CS 405G: Introduction to Database Systems

Database Design II

Review

- From Database Requirement to Relational Model
  - Entity type(set)s
  - Relationship types

Next: ER-Design Principles

- Avoid redundancy.
- Limit the use of weak entity sets.
- Don’t use an entity set when an attribute will do.

Avoiding Redundancy

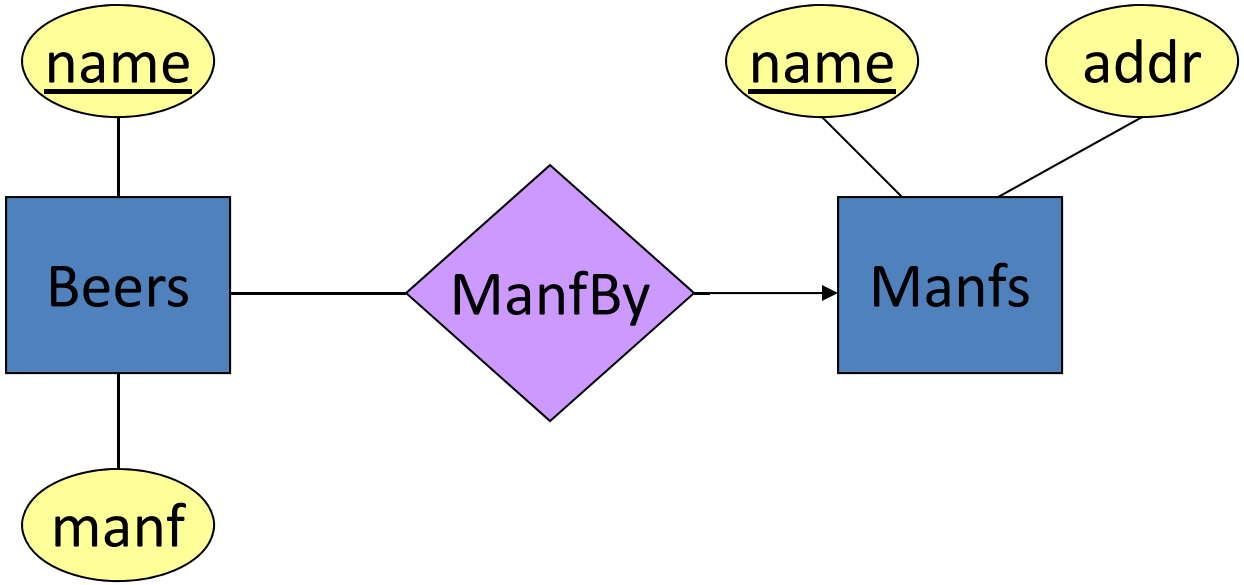
- Redundancy occurs when we say the same thing in two different ways.

- Redundancy
  - wastes space
  - (more importantly) encourages inconsistency.
  - The two instances of the same fact may become inconsistent if we change one and forget to change the other, related version.

