Design Pattern Lab Manual

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Division: 1

Group: 1

Structural Design Pattern

Sr. No	Name
1	Adapter
2	Composite
3	Façade
4	Decorator
5	Flyweight

Adapter Structural Design Pattern

Example 1: AdvancedMedia Player

MediaPlayer.java

```java
public interface MediaPlayer {
    public void play(String audioType, String fileName);
}
```

AdvancedMediaPlayer.java

```java
public interface AdvancedMediaPlayer {
    public void playVlc(String fileName);
    public void playMp4(String fileName);
}
```

VlcPlayer.java

```java
public class VlcPlayer implements AdvancedMediaPlayer{
    @Override
    public void playVlc(String fileName) {
        System.out.println("Playing vlc file. Name: "+ fileName);
    }

    @Override
    public void playMp4(String fileName) {
        //do nothing
    }
}
```

Mp4Player.java

```java
public class Mp4Player implements AdvancedMediaPlayer{

    @Override
    public void playVlc(String fileName) {
        //do nothing
    }

    @Override
    public void playMp4(String fileName) {
        System.out.println("Playing mp4 file. Name: "+ fileName);
    }
}
```

MediaAdapter.java

```java
public class MediaAdapter implements MediaPlayer {

    AdvancedMediaPlayer advancedMusicPlayer;
    public MediaAdapter(String audioType){

        if(audioType.equalsIgnoreCase("vlc") ){
            advancedMusicPlayer = new VlcPlayer();

        }else if (audioType.equalsIgnoreCase("mp4")){
            advancedMusicPlayer = new Mp4Player();
        }
    }

    @Override
    public void play(String audioType, String fileName) {

        if(audioType.equalsIgnoreCase("vlc")){
            advancedMusicPlayer.playVlc(fileName);
        }
        else if(audioType.equalsIgnoreCase("mp4")){
            advancedMusicPlayer.playMp4(fileName);
        }
    }
}
```

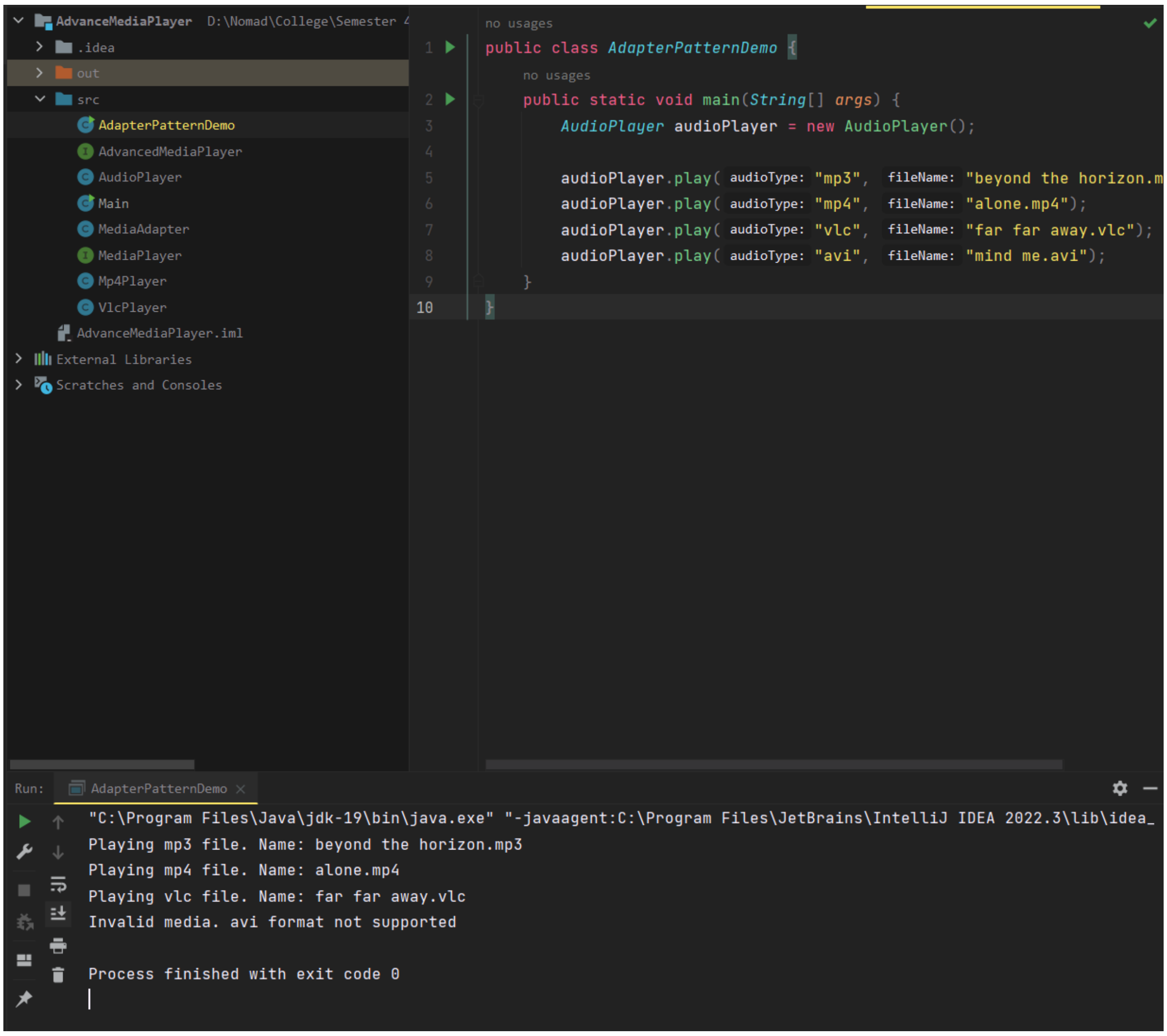
AudioPlayer.java

```java
public class AudioPlayer implements MediaPlayer {
    MediaAdapter mediaAdapter;

    @Override
    public void play(String audioType, String fileName) {

        //inbuilt support to play mp3 music files
        if(audioType.equalsIgnoreCase("mp3")){
            System.out.println("Playing mp3 file. Name: " + fileName);
        }

        //mediaAdapter is providing support to play other file formats
        else if(audioType.equalsIgnoreCase("vlc") ||
audioType.equalsIgnoreCase("mp4")){
            mediaAdapter = new MediaAdapter(audioType);
            mediaAdapter.play(audioType, fileName);
        }

        else{
            System.out.println("Invalid media. " + audioType + " format not
supported");
        }
    }
}
```

AdapterPatternDemo.java

```java
public class AdapterPatternDemo {
    public static void main(String[] args) {
        AudioPlayer audioPlayer = new AudioPlayer();
        audioPlayer.play("mp3", "beyond the horizon.mp3");
        audioPlayer.play("mp4", "alone.mp4");
        audioPlayer.play("vlc", "far far away.vlc");
        audioPlayer.play("avi", "mind me.avi");
    }
}
```

