Relational Databases

CPSC 315 – Programming Studio

Project 1, Lecture 2

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

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Relational Data Model

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

Sponsor	
Senator	**Bill**
Smith	Tax
Jones	Defense
Smith	Defense
Adams	Commerce

Atrributes

Tuples

Schemas

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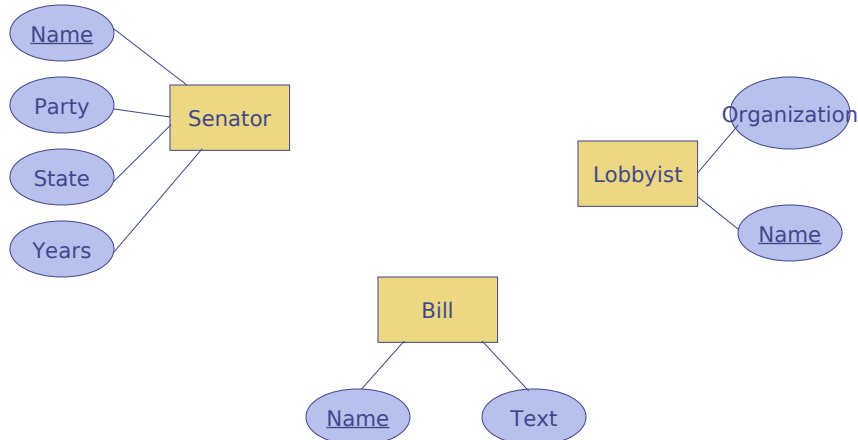- A **database schema** is the set of *all* the relation schemas in the database

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Converting from Entity-Relationship Model

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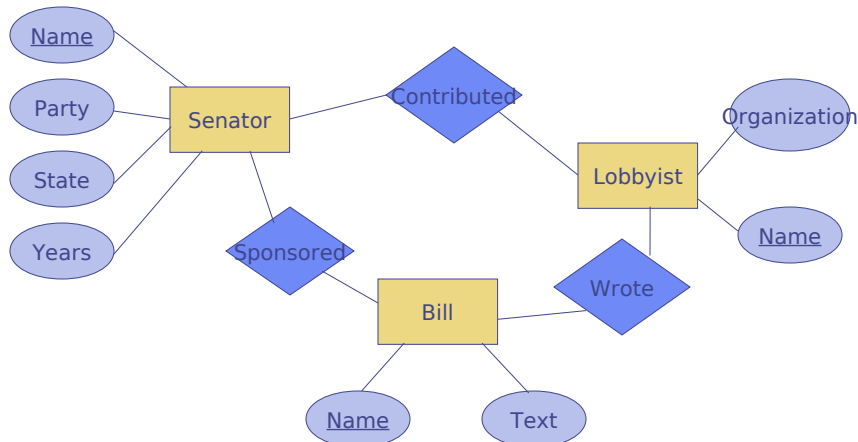 - Keys of connected ER entity sets become Relational attributes

ER Entity Sets

Relations

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

ER Relationships

Relations

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

- 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

Combining Relations

- 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
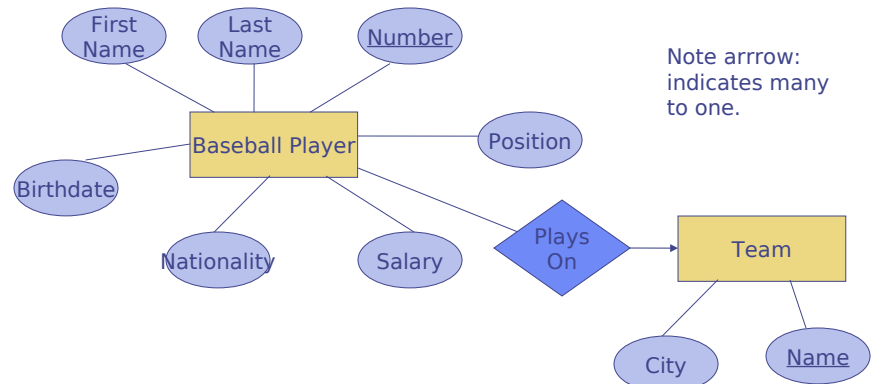
Note arrrow: indicates many to one.

First Name
Last Name
Number
Baseball Player
Position
Birthdate
Nationality
Salary
Plays On
Team
City
Name

Weak Entity Set Example

- Team(<u>Name</u>, City)
- Baseball Player(<u>Number</u>, <u>TeamName</u>, First Name, Last Name, Position, Birthdate, Nationality, Salary)

Weak Entity Set Example

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

Weak Entity Set Example

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

Redundant (same)

Weak Entity Set Example

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

Weak Entity Set Example

- Team(<u>Name</u>, City)
- Baseball Player(<u>Number</u>, <u>TeamName</u>, First Name, Last Name, Position, Birthdate, Nationality, Salary)
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Already Included

Subclasses
Different Options

- Different ways to represent subclasses
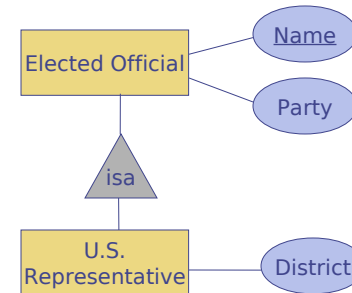
Object-Oriented Style

- One relation for each subset, including all "inherited" attributes

Elected Official	
Name	**Party**
Chet Edwards	Democrat
John Cornyn	Republican
John Adams	Federalist
Ron Paul	Republican

U.S. Representative		
Name	**Party**	**District**
Chet Edwards	Democrat	17
Ron Paul	Republican	14

Entity-Relationship Style

- One relation for each subclass (including key)

Elected Official	
Name	**Party**
Chet Edwards	Democrat
John Cornyn	Republican
John Adams	Federalist
Ron Paul	Republican

U.S. Representative	
Name	**District**
Chet Edwards	17
Ron Paul	14

Using Nulls Style

- One relation total, with nulls for unknown information

U.S. Representative		
Name	**Party**	**District**
Chet Edwards	Democrat	17
John Cornyn	Republican	**NULL**
John Adams	Federalist	**NULL**
Ron Paul	Republican	14

- Can save space, but problematic if multiple subclasses or lots of NULLs

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.