Database Systems
Lab Manual 1

Learning Objectives:

1. Install and configure the MySQL server to prepare a working environment for database development and management.
2. Create a new database named "Northwind" to understand the basic process of setting up a database.
3. Restore database schema by executing scripts (e.g., northwind.sql) to comprehend how schema scripts define database structure.
4. Populate the database with data using northwind_data.sql to practice importing data into a structured database.
5. **Create** a new database to practice the fundamental steps of setting up a database environment for structured data storage and management
6. .Generate scripts for a database schema to understand how database structures (e.g., tables, constraints) are defined and exported.

LO1: Installation and Configuration of MySQL
Step 1: Download MySQL Installer

1. Open your browser and go to:
   https://dev.mysql.com/downloads/installer/
2. Select the larger installer (not the web installer) with the full setup.
   - Example: mysql-installer-community-x.x.x.msi.

3. Click Download and then "No thanks, just start my download"
   to proceed without creating an account.

Step 2: Launch the Installer

1. Navigate to your Downloads folder and double-click the downloaded file to start the installation.
2. If prompted by Windows User Account Control, click Yes to allow the installer to run.

Step 3: Select Setup Type

1. On the Setup Type screen:
   - Choose Full (recommended for a complete installation with all features).
2. Click Next.
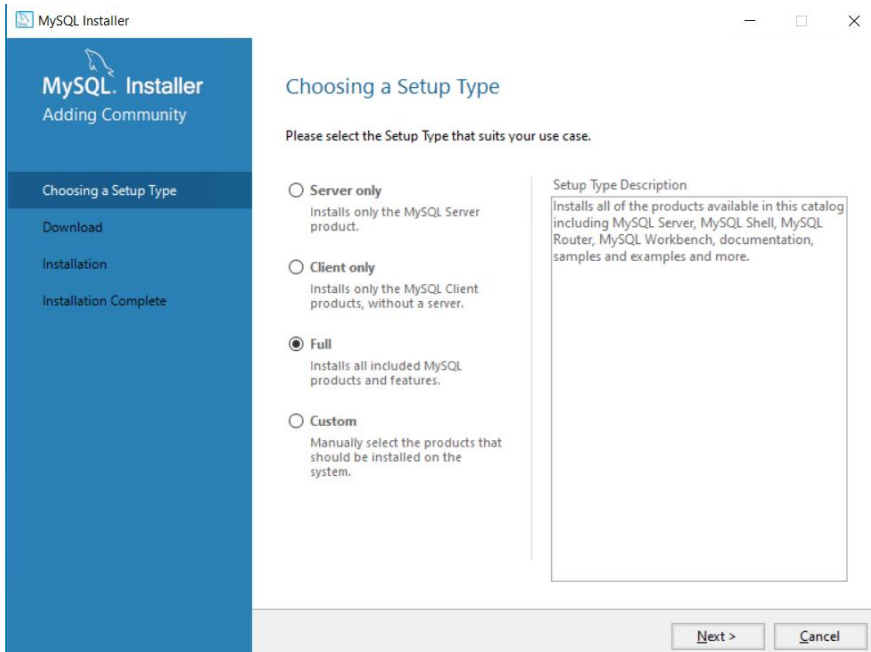
Step 4: Install Required Components

1. On the Check Requirements screen, ensure all required components are listed.
2. Click Execute to download and install the required components.
   - If a license agreement pops up, click I Agree.
3. Wait for the process to complete, and then click Next.
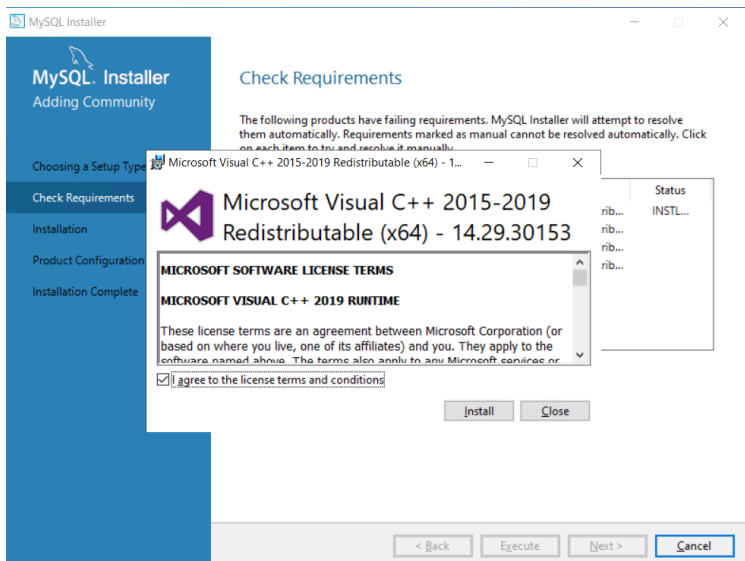
Step 5: Configuration

