SPRING DATA JPA 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();
```

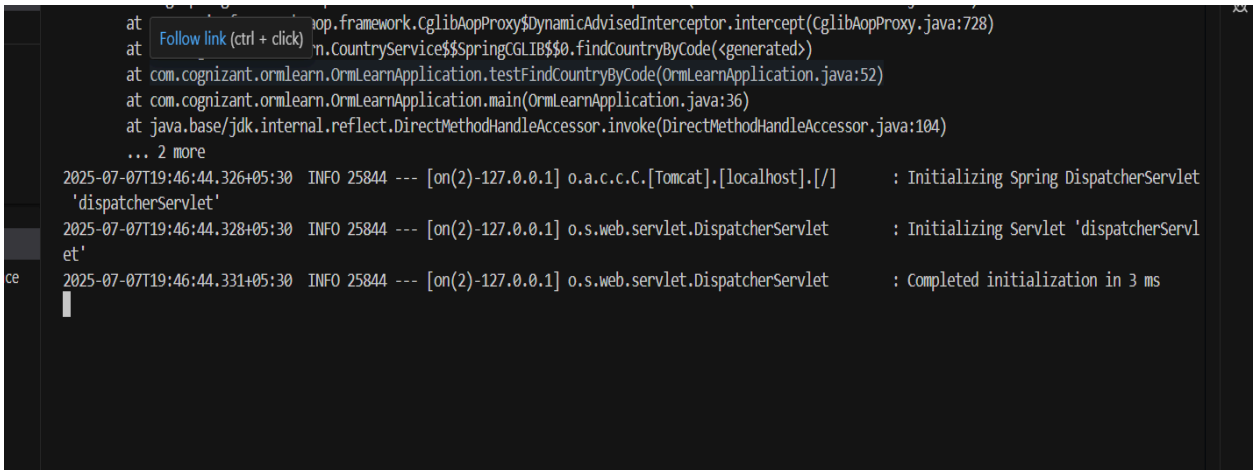
- Execute main method to check if data from ormlearn database is retrieved.

SQL OUTPUT:

```
mysql> show tables
    -> ;
+---------------------+
| Tables_in_ormlearn  |
+---------------------+
| country             |
+---------------------+
1 row in set (0.06 sec)

mysql> select * from country;
+------+---------------------------+
| code | name                      |
+------+---------------------------+
| IN   | India                     |
| US   | United States of America  |
+------+---------------------------+
2 rows in set (0.08 sec)
```

CONSOLE OUTPUT:



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);

        }
```

Reference Links:

https://dzone.com/articles/what-is-the-difference-between-hibernate-and-sprin-1

https://www.javaworld.com/article/3379043/what-is-jpa-introduction-to-the-java-persistence-api.html

Hands on 5

Implement services for managing Country

An application requires for features to be implemented with regards to country. These features needs to be supported by implementing them as service using Spring Data JPA.

- Find a country based on country code

- Add new country
- Update country
- Delete country
- Find list of countries matching a partial country name

Before starting the implementation of the above features, there are few configuration and data population that needs to be incorporated. Please refer each topic below and implement the same.

Explanation for Hibernate table creation configuration

- Moreover the ddl-auto defines how hibernate behaves if a specific table or column is not present in the database.
    - create - drops existing tables data and structure, then creates new tables
    - validate - check if the table and columns exist or not, throws an exception if a matching table or column is not found
    - update - if a table does not exists, it creates a new table; if a column does not exists, it creates a new column
    - create-drop - creates the table, once all operations are completed, the table is dropped

```
# Hibernate ddl auto (create, create-drop, update, validate)

spring.jpa.hibernate.ddl-auto=validate
```

Populate country table

- Delete all the records in Country table and then use the below script to create the actual list of all countries in our world.

```
insert into country (co_code, co_name) values ("AF", "Afghanistan");

insert into country (co_code, co_name) values ("AL", "Albania");

insert into country (co_code, co_name) values ("DZ", "Algeria");

insert into country (co_code, co_name) values ("AS", "American Samoa");

insert into country (co_code, co_name) values ("AD", "Andorra");

insert into country (co_code, co_name) values ("AO", "Angola");

insert into country (co_code, co_name) values ("AI", "Anguilla");

insert into country (co_code, co_name) values ("AQ", "Antarctica");
```

```
insert into country (co_code, co_name) values ("AG", "Antigua and Barbuda");
insert into country (co_code, co_name) values ("AR", "Argentina");
insert into country (co_code, co_name) values ("AM", "Armenia");
insert into country (co_code, co_name) values ("AW", "Aruba");
insert into country (co_code, co_name) values ("AU", "Australia");
insert into country (co_code, co_name) values ("AT", "Austria");
insert into country (co_code, co_name) values ("AZ", "Azerbaijan");
insert into country (co_code, co_name) values ("BS", "Bahamas");
insert into country (co_code, co_name) values ("BH", "Bahrain");
insert into country (co_code, co_name) values ("BD", "Bangladesh");
insert into country (co_code, co_name) values ("BB", "Barbados");
insert into country (co_code, co_name) values ("BY", "Belarus");
insert into country (co_code, co_name) values ("BE", "Belgium");
insert into country (co_code, co_name) values ("BZ", "Belize");
insert into country (co_code, co_name) values ("BJ", "Benin");
insert into country (co_code, co_name) values ("BM", "Bermuda");
insert into country (co_code, co_name) values ("BT", "Bhutan");
insert into country (co_code, co_name) values ("BO", "Bolivia, Plurinational State of");
insert into country (co_code, co_name) values ("BQ", "Bonaire, Sint Eustatius and Saba");
insert into country (co_code, co_name) values ("BA", "Bosnia and Herzegovina");
insert into country (co_code, co_name) values ("BW", "Botswana");
insert into country (co_code, co_name) values ("BV", "Bouvet Island");
insert into country (co_code, co_name) values ("BR", "Brazil");
```

```
insert into country (co_code, co_name) values ("IO", "British Indian Ocean Territory");

insert into country (co_code, co_name) values ("BN", "Brunei Darussalam");

insert into country (co_code, co_name) values ("BG", "Bulgaria");

insert into country (co_code, co_name) values ("BF", "Burkina Faso");

insert into country (co_code, co_name) values ("BI", "Burundi");

insert into country (co_code, co_name) values ("KH", "Cambodia");

insert into country (co_code, co_name) values ("CM", "Cameroon");

insert into country (co_code, co_name) values ("CA", "Canada");

insert into country (co_code, co_name) values ("CV", "Cape Verde");

insert into country (co_code, co_name) values ("KY", "Cayman Islands");

insert into country (co_code, co_name) values ("CF", "Central African Republic");

insert into country (co_code, co_name) values ("TD", "Chad");

insert into country (co_code, co_name) values ("CL", "Chile");

insert into country (co_code, co_name) values ("CN", "China");

insert into country (co_code, co_name) values ("CX", "Christmas Island");

insert into country (co_code, co_name) values ("CC", "Cocos (Keeling) Islands");

insert into country (co_code, co_name) values ("CO", "Colombia");

insert into country (co_code, co_name) values ("KM", "Comoros");

insert into country (co_code, co_name) values ("CG", "Congo");

insert into country (co_code, co_name) values ("CD", "Congo, the Democratic Republic of
the");

insert into country (co_code, co_name) values ("CK", "Cook Islands");

insert into country (co_code, co_name) values ("CR", "Costa Rica");

insert into country (co_code, co_name) values ("HR", "Croatia");
```

```
insert into country (co_code, co_name) values ("CU", "Cuba");
insert into country (co_code, co_name) values ("CW", "Curaçao");
insert into country (co_code, co_name) values ("CY", "Cyprus");
insert into country (co_code, co_name) values ("CZ", "Czech Republic");
insert into country (co_code, co_name) values ("CI", "Côte d'Ivoire");
insert into country (co_code, co_name) values ("DK", "Denmark");
insert into country (co_code, co_name) values ("DJ", "Djibouti");
