Exercise 1: Configuring a Basic Spring Application

Scenario:

Your company is developing a web application for managing a library. You need to use the Spring Framework to handle the backend operations.

Steps:

1. **Set Up a Spring Project:**
   - Create a Maven project named **LibraryManagement**.
   - Add Spring Core dependencies in the **pom.xml** file.
2. **Configure the Application Context:**
   - Create an XML configuration file named **applicationContext.xml** in the **src/main/resources** directory.
   - Define beans for **BookService** and **BookRepository** in the XML file.
3. **Define Service and Repository Classes:**
   - Create a package **com.library.service** and add a class **BookService**.
   - Create a package **com.library.repository** and add a class **BookRepository**.
4. **Run the Application:**
   - Create a main class to load the Spring context and test the configuration.

CODE:

pom.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
   <modelVersion>4.0.0</modelVersion>

   <groupId>org.example</groupId>
   <artifactId>LibraryManagementSystem</artifactId>
   <version>1.0-SNAPSHOT</version>

   <properties>
      <maven.compiler.source>17</maven.compiler.source>
      <maven.compiler.target>17</maven.compiler.target>
   </properties>
```

```
<dependencies>
  <!-- Spring Core -->
  <dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-context</artifactId>
    <version>5.3.30</version>
  </dependency>

  <!-- Spring AOP -->
  <dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-aop</artifactId>
    <version>5.3.30</version>
  </dependency>

  <!-- AspectJ for AOP -->
  <dependency>
    <groupId>org.aspectj</groupId>
    <artifactId>aspectjweaver</artifactId>
    <version>1.9.20.1</version>
  </dependency>

  <!-- JUnit for testing (optional) -->
  <dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.13.2</version>
    <scope>test</scope>
  </dependency>
</dependencies>

<build>
  <plugins>
    <!-- Maven Compiler Plugin -->
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-compiler-plugin</artifactId>
      <version>3.11.0</version>
      <configuration>
        <source>${maven.compiler.source}</source>
        <target>${maven.compiler.target}</target>
      </configuration>
    </plugin>
```

```
        </plugins>
    </build>
</project>
```

BookRepository.java

src/main/java/com.library/repository

```
package com.library.repository;

import org.springframework.stereotype.Repository;

@Repository
public class BookRepository {
    public void save() {
        System.out.println("BookRepository: book saved.");
        }
    }
```

BookService.java

src/main/java/com.library/service

```
package com.library.service;

import com.library.repository.BookRepository;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

@Service("bookService")
public class BookService {
    @Autowired
    private BookRepository bookRepository;

    public void performSave() {
        System.out.println("BookService: calling repository...");
        bookRepository.save();
    }
}
```

MainApp.java

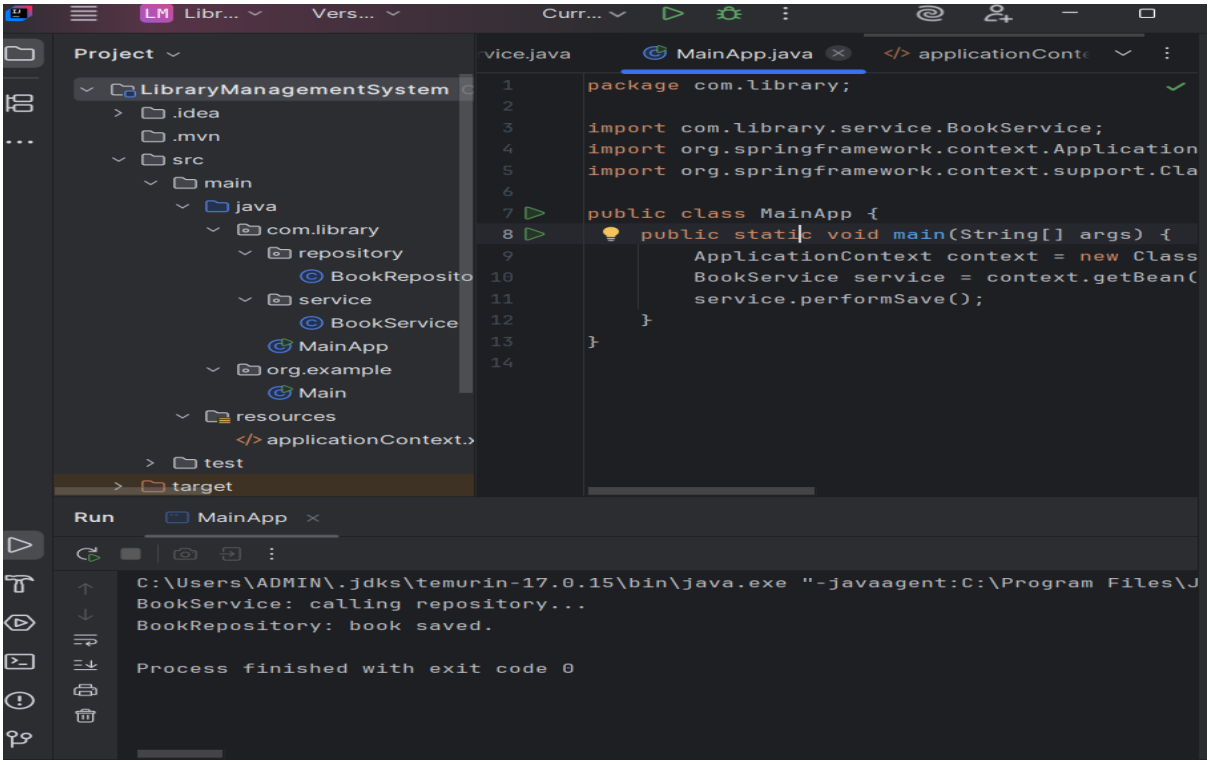
Src/main/java/com.library/MainApp

```
package com.library;

import com.library.service.BookService;
import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

public class MainApp {
   public static void main(String[] args) {
      ApplicationContext context = new ClassPathXmlApplicationContext("applicationContext.xml");
      BookService service = context.getBean("bookService", BookService.class);
      service.performSave();
   }
}
```

src/main/resources

```
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:aop="http://www.springframework.org/schema/aop"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="
      http://www.springframework.org/schema/beans
      http://www.springframework.org/schema/beans/spring-beans.xsd
      http://www.springframework.org/schema/context
      http://www.springframework.org/schema/context/spring-context.xsd
      http://www.springframework.org/schema/aop
      http://www.springframework.org/schema/aop/spring-aop.xsd">

  <!-- Enable component scanning -->
  <context:component-scan base-package="com.library" />

  <!-- Enable AOP -->
  <aop:aspectj-autoproxy />
</beans>
```

OUTPUT:



Exercise 2: Implementing Dependency Injection

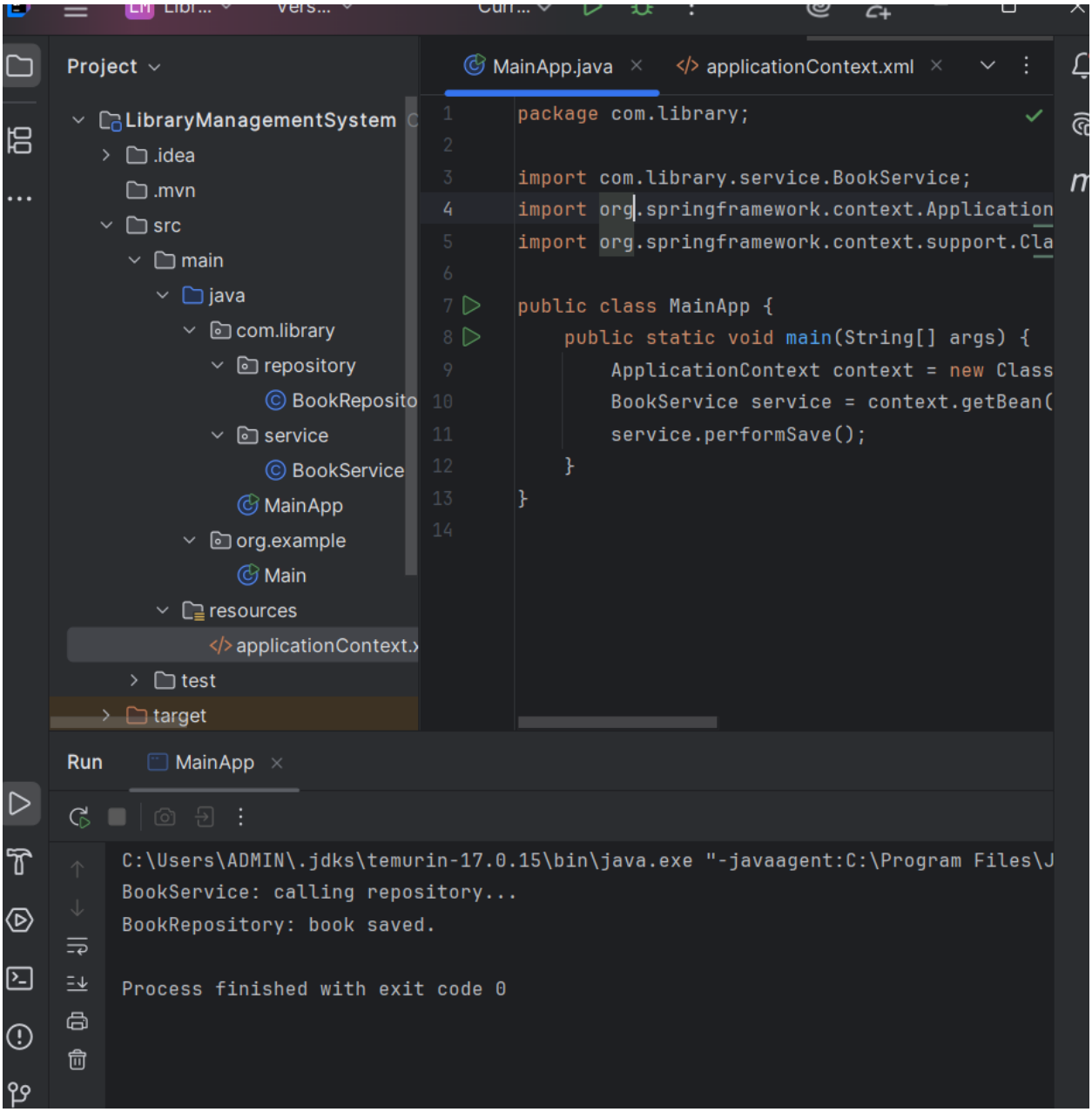
Scenario:

In the library management application, you need to manage the dependencies between the BookService and BookRepository classes using Spring's IoC and DI.

Steps:

1. **Modify the XML Configuration:** ○ Update **applicationContext.xml** to wire **BookRepository** into **BookService**.
2. **Update the BookService Class:**
   - Ensure that **BookService** class has a setter method for **BookRepository**.
3. **Test the Configuration:**
   - Run the **LibraryManagementApplication** main class to verify the dependency injection.

OUTPUT:



Exercise 4: Implementing Logging with Spring AOP

Scenario:

The library management application requires logging capabilities to track method execution times.

Steps:

1. **Add Spring AOP Dependency:** ○ Update **pom.xml** to include Spring AOP dependency.