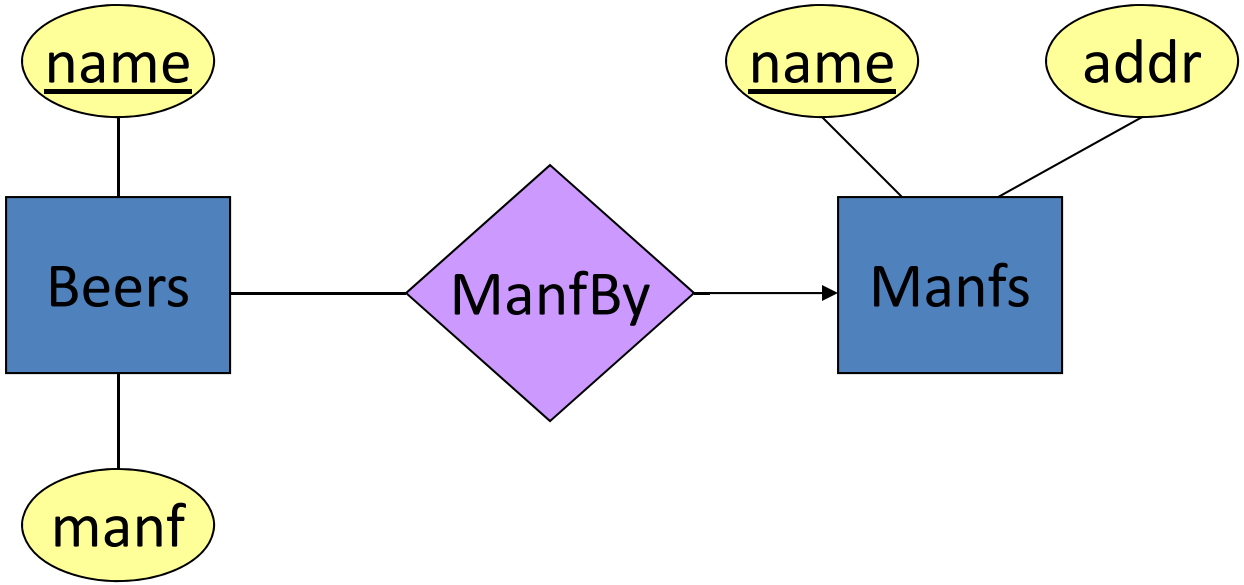
Example

- Assume we would like to set up a database for a wine distribution company.
  - Wine
  - Manufacture

Example

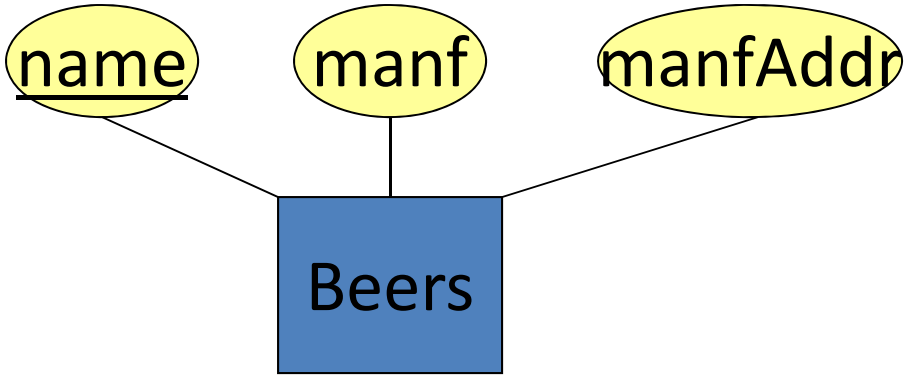


Example

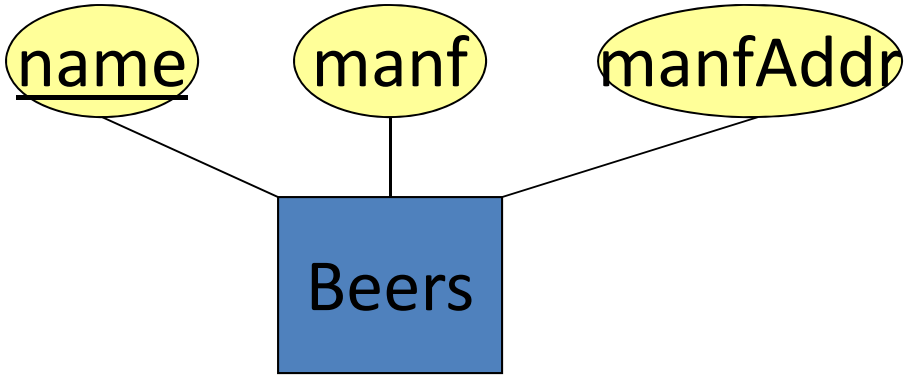


This design states the manufacturer of a beer twice: as an attribute and as a related entity.

