :4.0

3rd student data
name :Reza
nim :8765398
gender:L
IPK :3.8

5. Modify the program above so that it can receive the average of IPK score from all students.
   (Note: create a new function to calculate the average of IPK Score in class **Students**)

   Insert 1st student data
   Insert name :Rina
   Insert nim :1234567
   Insert gender :P
   Insert IPK :3.5

   Insert 2nd student data
   Insert name :Rio
   Insert nim :7654321
   Insert gender:L
   Insert IPK :4.0

   Insert 3rd student data
   Insert name :Reza
   Insert nim :8765398
   Insert gender:L
   Insert IPK :3.8

`Result`

1st student data
name :Rina
nim :1234567
gender :P
IPK :3.5

2nd student data
name :Rio
nim :7654321
gender:L
IPK :4.0

3rd student data
name :Reza
nim :8765398
gender:L
IPK :3.8

Avergae IPK of all students : 3.7666667