Today

- Using the DB Server / MariaDB
- Creating tables in SQL (cont)

Assignments

- HW2 out, due next Tues
Basic Table Declarations (CREATE TABLE)

CREATE TABLE tablename ( 
    att1 type1, 
    att2 type2, 
    ... 
); 

where:

• att1 is the name of the attribute and type1 is the data type (domain)
• table created from within an existing database

We can also add various additional information:

• constraints (e.g., NOT NULL, keys, foreign keys)
• default values
• in MySQL, the underlying DB engine
• and so on ...
Defining the Accounts table:

- account(number, owner, balance, type)

Q: What would be reasonable data types?

Q: What is the CREATE TABLE statement?

```sql
CREATE TABLE account (
    number INT,
    owner VARCHAR(50), -- or: owner TINYTEXT
    balance DECIMAL(8,2),
    type VARCHAR(8), -- or: type ENUM('checking', 'savings')
);
```

Recall that “number” is a primary key ...

```sql
CREATE TABLE account (
    number INT,
    owner VARCHAR(50),
    balance DECIMAL(8,2),
    type VARCHAR(8),
    PRIMARY KEY (number)
);
```
Q: How would we create this table? ... ignoring FKs for now

- check(account, number, amount, date)

```sql
CREATE TABLE check (
    account INT,
    check_number INT,
    date VARCHAR(10), /* better to use date type here */
    amount DECIMAL(8,2),
    PRIMARY KEY (account, check_number)
);
```

**Defining a foreign key:**

```sql
CREATE TABLE check (
    account INT,
    check_number INT,
    date VARCHAR(10),
    amount DECIMAL(8,2),
    PRIMARY KEY (account, check_number),
    FOREIGN KEY (account) REFERENCES accounts (number)
);
```
Connecting to our MariaDB server ...

See handout ...
Declaring Tables in SQL (redux)

Defining the Account table:

- better names, more specific types

```sql
CREATE TABLE account (
    account_id INT UNSIGNED,
    owner TINYTEXT NOT NULL,
    balance DECIMAL(8,2) UNSIGNED NOT NULL,
    account_type ENUM('checking', 'savings'),
    PRIMARY KEY (account_id)
) ENGINE = InnoDB;
```

Defining the Check table:

```sql
CREATE TABLE check_transaction (
    account_id INT UNSIGNED,
    check_number INT UNSIGNED NOT NULL,
    check_date DATE,
    amount DECIMAL(8,2) NOT NULL,
    PRIMARY KEY (account_id, check_number),
    FOREIGN KEY (account_id) REFERENCES account (account_id)
) ENGINE = InnoDB;
```
Naming your constraints

```sql
CREATE TABLE check_transaction ( 
  account_id INT UNSIGNED,
  check_number INT UNSIGNED NOT NULL,
  check_date DATE,
  amount DECIMAL(8,2) UNSIGNED NOT NULL,
  PRIMARY KEY (account_id, check_number),

  CONSTRAINT account_fk FOREIGN KEY (account)
    REFERENCES account (number)
) engine = InnoDB;
```

Remove constraints “after the fact” (by name)

```sql
ALTER TABLE check DROP FOREIGN KEY account_fk;
```

NOTE 1: Don’t usually do this for foreign keys ...

NOTE 2: MySQL and FKs

- the default database engine in MySQL is MyISAM (more later)
- which doesn’t support FKs
- instead use engine=InnoDB:

```sql
CREATE TABLE mytable ( ... ) engine = InnoDB;
```
Adding constraints “after the fact”

ALTER TABLE check_transaction ADD CONSTRAINT account_fk
    FOREIGN KEY (account_id) REFERENCES account (account_id);

Dropping a foreign-key constraint

ALTER TABLE check_transaction DROP FOREIGN KEY account_fk;

CHECK constraints ...

CREATE TABLE check_transaction (  
    account_id INT UNSIGNED,  
    check_number INT UNSIGNED,  
    check_date DATE,  
    amount DECIMAL(8,2) UNSIGNED,  
    PRIMARY KEY (account_id, check_number),  

    CONSTRAINT account_fk FOREIGN KEY (account)
        REFERENCES account (number),

    CONSTRAINT check_amt_range
        CHECK (amount > 0 and amount <= 100000)

) engine = InnoDB;

Or can add it “after the fact”

Can also drop it “after the fact”

ALTER TABLE check_transaction DROP CONSTRAINT check_amt_range;
Prohibiting NULL values

• NULL is a special value in SQL
• using NULL values can be very tricky!!! (more later)
• you can constrain attributes to be not null

```sql
CREATE TABLE check_transaction (  
    account_id INT UNSIGNED NOT NULL,  -- primary keys always not null
    check_number INT UNSIGNED NOT NULL,
    check_date DATE,
    amount DECIMAL(8,2) UNSIGNED NOT NULL,
    ...
) engine=InnoDB;
```

• e.g., OK for the date field to have NULL values (i.e., might not be known)
• every other value must not be NULL
Inserting Values

\[
\begin{align*}
&\text{INSERT INTO table VALUES (v1, v2, ...);} \\
&\text{INSERT INTO table VALUES (v1, v2, ...), (v3, v4, ...), ...;} \\
&\text{INSERT INTO table(a1, a2) VALUES (v1, v2);} \\
&\text{INSERT INTO table SET a1 = v1, a2 = v2, ...;} \\
\end{align*}
\]

For example:

\[
\begin{align*}
&\text{INSERT INTO account} \\
&\text{VALUES (101, 'J. Smith', 1000.00, 'checking');}
\end{align*}
\]

Default Values

\[
\begin{align*}
&\text{CREATE TABLE account (} \\
&\quad \text{account_id INT UNSIGNED,} \\
&\quad \text{owner TINYTEXT NOT NULL,} \\
&\quad \text{balance DECIMAL(8,2) UNSIGNED NOT NULL DEFAULT 5.00,} \\
&\quad \text{account_type ENUM('checking', 'savings') DEFAULT 'checking',} \\
&\quad \text{PRIMARY KEY (account_id)} \\
&\quad\); \\
\end{align*}
\]

For example:

\[
\begin{align*}
&\text{INSERT INTO account(account_id, owner) VALUES (102, 'W. Wei');}
\end{align*}
\]

Produces the row:

\[
\begin{align*}
&\text{+---------------------------+} \\
&| 102 | W. Wei | 5.00 | checking |
\end{align*}
\]
Removing tables (DROP TABLE)

    DROP TABLE check_transaction;

• Note: this removes the entire table!

    DROP TABLE IF EXISTS check_transaction;

• only removes table if it has already been created

• good for avoiding errors in a script

Note if you have foreign keys, the order you drop tables matters!

Q: Why?
More on MariaDB

To change your password:

```
mysql> SET PASSWORD FOR 'login'@'%' = password('newpass');
```

- note the second one only works for how we’re connecting to the server

Use `describe tablename` to get information about a table’s schema

```
mysql> describe test;
+-------+------------+------+-----+---------+-------+
| Field | Type       | Null | Key | Default | Extra |
+-------+------------+------+-----+---------+-------+
| id    | int(11)    | NO   | PRI | 0       |       |
| val   | varchar(3) | YES  |     | NULL    |       |
+-------+------------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

- Note this is just another table!
- Use `show create table test` to see the corresponding SQL

MariaDB Strict Mode

By default, MariaDB doesn’t enforce all constraints

- it does enforce Primary Keys
- and Foreign Keys if InnoDB is used

To tell MariaDB to enforce other constraints (like ENUMs), use:

```
SET sql_mode = STRICT_ALL_TABLES;
```