

E-R Diagram: Roles in relationships, Binary vs. Multi-way relationship, Weak entity

CS 4750 Database Systems

[A. Silberschatz, H. F. Korth, S. Sudarshan, Database System Concepts, Ch.6]
[C.M. Ricardo and S.D. Urban, Database Illuminated, Ch.3]

Degree of a Relationship

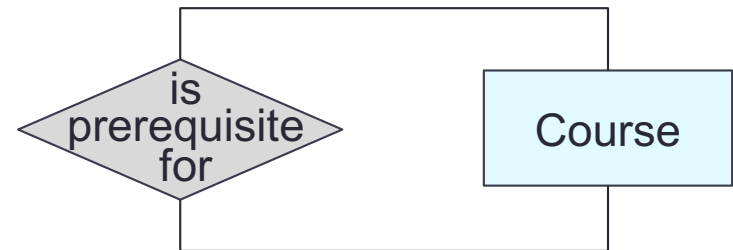
Binary relationship

Two entities participate in the relationship



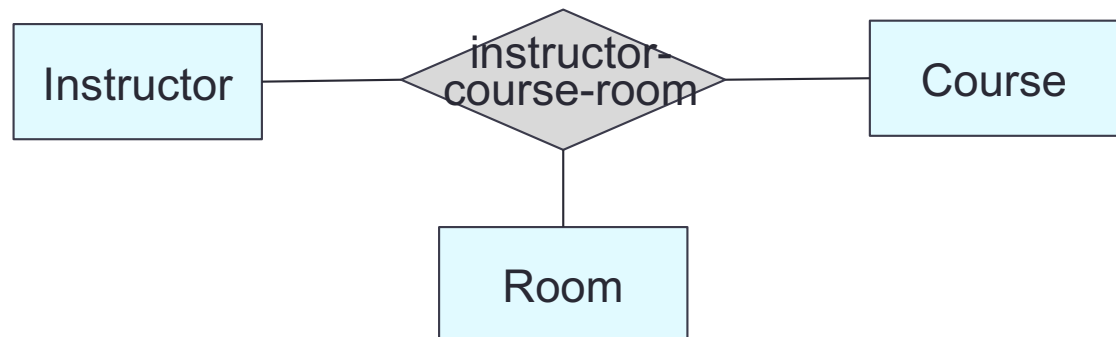
Unary relationship

Both participants in the relationship are the same entity



Ternary relationship

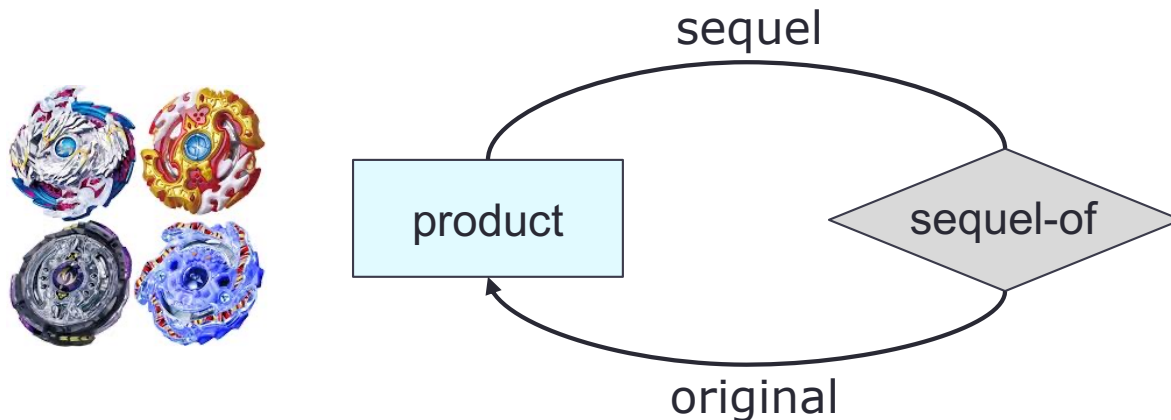
Three entities participate in the relationship



Roles in Relationships

- An entity set can appear two or more times in a single relationship
- Each edge to the entity set represents a different **role** that the entity set plays in the relationship

“self-referential relationship”



