SQL Overview
Defining a Schema
CPSC 315 – Programming Studio

Project 1, Lecture 3

Slides adapted from those used by Jeffrey Ullman, via Jennifer Welch

Generations of Programming Languages

• 1st generation
  - Machine code
• 2nd generation
  - Human-readable but directly related to processor
  - Assembly language, C (sort of)
• 3rd generation
  - Abstraction from processor, easier for humans
  - Fortran, C/C++, Java, etc.
• 4th generation
  - Programming Language for specific task
  - e.g. SQL, Matlab
• 5th generation
  - Give constraints (goal), and result follows logically
  - e.g. Prolog

SQL

• Structured Query Language
• Database language used to manage and query relational databases
• A well-known, commonly used standard
  - Regularly updated
• Many extensions, variations
  - Platform-specific versions, etc.

SQL Elements

• Data Definition Language (DDL)
  - Supports creation of database schema
• Data Manipulation Language (DML)
  - Supports entering/removing data
• Querying Language
  - Supports query operations (don’t change data itself)
• Others:
  - Transaction control, Data control
Our Discussion of SQL

• Will highlight some of the structures and features of SQL
• Give you an idea of the basics of how it works
  – Reflects how relational databases work
  – Not meant to make you SQL programmers
• You will need to implement equivalent functions for parts of what we discuss

Database Schema

• The set of relations (tables) in the database.
• Create, delete, change tables

CREATE

• Define a relation
CREATE TABLE <name> ( 
    <element list>
);

Element Types

• INT, INTEGER
  – Integers
• FLOAT, REAL
  – Floating-Point numbers
• CHAR(n)
  – Fixed-length string of n characters
• VARCHAR(n)
  – Variable-length string of up to n characters
• DATE
  – yyyy-mm-dd
• TIME
  – hh:mm:ss

element = <name> <type>
Example

CREATE TABLE HouseRep (  
    Name VARCHAR(80),  
    Party CHAR(10),  
    Birthdate DATE,  
    YearsInCongress INT,  
    Salary REAL  
);

Declaring Keys

- Keys declared within CREATE statement
- Key attributes functionally determine all other attributes in the relation
- List under PRIMARY KEY
  - Elements of primary key can not be NULL

Example

CREATE TABLE HouseRep (  
    Name VARCHAR(80),  
    Party CHAR(10),  
    Birthdate DATE,  
    YearsInCongress INT,  
    Salary REAL,  
    PRIMARY KEY (Name)  
);

Example

CREATE TABLE HouseRep (  
    Name VARCHAR(80),  
    Party CHAR(10),  
    Birthdate DATE,  
    YearsInCongress INT,  
    Salary REAL,  
    PRIMARY KEY (Name, Birthdate)  
);
Other Element Modifiers

- **UNIQUE**
  - Placed after type
  - Only one tuple in that relation for each value (except NULL)
  - Can imply key if no primary key given
  - Can be NULL
- **NOT NULL**
  - Cannot take value NULL
- **DEFAULT**
  - Default value specified

Example

```sql
CREATE TABLE HouseRep (  
    Name VARCHAR(80) UNIQUE,  
    Party CHAR(10),  
    Birthdate DATE NOT NULL,  
    YearsInCongress INT    
            DEFAULT 0,  
    Salary REAL  
            DEFAULT 120000.00
);  
```

Other Table Modifications

- **DROP <name>**
  - Deletes that table
- **ALTER TABLE <name> ADD <attribute>**
  - Adds a new column to table
- **ALTER TABLE <name> DROP <attribute>**
  - Removes the column from the table

Views

- Views are a sort of “virtual table”, usually created as the result of a query
  - We'll discuss queries later
- **Format:**
  ```sql
  CREATE VIEW <name> AS <query>
  ```