JOBSHEET III
ARRAY OF
OBJECTS

From:

AL AZHAR RIZQI RIFA'I FIRDAUS

Class:

1 I

Absence:

01

Major:

Information Technology

Study Program:

Informatic Engineering

1.1 Learning Objective

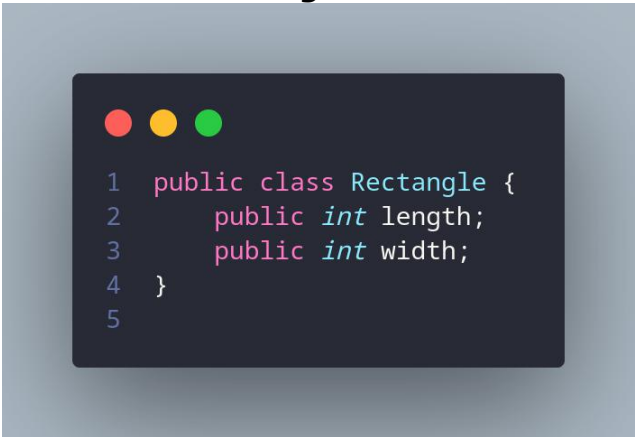At the end of this session, students will be able to:

1. Understand and explain the use of Array of Objects
2. Understand the logic of why we use Array of Objects in Java
3. Implement Array of Object in Java

1.2 Create, insert, and display Array of Object

In this session, we will have a practice of creating array of object, insert the data, and display it

1.2.1 Steps

1. Create a new project with name ArrayOfObjects. Create the package with name 'week3'
2. Create a **Rectangle** class:

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

3. In main method in ArrayOfObjects class, create an array **Rectangle** and its length is 3

```java
public class ArrayOfObject {
    public static void main(String[] args) throws Exception {
        Rectangle [] rectangleArray = new Rectangle[3];
    }
}
```

4. Then insert values for each the object's attributes

```java
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;
```

5. Print all the attributes object from ppArray as follows

```java
System.out.println("First rectangle, width : " + rectangleArray[0].width + ", length : " + rectangleArray[0].length);
System.out.println("Seccond rectangle, width : " + rectangleArray[1].width + ", length : " + rectangleArray[1].length);
System.out.println("Third rectangle, width : " + rectangleArray[2].width + ", length : " + rectangleArray[2].length);
```

1.2.2 Result

Compile the code and see the result if it matches with following image.

```
┌─(zharsuke⊛asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└─$  /usr/bin/env /usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessages -cp /home/zharsuke/.config/
Code/User/workspaceStorage/43a06fa6fd5424dbb371669428440c56/redhat.java/jdt_ws/coding_ae5a711a/bin ArrayOfObject
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
First rectangle, width : 30, length : 110
Seccond rectangle, width : 40, length : 80
Third rectangle, width : 20, length : 100

┌─(zharsuke⊛asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└─$
```

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

   Yes, if you want to use a class as an array of objects, the class should have both attributes and methods.

2. Does class **Rectangle** have constructor? If not, why we instantiate the object as follows?

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

   because if we used constructor, we usually must instantiate with parameter.

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

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

   this line of code instantiate an array of object that have 3 length.

4. What's the meaning of these lines of code?

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

   this line of code instantiate index 1 of the array, then sets the length and width properties of this object to 80 and 40.

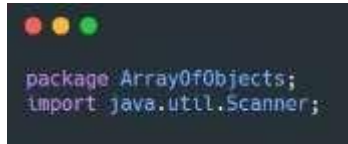5. Why **ArrayOfObject** class and **Rectangle** class should be differentiated?

   because both have difference functionality, the function of ArrayOfObject is to create main class, then the function of rectangle class is to store properties of rectangle.