insert into country (co_code, co_name) values ("DM", "Dominica");
insert into country (co_code, co_name) values ("DO", "Dominican Republic");
insert into country (co_code, co_name) values ("EC", "Ecuador");
insert into country (co_code, co_name) values ("EG", "Egypt");
insert into country (co_code, co_name) values ("SV", "El Salvador");
insert into country (co_code, co_name) values ("GQ", "Equatorial Guinea");
insert into country (co_code, co_name) values ("ER", "Eritrea");
insert into country (co_code, co_name) values ("EE", "Estonia");
insert into country (co_code, co_name) values ("ET", "Ethiopia");
insert into country (co_code, co_name) values ("FK", "Falkland Islands (Malvinas)");
insert into country (co_code, co_name) values ("FO", "Faroe Islands");
insert into country (co_code, co_name) values ("FJ", "Fiji");
insert into country (co_code, co_name) values ("FI", "Finland");
insert into country (co_code, co_name) values ("FR", "France");
insert into country (co_code, co_name) values ("GF", "French Guiana");
insert into country (co_code, co_name) values ("PF", "French Polynesia");
```

```
insert into country (co_code, co_name) values ("TF", "French Southern Territories");

insert into country (co_code, co_name) values ("GA", "Gabon");

insert into country (co_code, co_name) values ("GM", "Gambia");

insert into country (co_code, co_name) values ("GE", "Georgia");

insert into country (co_code, co_name) values ("DE", "Germany");

insert into country (co_code, co_name) values ("GH", "Ghana");

insert into country (co_code, co_name) values ("GI", "Gibraltar");

insert into country (co_code, co_name) values ("GR", "Greece");

insert into country (co_code, co_name) values ("GL", "Greenland");

insert into country (co_code, co_name) values ("GD", "Grenada");

insert into country (co_code, co_name) values ("GP", "Guadeloupe");

insert into country (co_code, co_name) values ("GU", "Guam");

insert into country (co_code, co_name) values ("GT", "Guatemala");

insert into country (co_code, co_name) values ("GG", "Guernsey");

insert into country (co_code, co_name) values ("GN", "Guinea");

insert into country (co_code, co_name) values ("GW", "Guinea-Bissau");

insert into country (co_code, co_name) values ("GY", "Guyana");

insert into country (co_code, co_name) values ("HT", "Haiti");

insert into country (co_code, co_name) values ("HM", "Heard Island and McDonald
Islands");

insert into country (co_code, co_name) values ("VA", "Holy See (Vatican City State)");

insert into country (co_code, co_name) values ("HN", "Honduras");

insert into country (co_code, co_name) values ("HK", "Hong Kong");

insert into country (co_code, co_name) values ("HU", "Hungary");
```

```
insert into country (co_code, co_name) values ("IS", "Iceland");

insert into country (co_code, co_name) values ("IN", "India");

insert into country (co_code, co_name) values ("ID", "Indonesia");

insert into country (co_code, co_name) values ("IR", "Iran, Islamic Republic of");

insert into country (co_code, co_name) values ("IQ", "Iraq");

insert into country (co_code, co_name) values ("IE", "Ireland");

insert into country (co_code, co_name) values ("IM", "Isle of Man");

insert into country (co_code, co_name) values ("IL", "Israel");

insert into country (co_code, co_name) values ("IT", "Italy");

insert into country (co_code, co_name) values ("JM", "Jamaica");

insert into country (co_code, co_name) values ("JP", "Japan");

insert into country (co_code, co_name) values ("JE", "Jersey");

insert into country (co_code, co_name) values ("JO", "Jordan");

insert into country (co_code, co_name) values ("KZ", "Kazakhstan");

insert into country (co_code, co_name) values ("KE", "Kenya");

insert into country (co_code, co_name) values ("KI", "Kiribati");

insert into country (co_code, co_name) values ("KP", "Democratic People's Republic of
Korea");

insert into country (co_code, co_name) values ("KR", "Republic of Korea");

insert into country (co_code, co_name) values ("KW", "Kuwait");

insert into country (co_code, co_name) values ("KG", "Kyrgyzstan");

insert into country (co_code, co_name) values ("LA", "Lao People's Democratic
Republic");

insert into country (co_code, co_name) values ("LV", "Latvia");
```

```
insert into country (co_code, co_name) values ("LB", "Lebanon");

insert into country (co_code, co_name) values ("LS", "Lesotho");

insert into country (co_code, co_name) values ("LR", "Liberia");

insert into country (co_code, co_name) values ("LY", "Libya");

insert into country (co_code, co_name) values ("LI", "Liechtenstein");

insert into country (co_code, co_name) values ("LT", "Lithuania");

insert into country (co_code, co_name) values ("LU", "Luxembourg");

insert into country (co_code, co_name) values ("MO", "Macao");

insert into country (co_code, co_name) values ("MK", "Macedonia, the Former Yugoslav
Republic of");

insert into country (co_code, co_name) values ("MG", "Madagascar");

insert into country (co_code, co_name) values ("MW", "Malawi");

insert into country (co_code, co_name) values ("MY", "Malaysia");

insert into country (co_code, co_name) values ("MV", "Maldives");

insert into country (co_code, co_name) values ("ML", "Mali");

insert into country (co_code, co_name) values ("MT", "Malta");

insert into country (co_code, co_name) values ("MH", "Marshall Islands");

insert into country (co_code, co_name) values ("MQ", "Martinique");

insert into country (co_code, co_name) values ("MR", "Mauritania");

insert into country (co_code, co_name) values ("MU", "Mauritius");

insert into country (co_code, co_name) values ("YT", "Mayotte");

insert into country (co_code, co_name) values ("MX", "Mexico");

insert into country (co_code, co_name) values ("FM", "Micronesia, Federated States of");

insert into country (co_code, co_name) values ("MD", "Moldova, Republic of");
```

```
insert into country (co_code, co_name) values ("MC", "Monaco");
insert into country (co_code, co_name) values ("MN", "Mongolia");
insert into country (co_code, co_name) values ("ME", "Montenegro");
insert into country (co_code, co_name) values ("MS", "Montserrat");
insert into country (co_code, co_name) values ("MA", "Morocco");
insert into country (co_code, co_name) values ("MZ", "Mozambique");
insert into country (co_code, co_name) values ("MM", "Myanmar");
insert into country (co_code, co_name) values ("NA", "Namibia");
insert into country (co_code, co_name) values ("NR", "Nauru");
insert into country (co_code, co_name) values ("NP", "Nepal");
insert into country (co_code, co_name) values ("NL", "Netherlands");
insert into country (co_code, co_name) values ("NC", "New Caledonia");
insert into country (co_code, co_name) values ("NZ", "New Zealand");
insert into country (co_code, co_name) values ("NI", "Nicaragua");
insert into country (co_code, co_name) values ("NE", "Niger");
insert into country (co_code, co_name) values ("NG", "Nigeria");
insert into country (co_code, co_name) values ("NU", "Niue");
insert into country (co_code, co_name) values ("NF", "Norfolk Island");
insert into country (co_code, co_name) values ("MP", "Northern Mariana Islands");
insert into country (co_code, co_name) values ("NO", "Norway");
insert into country (co_code, co_name) values ("OM", "Oman");
insert into country (co_code, co_name) values ("PK", "Pakistan");
insert into country (co_code, co_name) values ("PW", "Palau");
```

```
insert into country (co_code, co_name) values ("PS", "Palestine, State of");

insert into country (co_code, co_name) values ("PA", "Panama");

insert into country (co_code, co_name) values ("PG", "Papua New Guinea");

insert into country (co_code, co_name) values ("PY", "Paraguay");

insert into country (co_code, co_name) values ("PE", "Peru");

insert into country (co_code, co_name) values ("PH", "Philippines");

insert into country (co_code, co_name) values ("PN", "Pitcairn");

insert into country (co_code, co_name) values ("PL", "Poland");

insert into country (co_code, co_name) values ("PT", "Portugal");

insert into country (co_code, co_name) values ("PR", "Puerto Rico");

insert into country (co_code, co_name) values ("QA", "Qatar");

insert into country (co_code, co_name) values ("RO", "Romania");

insert into country (co_code, co_name) values ("RU", "Russian Federation");

insert into country (co_code, co_name) values ("RW", "Rwanda");

insert into country (co_code, co_name) values ("RE", "Réunion");

insert into country (co_code, co_name) values ("BL", "Saint Barthélemy");

insert into country (co_code, co_name) values ("SH", "Saint Helena, Ascension and
Tristan da Cunha");

insert into country (co_code, co_name) values ("KN", "Saint Kitts and Nevis");

insert into country (co_code, co_name) values ("LC", "Saint Lucia");

insert into country (co_code, co_name) values ("MF", "Saint Martin (French part)");

