CS 405G: Introduction to Database Systems

Relations

Review

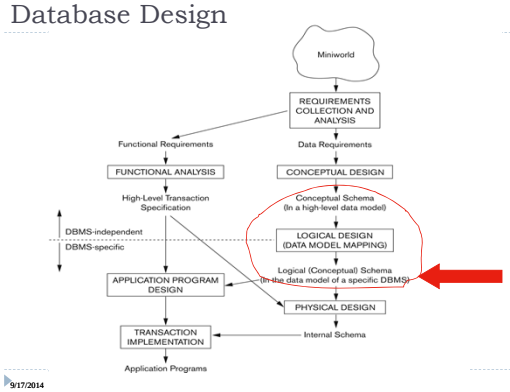
- A data model is
  - a group of concepts for describing data.
- What are the two terms used by ER model to describe a miniworld?
  - Entity
  - Relationship
- What makes a good database design

Student *(sid: string, name: string, login: string, age: integer, gpa:real)*

Topics Next

- Conversion of ER models to Schemas
- Reading Assignment
  - Chapter 3.1, 3.2

Database Design



A Relation is a Table

Attributes (column headers)

Tuples (rows)

name	manf
Winterbrew	Pete's
Bud Lite	Anheuser-Busch

Beers

Schemas

- *Relation schema* = relation name + attributes, in order (+ types of attributes).
  - Example: Beers(name, manf) or Beers(name: string, manf: string)
- *Database* = collection of relations.
- *Database schema* = set of all relation schemas in the database.

Why Relations?

- Very simple model.
- *Often* matches how we think about data.
- Abstract model that underlies SQL, the most important database language today.
  - But SQL uses bags, while the relational model is a set-based model.

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From E/R Diagrams to Relations

- Entity sets become relations with the same set of attributes.
- Relationships become relations whose attributes are only:
  - The keys of the connected entity sets.
  - Attributes of the relationship itself.

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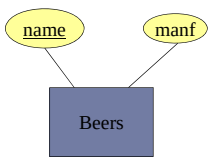
Entity Set -> Relation



Relation: Beers(name, manf)

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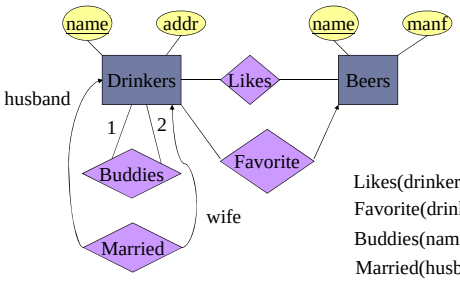
Relationship -> Relation



Likes(drinker, beer)
Favorite(drinker, beer)
Buddies(name1, name2)
Married(husband, wife)

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Combining Relations

- It is OK to combine the relation for an entity-set *E* with the relation *R* for a many-one relationship from *E* to another entity set.
- Example: Drinkers(name, addr) and Favorite(drinker, beer) combine to make Drinker1(name, addr, favBeer).

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Risk with Many-Many Relationships

- Combining Drinkers with Likes would be a mistake. It leads to redundancy, as:

name	addr	beer
Sally	123 Maple	Bud
Sally	123 Maple	Miller

Redundancy

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Handling Weak Entity Sets

- Relation for a weak entity set must include attributes for its complete key (including those belonging to other entity sets), as well as its own, nonkey attributes.
- A supporting (double-diamond) relationship is redundant and yields no relation.

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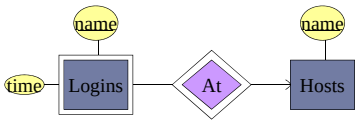
Example



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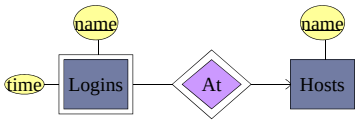
Example



Hosts(hostName)
Logins(loginName, hostName, time)
~~At(loginName, hostName, hostName2)~~

At becomes part of Logins

Must be the same

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A (Slightly) Formal Definition

- A *database* is a collection of *relations* (or tables)
- Each *relation* is identified by a name and a list of *attributes* (or columns)
- Each *attribute* has a name and a *domain* (or type)
  - Set-valued attributes not allowed

Schema versus instance

- Schema (metadata)
  - Specification of how data is to be structured logically
  - Defined at set-up
  - Rarely changes
- Instance
  - Content
  - Changes rapidly, but always conforms to the schema
- ☞ Compare to type and objects of type in a programming language

Example

- Schema
  - *Student* (*SID* integer, *name* string, *age* integer, *GPA* float)
  - *Course* (*CID* string, *title* string)
  - *Enroll* (*SID* integer, *CID* integer)
- Instance
  - { h142, Bart, 10, 2.3i, h123, Milhouse, 10, 3.1i, ...}
  - { hCPS116, Intro. to Database Systemsi, ...}
  - { h142, CPS116i, h142, CPS114i, ...}