Design Pattern Lab Manual

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Behavioral Design Pattern

Sr. No	Name
1	Iterator
2	Observer
3	Mediator
4	State
5	Memento

Iterator Behavioral Design Pattern

Example: 1 Menu repo

Container.java

```
public interface Container {
    public Iterator getIterator();
}
```

Iterator.java

```
public interface Iterator {
    public boolean hasNext();
    public Object next();
}
```

OrderRepository.java

```
public class OrderRepository implements Container {
    public String orders[] = {"pizza", "pasta", "ice cream", "burger"};

    public Iterator getIterator() {
        return new OrderIterator();
    }

    private class OrderIterator implements Iterator {
        int index;

        public boolean hasNext() {
            return index < orders.length;
        }

        public Object next() {
            if (this.hasNext()) {
                return orders[index++];
            }
            return null;
        }
    }
}
```

IteratorPatternDemo.java

```
public class IteratorPatternDemo {
    public static void main(String[] args) {
        OrderRepository orderRepository = new OrderRepository();
        for (Iterator iter = orderRepository.getIterator();
iter.hasNext();) {
            String order = (String) iter.next();
            System.out.println("order: " + order);
        }
    }
}
```

Output:

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
order: pizza
order: pasta
order: ice cream
order: burger

Process finished with exit code 0
```

Example:2 Shape

Shape.java

```
public class Shape {
    private int id;
    private String name;

    public Shape(int id ,  String name){
        this.id = id;
        this.name = name;
    }

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    @Override
    public String toString() {
        return " ID number : " +id+ " Shape is  : " +name;
    }
}
```

ShapeIterator.java

```
import java.util.Iterator;

public class ShapeIterator implements Iterator<Shape> {

    private Shape[] shapes;
    int pos;

    public ShapeIterator(Shape []shapes){
        this.shapes = shapes;
    }

    @Override
    public boolean hasNext(){
        if(pos >= shapes.length || shapes[pos] == null)
            return false;
        return true;
    }

    @Override
    public Shape next(){
        return shapes[pos++];
```

```
    }

    @Override
    public void remove(){
        if(pos <= 0)
            throw new IllegalStateException("wrong place buddy");
        if(shapes[pos-1] != null){
            for(int i=pos-1; i <(shapes.length-1);i++){
                shapes[i] = shapes[i+1];
            }
            shapes[shapes.length-1] = null;
        }
    }
}
```

ShapeStorage.java

```
public class ShapeStorage {

    private Shape[]shapes = new Shape[3];
    private int index;

    public void addShape(String name){
        int i = index++;
        shapes[i]= new Shape(i ,name);
    }

    public Shape[] getShapes(){
        return shapes;
    }
}
```

testIteratorPattern.java

```
public class testIteraorPattern {
    public static void main(String[] args){
        ShapeStorage store = new ShapeStorage();
        store.addShape("triangle");
        store.addShape("square");
        store.addShape("n-gon");

        ShapeIterator iterator = new ShapeIterator(store.getShapes());
        while (iterator.hasNext()){
            System.out.println(iterator.next());
        }
        System.out.println("remove");
        iterator = new ShapeIterator(store.getShapes());
        while (iterator.hasNext()){
            System.out.println(iterator.next());
            iterator.remove();
        }
    }
}
```

Output

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
 ID number : 0 Shape is  : triangle
 ID number : 1 Shape is  : square
 ID number : 2 Shape is  : n-gon
remove
 ID number : 0 Shape is  : triangle
 ID number : 2 Shape is  : n-gon

Process finished with exit code 0
```

```java
public class testIteraorPattern {
    public static void main(String[] args){
        ShapeStorage store = new ShapeStorage();
        store.addShape( name: "triangle");
        store.addShape( name: "square");
        store.addShape( name: "n-gon");

        ShapeIterator iterator = new ShapeIterator(store.getShapes());
        while (iterator.hasNext()){
            System.out.println(iterator.next());
        }
        System.out.println("remove");
        iterator = new ShapeIterator(store.getShapes());
        while (iterator.hasNext()){
            System.out.println(iterator.next());
            iterator.remove();
        }
    }
}
```

Memento Behavioral Design Pattern

Example: 1

CareTaker.java

```
import java.util.ArrayList;
import java.util.List;
public class CareTaker {
    private List<Memento> mementoList = new ArrayList<Memento>();

    public void add(Memento state){
        mementoList.add(state);
    }

    public Memento get(int index){
        return mementoList.get(index);
    }
}
```

Memento.java

```
public class Memento {
    private String state;
    public Memento(String state){
        this.state = state;
    }

    public String getState(){
        return state;
    }
}
```

