today’s topics:
- relational databases
- SQL

relational databases
- a relational database consists of multiple tables
- each table is defined as having a number of fields
- data is stored in a table so that a single entry in a table, called a record, provides one data element for each field
- a table can be thought of as a spreadsheet, where the fields are columns in the spreadsheet, and the records are rows
- records can have “unique” fields, which are called keys
- if a record does not have a value for a particular field, then a NULL value is entered
- “relational” databases consist of multiple tables that relate to each other by having one column (field) in common

SQL
- SQL = Structured Query Language
- MySQL is a free database management system (DBMS) that implements SQL
  http://www.mysql.com
- basic data definition commands:
  - CREATE — to create a table
  - DESCRIBE — to describe a table’s definition
  - DROP — to delete a table
- basic data manipulation commands:
  - INSERT — to put data into a table
  - SELECT — to see what is in a table
  - UPDATE — to edit data that is already in a table
  - DELETE — to remove data from a table

example: create, describe, insert, select
- tblUser
  userID | lastname | firstname
  1     | sklar    | elizabeth
  2     | mouse    | mickey
  3     | mouse    | minnie
  4     | potter   | harry
- The userID uniquely identifies a single person in the tblUser table.
- tblBday
  bdayID | month | day
  1     | 12    | 11
  2     | 10    | 9
  3     | 8     | 7
- The bdayID uniquely identifies a single birth date in the tblBday table.
- These are connected using a “relation” called rltUserBday.
• **rltUserBday**

<table>
<thead>
<tr>
<th>userID</th>
<th>bdayID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

- The **rltUserBday** table is used to join the **tblUser** table to the **tblBday** table in order to look up a person’s birthday.
- Note that users with userID=1 and userID=4 have the same birthday!
- Here is the “join” command in mysql:

```sql
SELECT * FROM tblUser, tblBday, rltUserBday WHERE tblUser.userID=rltUserBday.userID AND tblBday.bdayID=rltUserBday.bdayID;
```

- Here are the commands to generate the example.
  - Note the convention of putting MySQL keywords in all CAPS.
  - First, create the user table:
    ```sql
    mysql> CREATE TABLE tblUser (userID INT(11) NOT NULL PRIMARY KEY AUTO_INCREMENT, lastname TEXT, firstname TEXT);
    ```
    - Note the keywords:
      - “NOT NULL” means that the field can never be null (empty)
      - “PRIMARY KEY” means that the field must be unique
      - “AUTO_INCREMENT” means that MySQL will generate a unique key automatically
  - Second, create the birthday table:
    ```sql
    mysql> CREATE TABLE tblBday (bdayID INT(11) NOT NULL PRIMARY KEY AUTO_INCREMENT, month INT, day INT);
    ```
  - Third, create the relation:
    ```sql
    mysql> CREATE TABLE rltUserBday (userID INT(11) NOT NULL PRIMARY KEY, bdayID INT(11) NOT NULL);
    ```
  - Now look at your tables:
    ```sql
    mysql> SHOW TABLES;
    mysql> DESCRIBE tblUser;
    ```
    - to get a list of all the tables in your database
    - to look at the definition of the user table
  - Next, put data into your user table using the “INSERT” command:
    ```sql
    mysql> INSERT INTO tblUser (lastname, firstname) VALUES ('sklar', 'elizabeth');
    mysql> INSERT INTO tblUser (lastname, firstname) VALUES ('mouse', 'minnie');
    mysql> INSERT INTO tblUser (lastname, firstname) VALUES ('potter', 'harry');
    ```
    - and look at your data:
      ```sql
      mysql> SELECT * FROM tblUser;
      ```
Then, put data into your bday table:

```
mysql> INSERT INTO tblBday (month, day) VALUES (12, 11);
mysql> INSERT INTO tblBday (month, day) VALUES (10, 9);
mysql> INSERT INTO tblBday (month, day) VALUES (8, 7);
```

and look at your data:

```
mysql> SELECT * FROM tblBday;
```

Then, populate the user-bday relation. You can do this manually:

```
mysql> INSERT INTO rltUserBday (userID, bdayID) VALUES (1, 1);
```

which requires that you know what the values of `userID` and `bdayID` are.

You can also do this with a query that looks up the ID values and inserts them automatically into the relation:

```
INSERT INTO rltUserBday (userID, bdayID)
SELECT userID, bdayID
FROM tblUser, tblBday
WHERE lastname='sklar'
AND firstname='elizabeth'
AND month=1
AND day=1;
```

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**Updating table values**

- use the `UPDATE` command to change the values in a table

  ```
  UPDATE tblUser
  SET lastname='mantle'
  WHERE firstname='mickey';
  ```

**Deleting entries from tables**

- use the `DELETE` command to remove an entry (row) from a table

  ```
  mysql> DELETE
  FROM tblUser
  WHERE lastname='mouse';
  ```

- WARNING: be careful when deleting! I always run a `SELECT` command first, to make sure that I am deleting the row(s) that I wanted:

  ```
  mysql> SELECT *
  FROM tblUser
  WHERE lastname='mouse';
  ```

  ```
  mysql> DELETE
  FROM tblUser
  WHERE lastname='mouse';
  ```
deleting tables

- you can delete an entire table using the DROP command

```sql
mysql> DROP TABLE tblUser;
```