61A Lecture 33

Monday, April 20

Announcements

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- Course survey due Monday 4/20 @ 11:59pm

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- If 85% of students complete the course survey on resources, everyone gets 1 bonus point!

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  - Early point #2: All questions (including Extra Credit) by Wednesday 4/22 @ 11:59pm

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  - Email your code & a screenshot of your art to cs61a-tae@imail.eecs.berkeley.edu (Albert)

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- Project 4 due Thursday 4/23 @ 11:59pm
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- 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

Local Tables

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A `create table` statement names a table globally

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```
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";
```

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  select "fillmore"         , "abraham"         union
  select "fillmore"         , "delano"          union
  select "fillmore"         , "grover"          union
  select "eisenhower"       , "fillmore";
```

parents:

Parent	Child
abraham	barack
abraham	clinton
delano	herbert
fillmore	abraham
fillmore	delano
fillmore	grover
eisenhower	fillmore

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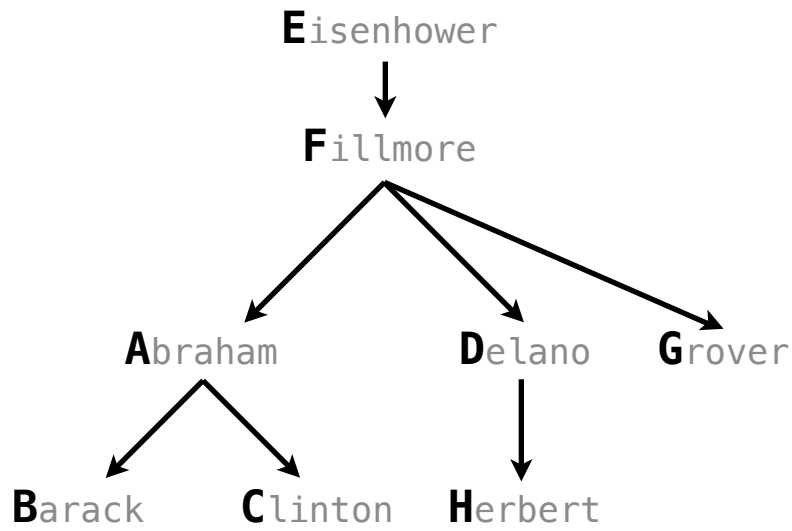

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A `create table` statement names a table globally

A `with` clause of a `select` statement names a table that is local to the statement

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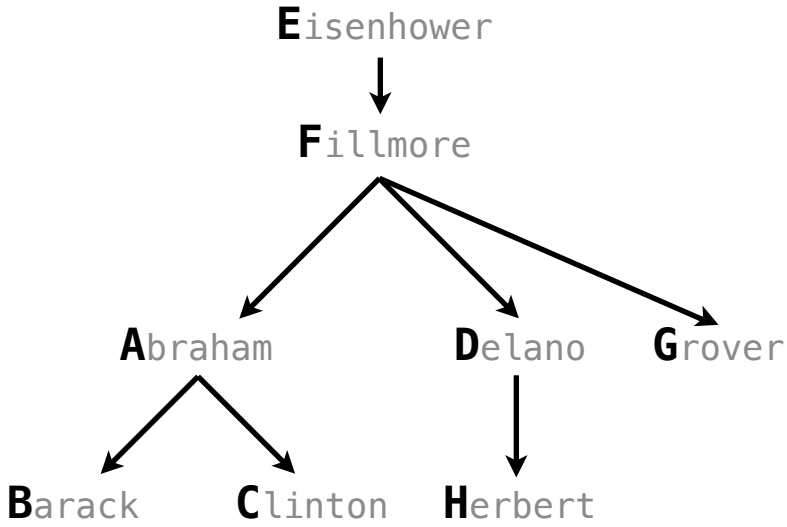

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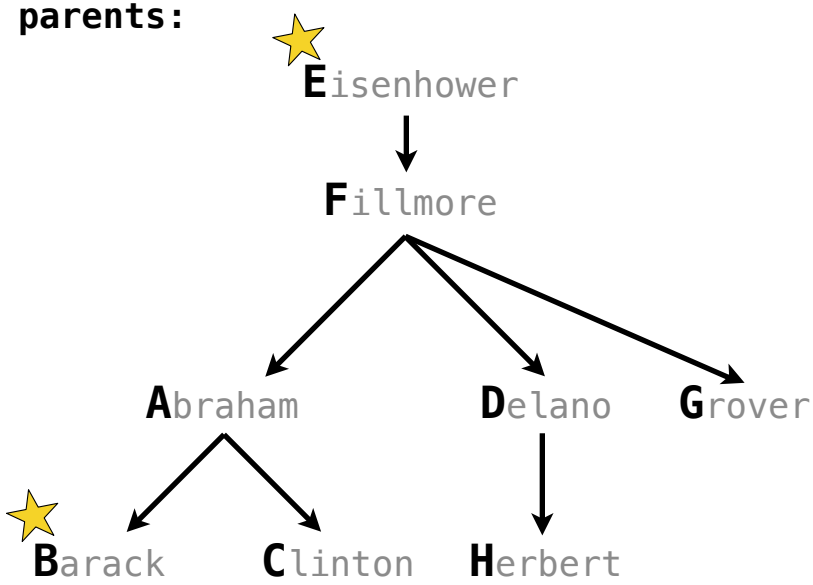