Example

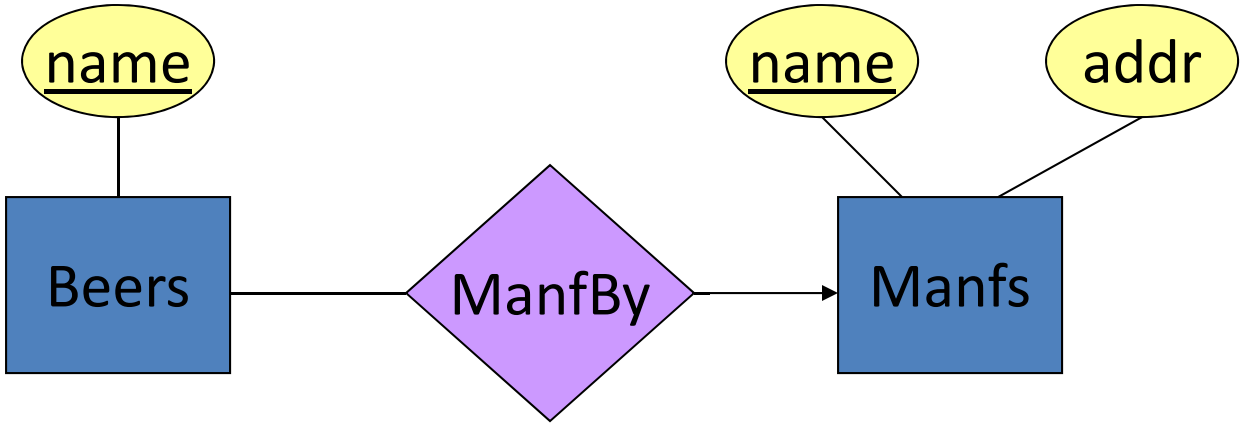


Example

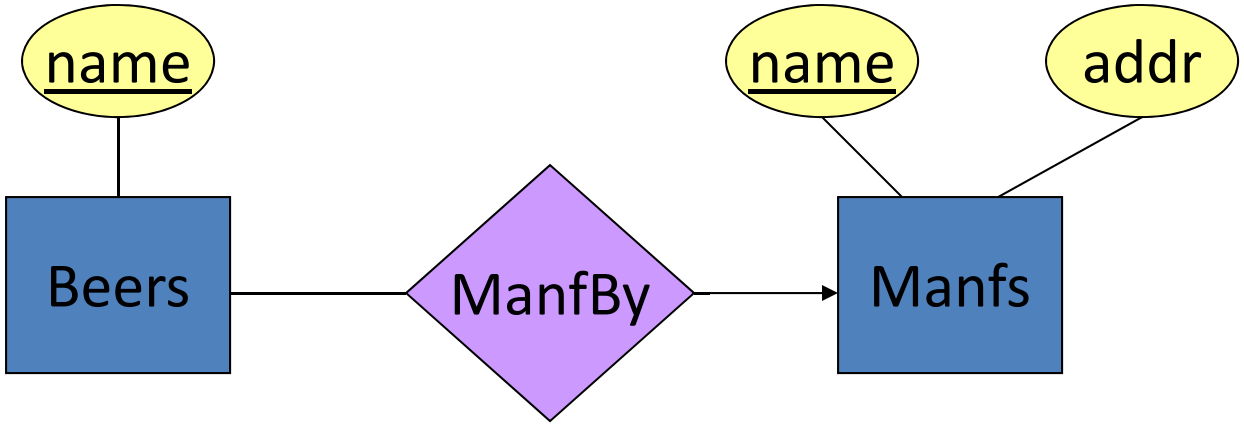


This design repeats the manufacturer's address once for each beer; loses the address if there are temporarily no beers for a manufacturer.