2. **Create an Aspect for Logging:**
   - Create a package **com.library.aspect** and add a class **LoggingAspect** with a method to log execution times.
3. **Enable AspectJ Support:**
   - Update **applicationContext.xml** to enable **AspectJ** support and register the aspect.
4. **Test the Aspect:**
   - Run the **LibraryManagementApplication** main class and observe the console for log messages indicating method execution times. **Exercise 4: Creating and Configuring a Maven Project**

Scenario:

You need to set up a new Maven project for the library management application and add Spring dependencies.

Steps:

1. **Create a New Maven Project:**
   - Create a new Maven project named **LibraryManagement**.
2. **Add Spring Dependencies in pom.xml:**
   - Include dependencies for Spring Context, Spring AOP, and Spring WebMVC.
3. **Configure Maven Plugins:**
   - Configure the Maven Compiler Plugin for Java version 1.8 in the pom.xml file.

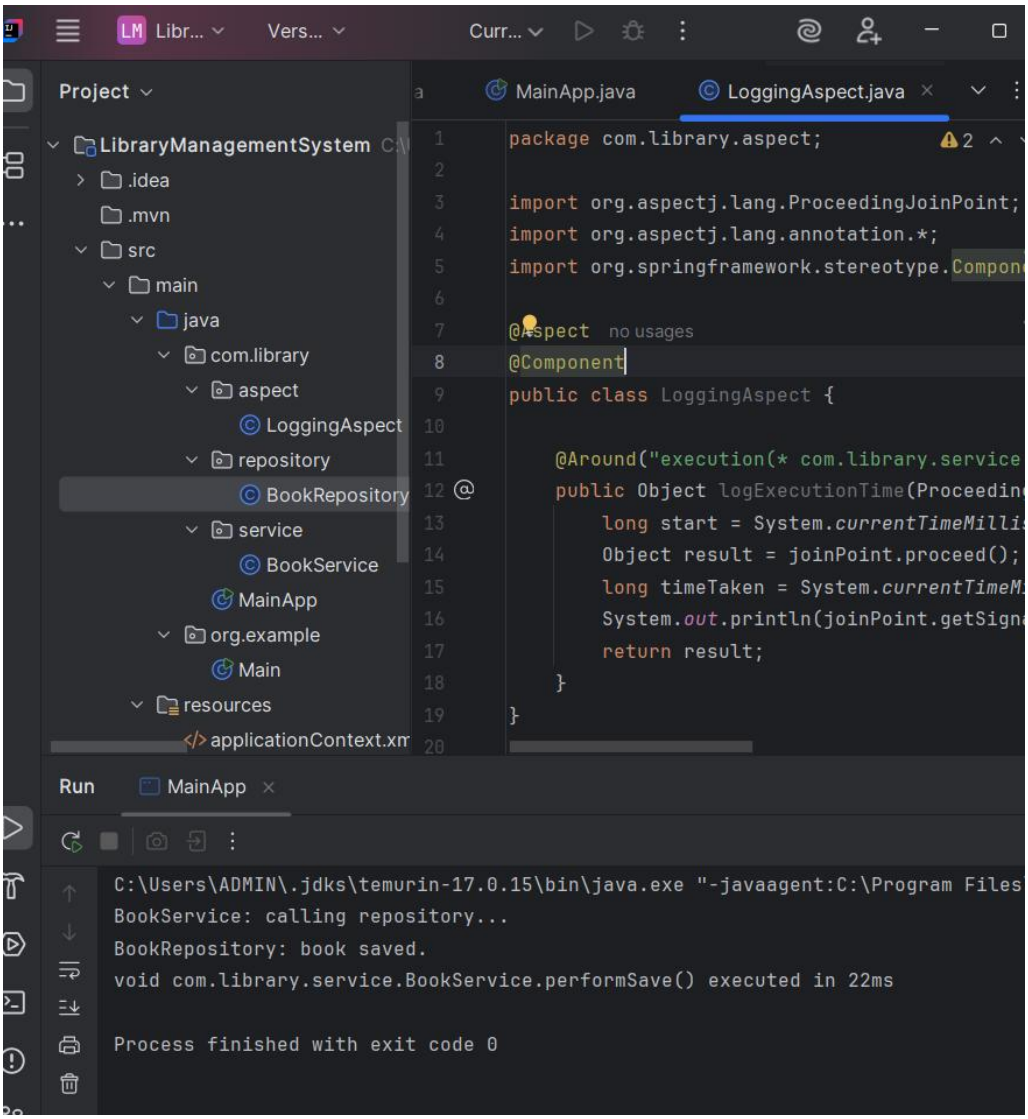
CODE:

LoggingAspect.java

