Spring Core and Maven

Exercise 1: Configuring a Basic Spring Application
Exercise 2: Implementing Dependency Injection
Exercise 4: Creating and Configuring a Maven Project
Exercise 5: Configuring the Spring IoC Container
Exercise 7: Implementing Constructor and Setter Injection
Exercise 9: Creating a Spring Boot Application

CODE:

```
package com.library.LibraryManagement;

import jakarta.persistence.*;

@Entity

public class Book {

    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)

    private Long id;

    private String title;

    private String author;

    // ✅ Constructors (at least no-args constructor is needed)

    public Book() {}

    public Book(String title, String author) {

        this.title = title;

        this.author = author;

    }

    // ✅ Getters and Setters

    public Long getId() {

        return id;

    }
```

```
    public void setId(Long id) {
        this.id = id;
    }
    public String getTitle() {
        return title;
    }
    public void setTitle(String title) {
        this.title = title;
    }
    public String getAuthor() {
        return author;
    }
    public void setAuthor(String author) {
        this.author = author;
    }
}
```

```
package com.library.LibraryManagement;
import org.springframework.data.jpa.repository.JpaRepository;
public interface BookRepository extends JpaRepository<Book, Long> {
}
```

```
package com.library.LibraryManagement;
import org.springframework.web.bind.annotation.*;
import java.util.List;
@RestController
@RequestMapping("/books")
public class BookController {
```

```
    private final BookRepository bookRepository;
    public BookController(BookRepository bookRepository) {
        this.bookRepository = bookRepository;
    }
    @GetMapping
    public List<Book> getAllBooks() {
        return bookRepository.findAll();
    }
    @PostMapping
    public Book addBook(@RequestBody Book book) {
        return bookRepository.save(book);
    }
}
```

```
package com.library.LibraryManagement;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
@SpringBootApplication
public class LibraryManagementApplication {
    public static void main(String[] args) {
        SpringApplication.run(LibraryManagementApplication.class, args);
    }
}
```

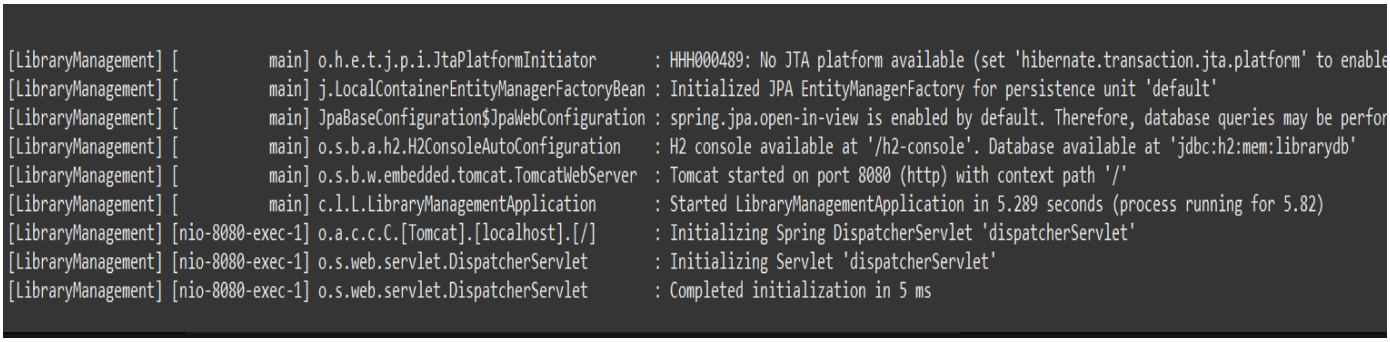
```
spring.application.name=LibraryManagement
spring.datasource.url=jdbc:h2:mem:librarydb
spring.datasource.driver-class-name=org.h2.Driver
spring.datasource.username=sa
spring.datasource.password=
```