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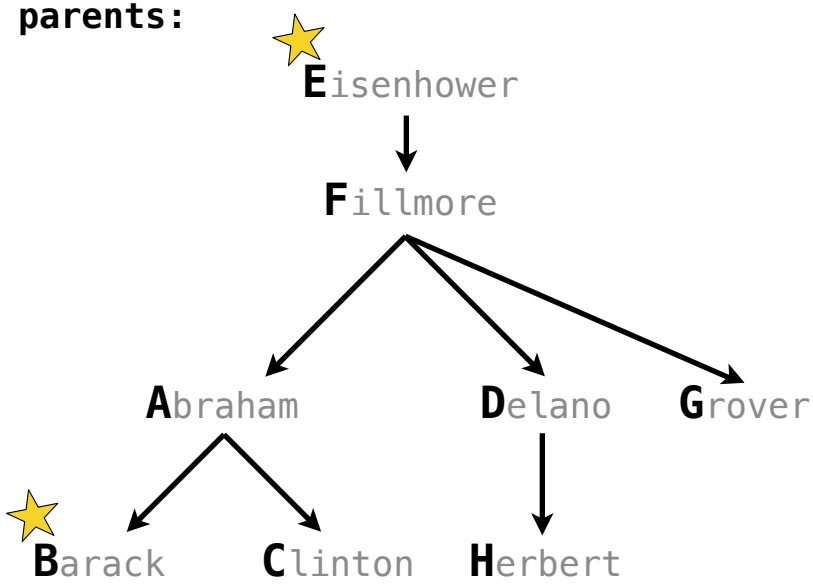


```
select parent from ...
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select parent from ...
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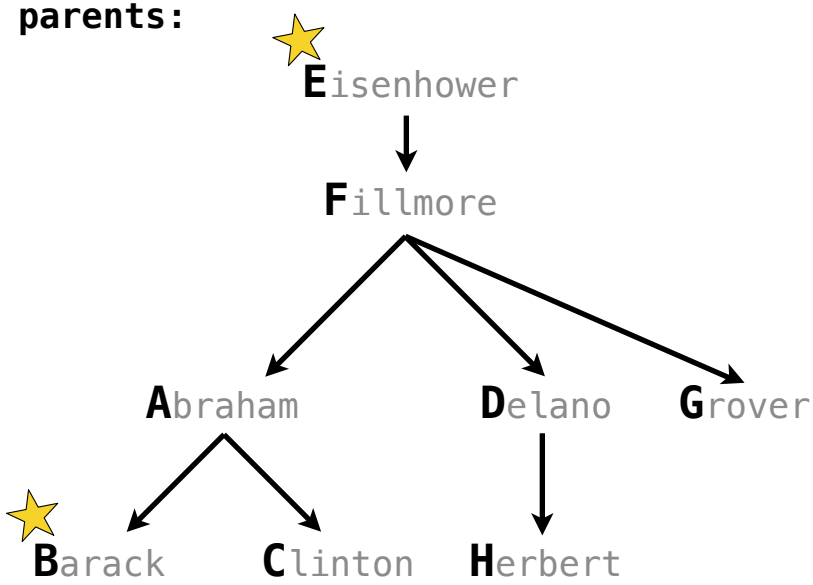

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```
create table parents as
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  ...

with
  best(dog) as (



select parent from ...
```
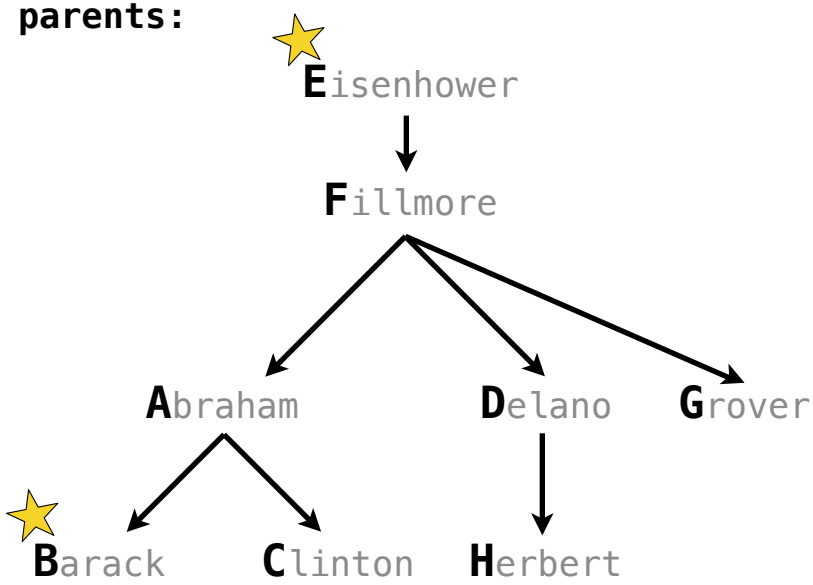

parents:



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with
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select parent from ...
```

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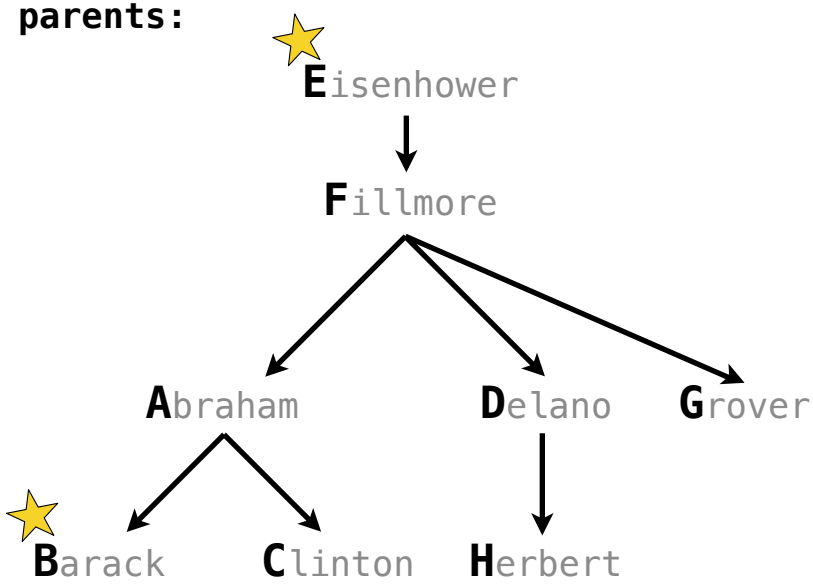

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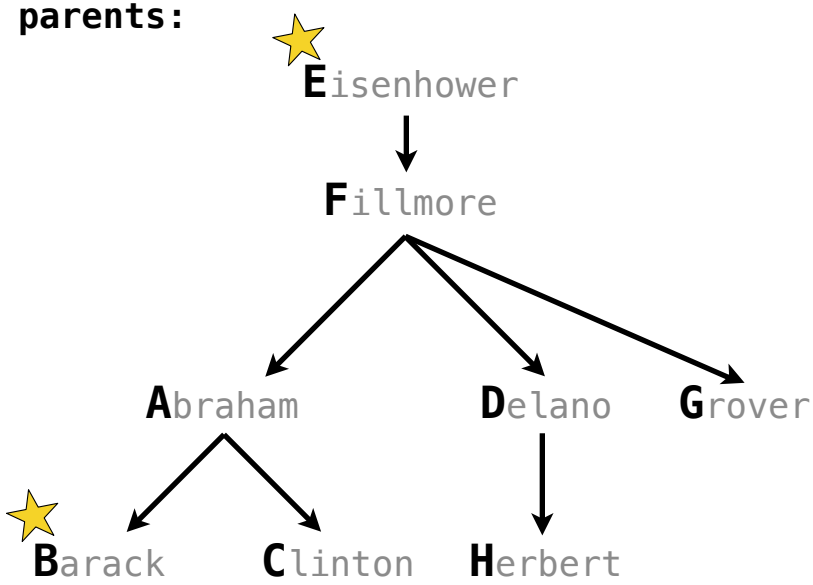

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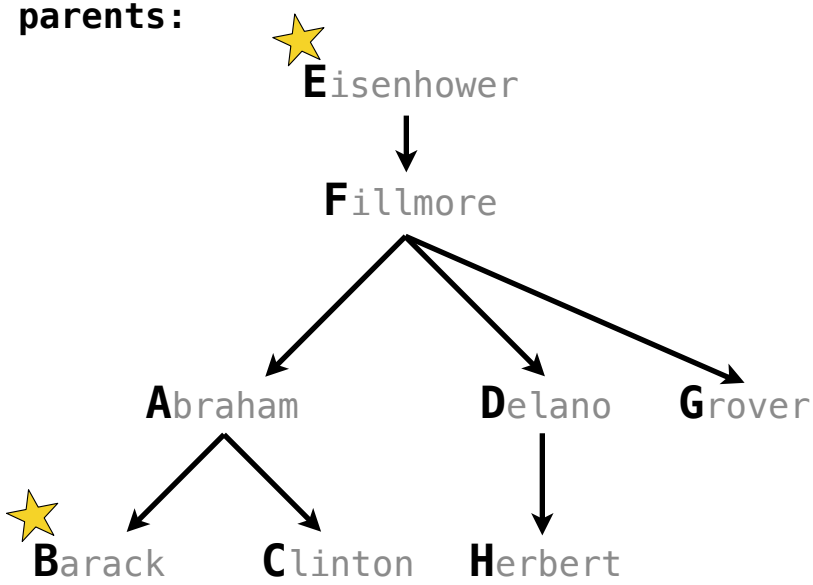

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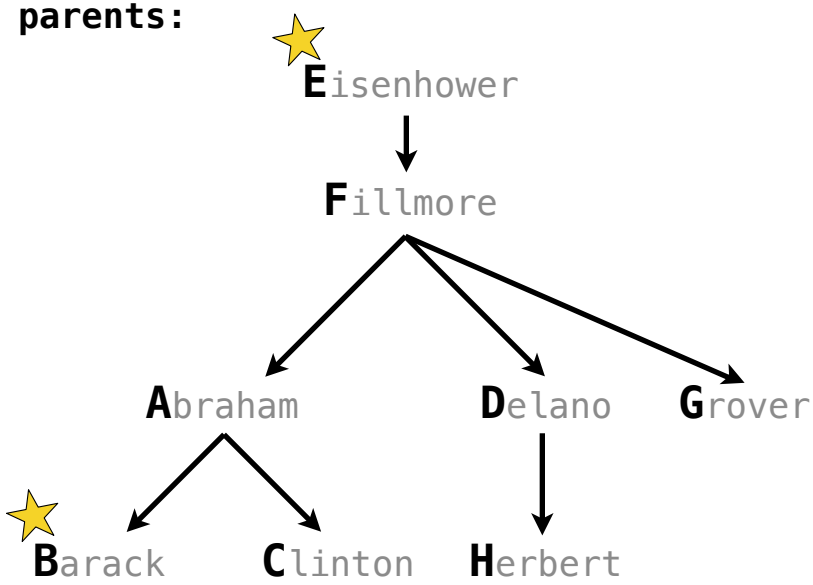
best:

dog
eisenhower
barack

parents:



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    select "barack"
  )
select parent from parents, best where child=dog;
```
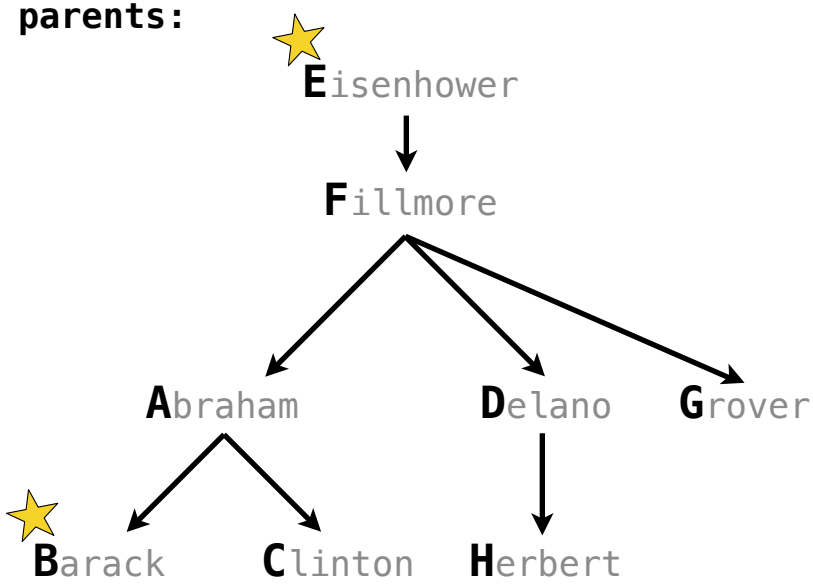

best:

dog
eisenhower
barack

parents:



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parent
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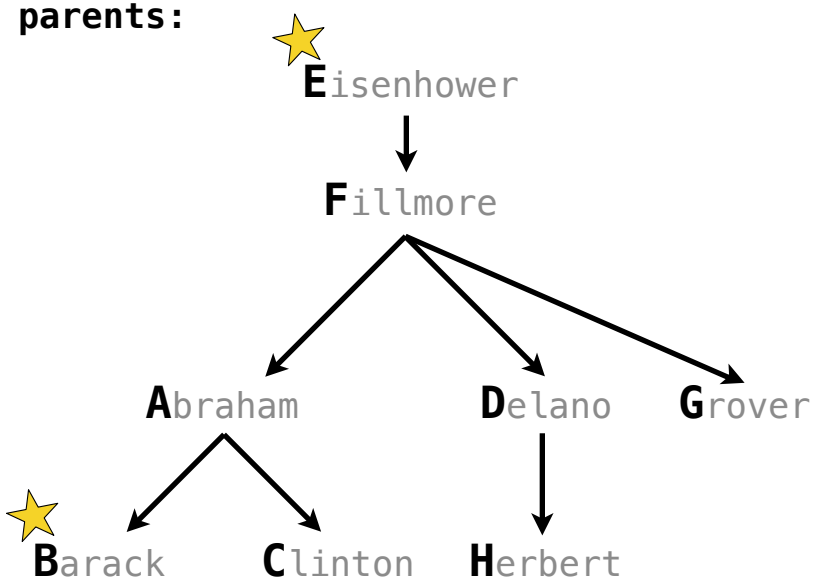

