Relational Databases - Comp2400 / Comp6240

Lecture 2: SQL and the Relational Data Model

A quick overview of the relational data model and SQL

- Data in tables
- SQL basics
- Relational Algebra basics
- Keys and Joins

This material is covered in Chapter 5 of Elmasri and Navathe.

News and Administration

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  - in a smaller group, you get more of the tutors time
  - Greg will *probably* be taking the Wednesday and Thursday groups
    (some people prefer to be in the lecturer's tute group)

Relations and Relation Schemas

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Abbott	Marketing
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- as our company changes, the table can change, but the column headings remain the same
- the column headings correspond to a *relation schema*
- each row is a *fact* about an employee
- the employee is identified by his/her *name*

SQL - create and populate table

We can use SQL to create this table (schema).

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who works for the accounts department?

```
SELECT name
FROM employee
WHERE department='Accounts';
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However, let’s see what the Postgres relational DBMS does with this:

```
INSERT INTO employee (name, department)
VALUES ('Downer', 'Accounts');
```

But if you ask it nicely. . .

It takes a lot of work to remove duplicates from a big table, so the lazy DBMS doesn’t do it unless we ask explicitly.

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SELECT DISTINCT *
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- We want the database structure to be faithful to the *business rules*.

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- We often draw figures on the plane to represent a subset of the points that interest us, eg those points where $y = 2x$.

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relationAsTable

letter	**number**
A	1
A	2
B	2

Relation and Planes

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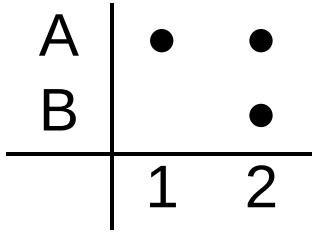
It can also be written as an x, y plane

Relation and Planes

$$\{(A,1),(A,2),(B,2)\}$$

It can also be written as an x, y plane



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- r is a *function* if there is exactly one y for each x
- This means we can use it to look up the unique y for any given x

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- That is, the relation is a *function* from the names of our employees, to the names of our departments.
- This table violates that rule, there are two rows for Downer.

Keys in SQL

first, let’s lose the previous version of the relation

```
DROP TABLE employee;
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Now, create it again with a key.

```
CREATE TABLE employee (
   name varchar(20),
   department varchar(20),
   PRIMARY KEY (name)
);
```

A Key is a Constraint

```
INSERT INTO employee (name, department)
VALUES (’Downer’, ’Marketing’);

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- That is, it enforces that the relation is a function of its key values.

More Than One Kind of Fact!

We might also want to record some information about our departments.

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department

deptName	**budget**	**location**
Marketing	$250,000	Melbourne
Accounts	$150,000	Sydney

employee

name	**department**
⋮	⋮
Downer	Marketing

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- Where does Downer work?
- How did you find that answer?

“Joining” two rows

You probably did something like this

1. find the row in the employees table with the **name** Downer

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2. get the **department** value from that row, Marketing
3. find the row in the department table with **deptName** Marketing
4. get the **location** value from that row

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To find the location of *every* employee, it would be convenient to make a super-table, which adds the department information to each employee.

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It would contain the following row:

$$\text{employee} \bowtie_{department=deptName} \text{department}$$

name	**department**	**deptName**	**budget**	**location**
⋮	⋮	⋮	⋮	⋮
Downer	Marketing	Marketing	$250,000	Melbourne

SQL for Joins: Product

We can include more than one table in our query.

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SELECT *
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- The result is the *product* of the two relations.
- But many of these rows do not represent facts.
- Which ones?
- The useful ones are where *department* $=$ *deptName*.

SQL for Joins

```
SELECT *
FROM employee, department
WHERE department=deptName;
```

SQL for Joins

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SELECT *
FROM employee, department
WHERE department=deptName;
```

But we just want to know where people work

```
SELECT name, location
FROM employee, department
WHERE department=deptName;
```

Where does he work?

It was only Downer we wanted to know about.

```
SELECT name, location
FROM employee, department
WHERE department=deptName
AND name='Downer';
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SELECT name, location
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Now, what about Burns?

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SELECT name, location
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Oops, we don't have an executive department!

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Oops, we don't have an executive department!
This database is kind of broken, and should not be allowed.

Foreign Key Constraints

The values in **department** in the employee relation are meant to “point to” rows in the department table.

```
CREATE TABLE employee (
   name varchar(20),
   department varchar(20),
   PRIMARY KEY (name),
   FOREIGN KEY (department) REFERENCES department(de
);
```

This tells the DBMS that when this table “points to” a row in department, it must be there!

```
INSERT INTO employee (name, department)
VALUES (’Burns’,’Executive’);
```

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That was a lot of material!

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- Keys, to identify the thing the “fact” is about
- Relations, products of sets
- Function, a kind of relation
- Key constrains a relation to be a function
- Combining relations using join
- Basics of SQL for all of the above!