1.3 Get input in Array of Objects using Loops

In this practicum we will update the program result in 1.2 so that the program could receive user inputs and use loops to assign values of each attributes of rectangles in ppArray
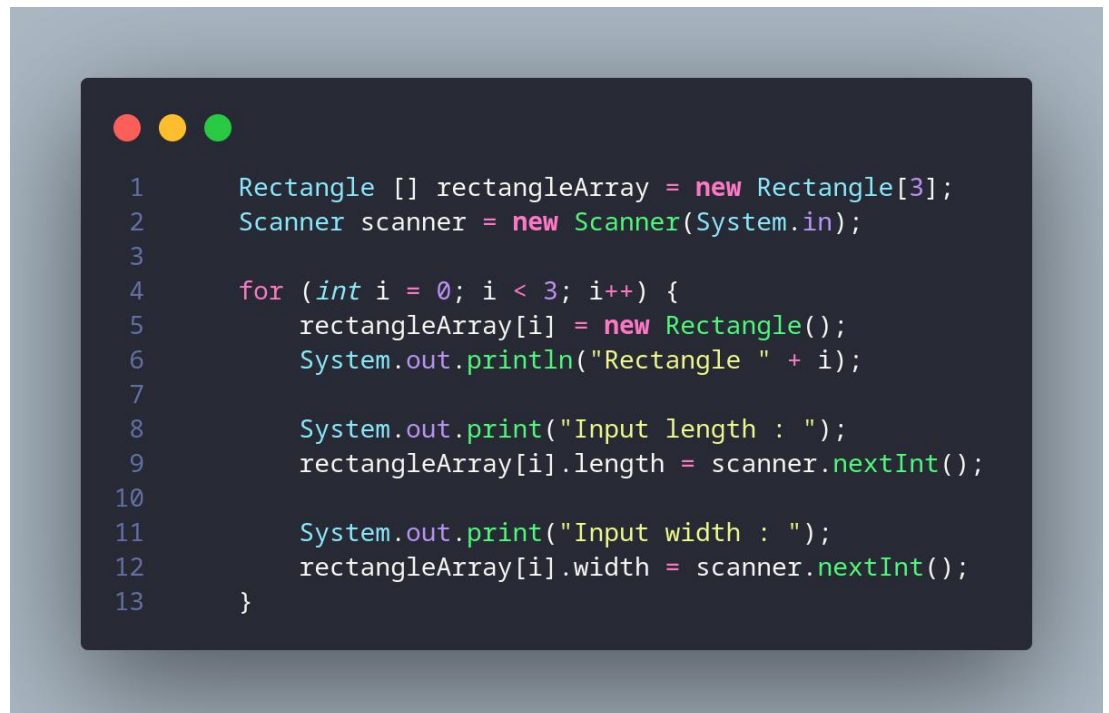
1.3.1 Steps

1. Import scanner in **ArrayOfObjects** class below the package declaration.
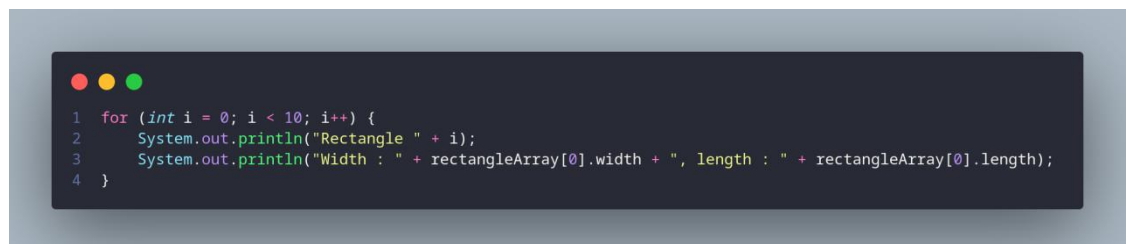
```
package ArrayOfObjects;
import java.util.Scanner;
```

2. In practicum 1.2 in 4th steps. Change the code as follows, this allows the Scanner object to be included in loops to receive input and assign user input values to the attributes.

```java
Rectangle [] rectangleArray = new Rectangle[3];
Scanner scanner = new Scanner(System.in);

for (int i = 0; i < 3; i++) {
    rectangleArray[i] = new Rectangle();
    System.out.println("Rectangle " + i);

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

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

3. In practicum 1.2 in 5th steps. Change the code as follows. This time, we will use loop to access the element of **ppArray** and print it on the console

```java
for (int i = 0; i < 10; i++) {
    System.out.println("Rectangle " + i);
    System.out.println("Width : " + rectangleArray[0].width + ", length : " + rectangleArray[0].length);
}
```

4. See the result

1.3.2 Result

Run the program and see if it matches with following result:

