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HANDSON EXERCISES - WEEK 1

Skill : Design Patterns and Principles

Exercise 1: Implementing the Singleton Pattern

Scenario:

You need to ensure that a logging utility class in your application has only one instance throughout the application lifecycle to ensure consistent logging.

CODE

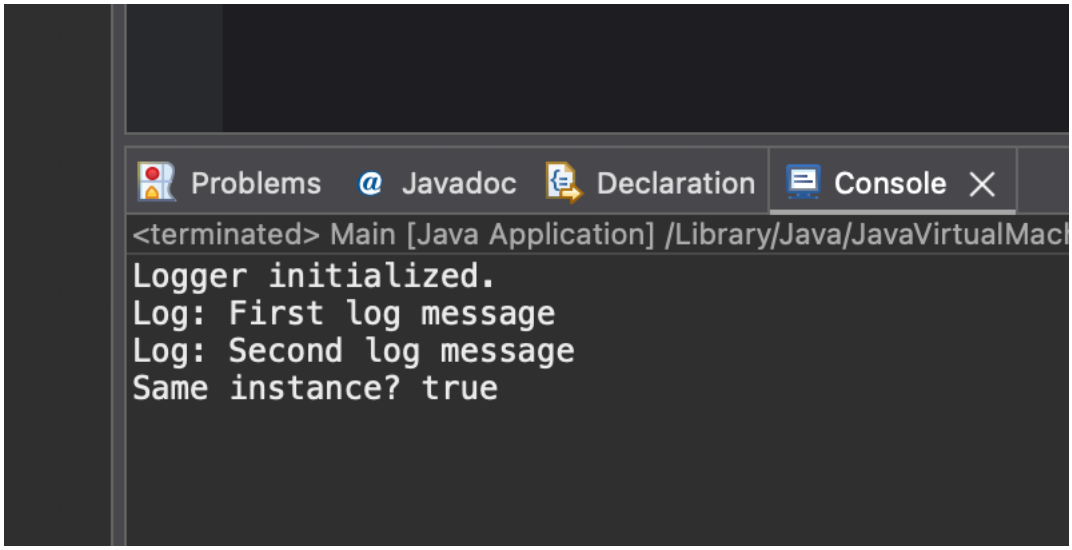
Logger.java

```
package com.example.singleton;

public class Logger {
	private static Logger instance;

	private Logger() {
		System.out.println("Logger initialized.");
	}

	public static Logger getInstance() {
		if (instance == null) {
			instance = new Logger();
		}
		return instance;
	}

	public void log(String message) {
		System.out.println("Log: " + message);
	}
}
```

Main.java

```
package com.example.singleton;

public class Main {
	public static void main(String[] args) {
		Logger logger1 = Logger.getInstance();
		Logger logger2 = Logger.getInstance();

		logger1.log("First log message");
		logger2.log("Second log message");

		System.out.println("Same instance? " + (logger1 == logger2));
	}
}
```

OUTPUT :



Exercise 2: Implementing the Factory Method Pattern

Scenario:

You are developing a document management system that needs to create different types of documents (e.g., Word, PDF, Excel). Use the Factory Method Pattern to achieve this.

CODE :

Document.java :

```
package com.example.Factory_Method_Pattern;

public interface Document {
	void open();
}
```

WordDocument.java :

```
package com.example.Factory_Method_Pattern;

public class WordDocument implements Document {
	public void open() {
		System.out.println("Opening Word Document");
	}
}
```

PdfDocument.java :

```
package com.example.Factory_Method_Pattern;

public class PdfDocument implements Document {
	public void open() {
		System.out.println("Opening PDF Document");
	}
}
```

DocumentFactory.java :

```
package com.example.Factory_Method_Pattern;

public abstract class DocumentFactory {
	public abstract Document createDocument();
}
```

WordFactory.java :

```
package com.example.Factory_Method_Pattern;

public class WordFactory extends DocumentFactory {
	public Document createDocument() {
		return new WordDocument();
	}
}
```

