Week 1 | Assignment 2 | Core Java | By: Sejal Aggarwal

Q1.

Given:

```
public class TaxUtil {
  double rate = 0.15;

  public double calculateTax(double amount) {
     return amount * rate;
  }
}
```

a) Would you consider the method calculateTax() a 'pure function'? Why or why not?
b) If you claim the method is NOT a pure function, please suggest a way to make it pure.

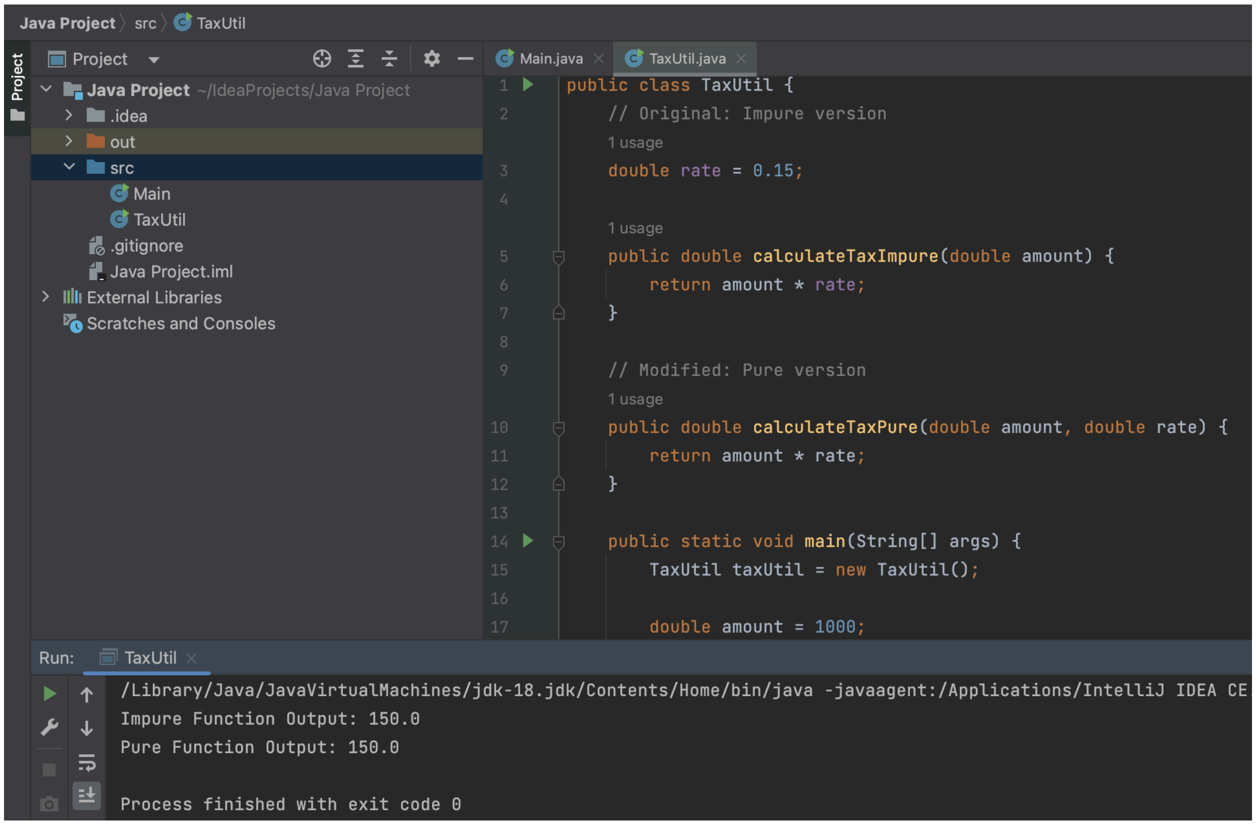
Ans 1.

a) No, method calculateTax() is not a pure function because it depends on the instance variable rate, which is external to the method and can change, breaking the pure function rules.

b) Way to make the method calculateTax() pure is as follows:
   - Make rate a local variable or pass it as a parameter.