Output



```
public class AdapterPatternDemo {
    public static void main(String[] args) {
        AudioPlayer audioPlayer = new AudioPlayer();

        audioPlayer.play( audioType: "mp3",  fileName: "beyond the horizon.m
        audioPlayer.play( audioType: "mp4",  fileName: "alone.mp4");
        audioPlayer.play( audioType: "vlc",  fileName: "far far away.vlc");
        audioPlayer.play( audioType: "avi",  fileName: "mind me.avi");
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Playing mp3 file. Name: beyond the horizon.mp3
Playing mp4 file. Name: alone.mp4
Playing vlc file. Name: far far away.vlc
Invalid media. avi format not supported

Process finished with exit code 0
```

Example 2: Bank-Access

CreditCard.java

```java
public interface CreditCard {
    public void giveBankDetails();
    public String getCreditCard();
}
```

BankDetails.java

```java
public class BankDetails{
    private String bankName;
    private String accHolderName;
    private long accNumber;

    public String getBankName() {
        return bankName;
    }
    public void setBankName(String bankName) {
        this.bankName = bankName;
    }
    public String getAccHolderName() {
        return accHolderName;
    }
    public void setAccHolderName(String accHolderName) {
        this.accHolderName = accHolderName;
    }
    public long getAccNumber() {
        return accNumber;
    }
    public void setAccNumber(long accNumber) {
        this.accNumber = accNumber;
    }
}
```

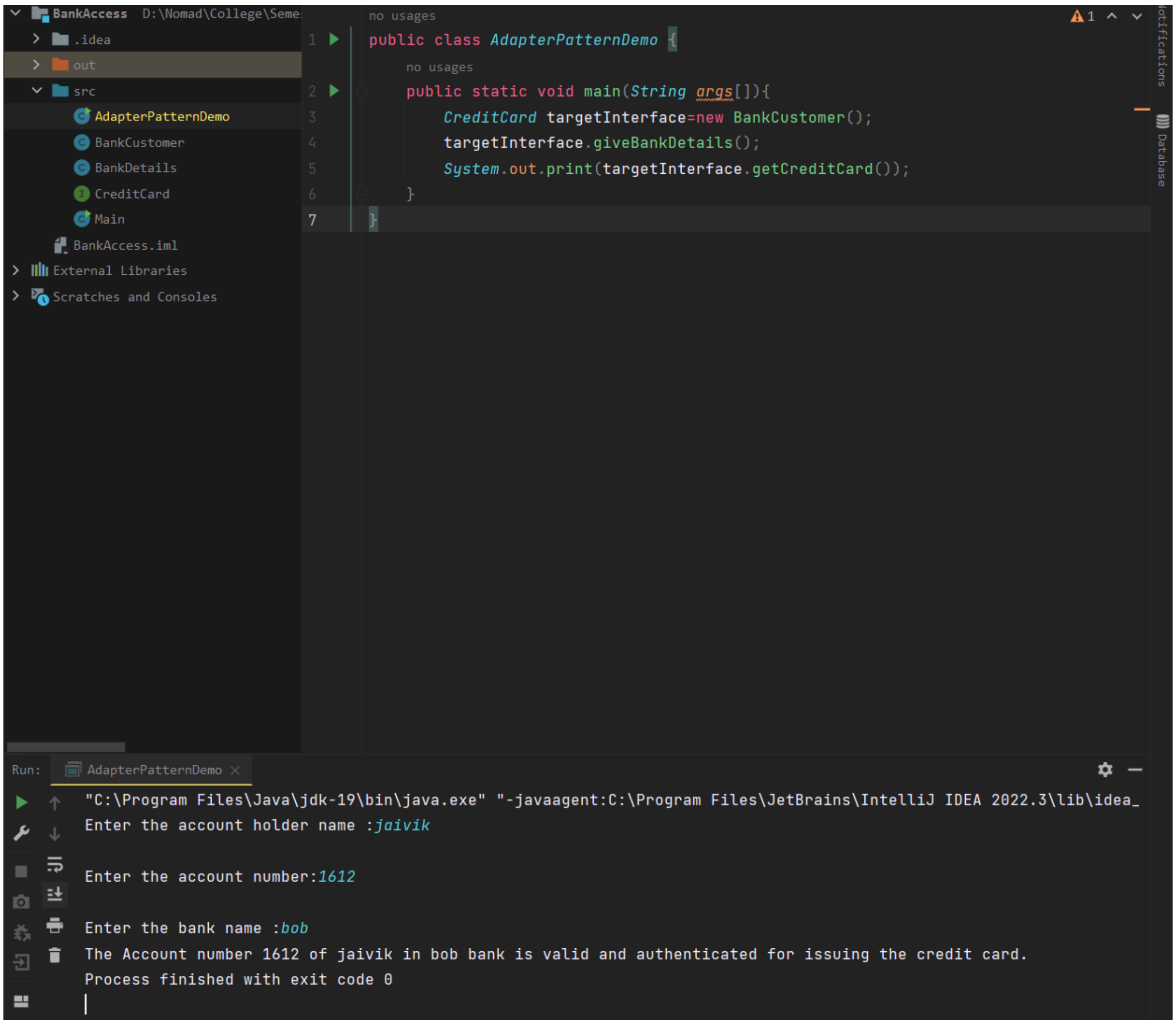
BankCustomer.java

```java
public class BankDetails{
    private String bankName;
    private String accHolderName;
    private long accNumber;

    public String getBankName() {
        return bankName;
    }
    public void setBankName(String bankName) {
        this.bankName = bankName;
    }
    public String getAccHolderName() {
        return accHolderName;
    }
    public void setAccHolderName(String accHolderName) {
        this.accHolderName = accHolderName;
    }
    public long getAccNumber() {
        return accNumber;
    }
    public void setAccNumber(long accNumber) {
        this.accNumber = accNumber;
    }
}
```

AdapterPatternDemo.java

```java
public class AdapterPatternDemo {
    public static void main(String args[]){
        CreditCard targetInterface=new BankCustomer();
        targetInterface.giveBankDetails();
        System.out.print(targetInterface.getCreditCard());
    }
}
```

Output



```java
public class AdapterPatternDemo {
    public static void main(String args[]){
        CreditCard targetInterface=new BankCustomer();
        targetInterface.giveBankDetails();
        System.out.print(targetInterface.getCreditCard());
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Enter the account holder name :jaivik

Enter the account number:1612

Enter the bank name :bob
The Account number 1612 of jaivik in bob bank is valid and authenticated for issuing the credit card.
Process finished with exit code 0
```