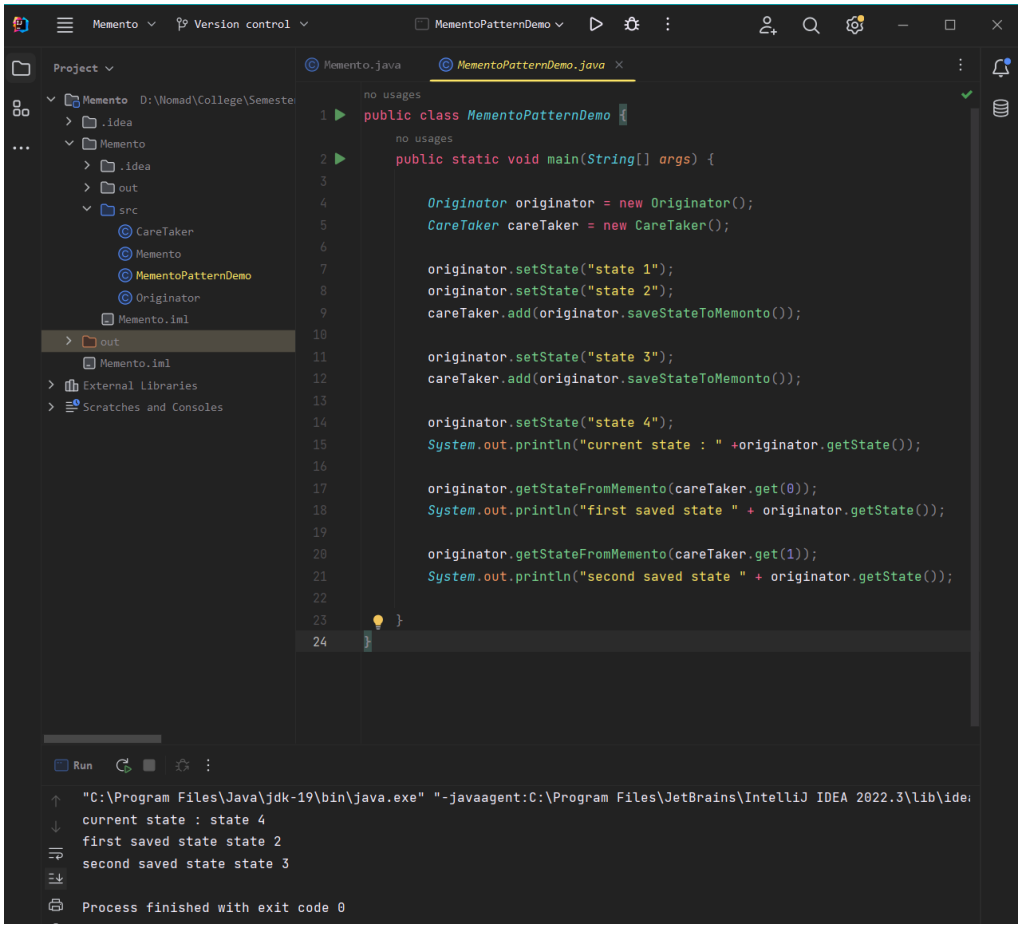
Originator.java

```
public class Originator {
    private String state;
    public void setState(String state){
        this.state = state;
    }

    public String getState(){
        return state;
    }

    public Memento saveStateToMemonto(){
        return new Memento(state);
    }

    public void getStateFromMemento(Memento memento){
        state = memento.getState();
    }
}
```

MementoPatternDemo.java

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

        Originator originator = new Originator();
        CareTaker careTaker = new CareTaker();

        originator.setState("state 1");
        originator.setState("state 2");
        careTaker.add(originator.saveStateToMemonto());

        originator.setState("state 3");
        careTaker.add(originator.saveStateToMemonto());

        originator.setState("state 4");
        System.out.println("current state : " +originator.getState());

        originator.getStateFromMemento(careTaker.get(0));
        System.out.println("first saved state " + originator.getState());

        originator.getStateFromMemento(careTaker.get(1));
        System.out.println("second saved state " + originator.getState());

    }
}
```

Output



Example:2

Document.java

```
public class Document {
    private String content;

    public void setContent(String content) {
        this.content = content;
        System.out.println("Document content updated to: " + content);
    }

    public Memento createMemento() {
        System.out.println("Creating memento...");
        return new Memento(content);
    }

    public void restoreFromMemento(Memento memento) {
        content = memento.getContent();
        System.out.println("Restoring document content from memento: " +
content);
    }

    public String getContent() {
        return content;
    }
}
```

Memento.java

```
public class Memento {
    private String content;

    public Memento(String content) {
        this.content = content;
    }

    public String getContent() {
        return content;
    }
}
```

Caretaker.java

```
import java.util.Stack;

public class Caretaker {
    private Stack<Memento> mementos = new Stack<>();

    public void saveMemento(Memento memento) {
        System.out.println("Saving memento...");
        mementos.push(memento);
    }

    public Memento undo() {
        if (!mementos.isEmpty()) {
            System.out.println("Undoing...");
```

```
            return mementos.pop();
        } else {
            System.out.println("No more mementos to undo.");
            return null;
        }
    }
}
```

Documentmain.java

