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

- name
- manf
- manfAddr

Beers
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

Beers \(\xrightarrow{\text{name}}\) ManfBy \(\xleftarrow{\text{name}}\) Manfs
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