CS320 Web and Internet Programming
SQL and MySQL

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Web and Databases

- E-commerce sites
  - Products, order, customers
- News sites
  - Subscribers, articles
- Web boards
  - Users, postings
- … anywhere where a large amount of information needs to be managed safely and efficiently

A Relational DB Example

employees

id	first_name	last_name	address	supervisor_id
1	Chengyu	Sun	Street #215	null
2	John	Doe	Street #711	1

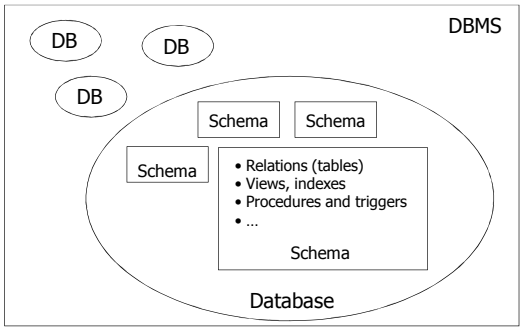
projects

id	name	leader_id
1	Firestone	1
2	Blue	2

project_members

project_id	employee_id
1	1
2	1
2	2

Terminology



DBMS

- Database Management System (DBMS) is a software that manages databases
- Common DBMS
  - Commercial – Oracle, IBM DB2, MS SQL Server, Access
  - Open source – MySQL, PostgreSQL

Database and Schema

- A database is a collection of data managed by a DBMS
- A database contains one or more *schemas*
- A schema contains a number of *schema elements*, such as tables, indexes, stored procedures, and so on

More Terminology

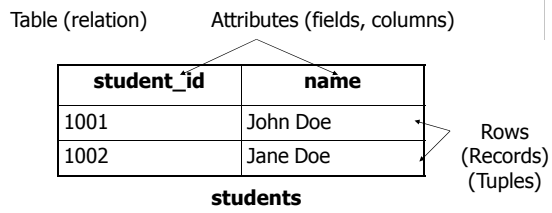


Table (relation) schema:
students(student_id, name)

Database schema: database name + table schemas

SQL

- Structured Query Language
- Standard query language of relational databases
- Supported by all major relational databases with some variations

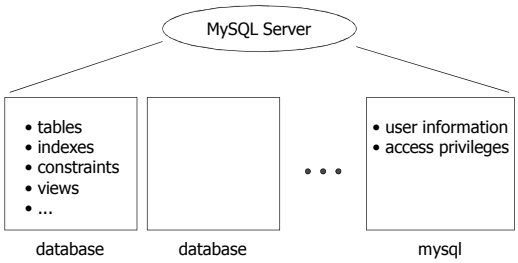
SQL Script

- A text file contains SQL *statements* and *comments*
  - Statements: `select`, `insert`, `create` …
  - Comments
    - lines started with **--**
    - MySQL also supports C-style comment syntax, i.e. **/* */**
- Usually uses the .sql suffix

MySQL

- Very popular in web development
  - Open source
  - Very fast search
  - Full text indexing and search
  - Developer-friendly features
    - drop table if exists
    - insert … on duplicate key update
    - /* */
    - …

Databases in MySQL



In MySQL, schema = database

MySQL on the CS3 Server

- Version 5.1
- One database per account
  - DB name is the same as the server account username. E.g. `cs320stu31`
  - Username and password are the same as the ones for the server account

Connect to a MySQL Database

- Host
- Port (default 3306)
- Username
- Password
- Default Database/Schema

Connect to Your MySQL Database on CS3

- http://csns.calstatela.edu/wiki/content/cysun/course_materials/cs3
  - Command line client `mysql`
  - MySQL Workbench
  - phpMyAdmin
- Change password
  - set password = password ('something');

Run SQL Scripts

- Command line client
  - \. *path/to/script.sql*
  - source *path/to/script.sql;*
- MySQL Workbench
  - *SQL Development* → Open SQL Script File → Execute
- phpMyAdmin
  - Import
    - Format of the imported file: `SQL`

Schema Design Example

- Employee and Project

```
public class Employee {
   Integer   id;
   String    firstName;
   String    lastName;
   String    address;
   Employee  supervisor;
}
```

```
public class Project{
   Integer          id;
   String           name;
   Employee         leader;
   Set<Employee>    members;
   }
```

Simple Schema Design Rules

OO	**Relational**
Class	Table
Class variables	Attributes
Java types	SQL types
Object References	IDs
Collection	New Table (possibly)

Create a Table

```
create table table_name (
   field_name field_type [NOT NULL] [UNIQUE] [DEFAULT value],
   field_name field_type [NOT NULL] [UNIQUE] [DEFAULT value],
   …
   [PRIMARY KEY(field_name, …)]
);
```

```
create table employees (
   id              integer auto_increment primary key,
   first_name      varchar(255) not null,
   last_name       varchar(255) not null,
   address         varchar(255),
   supervisor_id   integer references employees(id)
);
```

About CREATE TABLE

- Field types
  - integer, real, char(n), varchar(n)
  - date, time, datetime, timestamp
- auto_increment
- Integrity constraints
  - unique, not null, primary key
  - foreign key

Populate Tables

insert into table values (value1, value2, …);

insert into table (field, …) values (value, …);

Search for Records

select field(s) from table(s) where condition(s);

- Find the name and address of employee with id=1
- Find the name of employee who leads the project Firestone
- Find the name of John Doe's supervisor
- Find the number of projects led by John Doe

Update Records

update table set field=value [, …]
where condition(s);

- Change John Doe's address to 123 Main St.
- Change John Doe's name to Tom Smith

Delete Records

delete from table where condition(s);

- Delete all the projects led by John Doe
- Delete all the projects

Delete Tables and Databases

- Delete a database
  - drop database cs320stu31; -- don't do this!
- Delete a table
  - drop table projects;
  - drop table if exists projects; -- MySQL only

Readings

- CS122 Textbook
- MySQL Reference Manual
  - String functions
  - Date and time functions