1. On the Product Configuration screen, click Next.
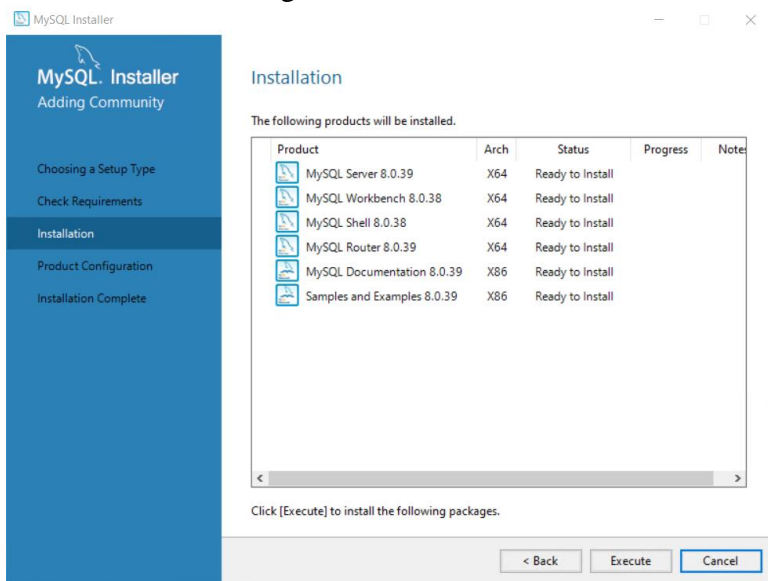
2. Type and Networking:
   - o Leave the default settings (e.g., Development Computer).
   - o Click Next.

Step 6: Authentication Method

1. On the Authentication Method screen:
   o Select "Use Strong Password Encryption for Authentication (Recommended)".
2. Click Next.

Step 7: Set Root Password

1. On the Accounts and Roles screen:
   o Enter a strong password for the root user.
      ▪ Example: Choose a mix of uppercase, lowercase, numbers, and symbols.
   o Important: Save this password securely, as it will be required for accessing the database.
2. Click Next

Step 8: Service Configuration
1. Leave the Windows Service Configuration settings as default.
   - o MySQL will automatically start as a service on system boot.
2. Click Next.

Step 9: Apply Configuration
1. On the Apply Configuration screen, click Execute to apply all settings.
2. Wait for the configuration process to complete.
3. Once completed, click Finish.
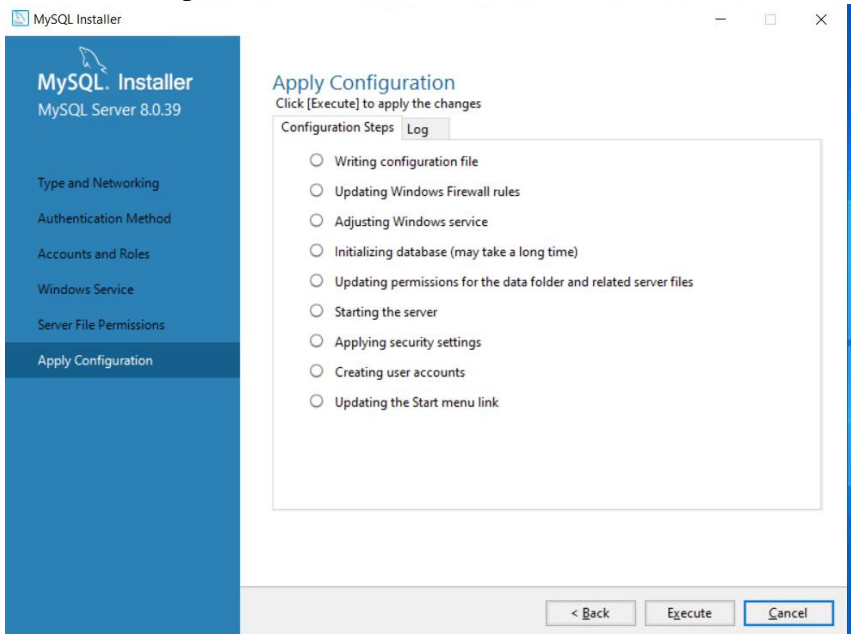
Step 10: Test Server Connection
1. On the Connect to Server screen:
   - o Enter the root username and the password you set earlier.
2. Click Check to verify the connection.
   - o If successful, you'll see a confirmation message.
3. Click Next.
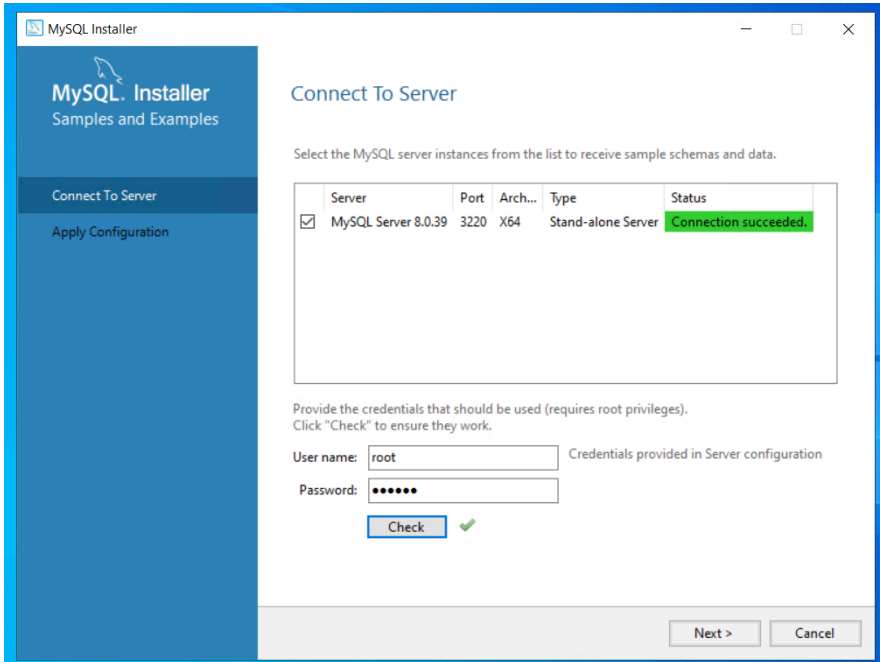
Step 11: Finish Installation

