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**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.

**Steps:**

1. **Create a New Java Project:**
   * Create a new Java project named **SingletonPatternExample**.
2. **Define a Singleton Class:**
   * Create a class named Logger that has a private static instance of itself.
   * Ensure the constructor of Logger is private.
   * Provide a public static method to get the instance of the Logger class.
3. **Implement the Singleton Pattern:**
   * Write code to ensure that the Logger class follows the Singleton design pattern.
4. **Test the Singleton Implementation:**
   * Create a test class to verify that only one instance of Logger is created and used across the application.

Solution:

Logger.java

Code:

package SingletonPatternExample;

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);

}

}

TestLogger.java

Code:

package SingletonPatternExample;

public class TestLogger {

public static void main(String[] args) {

Logger logger1 = Logger.*getInstance*();

Logger logger2 = Logger.*getInstance*();

logger1.log("First message");

logger2.log("Second message");

if (logger1 == logger2) {

System.***out***.println("Both logger instances are the same (Singleton confirmed)");

} else {

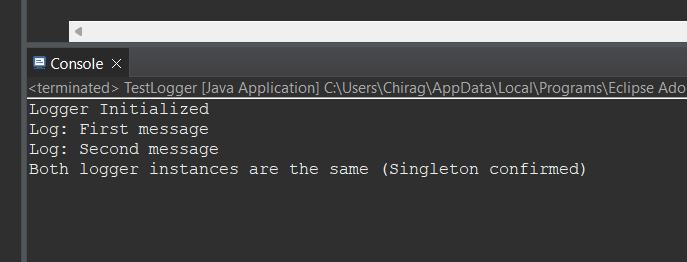
System.***out***.println("Logger instances are different (Singleton failed)");

}

}

}

Solution:



**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.

**Steps:**

1. **Create a New Java Project:**
   * Create a new Java project named **FactoryMethodPatternExample**.
2. **Define Document Classes:**
   * Create interfaces or abstract classes for different document types such as **WordDocument**, **PdfDocument**, and **ExcelDocument**.
3. **Create Concrete Document Classes:**
   * Implement concrete classes for each document type that implements or extends the above interfaces or abstract classes.
4. **Implement the Factory Method:**
   * Create an abstract class **DocumentFactory** with a method **createDocument()**.
   * Create concrete factory classes for each document type that extends DocumentFactory and implements the **createDocument()** method.
5. **Test the Factory Method Implementation:**
   * Create a test class to demonstrate the creation of different document types using the factory method.

Solution:

Code:

Document.java

package FactoryMethodPatternExample;

public interface Document {

void open();

}

* WordDocument
* PdfDocument
* ExcelDocument

Each one will implement the Document interface.

WordDocument.java

package FactoryMethodPatternExample;

public class WordDocument implements Document {

public void open() {

System.***out***.println("Opening Word Document...");

}

}

PdfDocument.java

package FactoryMethodPatternExample;

public class PdfDocument implements Document {

public void open() {

System.***out***.println("Opening PDF Document...");

}

}

ExcelDocument.java

package FactoryMethodPatternExample;

public class ExcelDocument implements Document {

public void open() {

System.***out***.println("Opening Excel Document...");

}

}

abstract class: DocumentFactory

DocumentFactory.java

package FactoryMethodPatternExample;

public abstract class DocumentFactory {

public abstract Document createDocument();

}

* WordDocumentFactory
* PdfDocumentFactory
* ExcelDocumentFactory

Each class will extend DocumentFactory.

WordDocumentFactory.java

package FactoryMethodPatternExample;

public class WordDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new WordDocument();

}

}

PdfDocumentFactory.java

package FactoryMethodPatternExample;

public class PdfDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new PdfDocument();

}

}

ExcelDocumentFactory.java

package FactoryMethodPatternExample;

public class ExcelDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new ExcelDocument();

}

}

FactoryMethodTest.java

package FactoryMethodPatternExample;

public class FactoryMethodTest {

public static void main(String[] args) {

// Create a Word Document

DocumentFactory wordFactory = new WordDocumentFactory();

Document wordDoc = wordFactory.createDocument();

wordDoc.open();

// Create a PDF Document

DocumentFactory pdfFactory = new PdfDocumentFactory();

Document pdfDoc = pdfFactory.createDocument();

pdfDoc.open();

// Create an Excel Document

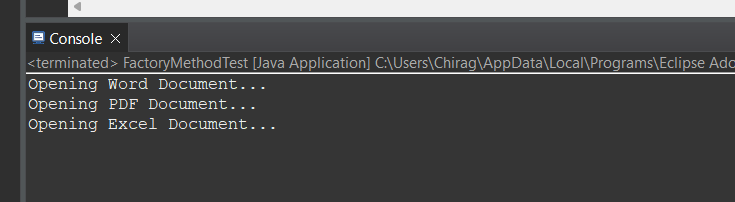
DocumentFactory excelFactory = new ExcelDocumentFactory();

Document excelDoc = excelFactory.createDocument();

excelDoc.open();

}

}

Output: