

# 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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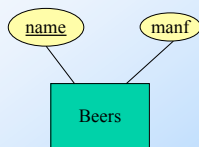
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## Entity Set -> Relation 🌐



Relation: Beers(name, manf) 🌐

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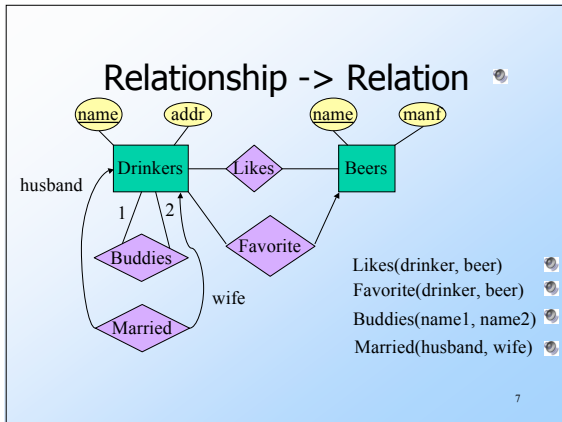
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### Combining Relations

- ◆ 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 |
| Sally | 123  | Maple |

Bud 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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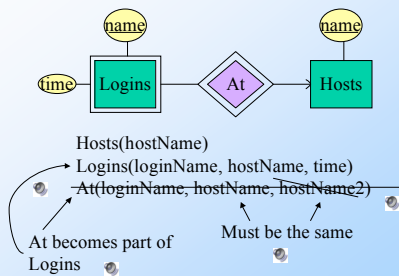
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## Example



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## Entity Sets With Subclasses

- ◆ Three approaches:
  - 🔗 *Object-oriented* : each entity belongs to exactly one class; create a relation for each class subtree, with all its attributes.
  - 🔗 *Use nulls* : create one relation; entities have null in attributes that don't belong to them.
  - 🔗 *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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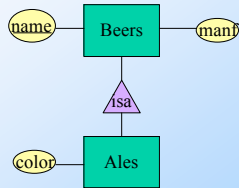
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## Example



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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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