Database Theory and Applications for Biomedical Research and Practice

BMIN 502 / EPID 635
Week 6: Database Programming

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Agenda

- Review REDCap surveys
- Review REDCap longitudinal studies
- Introduction to Structured Query Language
- Installing MySQL
- Installing MySQL Workbench
- Implementing a simple database in MySQL

Objectives for today

- You will learn:
  - Basic SQL commands and programming
  - How to install MySQL and MySQL Workbench
  - How to use MySQL Workbench to design and implement a simple database

What is SQL?

- Structured Query Language
- Standard (sort of) for creating and manipulating relational databases
- Things you can do with SQL
  - Create databases and tables
  - Establish relationships (permanent or temporary) between tables
  - Create views of a database
  - Enter, import, export, modify, and delete data
  - Create reports
  - Real-time transactions

Some basic SQL syntax: Creating a database

CREATE DATABASE *database_name;*

Example:
CREATE DATABASE ABIC;

This SQL code creates the database, but no tables within it and it, but does not populate the database with data.

Some basic SQL syntax: Creating a table

CREATE TABLE *table_name (“field_name1” “data_type”,.., “field_name_n” “data_type”);*

Example:

```
CREATE TABLE patient
        (study_id NUMBER(3),
        dob DATE(),
        sex NUMBER(1),
        race CHAR(1),
        hospital VARCHAR(10)
        PRIMARY  KEY (study_id));
```

This SQL code creates the table (demographics), but does not populate the database with data.

Some basic SQL syntax: Inserting data

INSERT INTO *table_name (field_name _1, …, field_name_n) VALUES (value for field1,…etc);*
Example:

```
INSERT INTO demographics
      (study_id, dob, sex, race, hospital)
      VALUES   (1,'10/1/1998',1,'Caucasian','HUP'),
               (2,'4/16/2004',2,'Asian','PUPMC'),
               (314,'3/7/1995,1,'Caucasian','PAH'),
                …
               (10,'4/5/2000',1,'Asian','HUP');
```

Here is the result:

study_id	dob	sex	race	hospital
1	10/1/1998	1	Caucasian	HUP
2	4/16/2004	2	Asian	PUPMC
314	3/7/1995	1	Caucasian	PAH
40	9/1/2000	1	African American	PAH
506	11/15/1993	2	African American	HUP
600	7/13/2003	1	Pacific Islander	HUP
7	9/18/2007	2	Caucasian	PAH
823	1/4/1999	2	African American	PUPMC
9	10/4/1994	2	Asian	PAH
10	4/5/2000	1	Asian	HUP

Some basic SQL syntax: Selecting records

SELECT *field_name* FROM *table_name* WHERE *condition;*
This command selects a field from a table, filtered by the condition
Example:

```
      SELECT race
          FROM demographics
          WHERE race='Caucasian';
```

race
Caucasian
Caucasian
Caucasian

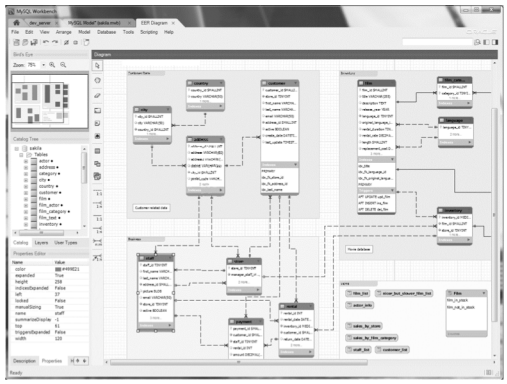
MySQL

- Open-source, freely available relational database platform
  - They prefer you call it ”My S-Q-L”, but whatever…
- Supports ANSI SQL
- Works as a standalone, client-server, or embedded system
- Several versions
  - Community server is the one you want!
- Can be used as-is, but you will need to program in SQL
  - Best to use MySQL Workbench

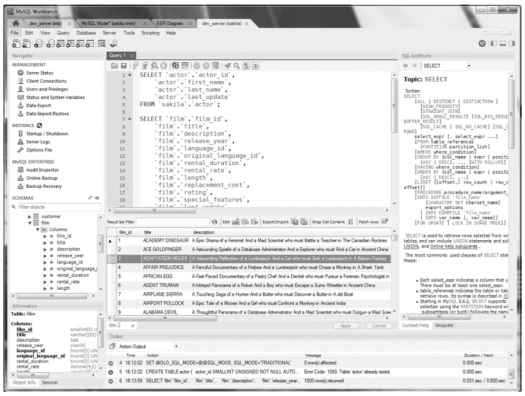
MySQL Workbench

- Open-source, freely available component (or add-in) for MySQL
- Graphical user interface for designing, modeling, implementing, and administering a fully relational database system

Visual database design with Workbench



SQL Editor in Workbench



Performance Monitor in Workbench

Creating your first database using Workbench

- Make sure the MySQL server instance in running
  - Mac: Go to System Preferences, then MySQL Preference Pane, and click on Start MySQL server if needed
  - Windows: you can select run as a service during the installation
- Start Workbench
- Create a database connection
  - See the “Creating a new database connection” handout
- Create your model using your E-R diagram
  - See “Creating a MySQL database from a model in Workbench” handout

Installing MySQL and Workbench

- See the Installation Instructions handout
  - Mac OSx
  - Windows
- Let's get to it!