   Code - Modified: Pure version
```
public class TaxUtil {
  public double calculateTax(double amount, double rate) {
     return amount * rate;
  }
}
```

O/p



```java
public class TaxUtil {
    // Original: Impure version
    1 usage
    double rate = 0.15;

    1 usage
    public double calculateTaxImpure(double amount) {
        return amount * rate;
    }

    // Modified: Pure version
    1 usage
    public double calculateTaxPure(double amount, double rate) {
        return amount * rate;
    }

    public static void main(String[] args) {
        TaxUtil taxUtil = new TaxUtil();

        double amount = 1000;
```

```
/Library/Java/JavaVirtualMachines/jdk-18.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA CE
Impure Function Output: 150.0
Pure Function Output: 150.0

Process finished with exit code 0
```

Q2.

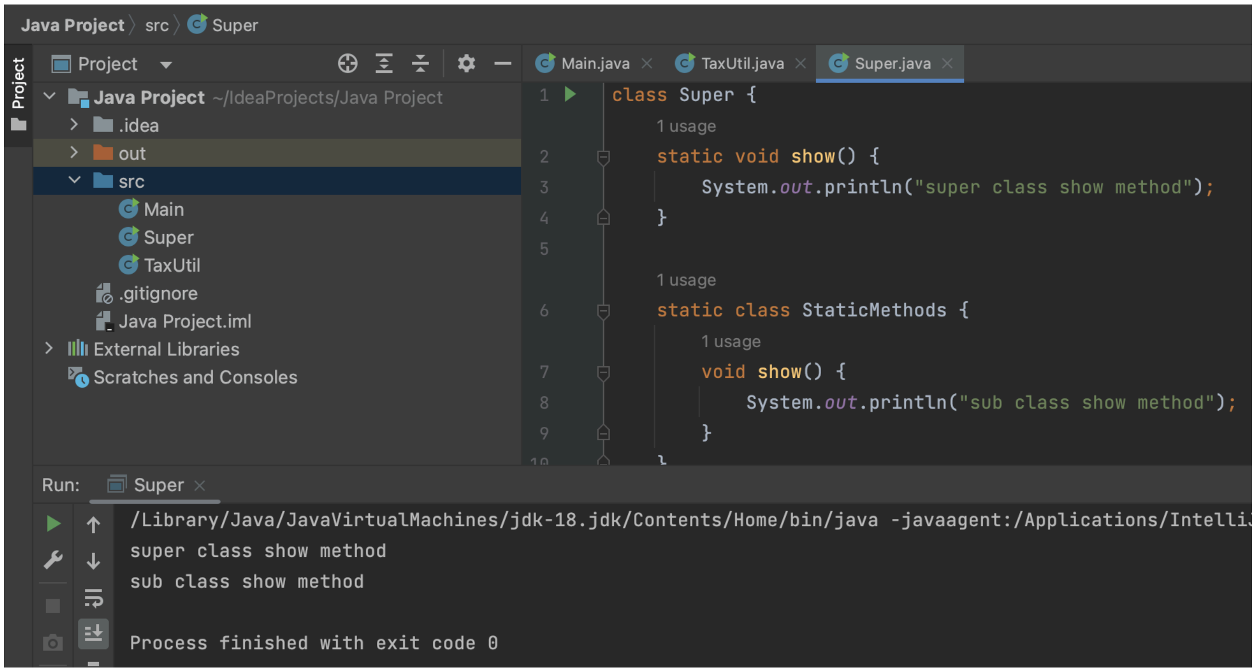
What will be the output for the following code?

```
class Super
{
static void show()
{
System.out.println("super class show method");
}
static class StaticMethods
{
void show()
{
System.out.println("sub class show method");
}
}
public static void main(String[]args)
{
Super.show();
new Super.StaticMethods().show();
}
```

}

Ans 2.