insert into country (co_code, co_name) values ("PM", "Saint Pierre and Miquelon");

insert into country (co_code, co_name) values ("VC", "Saint Vincent and the
Grenadines");
```

```
insert into country (co_code, co_name) values ("WS", "Samoa");

insert into country (co_code, co_name) values ("SM", "San Marino");

insert into country (co_code, co_name) values ("ST", "Sao Tome and Principe");

insert into country (co_code, co_name) values ("SA", "Saudi Arabia");

insert into country (co_code, co_name) values ("SN", "Senegal");

insert into country (co_code, co_name) values ("RS", "Serbia");

insert into country (co_code, co_name) values ("SC", "Seychelles");

insert into country (co_code, co_name) values ("SL", "Sierra Leone");

insert into country (co_code, co_name) values ("SG", "Singapore");

insert into country (co_code, co_name) values ("SX", "Sint Maarten (Dutch part)");

insert into country (co_code, co_name) values ("SK", "Slovakia");

insert into country (co_code, co_name) values ("SI", "Slovenia");

insert into country (co_code, co_name) values ("SB", "Solomon Islands");

insert into country (co_code, co_name) values ("SO", "Somalia");

insert into country (co_code, co_name) values ("ZA", "South Africa");

insert into country (co_code, co_name) values ("GS", "South Georgia and the South
Sandwich Islands");

insert into country (co_code, co_name) values ("SS", "South Sudan");

insert into country (co_code, co_name) values ("ES", "Spain");

insert into country (co_code, co_name) values ("LK", "Sri Lanka");

insert into country (co_code, co_name) values ("SD", "Sudan");

insert into country (co_code, co_name) values ("SR", "Suriname");

insert into country (co_code, co_name) values ("SJ", "Svalbard and Jan Mayen");

insert into country (co_code, co_name) values ("SZ", "Swaziland");
```

```
insert into country (co_code, co_name) values ("SE", "Sweden");

insert into country (co_code, co_name) values ("CH", "Switzerland");

insert into country (co_code, co_name) values ("SY", "Syrian Arab Republic");

insert into country (co_code, co_name) values ("TW", "Taiwan, Province of China");

insert into country (co_code, co_name) values ("TJ", "Tajikistan");

insert into country (co_code, co_name) values ("TZ", "Tanzania, United Republic of");

insert into country (co_code, co_name) values ("TH", "Thailand");

insert into country (co_code, co_name) values ("TL", "Timor-Leste");

insert into country (co_code, co_name) values ("TG", "Togo");

insert into country (co_code, co_name) values ("TK", "Tokelau");

insert into country (co_code, co_name) values ("TO", "Tonga");

insert into country (co_code, co_name) values ("TT", "Trinidad and Tobago");

insert into country (co_code, co_name) values ("TN", "Tunisia");

insert into country (co_code, co_name) values ("TR", "Turkey");

insert into country (co_code, co_name) values ("TM", "Turkmenistan");

insert into country (co_code, co_name) values ("TC", "Turks and Caicos Islands");

insert into country (co_code, co_name) values ("TV", "Tuvalu");

insert into country (co_code, co_name) values ("UG", "Uganda");

insert into country (co_code, co_name) values ("UA", "Ukraine");

insert into country (co_code, co_name) values ("AE", "United Arab Emirates");

insert into country (co_code, co_name) values ("GB", "United Kingdom");

insert into country (co_code, co_name) values ("US", "United States");

insert into country (co_code, co_name) values ("UM", "United States Minor Outlying
Islands");
```

```
insert into country (co_code, co_name) values ("UY", "Uruguay");

insert into country (co_code, co_name) values ("UZ", "Uzbekistan");

insert into country (co_code, co_name) values ("VU", "Vanuatu");

insert into country (co_code, co_name) values ("VE", "Venezuela, Bolivarian Republic
of");

insert into country (co_code, co_name) values ("VN", "Viet Nam");

insert into country (co_code, co_name) values ("VG", "Virgin Islands, British");

insert into country (co_code, co_name) values ("VI", "Virgin Islands, U.S.");

insert into country (co_code, co_name) values ("WF", "Wallis and Futuna");

insert into country (co_code, co_name) values ("EH", "Western Sahara");

insert into country (co_code, co_name) values ("YE", "Yemen");

insert into country (co_code, co_name) values ("ZM", "Zambia");

insert into country (co_code, co_name) values ("ZW", "Zimbabwe");

insert into country (co_code, co_name) values ("AX", "Åland Islands");
```

