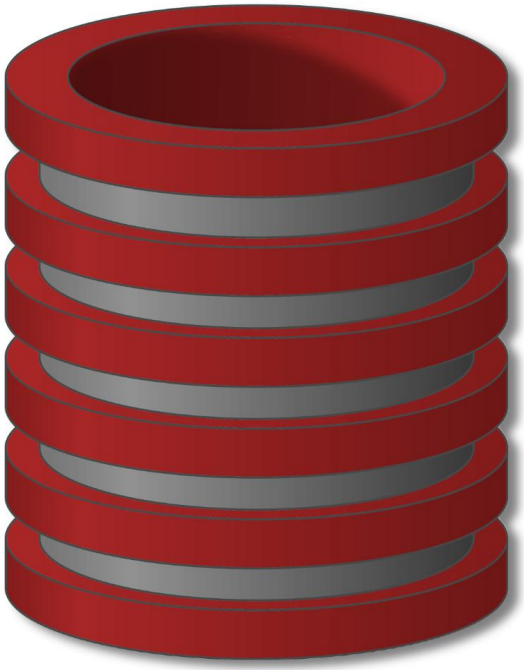


Recursion in SQL

Basic recursive WITH statement

Jennifer Widom

SQL is not a "Turing complete" language

- Simple, convenient, declarative
- Expressive enough for most database queries
- But basic SQL can't express unbounded computations

Example 1: Ancestors

`ParentOf(parent,child)`

- *Find all of Mary's ancestors*

Sue Mary
Bob Mary
Fred Bob
Jane Bob

parents

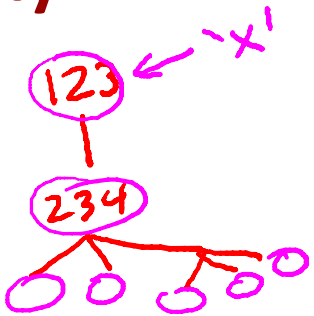
grandparents

Two instances of ParentOf

Three

Example 2: Company hierarchy

```
Employee(ID,salary)
Manager(mID,eID)
Project(name,mgrID)
```



- *Find total salary cost of project 'X'*

Example 3: Airline flights

```
Flight(orig,dest,airline,cost)
```

- *Find cheapest way to fly from 'A' to 'B'*

SQL With Statement

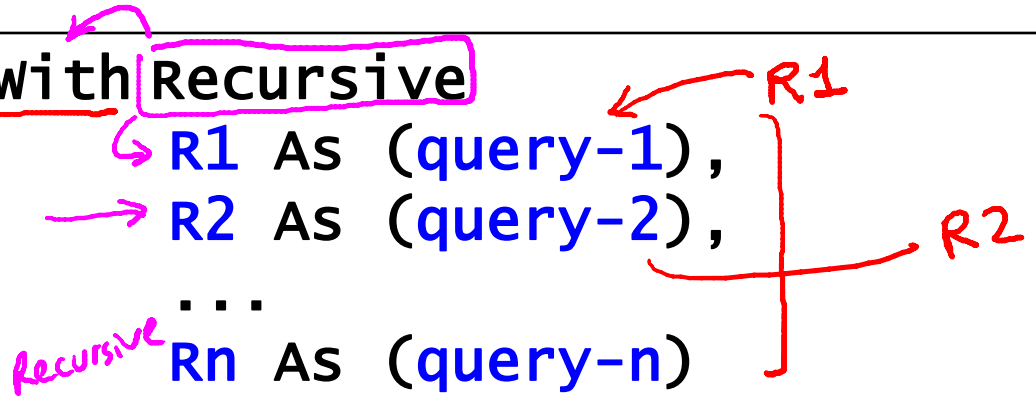
```
With R1 As (query-1),
     R2 As (query-2),
     ...
     Rn As (query-n)
<query involving R1,…,Rn (and other tables)>
```

SQL With Statement

```
With R1(A1,A2,…,Am) As (query-1),
     R2 As (query-2),
     ...
     Rn As (query-n)
<query involving R1,…,Rn (and other tables)>
```

SQL With Recursive Statement

```
With Recursive
     R1 As (query-1),
     R2 As (query-2),
     ...
     Rn As (query-n)
<query involving R1,…,Rn (and other tables)>
```



SQL With Recursive Statement

```
With Recursive
    R As ( base query
           Union all
           recursive query )
<query involving R (and other tables)>
```

not R

R