A SQL query goes into a bar, walks up to two tables and asks…

May I join you??

Module 2-1

Introduction to Databases and SQL

Objectives

- Introduction to Databases
- Tables, Rows, and Columns
- Writing SQL Queries

Databases

- A database is an electronically stored organized collection of data.
- A **relational database** is one in which the data is organized around columns and tables:
    - A table is designed to store an **entity**, a data representation of a real world object.
    - Each row of a table represents one instance of the entity.
    - The columns represent attributes the entity might have.

Relational Database: Example

Suppose we are interested in storing data about cars. We can model a car entity into its own table:

This table has 4 attributes: CarName, Manufacturer, NumberOfDoors, FuelEconomy

This table has 3 rows.

CarName	Manufacturer	NumberOfDoors	FuelEconomy
Explorer	Ford	4	23
C-Class	Mercedes Benz	4	28
Jeep Wrangler	Fiat Chrysler	2	20

Relational Database: Attribute Data Types

There is a large variety of data types in Postgresql, to name a few:

- **varchar**: holds text containing letters and numbers (somewhat like a String in Java).
- **char**: fixed length field containing letters and numbers.
- Various numeric data types: https://www.postgresql.org/docs/9.3/datatype-numeric.html
- When referring to a non-numeric "text" field (i.e. varchar or char) we must surround them in single quotes (i.e. country=**'USA'**).
- Numeric literals do not need single quotes (numberOfDoors = **4**).

Relational Database: SQL

- **SQL** is an acronym for **Structured Query Language**
- SQL is the language used to interact with relational database management systems.
- The exact implementation of SQL varies slightly depending on the database system involved, i.e. there will be minor differences in the language between PostgreSQL and MS SQL Server.
- This class will be using PostgreSQL.

SQL: SELECT

- The most basic SQL statement is a SELECT query, and it follows the following format:

SELECT **[column]**, **[column-n]** FROM **[table]**;

- **[column]** and **[column-n]** are stand ins for the attributes or columns that you want returned from your query.
- **[table]** refers to the name of the table you are querying.
- You can create column Aliases using the "**AS**" keyword followed by the alias.

SQL: SELECT Example

Let’s take the Vehicle table we just saw as an example:

- We could write the following SELECT statement:

  SELECT CarName, NumberOfDoors AS doors FROM Vehicle;

  The output of this would be:

CarName	doors
Explorer	4
C-Class	4
Jeep Wrangler	2

Note how the alias affects the column name in the output.

- Instead of listing specific columns we could use the wildcard * to indicate that all columns should be returned: *SELECT * FROM Vehicle;*

SQL: SELECT with WHERE clause

- We can include a WHERE clause in our select statements to limit the data returned by specifying a condition.
- The WHERE statement relies on comparison operators.
  - **Greater Than**: **>**
  - **Greater Than or Equal To**: **>=**
  - **Less Than**: **<**
  - **Less Than or Equal To**: **<=**
  - **Equa**l: **=**
  - **Not Equal To**: **<> !=**
- There is a special comparison operator called **LIKE** which is often used in conjunction with a wildcard (**%**) operator.

SQL: SELECT with WHERE clause Example 1

Let’s take the Vehicle table we just saw as an example:

- We could write the following SELECT statement:

  SELECT * FROM Vehicle WHERE Manufacturer = ‘Ford’;

- Only 1 row matches this criteria, and thus the results of the query will be:

CarName	Manufacturer	NumberOfDoors	FuelEconomy
Explorer	Ford	4	23

SQL: SELECT with WHERE clause Example 2

Here is an example of the WHERE clause using the LIKE / Wildcard.

- We could write the following SELECT statement:

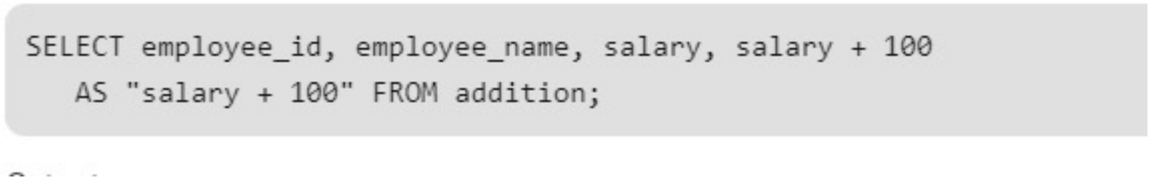
  SELECT * FROM Vehicle WHERE CarName LIKE ‘Ex%’;

- Only 1 row matches this criteria, and thus the results of the query will be:

CarName	Manufacturer	NumberOfDoors	FuelEconomy
Explorer	Ford	4	23

Derived Columns with Math Operations

- A custom field containing math operations can be included in the SELECT.
- The basic math operators are present: **+**, **-**, *, **/**, **%**



```
SELECT employee_id, employee_name, salary, salary + 100
   AS "salary + 100" FROM addition;
```

Derived Columns Example

- Consider the following example:

SELECT CarName, FuelEconomy * 0.425144 AS kpl FROM Vehicle;

CarName	kpl
Explorer	9.778312
C-Class	9.778312
Jeep Wrangler	8.50288

SQL: AND / OR on WHERE statements

- Within the WHERE statement, various filter conditions can be combined using the AND / OR statement.
- Consider the following example:
  SELECT * FROM Vehicle WHERE Manufacturer = 'Ford' OR NumberOfDoors = 4;
- Two rows are returned:

CarName	Manufacturer	NumberOfDoors	FuelEconomy
Explorer	Ford	4	23
C-Class	Mercedes Benz	4	28

3 types of commands

- DML
  - Database Manipulation Language
    - INSERT, SELECT, DELETE, etc.
- DDL
  - Data Definition Language
    - Commands for creating tables, defining relationships, etc.
- DCL
  - Data Control Language
    - Commands that control permissions on the data and access rights

Let’s get setup!