SQL AND SCRIPTACULOUS

Database and front end tricks

Announcements

- Demo Tuesday, April 1
  - Sprint 1
    - Each person chooses a story
    - The team presents the results to the TA
    - The TA grades the results
- MySQL is now available on Betaweb
  - Log on and change your password.
  - Try the examples

SQL

Databases on Betaweb

SQL

- 13.1: Database Basics
- **13.2: SQL**
- 13.3: Multi-table Queries
- 13.4: Databases and PHP

SQL (Structured Query Language)

SELECT name FROM cities WHERE id = 17;

INSERT INTO countries VALUES ('SLD', 'ENG', 'T', 100.0);

- A language for searching and updating a database
- Standard syntax used by every DBMS (with minor incompatibilities)
  - generally case-insensitive
- a declarative language: describes the data you are seeking, not how to find it

MySQL on Betaweb


```
betaweb:databases> pwd
/home/martin/databases
betaweb:databases> mysql -n martin -p
Enter password:

mysql>
```

Changing Password


```
mysql>SET PASSWORD = PASSWORD('password');
```

- Always put a semicolon after a SQL command
- SQL commands are case insensitive

```
mysql> quit;
```

- You can exit using the "quit" command.

Loading Databases


```
databases> mysql -u martin -p martin < simpsons.sql
Enter password:
databases> mysql -u martin -p
Enter password:

mysql>
```

Viewing Databases


```
mysql> show databases;
+--------------------+
| Database           |
+--------------------+
| information_schema |
| martin             |
+--------------------+
2 rows in set (0.00 sec)
```

Using Databases

mysql> use martin

Reading table information for completion of table and column names

You can turn off this feature to get a quicker startup with -A

Database changed

Seeing tables


```
mysql> show tables;
+-----------------+
| Tables_in_martin |
+-----------------+
| courses          |
| grades           |
| students         |
| teachers         |
+-----------------+
4 rows in set (0.00 sec)
```

SQL command in MySQL


```
SHOW DATABASES;
USE database;
SHOW TABLES;

mysql> USE world;
Database changed

mysql> SHOW TABLES;
+-----------+
| cities    |
| countries |
| languages |
+-----------+
3 rows in set (0.00 sec)
```

SQL **SELECT** Statement

- the SELECT statement searches a database and returns a set of results the column name(s) written after SELECT filter which parts of the rows are returned
  - table and column names are case-sensitive
  - SELECT * FROM *table*; keeps all columns

SELECT Example


```
mysql> SELECT name, code FROM countries;
+-------------------------------------------+------
+
| name                                      | code |
+-------------------------------------------+------
+
| Afghanistan                                | AFG  |
| Netherlands                                | NLD  |

....
```

The DISTINCT modifier

- SELECT language FROM languages;

language

- Dutch
- English
- English
- Spanish
- Spanish
- ...

- SELECT DISTINCT language FROM languages;

language

- Dutch
- English
- Spanish
- ...

The WHERE clause

- WHERE clause filters out rows based on their columns' data values
- in large databases, it's critical to use a WHERE clause to reduce the result set size
- suggestion: when trying to write a query, think of the FROM part first, then the WHERE part, and lastly the SELECT part

```
SELECT columns FROM table WHERE
conditions(s)
```

Conditions

- The WHERE portion of a SELECT statement can use the following operators:
  - =, >, >=, <, <=
  - <> : not equal
  - BETWEEN *min* AND *max*
  - LIKE *pattern*
  - IN (*value*, *value*, ..., *value*)
- Multiple WHERE clauses can be combined with AND, OR

Approximate matches: LIKE

- SELECT code, name, population FROM countries WHERE name *LIKE 'United%*

- LIKE '*text*%' searches for text that starts with a given prefix
- LIKE '%*text*' searches for text that ends with a given suffix
- LIKE '%*text*%' searches for text that contains a given substring

Sorting by a column: ORDER BY

- SELECT code, name, population FROM countries WHERE name LIKE 'United%' *ORDER BY population*
- can write ASC or DESC to sort in ascending (default) or descending order: SELECT * FROM countries *ORDER BY population DESC;*
- can specify multiple orderings in decreasing order of significance: SELECT * FROM countries *ORDER BY population DESC, gnp;*
- see also: GROUP BY

Limiting rows: LIMIT

- SELECT name FROM cities WHERE name LIKE 'K%' *LIMIT 5;*
- can be used to get the top-N of a given category (ORDER BY and LIMIT)
- also useful as a sanity check to make sure your query doesn't return 10^7 rows

The SQL INSERT statement

- INSERT INTO *table* VALUES (*value*, *value*, ..., *value*);
- adds a new row to the given table
- columns' values should be listed in the same order as in the table

More about INSERT

- INSERT INTO *table* (*columnName*, *columnName*, ..., *columnName*) VALUES (*value*, *value*, ..., *value*);
- some columns have default or auto-assigned values (such as IDs)
- omitting them from the INSERT statement uses the defaults

The SQL REPLACE statement

- REPLACE INTO *table* (*columnName*, *columnName*, ..., *columnName*) VALUES (*value*, *value*, ..., *value*);
- just like INSERT, but if an existing row exists for that key (ID), it will be replaced
- can pass optional list of column names, like with INSERT

The SQL UPDATE statement

- UPDATE *table* SET *column* = *value*, ..., *column* = *value* WHERE *column* = *value*;
- modifies an existing row(s) in a table
- BE CAREFUL! If you omit the WHERE, it modifies ALL rows

The SQL DELETE statement

- DELETE FROM *table* WHERE *condition*;
- removes existing row(s) in a table
- can be used with other syntax like LIMIT, LIKE, ORDER BY, etc.
- BE CAREFUL! If you omit the WHERE, it deletes ALL rows

Creating and deleting an entire database

- CREATE DATABASE *name*;
- DROP DATABASE *name*;

- adds/deletes an entire database from the server

Creating and deleting a table


```
CREATE TABLE name (
  columnName type constraints,
  ...
  columnName type constraints
);
DROP TABLE name;
```

- adds/deletes a table from this database
- all columns' names and types must be listed

SQL data types

- BOOLEAN: either TRUE or FALSE
- INTEGER
- DOUBLE
- VARCHAR(*length*) : a string
- ENUM(*value*, ..., *value*): a fixed set of values
- DATE, TIME, DATETIME
- BLOB : binary data

Column constraints


```
CREATE TABLE students (
  id INTEGER UNSIGNED NOT NULL PRIMARY
KEY,
  name VARCHAR(20) NOT NULL,
  email VARCHAR(32),
  password VARCHAR(16) NOT NULL DEFAULT
"12345"
);
```

- NOT NULL: cannot insert null/empty valuen in any row for that column
- PRIMARY KEY / UNIQUE: no two rows can have the same value
- DEFAULT *value*: if no value is provided, use the given default
- AUTO_INCREMENT: default value is last row's value plus 1 (e.g., for IDs)
- UNSIGNED: don't allow negative numbers (INTEGER only)

Rename a table

- ALTER TABLE *name* RENAME TO *newName*;

- changes the name of an existing table

Add/remove/modify table column


```
ALTER TABLE name
  ADD COLUMN columnName type constraints;

ALTER TABLE name DROP COLUMN
columnName;

ALTER TABLE name
  CHANGE COLUMN oldColumnName
newColumnName type constraints;
```

- adds/deletes/respecifies a column in an existing table
- if a column is added, all existing rows are given a default value for that column

SQL

- 13.1: Database Basics
- 13.2: SQL
- **13.3: Multi-table Queries**
- 13.4: Databases and PHP

Querying multi-table databases

- Datasets spread across multiple tables need queries that can answer high-level questions such as:
  - What courses has Bart taken and gotten a B- or better?
  - What courses have been taken by both Bart and Lisa?
  - Who are all the teachers Bart has had?
  - How many total students has Ms. Krabappel taught, and what are their names?
- To do this, we'll have to **join** data from several tables in our SQL queries.