```
┌──(zharsuke㉿asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└─$ cd /home/zharsuke/Documents/College/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/c
:+ShowCodeDetailsInExceptionMessages -cp /home/zharsuke/.config/Code/User/workspaceStorage/43a06fa6
yOfObject
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Rectangle 0
Input length : 9
Input width : 8
Rectangle 1
Input length : 7
Input width : 6
Rectangle 2
Input length : 5
Input width : 4
Rectangle 0
Width : 8, length : 9
Rectangle 1
Width : 8, length : 9
Rectangle 2
Width : 8, length : 9
Rectangle 3
Width : 8, length : 9
Rectangle 4
Width : 8, length : 9
Rectangle 5
Width : 8, length : 9
Rectangle 6
Width : 8, length : 9
Rectangle 7
Width : 8, length : 9
Rectangle 8
Width : 8, length : 9
Rectangle 9
Width : 8, length : 9
```

1.3.3 Questions

1. Does array of object can be implemented on 2D array?

   yes.

2. If yes, then please give an example. Otherwise, please explain?

   An array of objects can be implemented in a 2D array because a 2D array is simply an array of arrays. Each element of the 2D array can be an object, including an array of objects.

   Example:

```
1   public class Main {
2       public static void main(String[] args) {
3           Person[][] people = new Person[2][2];
4           people[0][0] = new Person("John", 30);
5           people[0][1] = new Person("Jane", 25);
6           people[1][0] = new Person("Bob", 40);
7           people[1][1] = new Person("Alice", 35);
8
9           // Accessing an element
10          System.out.println(people[0][1].name); // Output: Jane
11      }
12  }
```

```
1   public class Person {
2       String name;
3       int age;
4
5       public Person(String name, int age) {
6           this.name = name;
7           this.age = age;
8       }
9   }
```

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;
```

There will be an error when running this code because the squareArray[5] element is not initialized before accessing its side attribute.

4. Modify the code on practicum 1.3 so that the length of the array will be defined from user input

Code:

```java
import java.util.Scanner;

public class ArrayOfObject {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Insert amount of rectangle : ");
        int amount = scanner.nextInt();
        Rectangle [] rectangleArray = new Rectangle[amount];

        for (int i = 0; i < rectangleArray.length; i++) {
            rectangleArray[i] = new Rectangle();
            System.out.println("Rectangle " + i);

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

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

        for (int i = 0; i < rectangleArray.length; i++) {
            System.out.println("Rectangle " + i);
            System.out.println("Width : " + rectangleArray[i].width + ", length : " + rectangleArray[i].length);
        }

    }
}
```

Result:

```
┌─(zharsuke asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└─$  /usr/bin/env /usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessag
Code/User/workspaceStorage/43a06fa6fd5424dbb371669428440c56/redhat.java/jdt_ws/coding_ae5a711a/bin
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of rectangle : 2
Rectangle 0
Input length : 9
Input width : 8
Rectangle 1
Input length : 7
Input width : 6
Rectangle 0
Width : 8, length : 9
Rectangle 1
Width : 6, length : 7
```

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?

If you duplicate the instantiation process of an object in an array, such as assigning an object to both ppArray[i] and ppArray[0], then the effect will depend on the specifics of the code and the class being instantiated.

1.4 Mathematical operation in array of object's attribute

1.4.1 Steps

1. Create a new package called **ArrayBlock**
2. Create a class named **Blocks**

```java
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;
    }
}
```

3. In **main** function in **ArrayBlock,** instantiate array of **Blocks** that has size of 3

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

4. Then add these following codes to insert the value of **blArray** using its constructor

```java
blArray[0] = new Blocks(100, 30, 12);
blArray[1] = new Blocks(120, 40, 15);
blArray[2] = new Blocks(210, 50, 25);
```