```
package com.library.aspect;

import org.aspectj.lang.ProceedingJoinPoint;
import org.aspectj.lang.annotation.*;
import org.springframework.stereotype.Component;

@Aspect
@Component
```

```
public class LoggingAspect {

    @Around("execution(* com.library.service.*.*(..))")
    public Object logExecutionTime(ProceedingJoinPoint joinPoint) throws Throwable {
        long start = System.currentTimeMillis();
        Object result = joinPoint.proceed();
        long timeTaken = System.currentTimeMillis() - start;
        System.out.println(joinPoint.getSignature() + " executed in " + timeTaken + "ms");
        return result;
    }
}
```

OUTPUT:



Exercise 5: Configuring the Spring IoC Container

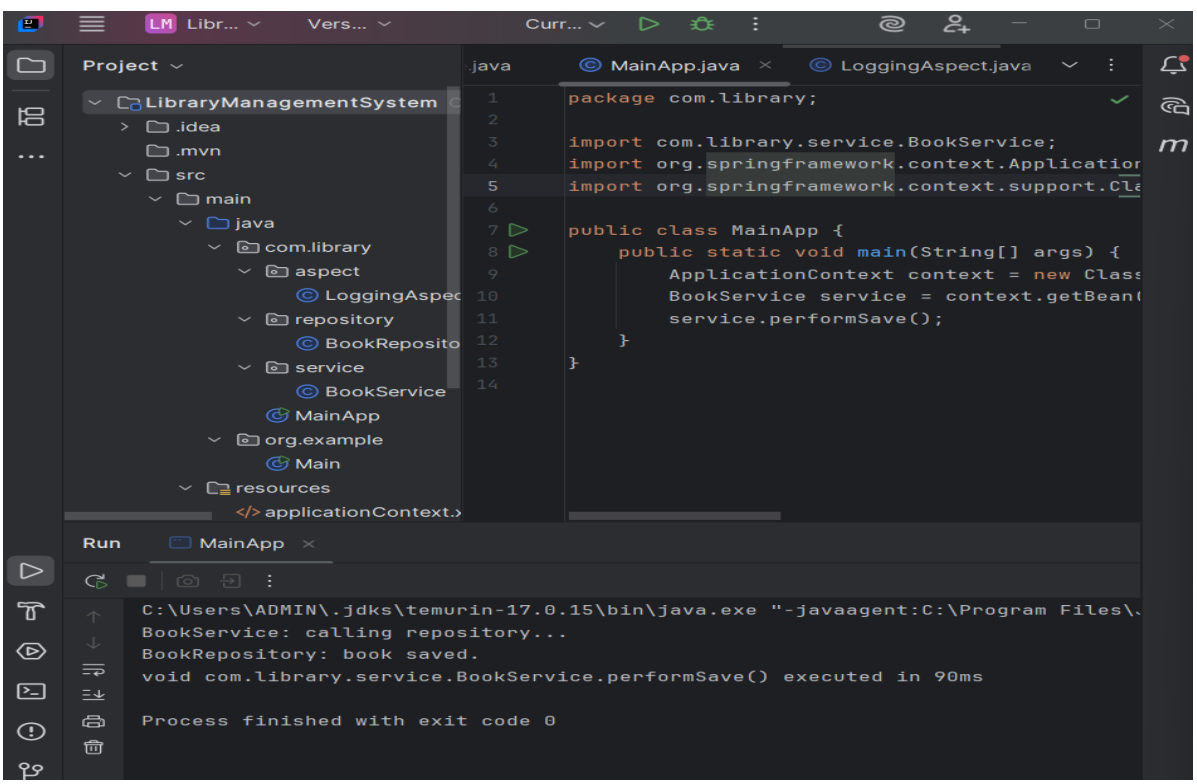
Scenario:

The library management application requires a central configuration for beans and dependencies.

Steps:

1. **Create Spring Configuration File:**
   - Create an XML configuration file named **applicationContext.xml** in the **src/main/resources** directory.
   - Define beans for **BookService** and **BookRepository** in the XML file.
2. **Update the BookService Class:**
   - Ensure that the **BookService** class has a setter method for **BookRepository**.
3. **Run the Application:**
   - Create a main class to load the Spring context and test the configuration.

OUTPUT:



Exercise 6: Configuring Beans with Annotations

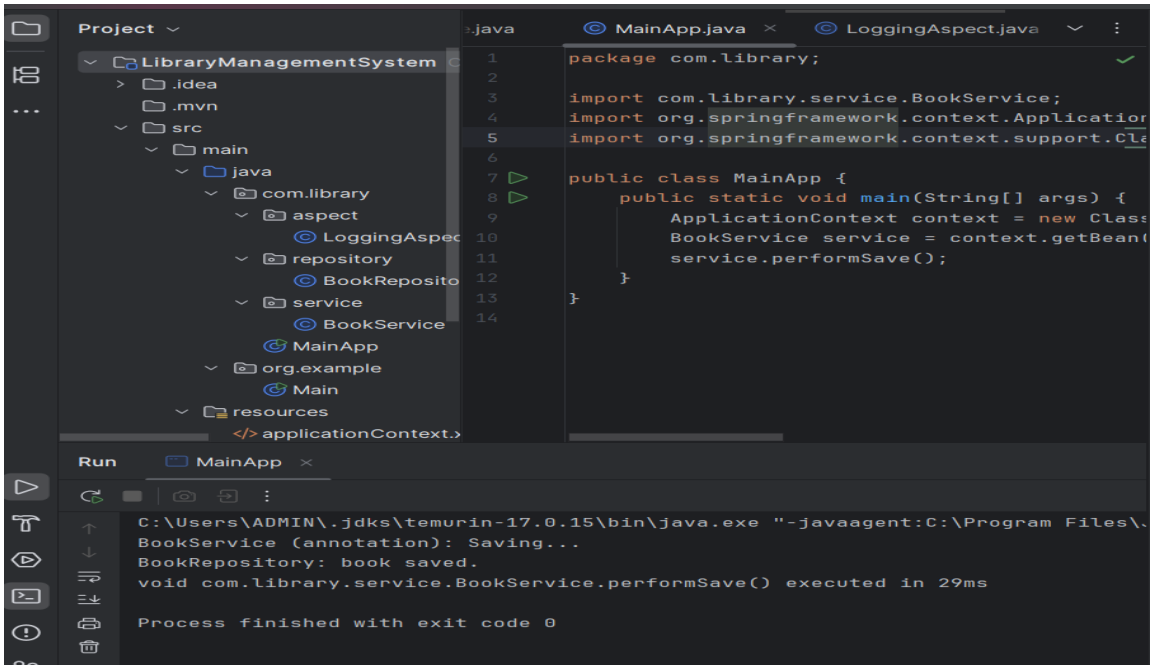
Scenario:

You need to simplify the configuration of beans in the library management application using annotations.

Steps:

1. **Enable Component Scanning:**
   - Update **applicationContext.xml** to include component scanning for the **com.library** package.
2. **Annotate Classes:**
   - Use **@Service** annotation for the **BookService** class.
   - Use **@Repository** annotation for the **BookRepository** class.
3. **Test the Configuration:**
   - Run the **LibraryManagementApplication** main class to verify the annotation-based configuration.

OUTPUT:



Exercise 7: Implementing Constructor and Setter Injection

Scenario:

The library management application requires both constructor and setter injection for better control over bean initialization.

Steps:

1. **Configure Constructor Injection:** ○ Update applicationContext.**xml** to configure constructor injection for **BookService**.