O/p



Java Project 〉 src 〉 Super

```java
class Super {
    static void show() {
        System.out.println("super class show method");
    }

    static class StaticMethods {
        void show() {
            System.out.println("sub class show method");
        }
    }
```

```
/Library/Java/JavaVirtualMachines/jdk-18.jdk/Contents/Home/bin/java -javaagent:/Applications/Intelli
super class show method
sub class show method

Process finished with exit code 0
```

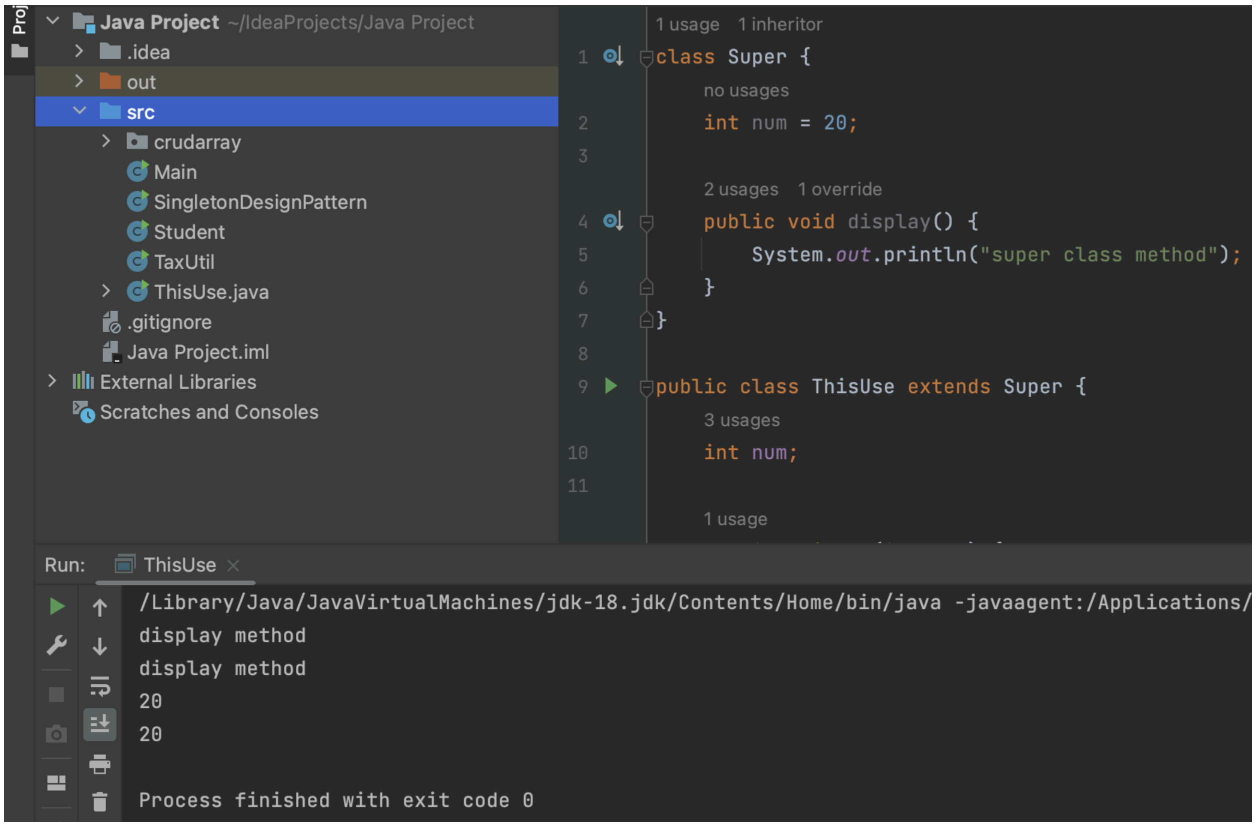
Q3.

```
class Super
{
int num=20;
public void display()
{
System.out.println("super class method");
}
}
public class ThisUse extends Super
{
int num;
public ThisUse(int num)
{
this.num=num;
}
public void display()
{
```

System.out.println("display method");
}
public void Show()
{
this.display();
display();
System.out.println(this.num);
System.out.println(num);
}
public static void main(String[]args)
{
ThisUse o=new ThisUse(10);
o.show();
}
}

Ans 3.

