

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	John	Doe	Street #215	null
2	Jane	Doe	Street #711	1

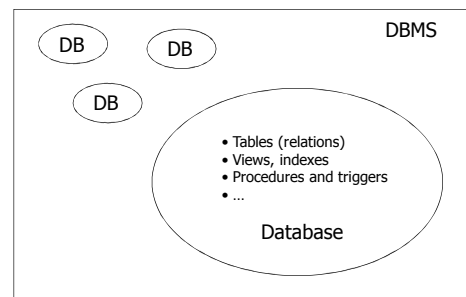
projects

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 a number of *schema elements*, such as tables, indexes, stored procedures, and so on

More Terminology

Table (relation) Attributes (fields, columns)

student_id	name
1001	John Doe
1002	Jane Doe

Rows (Records) (Tuples)

students

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

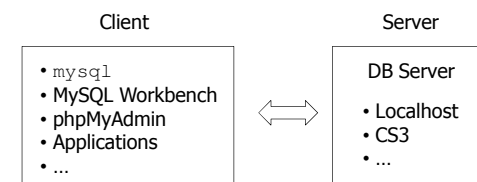
MySQL

- ◆ 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
 - ◆ `/* */`
 - ◆ ...

MySQL on the CS3 Server

- ◆ Version 5.5
- ◆ 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

Client-Server Architecture of MySQL



Connect to a MySQL Database

- ◆ Use one of the client software
- ◆ Create a connection with the information about the server
 - Host
 - Port (default 3306)
 - Username
 - Password
 - Database/Schema

Connect to Your MySQL Database on CS3

- ◆ http://csns.calstatela.edu/wiki/content/cysun/course_materials/cs3#MySQL
 - 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 Editor* → File → Open SQL Script → 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

<u>OO</u>		<u>Relational</u>
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)
);
```

Naming Conventions

- ◆ Use plural form for table names
- ◆ Use singular form for column names
- ◆ Use underscore to concatenate multiple words, e.g. `employee_id`
 - Do not use mixed cases in names (e.g. `ArtistName`) because many DBMS treat names as case-insensitive

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 Jane Doe's supervisor
- ◆ Find the number of projects led by John Doe
- ◆ List the number of members of each project

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