Cross product with JOIN

- Cross product or Cartesian product: combines each row of first table with each row of second
  - produces *M* * *N* rows, where table 1 has *M* rows and table 2 has *N*
  - problem: produces too much irrelevant/meaningless data

Example Database: Simpsons


```
mysql> show tables;
+-----------------+
| Tables_in_martin |
+-----------------+
| courses          |
| grades           |
| students         |
| teachers         |
+-----------------+
```

```
mysql> describe courses;
+------------+-----------------+
| Field      | Type            |
+------------+-----------------+
| id         | int(10) unsigned |
| name       | varchar(32)     |
| teacher_id | int(10) unsigned |
+------------+-----------------+
```

```
describe grades;
+------------+-----------------+
| Field      | Type            |
+------------+-----------------+
| student_id | int(10) unsigned |
| course_id  | int(10) unsigned |
| grade      | varchar(2)      |
+------------+-----------------+
```

Example simpsons database

students	id	name	email
	123	Bart	bart@fox.com
	456	Milhouse	milhouse@fox.com
	888	Lisa	lisa@fox.com

teachers	id	name
	1234	Krabappel
	5678	Hoover

courses	id	name	teacher_id
	10001	Computer Science 142	1234
	10002	Computer Science 143	5678

grades	student_id	course_id	grade
	123	10001	B-
	123	10002	C
	456	10001	B+
	888	10002	A+

Example Cross Produce

SELECT column(s) FROM table1 JOIN table2;

SELECT * FROM students JOIN grades;

id	name	email	st_id	c_id	grade
123	Bart	bart@fox.com	123	10001	B-
456	Milhouse	milhouse@f.c	123	10001	B-
888	Lisa	lisa@fox.com	123	10001	B-
123	Bart	bart@fox.com	123	10002	C

... (18 rows returned)

Joining with ON clauses


```
SELECT column(s)
FROM table1
JOIN table2 ON condition(s)
...
JOIN tableN ON condition(s);

SELECT *
FROM students
JOIN grades ON id = student_id;
```

- join: combines tables ON certain conditions
- the ON clause specifies which records to matches
- the rows are often linked by their key columns (id)

Join example


```
SELECT *
FROM students
JOIN grades ON id = student_id;
```

id	name	email	student_id	course_id	grade
123	Bart	bart@fox.com	123	10001	B-
123	Bart	bart@fox.com	123	10002	C
456	Milhouse	milhouse@fox.com	456	10001	B+
888	Lisa	lisa@fox.com	888	10002	A+

- *table.column* can be used to disambiguate column names:
- SELECT * FROM students JOIN grades ON *students*.id = *grades*.student_id;

Filtering columns in a join


```
SELECT name, course_id, grade
FROM students
JOIN grades ON id = student_id;
```

name	course_id	grade
Bart	10001	B-
Bart	10002	C
Ralph	10004	D+
Milhouse	10001	B+
Lisa	10002	A+
Lisa	10003	A+

Filtered join (JOIN with WHERE)


```
SELECT name, course_id, grade
FROM students
JOIN grades ON id = student_id
WHERE name = 'Bart';
```

name	course_id	grade
Bart	10001	B-
Bart	10002	C

- JOIN glues tables together; WHERE filters results
- ON vs Where
  - ON directly links columns of the joined tables
  - WHERE sets additional constraints such as particular values (123, 'Bart')

What's wrong with this?


```
SELECT name, id, course_id, grade
FROM students
JOIN grades ON id = 123
WHERE id = student_id;
```

name	id	course_id	grade
Bart	123	10001	B-
Bart	123	10002	C

- The above query is poor style. Why?
- The JOIN ON clause doesn't say what connects a grades record to a students record.
  - Grades/students related on a student id.
  - Filtered by a specific ID.

Giving names to tables


```
SELECT s.name, g.*
FROM students s
JOIN grades g ON s.id = g.student_id
WHERE g.grade <= 'C';
```

- can give names to tables, like a variable name in Java
- to specify all columns from a table, write *table*.*

Multi-way join


```
SELECT c.name
FROM courses c
JOIN grades g ON g.course_id = c.id
JOIN students bart ON g.student_id = bart.id
WHERE bart.name = 'Bart' AND g.grade <= 'B-';
```

- More than 2 tables can be joined, as shown above
- This query gets all courses in which Bart has gotten a B- or better

Another example

- What courses have been taken by both Bart and Lisa

```
SELECT DISTINCT c.name
FROM courses c
JOIN grades g1 ON g1.course_id = c.id
JOIN students bart ON g1.student_id = bart.id
JOIN grades g2 ON g2.course_id = c.id
JOIN students lisa ON g2.student_id = lisa.id
WHERE bart.name = 'Bart'
AND lisa.name = 'Lisa';
```

Designing a query

- Figure out the proper SQL queries in the following way:
  - Which table(s) contain the critical data? (FROM)
  - Which columns do I need in the result set? (SELECT)
  - How are tables connected (JOIN), filtered (WHERE)?
- Test on a small data set; confirm on real data set.
- Try out the queries first in the MySQL console.
- Write the PHP code to run those same queries.
  - Make sure to check for SQL errors at every step!!

