http://poloclub.gatech.edu/cse6242

CSE6242 / CX4242: Data & Visual Analytics

Simple Data Storage; SQLite

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Partly based on materials by
Professors Guy Lebanon, Jeffrey Heer, John Stasko, Christos Faloutsos

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: create table

```
>sqlite3 database.db


sqlite> create table student(ssn integer, name text);
sqlite> .schema
CREATE TABLE student(ssn integer, name text);
```

ssn	name

SQL Refresher: insert rows

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

ssn	name
111	Trump
222	Johnson
333	Obama

SQL Refresher: create another table

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

```
sqlite>.schema
```

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

ssn	course_id	grade

SQL Refresher: joining 2 tables

More than one tables - **joins**

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

ssn	name
111	Trump
222	Johnson
333	Obama

ssn	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.ssn = takes.ssn and
    takes.course_id = 6242;
```

ssn	name
111	**Trump**
222	**Johnson**
333	Obama

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

Summarizing data:
Find ssn and GPA (a summary) for each student

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

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

ssn	avg(grade)
111	100
222	85

Filtering Summarized Results

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

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

ssn	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

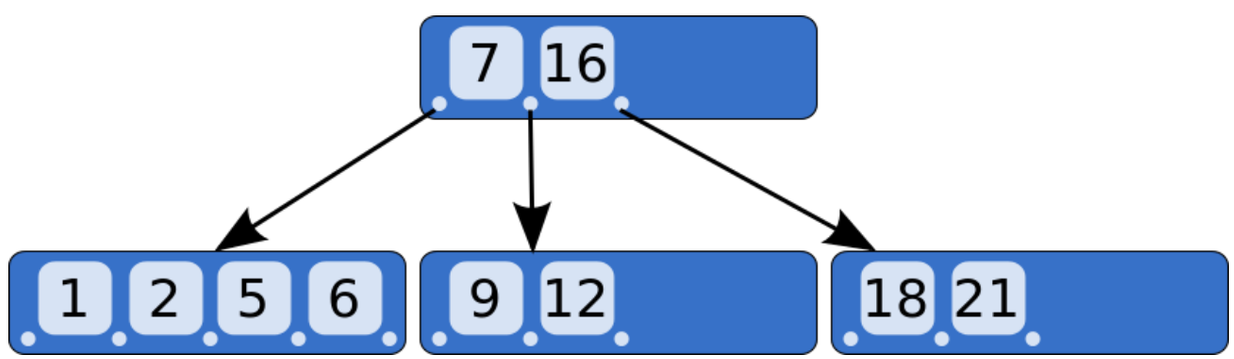
SQLite easily scales to multiple GBs. What if slow?

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_ssn_index on
student(ssn);
```

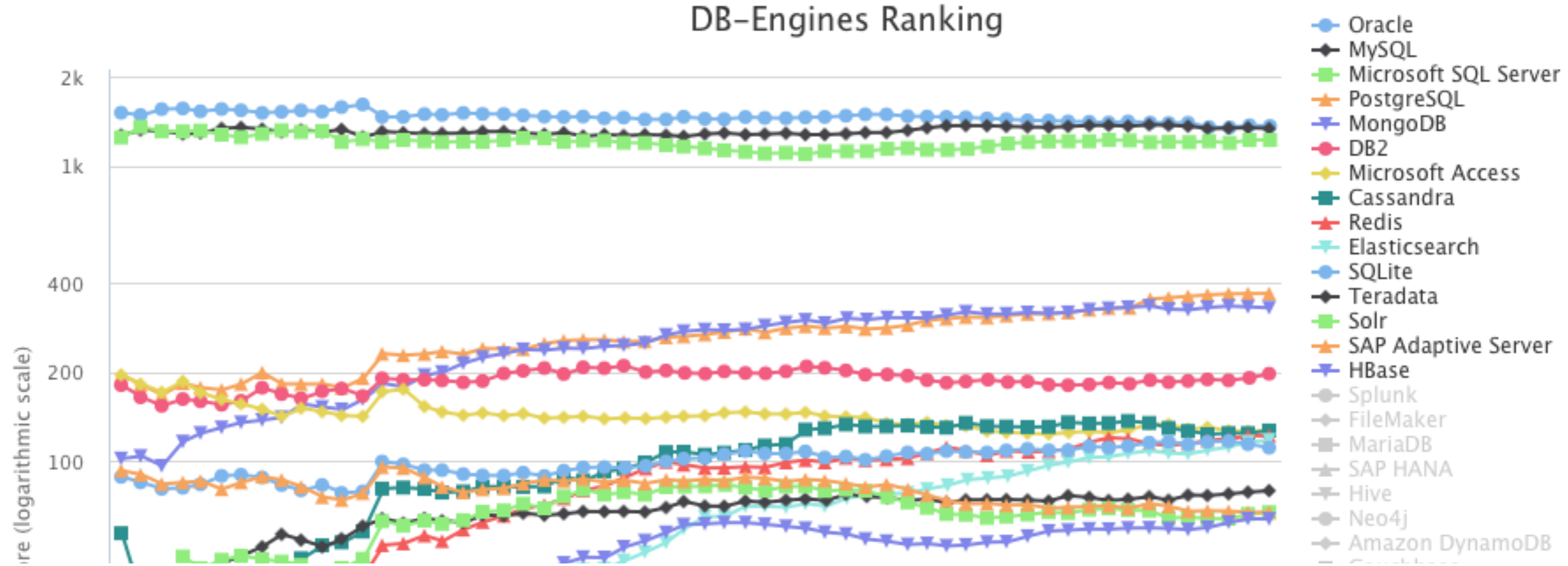


https://en.wikipedia.org/wiki/B-tree

Comparison & Popularity Ranking

https://db-engines.com/en/system/HBase%3BMySQL%3BOracle%3BPostgreSQL%3BSQLite

Like for any rankings, observe the general trends, and be **cautious** about making important decisions based on absolute ranks.



How ranking is computed: https://db-engines.com/en/ranking_definition

How to Store Petabytes++ ?

Likely need “No SQL” databases

HBase, Cassandra, MongoDB, many more

HBase covered in Hadoop/Spark modules later this semester