O/p



```
1 usage   1 inheritor
class Super {
    no usages
    int num = 20;

    2 usages   1 override
    public void display() {
        System.out.println("super class method");
    }
}

public class ThisUse extends Super {
    3 usages
    int num;

    1 usage
```

```
/Library/Java/JavaVirtualMachines/jdk-18.jdk/Contents/Home/bin/java -javaagent:/Applications/
display method
display method
20
20

Process finished with exit code 0
```

Q4.

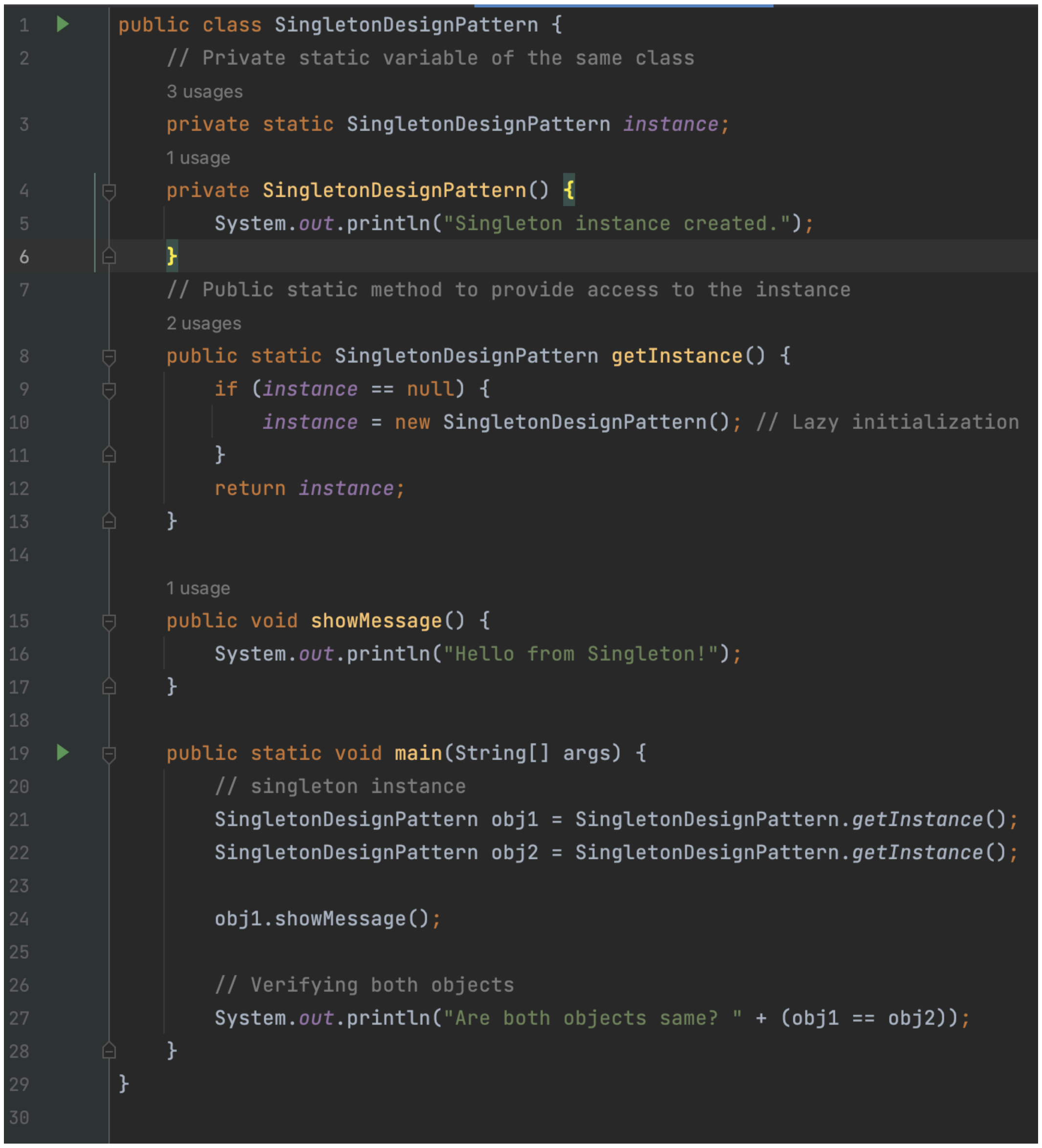
What is the singleton design pattern? Explain with a coding example.

