WEEK 3 SOLUTIONS

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

```
<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>
    <!-- Spring Core -->
    <dependency>
      <groupId>org.springframework</groupId>
      <artifactId>spring-context</artifactId>
      <version>5.3.31</version>
    </dependency>
  </dependencies>
</project>
```

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>
```

BookRepository.java

```
package com.library.repository;

public class BookRepository {
  public String getBookDetails() {
        return "Book: Spring in Action by Craig Walls";
    }
}
```

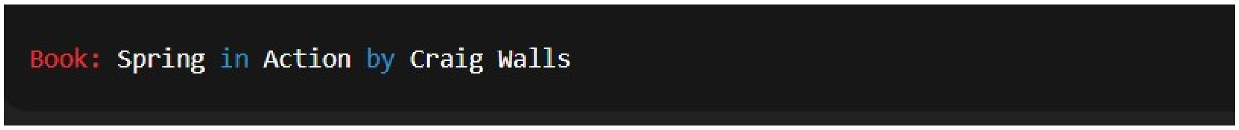
BookService.java

```
package com.library.service;

import com.library.repository.BookRepository;

public class BookService {
    private BookRepository bookRepository;

    // Setter for dependency injection
    public void setBookRepository(BookRepository bookRepository) {
        this.bookRepository = bookRepository;
    }

    public void displayBook() {
        System.out.println(bookRepository.getBookDetails());
    }
}
```

MainApp.java

```
package com.library;

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

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

OUTPUT:



```
Book: Spring in Action by Craig Walls
```

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.***

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>
        <!-- Spring Core Dependency -->
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-context</artifactId>
            <version>5.3.31</version>
        </dependency>
    </dependencies>
</project>
```

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">

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

    <!-- BookService Bean with Setter Injection -->
    <bean id="bookService" class="com.library.service.BookService">
        <property name="bookRepository" ref="bookRepository"/>
    </bean>

</beans>
```

BookRepository.java

```
package com.library.repository;

public class BookRepository {
    public String getBookDetails() {
        return "Book: Spring in Action by Craig Walls";
    }
}
```

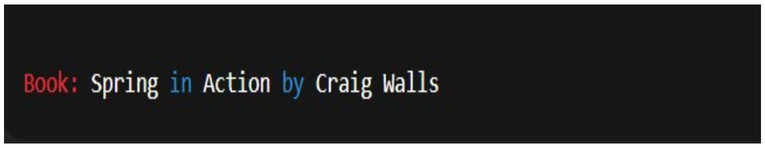
BookService.java

```
package com.library.service;

import com.library.repository.BookRepository;

public class BookService {
    private BookRepository bookRepository;

    // Setter method for Dependency Injection
    public void setBookRepository(BookRepository bookRepository) {
        this.bookRepository = bookRepository;
    }

    public void displayBook() {
        System.out.println(bookRepository.getBookDetails());
    }
}
```

LibraryManagementApplication.java

```
package com.library;

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

public class LibraryManagementApplication {
    public static void main(String[] args) {
        ApplicationContext context = new
ClassPathXmlApplicationContext("applicationContext.xml");

        BookService bookService = (BookService) context.getBean("bookService");
        bookService.displayBook();
    }
}
```

OUTPUT:



```
Book: Spring in Action by Craig Walls
```

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:

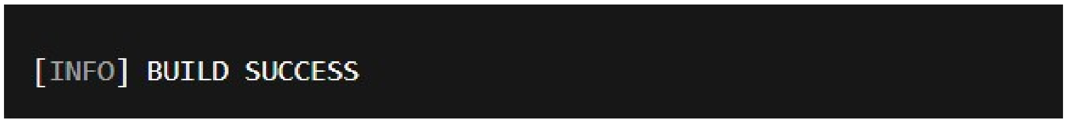
pom.xml

```
<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>

  <properties>
    <maven.compiler.source>1.8</maven.compiler.source>
    <maven.compiler.target>1.8</maven.compiler.target>
  </properties>

  <dependencies>
    <!-- Spring Context -->
    <dependency>
```

```xml
            <groupId>org.springframework</groupId>
            <artifactId>spring-context</artifactId>
            <version>5.3.31</version>
        </dependency>

        <!-- Spring AOP -->
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-aop</artifactId>
            <version>5.3.31</version>
        </dependency>

        <!-- Spring Web MVC -->
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-webmvc</artifactId>
            <version>5.3.31</version>
        </dependency>

        <!-- Servlet API (required for Spring MVC only at compile time) -->
        <dependency>
            <groupId>javax.servlet</groupId>
            <artifactId>javax.servlet-api</artifactId>
            <version>4.0.1</version>
            <scope>provided</scope>
        </dependency>
    </dependencies>
```

```
  <build>
    <plugins>
      <!-- Compiler Plugin for Java 8 -->
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-compiler-plugin</artifactId>
        <version>3.8.1</version>
        <configuration>
          <source>1.8</source>
          <target>1.8</target>
        </configuration>
      </plugin>
    </plugins>
  </build>

</project>
```

OUTPUT:



```
[INFO] BUILD SUCCESS
```

Hands on 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.***

CODE:

Country.java

```
package com.cognizant.ormlearn.model;

import javax.persistence.*;

@Entity
@Table(name = "country")
public class Country {
  @Id
  @Column(name = "co_code")
  private String code;

  @Column(name = "co_name")
  private String name;

  public String getCode() { return code; }
  public void setCode(String code) { this.code = code; }

  public String getName() { return name; }
  public void setName(String name) { this.name = name; }

  @Override
  public String toString() {
    return "Country [code=" + code + ", name=" + name + "]";
  }
}
```

CountryRepository.java

```
package com.cognizant.ormlearn.repository;


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> {}
```

