Relational Databases

CPSC 315 – Programming Studio

Project 1, Lecture 2

Schemas

- A **relation schema** is a relation name and a list of attributes
  - Sponsor(Senator, Bill)
- A **database** is a collection of relations
- A **database schema** is the set of all the relation schemas in the database

Relational Data Model

- Relations are stored in tables
  - e.g. Sponsor(Senator, Bill)

Converting from Entity-Relationship Model

- ER: Entity set -> relation
  - ER Attributes become Relational attributes
- ER: Relationship -> relation
  - Keys of connected ER entity sets become Relational attributes
ER Entity Sets

- Senator (Name, Party, State, Years)
- Bill (Name, Text)
- Lobbyist (Name, Organization)

ER Relationships

- Sponsored (Senator, Bill)
- Wrote (Bill, Lobbyist)
- Contributed (Senator, Lobbyist)

Relations

- Remember, each of these is expressed as a table (with the columns given by the “parameters”)
- Notice that columns can refer to “bigger” items, with even more attributes
Combining Relations

- Relations can sometimes be combined.
- Assume a “base” entity set with its relation.
- If there is a many-to-one relation, that can be combined with the base entity set.
- Should **not** combine many-to-many
  - Redundancy – each of the many stored

Example (many-to-one): (Good)
- Person(Name, Birthdate, Height, Weight, Eye Color, Hair Color)
- BornIn(Person, Town)
- Person(Name, Birthdate, Height, Weight, Eye Color, Hair Color, Town)

Example (many-to-many): (Bad)
- Senator(Name, Party, State, Years)
- Sponsored(Senator, Bill)
- Senator(Name, Party, State, Years, Bill)

Weak Entity Sets

- The relation for a weak entity set must contain all the elements of its key
- Supporting relationships are usually redundant (unless possibly multi-way)

Weak Entity Set Example

[Diagram of a weak entity set example showing relationships between Baseball Player, Team, City, Name, etc.]
Weak Entity Set Example

- Team(\text{Name}, \text{City})
- Baseball Player(\text{Number}, \text{TeamName}, \text{First Name}, \text{Last Name}, \text{Position}, \text{Birthdate}, \text{Nationality}, \text{Salary})

Note that we don’t need PlaysOn(BaseballPlayer\text{.Number}, BaseballPlayer\text{.TeamName}, Team\text{.Name})
Weak Entity Set Example

- Team(Name, City)
- Baseball Player(Number, TeamName, First Name, Last Name, Position, Birthdate, Nationality, Salary)
- Note that we don’t need PlaysOn(BaseballPlayer.Number, BaseballPlayer.Team.Name)

Subclasses
Different Options

- Different ways to represent subclasses

Object-Oriented Style

- One relation for each subset, including all “inherited” attributes

<table>
<thead>
<tr>
<th>Elected Official</th>
<th>U.S. Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Party</td>
</tr>
<tr>
<td>Chet Edwards</td>
<td>Democrat</td>
</tr>
<tr>
<td>John Cornyn</td>
<td>Republican</td>
</tr>
<tr>
<td>John Adams</td>
<td>Federalist</td>
</tr>
<tr>
<td>Ron Paul</td>
<td>Republican</td>
</tr>
</tbody>
</table>

Entity-Relationship Style

- One relation for each subclass (including key)

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Using Nulls Style

- One relation total, with nulls for unknown information.
- Can save space, but problematic if multiple subclasses or lots of NULLs.

<table>
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<th>Party</th>
<th>District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chet Edwards</td>
<td>Democrat</td>
<td>17</td>
</tr>
<tr>
<td>John Cornyn</td>
<td>Republican</td>
<td>NULL</td>
</tr>
<tr>
<td>John Adams</td>
<td>Federalist</td>
<td>NULL</td>
</tr>
<tr>
<td>Ron Paul</td>
<td>Republican</td>
<td>14</td>
</tr>
</tbody>
</table>

Keys

- A Key “functionally determines” all other attributes of the relation.
  - Given a relation and a key, there is only one tuple that corresponds to it.
- There are subtle differences from an E-R key, which we won’t go into.