Composite Structural Design Pattern

Example 1: EmployeeField data

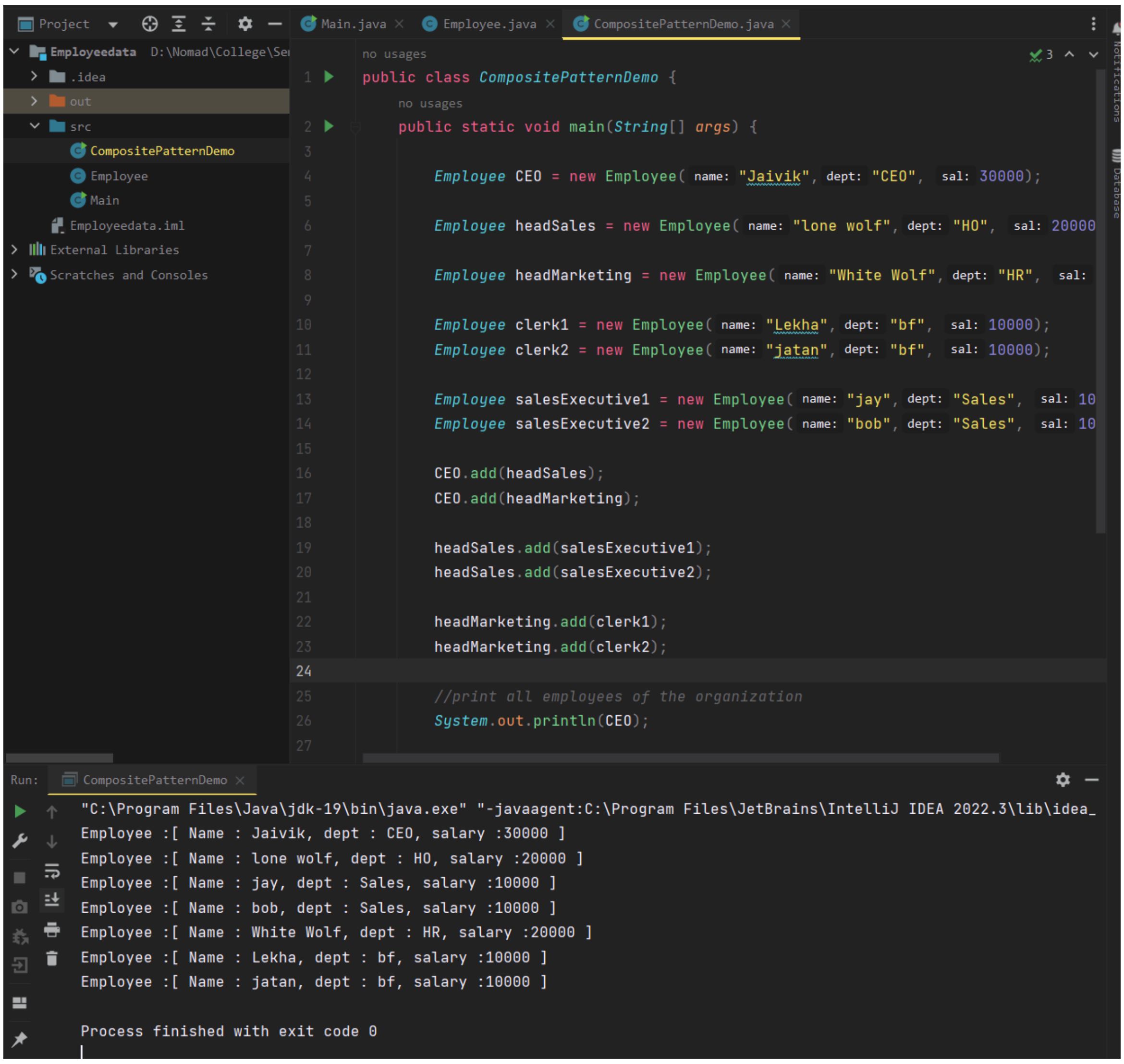
Employee.java

```java
import java.util.ArrayList;
import java.util.List;

public class Employee {
    private String name;
    private String dept;
    private int salary;
    private List<Employee> subordinates;

    // constructor
    public Employee(String name,String dept, int sal) {
        this.name = name;
        this.dept = dept;
        this.salary = sal;
        subordinates = new ArrayList<Employee>();
    }

    public void add(Employee e) {
        subordinates.add(e);
    }

    public void remove(Employee e) {
        subordinates.remove(e);
    }

    public List<Employee> getSubordinates(){
        return subordinates;
    }

    public String toString(){
        return ("Employee :[ Name : " + name + ", dept : " + dept + ",
salary :" + salary+" ]");
    }
}
```

CompositePatternDemo.java

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

        Employee CEO = new Employee("Jaivik","CEO", 30000);

        Employee headSales = new Employee("lone wolf","HO", 20000);

        Employee headMarketing = new Employee("White Wolf","HR", 20000);

        Employee clerk1 = new Employee("Lekha","bf", 10000);
        Employee clerk2 = new Employee("jatan","bf", 10000);

        Employee salesExecutive1 = new Employee("jay","Sales", 10000);
        Employee salesExecutive2 = new Employee("bob","Sales", 10000);
        CEO.add(headSales);
        CEO.add(headMarketing);

        headSales.add(salesExecutive1);
        headSales.add(salesExecutive2);

        headMarketing.add(clerk1);
        headMarketing.add(clerk2);

        //print all employees of the organization
        System.out.println(CEO);

        for (Employee headEmployee : CEO.getSubordinates()) {
            System.out.println(headEmployee);

            for (Employee employee : headEmployee.getSubordinates()) {
                System.out.println(employee);
            }
        }
    }
}
```

Output



```java
no usages
public class CompositePatternDemo {
    no usages
    public static void main(String[] args) {

        Employee CEO = new Employee( name: "Jaivik", dept: "CEO",  sal: 30000);

        Employee headSales = new Employee( name: "lone wolf", dept: "HO",  sal: 20000

        Employee headMarketing = new Employee( name: "White Wolf", dept: "HR",  sal:

        Employee clerk1 = new Employee( name: "Lekha", dept: "bf",  sal: 10000);
        Employee clerk2 = new Employee( name: "jatan", dept: "bf",  sal: 10000);

        Employee salesExecutive1 = new Employee( name: "jay", dept: "Sales",  sal: 10
        Employee salesExecutive2 = new Employee( name: "bob", dept: "Sales",  sal: 10

        CEO.add(headSales);
        CEO.add(headMarketing);

        headSales.add(salesExecutive1);
        headSales.add(salesExecutive2);

        headMarketing.add(clerk1);
        headMarketing.add(clerk2);

        //print all employees of the organization
        System.out.println(CEO);
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Employee :[ Name : Jaivik, dept : CEO, salary :30000 ]
Employee :[ Name : lone wolf, dept : HO, salary :20000 ]
Employee :[ Name : jay, dept : Sales, salary :10000 ]
Employee :[ Name : bob, dept : Sales, salary :10000 ]
Employee :[ Name : White Wolf, dept : HR, salary :20000 ]
Employee :[ Name : Lekha, dept : bf, salary :10000 ]
Employee :[ Name : jatan, dept : bf, salary :10000 ]

Process finished with exit code 0
```

Example : 2 DrawShapeswithColour

Shape.java

```
public interface Shape {
    public void draw(String fillColor);
}
```

Circle.java

```
public class Circle implements Shape {

    @Override
    public void draw(String fillColor) {
        System.out.println("Drawing Circle with color "+fillColor);
    }

}
```

Triangle.java

```
public class Triangle implements Shape{
    @Override
    public void draw(String fillColor) {
        System.out.println("Drawing Triangle with color "+fillColor);
    }
}
```

Drawing.java

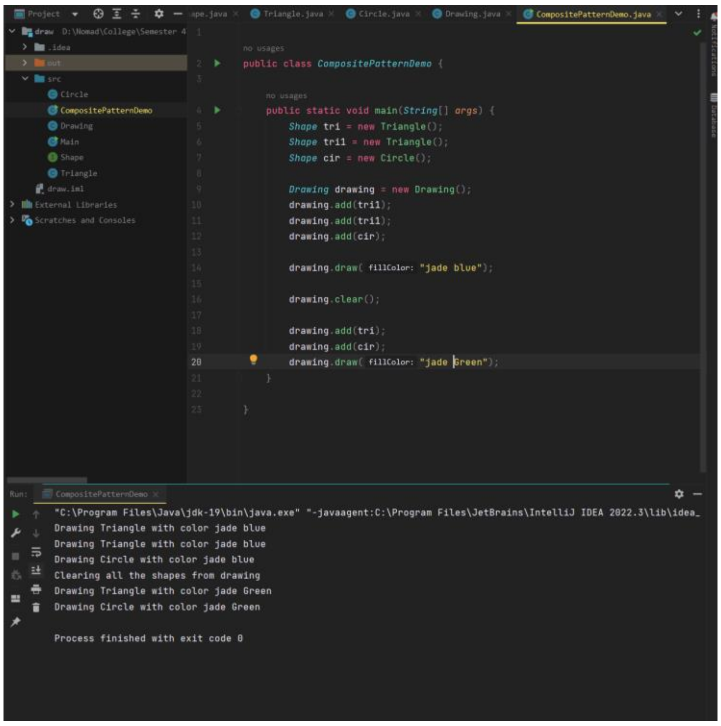
```

import java.util.ArrayList;
import java.util.List;

public class Drawing implements Shape{

    //collection of Shapes
    private List<Shape> shapes = new ArrayList<Shape>();

    @Override
    public void draw(String fillColor) {
        for(Shape sh : shapes)
        {
            sh.draw(fillColor);
        }
    }

    //adding shape to drawing
    public void add(Shape s){
        this.shapes.add(s);
    }

    //removing shape from drawing
    public void remove(Shape s){
        shapes.remove(s);
    }

```

```java
    //removing all the shapes
    public void clear(){
        System.out.println("Clearing all the shapes from drawing");
        this.shapes.clear();
    }
}
```

CompositePatternDemo.java

```java

public class CompositePatternDemo {

    public static void main(String[] args) {
        Shape tri = new Triangle();
        Shape tri1 = new Triangle();
        Shape cir = new Circle();

        Drawing drawing = new Drawing();
        drawing.add(tri1);
        drawing.add(tri1);
        drawing.add(cir);

        drawing.draw("jade blue");

        drawing.clear();

        drawing.add(tri);
        drawing.add(cir);
        drawing.draw("jade Green");
    }

}
```

Output



```
no usages
public class CompositePatternDemo {

    no usages
    public static void main(String[] args) {
        Shape tri = new Triangle();
        Shape tri1 = new Triangle();
        Shape cir = new Circle();

        Drawing drawing = new Drawing();
        drawing.add(tri1);
        drawing.add(tri1);
        drawing.add(cir);

        drawing.draw( fillColor: "jade blue");

        drawing.clear();

        drawing.add(tri);
        drawing.add(cir);
        drawing.draw( fillColor: "jade Green");
    }

}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Drawing Triangle with color jade blue
Drawing Triangle with color jade blue
Drawing Circle with color jade blue
Clearing all the shapes from drawing
Drawing Triangle with color jade Green
Drawing Circle with color jade Green

Process finished with exit code 0
```

Facade Structural Design Pattern

Example: 1 Draw shapes

Shape.java

```
public interface Shape {
    void draw();
}
```

Rectangle.java

```
public class Rectangle implements Shape {
    @Override
    public void draw() {
        System.out.println("Rectangle::draw()");
    }
}
```

Square.java

```
public class Square implements Shape {
    @Override
    public void draw() {
        System.out.println("Square::draw()");
    }
}
```

Circle.java

```
public class Circle implements Shape {
    @Override
    public void draw() {
        System.out.println("Circle::draw()");
    }
}
```

ShapeMaker.java

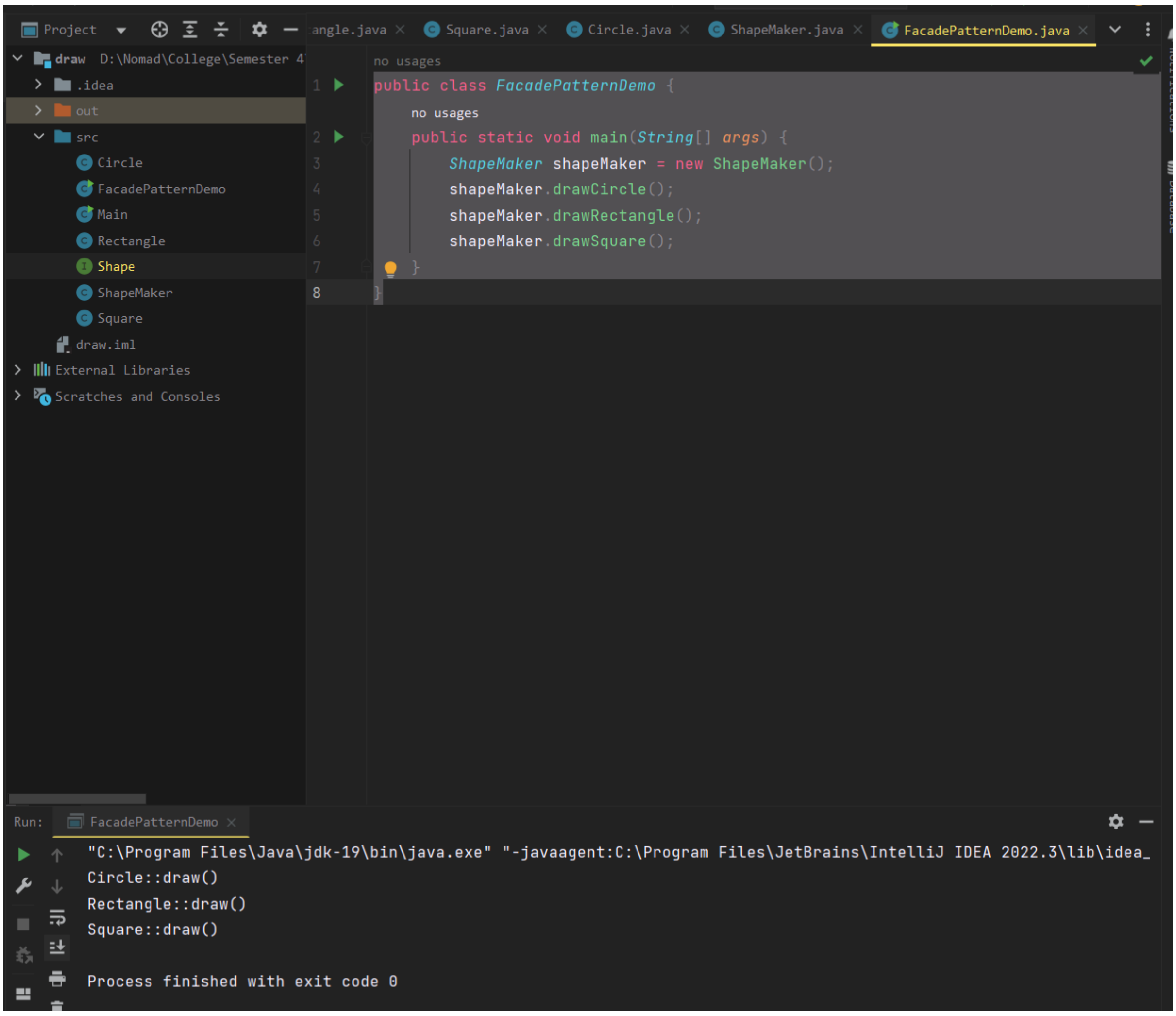
```
public class ShapeMaker {
    private Shape circle;
    private Shape rectangle;
    private Shape square;

    public ShapeMaker() {
        circle = new Circle();
        rectangle = new Rectangle();
        square = new Square();
    }

    public void drawCircle(){
        circle.draw();
    }
    public void drawRectangle(){
```

```java
        rectangle.draw();
    }
    public void drawSquare(){
        square.draw();
    }
}
```

FacadeDemoPattern.java

```java
public class FacadePatternDemo {
    public static void main(String[] args) {
        ShapeMaker shapeMaker = new ShapeMaker();
        shapeMaker.drawCircle();
        shapeMaker.drawRectangle();
        shapeMaker.drawSquare();
    }
}
```

Output



```java
no usages
public class FacadePatternDemo {
    no usages
    public static void main(String[] args) {
        ShapeMaker shapeMaker = new ShapeMaker();
        shapeMaker.drawCircle();
        shapeMaker.drawRectangle();
        shapeMaker.drawSquare();
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Circle::draw()
Rectangle::draw()
Square::draw()

Process finished with exit code 0
```

Example: 2 Server-based System

Subsystem1.java

```java
class Subsystem1 {
    public void operation1() {
        System.out.println("Subsystem1 operational");
    }
}
```

Subsystem2.java

```java
class Subsystem2 {
    public void operation2() {
        System.out.println("Subsystem2 operational");
    }
}
```

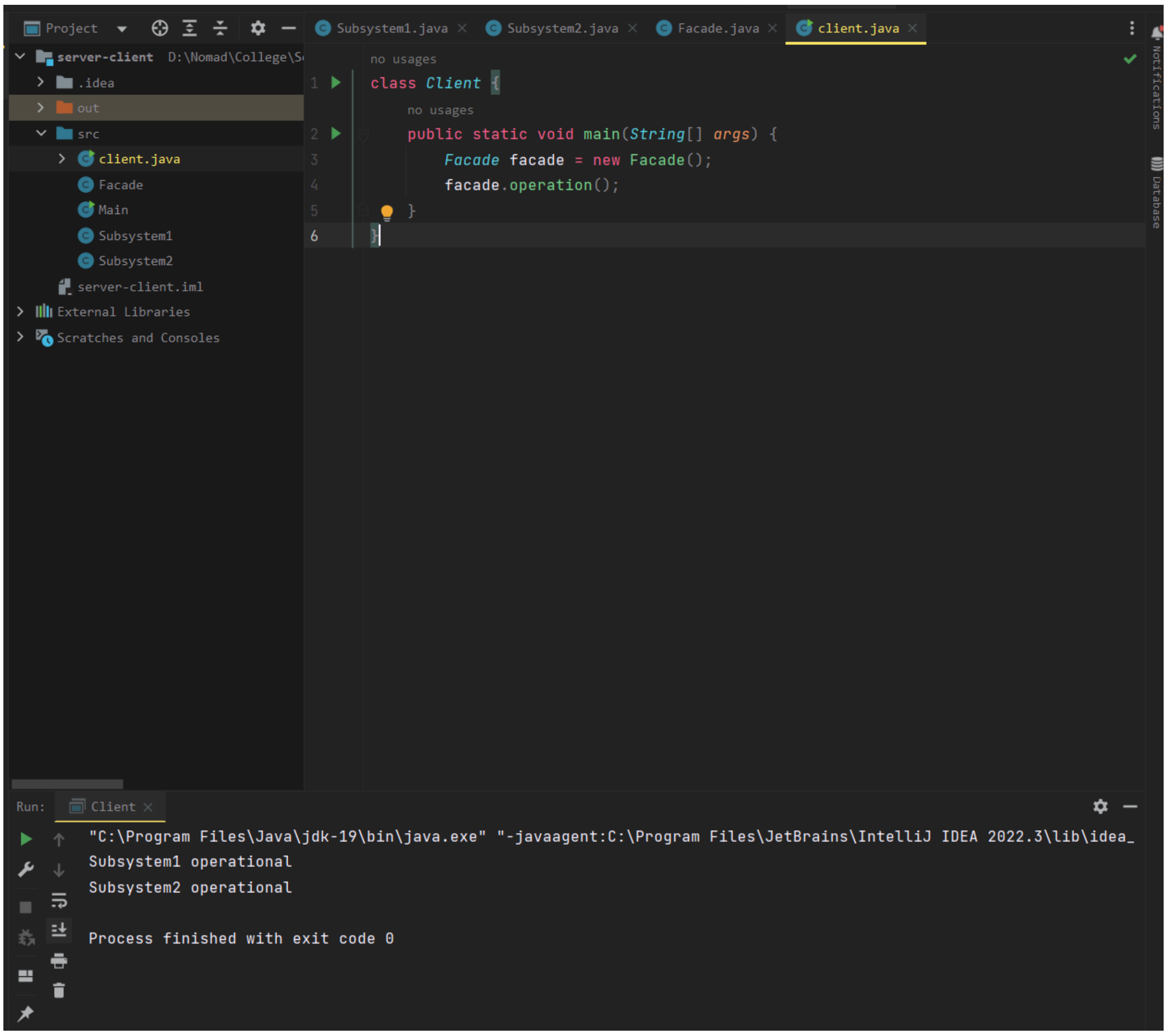
Façade.java

```java
class Facade {
    private Subsystem1 subsystem1;
    private Subsystem2 subsystem2;

    public Facade() {
        subsystem1 = new Subsystem1();
        subsystem2 = new Subsystem2();
    }

    public void operation() {
        subsystem1.operation1();
        subsystem2.operation2();
    }
}
```

Client.java

```java
class Client {
    public static void main(String[] args) {
        Facade facade = new Facade();
        facade.operation();
    }
}
```

Output



```
class Client {
    public static void main(String[] args) {
        Facade facade = new Facade();
        facade.operation();
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Subsystem1 operational
Subsystem2 operational

Process finished with exit code 0
```

Decorator Structural Design Pattern

Example: 1 Draw

Shape.java

```
public interface Shape {
        void draw();
}
```

Rectangle.java

```
public class Rectangle implements Shape{
    @Override
    public void draw(){
        System.out.println("Shape : rectangle");
    }
}
```

Circle.java

```
public class Circle implements Shape {
    @Override
    public void draw() {
        System.out.println("Shape: Circle");
    }
}
```

ShapeDecorator.java