5. Display the volume of all blocks by calling the method countVolume() in loop as follows.

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

6. Run and observe the result

1.4.2 Result

Run the program and see if it matches with following result:

```
run:
Volume blocks - 0 : 36000
Volume blocks - 1 : 72000
Volume blocks - 2 : 262500
BUILD SUCCESSFUL (total time: 0 seconds)
```
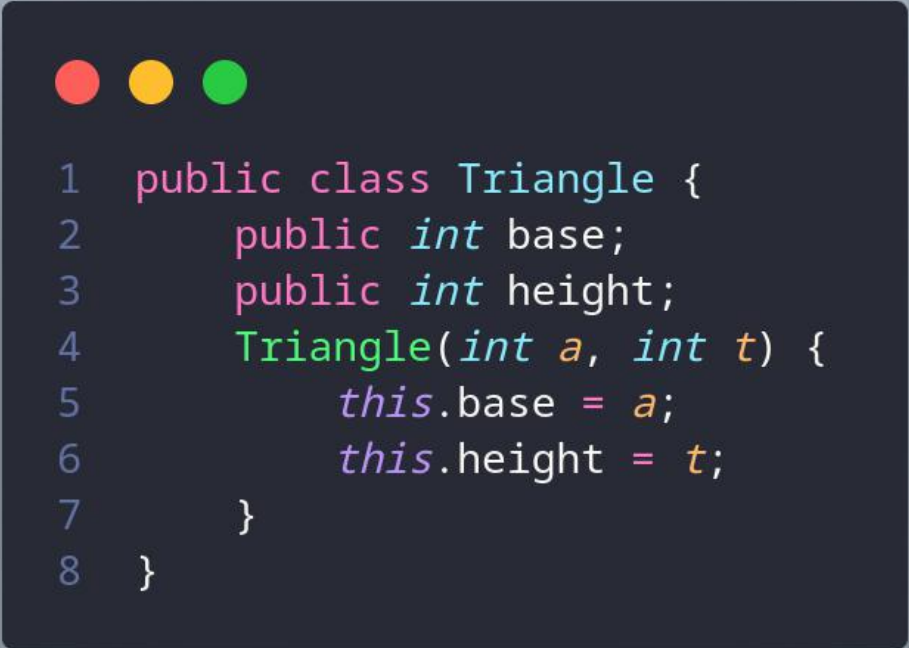
1.4.3 Questions

1. Can we have more than one constructor in one class? Please explain

   Yes, you can have more than one constructor in a class in most object-oriented programming languages. A constructor is a special method that gets called when you create a new object of a class. It initializes the object's state and sets up any necessary resources.

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 representsits base and height.

```
1  public class Triangle {
2      public int base;
3      public int height;
4      Triangle(int a, int t) {
5          this.base = a;
6          this.height = t;
7      }
8  }
```

3. Add method **countArea()** and **countPerimeter()** in class **Triangle**

```
1   static int countArea(int a, int t) {
2       double result = 0.5 * a * t;
3       int resultInt = (int) result;
4       return resultInt;
5   }
6
7   static int countPerimeter(int a, int t) {
8       double result = a + t + Math.sqrt(a * a + t * t);
9       int resultInt = (int) result;
10      return resultInt;
11  }
```

4. In main function, instantiate array of **Triangle** objects. Assign the attributes values as follows:

   0th trArray   base: 10, height: 4

   1st trArray   base: 20, height: 10

   2nd trArray   base: 15, height: 6

   3rd trArray   base: 25, height: 10

```
1   Triangle [] trArray = new Triangle[4];
2   trArray[0] = new Triangle(10, 4);
3   trArray[1] = new Triangle(20, 10);
4   trArray[2] = new Triangle(15, 6);
5   trArray[3] = new Triangle(25, 10);
```

5. Display the result of area and perimeter for each triangle by calling the method **countArea()** and **countPerimeter()**
Code:

```
 1  public class App {
 2      public static void main(String[] args) throws Exception {
 3          Triangle [] trArray = new Triangle[4];
 4          trArray[0] = new Triangle(10, 4);
 5          trArray[1] = new Triangle(20, 10);
 6          trArray[2] = new Triangle(15, 6);
 7          trArray[3] = new Triangle(25, 10);
 8
 9          for (int i = 0; i < 4; i++) {
10              System.out.println(i + "th trArray base : " + trArray[i].base + ", height : " + trArray[i].height);
11          }
12          System.out.println();
13          for (int i = 0; i < trArray.length; i++) {
14              System.out.println(i + "th trArray area : " + trArray[i].countArea(trArray[i].base, trArray[i].height) +
15              ", perimeter : " + trArray[i].countPerimeter(trArray[i].base, trArray[i].height));
16          }
17      }
18  }
19
```