```
public class documentmain {
    public static void main(String[] args) {
        Document document = new Document();
        Caretaker caretaker = new Caretaker();

        document.setContent("This is the first version of the document.");
        caretaker.saveMemento(document.createMemento());

        document.setContent("This is the second version of the document.");
        caretaker.saveMemento(document.createMemento());

        document.setContent("This is the third version of the document.");
        caretaker.saveMemento(document.createMemento());

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " +
document.getContent());

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " +
document.getContent());

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " +
document.getContent());

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " +
document.getContent());
    }
}
```

```java
public class documentmain {
    public static void main(String[] args) {
        Document document = new Document();
        Caretaker caretaker = new Caretaker();

        document.setContent("This is the first version of the document.");
        caretaker.saveMemento(document.createMemento());

        document.setContent("This is the second version of the document.")
        caretaker.saveMemento(document.createMemento());

        document.setContent("This is the third version of the document.");
        caretaker.saveMemento(document.createMemento());

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " + document.getConte

        document.restoreFromMemento(caretaker.undo());
        System.out.println("Current document content: " + document.getConte
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
Document content updated to: This is the first version of the document.
Creating memento...
Saving memento...
Document content updated to: This is the second version of the document.
Creating memento...
Saving memento...
Document content updated to: This is the third version of the document.
Creating memento...
Saving memento...
Undoing...
Restoring document content from memento: This is the third version of the document.
Current document content: This is the third version of the document.
Undoing...
Restoring document content from memento: This is the second version of the document.
Current document content: This is the second version of the document.
Undoing...
Restoring document content from memento: This is the first version of the document.
Current document content: This is the first version of the document.
No more mementos to undo.
Exception in thread "main" java.lang.NullPointerException Create breakpoint : Cannot invoke "Memento.getContent()"
    at Document.restoreFromMemento(Document.java:15)
    at documentmain.main(documentmain.java:24)
```

Observer Behavioral Design Pattern

Example: 1

BinaryObserver.java

```
public class BinaryObserver extends Observer{
    public BinaryObserver(Subject subject){
        this.subject = subject;
        this.subject.attach(this);
    }

    @Override
    public void update(){
        System.out.println("Binary String" +
Integer.toBinaryString(subject.getState()));
    }
}
```

HexaObserver.java

```
public class HexaObserver extends Observer{
    public HexaObserver(Subject subject){
        this.subject = subject;
        this.subject.attach(this);
    }

    @Override
    public void update(){
        System.out.println("hexa string" +
Integer.toHexString(subject.getState()).toUpperCase());
    }
}
```

OctalObserver.java

```
public class OctalObserver extends Observer{
    public OctalObserver(Subject subject){
        this.subject = subject;
        this.subject.attach(this);
    }

    @Override
    public void update(){
        System.out.println("Octal String" +
Integer.toOctalString(subject.getState()));
    }
}
```

Subject.java

```
import java.util.ArrayList;
import java.util.List;
public class Subject {
    private List<Observer> observers = new ArrayList<Observer>();
```

```
    private int state;

    public int getState(){
        return state;
    }

    public void setState(int state){
        this.state = state;
        notifyAllObservers();
    }

