http://poloclub.gatech.edu/cse6242

CSE6242 / CX4242: Data & Visual Analytics

Simple Data Storage; SQLite

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Partly based on materials by
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How to store the data?

What’s the easiest way?

Easiest Way to Store Data

As comma-separated files (CSV)

But may not be easy to parse. Why?

```
1997,Ford,E350
```

Easiest Way to Store Data

```
1997,Ford,E350
```

- Any field *may* be *quoted* (that is, enclosed within double-quote characters). Some fields *must* be quot

```
"1997","Ford","E350"
```

- Fields with embedded commas or double-quote characters must be quoted.

```
1997,Ford,E350,"Super, luxurious truck"
```

- Each of the embedded double-quote characters must be represented by a pair of double-quote chara

```
1997,Ford,E350,"Super, ""luxurious"" truck"
```

- Fields with embedded line breaks must be quoted (however, many CSV implementations do not supp

https://en.wikipedia.org/wiki/Comma-separated_values

Most popular embedded database in the world

Well-known users: http://www.sqlite.org/famous.html

iPhone (iOS), Android, Chrome (browsers), Mac, etc.

Self-contained: one file contains data + schema

Serverless: database right on your computer

Zero-configuration: no need to set up!

http://www.sqlite.org http://www.sqlite.org/different.html

SQL Refresher

SQL Refresher: create table

```
>sqlite3 database.db


sqlite> create table student(id integer, name text);
sqlite> .schema
```

```
CREATE TABLE student(id integer, name text);
```

Id	name

SQL Refresher: insert rows

```
insert into student values(111, "Smith");
insert into student values(222, "Johnson");
insert into student values(333, "Lee");
select * from student;
```

id	name
111	Smith
222	Johnson
333	Lee

SQL Refresher: create another table

```
create table takes
(id integer, course_id integer, grade integer);
```

```
sqlite>.schema
```

```
CREATE TABLE student(id integer, name text);
CREATE TABLE takes (id integer, course_id integer,
grade integer);
```

id	course_id	grade

SQL Refresher: joining 2 tables

More than one tables - **joins**

E.g., create roster for this course (6242)

id	name
111	Smith
222	Johnson
333	Lee

id	course_id	grade
111	6242	100
222	6242	90
222	4000	80

SQL Refresher: joining 2 tables + filtering

```
select name from student, takes
where
    student.id = takes.id and
    takes.course_id = 6242;
```

id	name
111	**Smith**
222	**Johnson**
333	Lee

id	course_id	grade
111	6242	100
222	6242	90
222	4000	80

Summarizing data:

Find **id** and **GPA** (a summary) for each student

```
select id, avg(grade)
from takes
group by id;
```

Id	course_id	grade
111	6242	100
222	6242	90
222	4000	80

id	avg(grade)
111	100
222	85

Filtering Summarized Results

```
select id, avg(grade)
from takes
group by id
having avg(grade) > 90;
```

id	course_id	grade
111	6242	100
222	6242	90
222	4000	80

id	avg(grade)
111	100
~~222~~	~~85~~

SQL General Form

```
select a1, a2, ... an
from t1, t2, ... tm
where predicate
[order by ....]
[group by ...]
[having ...]
```

A lot more to learn! Oracle, MySQL, PostgreSQL, etc.
Highly recommend taking
CS 4400 Introduction to Database Systems

Beware of Missing Indexes

SQLite easily scales to multiple GBs.

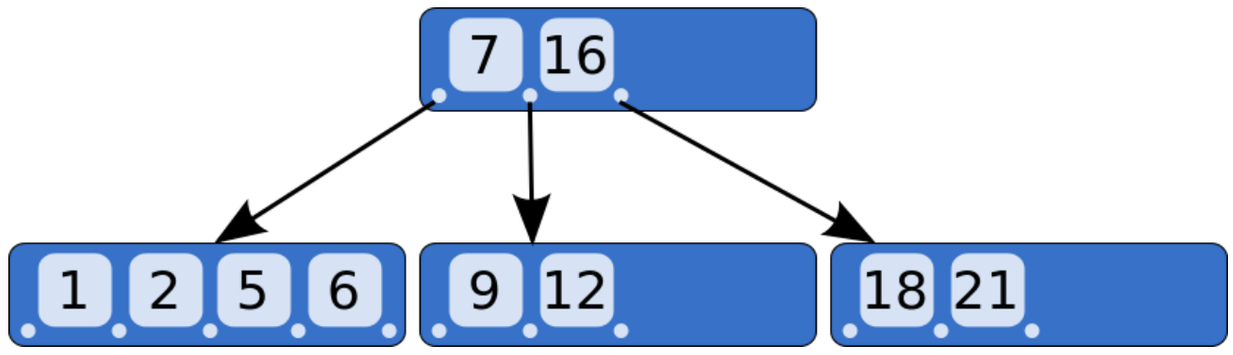
What if slow?

Important sanity check:
Have you (or someone) created appropriate **indexes**?

SQLite's indices use **B-tree** data structure.

O(log n) speed for adding/finding/deleting an item.

```
create index student_id_index on
student(id);
```



https://en.wikipedia.org/wiki/B-tree

How to Store Petabytes++ ?

Likely need “No SQL” databases

HBase, Cassandra, MongoDB, many more

HBase covered in Hadoop/Spark modules later this semester