Ans 4.

Singleton Design Pattern

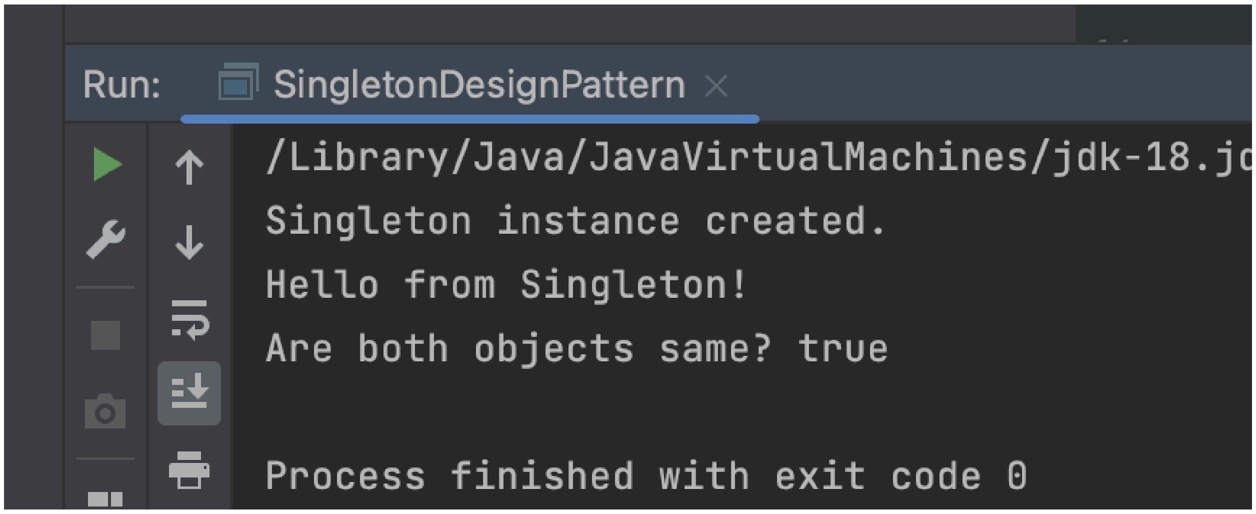
- The Singleton Design Pattern ensures that a class has only one instance and provides a global point of access to it.
- It is commonly used when exactly one object is needed to coordinate actions across a system.

