## Implementing SQL Functions and Aggregate Functions

### Step 1: Prepare for the Application

You'll create a small database and populate it with sample data using MySQL. This database will allow you to practice using SQL functions and aggregate functions.

- Open your MySQL environment or terminal.
- Create a new database called EmployeeDB using the following SQL command:

```
CREATE DATABASE EmployeeDB;
USE EmployeeDB;
```

- Create a table called **Employees** with the following schema:

```
CREATE TABLE Employees (
    EmployeeID INT AUTO_INCREMENT PRIMARY KEY,
    FirstName VARCHAR(50),
    LastName VARCHAR(50),
    Department VARCHAR(50),
    Salary DECIMAL(10, 2),
    HireDate DATE
);
```

- Insert sample data into the **Employees** table:

```
INSERT INTO Employees (FirstName, LastName, Department, Salary,
HireDate) VALUES
('Liam', 'Nguyen', 'Engineering', 85000.00, '2020-03-15'),
('Sophia', 'Smith', 'Marketing', 72000.00, '2019-05-22'),
('Raj', 'Patel', 'Sales', 64000.00, '2021-07-01'),
('Aisha', 'Khan', 'HR', 60000.00, '2020-09-12'),
('Carlos', 'Martinez', 'Engineering', 93000.00, '2018-12-01'),
('Chen', 'Zhao', 'Marketing', 77000.00, '2017-11-05'),
('Amara', 'Okafor', 'Sales', 67000.00, '2022-03-18');
```

### Step 2: Using SQL Functions for Data Manipulation

Write queries that use basic SQL functions such as **CONCAT**, **UPPER**, **LOWER**, **LENGTH**, and **SUBSTRING** to manipulate data.

1. Write a query to concatenate the first and last names of employees into a single column called **FullName**.
2. Use the **UPPER** function to convert the **Department** column to uppercase.
3. Use the **LOWER** function to convert the **LastName** column to lowercase.

4. Use the **LENGTH** function to calculate the length of each employee's **FirstName**.
5. Use the **SUBSTRING** function to extract the first three characters of the **LastName** column.

**Step 3: Using Aggregate Functions**

Write queries that use aggregate functions such as COUNT, SUM, AVG, MIN, and MAX to analyze data.

1. Count the total number of employees in the company.
2. Calculate the total salary expenditure for all employees.
3. Find the average salary of employees in the Engineering department.
4. Identify the minimum salary in the company.
5. Determine the maximum salary in the Sales department.

**Step 4: Combining Aggregate Functions with GROUP BY**

Write queries that group data by specific columns and apply aggregate functions.

1. Group employees by Department and calculate the total salary for each department.
2. Group employees by Department and find the average salary in each department.
3. Use the GROUP BY clause to count the number of employees in each department.

**Step 5: Exploring Advanced Functions**

Experiment with combinations of SQL functions and aggregate functions.

1. Concatenate FirstName and LastName, then calculate the length of the resulting full name.
2. Use a combination of COUNT and GROUP BY to determine how many employees were hired in each year (extract the year from the HireDate column).
3. Use SUM and GROUP BY to calculate the total salary expenditure per year of hiring.

**lab_functions.sql:**

```sql
-- ============================================
-- Lab: Implementing SQL Functions and Aggregate Functions
-- Database: EmployeeDB
-- ============================================

-- Step 1. Prepare for the Application
-- --------------------------------------------
CREATE DATABASE IF NOT EXISTS EmployeeDB;
USE EmployeeDB;

-- Drop table if exists (clean start)
DROP TABLE IF EXISTS Employees;

-- Create Employees table
CREATE TABLE Employees (
    EmployeeID INT AUTO_INCREMENT PRIMARY KEY,
    FirstName VARCHAR(50),
    LastName VARCHAR(50),
    Department VARCHAR(50),
    Salary DECIMAL(10, 2),
    HireDate DATE
);

-- Insert sample data
INSERT INTO Employees (FirstName, LastName, Department, Salary,
HireDate) VALUES
('Liam', 'Nguyen', 'Engineering', 85000.00, '2020-03-15'),
('Sophia', 'Smith', 'Marketing', 72000.00, '2019-05-22'),
('Raj', 'Patel', 'Sales', 64000.00, '2021-07-01'),
('Aisha', 'Khan', 'HR', 60000.00, '2020-09-12'),
('Carlos', 'Martinez', 'Engineering', 93000.00, '2018-12-01'),
('Chen', 'Zhao', 'Marketing', 77000.00, '2017-11-05'),
('Amara', 'Okafor', 'Sales', 67000.00, '2022-03-18');

-- Verify data
SELECT * FROM Employees;

-- ============================================
-- Step 2. Using SQL Functions for Data Manipulation
-- ============================================

-- 2.1 Concatenate first and last names into FullName
SELECT CONCAT(FirstName, ' ', LastName) AS FullName
FROM Employees;

-- 2.2 Convert Department to uppercase
SELECT UPPER(Department) AS UppercaseDepartment
FROM Employees;

-- 2.3 Convert LastName to lowercase
SELECT LOWER(LastName) AS LowercaseLastName
FROM Employees;

-- 2.4 Calculate length of each employee's FirstName
SELECT FirstName, LENGTH(FirstName) AS NameLength
FROM Employees;
```

```sql
-- 2.5 Extract first 3 characters of LastName
SELECT LastName, SUBSTRING(LastName, 1, 3) AS FirstThreeLetters
FROM Employees;

-- ===========================================
-- Step 3. Using Aggregate Functions
-- ===========================================

-- 3.1 Count total number of employees
SELECT COUNT(*) AS TotalEmployees FROM Employees;

-- 3.2 Total salary expenditure
SELECT SUM(Salary) AS TotalSalaryExpenditure FROM Employees;

-- 3.3 Average salary of Engineering department
SELECT AVG(Salary) AS AvgEngineeringSalary
FROM Employees
WHERE Department = 'Engineering';

-- 3.4 Minimum salary in the company
SELECT MIN(Salary) AS MinSalary FROM Employees;

-- 3.5 Maximum salary in Sales department
SELECT MAX(Salary) AS MaxSalesSalary
FROM Employees
WHERE Department = 'Sales';

-- ===========================================
-- Step 4. Combining Aggregate Functions with GROUP BY
-- ===========================================

-- 4.1 Total salary per department
SELECT Department, SUM(Salary) AS TotalDeptSalary
FROM Employees
GROUP BY Department;

-- 4.2 Average salary per department
SELECT Department, AVG(Salary) AS AvgDeptSalary
FROM Employees
GROUP BY Department;

-- 4.3 Number of employees per department
SELECT Department, COUNT(*) AS EmployeeCount
FROM Employees
GROUP BY Department;

-- ===========================================
-- Step 5. Exploring Advanced Functions
-- ===========================================

-- 5.1 Concatenate FirstName + LastName and calculate length of FullName
SELECT CONCAT(FirstName, ' ', LastName) AS FullName,
       LENGTH(CONCAT(FirstName, ' ', LastName)) AS FullNameLength
FROM Employees;

-- 5.2 Count employees hired each year
SELECT YEAR(HireDate) AS HireYear, COUNT(*) AS EmployeesHired
FROM Employees
GROUP BY YEAR(HireDate)
```

```sql
ORDER BY HireYear;

-- 5.3 Total salary expenditure per hire year
SELECT YEAR(HireDate) AS HireYear, SUM(Salary) AS TotalSalary
FROM Employees
GROUP BY YEAR(HireDate)
ORDER BY HireYear;
```