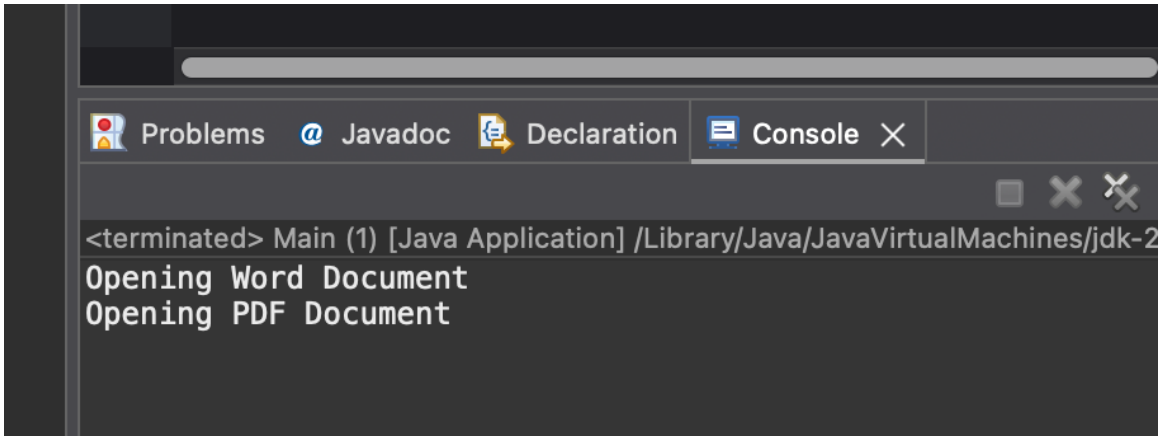
PdfFactory.java :

```
package com.example.Factory_Method_Pattern;

public class PdfFactory extends DocumentFactory {
	public Document createDocument() {
		return new PdfDocument();
	}
}
```

Main.java :

```
package com.example.Factory_Method_Pattern;

public class Main {

	public static void main(String[] args) {
		DocumentFactory wordFactory = new WordFactory();
		Document doc1 = wordFactory.createDocument();
		doc1.open();

		DocumentFactory pdfFactory = new PdfFactory();
		Document doc2 = pdfFactory.createDocument();
		doc2.open();
	}
}
```

OUTPUT :



Exercise 3: Implementing the Builder Pattern

Scenario:

You are developing a system to create complex objects such as a Computer with multiple optional parts. Use the Builder Pattern to manage the construction process.

CODE

Computer.java :

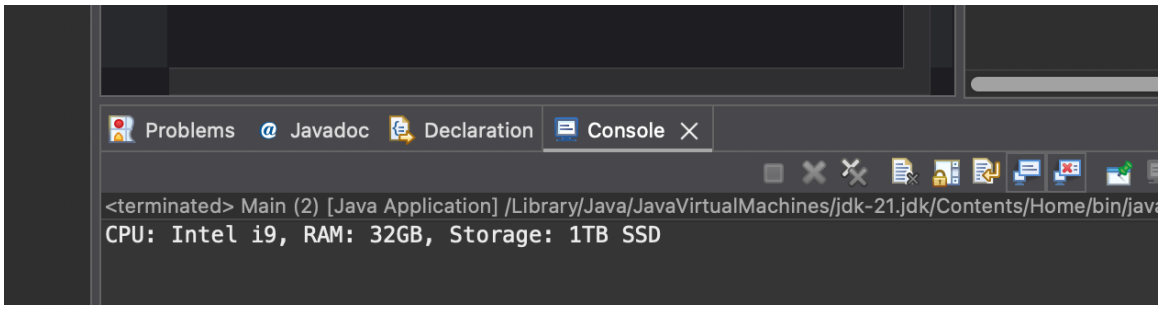
```
package com.example.BuilderPattern;

public class Computer {
  private String cpu, ram, storage;

  private Computer(Builder builder) {
        this.cpu = builder.cpu;
        this.ram = builder.ram;
        this.storage = builder.storage;
  }

  public void showSpecs() {
        System.out.println("CPU: " + cpu + ", RAM: " + ram + ", Storage: " + storage);
  }

public static class Builder {
        private String cpu, ram, storage;

        public Builder setCpu(String cpu) {
                this.cpu = cpu;
                return this;
        }

        public Builder setRam(String ram) {
                this.ram = ram;
                return this;
        }
```

```
        public Builder setStorage(String storage) {
            this.storage = storage;
            return this;
        }

        public Computer build() {
            return new Computer(this);
        }
    }
}
```

