**Exercise 1: Implementing the Singleton Pattern**

1. **Logger Singleton Class**

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);

}

}

1. **Test Class**

public class TestSingleton {

public static void main(String[] args) {

Logger logger1 = Logger.getInstance();

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

Logger logger2 = Logger.getInstance();

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

if (logger1 == logger2) {

System.out.println("Only one Logger instance is used.");

} else {

System.out.println("Different Logger instances exist.");

}

}

**}**

**Analysis:**

* This implementation uses lazy initialization (object created only when needed).
* You can make it thread-safe using synchronization (if required in a multithreaded context).

**Exercise 2: Implementing the Factory Method Pattern**

1. Document Interface

public interface Document {

void open();

}

2. Concrete Document Classes

public class WordDocument implements Document {

public void open() {

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

}

}

public class PdfDocument implements Document {

public void open() {

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

}

}

public class ExcelDocument implements Document {

public void open() {

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

}

}

3. Abstract Factory Class

public abstract class DocumentFactory {

public abstract Document createDocument();

}

**4. Concrete Factory Classes**

public class WordDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new WordDocument();

}

}

public class PdfDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new PdfDocument();

}

}

public class ExcelDocumentFactory extends DocumentFactory {

public Document createDocument() {

return new ExcelDocument();

}

}

**5. Test Class**

public class TestFactoryMethod {

public static void main(String[] args) {

DocumentFactory wordFactory = new WordDocumentFactory();

Document wordDoc = wordFactory.createDocument();

wordDoc.open();

DocumentFactory pdfFactory = new PdfDocumentFactory();

Document pdfDoc = pdfFactory.createDocument();

pdfDoc.open();

DocumentFactory excelFactory = new ExcelDocumentFactory();

Document excelDoc = excelFactory.createDocument();

excelDoc.open();

}

}