```
public abstract class ShapeDecorator implements Shape {
    protected Shape decoratedShape;
    public ShapeDecorator(Shape decoratedShape){
        this.decoratedShape = decoratedShape;
    }
    public void draw(){
        decoratedShape.draw();
    }
}
```

BlueShapeDecorator.java

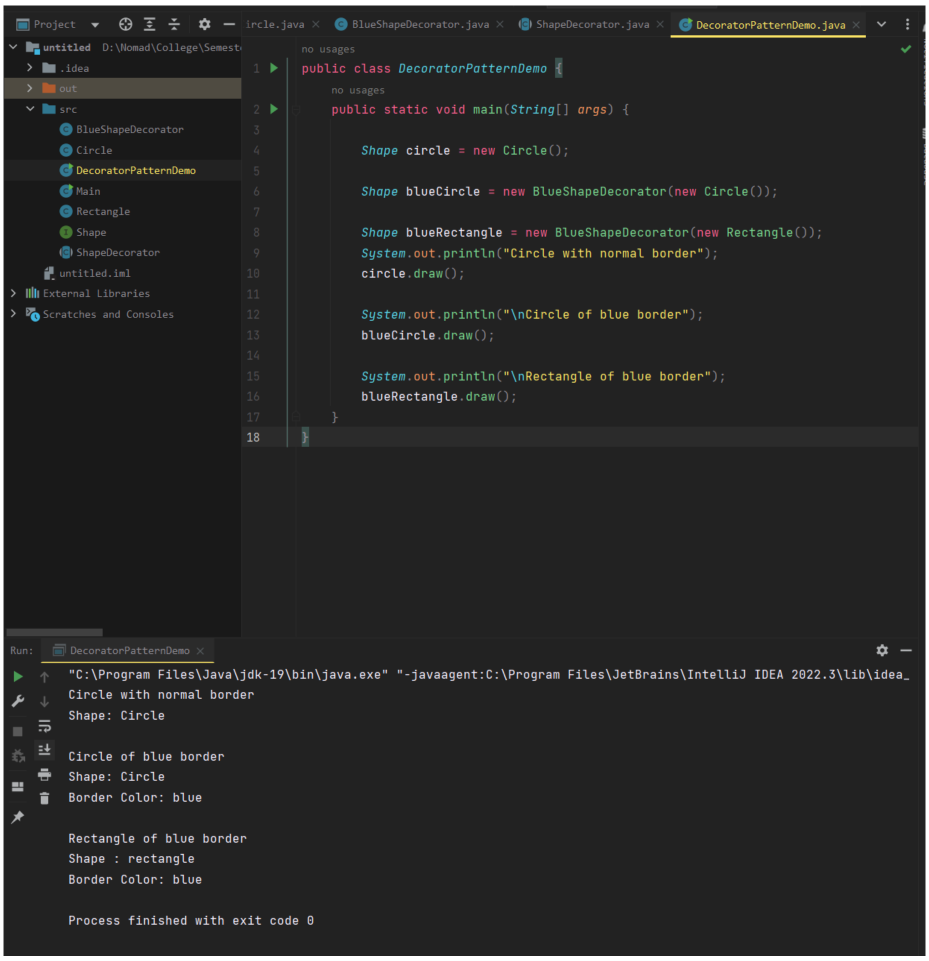
```
public class BlueShapeDecorator extends ShapeDecorator {

    public BlueShapeDecorator(Shape decoratedShape) {
        super(decoratedShape);
    }

    @Override
    public void draw() {
        decoratedShape.draw();
        setBlueBorder(decoratedShape);
    }

    private void setBlueBorder(Shape decoratedShape){
```

```java
        System.out.println("Border Color: blue");
    }
}
```

DecoratorPatternDemo.java

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

        Shape circle = new Circle();

        Shape blueCircle = new BlueShapeDecorator(new Circle());

        Shape blueRectangle = new BlueShapeDecorator(new Rectangle());
        System.out.println("Circle with normal border");
        circle.draw();

        System.out.println("\nCircle of blue border");
        blueCircle.draw();

        System.out.println("\nRectangle of blue border");
        blueRectangle.draw();
    }
}
```

Output



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

        Shape circle = new Circle();

        Shape blueCircle = new BlueShapeDecorator(new Circle());

        Shape blueRectangle = new BlueShapeDecorator(new Rectangle());
        System.out.println("Circle with normal border");
        circle.draw();

        System.out.println("\nCircle of blue border");
        blueCircle.draw();

        System.out.println("\nRectangle of blue border");
        blueRectangle.draw();
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Circle with normal border
Shape: Circle

Circle of blue border
Shape: Circle
Border Color: blue

Rectangle of blue border
Shape : rectangle
Border Color: blue

Process finished with exit code 0
```

Example: 2 car driving

Car.java

```java
public interface Car {
    void drive();
}
```

BasicCar.java

```java
public class BasicCar implements Car{
    public void drive(){
        System.out.println("driving car");
    }
}
```

CarDecorator.java

```java
public class CarDecorator implements Car{
    protected Car car;
    public CarDecorator(Car car){
        this.car = car;
    }
    public void drive(){
        car.drive();
    }
}
```

Bugatti.java

```java
public class bugatti extends CarDecorator{
    public bugatti(Car car){
        super(car);
    }
    public void drive(){
        car.drive();
        System.out.println("driving bugatti");
    }
}
```

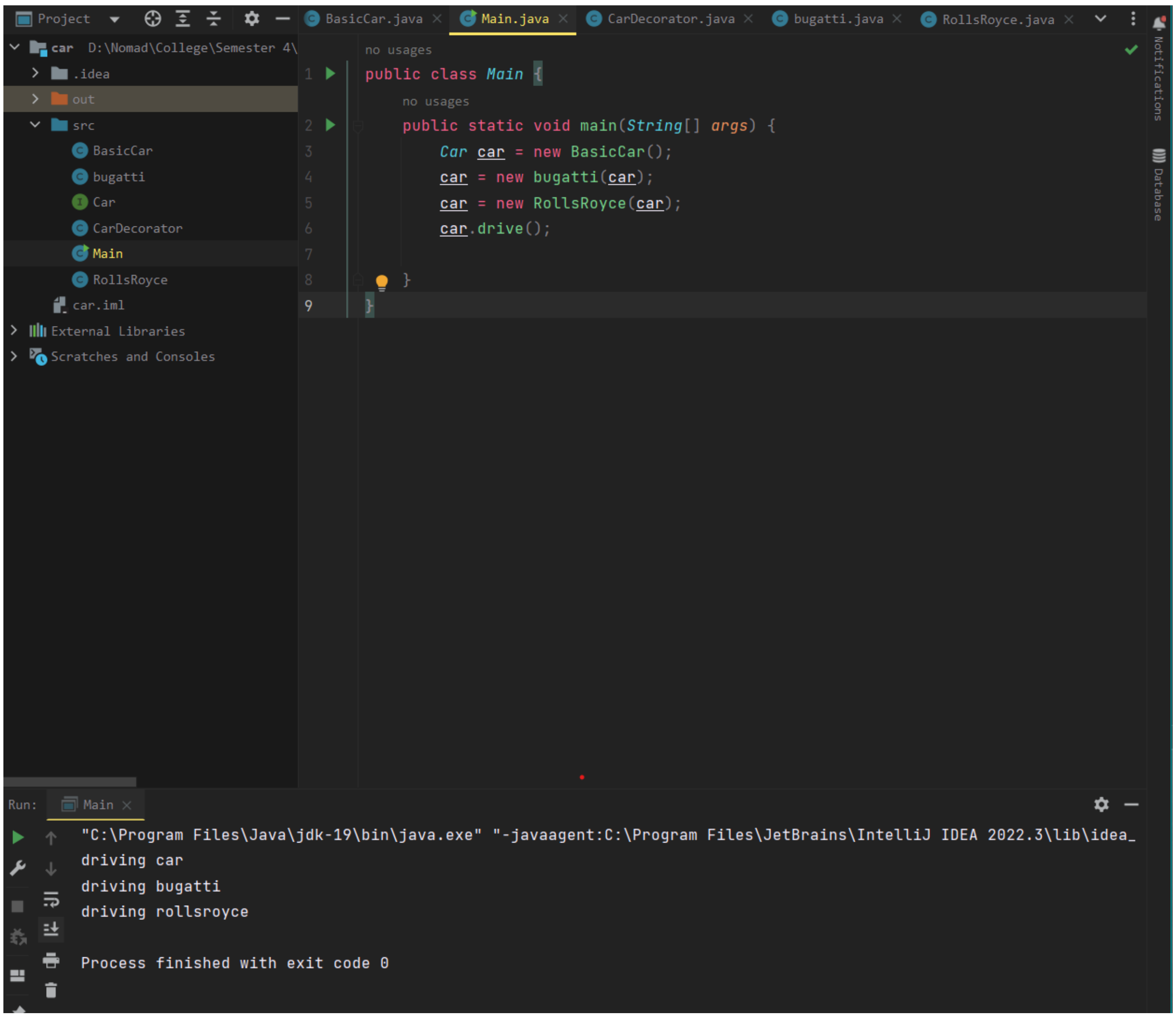
RollsRoyce.java

