

SQL Data Definition Language I

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1 Administrivia

Announcements

Recommendation: Use a special section of your notebook to collect SQL statement details. It will grow in terms of number of statements and aspects of statements; plan accordingly.

Assignment

Have a look through the *PostgreSQL Documentation* on the course web site to familiarize yourself with PostgreSQL.

From Last Time

Intro to relational data model.

Outline

1. SQL, psql info.
2. SQL DDL: creating tables, primary and candidate keys, constraints, and foreign keys.
3. Exercise.

Coming Up

SQL DDL II.

2 SQL Variants, Useful psql Meta-Commands

1. SQL-92.

Most DBMSs support most of this, with extensions.

2. SQL:99.

Some DBMSs support parts of this.

3. SQL 3.

Some DBMSs support parts of this?

Some useful psql meta-commands:

1. `\i <filename>` — Read and execute a list of SQL commands in the text file `<filename>`.
2. `\d <table>` — List `<table>`'s description.
3. `\l` — List available databases on the system.
4. `\ds` — Display list of system tables. Example queries on two system tables:

```
SELECT * FROM pg_user;  
SELECT * FROM pg_tables;
```

5. `\dp` — List permissions in current database.
6. `\dt` — List tables in current database.

Run `\?` in psql for the entire list and see the man page for psql.

3 SQL DDL

What we need to do:

1. Create tables.
2. Create assertions within tables.
 - (a) Domain constraints: NOT NULL, DEFAULT.
 - (b) Semantic constraints (cannot order a negative number of widgets).
 - (c) Keys: primary, candidate, and foreign.
3. Create assertions between (external to) tables.
4. Create data types (or restrict existing types).

3.1 Creating Tables

```
CREATE TABLE Course (  
  CrsCode      CHAR(6),  
  DeptId       CHAR(4),  
  CrsName      CHAR(20),  
  Descr        CHAR(100) ); -- Use text?
```

Some data types in PostgreSQL:

1. Numeric:
 - (a) INTEGER — four bytes. Also SMALLINT and BIGINT.
 - (b) REAL — single precision. Also DOUBLE PRECISION.
 - (c) SERIAL — unique serial number. Some caveats — see manual.

2. Character:

- (a) CHAR(*n*) — fixed length string of *n* characters.
- (b) VARCHAR(*n*) — variable length string of at most *n* characters.
- (c) TEXT — variable length string without limit. Not SQL standard.

3. Others: Monetary, date/time, boolean, etc.

See manual.

(Refer to the online documentation for details.

3.2 Primary and Candidate Keys

```
CREATE TABLE Course (  
  CrsCode      CHAR(6),  
  DeptId       CHAR(4),  
  CrsName      CHAR(20),  
  Descr        CHAR(100),  
  PRIMARY KEY (CrsCode),  
  UNIQUE (DeptId, CrsName) );
```

- 1. One PRIMARY KEY. Table usually indexed on this.
- 2. One UNIQUE constraint for each remaining candidate key.

3.3 Specifying Constraints

- 1. Domain and semantic constraint examples:

```
CREATE TABLE Course (  
  CrsCode      CHAR(6) NOT NULL,  
  Limit        INTEGER DEFAULT '10',  
  Division     CHAR(5),
```

```

DeptId      CHAR(4),
CrsName     CHAR(20),
Descr      CHAR(100),
CHECK (Limit > 0 AND Limit <= (SELECT MAX(Seats) from Room)),
CHECK (Division IN ('Upper', 'Lower')) );

```

(a) Use for intra-table constraints.

(b) Chicken and egg problem: use ALTER TABLE to add checks once tables are populated.

2. Assertion example:

```

CREATE ASSERTION CoursesShallNotBeEmpty
CHECK (NOT EXISTS (
    SELECT * FROM Teaching Te
    WHERE NOT EXISTS (
        SELECT * FROM Transcript Tr
        WHERE Te.CrsCode = Tr.CrsCode
        AND Te.Semester = Tr.Semester )));

```

(a) NOT EXISTS: empty set test. EXISTS?

Briefly explain the correlated sub-query: for loop similarity.

(b) Note: this will fail before the registration period!

(c) Use for inter-table constraints.

(d) Tables must first exist!

(e) PostgreSQL does not have assertions! Use triggers?

3.4 Foreign Keys

```

CREATE TABLE Teaching (
    ProfId      INTEGER,
    CrsCode     CHAR(6),

```

```
Semester      CHAR(6),  
PRIMARY KEY (CrsCode, Semester),  
FOREIGN KEY (CrsCode) REFERENCES Course,  
FOREIGN KEY (ProfID) REFERENCES Professor (Id) );
```

1. In PostgreSQL the referenced key must be a primary key!

4 Exercise

See handout.