Result:

```
(zharsuke⊛asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└$  /usr/bin/env /usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessag
Code/User/workspaceStorage/43a06fa6fd5424dbb371669428440c56/redhat.java/jdt_ws/coding_ae5a711a/bin
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
0th trArray base : 10, height : 4
1th trArray base : 20, height : 10
2th trArray base : 15, height : 6
3th trArray base : 25, height : 10

0th trArray area : 20, perimeter : 24
1th trArray area : 100, perimeter : 52
2th trArray area : 45, perimeter : 37
3th trArray area : 125, perimeter : 61

(zharsuke⊛asus-vivobook)-[~/…/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding]
└$
```

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
   Code:

```java
import java.util.*;

public class App {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Insert amount of 3d geometry : ");
        int amount = scanner.nextInt();
        Cube [] cubes = new Cube[amount];
        Blocks [] blocks = new Blocks[amount];
        Cylinder [] cylinders = new Cylinder[amount];

        for (int i = 0; i < amount; i++) {
            System.out.print("Insert side of cube : ");
            double side = scanner.nextDouble();
            cubes[i] = new Cube(side);
            System.out.print("Insert length of blocks : ");
            double length = scanner.nextDouble();
            System.out.print("Insert width of blocks : ");
            double width = scanner.nextDouble();
            System.out.print("Insert height of blocks : ");
            double heightBlocks = scanner.nextDouble();
            blocks[i] = new Blocks(length, width, heightBlocks);
            System.out.print("Insert radius of cylinder : ");
            double radius = scanner.nextDouble();
            System.out.print("Insert height of cylinder : ");
            double heightCylinders = scanner.nextDouble();
            cylinders[i] = new Cylinder(radius, heightCylinders);
        }
        System.out.println();

        for (int i = 0; i < amount; i++) {
            cubes[i].display();
            blocks[i].display();
            cylinders[i].display();
            System.out.println();
        }
    }
}
```

```java
public class Blocks {
    public double length, width, height;
    Blocks(double length, double width, double height) {
        this.length = length;
        this.width = width;
        this.height = height;
    }
    public double calculateVolume() {
        return length * width * height;
    }
    public double calculateSurfaceArea() {
        return 2 * (length * width + length * height + width * height);
    }
    public void display() {
        System.out.println("Volume of blocks = " + calculateVolume());
        System.out.println("Surface area of blocks = " + calculateSurfaceArea());
    }
}
```

```java
public class Cube {
    public double side;
    Cube(double side) {
        this.side = side;
    }
    public double calculateVolume() {
        return side * side * side;
    }
    public double calculateSurfaceArea() {
        return 6 * side * side;
    }
    public void display() {
        System.out.println("Volume of cube = " + calculateVolume());
        System.out.println("Surface area of cube = " + calculateSurfaceArea());
    }
}
```

```
1  public class Cylinder {
2      public double radius, height;
3      Cylinder(double radius, double height) {
4          this.radius = radius;
5          this.height = height;
6      }
7      public double calculateVolume() {
8          return 3.14 * radius * radius * height;
9      }
10      public double calculateSurfaceArea() {
11          return 2 * 3.14 * radius * height + 2 * 3.14 * radius * radius;
12      }
13      public void display() {
14          System.out.println("Volume of cylinder = " + calculateVolume());
15          System.out.println("Surface area of cylinder = " + calculateSurfaceArea());
16      }
17  }
18
```

Result:

```
┌─(zharsuke asus-vivobook)-[~/…/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice1]
└$  cd /home/zharsuke/Documents/College/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3
/usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessages -cp /home/zha
Practicum/Meet_3/coding/pratice1/bin App
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of 3d geometry : 2
Insert side of cube : 9
Insert length of blocks : 8
Insert width of blocks : 7
Insert height of blocks : 6
Insert radius of cylinder : 5
Insert height of cylinder : 4
Insert side of cube : 3
Insert length of blocks : 2
Insert width of blocks : 1
Insert height of blocks : 9
Insert radius of cylinder : 8
Insert height of cylinder : 7

Volume of cube = 729.0
Surface area of cube = 486.0
Volume of blocks = 336.0
Surface area of blocks = 292.0
Volume of cylinder = 314.0
Surface area of cylinder = 282.6


Volume of cube = 27.0
Surface area of cube = 54.0
Volume of blocks = 18.0
Surface area of blocks = 58.0
Volume of cylinder = 1406.72
Surface area of cylinder = 753.6
```