Main.java :

```
package com.example.BuilderPattern;

public class Main {
    public static void main(String[] args) {
        Computer myPc = new Computer.Builder()
                .setCpu("Intel i9")
                .setRam("32GB")
                .setStorage("1TB SSD")
                .build();

        myPc.showSpecs();
    }
}
```

OUTPUT :



Exercise 4: Implementing the Adapter Pattern

Scenario:

You are developing a payment processing system that needs to integrate with multiple third-party payment gateways with different interfaces. Use the Adapter Pattern to achieve this.

PaymentProcessor.java :

```
package com.example.AdapterPattern;

public interface PaymentProcessor {
    void processPayment(double amount);
}
```

ThirdPartyGateway.java :

```
package com.example.AdapterPattern;

public class ThirdPartyGateway {
	public void makeTransaction(double amount) {
		System.out.println("Paid using third party: ₹" + amount);
	}
}
```

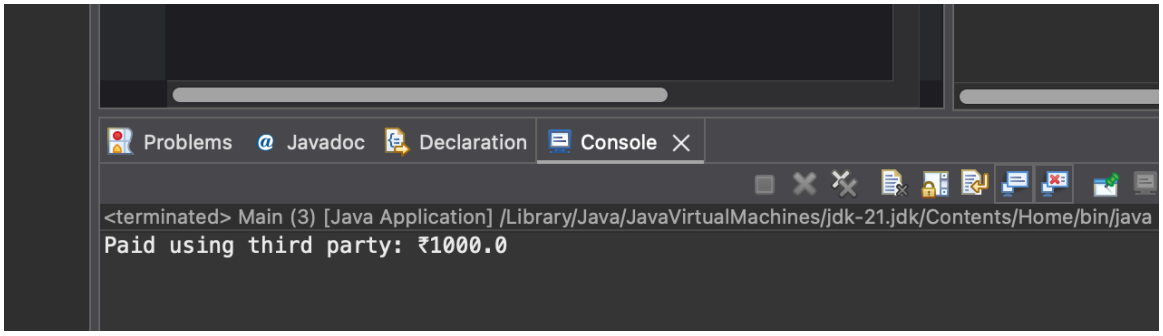
GatewayAdapter.java :

```
package com.example.AdapterPattern;

public class GatewayAdapter implements PaymentProcessor {
	private ThirdPartyGateway gateway;

	public GatewayAdapter(ThirdPartyGateway gateway) {
		this.gateway = gateway;
	}

	public void processPayment(double amount) {
		gateway.makeTransaction(amount);
	}
}
```

Main.java :

```
package com.example.AdapterPattern;

public class Main {
	public static void main(String[] args) {
		PaymentProcessor adapter = new GatewayAdapter(new
	ThirdPartyGateway());
	adapter.processPayment(1000);
	}
}
```

OUTPUT :



Exercise 5: Implementing the Decorator Pattern

Scenario:

You are developing a notification system where notifications can be sent via multiple channels (e.g., Email, SMS). Use the Decorator Pattern to add functionalities dynamically.

