Introduction to Data Management CSE 414

Lecture 2: Data Models & SQL

(Ch. 2.1-2.3)

Announcements

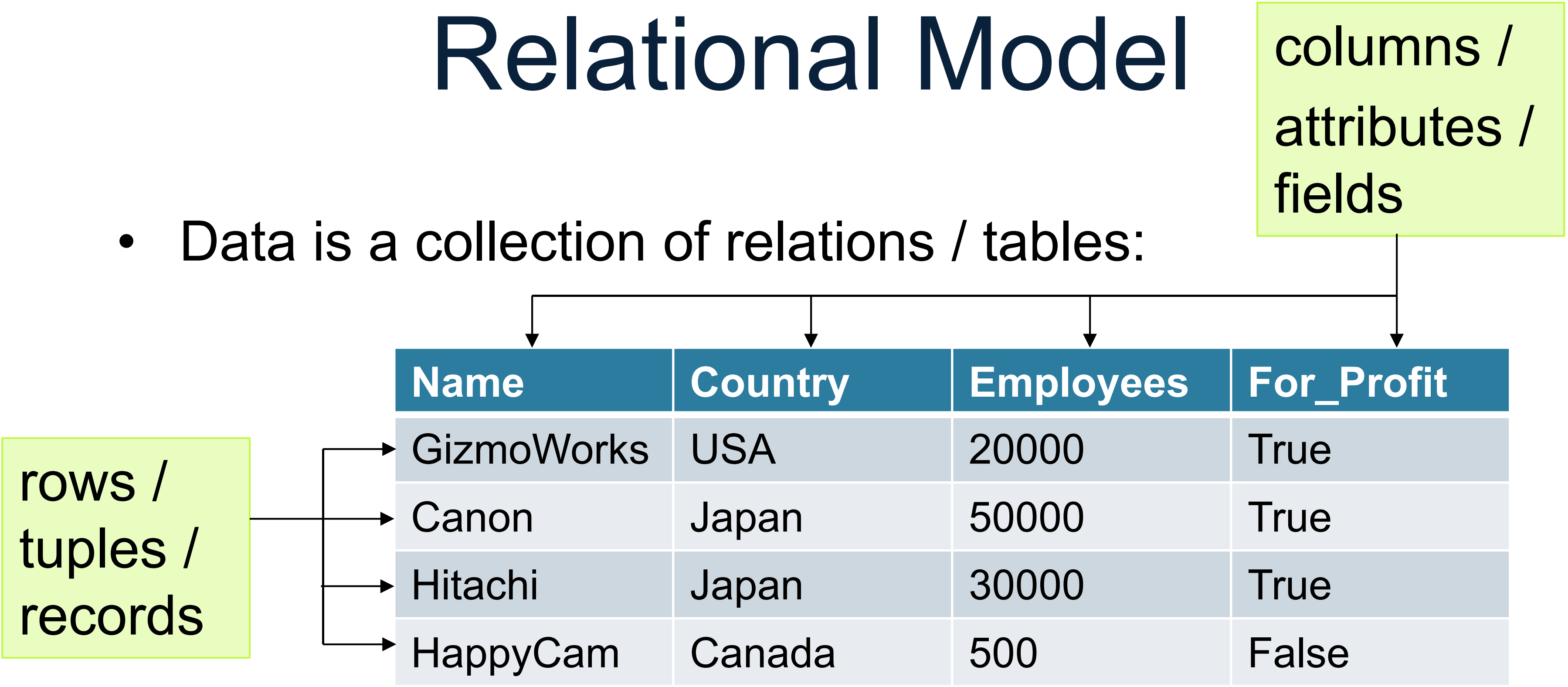
- Office Hours are listed on the calendar
  - one every Monday, Tuesday, Wednesday, and Friday

Data Models

- language / notation for talking about data
- models we will use:
  - relational: data is a collection of tables
  - semi-structured: data is a tree
- other models:
  - key-value pairs: used by NoSQL systems
  - graph data model: used by RDF (semi-structured can also do)
  - object oriented: often layered on relational, J2EE

Relational Model

- Data is a collection of relations / tables:



columns / attributes / fields

rows / tuples / records

Name	Country	Employees	For_Profit
GizmoWorks	USA	20000	True
Canon	Japan	50000	True
Hitachi	Japan	30000	True
HappyCam	Canada	500	False

- mathematically, relation is a set of tuples
  - each tuple appears 0 or 1 times in the table
  - order of the rows is unspecified

Relational Schema

- Each column has a “domain” (or type)
  - SQL has Java-like types for numbers, strings, etc.
  - domain is a constraint on the data allowed in the table
- Names and types part of the “schema” of the table:

```
Company(Name: string, Country: string,
        Employees: int, For_Profit: boolean)
```

- Particular data is an “instance” of that relation
  - data changes over time
  - DBMS usually just stores the current instance

Keys

- Key = subset of columns that uniquely identifies tuple
- Another constraint on the table
  - no two tuples can have the same values for those columns
- Examples:
  - Movie(title, year, length, genre): key is (title, year)
  - what is a good key for Company?
- Part of the schema (book notation is underline):

```
Company(Name: string, Country: string,
        Employees: int, For_Profit: boolean)
```

Keys (cont.)

- Can have multiple keys for a table
- Only one of those keys may be “primary”
  - DBMS often makes searches by primary key fastest
  - other keys are called “secondary”
- “Foreign key” is a column (or columns) whose value is a key of another table
  - i.e., a reference to another row in another table

SQL (“sequel”)

- Standard query language for relational data
  - used for databases in many different contexts
  - inspires query languages for non-relational (e.g. SQL++)
- Everything not in quotes (‘…’) is case insensitive
- Provides standard types. Examples:
  - numbers: INT, FLOAT, DECIMAL(p,s)
    - DECIMAL(p,s): Exact numerical, precision p, scale s. Example: decimal(5,2) is a number that has 3 digits before the decimal and 2 digits after the decimal
  - strings: CHAR(n), VARCHAR(n)
    - CHAR(n): Fixed-length n
    - VARCHAR(n): Variable length. Maximum length n

SQL ("sequel") – Cont.

- Provides standard types. Examples:
  - BOOLEAN
  - DATE, TIME, TIMESTAMP
    - DATE: Stores year, month, and day values
    - TIME: Stores hour, minute, and second values
    - TIMESTAMP: Stores year, month, day, hour, minute, and second values
- Additional types differ by vendor:
  - SQLite: http://www.sqlite.org/datatype3.html

SQL statements

- create table …
- drop table ...
- alter table ... add/remove ...
- insert into ... values ...
- delete from ... where ...
- update ... set ... where ...

create table …

```
CREATE TABLE Company(
   name VARCHAR(20) PRIMARY KEY,
   country VARCHAR(20),
   employees INT,
   for_profit CHAR(1));
```

drop table ...

```
DROP TABLE Company;
```

alter table ... add/remove ...

```
ALTER TABLE Company
ADD CEO VARCHAR(20);
```

insert into ... values ...

```
INSERT INTO Company VALUES
('GizmoWorks', 'USA',  20000, 'y');
```

delete from ... where ...

```
DELETE FROM Company
where name = 'GizmoWorks';
```

update ... set ... where ...

```
UPDATE Company
SET employees = employees + 120
where name = 'GizmoWorks';
```

Demo on Sqlite

- E.g., type sqlite3 in Cygwin
- .exit - exit from sqlite3