Announcements

- Course survey due Monday 4/20 @ 11:59pm
- If 85% of students complete the course survey on resources, everyone gets 1 bonus point!
  
  [URL: http://goo.gl/ajEBkT]

- Project 4 due Thursday 4/23 @ 11:59pm
  
  Early point #1: Questions 1-12 submitted (correctly) by Friday 4/17 @ 11:59pm
  
  Early point #2: All questions (including Extra Credit) by Wednesday 4/22 @ 11:59pm

- Recursive Art Contest Entries due Monday 4/27 @ 11:59pm
  
  Email your code & a screenshot of your art to cs61a-tae@imail.eecs.berkeley.edu (Albert)

- Homework 9 merged with Homework 10; both are due Wednesday 4/29 @ 11:59pm

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Joining Tables

Reminder: John the Patriotic Dog Breeder

create table parents as
  
  select "abraham" as parent, "barack" as child union
  select "abraham" , "clinton" union
  select "delano" , "herbert" union
  select "fillmore" , "abraham" union
  select "fillmore" , "delano" union
  select "fillmore" , "grover" union
  select "eisenhower" , "fillmore"

create table dogs as
  
  select "abraham" as name, "long" as fur union
  select "barack" as name, "short" as fur union
  select "clinton" as name, "long" as fur union
  select "delano" as name, "long" as fur union
  select "eisenhower" as name, "short" as fur union
  select "fillmore" as name, "curly" as fur union
  select "grover" as name, "short" as fur union
  select "herbert" as name, "curly"

Select the parents of curly-furred dogs
  
  select parent from parents, dogs
  where child = name and fur = "curly";

Aliases and Dot Expressions

Joining Two Tables

Two tables A & B are joined by a comma to yield all combos of a row from A & a row from B

create table dogs as
  
  select "abraham" as name, "long" as fur union
  select "barack" as name, "short" as fur union
  select "clinton" as name, "long" as fur union
  select "delano" as name, "long" as fur union
  select "eisenhower" as name, "short" as fur union
  select "fillmore" as name, "curly" as fur union
  select "grover" as name, "short" as fur union
  select "herbert" as name, "curly"

create table parents as
  
  select "abraham" as parent, "barack" as child union
  select "abraham" , "clinton" union
  select "delano" , "herbert" union
  select "fillmore" , "abraham" union
  select "fillmore" , "delano" union
  select "fillmore" , "grover" union
  select "eisenhower" , "fillmore"

Select all pairs of siblings
  
  select parent from parents as a, parents as b
  where a.parent = b.parent and a.child < b.child;

Select all pairs of grandparents
  
  select a.parent, b.child from parents as a, parents as b
  where a.parent = b.child;

Example: Grandparents

Which select statement evaluates to all grandparent, grandchild pairs?

1. select a.grandparent, b.child from parents as a, parents as b
   where b.parent = a.child;

2. select a.parent, b.child from parents as a, parents as b
   where b.parent = a.child;

3. select a.parent, b.child from parents as a, parents as b
   where b.parent = a.child;

4. select a.grandparent, b.child from parents as a, parents as b
   where b.parent = a.child;

5. None of the above
Joining Multiple Tables

Multiple tables can be joined to yield all combinations of rows from each.

```sql
create table grandparents as
select a.parent as grandpa, b.child as grandchild
from parents as a, parents as b
where b.parent = a.child;
```

Select all grandparents with the same fur as their grandchildren.

Which tables need to be joined together?

```sql
select grandpa from grandparents, dogs as c, dogs as d
where grandpa = c.name and
  grandchild = d.name and
  c.fur = d.fur;
```

Numerical Expressions

Expressions can contain function calls and arithmetic operators.

- Selection: `select [columns] from [table] where [expression] order by [expression];`
- Combine values: +, -, *, /, %, and, or
- Transform values: abs, round, not, -
- Compare values: <, <=, >, >=, <>, !=, =

String Expressions

String values can be combined to form longer strings.

- Selection: `sqlite> create table phrase as select "hello, world" as s;`
- Basic string manipulation: `sqlite> select substr(s, 4, 2) || substr(s, instr(s, " ")+1, 1) from phrase;` result: low

Strings can be used to represent structured values, but doing so is rarely a good idea.

- Selection: `sqlite> create table lists as select "one" as car, "two,three,four" as cdr;`
- Basic string manipulation: `sqlite> select substr(cdr, 1, instr(cdr, ",")-1) as cadr from lists;` result: two

Database Management Systems

Query Planning

The manner in which tables are filtered, sorted, and joined affects execution time.

Select the parents of curly-furred dogs:

```sql
select parent from parents, dogs
where child = name and
  fur = "curly";
```

Join all rows of parents to all rows of dogs, filter by child = name and fur = "curly".

Join only rows of parents and dogs where child = name, filter by fur = "curly".

Filter dogs by fur = "curly", join result with all rows of parents, filter by child = name.

Filter dogs by fur = "curly", join only rows of result and parents where child = name.