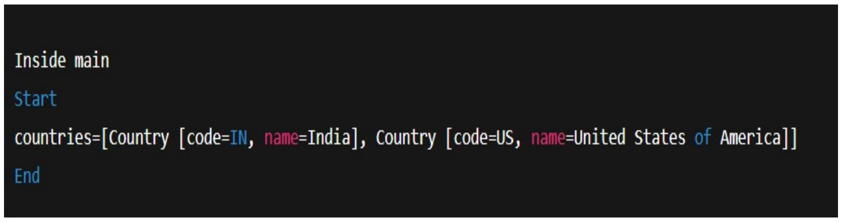
CountryService.java

```
package com.cognizant.ormlearn.service;


import java.util.List;
import javax.transaction.Transactional;


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


import com.cognizant.ormlearn.model.Country;
import com.cognizant.ormlearn.repository.CountryRepository;


@Service
public class CountryService {


    @Autowired
    private CountryRepository countryRepository;
    @Transactional
    public List<Country> getAllCountries() {
        return countryRepository.findAll();
    }
}
```

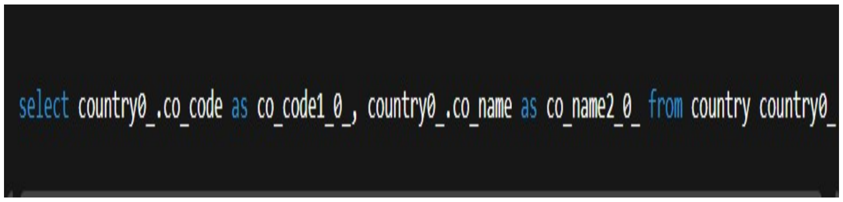
OrmLearnApplication.java

```
package com.cognizant.ormlearn;

import java.util.List;

import com.cognizant.ormlearn.model.Country;
import com.cognizant.ormlearn.service.CountryService;

import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.context.ApplicationContext;

@SpringBootApplication
public class OrmLearnApplication {

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

    public static void main(String[] args) {
        ApplicationContext context = SpringApplication.run(OrmLearnApplication.class, args);
        LOGGER.info("Inside main");
        countryService = context.getBean(CountryService.class);
        testGetAllCountries();
    }

    private static void testGetAllCountries() {
        LOGGER.info("Start");
        List<Country> countries = countryService.getAllCountries();
        LOGGER.debug("countries={}", countries);
        LOGGER.info("End");
    }
}
```

OUTPUT:



```
Inside main
Start
countries=[Country [code=IN, name=India], Country [code=US, name=United States of America]]
End
```



```
select country0_.co_code as co_code1_0_, country0_.co_name as co_name2_0_ from country country0_
```

Hands on 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);
    }
```

CODE:

Employee.java

```
package com.example.springdemo.model;

import javax.persistence.*;

@Entity
@Table(name = "employee")
public class Employee {

    @Id
    private int id;

    private String name;
    private double salary;

    public int getId() { return id; }
```

```java
    public void setId(int id) { this.id = id; }

    public String getName() { return name; }
    public void setName(String name) { this.name = name; }

    public double getSalary() { return salary; }
    public void setSalary(double salary) { this.salary = salary; }

    @Override
    public String toString() {
        return "Employee [id=" + id + ", name=" + name + ", salary=" + salary + "]";
    }
}
```

EmployeeRepository.java

```java
package com.example.springdemo.repository;

import org.springframework.data.jpa.repository.JpaRepository;
import com.example.springdemo.model.Employee;

public interface EmployeeRepository extends JpaRepository<Employee, Integer> {}
```

EmployeeService.java

```java
package com.example.springdemo.service;

import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;
import com.example.springdemo.model.Employee;
import com.example.springdemo.repository.EmployeeRepository;
```

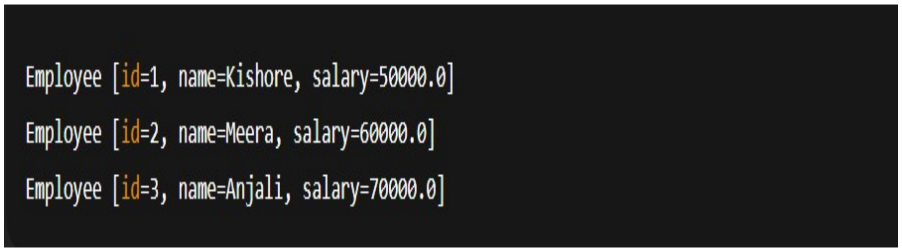
```
@Service
public class EmployeeService {

    @Autowired
    private EmployeeRepository employeeRepository;

    public void addEmployee(Employee employee) {
        employeeRepository.save(employee);
    }

    public List<Employee> getAllEmployees() {
        return employeeRepository.findAll();
    }
}
```

SpringdemoApplication.java

```
package com.example.springdemo;

import java.util.List;

import com.example.springdemo.model.Employee;
import com.example.springdemo.service.EmployeeService;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.context.ApplicationContext;
```

```
@SpringBootApplication
public class SpringdemoApplication {

    private static EmployeeService employeeService;

    public static void main(String[] args) {
        ApplicationContext context = SpringApplication.run(SpringdemoApplication.class, args);

        employeeService = context.getBean(EmployeeService.class);

        Employee e = new Employee();
        e.setId(3);
        e.setName("Anjali");
        e.setSalary(70000);
        employeeService.addEmployee(e);

        List<Employee> all = employeeService.getAllEmployees();
        all.forEach(System.out::println);
    }
}
```

OUTPUT:



```
Employee [id=1, name=Kishore, salary=50000.0]
Employee [id=2, name=Meera, salary=60000.0]
Employee [id=3, name=Anjali, salary=70000.0]
```