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dog
eisenhower
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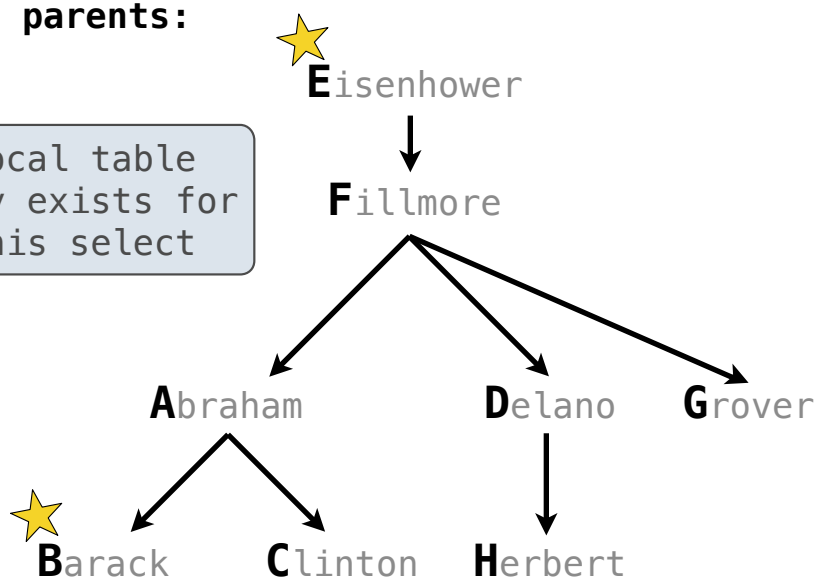
Local table only exists for this select

parent
abraham

parents:



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Part of the select statement

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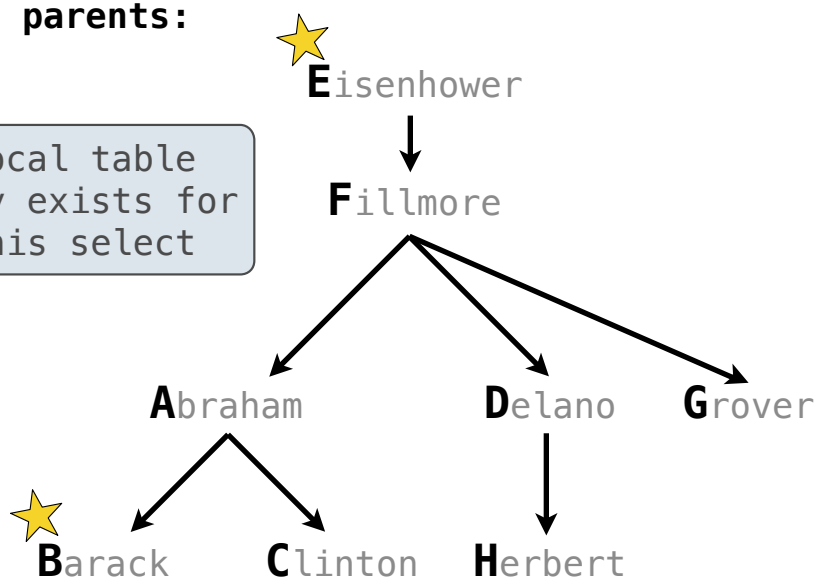
best:

dog
eisenhower
barack

parent
abraham

parents:



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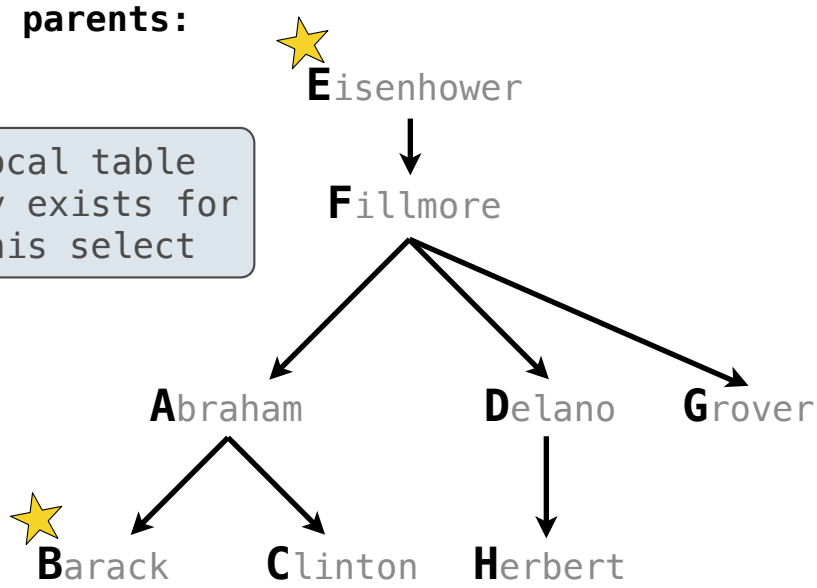
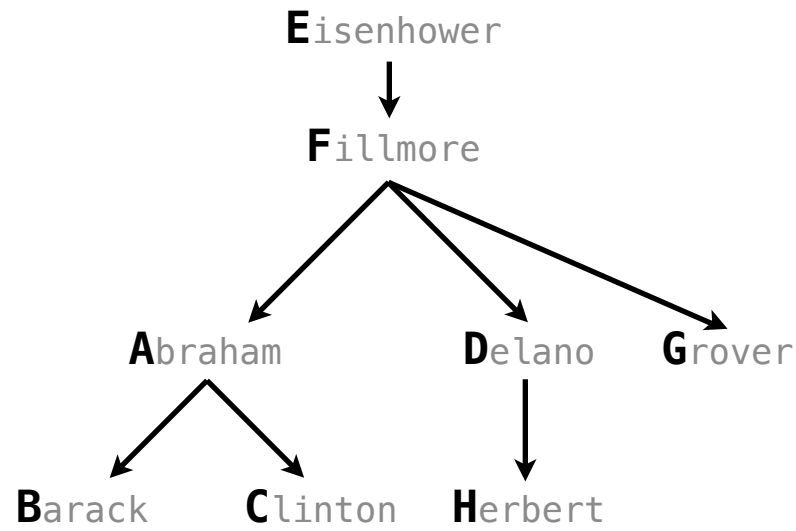


(Demo)

Example: Relationships

```
with
  what(first, second) as (
    select a.child, b.child
           from parents as a, parents as b
           where a.parent = b.parent and
                 a.child != b.child
  )
select child as _____________, second as _____________
       from parents, what where parent=first;
```

parents:



Example: Relationships

(A) What are appropriate names for the columns in this result?