2. **Configure Setter Injection:**
   - Ensure that the **BookService** class has a setter method for **BookRepository** and configure it in **applicationContext.xml**.
3. **Test the Injection:**
   - Run the **LibraryManagementApplication** main class to verify both constructor and setter injection.

Exercise 8: Implementing Basic AOP with Spring

Scenario:

The library management application requires basic AOP functionality to separate cross-cutting concerns like logging and transaction management.

Steps:

1. **Define an Aspect:** ○ Create a package **com.library.aspect** and add a class **LoggingAspect**.
2. **Create Advice Methods:** ○ Define advice methods in **LoggingAspect** for logging before and after method execution.
3. **Configure the Aspect:** ○ Update **applicationContext.xml** to register the aspect and enable **AspectJ** auto-proxying.
4. **Test the Aspect:**
   - Run the **LibraryManagementApplication** main class to verify the AOP functionality.

Exercise 9: Creating a Spring Boot Application

Scenario:

You need to create a Spring Boot application for the library management system to simplify configuration and deployment.

Steps:

1. **Create a Spring Boot Project:**
   - Use **Spring Initializr** to create a new Spring Boot project named **LibraryManagement**.
2. **Add Dependencies:**
   - Include dependencies for **Spring Web, Spring Data JPA, and H2 Database**.
3. **Create Application Properties:** ○ Configure database connection properties in **application.properties**.
4. **Define Entities and Repositories:**
   - Create **Book** entity and **BookRepository** interface.
5. **Create a REST Controller:** ○ Create a **BookController** class to handle CRUD operations.
6. **Run the Application:**
   - Run the Spring Boot application and test the REST endpoints.

CODE:

BookService.java

```
package com.library.service;


import com.library.repository.BookRepository;

import org.springframework.beans.factory.annotation.Autowired;

import org.springframework.stereotype.Service;


@Service

public class BookService {
```

```
    @Autowired
    private BookRepository bookRepository;

    public void performSave() {
        System.out.println("BookService (annotation): Saving...");
        bookRepository.save();
    }
}
```

OUTPUT: