**Week 3 Hands-On :**

**Spring Core and Maven :**

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.

**Source Code :**

Pom.xml

<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>com.library</groupId>

<artifactId>LibraryManagement</artifactId>

<version>1.0-SNAPSHOT</version>

<dependencies>

<dependency>

<groupId>org.springframework</groupId>

<artifactId>spring-context</artifactId>

<version>5.3.34</version>

</dependency>

</dependencies>

</project>

BookRepository.java

package com.library.repository;

public class BookRepository {

public void saveBook(String bookName) {

System.out.println("Book saved: " + bookName);

}

}

BookService.java

package com.library.service;

import com.library.repository.BookRepository;

public class BookService {

private BookRepository bookRepository;

public void setBookRepository(BookRepository bookRepository) {

this.bookRepository = bookRepository;

}

public void addBook(String bookName) {

bookRepository.saveBook(bookName);

}

}

MainApp.java

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 bookService = (BookService) context.getBean("bookService");

bookService.addBook("The Great Gatsby");

}

}

Applicationcontext.xml

<?xml version="1.0" encoding="UTF-8"?>

<beans xmlns="http://www.springframework.org/schema/beans"

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">

<bean id="bookRepository" class="com.library.repository.BookRepository" />

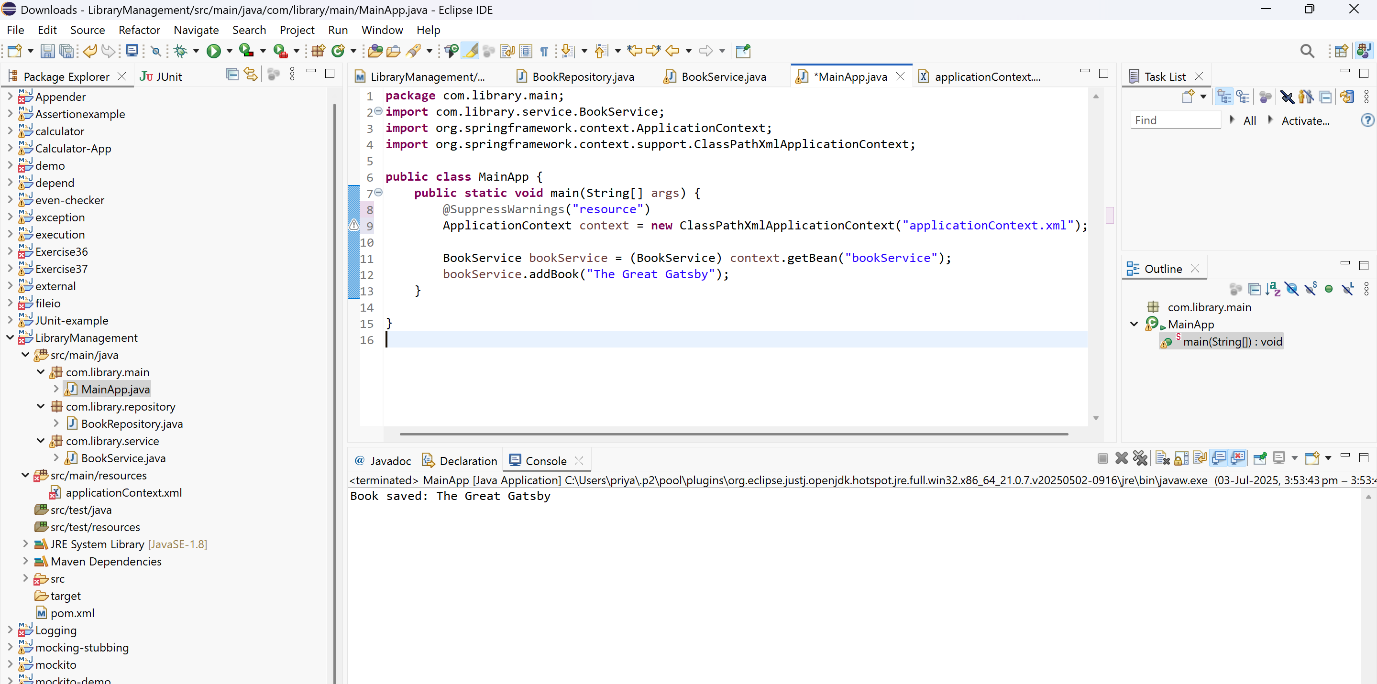
<bean id="bookService" class="com.library.service.BookService">

<property name="bookRepository" ref="bookRepository" />

</bean>

</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.