Example simpsons database

students	id	name	email
	123	Bart	bart@fox.com
	456	Milhouse	milhouse@fox.com
	888	Lisa	lisa@fox.com

teachers	id	name
	1234	Krabappel
	5678	Hoover

courses	id	name	teacher_id
	10001	Computer Science 142	1234
	10002	Computer Science 143	5678

grades	student_id	course_id	grade
	123	10001	B-
	123	10002	C
	456	10001	B+
	888	10002	A+

Quiz

1. What are the names of all teachers Bart has had?
2. What are the names of the students Ms. Krabappel has taught?

And the answer is …

Quiz Answers


```
SELECT DISTINCT t.name
FROM teachers t
JOIN courses c ON c.teacher_id = t.id
JOIN grades g ON g.course_id = c.id
JOIN students s ON s.id = g.student_id
WHERE s.name = 'Bart';
```

```
SELECT DISTINCT s.name
FROM students s
JOIN grades g ON s.id = g.student_id
JOIN courses c ON g.course_id = c.id
JOIN teachers t ON t.id = c.teacher_id
WHERE t.name = 'Krabappel';
```

Standup

Discuss questions with your Scrum Team

Designing for Web 2.0

Ch. 10.2

Usability

- Summarize
- Organize
- Write compactly
- Don’t be too creative!

Navigation and links

- Menus:
  - Horizontal
  - Vertical
  - Flyout
- Efficient forms
  - Proper input elements
  - Min number of fields
  - Javascript/PHP for validation

Visual Effects

Scriptaculous overview

Scriptaculous : a JavaScript library, built on top of Prototype, that adds:

- visual effects (animation, fade in/out, highlighting)
- drag and drop
- some DOM enhancements
- other stuff (unit testing, etc.)

Downloading and using Scriptaculous


```
<script src="http://ajax.googleapis.com/ajax/libs/
scriptaculous/1.9.0/scriptaculous.js" type="text/
javascript"></script>
```

JS

- documentation available on their wiki
- Scriptaculous Effects Cheat Sheet

Visual Effects

appear | blindDown | grow | slideDown (appearing)

blindUp | dropOut | fade | fold | puff
shrink | slideUp | squish | switchOff (disappearing)

highlight | pulsate | shake | morph
Effect.Move | Effect.Scale | Effect.toggle (blind) (Getting attention)

Adding effects to an element


```
element.effectName(); // for most effects

// some effects must be run the following way:
new Effect.name(element or id);
```
JS

```
$("sidebar").shake();
var buttons = $$("results > button");
for (var i = 0; i < buttons.length; i++) {
      buttons[i].fade();
}
```
JS

- the effect will begin to animate on screen (asynchronously) the moment you call it
- six core effects are used to implement all effects on the previous slides:
  - `Effect.Highlight, Effect.Morph, Effect.Move, Effect.Opacity, Effect.Parallel, Effect.Scale`

Adding effects to an element


```
element.effectName(
{
        option: value,
        option: value,
        ...
}
);
```
JS

```
$("my_element").pulsate({
        duration: 2.0,
        pulses: 2
});
```
JS

- many effects can be customized by passing additional options (note the {})
- options (wiki): `delay, direction, duration, fps, from, queue, sync, to, transition`

Adding effects to an element


```
$("my_element").fade({
        duration: 3.0,
        afterFinish: displayMessage
});
function displayMessage(effect) {
        alert(effect.element + " is done fading now!");
}
```
JS

- all effects have the following events that you can handle:
  - `beforeStart, beforeUpdate, afterUpdate, afterFinish`
- the afterFinish event fires once the effect is done animating
  - useful do something to the element (style, remove, etc.) when effect is done

Adding effects to an element


```
$("my_element").fade({
        duration: 3.0,
        afterFinish: displayMessage
});
function displayMessage(effect) {
        alert(effect.element + " is done fading now!");
}
```
JS

- each of these events receives the Effect object as its parameter
  - its properties: `element`, `options`, `currentFrame`, `startOn`, `finishOn`
  - some effects (e.g. Shrink) are technically "parallel effects", so to access the modified element, you write `effect.effects[0].element` rather than just `effect.element`

Drag and drop

Scriptaculous provides several objects for supporting drag-and-drop functionality:

- Draggable : an element that can be dragged
- Draggables : manages all Draggable objects on the page
- Droppables : elements on which a Draggable can be dropped
- Sortable : a list of items that can be reordered
- Puzzle Game demo

Draggable


```
new Draggable(element or id,
        { options }
);                                                    JS
```

- specifies an element as being able to be dragged
- **options:** `handle, revert, snap, zindex, constraint, ghosting, starteffect, reverteffect, endeffect`
- **event options:** `onStart, onDrag, onEnd`
  - each handler function accepts two parameters: the Draggable object, and the mouse event

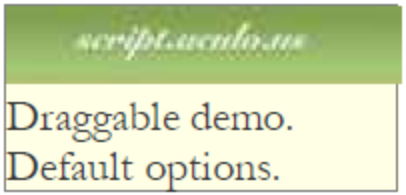
Draggable Example

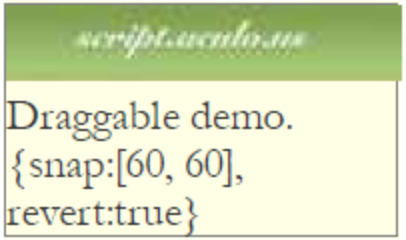

```
<div id="draggabledemo1">Draggable demo. Default
options.</div>
<div id="draggabledemo2">Draggable demo.
{snap: [40,40], revert: true}</div>
```

HTML

```
document.observe("dom:loaded", function() {
        new Draggable("draggabledemo1");
        new Draggable("draggabledemo2", {revert: true,
snap: [40, 40]});
});
```

JS





Draggables

- a global helper for accessing/managing all Draggable objects on a page
- **properties:** `drags, observers`
- **methods:** `register, unregister, activate, deactivate, updateDrag, endDrag, keyPress, addObserver, removeObserver, notify`

Droppables


```
Droppables.add(element or id,
        { options }
);                                                    JS
```

- To make an element react when a Draggable is dropped onto it, you'll add it to the *Droppables* of the page
- **options:** `accept, containment, hoverclass, overlap, greedy`
- **event options:** `onHover, onDrop`
  - each callback accepts three parameters: the Draggable, the Droppable, and the event

Draggable Example


```
<img id="product1" src="images/shirt.png" alt="shirt" />
<img id="product2" src="images/cup.png" alt="cup" />
<div id="droptarget"></div>
```

HTML

```
document.observe("dom:loaded", function() {
	new Draggable("product1");
	new Draggable("product2");
	Droppables.add("droptarget", {onDrop:
productDrop});
});
function productDrop(drag, drop, event) {
	alert("You dropped " + drag.id);
}
```

JS

Sortable


```
Sortable.create(element or id of list,
        { options }
);                                                    JS
```

- specifies a list (ul, ol) as being able to be dragged into any order
- implemented internally using Draggables and Droppables
- **options:** `tag, only, overlap, constraint, containment, format, handle, hoverclass, ghosting, dropOnEmpty, scroll, scrollSensitivity, scrollSpeed, tree, treeTag`
- to make a list un-sortable again, call `Sortable.destroy` on it

Sortable demo


```
<ol id="simpsons">
        <li id="simpsons_0">Homer</li>
        <li id="simpsons_1">Marge</li>
        <li id="simpsons_2">Bart</li>
        <li id="simpsons_3">Lisa</li>
        <li id="simpsons_4">Maggie</li>
</ol>
```

HTML

```
document.observe("dom:loaded", function() {
        Sortable.create("simpsons");
});
```

JS

Sortable demo

event	description
onChange	when any list item hovers over a new position while dragging
onUpdate	when a list item is dropped into a new position (more useful)

```
document.observe("dom:loaded", function() {
        Sortable.create("simpsons", {
                onUpdate: listUpdate
        });
});
```
JS