Example



Example



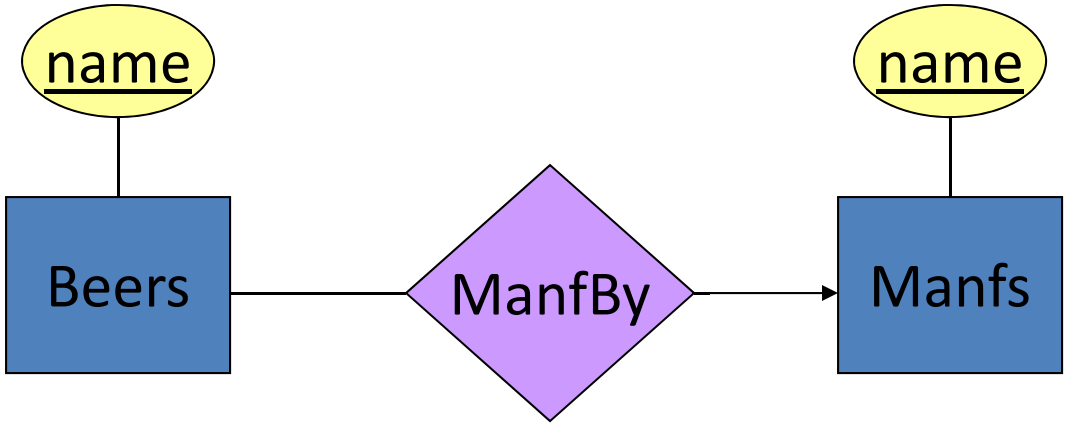
This design gives the address of each manufacturer exactly once.

Entity Sets Versus Attributes

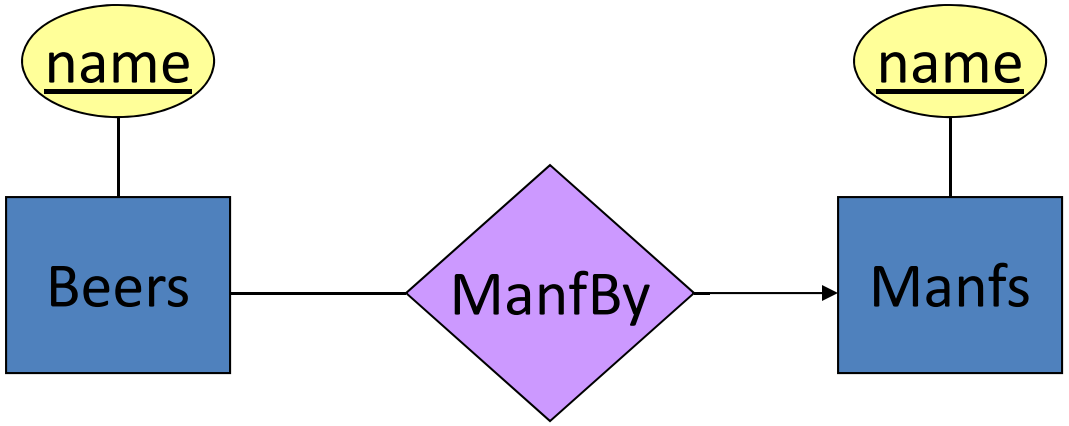
- An entity set should satisfy at least one of the following conditions:
  - It is more than the name of something;
  - it has at least one nonkey attribute.

    or
  - It is the “many” in a many-one or many-many relationship.