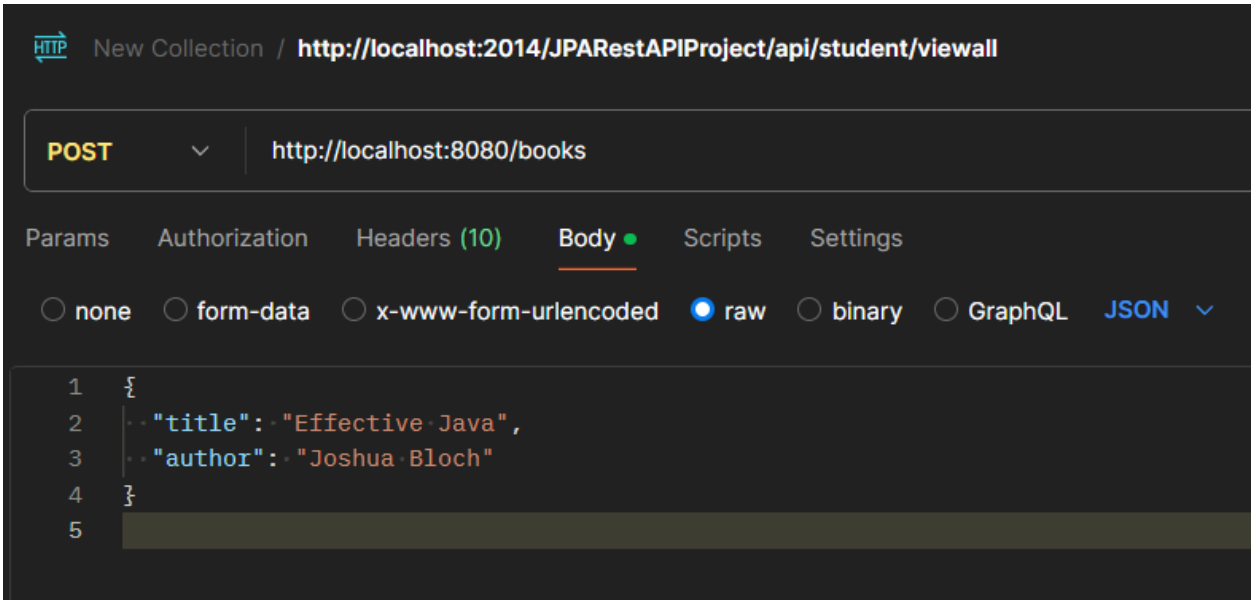
spring.jpa.database-platform=org.hibernate.dialect.H2Dialect

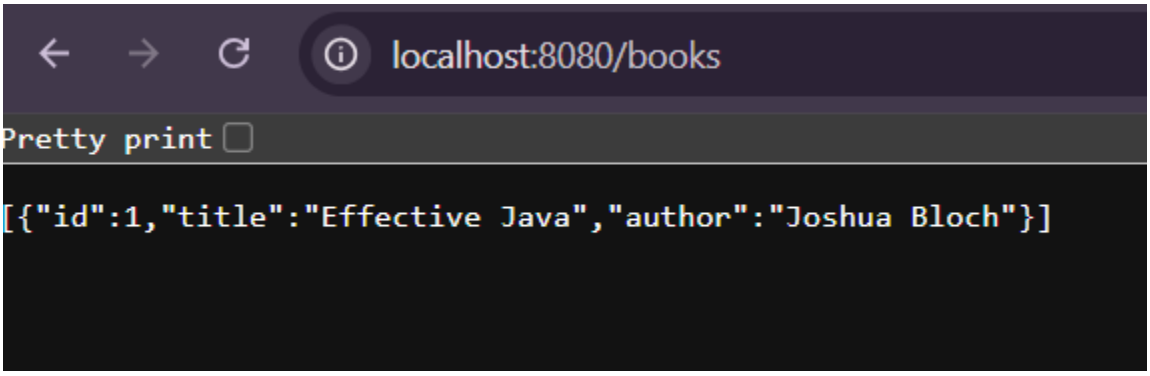
spring.jpa.hibernate.ddl-auto=update

spring.h2.console.enabled=true

OUTPUT:







Spring Data JPA with Spring Boot, Hibernate

1.spring-data-jpa-handson

Spring Data JPA - Quick Example
Difference between JPA, Hibernate and Spring Data JPA
Implement services for managing Country
Find a country based on country code
Add a new country

CODE:

```
package com.cognizant.orm_learn.model;

import jakarta.persistence.Column;

import jakarta.persistence.Entity;

import jakarta.persistence.Id;

import jakarta.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

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

```
package com.cognizant.orm_learn.repository;
import java.util.List;
import org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.stereotype.Repository;
import com.cognizant.orm_learn.model.Country;
@Repository
public interface CountryRepository extends JpaRepository<Country, String> {
    // Basic CRUD operations are inherited
    // Custom method to find countries by partial name (case-insensitive)
    List<Country> findByNameContainingIgnoreCase(String namePart);
}
```

```
package com.cognizant.orm_learn.service;
import java.util.List;
import java.util.Optional;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;
```

```
import org.springframework.transaction.annotation.Transactional;
import com.cognizant.orm_learn.model.Country;
import com.cognizant.orm_learn.repository.CountryRepository;
import com.cognizant.orm_learn.service.exception.CountryNotFoundException;
@Service
public class CountryService {
   @Autowired
   private CountryRepository countryRepository;
   @Transactional
   public List<Country> getAllCountries() {
      return countryRepository.findAll();
   }
   // ✅ Find by code and throw exception if not found
   @Transactional
   public Country findCountryByCode(String code) throws CountryNotFoundException {
      Optional<Country> result = countryRepository.findById(code);
      if (!result.isPresent()) {
         throw new CountryNotFoundException("Country with code '" + code + "' not found");
      }
      return result.get();
   }
   @Transactional
   public void addCountry(Country country) {
      countryRepository.save(country);
   }
   @Transactional
   public void updateCountry(Country country) {
```

```
        countryRepository.save(country); // save() handles both insert and update
    }
    @Transactional
    public void deleteCountry(String code) {
        countryRepository.deleteById(code);
    }
    @Transactional
    public List<Country> findCountriesByPartialName(String name) {
        return countryRepository.findByNameContainingIgnoreCase(name);
    }
}
```

```
package com.cognizant.orm_learn.service.exception;
public class CountryNotFoundException extends Exception {
    public CountryNotFoundException(String message) {
        super(message);
    }
}
```

```
package com.cognizant.orm_learn;
import java.util.List;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.context.ApplicationContext;
import com.cognizant.orm_learn.model.Country;
import com.cognizant.orm_learn.service.CountryService;
import com.cognizant.orm_learn.service.exception.CountryNotFoundException;
```

```
@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();
        testFindCountryByCode();  // Hands-on 6
        testAddCountry();        // Hands-on 7
    }
    private static void testGetAllCountries() {
        LOGGER.info("Start - testGetAllCountries");
        List<Country> countries = countryService.getAllCountries();
        for (Country country : countries) {
            LOGGER.debug("Country: {}", country);
        }
        LOGGER.info("End - testGetAllCountries");
    }
    private static void testFindCountryByCode() {
        LOGGER.info("Start - testFindCountryByCode");
        try {
            Country country = countryService.findCountryByCode("IN");
            LOGGER.debug("Country: {}", country);
        } catch (CountryNotFoundException e) {
            LOGGER.error("Exception: {}", e.getMessage());
```

```
        }
        LOGGER.info("End - testFindCountryByCode");
    }
    private static void testAddCountry() {
        LOGGER.info("Start - testAddCountry");
        // Step 1: Create new Country instance
        Country newCountry = new Country();
        newCountry.setCode("XY");
        newCountry.setName("Xyland");
        // Step 2: Add the new country
        countryService.addCountry(newCountry);
        LOGGER.debug("Country added: {}", newCountry);
        // Step 3: Retrieve the country to verify
        try {
            Country retrievedCountry = countryService.findCountryByCode("XY");
            LOGGER.debug("Retrieved Country: {}", retrievedCountry);
        } catch (CountryNotFoundException e) {
            LOGGER.error("Country not found after adding: {}", e.getMessage());
        }
        LOGGER.info("End - testAddCountry");
    }
}
```

```
spring.application.name=orm-learn
# --- Logging ---
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