Sortable list events example


```
document.observe("dom:loaded", function() {
	Sortable.create("simpsons", {
	onUpdate: listUpdate
	});
});
function listUpdate(list) {
	// can do anything I want here; effects, an Ajax
request, etc.
	list.shake();
}
```

JS

Auto-completing text fields

- Scriptaculous offers ways to make a text box that auto-completes based on prefix strings:
  - `Autocompleter.Local` : auto-completes from an array of choices
  - `Ajax.Autocompleter` : fetches and displays list of choices using Ajax

Using Autocompleter.Local


```
new Autocompleter.Local(
        element or id of text box,
        element or id of div to show completions,
        array of choices,
        { options }
);
```
JS

- you must create an (initially empty) div to store the auto-completion matches
  - it will be inserted as a ul that you can style with CSS
  - the user can select items by pressing Up/Down arrows; selected item is given a class of selected
- pass the choices as an array of strings
- pass any extra options as a fourth parameter between { }
  - options: `choices, partialSearch, fullSearch, partialChars, ignoreCase`

Using Autocompleter.Local


```
<input id="bands70s" size="40" type="text" />
<div id="bandlistarea"></div>
```
HTML

```
document.observe("dom:loaded", function() {
        new Autocompleter.Local(
                "bands70s",
                "bandlistarea",
                ["ABBA", "AC/DC", "Aerosmith", "America",
"Bay City Rollers", ...],
                {}
        );
});
```
JS

Using Autocompleter.Local


```
<input id="bands70s" size="40" type="text" />
<div id="bandlistarea"></div>
```
HTML

```
#bandlistarea {
	border: 2px solid gray;
}
/* 'selected' class is given to the autocomplete item
currently chosen */
#bandlistarea .selected {
	background-color: pink;
}
```
CSS

Using Ajax.Autocompleter


```
new Ajax.Autocompleter(
       element or id of text box,
       element or id of div to show completions,
       url,
       { options }
);
```
JS

- when you have too many choices to hold them all in an array, you can instead fetch subsets of choices from the server using Ajax
- instead of passing choices as an array, pass a URL from which to fetch them
  - the choices are sent back from the server as an HTML ul with li elements in it
- **options:** `paramName, tokens, frequency, minChars, indicator, updateElement, afterUpdateElement, callback, parameters`

Playing sounds (API)

method	description
Sound.play("url");	plays a sound/music file
Sound.disable();	stops future sounds from playing (doesn't mute any sound in progress)
Sound.enable();	re-enables sounds to be playable after a call to Sound.disable()

```
Sound.play("music/java_rap.mp3");
Sound.play("music/wazzaaaaaap.wav");
```
PHP

- to silence a sound playing in progress, use
  `Sound.play('', {replace: true});`
- cannot play sounds from a local computer (must be uploaded to a web site)

Ajax.InPlaceEditor


```
new Ajax.InPlaceEditor(element or id,
       url,
       { options }
);
```
JS

- **options:** `okButton, okText, cancelLink, cancelText, savingText, clickToEditText, formId, externalControl, rows, onComplete, onFailure, cols, size, highlightcolor, highlightendcolor, formClassName, hoverClassName, loadTextURL, loadingText, callback, submitOnBlur, ajaxOptions`
- **event options:** `onEnterHover, onLeaveHover, onEnterEditMode, onLeaveEditMode`

Ajax.InPlaceEditor


```
new Ajax.InPlaceCollectionEditor(element or id,
        url,
        {
                collection: array of choices,
                options
        }
);
```
JS

- a variation of `Ajax.InPlaceEditor` that gives a collection of choices
- requires `collection` option whose value is an array of strings to choose from
- all other options are the same as `Ajax.InPlaceEditor`

Ajax.InPlaceEditor

- slider control:

```
new Control.Slider("id of knob", "id of track",
{options});
```
JS

- Builder - convenience class to replace document.createElement:

```
var img = Builder.node("img", {
        src: "images/lolcat.jpg",
        width: 100, height: 100,
        alt: "I can haz Scriptaculous?"
});
$("main").appendChild(img);
```
JS

- Tabbed UIs