Coding Example



```java
public class SingletonDesignPattern {
    // Private static variable of the same class
    3 usages
    private static SingletonDesignPattern instance;
    1 usage
    private SingletonDesignPattern() {
        System.out.println("Singleton instance created.");
    }
    // Public static method to provide access to the instance
    2 usages
    public static SingletonDesignPattern getInstance() {
        if (instance == null) {
            instance = new SingletonDesignPattern(); // Lazy initialization
        }
        return instance;
    }

    1 usage
    public void showMessage() {
        System.out.println("Hello from Singleton!");
    }

    public static void main(String[] args) {
        // singleton instance
        SingletonDesignPattern obj1 = SingletonDesignPattern.getInstance();
        SingletonDesignPattern obj2 = SingletonDesignPattern.getInstance();

        obj1.showMessage();

        // Verifying both objects
        System.out.println("Are both objects same? " + (obj1 == obj2));
    }
}
```

O/p



```
/Library/Java/JavaVirtualMachines/jdk-18.jc
Singleton instance created.
Hello from Singleton!
Are both objects same? true

Process finished with exit code 0
```

Q5. How do we make sure a class is encapsulated? Explain with a coding example.

Ans 5.

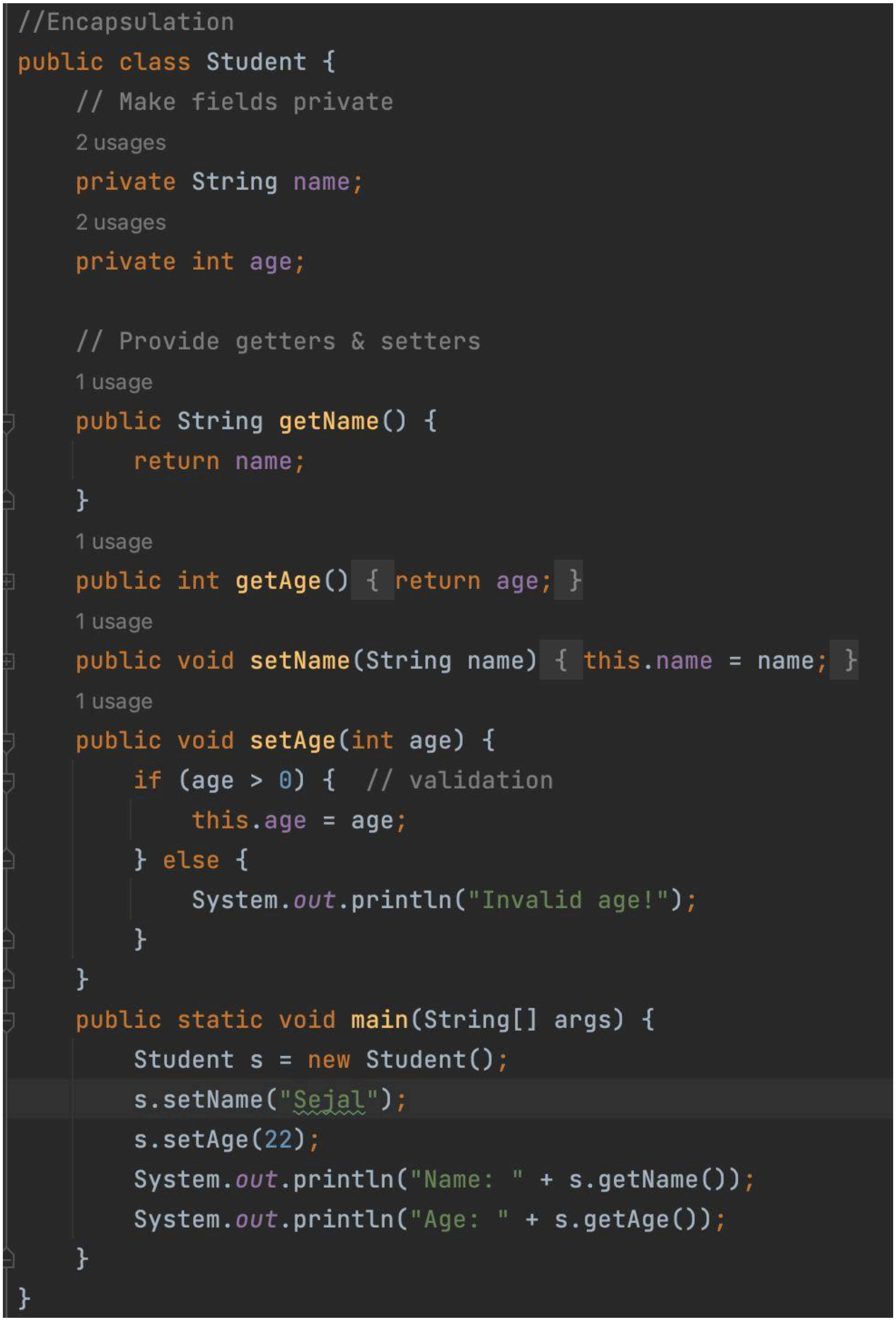
Encapsulation

- It is one of the fundamental principles of OOP (Object-Oriented Programming).
- It means hiding the internal details of an object and exposing only what's necessary using methods (getters/setters).
- It helps in data protection, control, and modularity.

Steps to ensure a class is encapsulated?

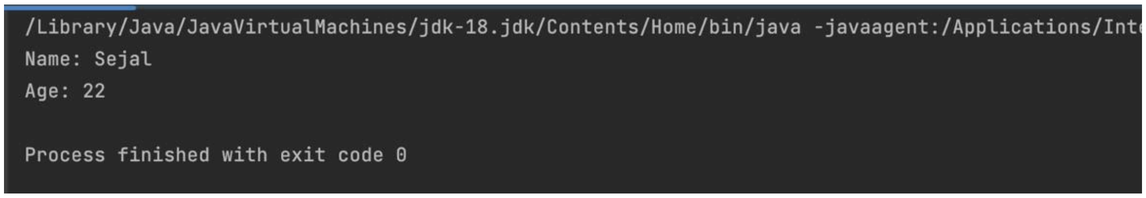
- Make all data members private (access modifier).
- Provide public getter and setter methods to access/update private fields.
- Optionally, add validation in setters to control changes.

Coding Example



```java
//Encapsulation
public class Student {
    // Make fields private
    2 usages
    private String name;
    2 usages
    private int age;

    // Provide getters & setters
    1 usage
    public String getName() {
        return name;
    }
    1 usage
    public int getAge() { return age; }
    1 usage
    public void setName(String name) { this.name = name; }
    1 usage
    public void setAge(int age) {
        if (age > 0) {  // validation
            this.age = age;
        } else {
            System.out.println("Invalid age!");
        }
    }
    public static void main(String[] args) {
        Student s = new Student();
        s.setName("Sejal");
        s.setAge(22);
        System.out.println("Name: " + s.getName());
        System.out.println("Age: " + s.getAge());
    }
}
```

O/p



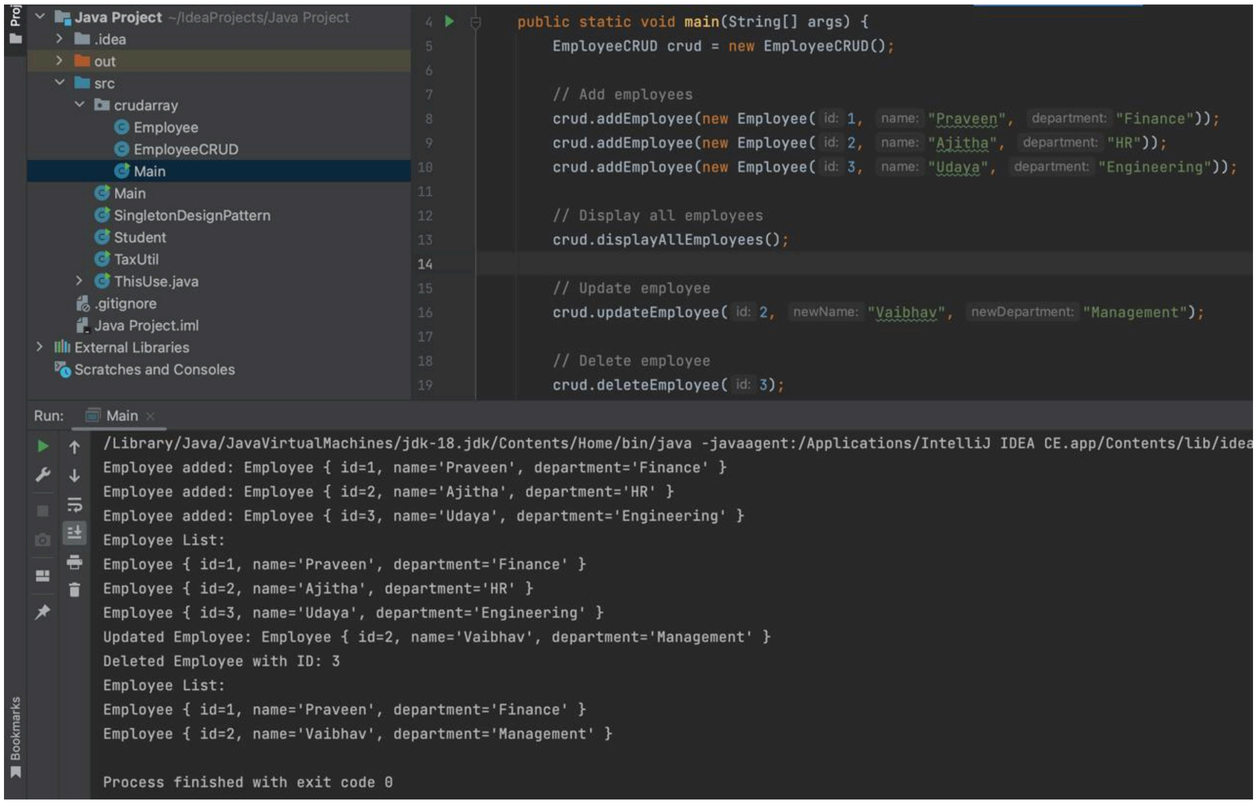
```
/Library/Java/JavaVirtualMachines/jdk-18.jdk/Contents/Home/bin/java -javaagent:/Applications/Inte
Name: Sejal
Age: 22

Process finished with exit code 0
```

Q6.

Perform CRUD operation using ArrayList collection in an EmployeeCRUD class for the below Employee

```
class Employee{
        private int id;
        private String name;
        private String department;
}
```

Ans 6.



```java
    public static void main(String[] args) {
        EmployeeCRUD crud = new EmployeeCRUD();

        // Add employees
        crud.addEmployee(new Employee( id: 1,  name: "Praveen",  department: "Finance"));
        crud.addEmployee(new Employee( id: 2,  name: "Ajitha",  department: "HR"));
        crud.addEmployee(new Employee( id: 3,  name: "Udaya",  department: "Engineering"));

        // Display all employees
        crud.displayAllEmployees();

        // Update employee
        crud.updateEmployee( id: 2,  newName: "Vaibhav",  newDepartment: "Management");

        // Delete employee
        crud.deleteEmployee( id: 3);
```

```
/Library/Java/JavaVirtualMachines/jdk-18.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA CE.app/Contents/lib/idea
Employee added: Employee { id=1, name='Praveen', department='Finance' }
Employee added: Employee { id=2, name='Ajitha', department='HR' }
Employee added: Employee { id=3, name='Udaya', department='Engineering' }
Employee List:
Employee { id=1, name='Praveen', department='Finance' }
Employee { id=2, name='Ajitha', department='HR' }
Employee { id=3, name='Udaya', department='Engineering' }
Updated Employee: Employee { id=2, name='Vaibhav', department='Management' }
Deleted Employee with ID: 3
Employee List:
Employee { id=1, name='Praveen', department='Finance' }
Employee { id=2, name='Vaibhav', department='Management' }

Process finished with exit code 0
```