    public void attach(Observer observer){
        observers.add(observer);
    }

    public void notifyAllObservers(){
        for(Observer observer : observers){
            observer.update();
        }
    }
}
```

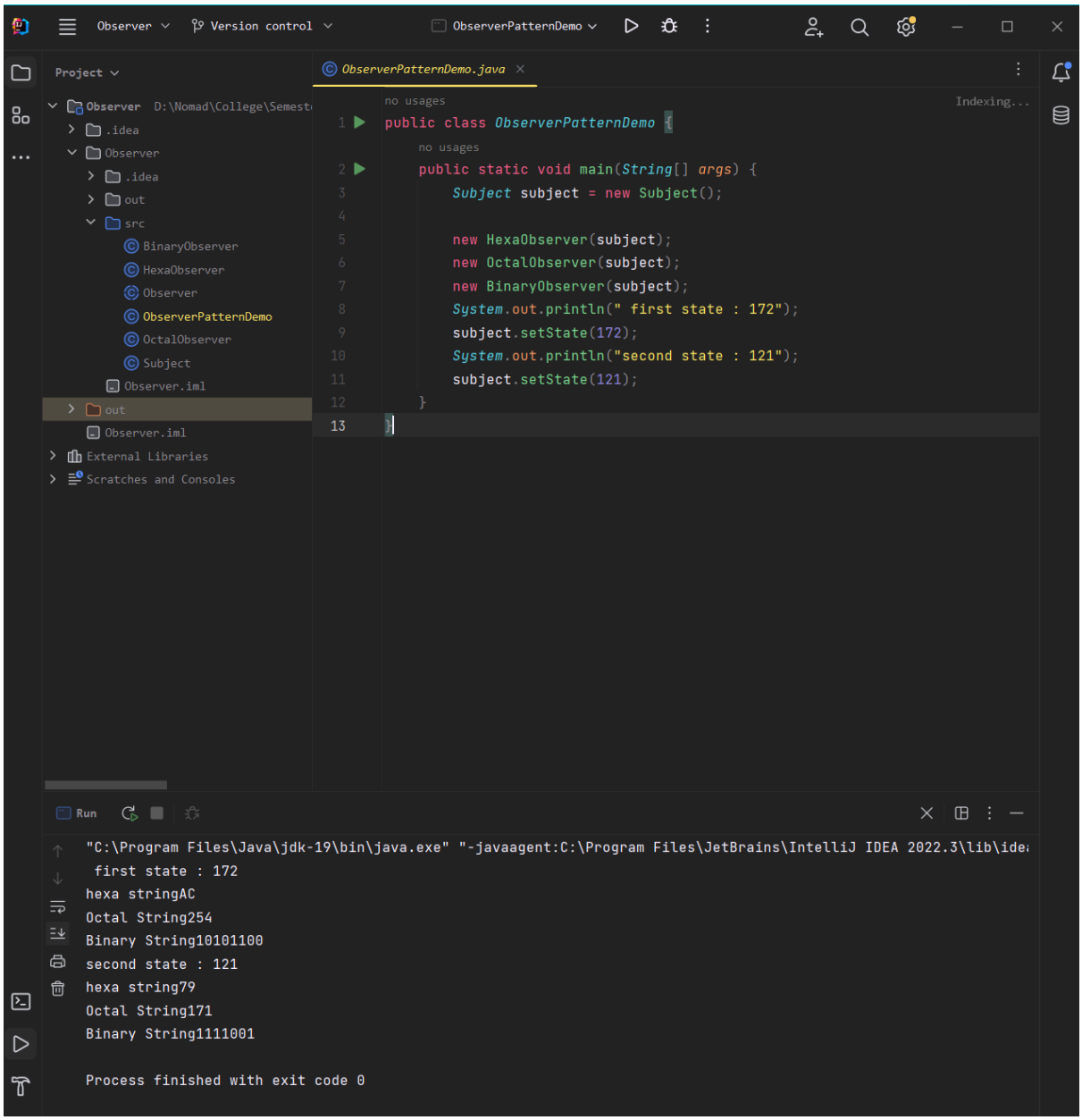
Observer.java

```
public abstract class Observer {
    protected Subject subject;
    public abstract void update();
}
```

ObserverPatternDemo.java

```
public class ObserverPatternDemo {
    public static void main(String[] args) {
        Subject subject = new Subject();

        new HexaObserver(subject);
        new OctalObserver(subject);
        new BinaryObserver(subject);
        System.out.println(" first state : 172");
        subject.setState(172);
        System.out.println("second state : 121");
        subject.setState(121);
    }
}
```

Output


Observer
Version control
ObserverPatternDemo
Project
ObserverPatternDemo.java
Observer D:\Nomad\College\Semest
.idea
Observer
.idea
out
src
BinaryObserver
HexaObserver
Observer
ObserverPatternDemo
OctalObserver
Subject
Observer.iml
out
Observer.iml
External Libraries
Scratches and Consoles
Indexing...
no usages
public class ObserverPatternDemo {
no usages
public static void main(String[] args) {
Subject subject = new Subject();
new HexaObserver(subject);
new OctalObserver(subject);
new BinaryObserver(subject);
System.out.println(" first state : 172");
subject.setState(172);
System.out.println("second state : 121");
subject.setState(121);
}
}
Run
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
first state : 172
hexa stringAC
Octal String254
Binary String10101100
second state : 121
hexa string79
Octal String171
Binary String1111001
Process finished with exit code 0

Example:2

Observer.java

```
public interface Observer {
    void update();
    void gotorestaurant(restaurant res);
}
```

Subject.java

```
public interface Subject {
    void order(customer o1);
    void cancelorder(Observer o1);
    void notifycustomer();
    void upload(String orderlist);
}
```

Customer.java

```
public class customer implements Observer {
    private String name;
    private restaurant res=new restaurant();
    public customer(String name) {
        this.name=name;
    }
    public void update() {
        System.out.println("hey"+name+"you are at
restaurant:"+res.orderlist);
    }
    public void gotorestaurant(restaurant rest)
    {
        res=rest;
    }
}
```

Restaurant.java

```
import java.util.ArrayList;
import java.util.List;
public class restaurant implements Subject {
    private List<customer> cus=new ArrayList<customer>();
    public String orderlist;
    public void order(customer o1) {
        cus.add(o1);
    }
    public void cancelorder(Observer o1) {
        cus.remove(o1);
    }
    public void notifycustomer()
    {
        for(Observer o1:cus)
        {
            o1.update();
        }
    }
```

```
    public void upload(String orderlist)
    {
        this.orderlist=orderlist;
        notifycustomer();
    }
}
```

dine.java