Example: Bad

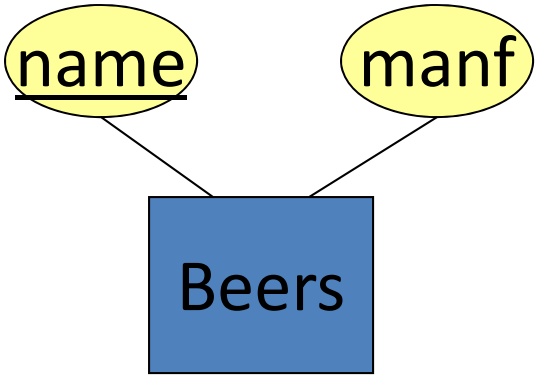


Example: Bad



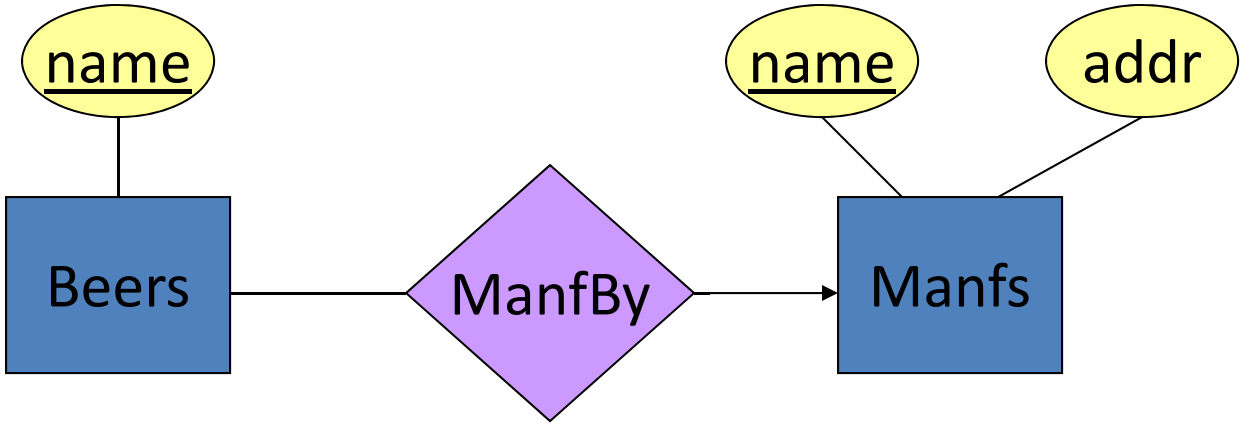
Since the manufacturer is nothing but a name, and is not at the "many" end of any relationship, it should not be an entity set.

Example: Good



There is no need to make the manufacturer an entity set, because we record nothing about manufacturers besides their name.

Example: Good



- *Manfs* deserves to be an entity set because of the nonkey attribute *addr*.
- *Beers* deserves to be an entity set because it is the "many" of the many-one relationship *ManfBy*.

Don’t Overuse Weak Entity Sets

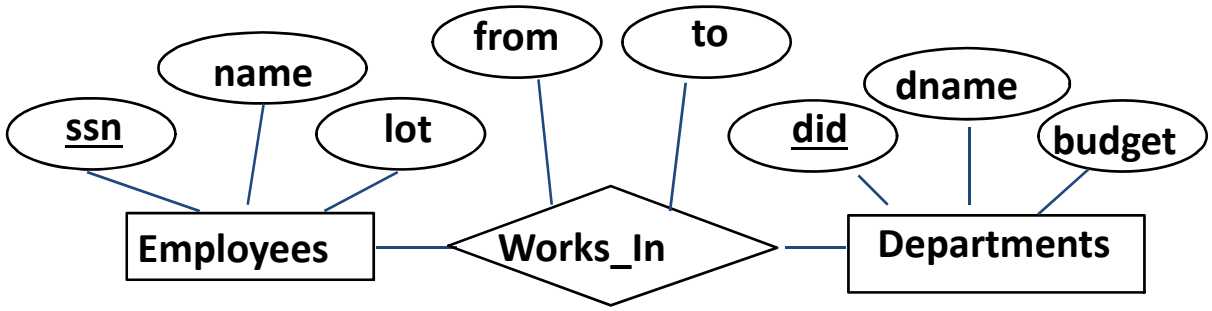
- Beginning database designers often doubt that anything could be a key by itself.
  - They make all entity sets weak, supported by all other entity sets to which they are linked.
- In reality, we usually create unique ID’s for entity sets.
  - Examples include social-security numbers, automobile VIN’s etc.

When Do We Need Weak Entity Sets?