Refer subsequent hands on exercises to implement the features related to country.

SQL TABLE:

```
mysql> insert into country (co_code, co_name) values ("AX", "Ål
Query OK, 1 row affected (0.01 sec)

mysql> select * from country;
+---------+-------------------------------------------+
| co_code | co_name                                   |
+---------+-------------------------------------------+
| AD      | Andorra                                   |
| AE      | United Arab Emirates                      |
| AF      | Afghanistan                               |
| AG      | Antigua and Barbuda                       |
| AI      | Anguilla                                  |
| AL      | Albania                                   |
| AM      | Armenia                                   |
| AO      | Angola                                    |
| AQ      | Antarctica                                |
| AR      | Argentina                                 |
| AS      | American Samoa                            |
| AT      | Austria                                   |
| AU      | Australia                                 |
| AW      | Aruba                                     |
| AX      | Åland Islands                             |
| AZ      | Azerbaijan                                |
| BA      | Bosnia and Herzegovina                    |
| BB      | Barbados                                  |
| BD      | Bangladesh                                |
| BE      | Belgium                                   |
| BF      | Burkina Faso                              |
| BG      | Bulgaria                                  |
| BH      | Bahrain                                   |
| BI      | Burundi                                   |
| BJ      | Benin                                     |
| BL      | Saint Barthélemy                          |
| BM      | Bermuda                                   |
| BN      | Brunei Darussalam                         |
| BO      | Bolivia, Plurinational State of           |
| BQ      | Bonaire, Sint Eustatius and Saba          |
| BR      | Brazil                                    |
| BS      | Bahamas                                   |
| BT      | Bhutan                                    |
| BV      | Bouvet Island                             |
| BW      | Botswana                                  |
| BY      | Belarus                                   |
| BZ      | Belize                                    |
| CA      | Canada                                    |
| CC      | Cocos (Keeling) Islands                   |
| CD      | Congo, the Democratic Republic of the     |
| CF      | Central African Republic                  |
| CG      | Congo                                     |
| CH      | Switzerland                               |
| CI      | Côte d'Ivoire                             |
| CK      | Cook Islands                              |
| CL      | Chile                                     |
| CM      | Cameroon                                  |
| CN      | China                                     |
```

CM	Cameroon
CN	China
CO	Colombia
CR	Costa Rica
CU	Cuba
CV	Cape Verde
CW	Curaçao
CX	Christmas Island
CY	Cyprus
CZ	Czech Republic
DE	Germany
DJ	Djibouti
DK	Denmark
DM	Dominica
DO	Dominican Republic
DZ	Algeria
EC	Ecuador
EE	Estonia
EG	Egypt
EH	Western Sahara
ER	Eritrea
ES	Spain
ET	Ethiopia
FI	Finland
FJ	Fiji
FK	Falkland Islands (Malvinas)
FM	Micronesia, Federated States of
FO	Faroe Islands
FR	France
GA	Gabon
GB	United Kingdom
GD	Grenada
GE	Georgia
GF	French Guiana
GG	Guernsey
GH	Ghana
GI	Gibraltar
GL	Greenland
GM	Gambia
GN	Guinea
GP	Guadeloupe
GQ	Equatorial Guinea
GR	Greece
GS	South Georgia and the South Sandwich Islands
GT	Guatemala
GU	Guam
GW	Guinea-Bissau
GY	Guyana
HK	Hong Kong
HM	Heard Island and McDonald Islands