```
public class dine {
    public static void main(String args[]) {
        restaurant Dine = new restaurant();
        customer c1=new customer("lekha");
        customer c2=new customer("wolf");
        customer c3=new customer("bhatt");
        customer c4=new customer("grey");
        customer c5=new customer("nomad");
        Dine.order(c1);
        Dine.order(c2);
        Dine.order(c3);
        Dine.order(c4);
        Dine.order(c5);
        c1.gotorestaurant(Dine);
        c2.gotorestaurant(Dine);
        c3.gotorestaurant(Dine);
        c4.gotorestaurant(Dine);
        c5.gotorestaurant(Dine);
        Dine.upload("mcd");
        Dine.cancelorder(c2);
        Dine.cancelorder(c3);
        Dine.upload("project ");
    }
}
```

Output

```java
public class dine {
    no usages
    public static void main(String grgs[]) {
        restaurant Dine = new restaurant();
        customer c1=new customer( name: "lekha");
        customer c2=new customer( name: "wolf");
        customer c3=new customer( name: "bhatt");
        customer c4=new customer( name: "grey");
        customer c5=new customer( name: "nomad");
        Dine.order(c1);
        Dine.order(c2);
        Dine.order(c3);
        Dine.order(c4);
        Dine.order(c5);
        c1.gotorestaurant(Dine);
        c2.gotorestaurant(Dine);
        c3.gotorestaurant(Dine);
        c4.gotorestaurant(Dine);
        c5.gotorestaurant(Dine);
        Dine.upload( orderlist: "mcd");
        Dine.cancelorder(c2);
        Dine.cancelorder(c3);
        Dine.upload( orderlist: "project ");
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
heylekhayou are at restaurant:mcd
heywolfyou are at restaurant:mcd
heybhattyou are at restaurant:mcd
heygreyyou are at restaurant:mcd
heynomadyou are at restaurant:mcd
heylekhayou are at restaurant:project
heygreyyou are at restaurant:project
heynomadyou are at restaurant:project

Process finished with exit code 0
```

Mediator Behavioral Design Pattern

Example: 1

Order.java

```
public class Order {
    private String order;
    private OrderMessageMediator mediator;

    public Order(OrderMessageMediator mediator, String order) {
        this.mediator = mediator;
        this.order = order;
    }

    public void sendMessage(String message) {
        mediator.sendMessage(this, message);
    }

    public void receiveMessage(String message) {
        System.out.println("Order " + order + " received message: " +
message);
    }
}
```

OrderMessageMediator.java

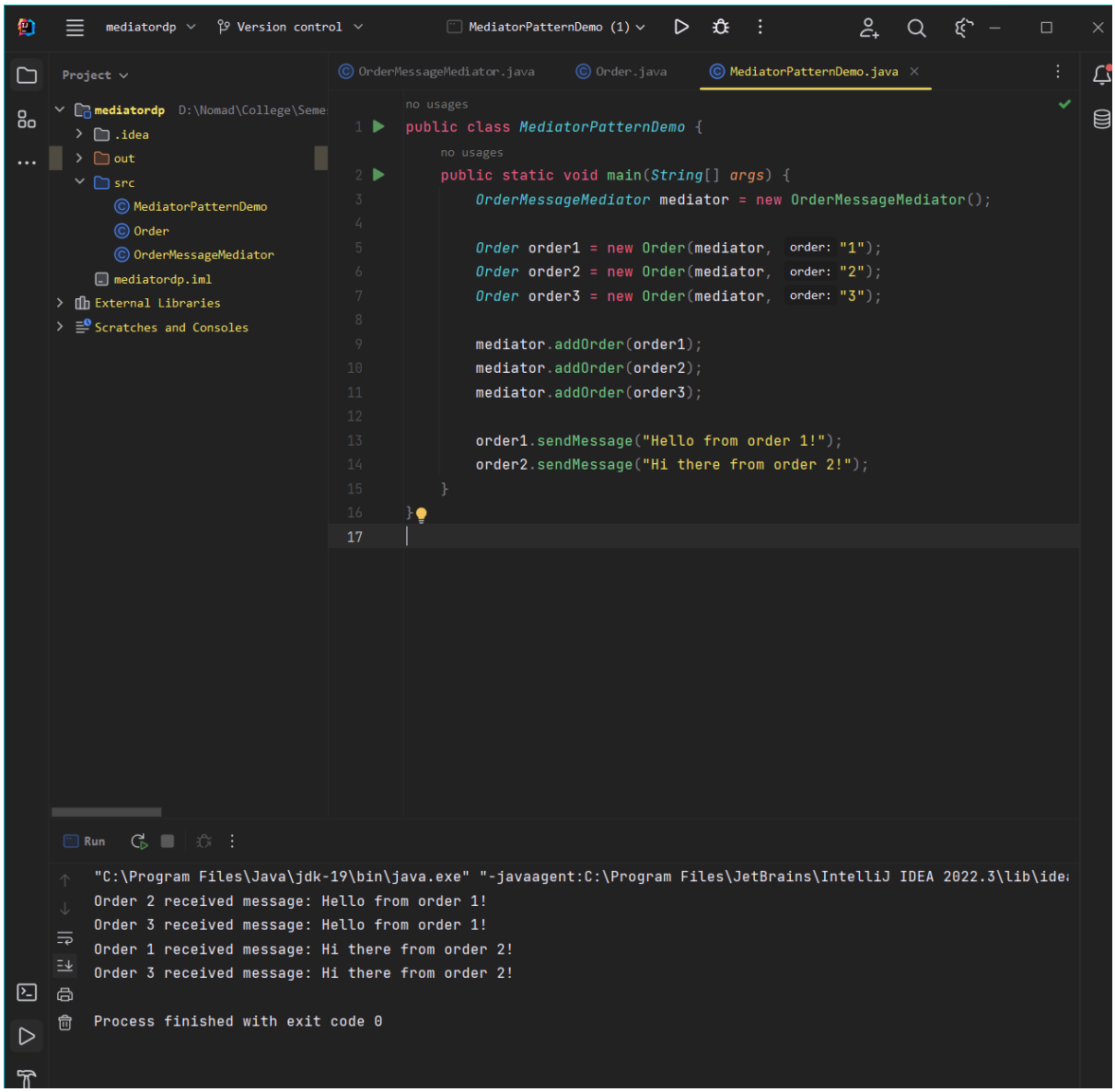
```
import java.util.ArrayList;
import java.util.List;

public class OrderMessageMediator {
    private List<Order> orders = new ArrayList<>();

    public void addOrder(Order order) {
        this.orders.add(order);
    }

    public void sendMessage(Order order, String message) {
        for (Order o : orders) {
            if (o != order) {
                o.receiveMessage(message);
            }
        }
    }
}
```

MediatorPatternDemo.java

```
public class MediatorPatternDemo {
    public static void main(String[] args) {
        OrderMessageMediator mediator = new OrderMessageMediator();

        Order order1 = new Order(mediator, "1");
        Order order2 = new Order(mediator, "2");
        Order order3 = new Order(mediator, "3");
```

```
        mediator.addOrder(order1);
        mediator.addOrder(order2);
        mediator.addOrder(order3);

        order1.sendMessage("Hello from order 1!");
        order2.sendMessage("Hi there from order 2!");
    }
}
```

Output



Example: 2

Chatroom.java

```
public interface Chatroom {
    void sendMessage(User user, String message);
    void addUser(User user);
}
```

User.java

```
public class User {
    private String name;
    private Chatroom chatroom;

    public User(String name, Chatroom chatroom) {
        this.name = name;
        this.chatroom = chatroom;
        this.chatroom.addUser(this);
    }

    public void sendMessage(String message) {
        this.chatroom.sendMessage(this, message);
    }

    public void receiveMessage(String message) {
        System.out.println(this.name + " received message: " + message);
    }

    public String getName() {
        return name;
    }
}
```

ChatroomImpl.java

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

public class ChatroomImpl implements Chatroom {
    private List<User> users;

    public ChatroomImpl() {
        this.users = new ArrayList<>();
    }

    @Override
    public void sendMessage(User user, String message) {
        for (User u : this.users) {
            if (!u.getName().equals(user.getName())) {
                u.receiveMessage(message);
            }
        }
    }

    @Override
    public void addUser(User user) {
```

```
        this.users.add(user);
    }
}
```

MediatorPatternDemo.java

```
public class MediatorPatternDemo {
    public static void main(String[] args) {
        Chatroom chatroom = new ChatroomImpl();

        User john = new User("John", chatroom);
        User jane = new User("Jane", chatroom);
        User bob = new User("Bob", chatroom);

        john.sendMessage("Hi everyone!");
        jane.sendMessage("Hello John!");
        bob.sendMessage("Welcome to the chatroom!");
    }
}
```

Output

```
no usages
public class MediatorPatternDemo {
    no usages
    public static void main(String[] args) {
        Chatroom chatroom = new ChatroomImpl();

        User john = new User( name: "John", chatroom);
        User jane = new User( name: "Jane", chatroom);
        User bob = new User( name: "Bob", chatroom);

        john.sendMessage("Hi everyone!");
        jane.sendMessage("Hello John!");
        bob.sendMessage("Welcome to the chatroom!");
    }
}
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\idea
Jane received message: Hi everyone!
Bob received message: Hi everyone!
John received message: Hello John!
Bob received message: Hello John!
John received message: Welcome to the chatroom!
Jane received message: Welcome to the chatroom!

Process finished with exit code 0
```

State Behavioral Design Pattern

Example: 1

State.java

```
public interface State {
    public void doAction(Context context);
}
```

Context.java

```
public class Context {
    private State state;


    public Context(){
        state = null;
    }

    public void setState(State state){
        this.state = state;
    }

    public State getState(){
        return state;
    }
}
```

StartState.java

```
public class StartState implements State {
    public void doAction(Context context){
        System.out.println("Game Begins");
        context.setState(this);
    }
    public String toString(){
        return "Start State";
    }
}
```

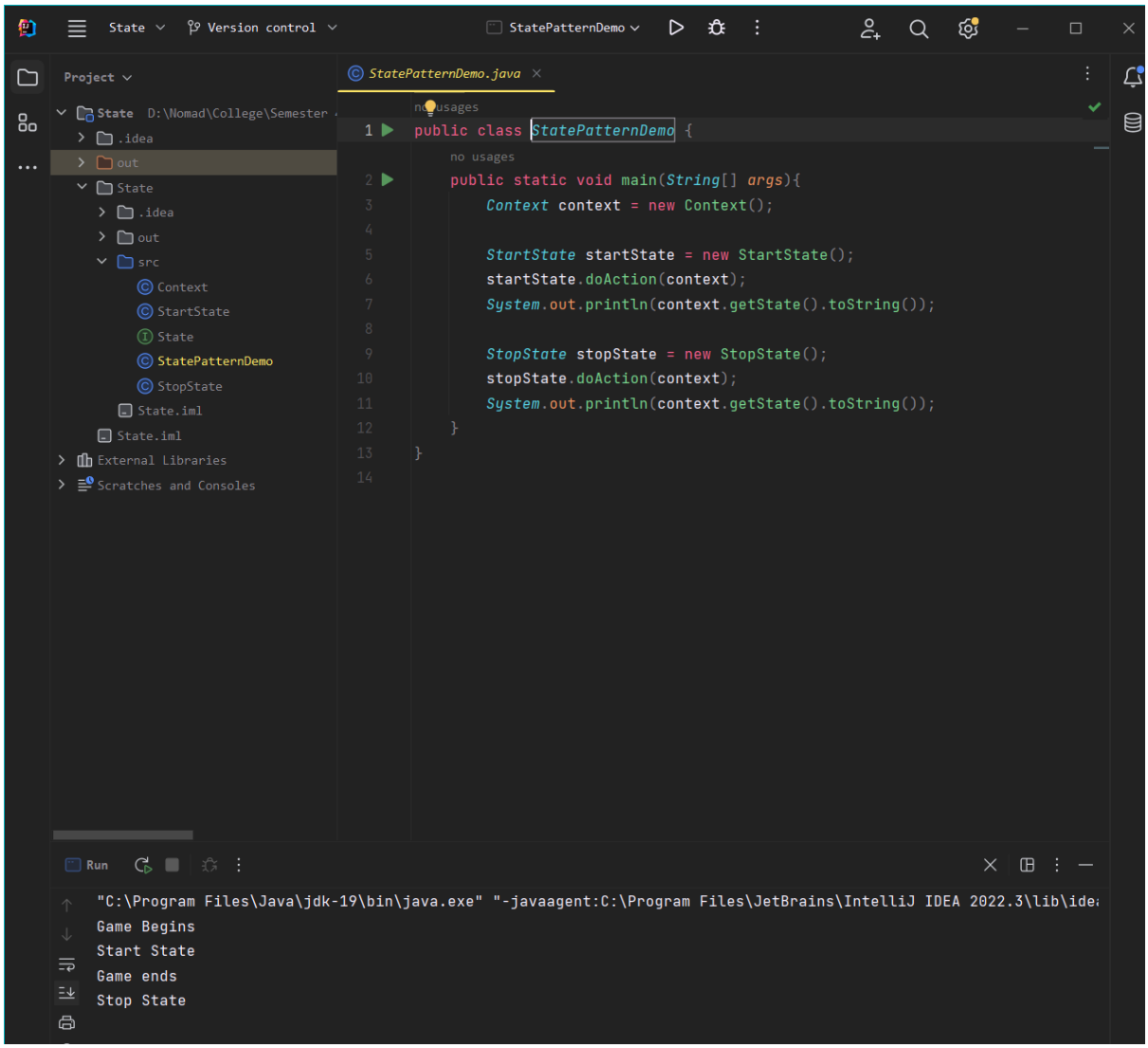
StopState.java

```
public class StopState implements State {
    public void doAction(Context context){
        System.out.println("Game ends");
        context.setState(this);
    }
    public String toString(){
        return "Stop State";
    }

}
```

StatePatternDemo

```java
public class StatePatternDemo {
    public static void main(String[] args){
        Context context = new Context();

        StartState startState = new StartState();
        startState.doAction(context);
        System.out.println(context.getState().toString());

        StopState stopState = new StopState();
        stopState.doAction(context);
        System.out.println(context.getState().toString());
    }
}
```

Output



Example: 2

MobileAlertState.java

```
public interface MobileAlertState {
    public void Alert();
}
```

MobileContext.java

```
public class mobileContext {
    private MobileAlertState currentState;
    public mobileContext() {
        currentState= new Ringing();
    }
    public void setState(MobileAlertState state) {
        currentState=state;
    }
    public void Alert() {
        currentState.Alert();
    }
}
```

Ringing.java

```
public class Ringing implements MobileAlertState {
    public void Alert()
    {
        System.out.println("Mobile is Ringing");
    }
}
```

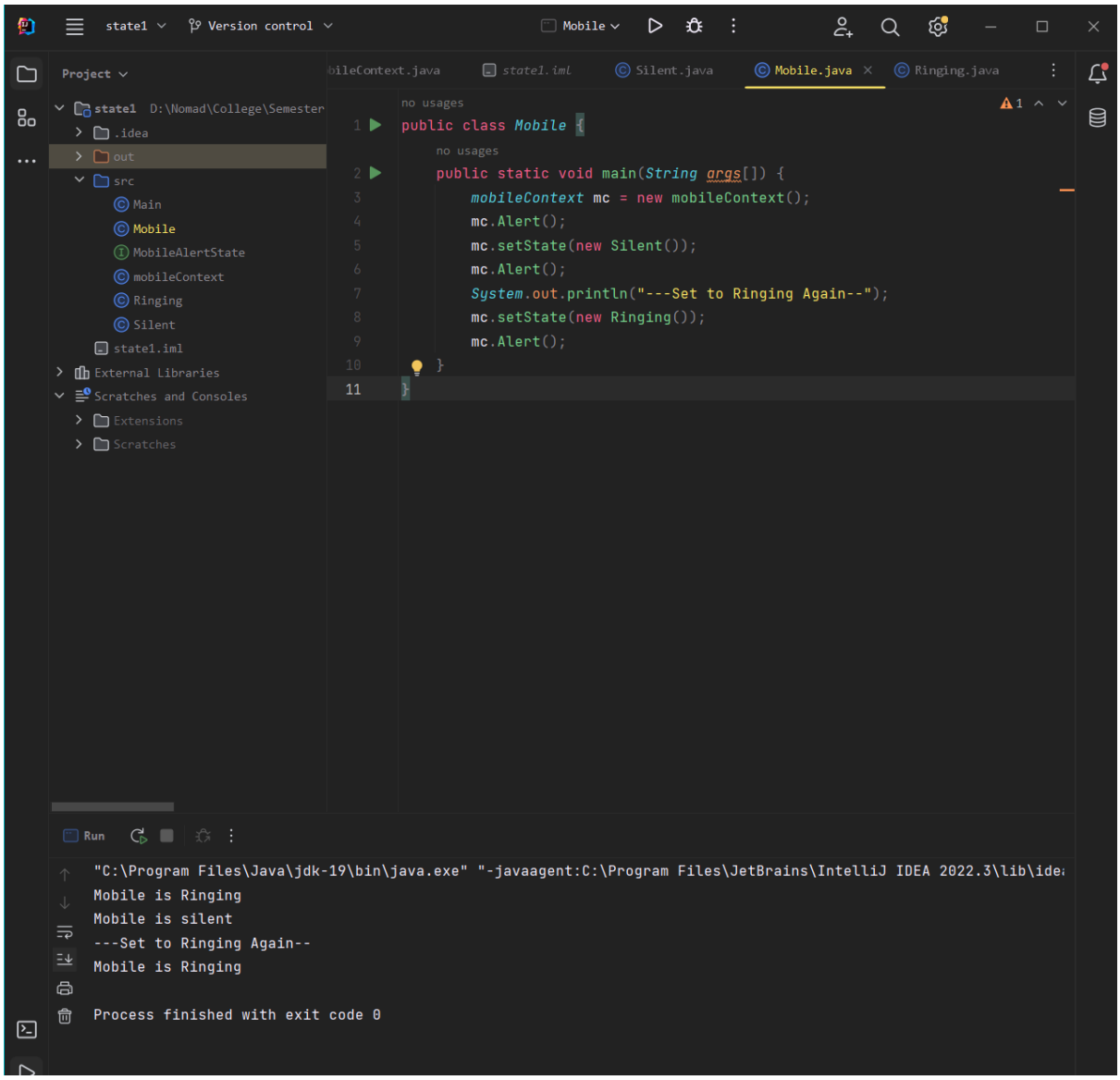
Silent.java

```
public class Silent implements MobileAlertState {
    public void Alert() {
        System.out.println("Mobile is silent");
    }
}
```

Mobile.java

```
public class Mobile {
    public static void main(String args[]) {
        mobileContext mc = new mobileContext();
        mc.Alert();
        mc.setState(new Silent());
        mc.Alert();
        System.out.println("---Set to Ringing Again--");
        mc.setState(new Ringing());
        mc.Alert();
    }
}
```

Output


state1
Version control
Mobile
Project
state1 D:\Nomad\College\Semester
.idea
out
src
Main
Mobile
MobileAlertState
mobileContext
Ringing
Silent
state1.iml
External Libraries
Scratches and Consoles
Extensions
Scratches
mobileContext.java
state1.iml
Silent.java
Mobile.java
Ringing.java
no usages
public class Mobile {
no usages
public static void main(String args[]) {
mobileContext mc = new mobileContext();
mc.Alert();
mc.setState(new Silent());
mc.Alert();
System.out.println("---Set to Ringing Again--");
mc.setState(new Ringing());
mc.Alert();
}
}
Run
"C:\Program Files\Java\jdk-19\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2022.3\lib\ide
Mobile is Ringing
Mobile is silent
---Set to Ringing Again--
Mobile is Ringing
Process finished with exit code 0