**Source code :**

BookRepository.java

package com.library.service;

import com.library.repository.BookRepository;

public class BookService {

private BookRepository bookRepository;

public void setBookRepository(BookRepository bookRepository) {

this.bookRepository = bookRepository;

}

public void addBook(String bookName) {

bookRepository.saveBook(bookName);

}

}

applicationContext.xml

<?xml version="1.0" encoding="UTF-8"?>

<beans xmlns="http://www.springframework.org/schema/beans"

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">

<bean id="bookRepository" class="com.library.repository.BookRepository" />

<bean id="bookService" class="com.library.service.BookService">

<property name="bookRepository" ref="bookRepository"/>

</bean>

</beans>

MainApp.java

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 bookService = (BookService) context.getBean("bookService");

bookService.addBook("To Kill a Mockingbird");

}

}

**Output :**

A screenshot of a computer

AI-generated content may be incorrect.

**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.

**Source code :**

Pom.xml

<dependencies>

<dependency>

<groupId>org.springframework</groupId>

<artifactId>spring-context</artifactId>

<version>5.3.34</version>

</dependency>

<dependency>

<groupId>org.springframework</groupId>

<artifactId>spring-aspects</artifactId>

<version>5.3.34</version>

</dependency>

<dependency>

<groupId>org.springframework</groupId>

<artifactId>spring-webmvc</artifactId>

<version>5.3.34</version>

</dependency>

<dependency>

<groupId>javax.servlet</groupId>

<artifactId>javax.servlet-api</artifactId>

<version>4.0.1</version>

<scope>provided</scope>

</dependency>

</dependencies>

Maven compiler

<build>

<plugins>

<plugin>

<groupId>org.apache.maven.plugins</groupId>

<artifactId>maven-compiler-plugin</artifactId>

<version>3.10.1</version>

<configuration>

<source>1.8</source>

<target>1.8</target>

</configuration>

</plugin>

</plugins>

</build>

MainApp.java

package com.library.main;

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.class);

service.addBook("The Hobbyy");

}

}

**Output :**

A screenshot of a computer

AI-generated content may be incorrect.

**Spring Data JPA :**

**Exercise 1 : Spring Data JPA – Quick Example**

Software Pre-requisites

• MySQL Server 8.0

• MySQL Workbench 8

• Eclipse IDE for Enterprise Java Developers 2019-03 R

• Maven 3.6.2

Create a Eclipse Project using Spring Initializr

• Go to https://start.spring.io/

• Change Group as “com.cognizant”

• Change Artifact Id as “orm-learn”

• In Options > Description enter "Demo project for Spring Data JPA and Hibernate"

• Click on menu and select "Spring Boot DevTools", "Spring Data JPA" and "MySQL Driver"

• Click Generate and download the project as zip

• Extract the zip in root folder to Eclipse Workspace

• Import the project in Eclipse "File > Import > Maven > Existing Maven Projects > Click Browse and select extracted folder > Finish"

• Create a new schema "ormlearn" in MySQL database. Execute the following commands to open MySQL client and create schema.

> mysql -u root -p

mysql> create schema ormlearn;

• In orm-learn Eclipse project, open src/main/resources/application.properties and include the below database and log configuration.

