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

Database vs. File

- SQL
- Faster search
- ACID
  - Atomicity
  - Consistency
  - Isolation
  - Durability

Relational Model

- Proposed by Edgar F. Codd in early 1970's
- All major DBMS are relational (and the good ones are *object-relational*)

A Relational DB Example

orders

OID	CID	ODATE	SDATE
1	1	4/29/2005	NULL
2	2	3/20/2005	3/37/2005

products

PID	Description	Price
1	Intel P4	$200
2	Intel P3	$49
3	AthlonXP	$100
4	ASUS	$128
5	TYAN	$400

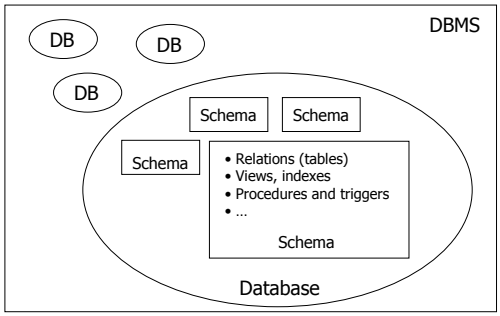
customers

CID	FNAME	LNAME	ADDRESS
1	Chengyu	Sun	Street #215
2	Steve	Sun	Street #711

order_details

OID	PID	Quantity
1	1	2
1	5	2
2	2	1

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) 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

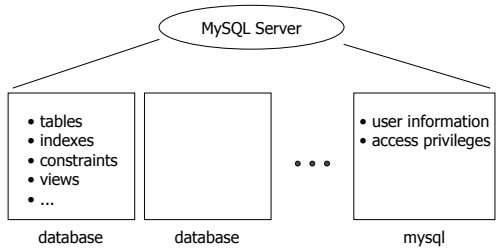
SQL Script

- 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
    - /* */
    - ...

Databases in MySQL



In MySQL, schema = database

MySQL on the CS3 Server

- Version 5.0.45
- 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)
- Database
- Username
- Password

Connect to Your MySQL Database on CS3

- http://sun.calstatela.edu/~cysun/www/teaching/servers/cs3.html#MySQL
  - Command line client `mysql`
  - MySQL Query Browser
  - phpMyAdmin
- Change password
  - set password = password ('something');

Run SQL Scripts

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

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 products (
      prod_id char(8) not null,    -- product id
      description text,            -- product description
      price decimal(12,2),         -- price
      primary key (prod_id)
);
```

Field Types

- Numerical types
  - int, float, double, decimal(m,n)
- String types
  - char(n), varchar(n)
- Date and time
  - date, time, datetime, timestamp
    - 'YYYY-MM-DD hh:mm:ss'

Auto Increment Field

```
create table users (
        id              int auto_increment primary key,
        username        varchar(64) not null unique,
        password        char(16)
);

insert into users (username,password) values ('cysun','abcd');
insert into users (username,password) values ('csun','xyz');
```

Populate Tables

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

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

- insert into orders values (1000, 1, '2004-04-29', '2004-05-01');
- insert into orders (oid, cid, odate) values (1001, 2, '2004-05-01');

Search for Records

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

- select description, price from products;
- select * from products;
- select * from products where price < 300;
- select * from products where prod_id = 'cpu-0001';

Pattern Matching

- LIKE, REGEXP
  - % -- any zero or more characters
  - . – any single charater
  - [abc], [a-z], [0-9] – range
  - * -- zero or more instances of the preceding character
  - ^ -- beginning of a string
  - $ -- end of a string
- select * from products where description like '%intel%';

Update Records

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

- update products set price=320 where prod_id = 'cpu-0001';
- update products set price=200, description='Intel Pentium M 1.7GHz' where prod_id = 'cpu-0001';

Delete Records

delete from table where condition(s);

- delete from orders;
- delete from orders where odate < '2005-12-31' and sdate is not null;

Delete Tables and Databases

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

Schema Design Example …

- Customer, Product, Order

```
public class Customer {
    int       id;
    String    lastName;
    String    firstName;
    String    address;
}
```

```
public class Product {
    int       id;
    String    description;
    double    price;
}
```

… Schema Design Example

```
public class Order {
    int                 id;
    Date                dateOrdered;
    Date                dateShipped;

    Customer            customer;
    Map<Product, int>   products;
}
```

Simple Schema Design Rules

OO	**Relational**
Class	Table
Class variables	Attributes
Java types	SQL types
References	ID
Collection	New Table

Exercises

- Read MySQL Reference Manual
  - String functions
  - Date and time functions