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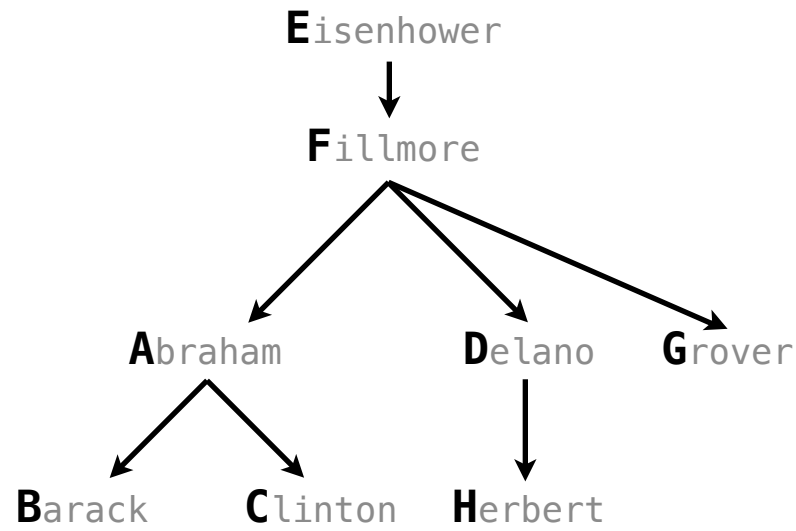

Example: Relationships

(A) What are appropriate names for the columns in this result?

(B) How many rows will result?

```
with
  what(first, second) as (
    select a.child, b.child
           from parents as a, parents as b
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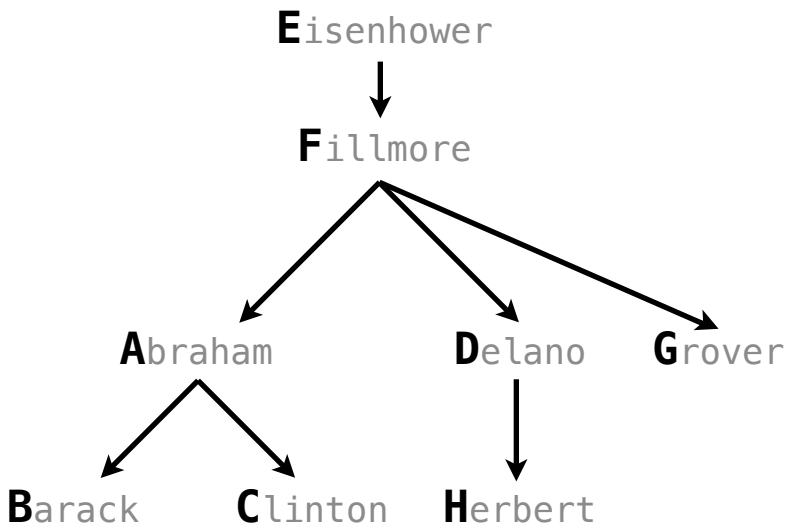

Example: Relationships

(A) What are appropriate names for the columns in this result?

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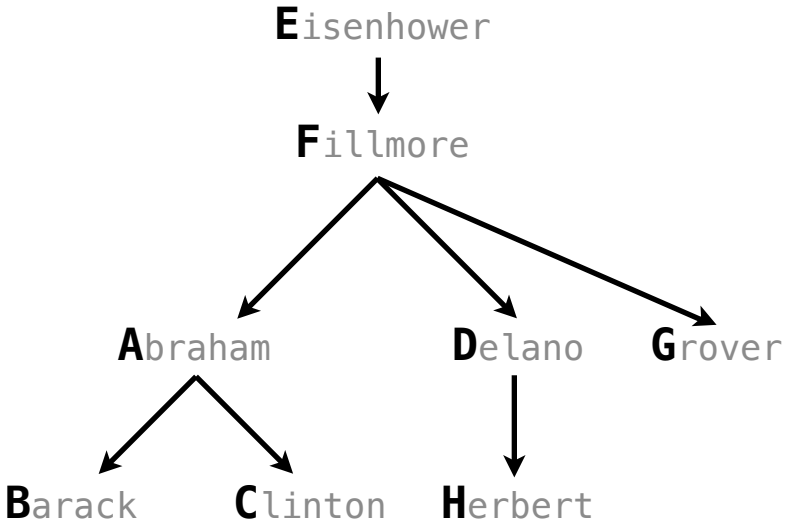
```
with
 siblings
  what(first, second) as (
    select a.child, b.child
           from parents as a, parents as b
           where a.parent = b.parent and
                 a.child != b.child
  )
select child as _____________, second as _____________
       from parents, what where parent=first;
```

siblings

parents:



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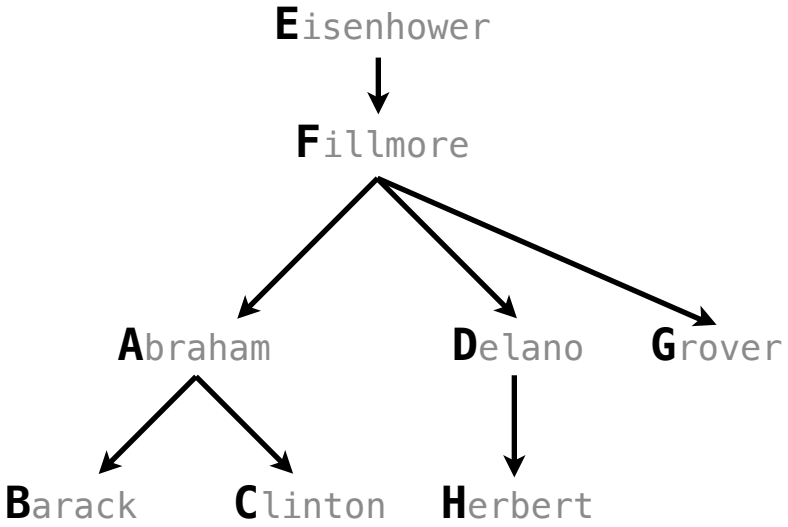
siblings

parents:



parent	child	first	second
abraham	barack	abraham	delano

Example: Relationships

(A) What are appropriate names for the columns in this result?

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siblings

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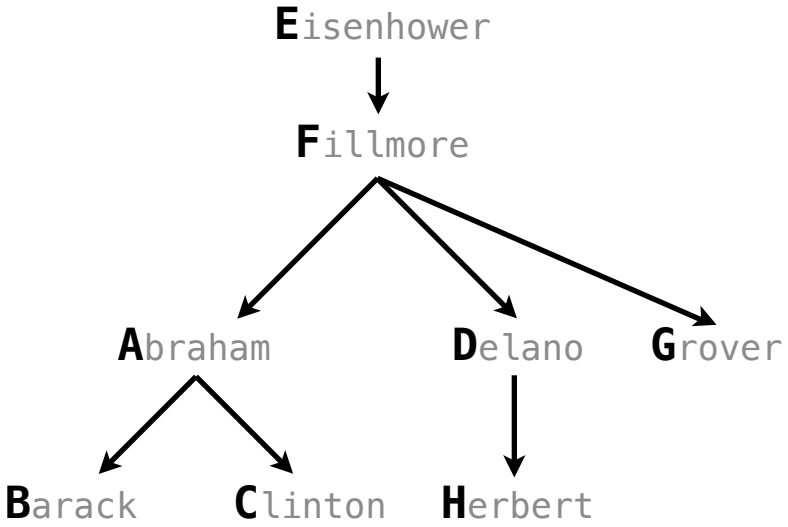

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siblings

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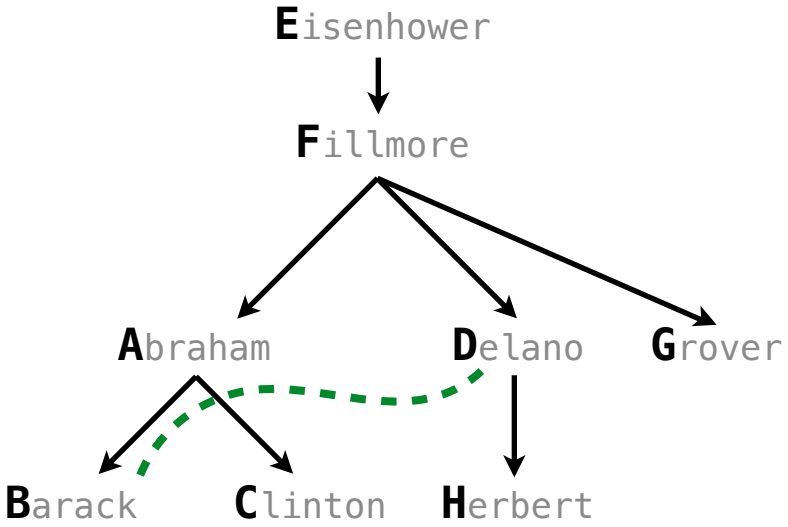
abraham	barack	abraham	delano

parents:



Example: Relationships

(A) What are appropriate names for the columns in this result?

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```
with
 siblings
  ~~what~~(first, second) as (
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           from parents as a, parents as b
           where a.parent = b.parent and
                 a.child != b.child
  )
select child as _____, second as _____
       from parents, ~~what~~ where parent=first;
```