--- MySQL 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

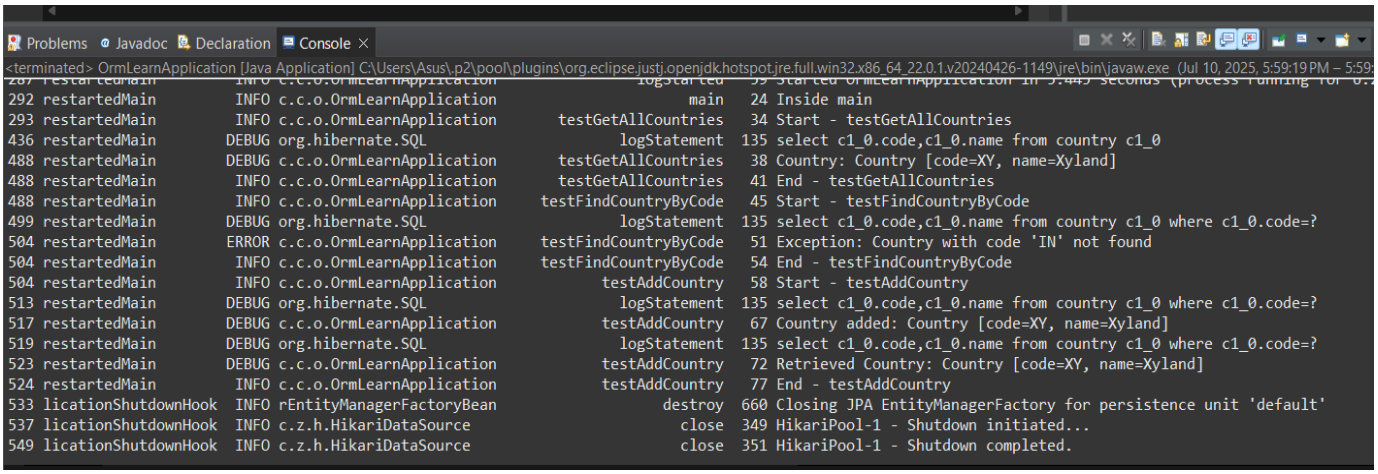
spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.MySQLDialect

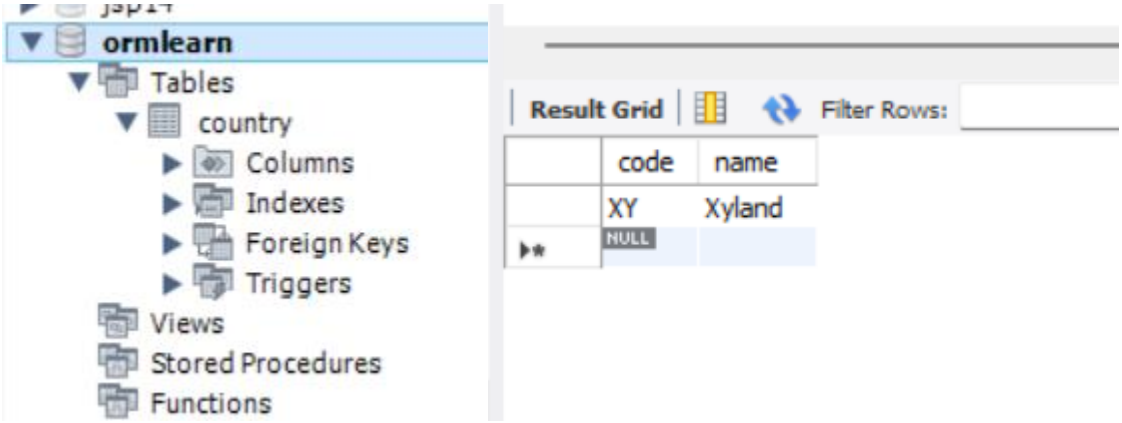
spring.jpa.hibernate.ddl-auto=create

spring.jpa.hibernate.ddl-auto=update

OUTPUT:

✓	3	18:08:19	USE LIMIT 0, 1000	0 row(s) affected
✗	4	18:08:19	SELECT * FROM country WHERE co_code = 'XY' LIMIT 0, 1000	Error Code: 1054. Unknown column 'co_code' in 'where clause'
✓	5	18:08:29	DESCRIBE country	2 row(s) returned
✓	6	18:10:15	SELECT * FROM country WHERE code = 'XY' LIMIT 0, 1000	1 row(s) returned





2. spring-data-jpa-handson

Demonstrate implementation of Query Methods feature of Spring Data JPA

CODE:

Update CountryService

```
@Transactional
public List<Country> getAllCountries() {
   return countryRepository.findAll();
}
@Transactional
public Country findCountryByCode(String code) throws CountryNotFoundException {
   return countryRepository.findById(code)
      .orElseThrow(() -> new CountryNotFoundException("Country not found for code: " + code));
}
@Transactional
public void addCountry(Country country) {
   countryRepository.save(country);
}
@Transactional
public void updateCountry(Country country) {
   countryRepository.save(country);
}
@Transactional
public void deleteCountry(String code) {
   countryRepository.deleteById(code);
}
@Transactional
public List<Country> findCountriesByPartialName(String name) {
   return countryRepository.findByNameContainingIgnoreCase(name);
}
```

```
@Transactional
public List<Country> findCountriesByNameStartingWith(String prefix) {
    return countryRepository.findByNameStartingWithIgnoreCase(prefix);
}
@Transactional
public List<Country> getTop3CountriesSortedByName() {
    return countryRepository.findTop3ByOrderByNameAsc();
}
@Transactional
public List<Country> getAllCountriesSortedByName() {
    return countryRepository.findAllByOrderByNameAsc();
}
```

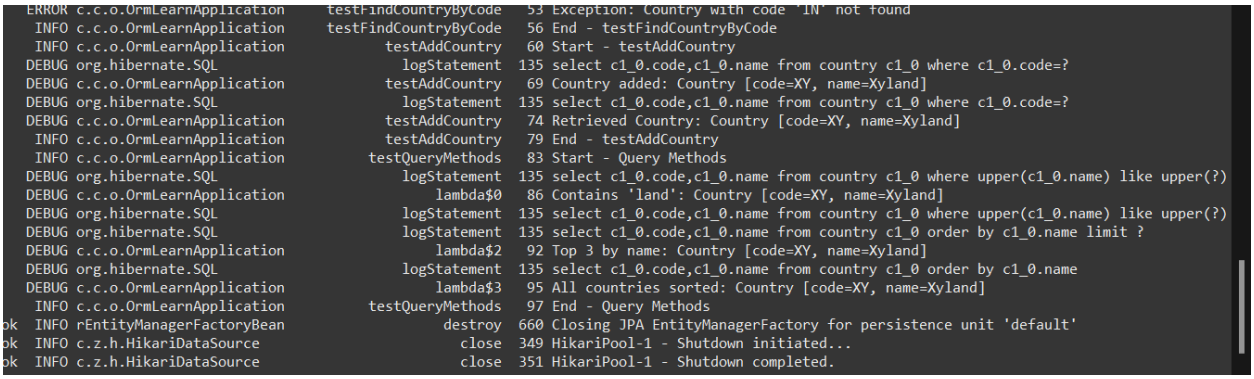
Add a testQueryMethods() in OrmLearnApplication.java

```
private static void testQueryMethods() {
    LOGGER.info("Start - testQueryMethods");
    // Partial match
    List<Country> partialMatches = countryService.findCountriesByPartialName("land");
    partialMatches.forEach(c -> LOGGER.debug("Contains 'land': {}", c));
    // Starts with
    List<Country> startsWith = countryService.findCountriesByNameStartingWith("A");
    startsWith.forEach(c -> LOGGER.debug("Starts with 'A': {}", c));
    // Top 3 countries
    List<Country> top3 = countryService.getTop3CountriesSortedByName();
    top3.forEach(c -> LOGGER.debug("Top 3 by name: {}", c));
    // All sorted
    List<Country> allSorted = countryService.getAllCountriesSortedByName();
    allSorted.forEach(c -> LOGGER.debug("Sorted: {}", c));
    LOGGER.info("End - testQueryMethods");
}
```

Call It in main()

```
public static void main(String[] args) {

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

   LOGGER.info("Inside main");

   countryService = context.getBean(CountryService.class);

   testGetAllCountries();

   testFindCountryByCode();    // Hands-on 6

   testAddCountry();          // Hands-on 7

   testQueryMethods();        // ✅ Hands-on 8: Query Methods
}
```

OUTPUT:



Demonstrate implementation of O/R Mapping

CODE:

```
package com.cognizant.orm_learn.model;

import jakarta.persistence.*;

import java.util.List;

@Entity

public class Department {

   @Id
```

```
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;
    private String name;
    @OneToMany(mappedBy = "department", fetch = FetchType.LAZY)
    private List<Employee> employees;
    // Getters and Setters
}
```

```
package com.cognizant.orm_learn.model;
import jakarta.persistence.*;
import java.util.Set;
@Entity
public class Employee {
    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;
    private String name;
    @ManyToOne(fetch = FetchType.EAGER)
    @JoinColumn(name = "department_id")
    private Department department;
    @ManyToMany(fetch = FetchType.LAZY)
    @JoinTable(
        name = "employee_project",
        joinColumns = @JoinColumn(name = "employee_id"),
        inverseJoinColumns = @JoinColumn(name = "project_id")
    )
    private Set<Project> projects;
    // Getters and Setters
}
```

```
package com.cognizant.orm_learn.model;
```

```
import jakarta.persistence.*;

import java.util.Set;

@Entity

public class Project {

   @Id

   @GeneratedValue(strategy = GenerationType.IDENTITY)

   private Long id;

   private String name;

   @ManyToMany(mappedBy = "projects")

   private Set<Employee> employees;

   // Getters and Setters

}
```

3. spring-data-jpa-handson

Demonstrate writing Hibernate Query Language and Native Query

CODE:

EmployeeRepository.java

```
package com.cognizant.orm_learn.repository;
import java.util.List;
import org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.data.jpa.repository.Query;
import com.cognizant.orm_learn.model.Employee;
public interface EmployeeRepository extends JpaRepository<Employee, Long> {
   // JPQL (same as HQL, operates on entity and property names)
   @Query("SELECT e FROM Employee e WHERE e.department.name = :departmentName")
   List<Employee> findEmployeesByDepartmentName(String departmentName);
   // HQL fetch join to eagerly fetch projects
   @Query("SELECT e FROM Employee e JOIN FETCH e.projects WHERE e.id = :id")
   Employee findEmployeeWithProjectsById(Long id);
   // Aggregate function - count employees in each department
   @Query("SELECT e.department.name, COUNT(e) FROM Employee e GROUP BY e.department.name")
   List<Object[]> countEmployeesByDepartment();
   // Native SQL Query
   @Query(value = "SELECT * FROM employee WHERE name LIKE %:keyword%", nativeQuery = true)
   List<Employee> searchEmployeeByNameNative(String keyword);
}
```

EmployeeService:

```
@Service
public class EmployeeService {
   @Autowired
   private EmployeeRepository employeeRepository;
```

```
    public List<Employee> getEmployeesByDepartment(String deptName) {
        return employeeRepository.findEmployeesByDepartmentName(deptName);
    }
    public Employee getEmployeeWithProjects(Long id) {
        return employeeRepository.findEmployeeWithProjectsById(id);
    }
    public List<Object[]> getEmployeeCountByDept() {
        return employeeRepository.countEmployeesByDepartment();
    }
    public List<Employee> searchEmployeeByNameNative(String keyword) {
        return employeeRepository.searchEmployeeByNameNative(keyword);
    }
}
```

OrmLearnApplication:

```
private static void testQueries() {
    LOGGER.info("Start - testQueries");
    List<Employee> devEmployees = employeeService.getEmployeesByDepartment("Development");
    devEmployees.forEach(e -> LOGGER.debug("Dev Employee: {}", e.getName()));
    Employee emp = employeeService.getEmployeeWithProjects(1L);
    LOGGER.debug("Employee with Projects: {}", emp.getName() + " -> " + emp.getProjects());
    List<Object[]> counts = employeeService.getEmployeeCountByDept();
    for (Object[] row : counts) {
        LOGGER.debug("Department: {}, Count: {}", row[0], row[1]);
    }
    List<Employee> searchResults = employeeService.searchEmployeeByNameNative("Ali");
    searchResults.forEach(e -> LOGGER.debug("Native search: {}", e.getName()));
    LOGGER.info("End - testQueries");
}
```

Call this method in main():

```
testQueries();
```

OUTPUT:

```
INFO  - Start - testQueries

DEBUG - Dev Employee: Alice
DEBUG - Dev Employee: Bob

DEBUG - Employee with Projects: Alice -> [Project(id=1, name=Apollo), Project(id=2, name=Hermes)]

DEBUG - Department: Development, Count: 2
DEBUG - Department: HR, Count: 1

DEBUG - Native search: Alice
DEBUG - Native search: Alina

INFO  - End - testQueries
```