```java
public class RollsRoyce extends CarDecorator{
    public RollsRoyce(Car car){
        super(car);
    }
    public void drive(){
        car.drive();
        System.out.println("driving rollsroyce");
    }
}
```

Main.java

```java
public class Main {
    public static void main(String[] args) {
        Car car = new BasicCar();
        car = new bugatti(car);
        car = new RollsRoyce(car);
        car.drive();

    }
}
```

Output



```
no usages
public class Main {
    no usages
    public static void main(String[] args) {
        Car car = new BasicCar();
        car = new bugatti(car);
        car = new RollsRoyce(car);
        car.drive();

    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
driving car
driving bugatti
driving rollsroyce

Process finished with exit code 0
```

Flyweight Structural Design Pattern

Example: 1 Draw

Shape.java

```java
public interface Shape {
    void draw();
}
```

Circle.java

```java
public class Circle implements Shape {
    private String color;
    private int x;
    private int y;
    private int radius;

    public Circle(String color){
        this.color = color;
    }

    public void setX(int x) {
        this.x = x;
    }

    public void setY(int y) {
        this.y = y;
    }

    public void setRadius(int radius) {
        this.radius = radius;
    }

    @Override
    public void draw() {
        System.out.println("Circle: Draw() [Color : " + color + ", x : " +
x + ", y :" + y + ", radius :" + radius);
    }
}
```

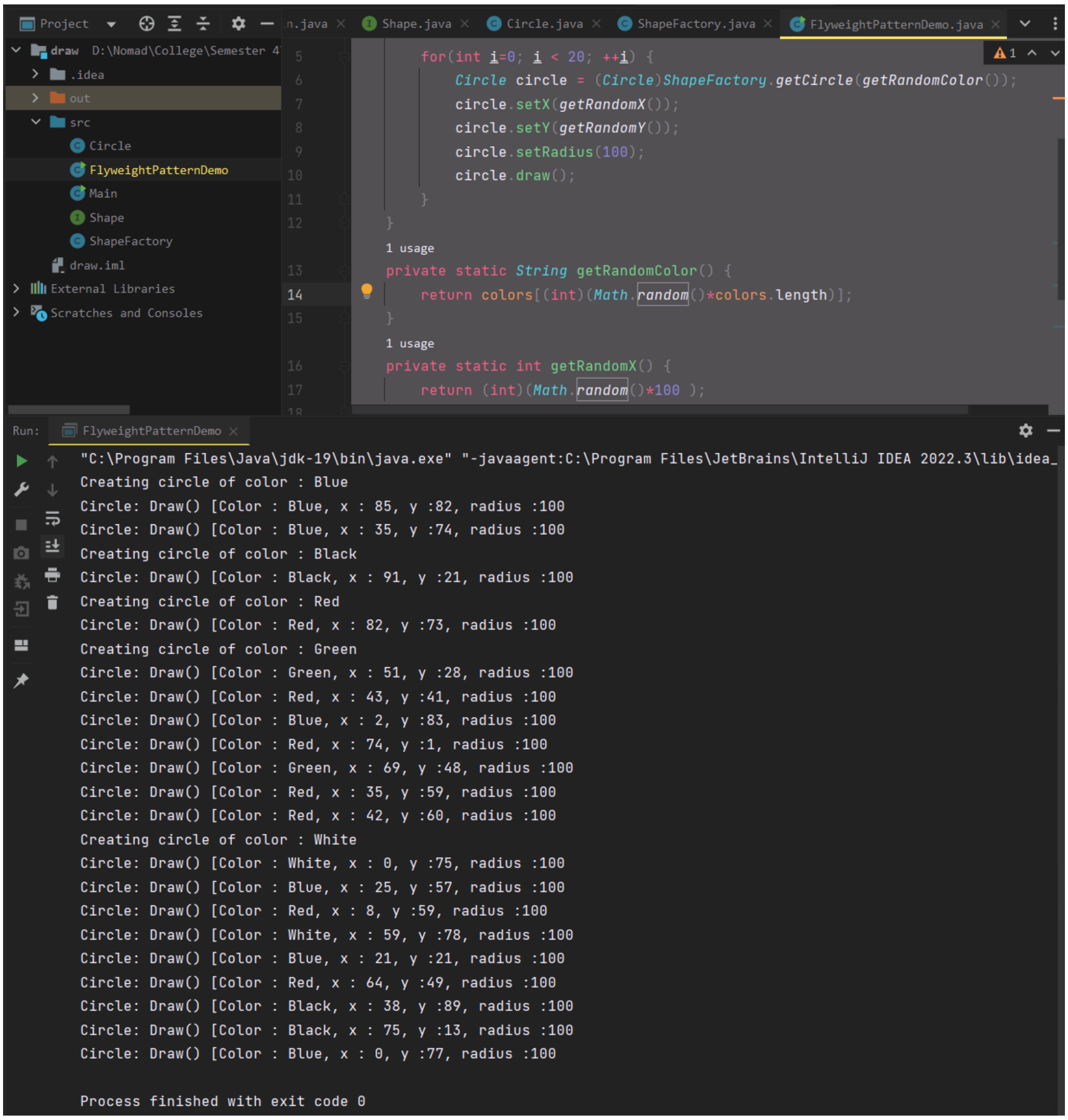
ShapeFactory.java

```java
import java.util.HashMap;

public class ShapeFactory {

    private static final HashMap circleMap = new HashMap();

    public static Shape getCircle(String color) {
        Circle circle = (Circle)circleMap.get(color);

        if(circle == null) {
            circle = new Circle(color);
            circleMap.put(color, circle);
            System.out.println("Creating circle of color : " + color);
        }
        return circle;
    }
}
```

FlyweightPatternDemo

```
public class FlyweightPatternDemo {
    private static final String colors[] = { "Red", "Green", "Blue",
"White", "Black" };
    public static void main(String[] args) {

        for(int i=0; i < 20; ++i) {
            Circle circle =
(Circle)ShapeFactory.getCircle(getRandomColor());
            circle.setX(getRandomX());
            circle.setY(getRandomY());
            circle.setRadius(100);
            circle.draw();
        }
    }
    private static String getRandomColor() {
        return colors[(int)(Math.random()*colors.length)];
    }
    private static int getRandomX() {
        return (int)(Math.random()*100 );
    }
    private static int getRandomY() {
        return (int)(Math.random()*100);
    }
}
```

Output