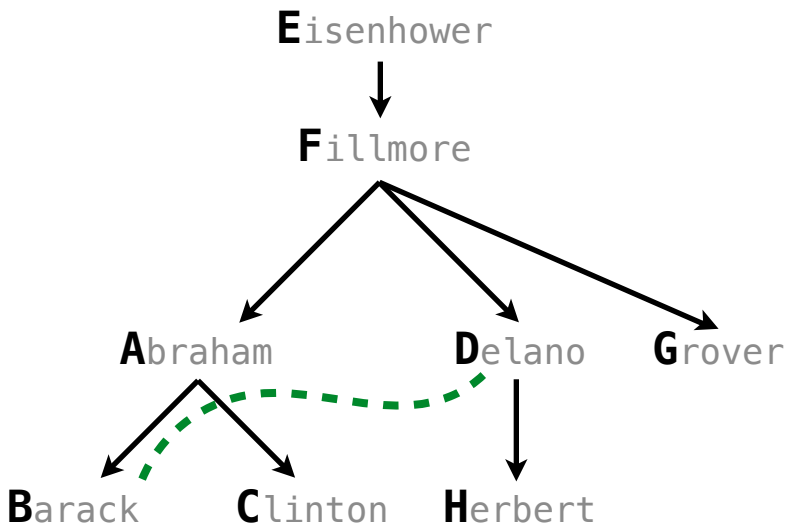
nephew

siblings

nephew

parent	~~child~~	first	second
abraham	barack	abraham	delano

parents:



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select child as _____, second as _____
       from parents, what where parent=first;
```
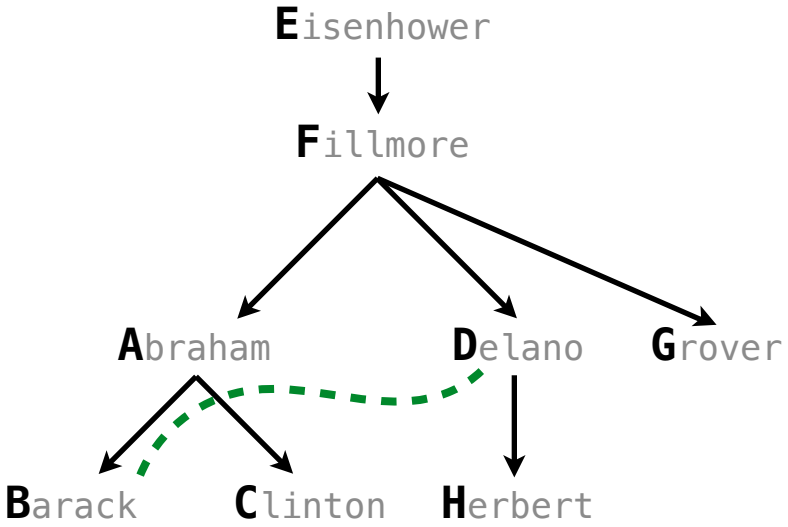

nephew (siblings) uncle

parent	~~child~~	first	~~second~~
abraham	barack	abraham	delano

parents:



Recursive Local Tables

Local Tables can be Declared Recursively

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```
An ancestor is your parent or an ancestor of your parent
```

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An ancestor is your parent or an ancestor of your parent