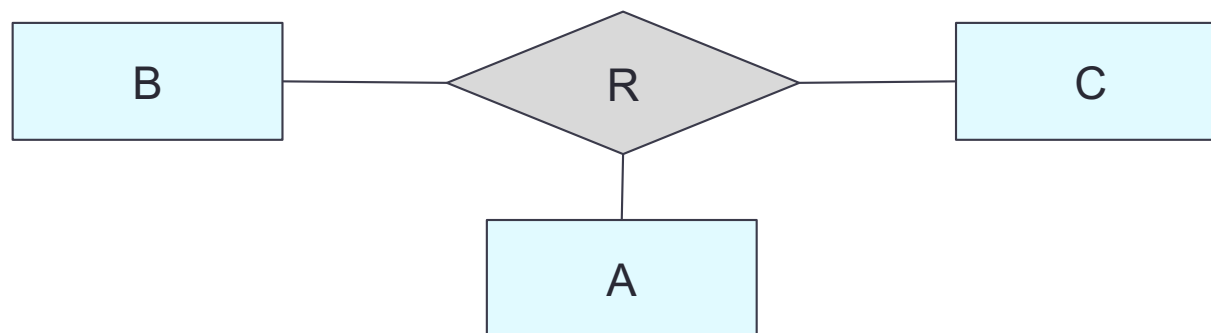
A product can have many sequels.
For each sequel, there is only one original product

Binary vs. Multi-Way Relationships

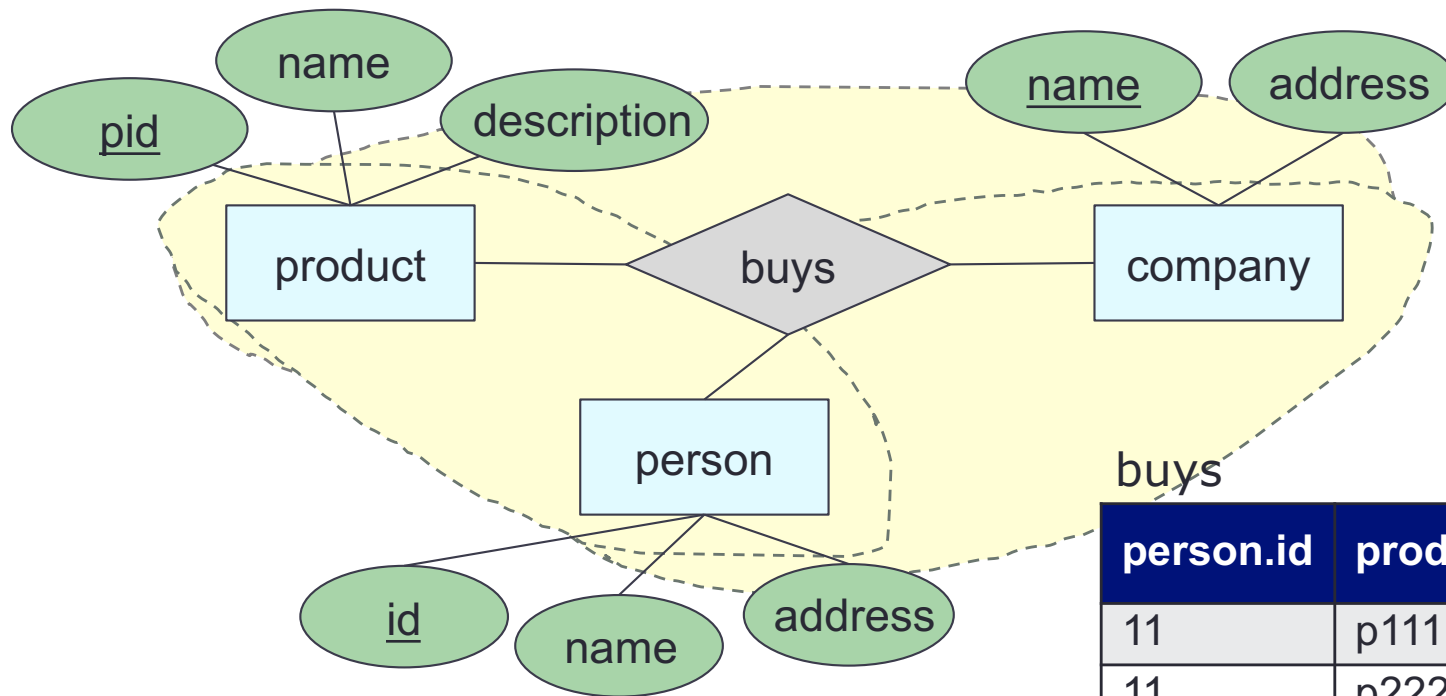
E-R model makes it convenient to define relationships involving more than two entity sets.

In practice, ternary (3-way) or higher-degree relationships are rare and usually add complexity to the design.

If A , B , and C are sets, a relationship R is a subset of $A \times B \times C$



Multi-Way Relationships



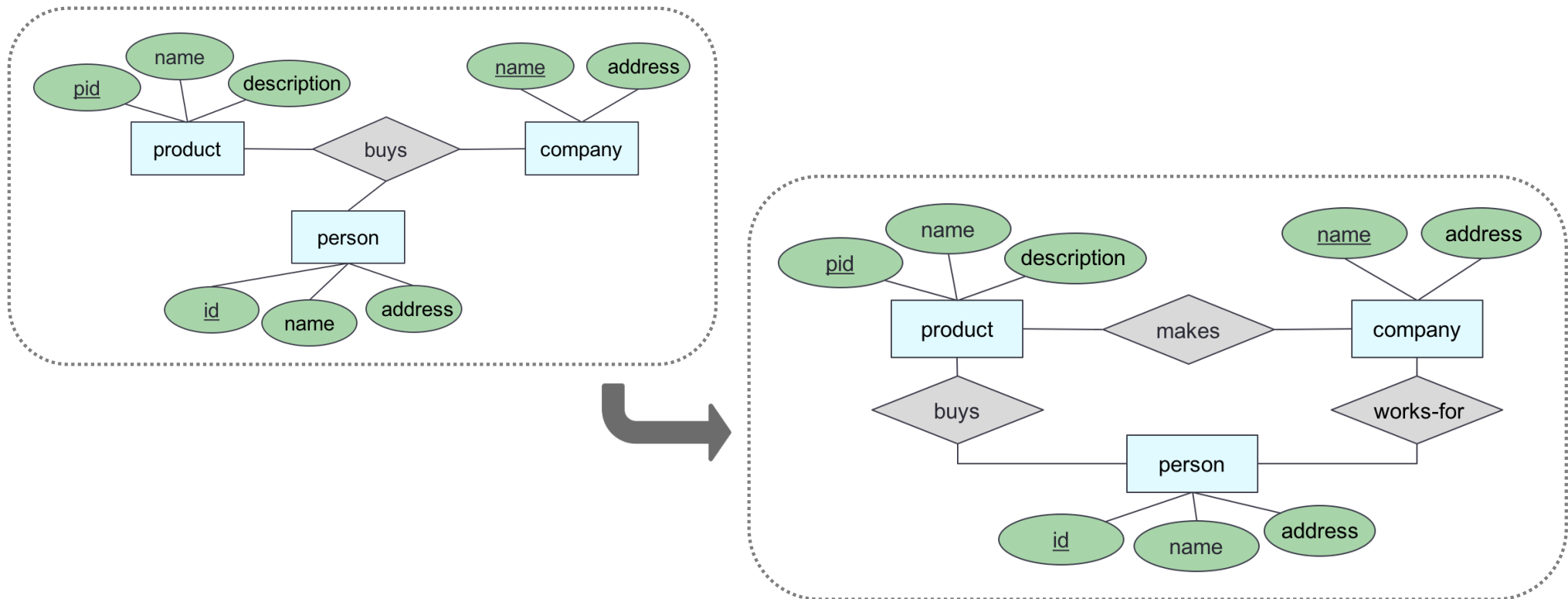
person.id	product.pid	company.name
11	p111	Humpty Inc.
11	p222	Humpty Inc.
22	p111	Humpty Inc.
22	p111	Dumpty Shop

Each (person, product) pair can connect to many companies.
Each (person, company) pair can connect to many products.
Each (company, product) pair can connect to many persons.

Note: instances do not exist in E-R. These tables are only to help visualize the database being designed.

Converting Multi-Way to Binary

- E-R model does not require binary relationships
- It is useful to convert a multi-way relationship to a collection of binary relationships
- To convert, replace a multi-way relationship with an **entity set** and **binary relationships**



E-R Diagram: Building Blocks

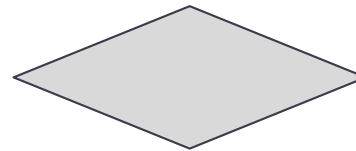
(strong) Entity set



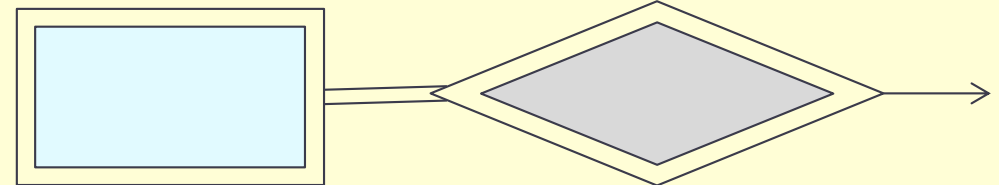
Attribute



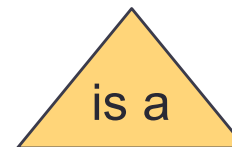
Relationship



Weak entity



Subclass



Note: colors are not part of E-R Diagram. They simply are used to increase readability.

Strong and Weak Entity Sets

Strong entity set

What we have been discussing so far

- Entities can be identified by the values of their attributes (a primary key)

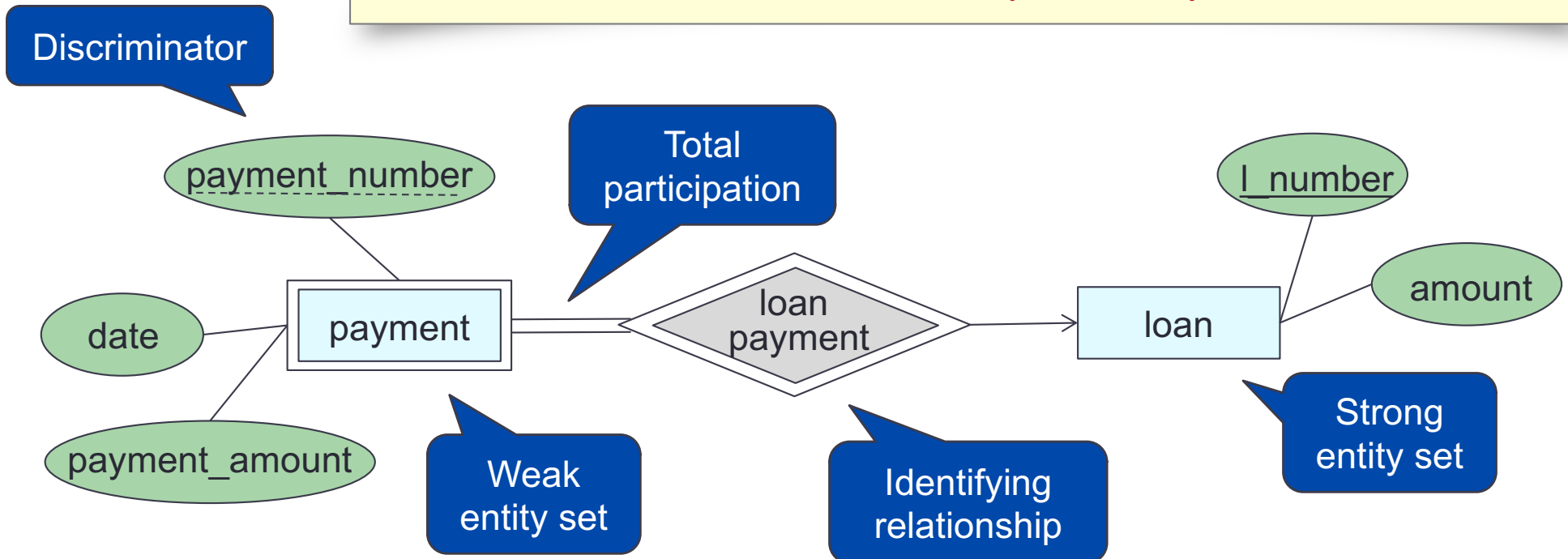
Weak entity set

A weak entity's existence depends on its strong entity

- No primary key → cannot be identified by their attributes
- To identify, need a combination of their attributes ("discriminator") and the relationship they have with another entity set ("identifying relationship")
- If X and Y are entities and each instance of Y must have a corresponding instance of X, Y is "existence dependent" on X
 - Y is a **weak entity**, and X is its strong entity
 - Y must have **total participation** in its relationship set with X

Weak Entity Set

By definition, there must be **total participation** between the weak entity set and its identifying relationship
"existence dependency"



- Does not have sufficient attributes to form a primary key.
- Depends on the strong entity set it is associated with.
- Needs a discriminator and a primary key of the strong entity set.

Wrap-Up

- Roles in Relationships
- Relationships: binary, n-ary
- Weak entity

What's next?

- Subclassing
- Converting from E-R diagrams to relational designs