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

Code:

```java
import java.util.*;;

public class App {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        int amount, length, width;
        System.out.print("Insert amount of land : ");
        amount = scanner.nextInt();
        Land [] lands = new Land[amount];

        for (int i = 0; i < amount; i++) {
            System.out.printf("Insert length of %d land : ", (i+1));
            length = scanner.nextInt();
            System.out.printf("Insert width of %d land : ", (i+1));
            width = scanner.nextInt();
            lands[i] = new Land(length, width);
        }
        System.out.println();

        for (int i = 0; i < amount; i++) {
            System.out.println((i+1) + " Land area = " + lands[i].calculateArea());
        }
    }
}
```

```java
1   public class Land {
2       public int length, width;
3       public Land(int length, int width) {
4           this.length = length;
5           this.width = width;
6       }
7       public int calculateArea() {
8           return length * width;
9       }
10  }
11
```

Result:

```
┌─(zharsuke⊗asus-vivobook)-[~/…/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice2]
└$  /usr/bin/env /usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMes
s/College/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice2/bin App
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of land : 3
Insert length of 1 land : 99
Insert width of 1 land : 88
Insert length of 2 land : 77
Insert width of 2 land : 66
Insert length of 3 land : 55
Insert width of 3 land : 44

1 Land area = 8712
2 Land area = 5082
3 Land area = 2420
```

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

Code:

```java
import java.util.*;;

public class App {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        int amount, length, width;
        System.out.print("Insert amount of land : ");
        amount = scanner.nextInt();
        Land [] lands = new Land[amount];

        for (int i = 0; i < amount; i++) {
            System.out.printf("Insert length of %d land : ", (i+1));
            length = scanner.nextInt();
            System.out.printf("Insert width of %d land : ", (i+1));
            width = scanner.nextInt();
            lands[i] = new Land(length, width);
        }
        System.out.println();

        for (int i = 0; i < amount; i++) {
            System.out.println((i+1) + " Land area = " + lands[i].calculateArea());
        }
        System.out.println();

        int max = lands[0].calculateArea();
        int idMax = 0;
        for (int i = 0; i < amount; i++) {
            if (lands[i].calculateArea() > max) {
                max = lands[i].calculateArea();
                idMax = i;
            }
        }
        System.out.println("The widest land is Land " + (idMax+1));
        System.out.println("Widest land = " + max);

    }
}
```

Result:

```
┌──(zharsuke⊛asus-vivobook)-[~/…/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice2]
└─$ cd /home/zharsuke/Documents/College/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3
/usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessages -cp /home/zha
_2/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice2/bin App
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of land : 3
Insert length of 1 land : 19
Insert width of 1 land : 29
Insert length of 2 land : 38
Insert width of 2 land : 48
Insert length of 3 land : 57
Insert width of 3 land : 66

1 Land area = 551
2 Land area = 1824
3 Land area = 3762

The widest land is Land 3
Widest land = 3762
```

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 dataInsert
name :Rina Insert
nim :1234567 Insert gender :P
Insert IPK :3.5

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

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

Result:

1st Student Data
name : Rina
nim : 1234567
gender: P
IPK score: 3.5

2nd Student Data
name : Rio
nim : 7654321
gender: L
IPK score: 4.0 3rd

student Data

name : Reza nim :
8765398
gender: L
IPK score: 3.8

Code:

```java
public class Student {
    public String name, nim, gender;
    public double ipk;
    Student(String name, String nim, String gender, double ipk) {
        this.name = name;
        this.nim = nim;
        this.gender = gender;
        this.ipk = ipk;
    }
}
```

```java
import java.util.*;

public class App {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        int amount;
        double ipk;
        String name, nim, gender;
        System.out.print("Insert amount of students : ");
        amount = scanner.nextInt();
        Student [] students = new Student[amount];
        for (int i = 0; i < amount; i++) {
            System.out.printf("Insert %d student\n", (i+1));
            System.out.print("Name : ");
            name = scanner.next();
            System.out.print("Nim : ");
            nim = scanner.next();
            System.out.print("Gender : ");
            gender = scanner.next();
            System.out.print("Ipk : ");
            ipk = scanner.nextDouble();
            students[i] = new Student(name, nim, gender, ipk);
            System.out.println();
        }
        System.out.println();
        for (int i = 0; i < amount; i++) {
            System.out.println((i+1) + " Student data");
            System.out.println("Name = " + students[i].name);
            System.out.println("Nim = " + students[i].nim);
            System.out.println("Gender = " + students[i].gender);
            System.out.println("Ipk = " + students[i].ipk);
            System.out.println();
        }
    }
}
```

Result:

```
┌──(zharsuke㉿asus-vivobook)-[~/…/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice3]
└─$  /usr/bin/env /usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessa
ure_and_Algorithm_Practicum/Meet_3/coding/pratice3/bin App
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of students : 2
Insert 1 student
Name : Azhar
Nim : 2241720263
Gender : L
Ipk : 4

Insert 2 student
Name : Ilham
Nim : 832742643
Gender : L
Ipk : 3.5


1 Student data
Name = Azhar
Nim = 2241720263
Gender = L
Ipk = 4.0

2 Student data
Name = Ilham
Nim = 832742643
Gender = L
Ipk = 3.5
```

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 dataInsert
name :Rina Insert
nim :1234567 Insert gender :P
Insert IPK :3.5

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

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

Result:

1st Student Data
name : Rina
nim : 1234567
gender: P
IPK score: 3.5

2nd Student Data
name : Rio
nim : 7654321
gender: L
IPK score: 4.0

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

Average IPK of all students : 3.7666667

Code:

```java
public class Student {
    public String name, nim, gender;
    public double ipk;
    Student(String name, String nim, String gender, double ipk) {
        this.name = name;
        this.nim = nim;
        this.gender = gender;
        this.ipk = ipk;
    }
}
```

```java
import java.util.*;

public class App {
    public static void main(String[] args) throws Exception {
        Scanner scanner = new Scanner(System.in);
        int amount;
        double ipk, totalIpk = 0;
        String name, nim, gender;
        System.out.print("Insert amount of students : ");
        amount = scanner.nextInt();
        Student [] students = new Student[amount];
        for (int i = 0; i < amount; i++) {
            System.out.printf("Insert %d student\n", (i+1));
            System.out.print("Name : ");
            name = scanner.next();
            System.out.print("Nim : ");
            nim = scanner.next();
            System.out.print("Gender : ");
            gender = scanner.next();
            System.out.print("Ipk : ");
            ipk = scanner.nextDouble();
            students[i] = new Student(name, nim, gender, ipk);
            totalIpk += ipk;
            System.out.println();
        }
        System.out.println();
        for (int i = 0; i < amount; i++) {
            System.out.println((i+1) + " Student data");
            System.out.println("Name = " + students[i].name);
            System.out.println("Nim = " + students[i].nim);
            System.out.println("Gender = " + students[i].gender);
            System.out.println("Ipk = " + students[i].ipk);
            System.out.println();
        }
        System.out.println();
        double avg = totalIpk / amount;
        System.out.println("Average Ipk of all students = " + avg);
    }
}
```

Result:

```
┌──(zharsuke⊛asus-vivobook)-[~/…/Data_Structure_and_Algorithm_Practicum/Meet_3/coding/pratice3]
└─$  cd /home/zharsuke/Documents/College/Semester_2/Data_Structure_and_Algorithm_Practicum/Meet_3/
/usr/lib/jvm/java-17-openjdk-amd64/bin/java -XX:+ShowCodeDetailsInExceptionMessages -cp /home/zhar
Practicum/Meet_3/coding/pratice3/bin App
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Insert amount of students : 2
Insert 1 student
Name : Azhar
Nim : 2241720263
Gender : L
Ipk : 4

Insert 2 student
Name : Ilham
Nim : 738426534
Gender : L
Ipk : 3


1 Student data
Name = Azhar
Nim = 2241720263
Gender = L
Ipk = 4.0

2 Student data
Name = Ilham
Nim = 738426534
Gender = L
Ipk = 3.0


Average Ipk of all students = 3.5
```