CODE

Notifier.java :

```
package com.example.DecoratorPattern;

public interface Notifier {
	void send(String message);
}
```

EmailNotifier.java :

```
package com.example.DecoratorPattern;

public class EmailNotifier implements Notifier {
	public void send(String message) {
		System.out.println("Email: " + message);
	}
}
```

NotifierDecorator.java :

```
package com.example.DecoratorPattern;

public abstract class NotifierDecorator implements Notifier {
	protected Notifier notifier;

	public NotifierDecorator(Notifier notifier) {
		this.notifier = notifier;
	}

	public void send(String message) {
		notifier.send(message);
	}
}
```

SMSNotifierDecorator.java :

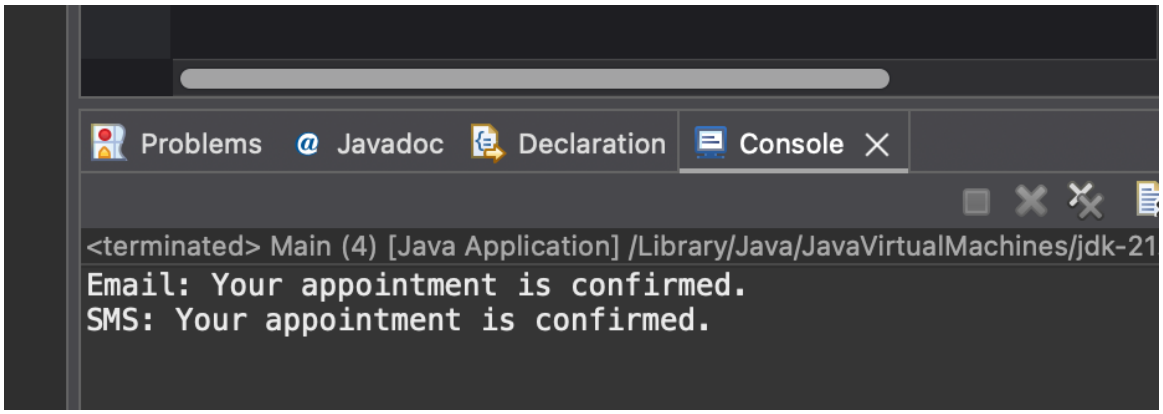
```
package com.example.DecoratorPattern;

public class SMSNotifierDecorator extends NotifierDecorator {
	public SMSNotifierDecorator(Notifier notifier) {
		super(notifier);
	}

	public void send(String message) {
		super.send(message);
```

```
                System.out.println("SMS: " + message);
        }
}
```

Main.java :

```
package com.example.DecoratorPattern;

public class Main {
        public static void main(String[] args) {
                Notifier notifier = new SMSNotifierDecorator(new EmailNotifier());
                notifier.send("Your appointment is confirmed.");
        }
}
```

OUTPUT :



Exercise 6: Implementing the Proxy Pattern

Scenario:

You are developing an image viewer application that loads images from a remote server. Use the Proxy Pattern to add lazy initialization and caching.

CODE

Image.java :

```
package com.example.ProxyPattern;

public interface Image {
        void display();
}
```

RealImage.java :

```
package com.example.ProxyPattern;

public class RealImage implements Image {
        private String fileName;

        public RealImage(String fileName) {
                this.fileName = fileName;
                loadFromDisk();
```

```
    }

    private void loadFromDisk() {
        System.out.println("Loading image: " + fileName);
    }

    public void display() {
        System.out.println("Displaying: " + fileName);
    }
}
```

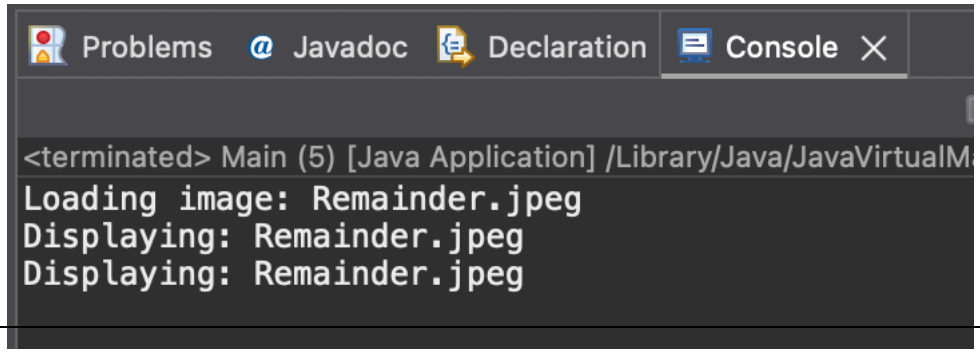
ProxyImage.java :

```
package com.example.ProxyPattern;

public class ProxyImage implements Image {
    private RealImage realImage;
    private String fileName;

    public ProxyImage(String fileName) {
        this.fileName = fileName;
    }

    public void display() {
        if (realImage == null) {
            realImage = new RealImage(fileName);
        }
        realImage.display();
    }
}
```