# Spring Framework and application log

logging.level.org.springframework=info

logging.level.com.cognizant=debug

# Hibernate logs for displaying executed SQL, input and output

logging.level.org.hibernate.SQL=trace

logging.level.org.hibernate.type.descriptor.sql=trace

# Log pattern

logging.pattern.console=%d{dd-MM-yy} %d{HH:mm:ss.SSS} %-20.20thread %5p %-25.25logger{25} %25M %4L %m%n

# Database configuration

spring.datasource.driver-class-name=com.mysql.cj.jdbc.Driver

spring.datasource.url=jdbc:mysql://localhost:3306/ormlearn

spring.datasource.username=root

spring.datasource.password=root

# Hibernate configuration

spring.jpa.hibernate.ddl-auto=validate

spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.MySQL5Dialect

• Build the project using ‘mvn clean package -Dhttp.proxyHost=proxy.cognizant.com -Dhttp.proxyPort=6050 -Dhttps.proxyHost=proxy.cognizant.com -Dhttps.proxyPort=6050 -Dhttp.proxyUser=123456’ command in command line

• Include logs for verifying if main() method is called.

import org.slf4j.Logger;

import org.slf4j.LoggerFactory;

private static final Logger LOGGER = LoggerFactory.getLogger(OrmLearnApplication.class);

public static void main(String[] args) {

SpringApplication.run(OrmLearnApplication.class, args);

LOGGER.info("Inside main");

}

• Execute the OrmLearnApplication and check in log if main method is called.

SME to walk through the following aspects related to the project created:

1. src/main/java - Folder with application code

2. src/main/resources - Folder for application configuration

3. src/test/java - Folder with code for testing the application

4. OrmLearnApplication.java - Walkthrough the main() method.

5. Purpose of @SpringBootApplication annotation

6. pom.xml

1. Walkthrough all the configuration defined in XML file

2. Open 'Dependency Hierarchy' and show the dependency tree.

Country table creation

• Create a new table country with columns for code and name. For sample, let us insert one country with values 'IN' and 'India' in this table.

create table country(co\_code varchar(2) primary key, co\_name varchar(50));

• Insert couple of records into the table

insert into country values ('IN', 'India');

insert into country values ('US', 'United States of America');

Persistence Class - com.cognizant.orm-learn.model.Country

• Open Eclipse with orm-learn project

• Create new package com.cognizant.orm-learn.model

• Create Country.java, then generate getters, setters and toString() methods.

• Include @Entity and @Table at class level

• Include @Column annotations in each getter method specifying the column name.

import javax.persistence.Column;

import javax.persistence.Entity;

import javax.persistence.Id;

import javax.persistence.Table;

@Entity

@Table(name="country")

public class Country {

@Id

@Column(name="code")

private String code;

@Column(name="name")

private String name;

// getters and setters

// toString()

}

Notes:

• @Entity is an indicator to Spring Data JPA that it is an entity class for the application

• @Table helps in defining the mapping database table

• @Id helps is defining the primary key

• @Column helps in defining the mapping table column

Repository Class - com.cognizant.orm-learn.CountryRepository

• Create new package com.cognizant.orm-learn.repository

• Create new interface named CountryRepository that extends JpaRepository<Country, String>

• Define @Repository annotation at class level

import org.springframework.data.jpa.repository.JpaRepository;

import org.springframework.stereotype.Repository;

import com.cognizant.ormlearn.model.Country;

@Repository

public interface CountryRepository extends JpaRepository<Country, String> {

}

Service Class - com.cognizant.orm-learn.service.CountryService

• Create new package com.cognizant.orm-learn.service

• Create new class CountryService

• Include @Service annotation at class level

• Autowire CountryRepository in CountryService

• Include new method getAllCountries() method that returns a list of countries.

• Include @Transactional annotation for this method

• In getAllCountries() method invoke countryRepository.findAll() method and return the result

Testing in OrmLearnApplication.java

• Include a static reference to CountryService in OrmLearnApplication class

private static CountryService countryService;

• Define a test method to get all countries from service.

private static void testGetAllCountries() {

LOGGER.info("Start");

List<Country> countries = countryService.getAllCountries();

LOGGER.debug("countries={}", countries);

LOGGER.info("End");

}

• Modify SpringApplication.run() invocation to set the application context and the CountryService reference from the application context.

ApplicationContext context = SpringApplication.run(OrmLearnApplication.class, args);

countryService = context.getBean(CountryService.class);

testGetAllCountries();

• Execute main method to check if data from ormlearn database is retrieved.