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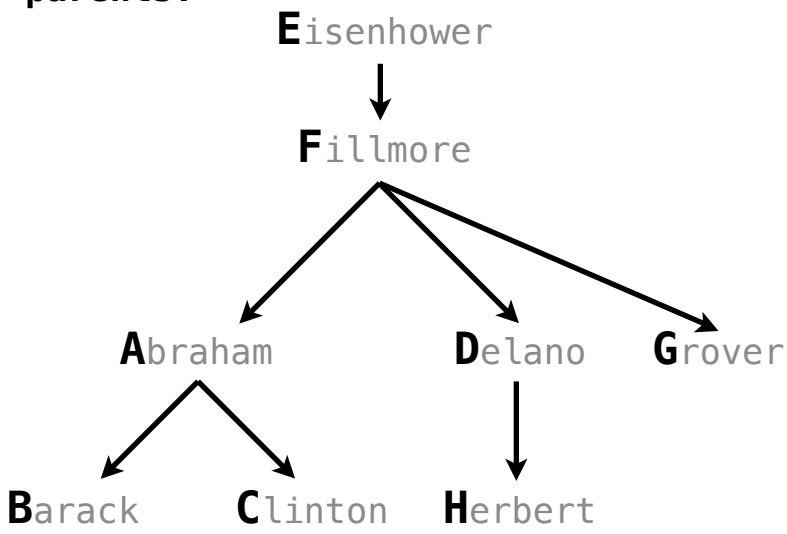
create table parents as
  select "abraham" as parent, "barack" as child union
  ...
```

parents:



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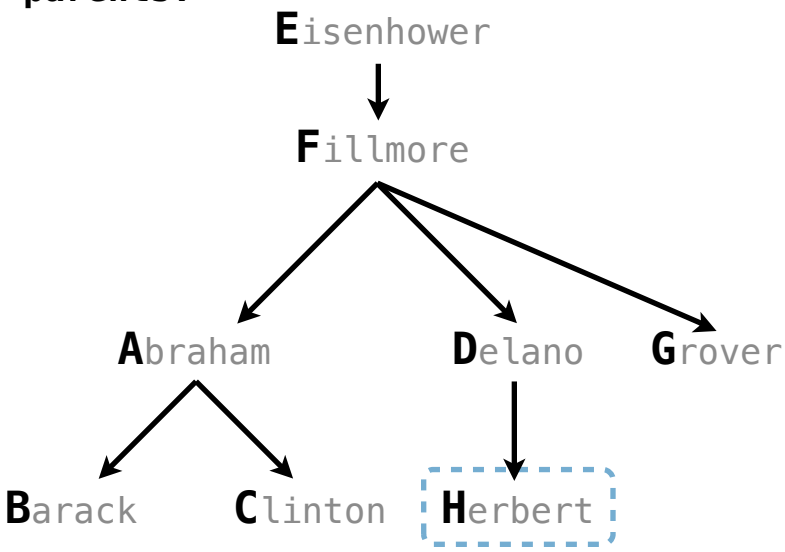

Local Tables can be Declared Recursively

An ancestor is your parent or an ancestor of your parent

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create table parents as
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```
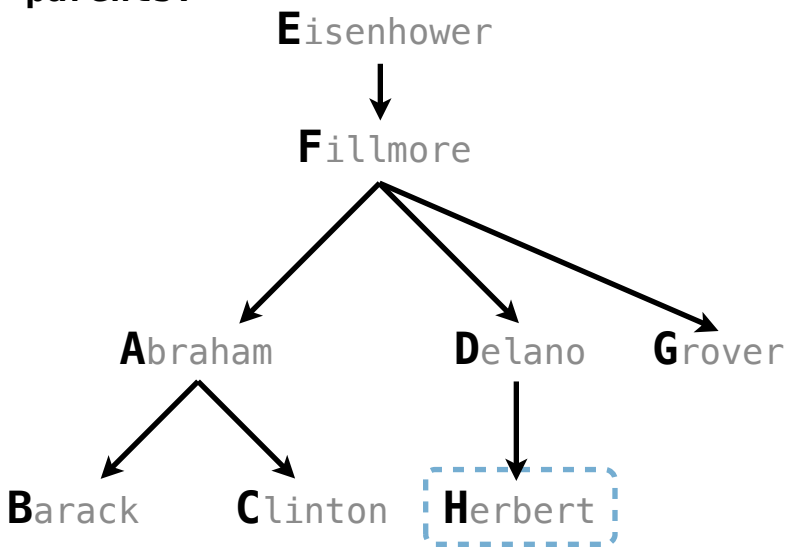

```
  ancestors(ancestor, descendent)
```

parents:



Local Tables can be Declared Recursively

An ancestor is your parent or an ancestor of your parent

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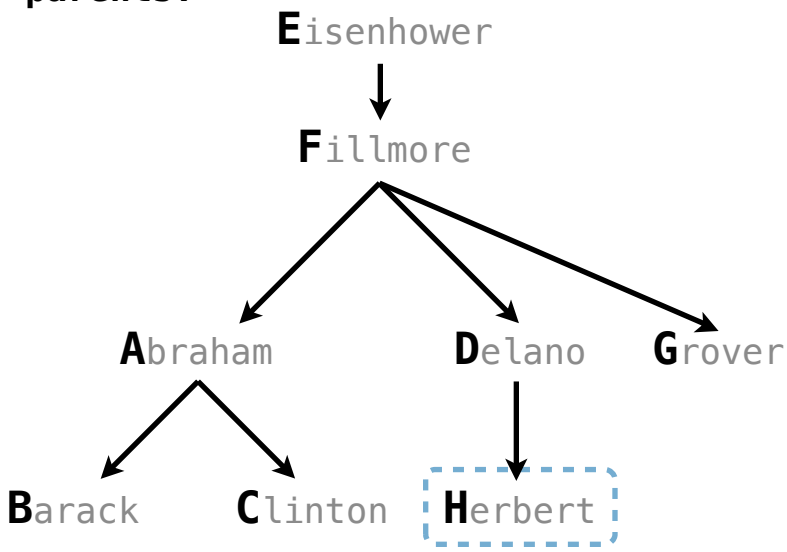
  ...


  ancestors(ancestor, descendent) as (
    select parent, child from parents union
    select ancestor, child
           from ancestors, parents
           where parent = descendent
  )
```

parents:



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    select parent, child from parents union
    select ancestor, child
           from ancestors, parents
           where parent = descendent
  )
select ancestor from ancestors where descendent="herbert";
```
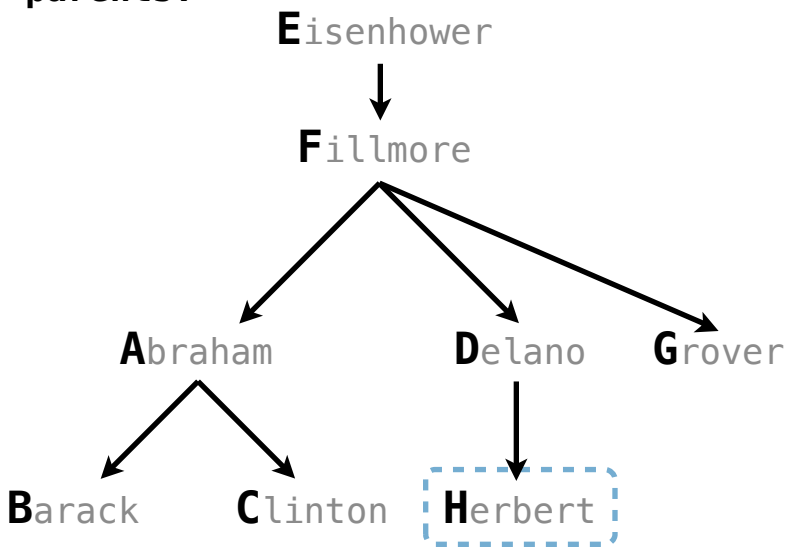

parents:

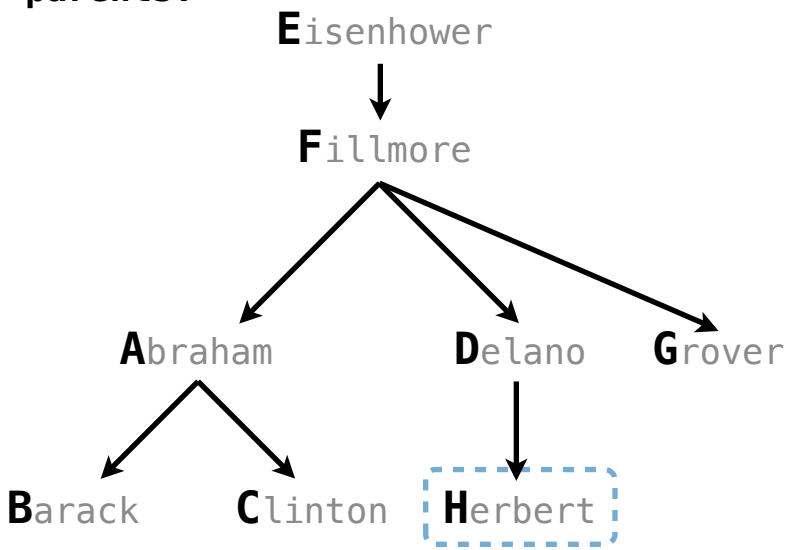


Local Tables can be Declared Recursively

An ancestor is your parent or an ancestor of your parent

```
create table parents as
  select "abraham" as parent, "barack" as child union
  ...

with
  ancestors(ancestor, descendent) as (
    select parent, child from parents union
    select ancestor, child
           from ancestors, parents
           where parent = descendent
  )
select ancestor from ancestors where descendent="herbert";
```

parents:



ancestor
delano
fillmore
eisenhower

Global Names for Recursive Tables

To create a table with a global name, you need to select the contents of the local table

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create table odds as
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odds:

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1
3
5
7
9
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Which names above can change without affecting the result?

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```
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           from ints as a, ints as b
  )
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String Examples

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(Demo)

Integer Examples

Input-Output Tables

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  with
    i(n) as (
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    )
  select a.n as x, b.n as y from i as a, i as b where a.n <= b.n;
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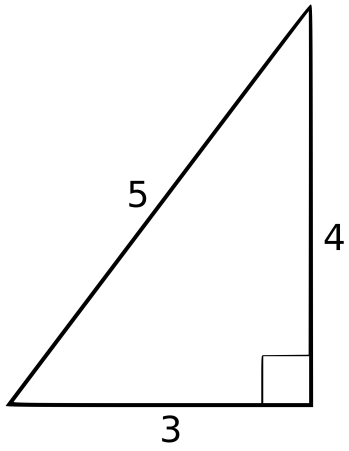

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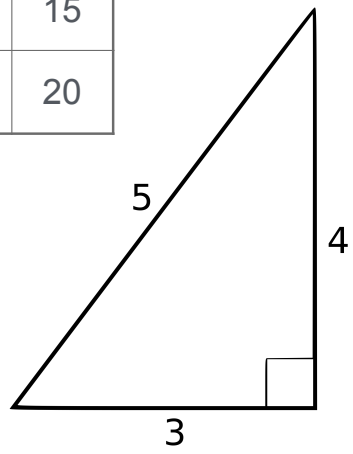
All triples a, b, c such that $a^2 + b^2 = c^2$

a	b	c
3	4	5
5	12	13
6	8	10
8	15	17
9	12	15
12	16	20



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  i(n) as (
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  )
select a.n as a, b.n as b, c.n as c
       from ____________________________________________
       where _______________ and a.n*a.n + b.n*b.n = c.n*c.n;
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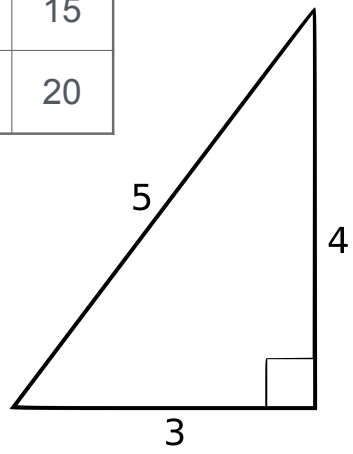

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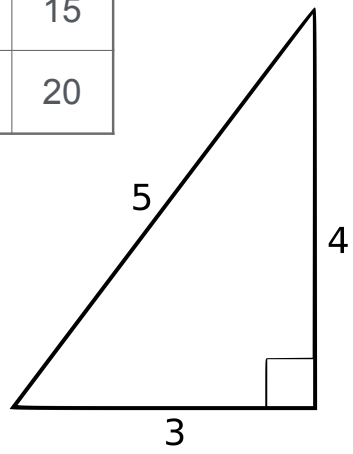

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       where ____a.n < b.n_____ and a.n*a.n + b.n*b.n = c.n*c.n;
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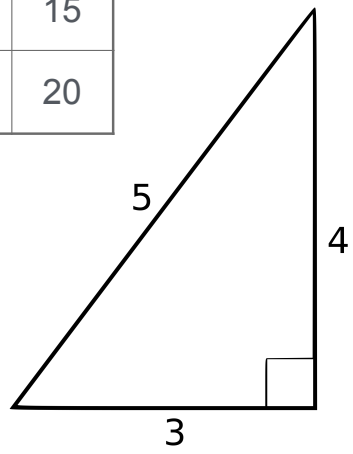

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fibs:

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```
create table fibs as
  with
    fib(previous, current) as (
      select 0, 1 union
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      where current <= ____________________________
    )
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    )
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A Very Interesting Number

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The mathematician G. H. Hardy once remarked to the mathematician Srinivasa Ramanujan...
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