Manipulation

Introduction to SQL

- SQL stands for **Structured Query Language,** and is the programming language implemented by a database management system (DBMS) used for **managing and querying data held in a relational database.**
- A **relational database** is a store of data organized in tables made of columns and rows, and the relationships between those tables. The software that controls a relational database is called a relational database management system (RDBMS) and typically allows management and updates to the database through an implementation of the structured query language (SQL).
- A *relational database* is a database that organizes information into one or more tables.
- A **database** is a collection of structured information stored so it can be easily accessed and updated. In a computer system, databases are commonly accessed through a database management system, or DBMS.
- A *table* is a collection of data organized into rows and columns. Tables are sometimes referred to as *relations*

Types of Statements
- Data Query Language (DQL)
- Data Definition Language (DDL)
- Data Manipulation Language (DML)
- Data Control Language (DCL)

SQL statements can be broadly grouped into four different classes, or sub-languages:

- **Data Query Language (DQL):** Includes commands for **performing queries on data** within schema objects, retrieving some schema relation based on the query passed to it. Examples include:
    - SELECT retrieves data from the database.
- **Data Definition Language (DDL):** Includes commands used to **define the database schema.** These commands are used to create and modify the structure of database objects. Examples include:
    - CREATE creates an object in the database.
    - DROP deletes an object from the database.
    - ALTER changes the definition of an existing object in the database.

- **Data Manipulation Language (DML):** Includes commands used to **modify the data stored in the database.** Examples include:
    - INSERT inserts new data into a database table.
    - UPDATE alters data in a database table.
    - DELETE removes data from a database table.
- **Data Control Language (DCL):** Includes commands **dealing with the controls and properties of the DBMS, such as rights and permissions to database objects.** Examples include:
    - GRANT grants a user permissions on a database object.
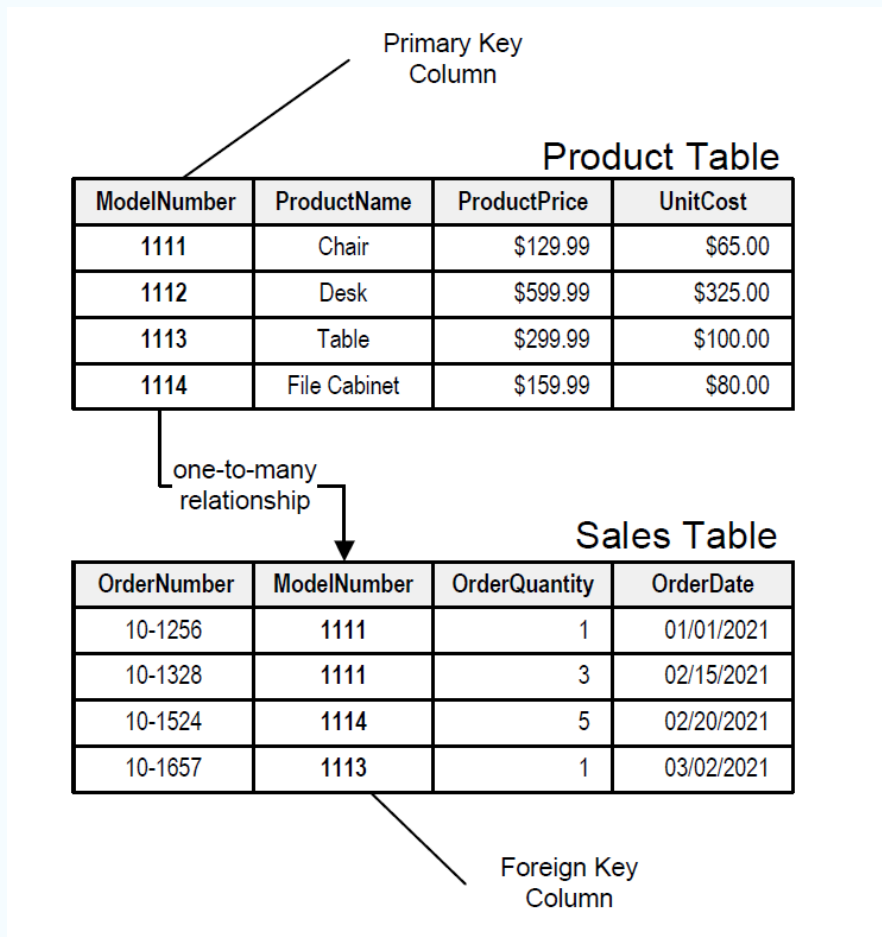   - REVOKE removes a user's permissions on a database object.

Different Databases and Query Languages

- MySQL (Standard SQL)
- SQLite (Non-standard SQL Variant)
- PostgreSQL (PSQL)

Structure of a Relational Database

- Most tables are defined with a key column that holds a unique value for every row. That column is called a **primary key.**
- Columns in a table that reference primary keys in other tables are called **foreign keys**.
- Data in different tables are related to each other via matching values in the key columns in those tables.
- Rows in each table are also called records.

- Columns can also be called fields or attributes.

Primary Key
Column

Product Table

ModelNumber	ProductName	ProductPrice	UnitCost
1111	Chair	$129.99	$65.00
1112	Desk	$599.99	$325.00
1113	Table	$299.99	$100.00
1114	File Cabinet	$159.99	$80.00

one-to-many
relationship

Sales Table

OrderNumber	ModelNumber	OrderQuantity	OrderDate
10-1256	1111	1	01/01/2021
10-1328	1111	3	02/15/2021
10-1524	1114	5	02/20/2021
10-1657	1113	1	03/02/2021

Foreign Key
Column

Examples of Relational Database Management Systems

- MySQL is a free open-source RDBMS that is used for many database-driven web applications such as Drupal, Joomla and WordPress.
- SQLite is a C library used to embed relational database functionality into software packages.
- PostgreSQL is a free open-source RDBMS that emphasizes extensibility and compliance to the ANSI SQL standards.
- Microsoft SQL Server is a server-based RDBMS from Microsoft typically used as a back-end for applications running on a network.
- Microsoft Access is part of the Microsoft 365 suite of applications. It combines an RDBMS with a graphical user interface and programming tools, allowing application development inside the software.
- Microsoft Azure SQL Database is a managed cloud-based RDBMS provided as part of Microsoft Azure.

Datatype

- Data types provide categories for values we store in tables.

    `INTEGER`, a positive or negative whole number

    `TEXT`, a text string

    `DATE`, the date formatted as YYYY-MM-DD

    `REAL`, a decimal value

Constraints

- **Constraints** in SQL are the rules applied to the values of individual columns. They add information about how a column can be used after specifying the data type for a column. They can be used to tell the database to reject inserted data that does not adhere to a certain restriction.

Here are some of the constraints that can be set:

- **PRIMARY KEY** columns can be used to uniquely identify the row. Attempts to insert a row with an identical value to a row already in the table will result in a *constraint violation* which will not allow you to insert the new row.
- **UNIQUE** columns have a different value for every row. This is similar to PRIMARY KEY except a table can have many different UNIQUE columns.
- **NOT NULL** columns must have a value. Attempts to insert a row without a value for a NOT NULL column will result in a constraint violation and the new row will not be inserted.
- **DEFAULT** columns take an additional argument that will be the assumed value for an inserted row if the new row does not specify a value for that column.

Note: There can be only one PRIMARY KEY column per table, but there can be multiple UNIQUE columns.

```
CREATE TABLE celebs (

 id INTEGER PRIMARY KEY,

 name TEXT UNIQUE,

 grade INTEGER NOT NULL,

 age INTEGER DEFAULT 10
);
```

Queries Example

1. **Select * from tablename; //** `SELECT` statements are used to fetch data from a database
2. **Select column_name from table_name;**

3. **CREATE TABLE table_name (**
   column_1 data_type,
   column_2 data_type,
   column_3 data_type
   );

4. **INSERT INTO table_name(column1, column2, column3...)**
   VALUES (value1, 'value2', value3....)

5. **ALTER TABLE table_name ADD COLUMN column_name**

6. **UPDATE tablename SET column_name = value WHERE id=value**

7. **DELETE FROM table_name WHERE column_name = value**
   (middle_name IS NULL)

Quick Overview

- SQL is a programming language designed to manipulate and manage data stored in relational databases.
- A relational database is a database that organizes information into one or more tables.
- A table is a collection of data organized into rows and columns.
- A statement is a string of characters that the database recognizes as a valid command.
  `CREATE TABLE` creates a new table.

  `INSERT INTO` adds a new row to a table.

  `SELECT` queries data from a table.

  `ALTER TABLE` changes an existing table.

> `UPDATE` edits a row in a table.
>
> `DELETE FROM` deletes rows from a table.
>
> *Constraints -* add information about how a column can be used.

Links

https://www.codecademy.com/article/sql-commands

https://www.codecademy.com/learn/learn-sql/modules/learn-sql-manipulation/cheatsheet

Quiz

1. What is a null value? A value that represents missing or unknown data
2. What does SQL stands for? Structured Query Language
3. Whats the purpose of * character is select * from celebs; ? it selects every column in the table
4. Which clause is used with the ALTER TABLE statement? ADD COLUMN
5. What would you need to complete the associated UPDATE statement?
   Update —-------- SET height = 6 where id = 1
   Answer: table name
6. Common datatypes in SQL? Integer, Text, Date, Real
7. What is a relational database?A database that organizes information into one or more tables
8. What does the INSERT statement do? Insert new rows into a table
9. Correct syntax for create table
10. Which of the following statement is correct and complete? Delete FROM icecream WHERE flavor IS NULL;

SQLite

- SQLite is a database engine.
- It is software that allows users to interact with a relational database.

- In SQLite, **a database is stored in a single file** — a trait that distinguishes it from other database engines.
- This fact allows for a **great deal of accessibility: copying a database is no more complicated than copying the file that stores the data, sharing a database can mean sending an email attachment.**

Drawbacks to SQLite

- SQLite's signature portability **unfortunately makes it a poor choice when many different users are updating the table at the same time** (to maintain integrity of data, only one user can write to the file at a time).
- It also may require some more work to ensure the **security** of private data due to the same features that make SQLite accessible.
- Furthermore, SQLite **does not offer the same exact functionality as many other database** systems, limiting some advanced features other relational database systems offer.
- Lastly, **SQLite does not validate data types.** Where many other database software would reject data that does not conform to a table's schema, SQLite allows users to store data of any type into any column.
- SQLite creates schemas, **which constrain the type of data in each column, but it does not enforce them.** The example below shows that the id column expects to store integers, the name column expects to store text, and the age column expects to store integers:
  ```
  CREATE TABLE celebs (
    id INTEGER,
    name TEXT,
    age INTEGER
  );
  ```

However, SQLite will not reject values of the wrong type. We could accidentally insert the wrong data types in the columns. Storing different data types in the same column is a bad habit that can lead to errors that are difficult to fix, so it's important to be strict about your schema even though SQLite will not enforce it.

Common use cases for SQLite

Even considering the drawbacks, the benefits of being able to access and manipulate a database without involving a server application are huge. SQLite is used worldwide for testing, development, and in any other scenario where it makes sense for the database to be on the same disk as the application code.

SQLite Installation :

https://www.youtube.com/watch?v=dcfh5iQ_-3s