1. Entity Relationship Diagram (ERD)

Entities might include:

Users

Products

Orders

OrderDetails

Relationships:

A User can place many Orders

An Order can have multiple OrderDetails

Each OrderDetail relates to one Product

This is a high-level description. You'd typically use tools like ERDPlus, LucidChart, etc. to visually create the ERD.

2. Create Database Objects

sql

Copy code

```
CREATE TABLE Users (
    UserID INT PRIMARY KEY,
    UserName VARCHAR(100),
    Email VARCHAR(100),
    Password VARCHAR(100)
);
CREATE TABLE Products (
    ProductID INT PRIMARY KEY,
    ProductName VARCHAR(255),
    Price DECIMAL(10, 2)
);
CREATE TABLE Orders (
    OrderID INT PRIMARY KEY,
    UserID INT,
```

```sql
    OrderDate DATE,

    FOREIGN KEY (UserID) REFERENCES Users(UserID)

);

CREATE TABLE OrderDetails (

    OrderDetailID INT PRIMARY KEY,

    OrderID INT,

    ProductID INT,

    Quantity INT,

    FOREIGN KEY (OrderID) REFERENCES Orders(OrderID),

    FOREIGN KEY (ProductID) REFERENCES Products(ProductID)

);
```

3. SQL Stored Procedure for User Registration:

sql

Copy code

```sql
CREATE PROCEDURE RegisterUser @UserName VARCHAR(100), @Email VARCHAR(100), @Password VARCHAR(100)

AS

BEGIN

  BEGIN TRY

    BEGIN TRANSACTION

      -- Validation

    IF EXISTS (SELECT 1 FROM Users WHERE Email = @Email)

    BEGIN

        THROW 50000, 'Email already exists!', 1

    END


 INSERT INTO Users (UserName, Email, Password)

    VALUES (@UserName, @Email, @Password)
```

```
        COMMIT

    END TRY


    BEGIN CATCH

        ROLLBACK

        THROW

    END CATCH

END;
```

4. SQL Aggregate Functions:

Aggregate functions perform calculations on a set of values and return a single value. Examples include:

COUNT()

SUM()

AVG()

MIN()

MAX()

Usage:

sql

Copy code

```sql
SELECT AVG(Price) as AveragePrice FROM Products;
```

5. Pivot Query in SQL:

Assuming a table Sales with Year, Product and Amount:

sql

Copy code

```sql
SELECT Product, [2021], [2022], [2023]
```

FROM (SELECT Year, Product, Amount FROM Sales) as SourceTable

PIVOT (SUM(Amount) FOR Year IN ([2021], [2022], [2023])) AS PivotTable;

6. Joins in SQL:

For example, to get the list of orders for a specific user:

sql

Copy code

```sql
SELECT Orders.OrderID, Users.UserName, Products.ProductName
FROM Orders
JOIN Users ON Orders.UserID = Users.UserID
JOIN OrderDetails ON Orders.OrderID = OrderDetails.OrderID
JOIN Products ON OrderDetails.ProductID = Products.ProductID;
```

7. 4th Highest Value in a Column:

Let's use the Products table and find the 4th highest price:

sql

Copy code

```sql
CREATE TABLE ProductsSample (
    ProductID INT PRIMARY KEY,
    ProductName VARCHAR(255),
    Price DECIMAL(10, 2)
);
-- Find the 4th highest price
SELECT MIN(Price) FROM
(SELECT DISTINCT TOP 4 Price FROM ProductsSample ORDER BY Price DESC) as SubQuery
```