```java
        for(int i=0; i < 20; ++i) {
            Circle circle = (Circle)ShapeFactory.getCircle(getRandomColor());
            circle.setX(getRandomX());
            circle.setY(getRandomY());
            circle.setRadius(100);
            circle.draw();
        }
    }
    1 usage
    private static String getRandomColor() {
        return colors[(int)(Math.random()*colors.length)];
    }
    1 usage
    private static int getRandomX() {
        return (int)(Math.random()*100 );
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
Creating circle of color : Blue
Circle: Draw() [Color : Blue, x : 85, y :82, radius :100
Circle: Draw() [Color : Blue, x : 35, y :74, radius :100
Creating circle of color : Black
Circle: Draw() [Color : Black, x : 91, y :21, radius :100
Creating circle of color : Red
Circle: Draw() [Color : Red, x : 82, y :73, radius :100
Creating circle of color : Green
Circle: Draw() [Color : Green, x : 51, y :28, radius :100
Circle: Draw() [Color : Red, x : 43, y :41, radius :100
Circle: Draw() [Color : Blue, x : 2, y :83, radius :100
Circle: Draw() [Color : Red, x : 74, y :1, radius :100
Circle: Draw() [Color : Green, x : 69, y :48, radius :100
Circle: Draw() [Color : Red, x : 35, y :59, radius :100
Circle: Draw() [Color : Red, x : 42, y :60, radius :100
Creating circle of color : White
Circle: Draw() [Color : White, x : 0, y :75, radius :100
Circle: Draw() [Color : Blue, x : 25, y :57, radius :100
Circle: Draw() [Color : Red, x : 8, y :59, radius :100
Circle: Draw() [Color : White, x : 59, y :78, radius :100
Circle: Draw() [Color : Blue, x : 21, y :21, radius :100
Circle: Draw() [Color : Red, x : 64, y :49, radius :100
Circle: Draw() [Color : Black, x : 38, y :89, radius :100
Circle: Draw() [Color : Black, x : 75, y :13, radius :100
Circle: Draw() [Color : Blue, x : 0, y :77, radius :100

Process finished with exit code 0
```

Example: 2 learning to code this

Flyweight.java

```java
public interface Flyweight {
    public void operation();
}
```

FlyweightFactory.java

```java
import java.util.HashMap;

public class FlyweightFactory {

    private static final HashMap<String, Flyweight> flyweights = new
HashMap<String, Flyweight>();

    public static Flyweight getFlyweight(String key) {
        Flyweight flyweight = flyweights.get(key);

        if(flyweight == null) {
            flyweight = new ConcreteFlyweight();
            flyweights.put(key, flyweight);
        }

        return flyweight;
    }
}
```

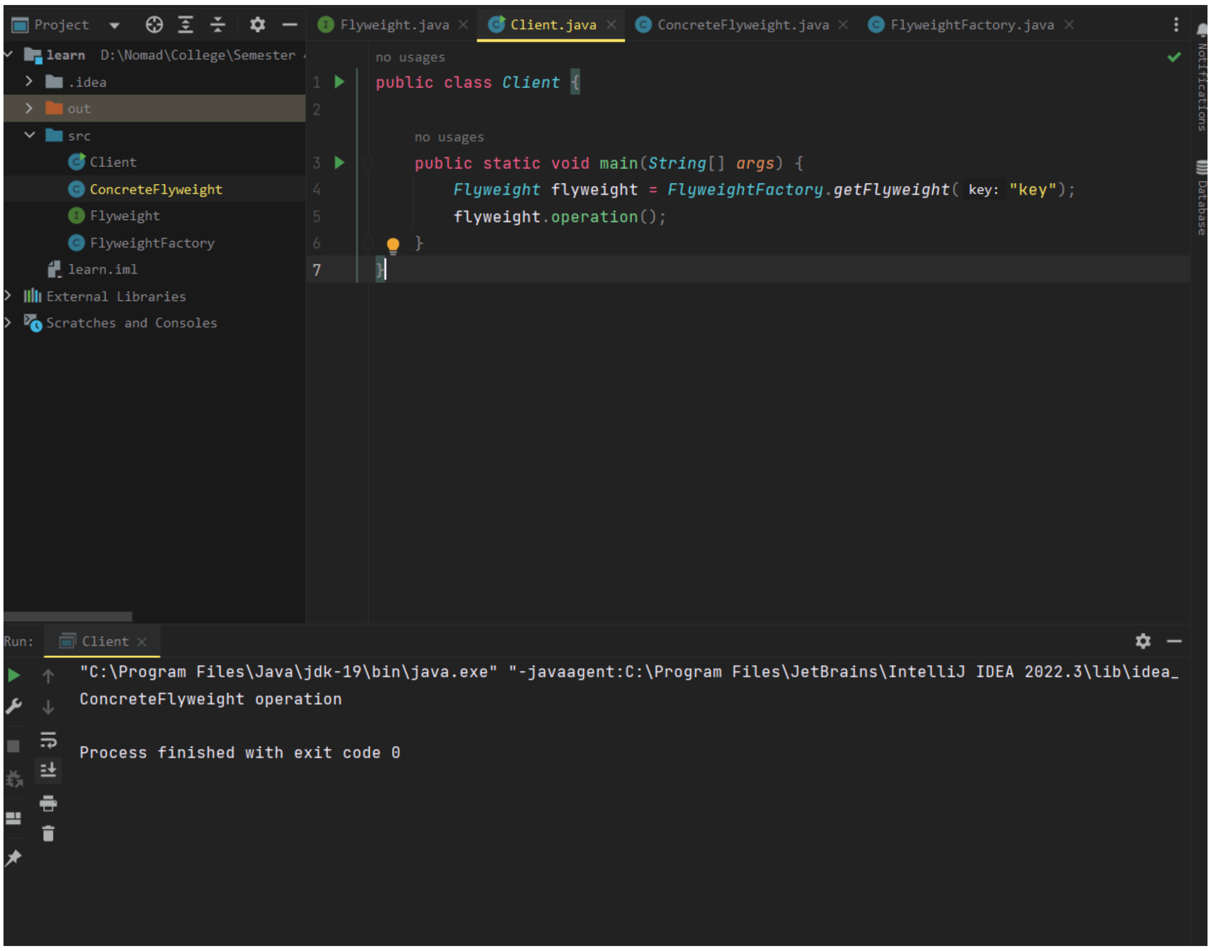
ConcreteFlyweight.java

```java
public class ConcreteFlyweight implements Flyweight {

    public void operation() {
        System.out.println("ConcreteFlyweight operation");
    }
}
```

Client.java

```java
public class Client {

    public static void main(String[] args) {
        Flyweight flyweight = FlyweightFactory.getFlyweight("key");
        flyweight.operation();
    }
}
```

Output



```java
no usages
public class Client {

    no usages
    public static void main(String[] args) {
        Flyweight flyweight = FlyweightFactory.getFlyweight( key: "key");
        flyweight.operation();
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea_
ConcreteFlyweight operation

Process finished with exit code 0
```