

# Relational Databases

CPSC 315 – Programming Studio

Project 1, Lecture 2

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

## 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

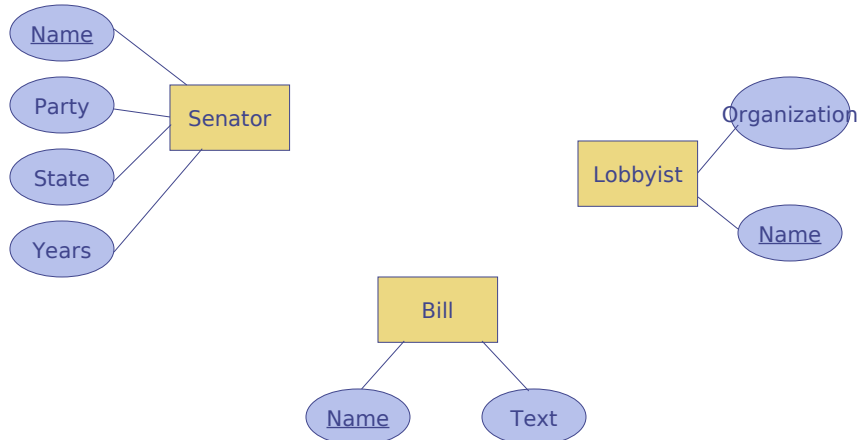
- Relations are stored in tables
  - e.g. Sponsor(Senator,Bill)

Sponsor	
Senator	Bill
Smith	Tax
Jones	Defense
Smith	Defense
Adams	Commerce

## 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

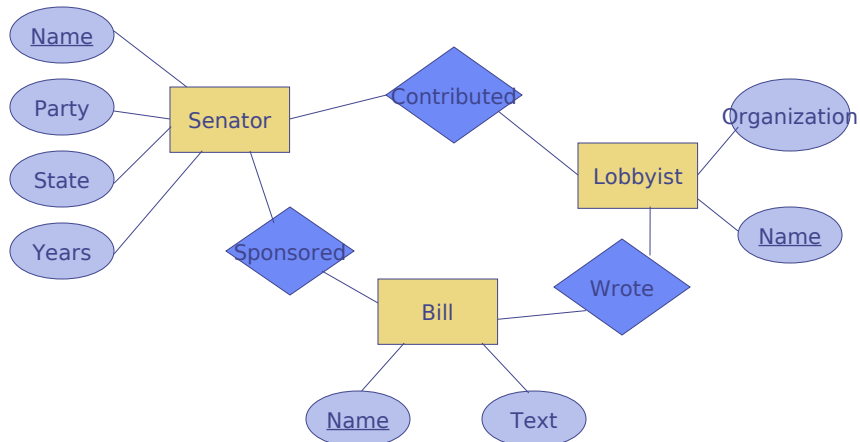
## ER Entity Sets



## 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

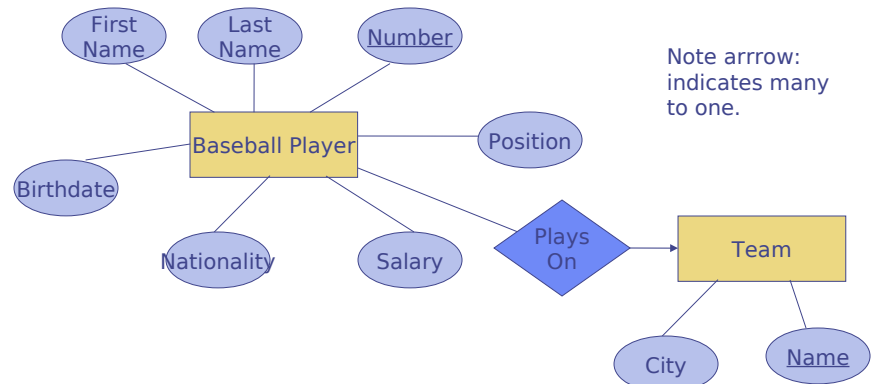
## Combining Relations

- 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



## Weak Entity Set Example

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

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- 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.TeamName, Team.Name)

## Weak Entity Set Example

- Team(Name, City)
- Baseball Player(Number, TeamName, First Name, Last Name, Position, Birthdate, Nationality, Salary)
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Redundant (same)



## Weak Entity Set Example

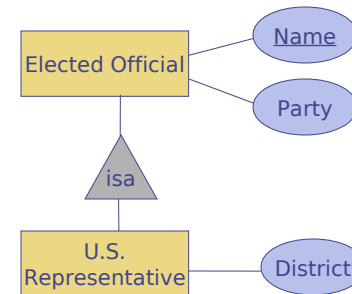
- Team(Name, City)
- Baseball Player(Number, TeamName, First Name, Last Name, Position, Birthdate, Nationality, Salary)
- Note that we don't need PlaysOn(BaseballPlayer.Number, BaseballPlayer.Team.Name)

## 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)
- 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.