Main.java :

```
package com.example.ProxyPattern;

public class Main {
    public static void main(String[] args) {
        Image image = new ProxyImage("Remainder.jpeg");
        image.display();
        image.display();
    }
}
```

OUTPUT :



Exercise 7: Implementing the Observer Pattern

Scenario:

You are developing a stock market monitoring application where multiple clients need to be notified whenever stock prices change. Use the Observer Pattern to achieve this.

CODE

Observer.java :

```
package com.example.ObserverPattern;

public interface Observer {
	void update(String stock);
}
```

Stock.java :

```
package com.example.ObserverPattern;

public interface Stock {
	void register(Observer o);
	void remove(Observer o);
	void notifyObservers();
}
```

StockMarket.java :

```
package com.example.ObserverPattern;

import java.util.*;

public class StockMarket implements Stock {
	private List<Observer> observers = new ArrayList<>();
	private String stock;

	public void setStock(String stock) {
		this.stock = stock;
		notifyObservers();
	}

	public void register(Observer o) {
		observers.add(o);
	}

	public void remove(Observer o) {
		observers.remove(o);
	}

	public void notifyObservers() {
		for (Observer o : observers) {
			o.update(stock);
		}
	}
}
```

MobileApp.java :

```
package com.example.ObserverPattern;

public class MobileApp implements Observer {
        public void update(String stock) {
                System.out.println("Mobile App: Stock update → " + stock);
        }
}
```

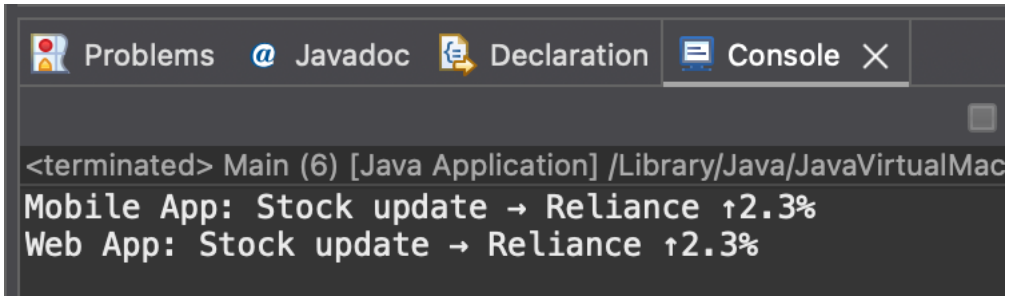
WebApp.java :

```
package com.example.ObserverPattern;

public class WebApp implements Observer {
        public void update(String stock) {
                System.out.println("Web App: Stock update → " + stock);
        }
}
```

Main.java :

```
package com.example.ObserverPattern;

public class Main {
        public static void main(String[] args) {
                StockMarket market = new StockMarket();
                Observer mobile = new MobileApp();
                Observer web = new WebApp();

                market.register(mobile);
                market.register(web);

                market.setStock("Reliance ↑2.3%");
        }
}
```

OUTPUT :



Exercise 8: Implementing the Strategy Pattern

Scenario:

You are developing a payment system where different payment methods (e.g., Credit Card, PayPal) can be selected at runtime. Use the Strategy Pattern to achieve this.