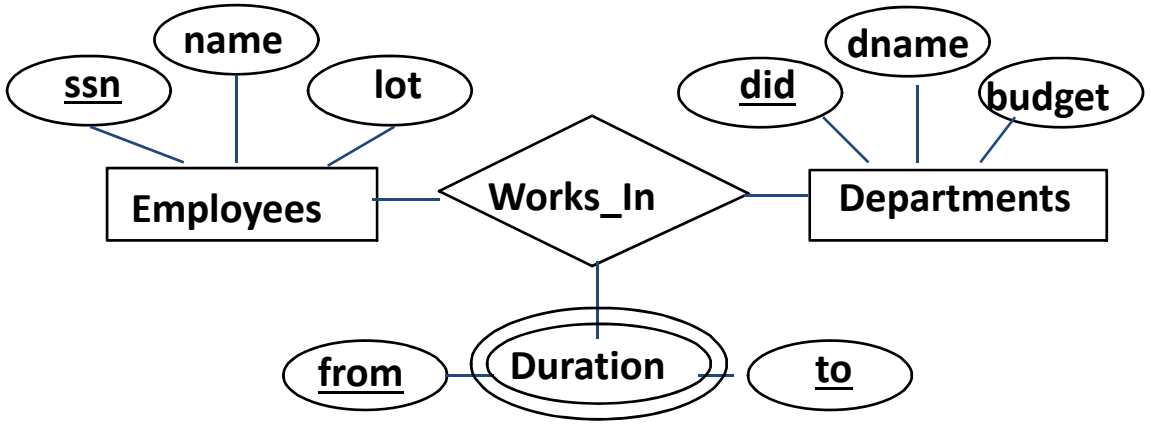
- The usual reason is that there is no global authority capable of creating unique ID's.
  - Example
  - it is unlikely that there could be an agreement to assign unique player numbers across all football teams in the world.

ER Case Study I

- Works_In does not allow an employee to work in a department for two or more periods.



- We want to record *several values of the descriptive attributes for each instance of this relationship.*



ER Case study II

- Design a database representing cities, counties, and states
  - For states, record name and capital (city)
  - For counties, record name, area, and location (state)
  - For cities, record name, population, and location (county and state)
- Assume the following:
  - Names of states are unique
  - Names of counties are only unique within a state
  - Names of cities are only unique within a county
  - A city is always located in a single county
  - A county is always located in a single state

