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**Design Patterns and Principles**

**Exercise 1: Implementing the Singleton Pattern**

Code-

|  |
| --- |
| public class SingletonPatternExample {     static class Logger {  private static Logger instance;     private Logger() {  System.out.println("Logger instance created.");  }     public static Logger getInstance() {  if (instance == null) {  instance = new Logger();  }  return instance;  }   public void log(String message) {  System.out.println("Log: " + message);  }  }   public static void main(String[] args) {  Logger logger1 = Logger.getInstance();  Logger logger2 = Logger.getInstance();   logger1.log("First log message.");  logger2.log("Second log message.");   if (logger1 == logger2) {  System.out.println("Both logger1 and logger2 refer to the same instance.");  } else {  System.out.println("logger1 and logger2 are different instances.");  }  } } |

Output-

Logger instance created.

Log: First log message.

Log: Second log message.

Both logger1 and logger2 refer to the same instance.

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

code-

|  |
| --- |
| public class FactoryMethodPatternExample {   // Step 2: Define Document interface  interface Document {  void open();  }   // Step 3: Concrete Document classes  static class WordDocument implements Document {  public void open() {  System.out.println("Opening a Word document.");  }  }   static class PdfDocument implements Document {  public void open() {  System.out.println("Opening a PDF document.");  }  }   static class ExcelDocument implements Document {  public void open() {  System.out.println("Opening an Excel document.");  }  }   // Step 4: Abstract Factory  abstract static class DocumentFactory {  public abstract Document createDocument();  }   // Concrete Factories  static class WordDocumentFactory extends DocumentFactory {  public Document createDocument() {  return new WordDocument();  }  }   static class PdfDocumentFactory extends DocumentFactory {  public Document createDocument() {  return new PdfDocument();  }  }   static class ExcelDocumentFactory extends DocumentFactory {  public Document createDocument() {  return new ExcelDocument();  }  }   // Step 5: Test the factory method pattern  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();  } } |

Output-

Opening a Word document.

Opening a PDF document.

Opening an Excel document.