Using SQL

Types of Databases

- Relational
- Non-relational

Relational

- Represent and store data in tables and rows.
- Use Structured Query Language (SQL), which is like a programming language for relational databases.
- Examples include SQLite, MySQL, PostreSQL, T-SQL.

Non-Relational

- Represent and store data as collections of documents, objects, key-value stores, or heirarchal data formats.
- Also known as "NoSQL" databases.
- Examples include JSON, MongoDB.

SQL: Structured Query Language

- Programming language for storing, manipulating, and retreiving data stored in a relational database.
- All relational database management systems (e.g. MySQL, SQLite, PostgreSQL) use SQL as their standard database language.

SQL: Structured Query Language

- SQL can have different dialects that contain small, subtle differences (just like there are different accents in the english language). For example, a string-like data type in MySQL is defined as STRING, while in SQLite it is defined as TEXT.
- However, the vast majority of SQL is the same in all relational database management systems.

What will we learn?

- How to retrieve data
- How to select a subsets of data
- How to sort results
- How to combine data from multiple tables

First with SQLite command line interface.
Then how accomplish the same tasks using Python.

The `hipparcos.db` Database

We will use with the hipparcos.db database, which stores data from the Extended Hipparcos Compilation (XHIP).

It contains information about the stars closest to Earth, observed with the Hipparcos satelite.

The `hipparcos.db` Database

This database contains two tables:

- `data` : stores Astrometry, spectrography, space motions, and exoplanet indications.
- `photometry` stores photometry information.

Summary of Useful Terms: Kinematics

- RA/Dec: location of star in sky (like longitude and lattitude for the night sky)
- pm: proper motion - movement of the star in the plane of the sky (against background stars)
- RV: radial velocity - velocity towards or away from the observer

Summary of Useful Terms: Astoronomy

- magnitude: brightness - lower numbers are brighter
- photometry: brightness measured by from an image
- U, B, V, R, I, J, H, K - band: brightness integrated over a specific wavelength range
  (ordered bluest to redest)
- B-V: color - B-band magnitude - V-band magnitude. Proxy for temperature
- e_prefix: error

Opening and Navigating the Database

To connect to the database, we can use the `sqlite3` command line interface:

```
>>> sqlite3 hipparcos.db

SQLite version 3.13.0 2016-05-18 10:57:30
Enter ".help" for usage hints.
```

Excercise 1: Try connecting to the `hipparcos.db` database. Use the `.help` command to determine which command to use to list the names of tables of the database and run it.

- Solution:
  - sqlite3> .table