

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

customers

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

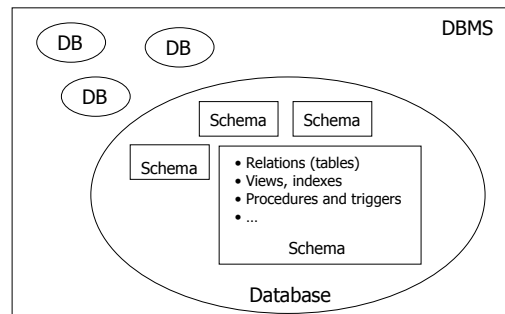
products

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

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

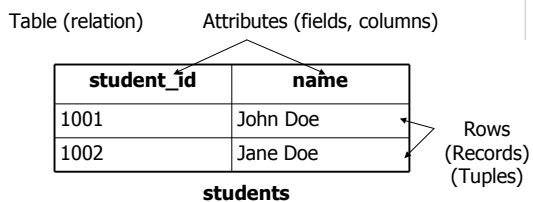


Table (relation) schema:
students(student_id, name)

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

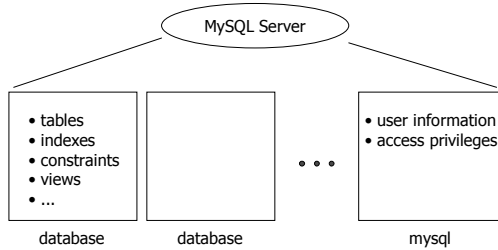
SQL Script

- ◆ 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 ...

- ◆ 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

<u>OO</u>	<u>Relational</u>
Class	Table
Class variables	Attributes
Java types	SQL types
References	ID
Collection	New Table

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 character
- [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

Readings and Exercises

- ◆ MySQL Reference Manual
 - String functions
 - Date and time functions
- ◆ Exercises