The Relational Data Model

Tables
Schemas
Conversion from E/R to Relations

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A Relation is a Table

Attributes (column headers)

Tuples (rows)

name	manf
Winterbrew	Pete's
Bud Lite	Anheuser-Busch
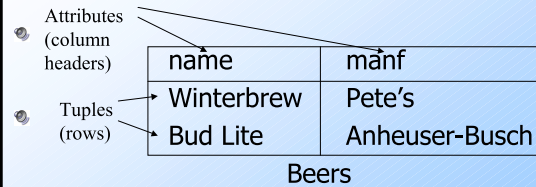
Beers

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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.

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Why Relations?

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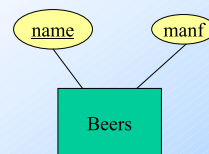 ◆ But SQL uses bags, while the relational model is a set-based model.

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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.
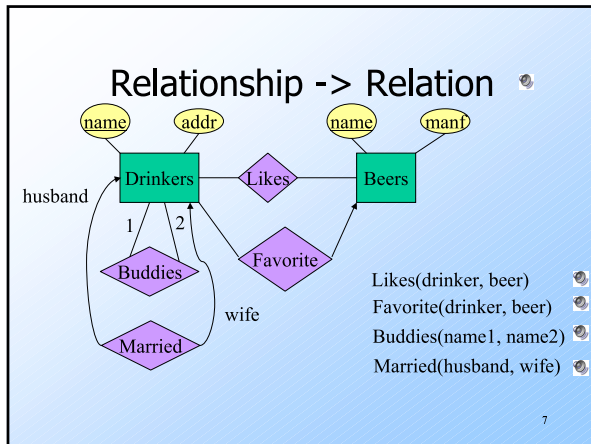 ◆ Attributes of the relationship itself.

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Entity Set -> Relation

name   manf

Beers

Relation: Beers(name, manf)

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Relationship -> Relation

name addr   name manf

husband

Drinkers — Likes — Beers

1   2

Buddies   Favorite

wife

Married

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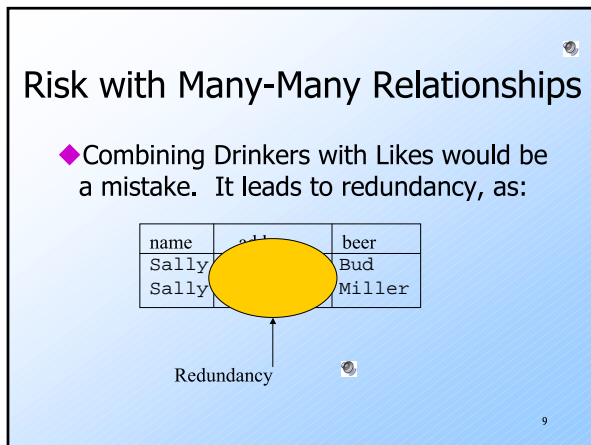Buddies(name1, name2)
Married(husband, wife)

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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:

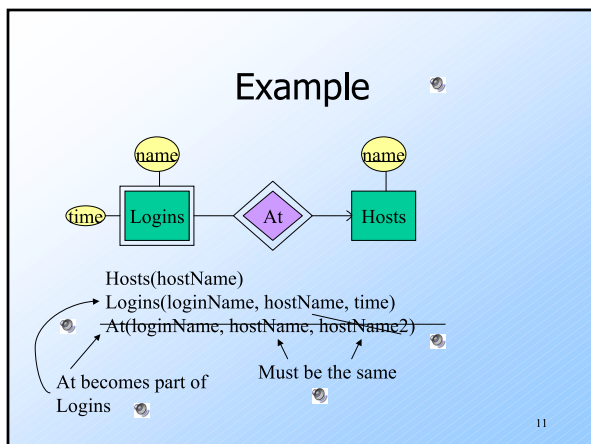| name	addr	beer
Sally		Bud
Sally		Miller

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

name   name

time Logins — At — Hosts

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

At becomes part of Logins   Must be the same

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Entity Sets With Subclasses

◆ Three approaches:

1. *Object-oriented* : each entity belongs to exactly one class; create a relation for each class, with all its attributes.
2. *Use nulls* : create one relation; entities have null in attributes that don't belong to them.
3. *E/R style* : create one relation for each subclass, with only the key attribute(s) and attributes attached to that E.S.; entity represented in all relations to whose subclass/E.S. it belongs.

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Example

name — Beers — manf
isa
color — Ales
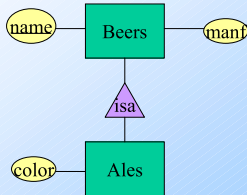
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Object-Oriented

name	manf
Bud	Anheuser-Busch

Beers

name	manf	color
Summerbrew	Pete's	dark

Ales

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E/R Style

name	manf
Bud	Anheuser-Busch
Summerbrew	Pete's

Beers

name	color
Summerbrew	dark

Ales

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Using Nulls

name	manf	color
Bud	Anheuser-Busch	NULL
Summerbrew	Pete's	dark

Beers

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Comparisons

◆ O-O approach good for queries like "find the color of ales made by Pete's."
   ◆ Just look in Ales relation.
◆ E/R approach good for queries like "find all beers (including ales) made by Pete's."
   ◆ Just look in Beers relation.
◆ Using nulls saves space unless there are *lots* of attributes that are usually null.

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