1. On the final screen, click Finish to complete the installation.
2. If a MySQL console appears, you can close it.

Post-Installation Steps

1. Open MySQL Workbench or any MySQL-compatible client to connect to your server.
2. Use the credentials (root and your password) to log in and begin creating databases or executing SQL queries.

LO2: Create a new database named "Northwind" to understand the basic process of setting up a database.

Step 1: Open MySQL Workbench

1. Launch MySQL Workbench from the Start Menu or desktop.
2. Under the "MySQL Connections" section:

- o Click on your database connection (e.g., Local Instance MySQL).
- o Enter your root password (set during installation) if prompted.

Step 2: Create a New Database

1. Once connected, navigate to the top menu and click on "File" > "New Query Tab" (or press Ctrl+T).
2. In the query editor window, type the following SQL command:

CREATE DATABASE Northwind;

3. Click on the "Execute" button (lightning bolt icon) or press Ctrl+Enter to run the command.

Step 3: Verify the Database Creation

1. On the left-hand Schema Browser pane, right-click and select "Refresh All".
2. Look for the Northwind database in the list of schemas.

Step 4: Set Northwind as the Active Database

1. To ensure you're working with the Northwind database, execute the following command:
   USE Northwind;
2. Click on the "Execute" button to set Northwind as the current database.

Step 5: Confirm the Database Exists

1. Run the following command to list all databases in your MySQL instance:

SHOW DATABASES;

2. Verify that Northwind appears in the list of databases.

Additional Notes

- The Northwind database is now created, but it does not yet contain any tables or data. You will populate it later using the provided northwind.sql and northwind_data.sql scripts.
- If you encounter errors, ensure you are logged in with a user account that has privileges to create databases.

LO3: Restore database schema by executing to comprehend how schema scripts define database structure.

Step 1: Download the Database Scripts

1. Download the northwind.sql file from https://shorturl.at/wUFhw and store in a location to access later.

Step 2: Select the Target Database

1. In the left-hand Schemas pane:
   - Right-click on the Northwind database.
   - Select "Set as Default Schema" to ensure that all operations target this database.

Step 3: Open the Schema Script

1. In the top menu, click on File > Open SQL Script.
2. Navigate to the folder containing northwind.sql.
3. Select the northwind.sql file and click Open.

Step 4: Review the Schema Script

1. The contents of the northwind.sql script will appear in the query editor.
2. Review the script to understand its structure:
   - CREATE TABLE statements define the tables.
   - ALTER TABLE statements define relationships and constraints.

Step 5: Execute the Schema Script

1. Click on the "Execute" button (lightning bolt icon) in the toolbar or press Ctrl+Shift+Enter.
2. Monitor the Action Output pane at the bottom:
   - Look for messages indicating successful execution (e.g., Table Created).

Step 6: Verify the Schema Restoration

1. Refresh the Schemas pane by right-clicking and selecting "Refresh All".
2. Expand the Northwind database to view the restored structure:
   - Check the Tables, Views, and Stored Procedures folders.
3. Run the following query to list the tables in the database:

Show TABLES;

Step 7: Resolve Errors (If Any)

1. If you encounter errors:
   - Check for missing privileges or syntax errors.
   - Ensure the Northwind database exists and is set as the default schema.
2. Common command to use if permissions are missing:
   GRANT ALL PRIVILEGES ON Northwind.* TO 'root
@'localhost';

Step 9: Test the Schema

1. Verify that the schema is functional by running the following query to describe one of the tables (e.g., Customers):
   DESCRIBE Customers;
2. Confirm that all columns, data types, and constraints are correctly defined.