**Source Code :**

Country.java

com.cognizant.ormlearn.model

@Entity

@Table(name = "country")

public class Country {

@Id

@Column(name = "co\_code")

private String code;

@Column(name = "co\_name")

private String name;

}

CountryRepository.java

com.cognizant.ormlearn.repository

@Repository

public interface CountryRepository extends JpaRepository<Country, String> {

}

CountryService.java

com.cognizant.ormlearn.service

@Service

public class CountryService {

@Autowired

private CountryRepository countryRepository;

@Transactional

public List<Country> getAllCountries() {

return countryRepository.findAll();

}

}

OrmLearnApplication.java

private static final Logger LOGGER = LoggerFactory.getLogger(OrmLearnApplication.class);

public static void main(String[] args) {

ApplicationContext context = SpringApplication.run(OrmLearnApplication.class, args);

countryService = context.getBean(CountryService.class);

LOGGER.info("Inside main");

testGetAllCountries();

}

private static void testGetAllCountries() {

LOGGER.info("Start");

List<Country> countries = countryService.getAllCountries();

LOGGER.debug("countries={}", countries);

LOGGER.info("End");

}

private static CountryService countryService;

application.properties

logging.level.org.springframework=info

logging.level.com.cognizant=debug

logging.level.org.hibernate.SQL=trace

logging.level.org.hibernate.type.descriptor.sql=trace

logging.pattern.console=%d{dd-MM-yy} %d{HH:mm:ss.SSS} %-20.20thread %5p %-25.25logger{25} %25M %4L %m%n

spring.datasource.driver-class-name=com.mysql.cj.jdbc.Driver

spring.datasource.url=jdbc:mysql://localhost:3306/ormlearn

spring.datasource.username=root

spring.datasource.password=root

spring.jpa.hibernate.ddl-auto=validate

spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.MySQL5Dialect

Sql

mysql -u root -p

create schema ormlearn;

create table country(co\_code varchar(2) primary key, co\_name varchar(50));

insert into country values ('IN', 'India');

insert into country values ('US', 'United States of America');

**Exercise 4 : Difference between JPA , Hibernate and Spring Data JPA**

Java Persistence API (JPA)

* JSR 338 Specification for persisting, reading and managing data from Java objects
* Does not contain concrete implementation of the specification
* Hibernate is one of the implementation of JPA

Hibernate

* ORM Tool that implements JPA

Spring Data JPA

* Does not have JPA implementation, but reduces boiler plate code
* This is another level of abstraction over JPA implementation provider like Hibernate
* Manages transactions

Refer code snippets below on how the code compares between Hibernate and Spring Data JPA  
Hibernate

   /\* Method to CREATE an employee in the database \*/

   public Integer addEmployee(Employee employee){

      Session session = factory.openSession();

      Transaction tx = null;

      Integer employeeID = null;

      try {

         tx = session.beginTransaction();

         employeeID = (Integer) session.save(employee);

         tx.commit();

      } catch (HibernateException e) {

         if (tx != null) tx.rollback();

         e.printStackTrace();

      } finally {

         session.close();

      }

      return employeeID;

   }

Spring Data JPA  
EmployeeRespository.java

public interface EmployeeRepository extends JpaRepository<Employee, Integer> {

}

EmployeeService.java

@Autowire

  private EmployeeRepository employeeRepository;

@Transactional

public void addEmployee(Employee employee) {

  employeeRepository.save(employee);

  }

**Source code :**

EntityManager(JPA)

public interface EntityManager {

void persist(Object entity);

Object find(Class entityClass, Object primaryKey);

}

Hibernate

public Integer addEmployee(Employee employee) {

Session session = factory.openSession();

Transaction tx = null;

Integer employeeID = null

try {

tx = session.beginTransaction();

employeeID = (Integer) session.save(employee);

tx.commit();

} catch (HibernateException e) {

if (tx != null) tx.rollback();

e.printStackTrace();

} finally {

session.close();

}

return employeeID;

}

Spring Data JPA

public interface EmployeeRepository extends JpaRepository<Employee, Integer> {

}

Service class

@Service

public class EmployeeService {

@Autowired

private EmployeeRepository employeeRepository;

@Transactional

public void addEmployee(Employee employee) {

employeeRepository.save(employee);

}

}