CODE

PayementStrategy.java :

```
package com.example.StrategyPattern;

public interface PaymentStrategy {
	void pay(double amount);
}
```

CreditCardPayment.java :

```
package com.example.StrategyPattern;

public class CreditCardPayment implements PaymentStrategy {
	public void pay(double amount) {
		System.out.println("Paid ₹" + amount + " via Credit Card");
	}
}
```

PayPalPayment.java :

```
package com.example.StrategyPattern;

public class PayPalPayment implements PaymentStrategy {
	public void pay(double amount) {
		System.out.println("Paid ₹" + amount + " via PayPal");
	}
}
```

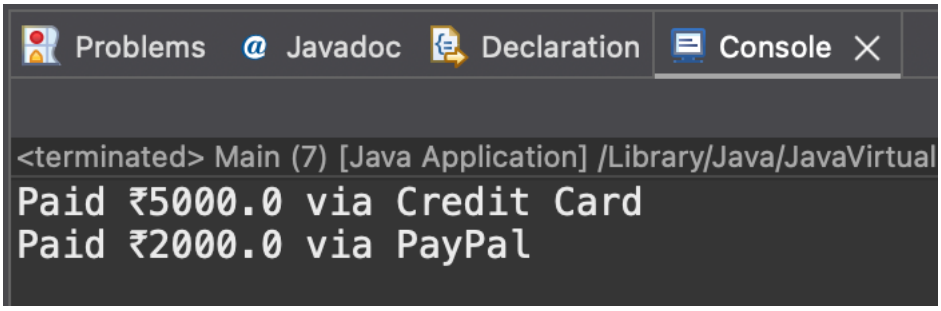
PaymentContext.java :

```
package com.example.StrategyPattern;

public class PaymentContext {
	private PaymentStrategy strategy;

	public void setStrategy(PaymentStrategy strategy) {
		this.strategy = strategy;
	}

	public void pay(double amount) {
		strategy.pay(amount);
	}
}
```

Main.java :

```
package com.example.StrategyPattern;

public class Main {
	public static void main(String[] args) {
		PaymentContext context = new PaymentContext();

		context.setStrategy(new CreditCardPayment());
		context.pay(5000);

		context.setStrategy(new PayPalPayment());
		context.pay(2000);
	}
}
```

OUTPUT :



Exercise 9: Implementing the Command Pattern

Scenario:

You are developing a home automation system where commands can be issued to turn devices on or off. Use the Command Pattern to achieve this.

CODE

Command.java :

```
package com.example.CommandPattern;

public interface Command {
	void execute();
}
```

Light.java :

```
package com.example.CommandPattern;

public class Light {
	public void on() {
		System.out.println("Light turned ON");
	}
	public void off() {
		System.out.println("Light turned OFF");
	}
}
```

LightOnCommand.java :

```
package com.example.CommandPattern;

public class LightOnCommand implements Command {
	private Light light;

	public LightOnCommand(Light light) {
		this.light = light;
	}

	public void execute() {
		light.on();
	}
}
```

LightOffCommand.java :

```
package com.example.CommandPattern;

public class LightOffCommand implements Command {
	private Light light;

	public LightOffCommand(Light light) {
		this.light = light;
	}

	public void execute() {
		light.off();
	}
}
```

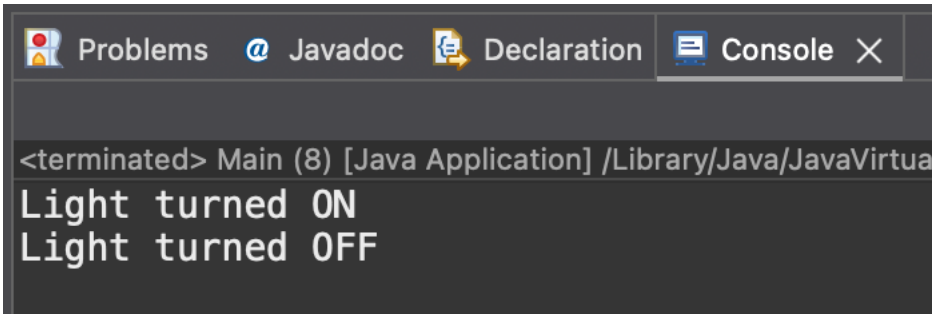
RemoteControl.java :

```
package com.example.CommandPattern;

public class RemoteControl {
	private Command command;

	public void setCommand(Command command) {
		this.command = command;
	}

	public void pressButton() {
		command.execute();
	}
}
```

Main.java :

```
package com.example.CommandPattern;

public class Main {
	public static void main(String[] args) {
		Light livingRoomLight = new Light();
		Command lightOn = new LightOnCommand(livingRoomLight);
		Command lightOff = new LightOffCommand(livingRoomLight);

		RemoteControl remote = new RemoteControl();
		remote.setCommand(lightOn);
		remote.pressButton();

		remote.setCommand(lightOff);
		remote.pressButton();
	}
}
```

OUTPUT :



Exercise 10: Implementing the MVC Pattern

Scenario:

You are developing a simple web application for managing student records using the MVC pattern.

CODE

Student.java :

```
package com.example.MVCPattern;

public class Student {
	private String name;
	private String id;

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

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

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

StudentView.java :

```
package com.example.MVCPattern;

public class StudentView {
        public void displayStudentDetails(String name, String id) {
                System.out.println("Student Name: " + name + ", ID: " + id);
        }
}
```

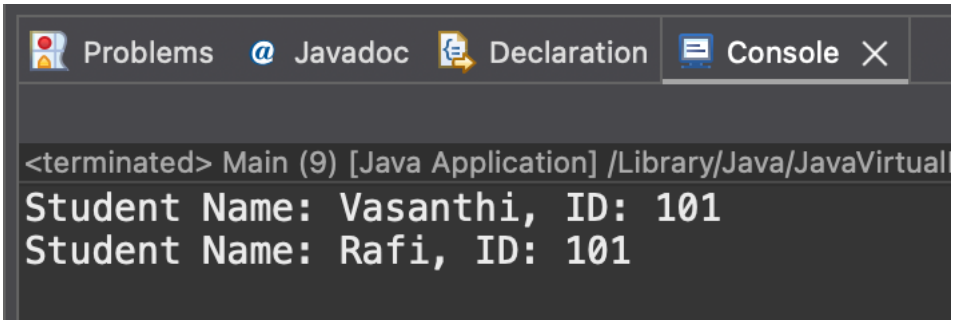
StudentController.java :

```
package com.example.MVCPattern;

public class StudentController {
        private Student model;
        private StudentView view;

        public StudentController(Student model, StudentView view) {
                this.model = model;
                this.view = view;
        }

        public void updateView() {
                view.displayStudentDetails(model.getName(), model.getId());
        }

        public void changeName(String name) {
                model.setName(name);
        }
}
```

Main.java :

```
package com.example.MVCPattern;

public class Main {
        public static void main(String[] args) {
                Student student = new Student("Vasanthi", "101");
                StudentView view = new StudentView();
                StudentController controller = new StudentController(student, view);

                controller.updateView();

                controller.changeName("Rafi");
                controller.updateView();
        }
}
```

OUTPUT :



Exercise 11: Implementing Dependency Injection

Scenario:

You are developing a customer management application where the service class depends on a repository class. Use Dependency Injection to manage these dependencies.

CODE

CustomerRepository.java :

```
package com.example.DependencyInjection;

public interface CustomerRepository {
	String findCustomerById(String id);
}
```

CustomerRepositoryImpl.java :

```
package com.example.DependencyInjection;

public class CustomerRepositoryImpl implements CustomerRepository {
	public String findCustomerById(String id) {
		return "Customer: Rafi | ID: " + id;
	}
}
```

CustomerService.java :

```
package com.example.DependencyInjection;

public class CustomerService {
	private CustomerRepository repo;

	public CustomerService(CustomerRepository repo) {
		this.repo = repo;
	}

	public void showCustomer(String id) {
		System.out.println(repo.findCustomerById(id));
	}
}
```

Main.java :

```
package com.example.DependencyInjection;

public class Main {
	public static void main(String[] args) {
		CustomerRepository repo = new CustomerRepositoryImpl();
		CustomerService service = new CustomerService(repo);

		service.showCustomer("007");
	}
}
```

OUTPUT :