ER Case study

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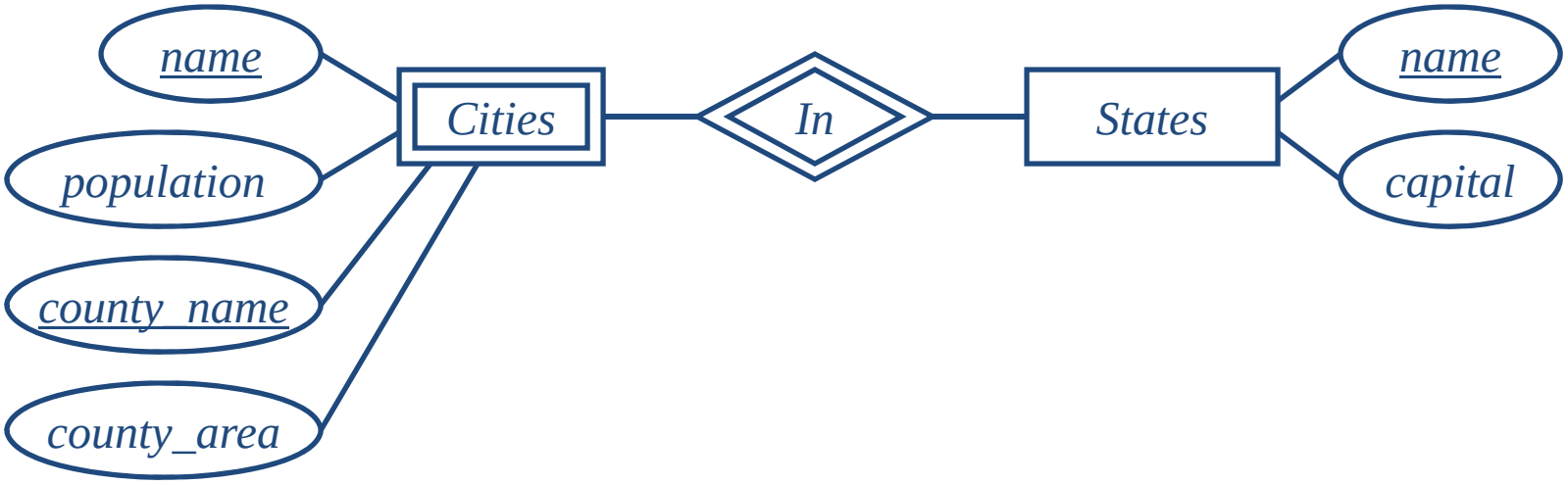
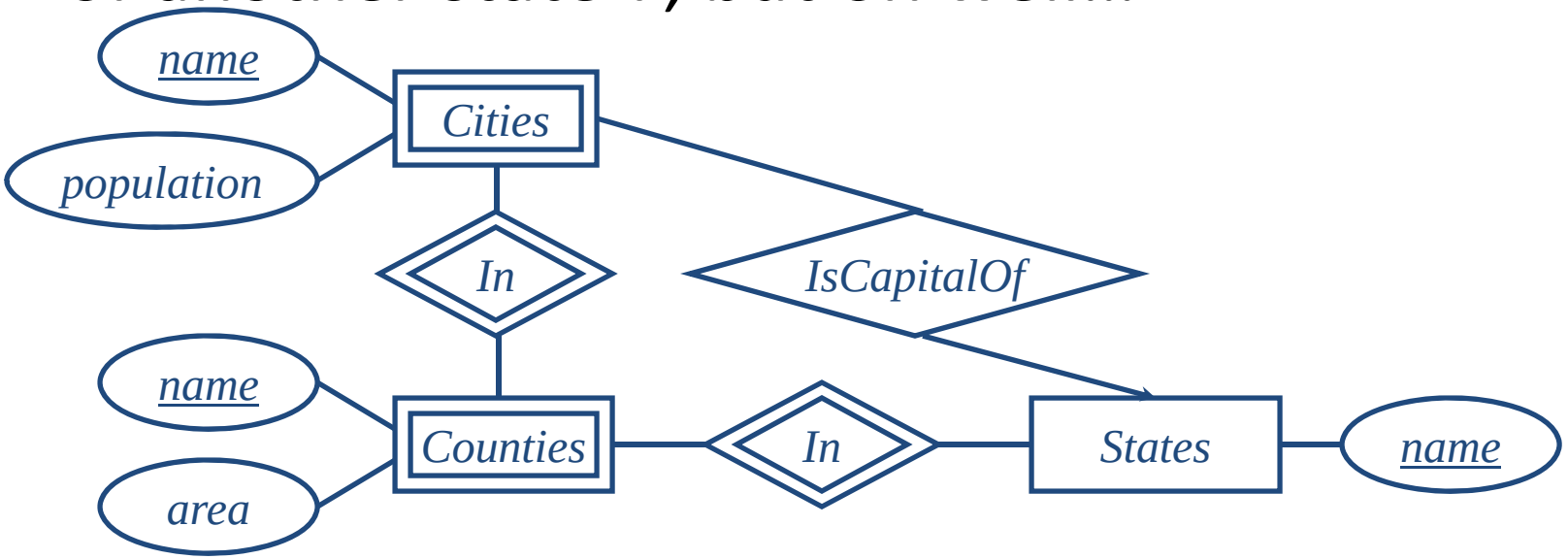
Case study : first design

- County area information is repeated for every city in the county
  - ☞ Redundancy is bad.
  - ☞ What else?
- State capital should really be a city
  - ☞ Should “reference” entities through explicit relationships



Case study : second design

- Technically, nothing in this design could prevent a city in state *X* from being the capital of another state *Y*, but oh well…



Homework

- Reading
  - Chapter 7.1-7.5

- Project
  - Find your partner