

Recursion in SQL

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Reference:
A First Course in Database Systems,
3rd edition, Chapter 10.2

Recursion in SQL

- Although not part of the core SQL-99 standard, SQL-99 includes provision for recursive definitions of queries.
 - Implemented by IBM DB2 and other DB vendors

Syntax:

WITH [**RECURSIVE**] *R* **AS** *<definition of R>* *<query involving R>*

- *R* is a temporary relation used by the query in *<query involving R>*
- *R* is not visible outside the **WITH** clause

- Several relations can be defined with the WITH clause.

```
WITH [RECURSIVE] R1 AS <definition of R1>,  
      [RECURSIVE] R2 AS <definition of R2>,  
      ...  
      [RECURSIVE] Rn AS <definition of Rn>,  
      <query involving R1, ..., Rn>
```

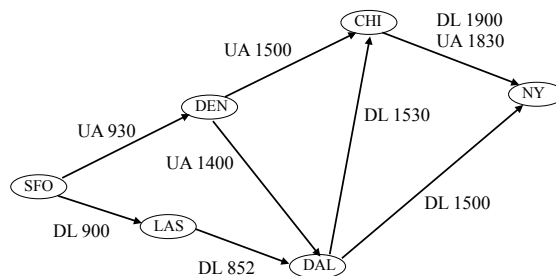
Examples

- Examples of queries that need recursion.
- Find all pairs of nodes that are connected.
- Find all ancestors (or descendants) of a person.

These queries cannot be answered without the use of recursion.

ParentChild(parent, child)

- Find all parents of X.
SELECT parent
FROM ParentChild
WHERE child = 'X';
- Find all parents and grandparents of X.
SELECT parent
FROM ParentChild r1, Parent Child r2
WHERE r1.child = r2.parent AND r2.child='X';
UNION
<query above>
- Find all ancestors of X?



- Flights(airline, from, to, departs, arrives)
- For what pairs of cities (x,y) is it possible to get from city x to city y by taking one or more flights?

```

WITH RECURSIVE Reaches(frm, to) AS
  (SELECT frm, to FROM Flights)
  UNION
  (SELECT R1.frm, R2.to
   FROM Reaches r1, Reaches r2
   WHERE r1.to = r2.frm)
SELECT * from Reaches;

```

Definition of Reaches

Query involving Reaches

Reaches(x,y) :- Flights(a,x,y,d,r)
 Reaches (x,y) :- Reaches(x,z), Reaches(z,y)

Linear recursion

- The SQL standard allows only a limited form of recursion, called the *linear recursion*.
 - At most one “subgoal” is recursive.
 - The previous SQL query is not linearly recursive. Two occurrences of the Reaches relation in the definition of Reaches.

```

WITH RECURSIVE Reaches(frm, to) AS
  (SELECT frm, to FROM Flights)
  UNION
  (SELECT R1.frm, R2.to
   FROM Flights r1, Reaches r2
   WHERE r1.to = r2.frm)
SELECT * from Reaches;

```

END