LO4: Populate the database with data to practice importing data into a structured database.

Step 1: Download the data scripts

1. Download the northwind_data.sql file from
   https://shorturl.at/aKOBQ and store in a location to access later.

Step 2: Select the Target Database

1. In the left-hand Schemas pane:
   - Right-click on the Northwind database.
   - Select "Set as Default Schema" to ensure that the data is imported into the correct database.

Step 3: Open the Data Script

1. In the top menu, click on File > Open SQL Script.
2. Navigate to the folder containing the northwind_data.sql file.
3. Select the northwind_data.sql file and click Open.

Step 4: Review the Data Script

1. The contents of the northwind_data.sql script will appear in the query editor.
2. Review the script to understand its structure:

- o Look for INSERT INTO statements, which populate the tables with data.

Step 5: Execute the Data Script

1. Click on the "Execute" button (lightning bolt icon) in the toolbar or press Ctrl+Shift+Enter.
2. Monitor the Action Output pane at the bottom:
   - o Look for messages indicating successful execution (e.g., Rows Inserted).

Step 6: Verify Data Population

1. Refresh the Schemas pane by right-clicking and selecting "Refresh All".
2. Expand the Tables folder under the Northwind database.
3. Test the data population by running a SELECT query for one of the tables. For example, to check the Customers table: SELECT * FROM Customers;
4. Review the output to ensure the table is populated with data.

LO5: Create a new database to practice the fundamental steps of setting up a database environment for structured data storage and management

Step 1: Create a New Database

1. Open MySQL Workbench:
   - o Launch MySQL Workbench and connect to your MySQL server (e.g., Local Instance MySQL).
   - o Enter your root password if prompted.
2. Go to the "Schemas" Pane:
   - o Locate the Schemas section on the left-hand side.
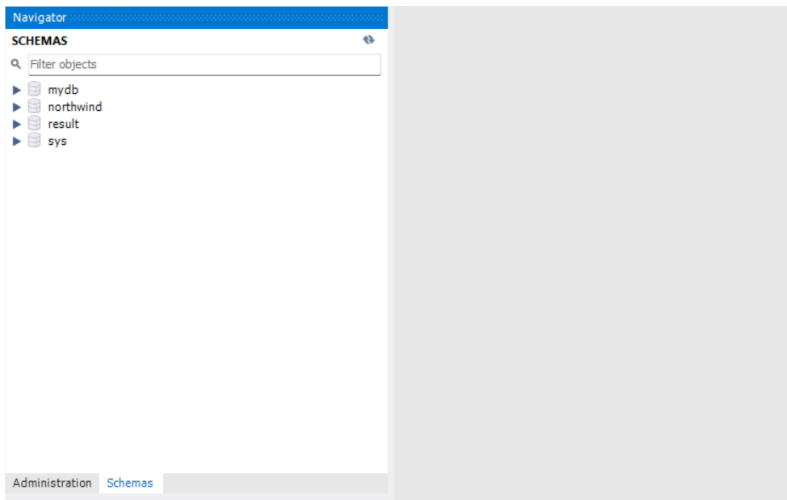
3. Create a New Database:
   - o Right-click anywhere in the Schemas pane and select "Create Schema...".
   - o A new window titled "Create Schema" will appear.
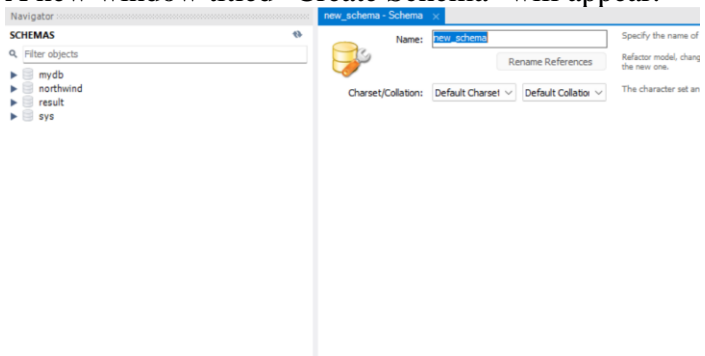
4. Provide the Database Name:
   - o In the Name field, enter the name of the database (e.g., spikodb1).
   - o Leave other settings (Character Set and Collation) as default.
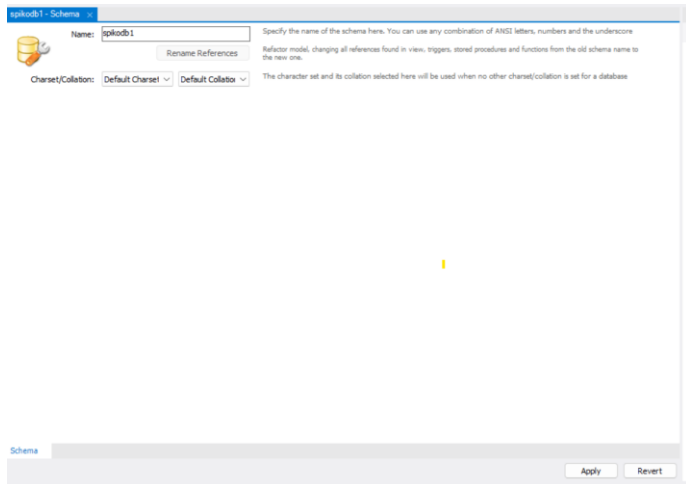
5. Click "Apply":
   o Review the automatically generated SQL script (e.g., CREATE DATABASE spikodb1;).
   o Click Apply to execute the script.
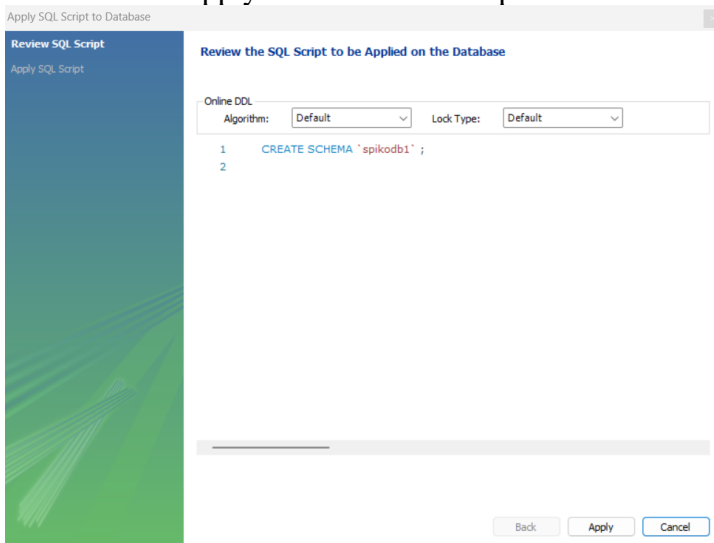
6. Confirm Database Creation:
   o Check for the success message and click Finish.
   o Refresh the Schemas pane to see the new database (spikodb1).

Step 2: Create a Table

1. **Set the Default Schema**:
    o Right-click on the newly created database (spikodb1) in the **Schemas** pane and select **"Set as Default Schema"**.
2. **Open the Table Creation Wizard**:
    o Expand the spikodb1 database in the **Schemas** pane.
    o Right-click on the **Tables** folder and select **"Create Table..."**.

3. **Define the Table Structure**:
    o **Table Name**: Enter Product in the **Table Name** field.
    o Add columns by filling out the grid:
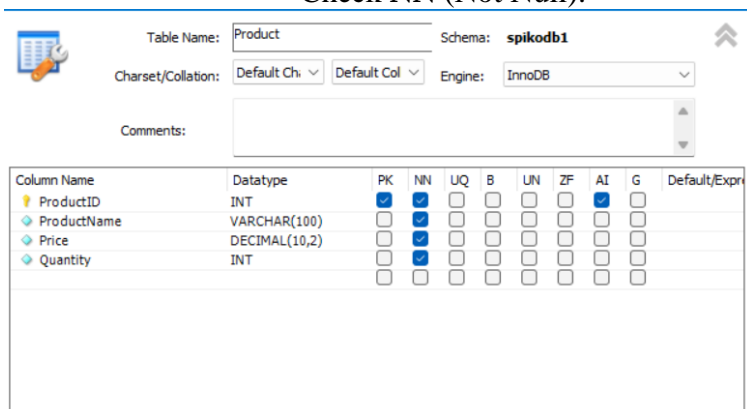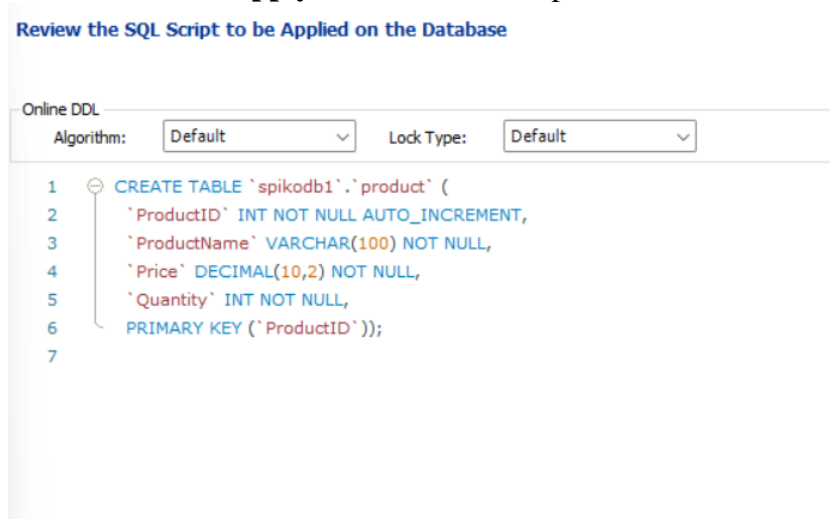   ▪ **Column Name**: ProductID
            ▪ Data Type: INT
            ▪ Check **PK** (Primary Key), **NN** (Not Null), and **AI** (Auto Increment).
        ▪ **Column Name**: ProductName
            ▪ Data Type: VARCHAR(100)
            ▪ Check **NN** (Not Null).
        ▪ **Column Name**: Price
            ▪ Data Type: DECIMAL(10,2)
            ▪ Check **NN** (Not Null).
        ▪ **Column Name**: Quantity
            ▪ Data Type: INT
            ▪ Check **NN** (Not Null).

	Table Name:	Product		Schema:	**spikodb1**						
	Charset/Collation:	Default Chi ⌄ Default Col ⌄		Engine:	InnoDB			⌄			
	Comments:										

Column Name	Datatype	PK	NN	UQ	B	UN	ZF	AI	G	Default/Expre
🔑 ProductID	INT	☑	☑	☐	☐	☐	☐	☑	☐	
◇ ProductName	VARCHAR(100)	☐	☑	☐	☐	☐	☐	☐	☐	
◇ Price	DECIMAL(10,2)	☐	☑	☐	☐	☐	☐	☐	☐	
◇ Quantity	INT	☐	☑	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	

4. **Click "Apply"**:
   - Review the SQL script (e.g., CREATE TABLE Product...).
   - Click **Apply** to execute the script.

Review the SQL Script to be Applied on the Database

Online DDL

Algorithm: Default ∨   Lock Type: Default ∨

```
1    ⊖ CREATE TABLE `spikodb1`.`product` (
2        `ProductID` INT NOT NULL AUTO_INCREMENT,
3        `ProductName` VARCHAR(100) NOT NULL,
4        `Price` DECIMAL(10,2) NOT NULL,
5        `Quantity` INT NOT NULL,
6        PRIMARY KEY (`ProductID`));
7
```

5. **Confirm Table Creation**:
   - Check for the success message and click **Finish**.
   - Expand the **Tables** folder in spikodb1 to see the Product table.

Step 3: Insert Data into the Table

1. **Open the Table Editor**:
   - In the **Schemas** pane, expand the Tables folder under spikodb1.
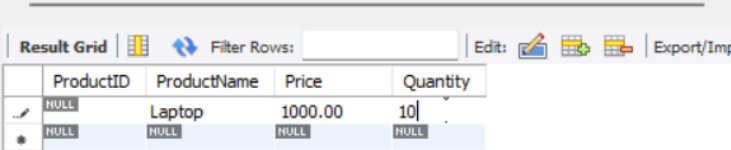   - Right-click on the Product table and select **"Select Rows - Limit 1000"**.
2. **Switch to Edit Mode**:
   - In the result grid, click the **Edit (pencil icon)** at the bottom-right corner.
3. **Enter Data**:
   - Add rows directly into the table by filling out the grid:
     - **ProductName**: Laptop, **Price**: 1000.00, **Quantity**: 10

- **ProductName**: Smartphone, **Price**: 500.00, **Quantity**: 20
- **ProductName**: Headphones, **Price**: 50.00, **Quantity**: 50
- **ProductName**: Keyboard, **Price**: 25.00, **Quantity**: 30
- **ProductName**: Mouse, **Price**: 15.00, **Quantity**: 40

	ProductID	ProductName	Price	Quantity
	NULL	Laptop	1000.00	10
*	NULL	NULL	NULL	NULL

4. **Apply Changes**:
   - Click **Apply** to save the data into the database.
   - Confirm the SQL INSERT statements in the wizard and click **Apply**.
5. **Verify the Data**:
   - Refresh the data grid to ensure the rows are successfully added.

Step 4: Verify the Table and Data
   1. **Check Table Data**:
      - Right-click on the Product table and select **"Select Rows - Limit 1000"** to view the inserted data.
   2. **Output Example**:

| ProductID	ProductName	Price	Quantity
1	Laptop	1000.00	10
2	Smartphone	500.00	20
3	Headphones	50.00	50
4	Keyboard	25.00	30
5	Mouse	15.00	40

LO6: Generate scripts for a database schema to understand how database structures (e.g., tables, constraints) are defined and exported.

Step 1: Open MySQL Workbench
1. Launch MySQL Workbench.
2. Connect to your MySQL server:
    - Select your connection (e.g., Local Instance MySQL).
    - Enter your root password (if prompted).

Step 2: Select the Target Schema
1. In the left-hand Schemas pane:
    - Locate the database schema you want to export (e.g., my_db).
    - Right-click on the my_db schema.
    - Select "Schema Export" or proceed to the next step to use the Dump tool.
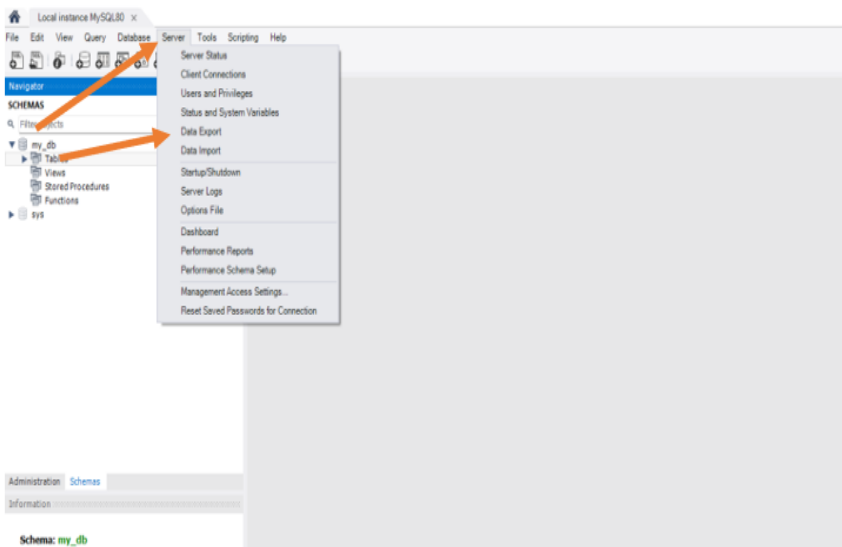
Step 3: Open the Data Export Tool

1. Go to the top menu and click Server > Data Export.
2. In the Data Export window:
   - Select the schema you want to generate scripts for (e.g., Northwind).
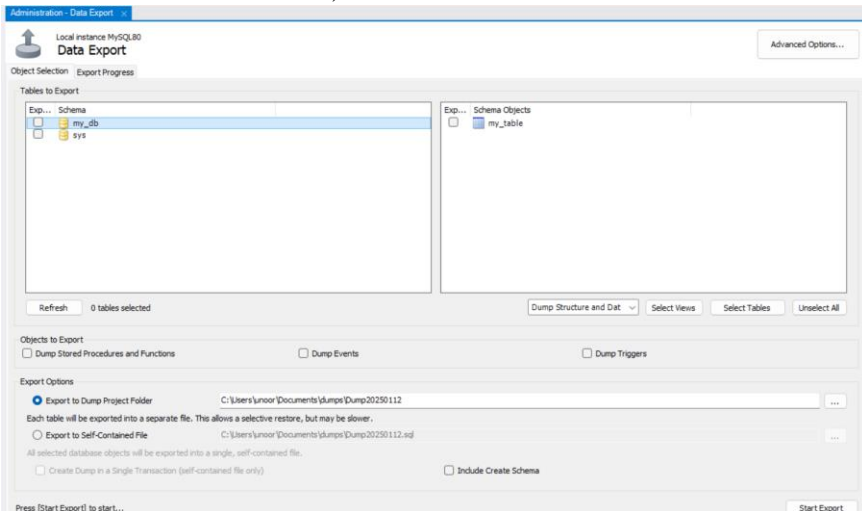
Step 4: Configure Export Settings

1. Choose Export Options:
   - Check the box for "Export to Self-Contained File".
   - Specify the file path where the script will be saved (e.g., C:\Database_Scripts\my_db.sql).
2. Export Type:
   - Under Objects to Export, select:
     - Dump Structure Only to export only the schema (tables, constraints, etc.).
   - Leave Data Export unchecked if you do not want the data.
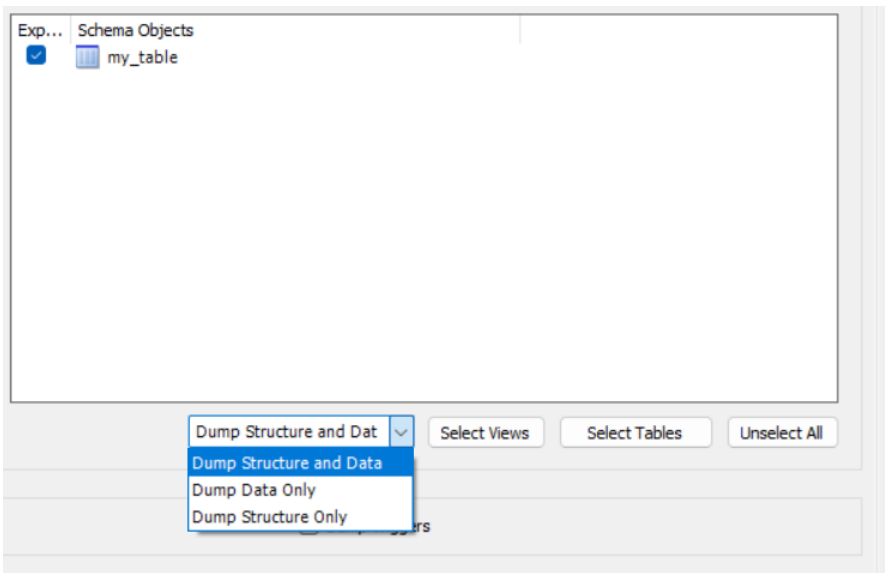
Step 5: Export the Schema

1. Click Start Export.
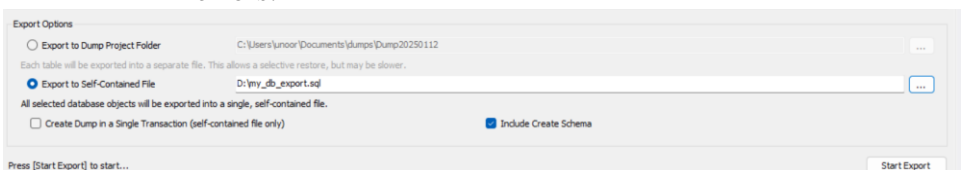2. Monitor the Progress Log at the bottom of the window:
   - o Ensure that the export completes successfully without errors.

Step 6: Verify the Generated Script

1. Navigate to the file path where the schema script was saved.
2. Open the script file (e.g., my_db.sql) in a text editor or IDE (e.g., Notepad++, Visual Studio Code).
3. Review the contents:
   - o Look for CREATE TABLE statements defining the structure of tables.
   - o Check for ALTER TABLE statements defining relationships, indexes, and constraints.

Lab Tasks

Part 1:

1. Create a new database named TestDB_2024_CS_X
2. Create a new table named student using 5 to 6 attributes
3. Generate Scripts of your database
4. Restore your schema to another machine
5. Generate scripts of data
6. Restore data to other system as well

Part 2:

Task 1: Connect to the Northwind Database

- **Objective**: Ensure the database connection is set up properly.
- **Steps**:
    1. Open MySQL Workbench.
    2. Connect to your MySQL server by selecting your connection (e.g., Local Instance MySQL).
    3. Verify that the Northwind database is visible in the **Schemas** pane.

Task 2: List All Tables

- **Objective**: Identify the tables in the Northwind database.
- **Steps**:
    1. Expand the Northwind schema in the **Schemas** pane.
    2. Note down the names of all tables (e.g., Customers, Orders, Products, etc.).
    3. **Output Example**:

Tables in Northwind:
- Customers
- Orders
- Products
- Employees
- Categories

Task 3: View Table Structures

- **Objective**: Understand the columns and data types in key tables.

- **Steps**:
    1. Right-click on a table (e.g., Customers) in the **Schemas** pane.
    2. Select **"Table Inspector"** or **"View Table Details"**.
    3. Note the column names, data types, and constraints (e.g., primary keys).

Task 4: Record Key Details

- **Objective**: Document the structure of a few key tables.
- **Example for Customers**:

Column Name	Data Type	Key/Constraint
CustomerID	VARCHAR(5)	Primary Key
CompanyName	VARCHAR(40)	Not Null
ContactName	VARCHAR(30)	-
Country	VARCHAR(15)	-

Task 5: Browse Data

- **Objective**: View a sample of the data stored in each table.
- **Steps**:
    1. Right-click on a table (e.g., Customers) in the **Schemas** pane.
    2. Select **"Select Rows - Limit 1000"** to view the data.
    3. Review the first few rows of data to understand the type of information stored.

Task 6: Document Examples

- **Objective**: Record a few rows of data from key tables for reference.
- **Example for Customers**:

CustomerID	CompanyName	ContactName	Country
ALFKI	Alfreds Futterkiste	Maria Anders	Germany
ANATR	Ana Trujillo Emparedados y helados	Ana Trujillo	Mexico

Task 7: Review Table Relationships

- **Objective**: Understand how tables are related without using queries.
- **Steps**:
    1. In MySQL Workbench, reverse engineer the schema (if available).
        - **Database > Reverse Engineer**.
    2. Review the **Entity-Relationship (ER)** diagram for the Northwind database.

3. Note key relationships between tables:
    - Example: Orders table references Customers via the CustomerID column.
4. Document simple relationships:
    - **Example**:
        - Orders.CustomerID → Customers.CustomerID (Foreign Key).

Task 8: Prepare a Lab Report

- **Objective**: Summarize findings in a concise report.
- **Content to Include**:
    1. **List of Tables**: Document all tables in the database.
    2. **Table Structures**: Provide column details for 2-3 key tables.
    3. **Sample Data**: Include a few rows of data from each table.
    4. **Relationships**: Highlight primary relationships between tables.