HN	Honduras
HR	Croatia
HT	Haiti
HU	Hungary
ID	Indonesia
IE	Ireland
IL	Israel
IM	Isle of Man
IN	India
IO	British Indian Ocean Territory
IQ	Iraq
IR	Iran, Islamic Republic of
IS	Iceland
IT	Italy
JE	Jersey
JM	Jamaica
JO	Jordan
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KH	Cambodia
KI	Kiribati
KM	Comoros
KN	Saint Kitts and Nevis
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KW	Kuwait
KY	Cayman Islands
KZ	Kazakhstan
LA	Lao People's Democratic Republic
LB	Lebanon
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
LY	Libya
MA	Morocco
MC	Monaco
MD	Moldova, Republic of
ME	Montenegro
MF	Saint Martin (French part)
MG	Madagascar
MH	Marshall Islands
MK	Macedonia, the Former Yugoslav Republic of
ML	Mali
MM	Myanmar

ML	Mali
MM	Myanmar
MN	Mongolia
MO	Macao
MP	Northern Mariana Islands
MQ	Martinique
MR	Mauritania
MS	Montserrat
MT	Malta
MU	Mauritius
MV	Maldives
MW	Malawi
MX	Mexico
MY	Malaysia
MZ	Mozambique
NA	Namibia
NC	New Caledonia
NE	Niger
NF	Norfolk Island
NG	Nigeria
NI	Nicaragua
NL	Netherlands
NO	Norway
NP	Nepal
NR	Nauru
NU	Niue
NZ	New Zealand
OM	Oman
PA	Panama
PE	Peru
PF	French Polynesia
PG	Papua New Guinea
PH	Philippines
PK	Pakistan
PL	Poland
PM	Saint Pierre and Miquelon
PN	Pitcairn
PR	Puerto Rico
PS	Palestine, State of
PT	Portugal
PW	Palau
PY	Paraguay
QA	Qatar
RE	Réunion
RO	Romania
RS	Serbia
RU	Russian Federation
RW	Rwanda
SA	Saudi Arabia

SB	Solomon Islands
SC	Seychelles
SD	Sudan
SE	Sweden
SG	Singapore
SH	Saint Helena, Ascension and Tristan da Cunha
SI	Slovenia
SJ	Svalbard and Jan Mayen
SK	Slovakia
SL	Sierra Leone
SM	San Marino
SN	Senegal
SO	Somalia
SR	Suriname
SS	South Sudan
ST	Sao Tome and Principe
SV	El Salvador
SX	Sint Maarten (Dutch part)
SY	Syrian Arab Republic
SZ	Swaziland
TC	Turks and Caicos Islands
TD	Chad
TF	French Southern Territories
TG	Togo
TH	Thailand
TJ	Tajikistan
TK	Tokelau
TL	Timor-Leste
TM	Turkmenistan
TN	Tunisia
TO	Tonga
TR	Turkey
TT	Trinidad and Tobago
TV	Tuvalu
TW	Taiwan, Province of China
TZ	Tanzania, United Republic of
UA	Ukraine
UG	Uganda
UM	United States Minor Outlying Islands
US	United States
UY	Uruguay
UZ	Uzbekistan
VA	Holy See (Vatican City State)
VC	Saint Vincent and the Grenadines
VE	Venezuela, Bolivarian Republic of
VG	Virgin Islands, British
VI	Virgin Islands, U.S.
VN	Viet Nam
VU	Vanuatu

TR	Turkey
TT	Trinidad and Tobago
TV	Tuvalu
TW	Taiwan, Province of China
TZ	Tanzania, United Republic of
UA	Ukraine
UG	Uganda
UM	United States Minor Outlying Islands
US	United States
UY	Uruguay
UZ	Uzbekistan
VA	Holy See (Vatican City State)
VC	Saint Vincent and the Grenadines
VE	Venezuela, Bolivarian Republic of
VG	Virgin Islands, British
VI	Virgin Islands, U.S.
VN	Viet Nam
VU	Vanuatu
WF	Wallis and Futuna
WS	Samoa
YE	Yemen
YT	Mayotte
ZA	South Africa
ZM	Zambia
ZW	Zimbabwe

249 rows in set (0.00 sec)

CONSOLE OUTPUT: