Intro to SQL
Focusing on Sqlite

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Fordham University CS Society

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Game Plan

- Installing Sqlite
- Why you need SQL
- What is SQL
- What is Sqlite
- Basics of SQL syntax and database design
- How adding a SQL[1] database to an existing project can simplify your code

_____

[1]If pronounced "sequel", "a" is the correct article.

Let's get it Installed!

Mac and Linux
There's a 99% chance it's already installed. Open a terminal window and try `sqlite3`, and if that doesn't work, `sqlite`. If for some reason your OS didn't come with it, install it at https://www.sqlite.org

Windows
You could have unknowingly installed Sqlite when installing something else. Give it a try in Powershell or CMD, but it's likley you'll need to install Sqlite at: https://www.sqlite.org

If it works you will see:
(The specific version does not matter.)

```
SQLite version 3.30.0 2019-10-04 15:03:17
Enter ".help" for usage hints.
Connected to a transient in-memory database.
Use ".open FILENAME" to reopen on a persistent database.
sqlite>
```

Non-CS majors that don't know SQL say, "Can't I just use a GUI tool like MS Access?"

CS majors that don't know SQL say, "There's plenty of tools in the language I'm already using, why do I need another one?"
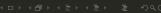
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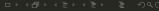
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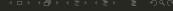- SQL gets to the point.

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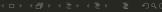 - Syntax isn't always consistent with itself.
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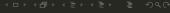- The gold standard for managing *relational databases*.
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- The gold standard for managing *relational databases*.
  - A bit of a victim of its popularity, SQL isn't always implemented identically across database software from different vendors.
  - 90% of syntax is the same, but some things you "get away with" on one database you won't in others.
- Technically a fully-fledged programming language, although rarely used this way[2].

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[2]With one important exception we'll see later.

Relational Databases

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Department

Name	Manager	Building

Employee

Id Number	Name	Email	Supervisor	Department

Insert about 100 more tables here . . .

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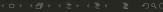
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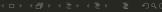
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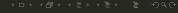
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- SQL builds consistency protection directly into the data storage[3].
  - Bad data is rejected... No Exceptions!
  - Strict column types
  - Foreign keys: Can't insert an employee if his department is non-existent.
  - Triggers: Arbitrary code that can stop mistakes in their tracks.

---

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Basics of SQL: Making a Table

1. Open a terminal.
2. Navigate to a directory you can use for temporary files.
3. Type in $ sqlite demo.db
4. On the sqlite> prompt that will come up, enter the commands below.

IN SQL WE ALWAYS SHOUT!

```
1  CREATE TABLE "employee" (
2      "id" INTEGER PRIMARY KEY,
3      "name" VARCHAR,
4      "dob" VARCHAR,
5      "joinDate" VARCHAR
6  );
```

To see if it worked:
.tables
.schema "employee"

Basics of SQL: Inserting and Reading Data

To make things more readable:

```
.mode column
.nullvalue NULL
.headers on
```

Add Some Data:

```
1  INSERT INTO "employee"
2      VALUES (12, "Sam Smith", "1980-05-06", "2008-06-22");
3  INSERT INTO "employee" (id, "dob")
4      VALUES (44, "1968-04-18");
```

Read It Back:

```
1  SELECT * FROM "employee";
2  SELECT "id", "name" FROM "employee";
```

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Note that there is a MAX() function in SQL, but it probably won't work the way you expect.

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To delete a table, you use DROP not DELETE:
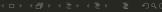
```
1   DROP TABLE "employee";
```

The convention of using DELETE for *data* and DROP for *structures* is widely used in SQL.

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- Foreign Keys
    - The primary key[4] of another table, stored as a regular column in your table
    - Database engine will enforce the validity of whatever value you attempt to insert (e.g. can't insert an employee with a nonexistent department)
    - Advanced Topic: You can control what happens to dependant rows on delete

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- Other Keys / Indices
  - The terms "key" and "index" have overlapping meanings
  - You can arbitrarily enforce uniqueness on any column
  - You can tell the database engine to optimize queries involving any column

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First, enable foreign keys:

```
1  PRAGMA foreign_keys = ON;
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Let's make a table with a foreign key:

```
1  CREATE TABLE customer (
2      id INTEGER PRIMARY KEY,
3      name VARCHAR,
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Now try to insert a customer whose contact has Id 99

We've barely scratched the surface of what SQL can do, but before you learn any more facts, you should get some practice employing what we just learned.

In this repo you'll find some demo code, and a testing database:
https://github.com/fordham-css/SQL_Workshop
Clone / download the repo, and we'll do some exercises with the testing database.

Let's walk through the C code in the repo to see how you can integrate Sqlite into C or C++.