CSE 344

MAY 11TH – ENTITIES

ADMINISTRIVIA

- **HW6 Due next Wednesday (May 16)**
  - Section 7 slides very helpful
- **HW7 Out Wednesday**
  - Due May 23rd
- **HW8 Out May 23rd**
  - Due last day of class, Jun 1
- **Exam**
  - Graded and on canvas tonight
  - Back in class or in OH on Monday

DATABASE DESIGN

What it is:

Starting from scratch, design the database schema: relation, attributes, keys, foreign keys, constraints etc

Why it's hard

The database will be in operation for a very long time (years). Updating the schema while in production is very expensive (why?)

DATABASE DESIGN

Consider issues such as:

- What entities to model
- How entities are related
- What constraints exist in the domain

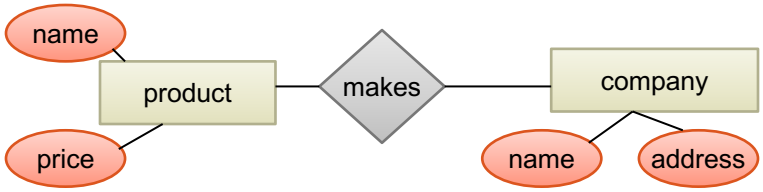
Several formalisms exists

- We discuss E/R diagrams
- UML, model-driven architecture

Reading: Sec. 4.1-4.6

DATABASE DESIGN PROCESS

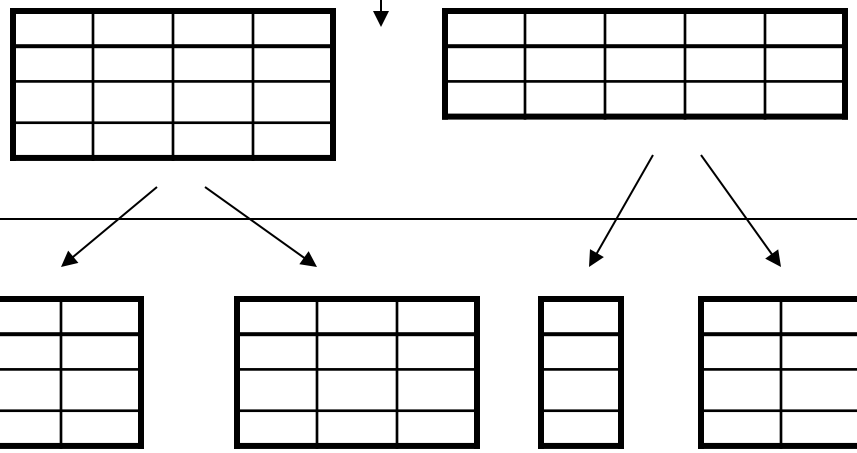
Conceptual Model:



Relational Model:

Tables + constraints

And also functional dep.



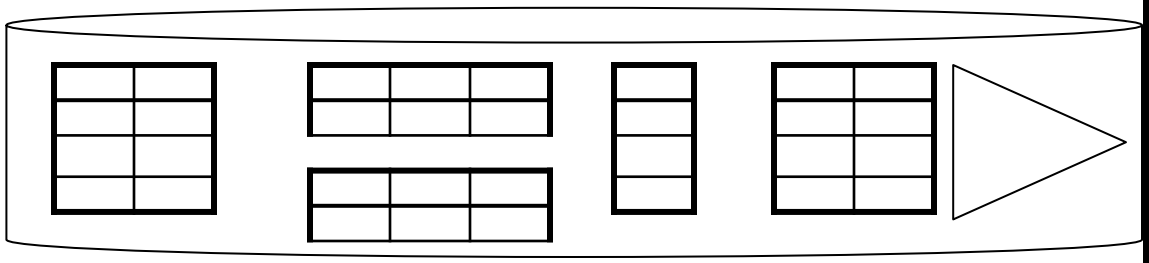
Normalization:

Eliminates anomalies

Conceptual Schema

Physical storage details

Physical Schema



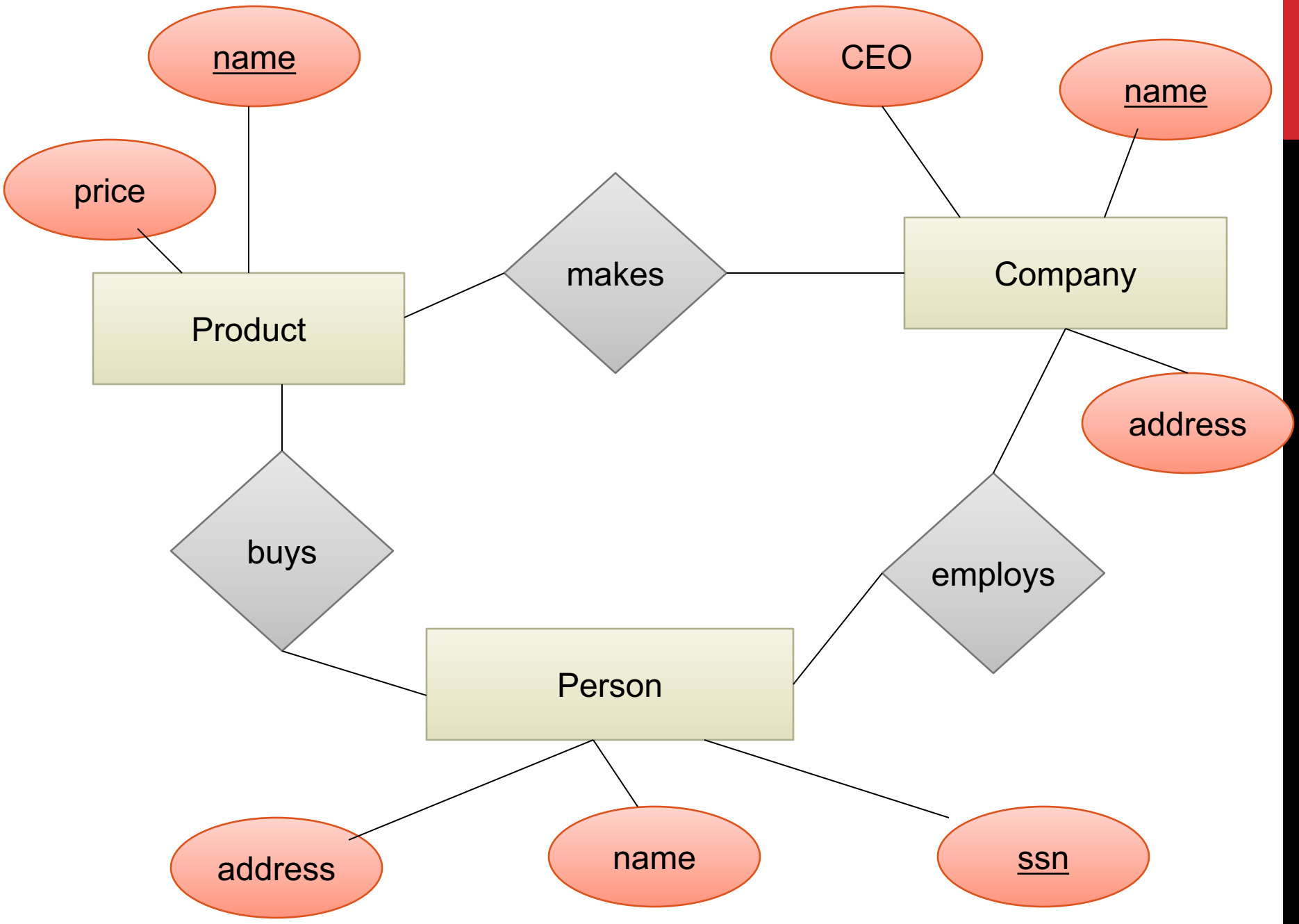
ENTITY / RELATIONSHIP DIAGRAMS

Entity set = a class

- An entity = an object

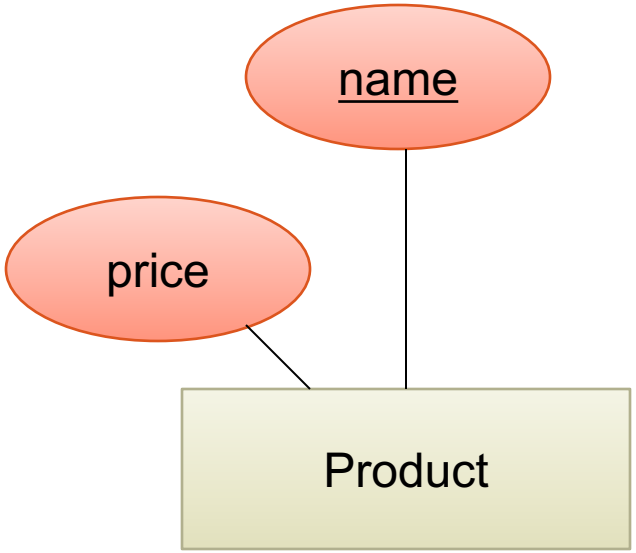
Attribute

Relationship


name
CEO
name
price
makes
Company
Product
address
buys
employs
Person
address
name
ssn

KEYS IN E/R DIAGRAMS

Every entity set must have a key



WHAT IS A RELATION ?

A mathematical definition:

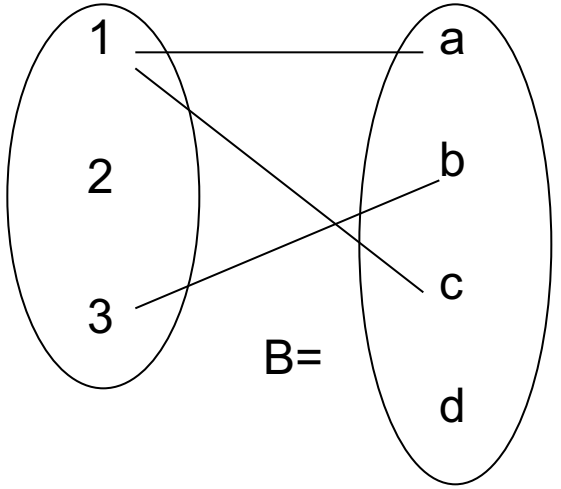
- if A, B are sets, then a relation R is a subset of A × B

A={1,2,3}, B={a,b,c,d},

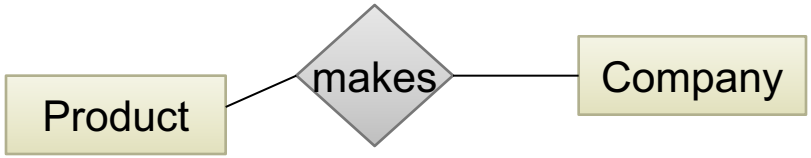
A × B = {(1,a),(1,b), . . ., (3,d)}

R = {(1,a), (1,c), (3,b)}

A=

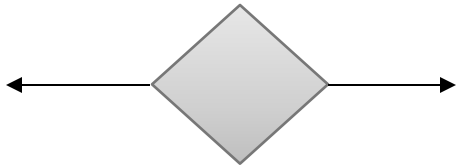


makes is a subset of Product × Company:

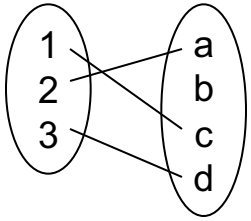


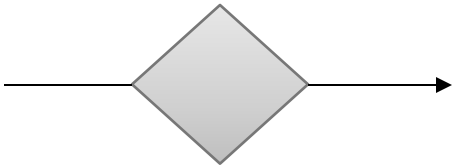
MULTIPLICITY OF E/R RELATIONS

one-one:

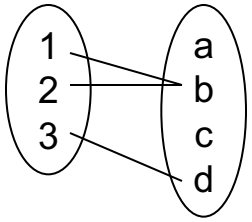


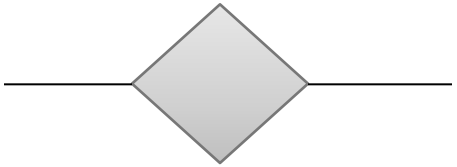
many-one

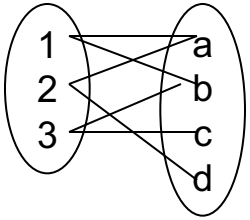


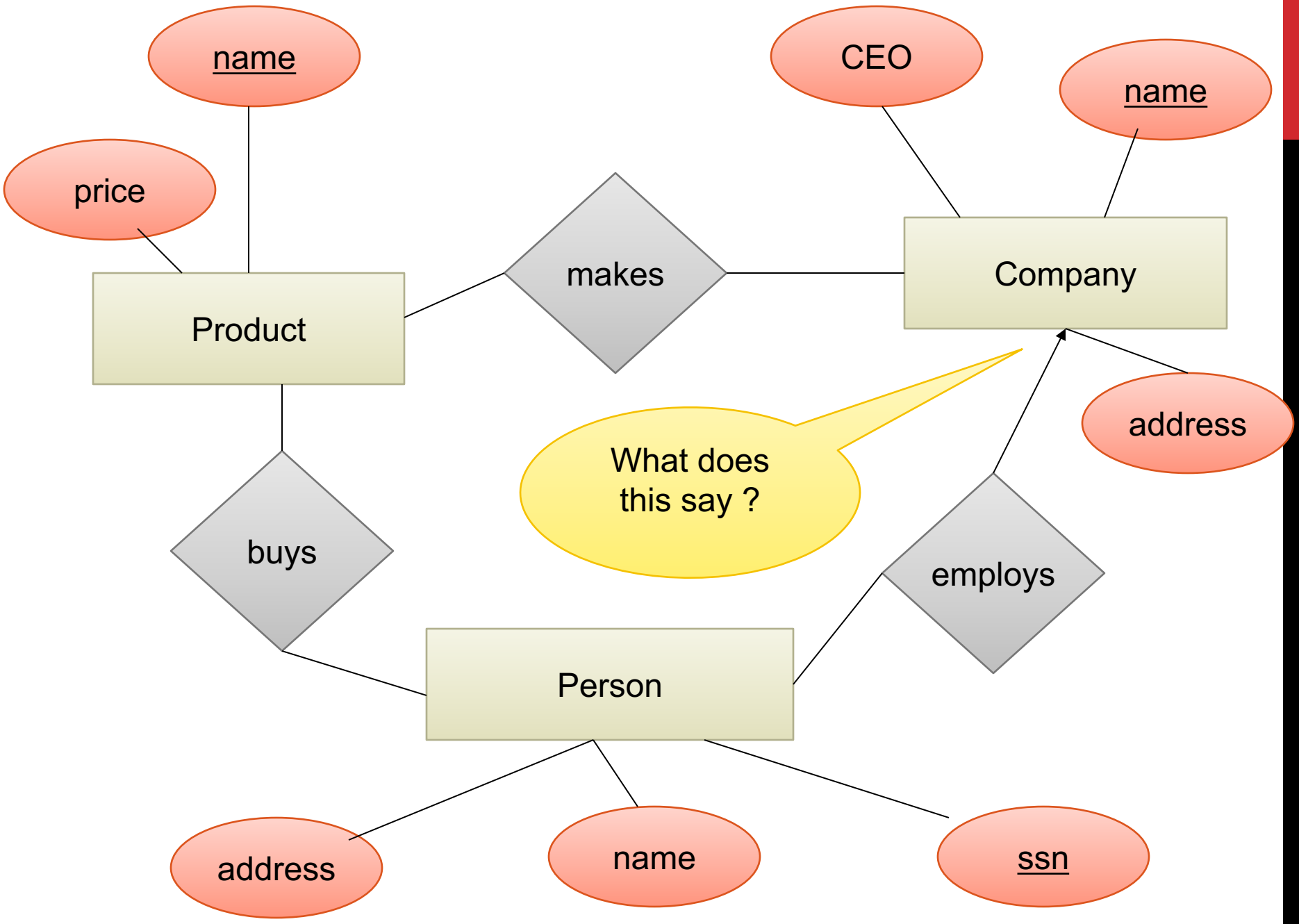


many-many

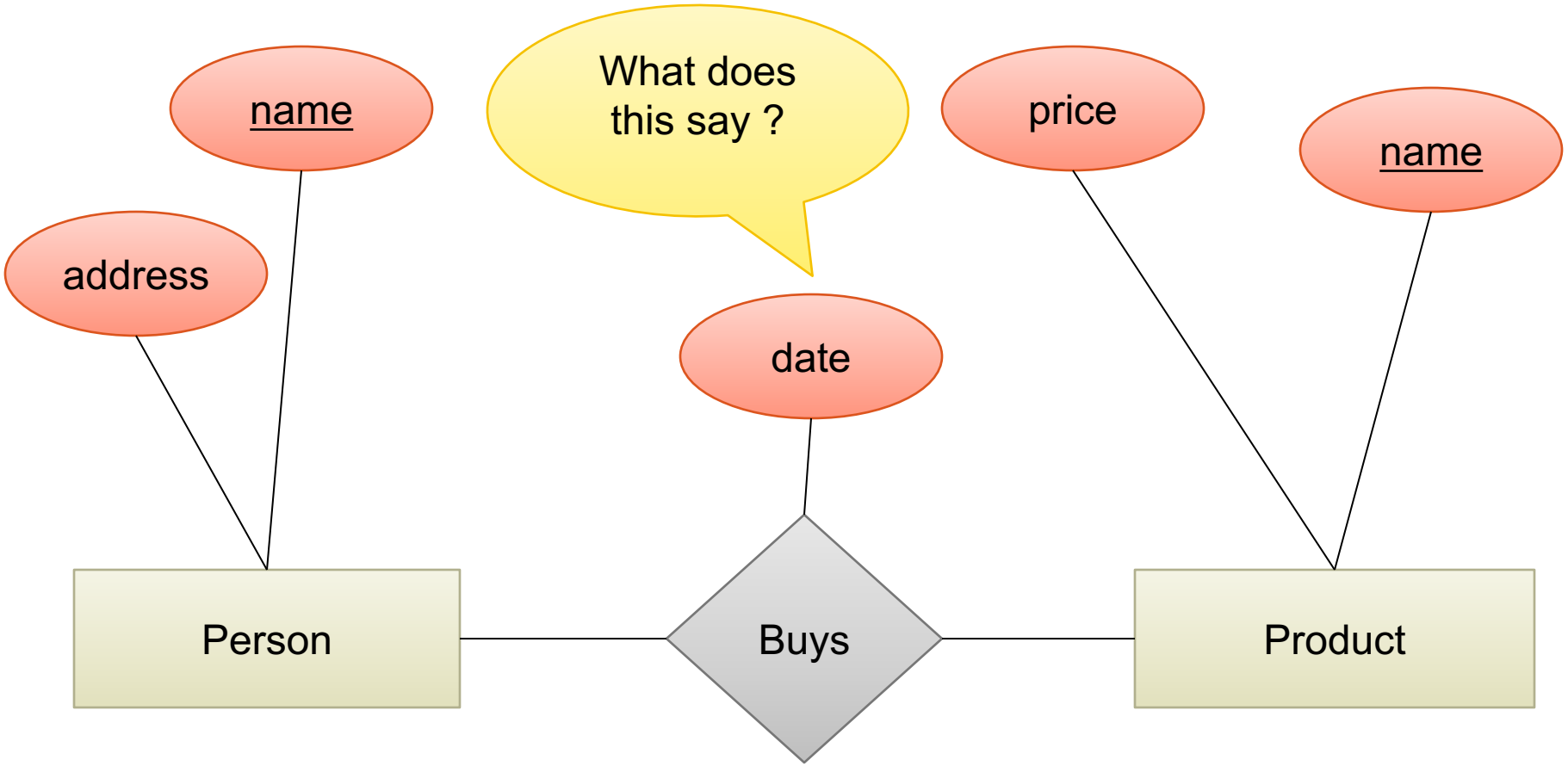






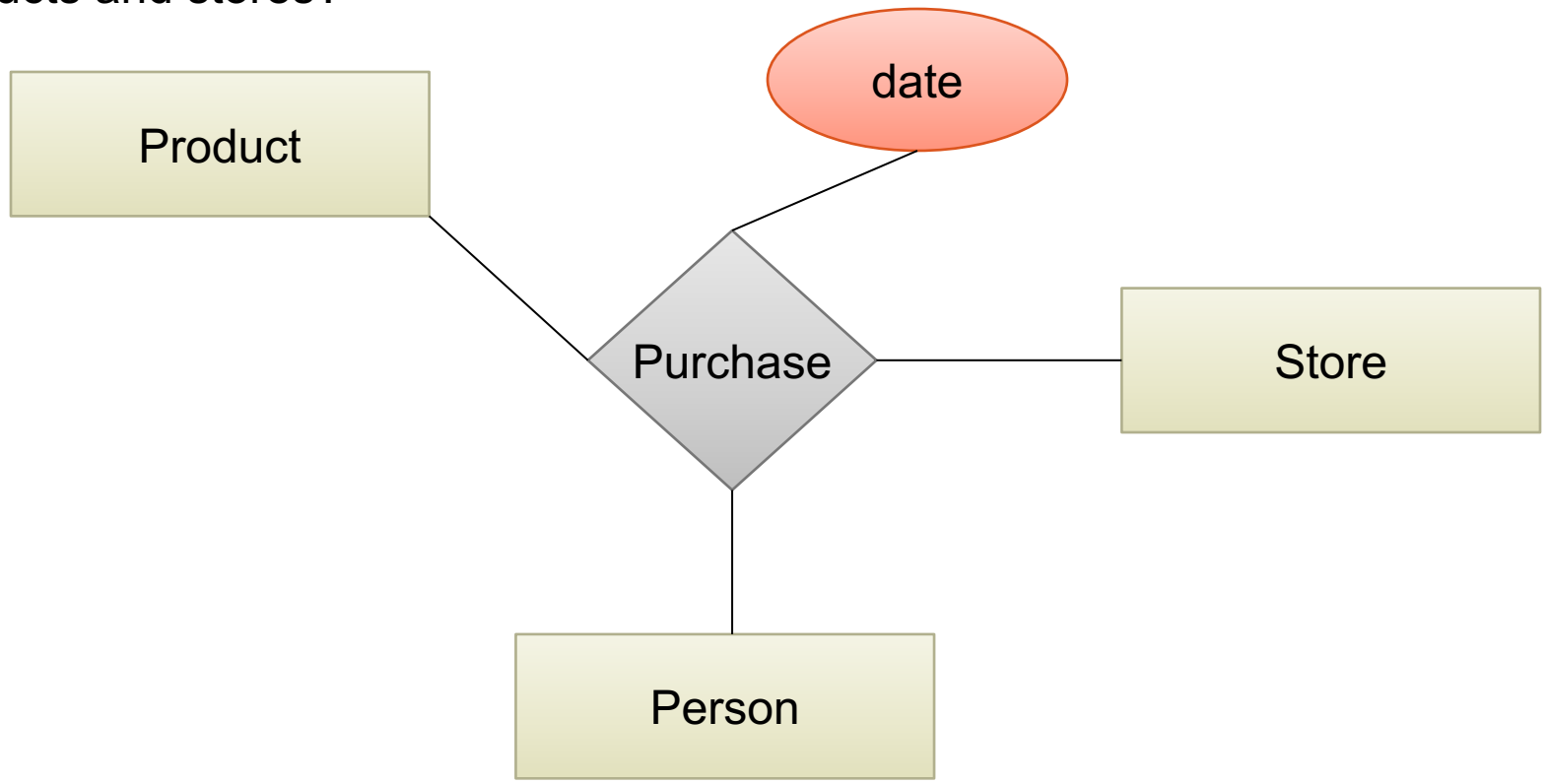

name
CEO
name
price
makes
Company
Product
address
What does this say ?
buys
employs
Person
address
name
ssn

ATTRIBUTES ON RELATIONSHIPS



MULTI-WAY RELATIONSHIPS

How do we model a purchase relationship between buyers, products and stores?

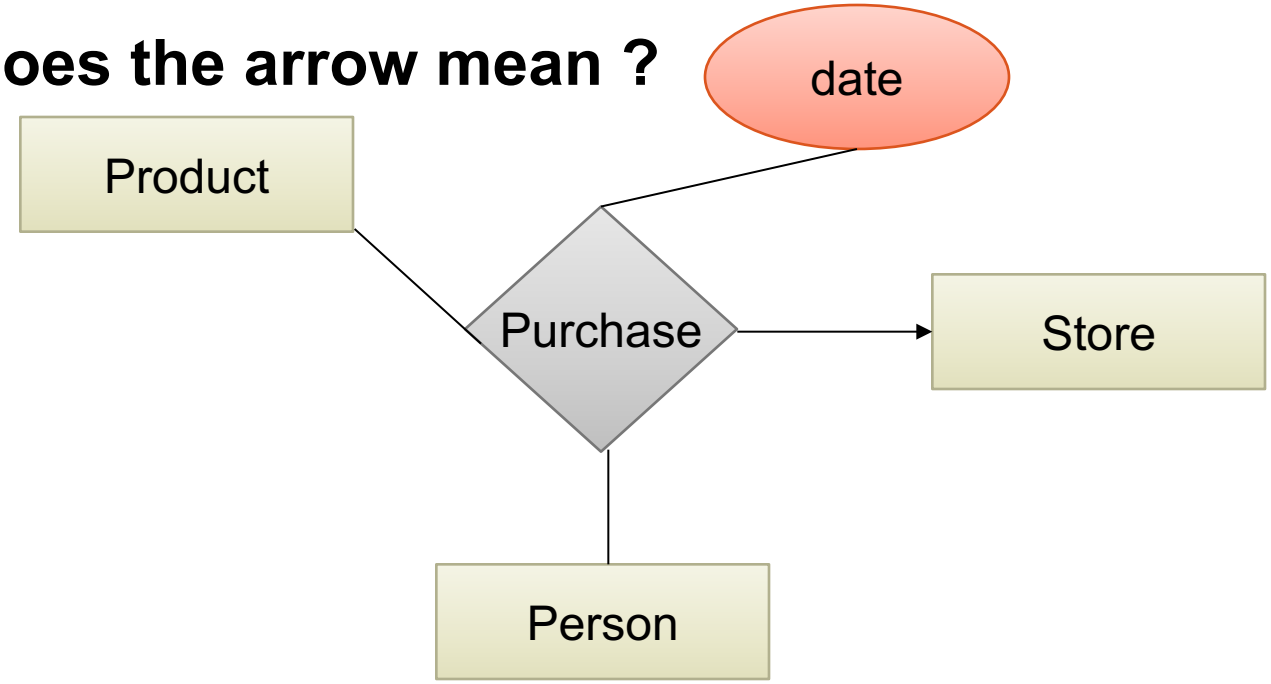


Can still model as a mathematical set (How?)

As a set of triples $\subseteq$ Person $\times$ Product $\times$ Store

ARROWS IN MULTIWAY RELATIONSHIPS

Q: What does the arrow mean ?

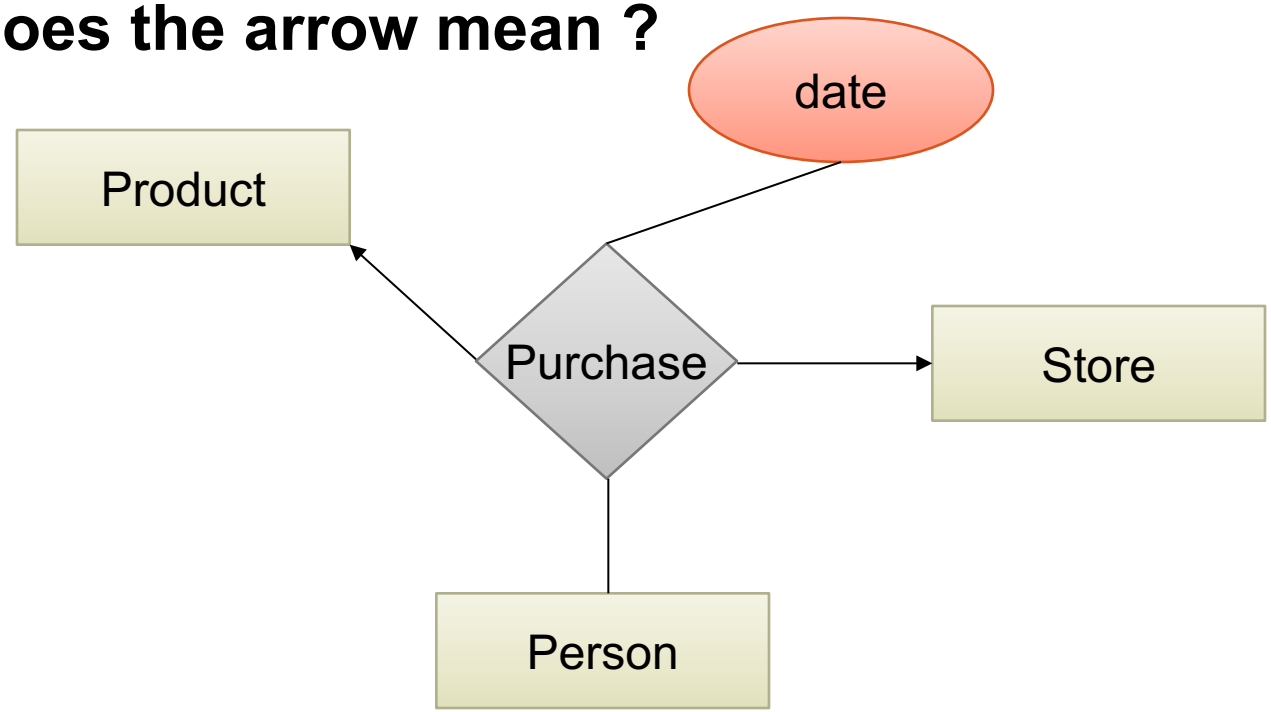


A: Any person buys a given product from at most one store

[Fine print: Arrow pointing to E means that if we select one entity from each of the other entity sets in the relationship, those entities are related to at most one entity in E]

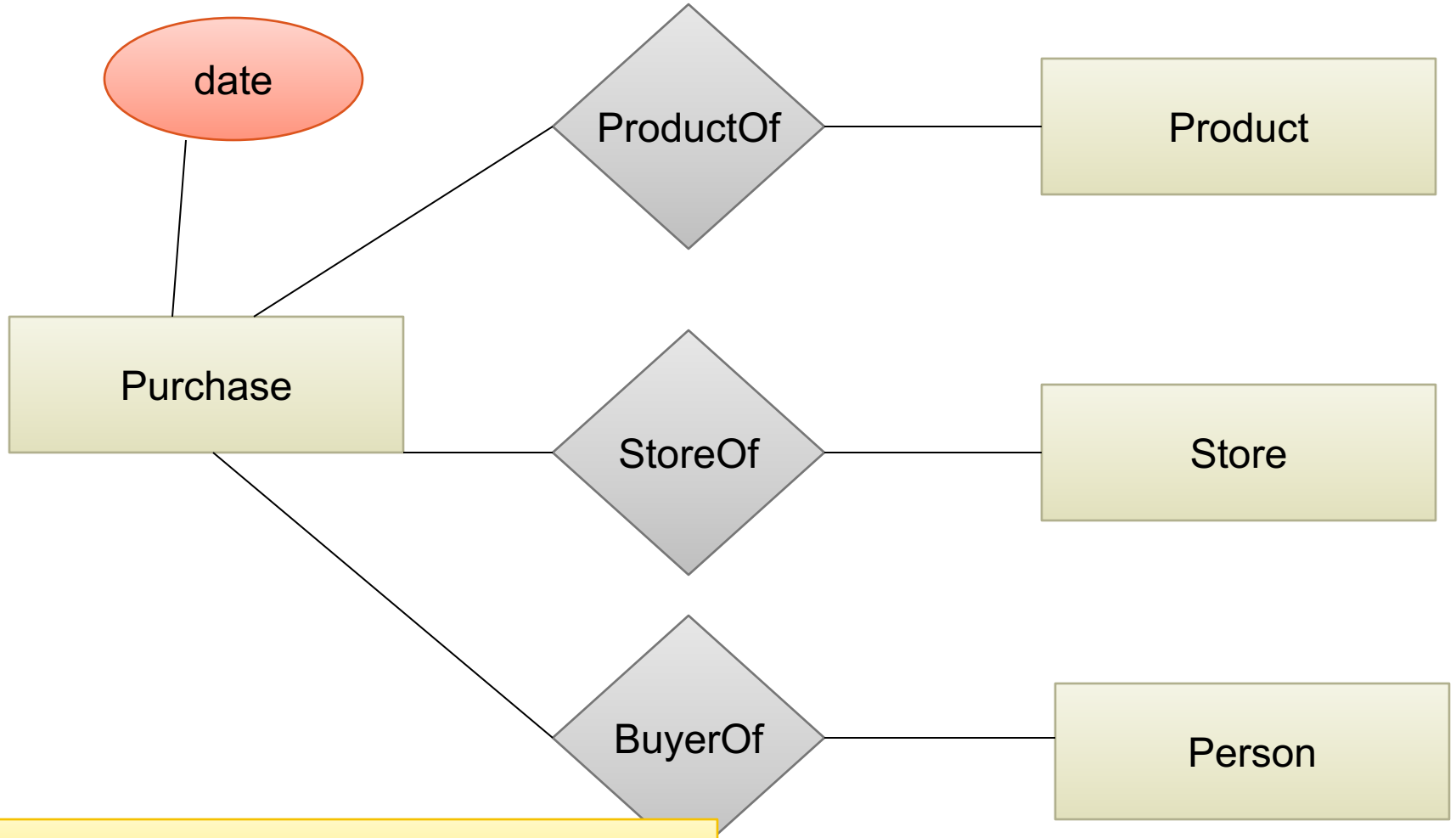
ARROWS IN MULTIWAY RELATIONSHIPS

Q: What does the arrow mean ?



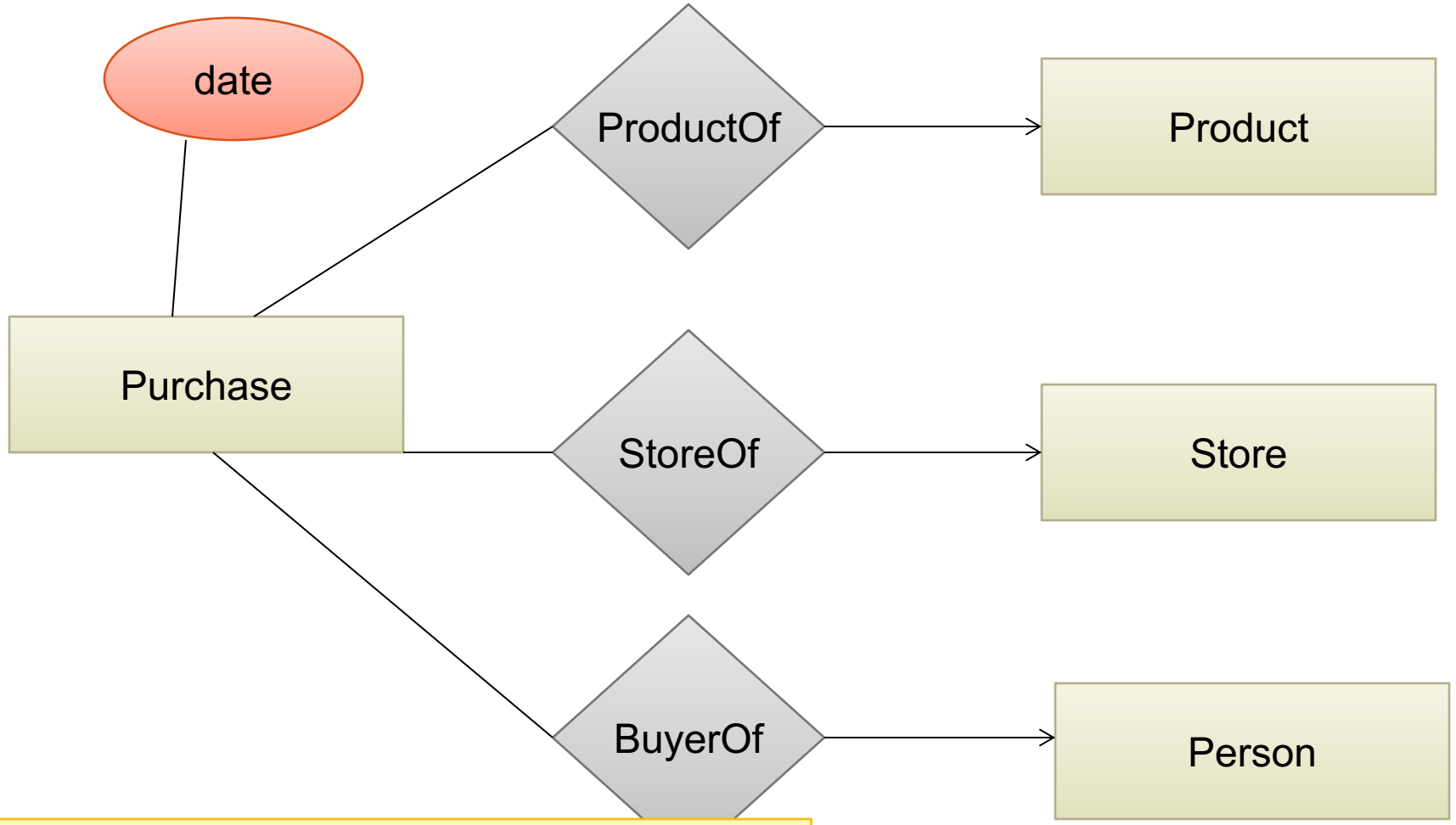
A: Any person buys a given product from at most one store AND every store sells to every person at most one product

CONVERTING MULTI-WAY RELATIONSHIPS TO BINARY



Arrows go in which direction?

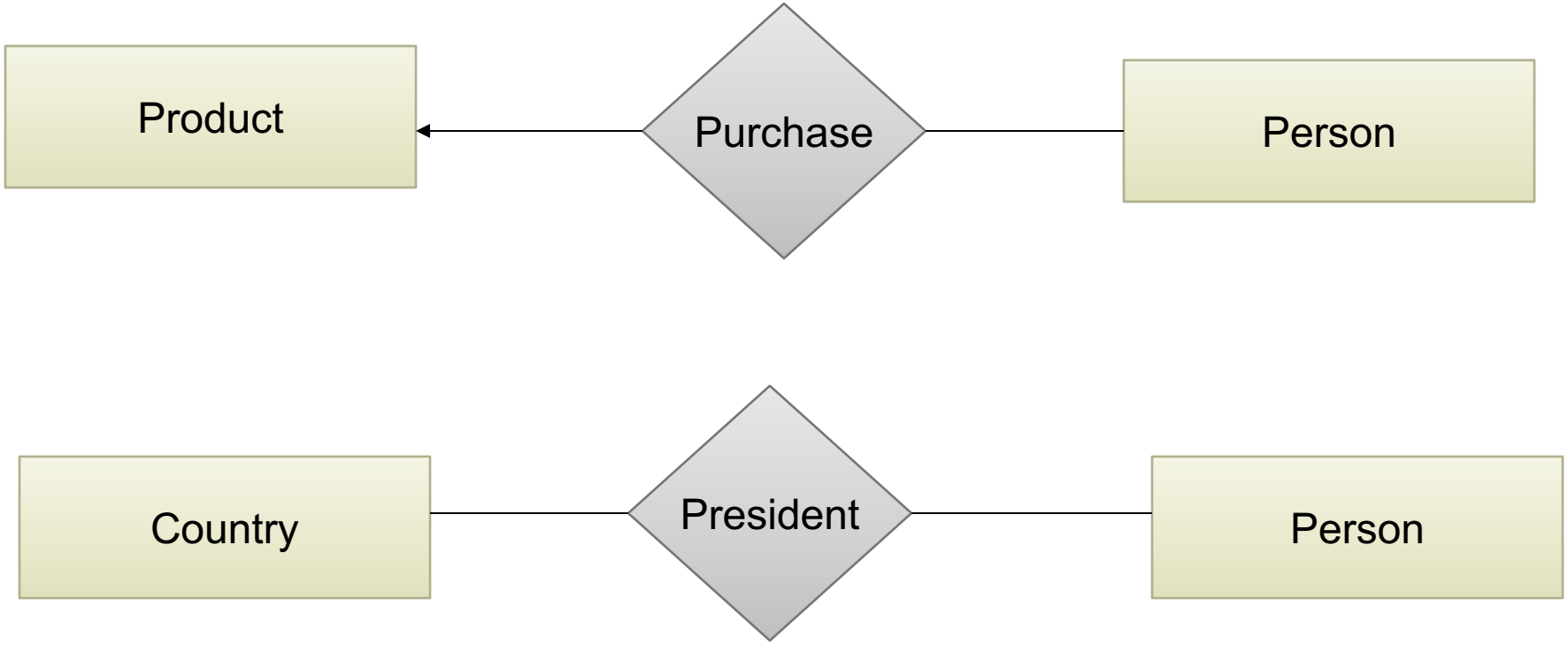
CONVERTING MULTI-WAY RELATIONSHIPS TO BINARY



Make sure you understand why!

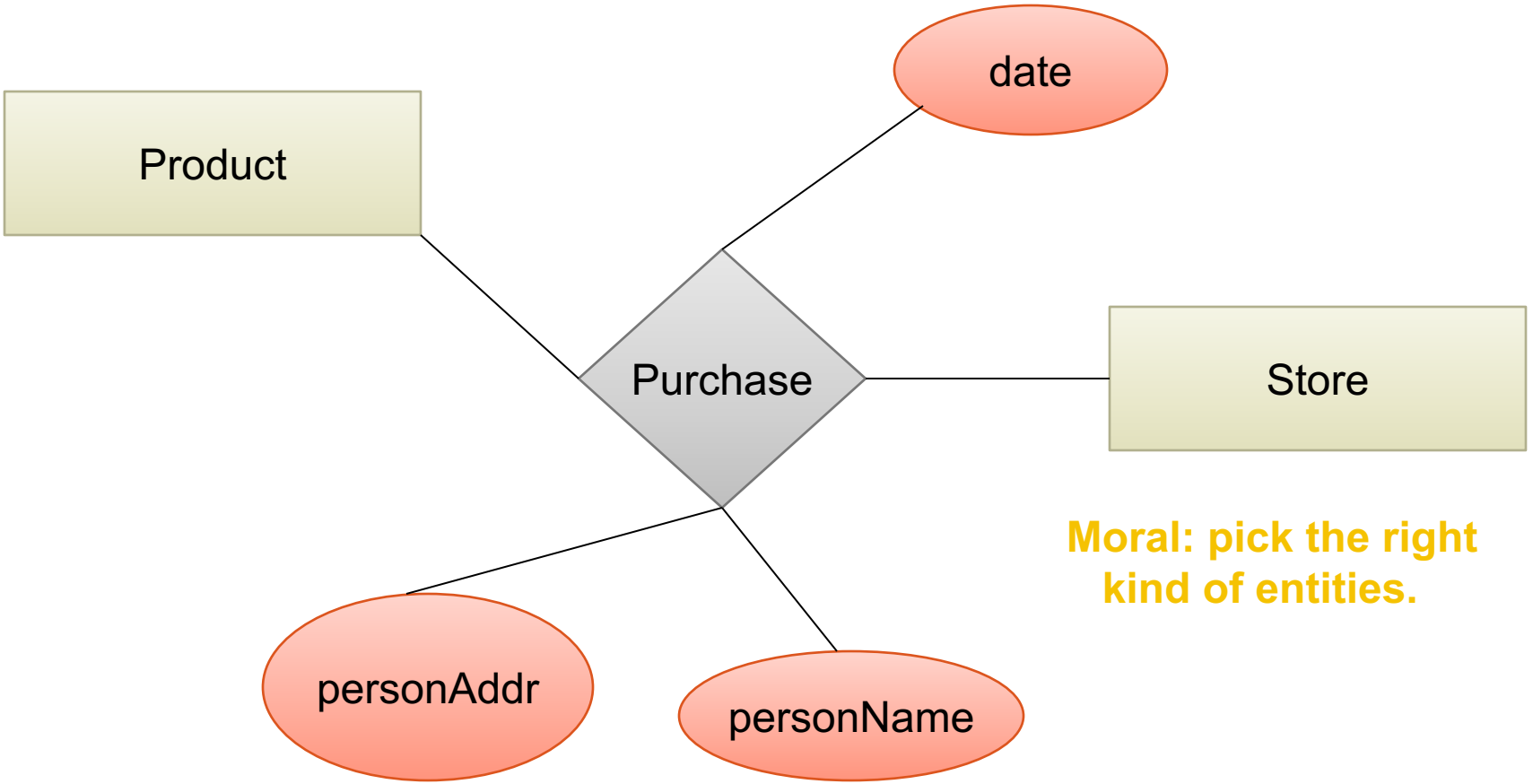
3. DESIGN PRINCIPLES

What's wrong?



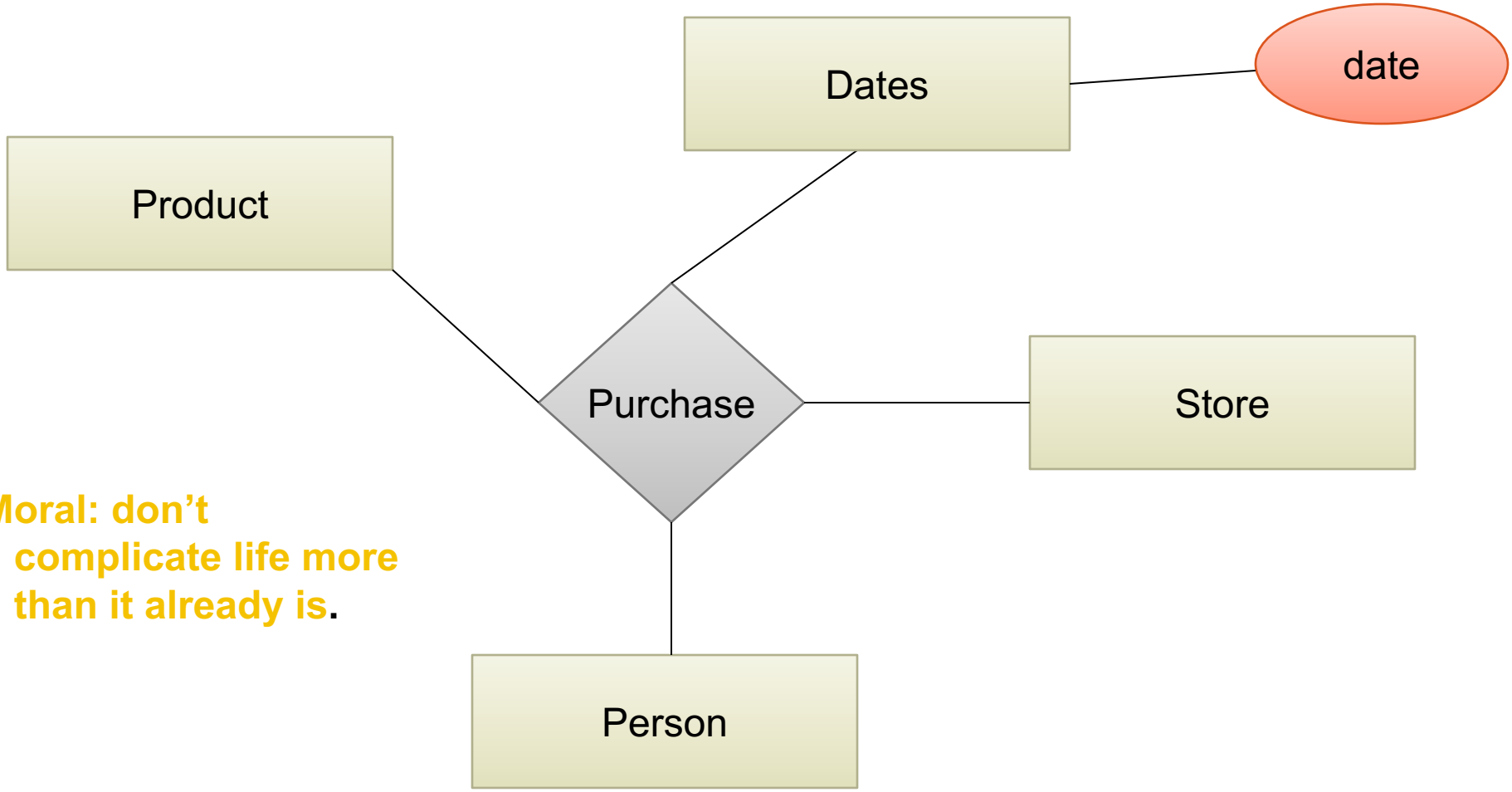
Moral: Be faithful to the specifications of the application!

DESIGN PRINCIPLES: WHAT'S WRONG?



Moral: pick the right kind of entities.

DESIGN PRINCIPLES: WHAT'S WRONG?



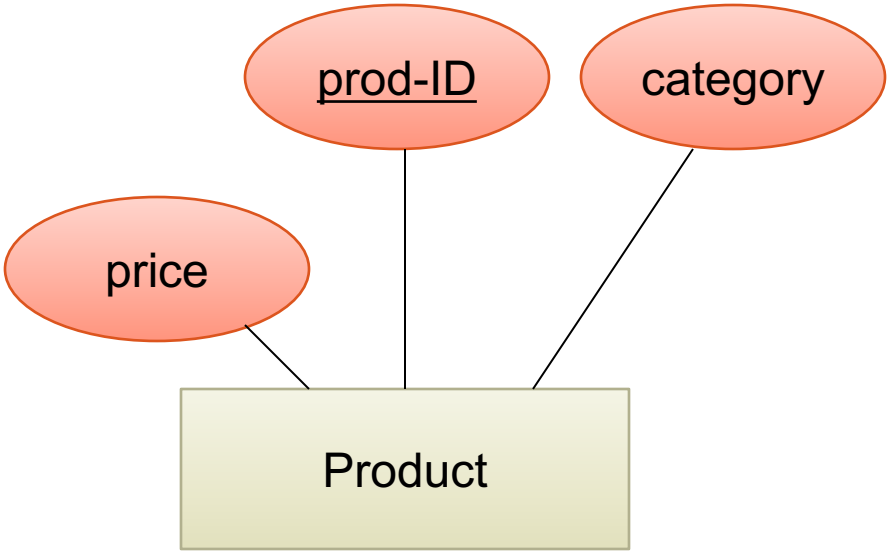
Moral: don't complicate life more than it already is.

FROM E/R DIAGRAMS TO RELATIONAL SCHEMA

Entity set → relation

Relationship → relation

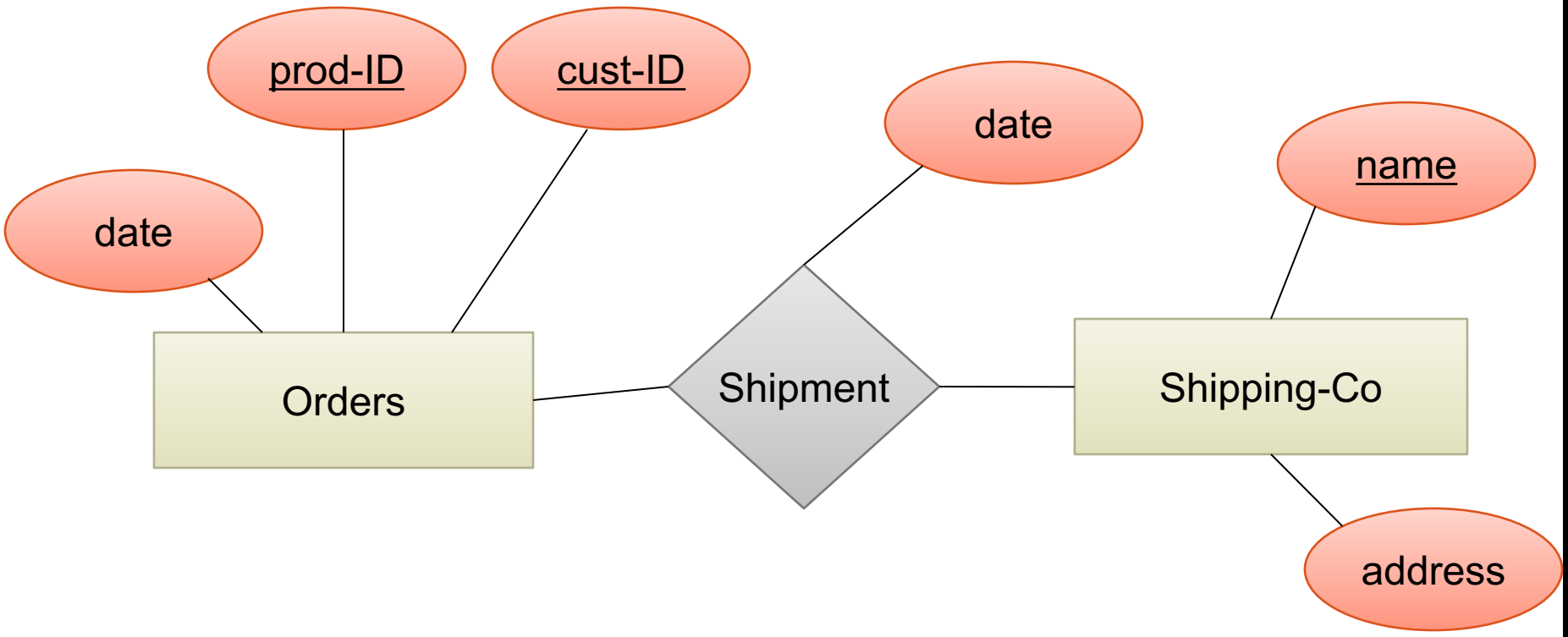
ENTITY SET TO RELATION



Product(prod-ID, category, price)

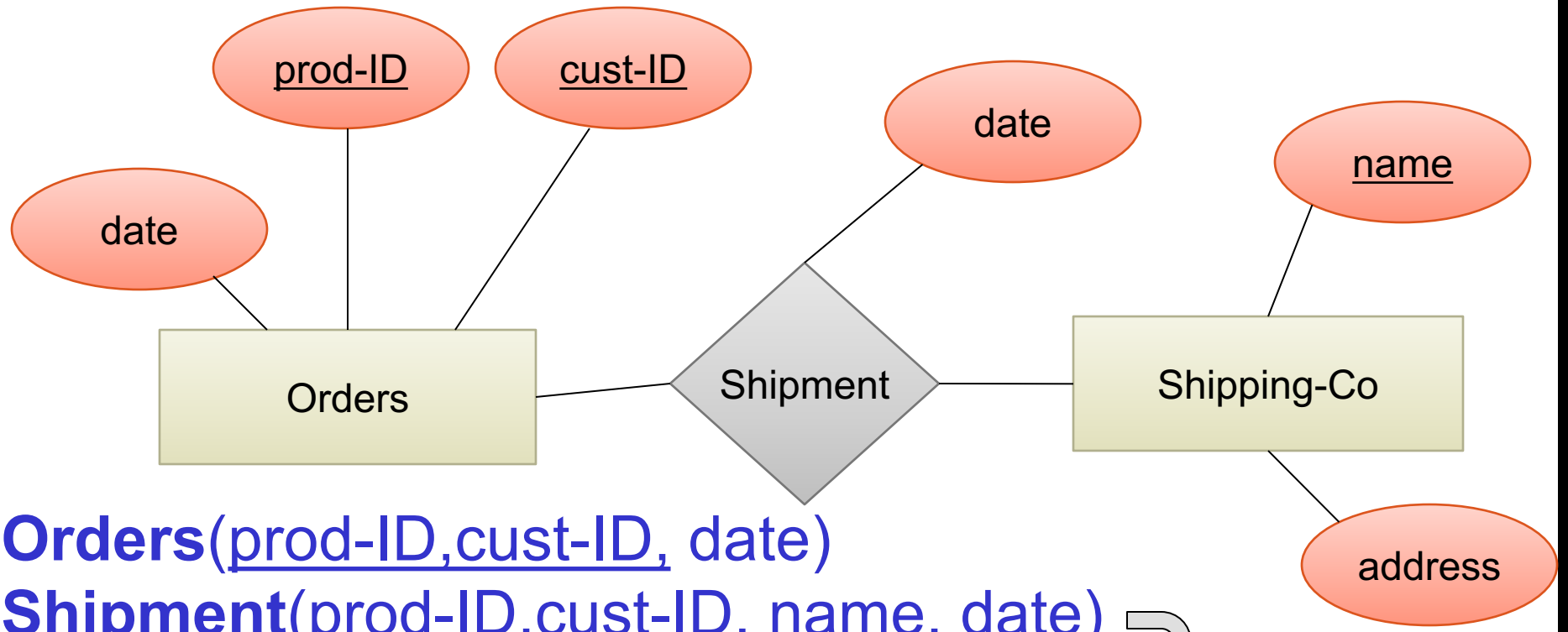
prod-ID	category	price
Gizmo55	Camera	99.99
Pokemn19	Toy	29.99

N-N RELATIONSHIPS TO RELATIONS



Represent this in relations

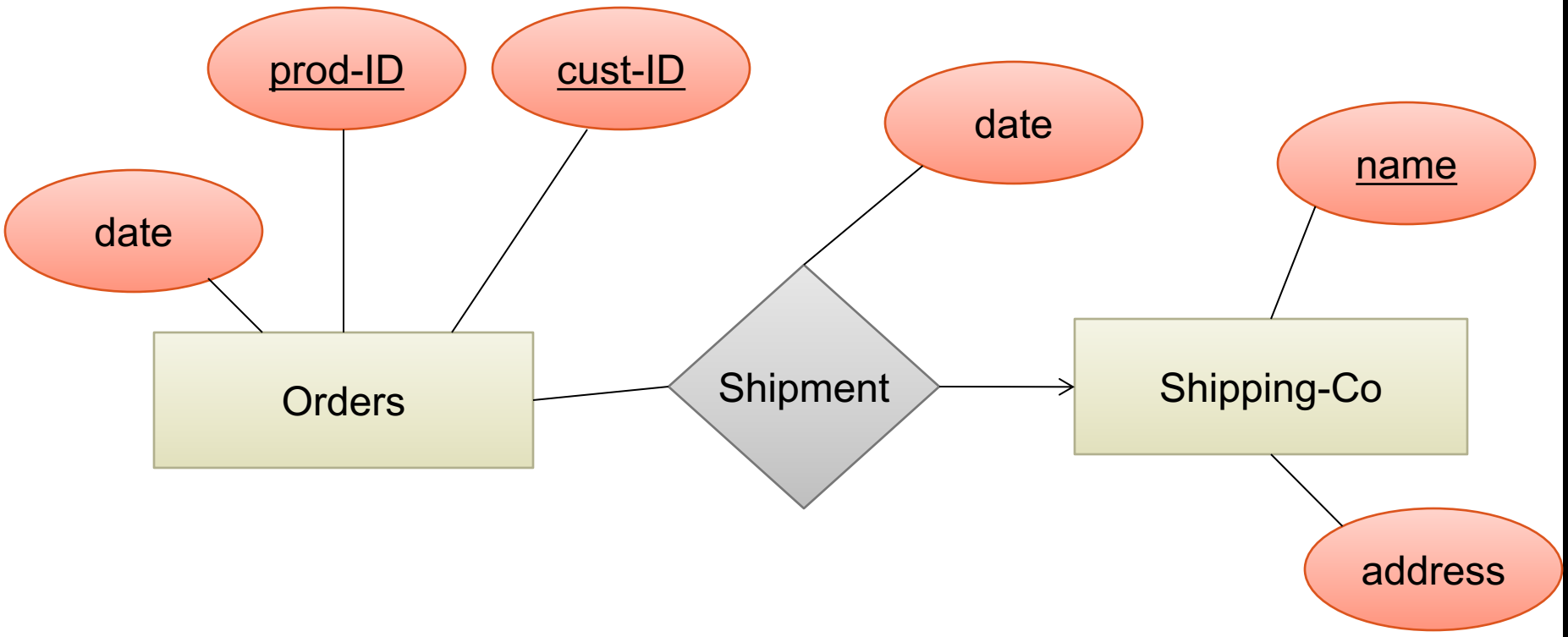
N-N RELATIONSHIPS TO RELATIONS



Orders(prod-ID,cust-ID, date)
Shipment(prod-ID,cust-ID, name, date)
Shipping-Co(name, address)

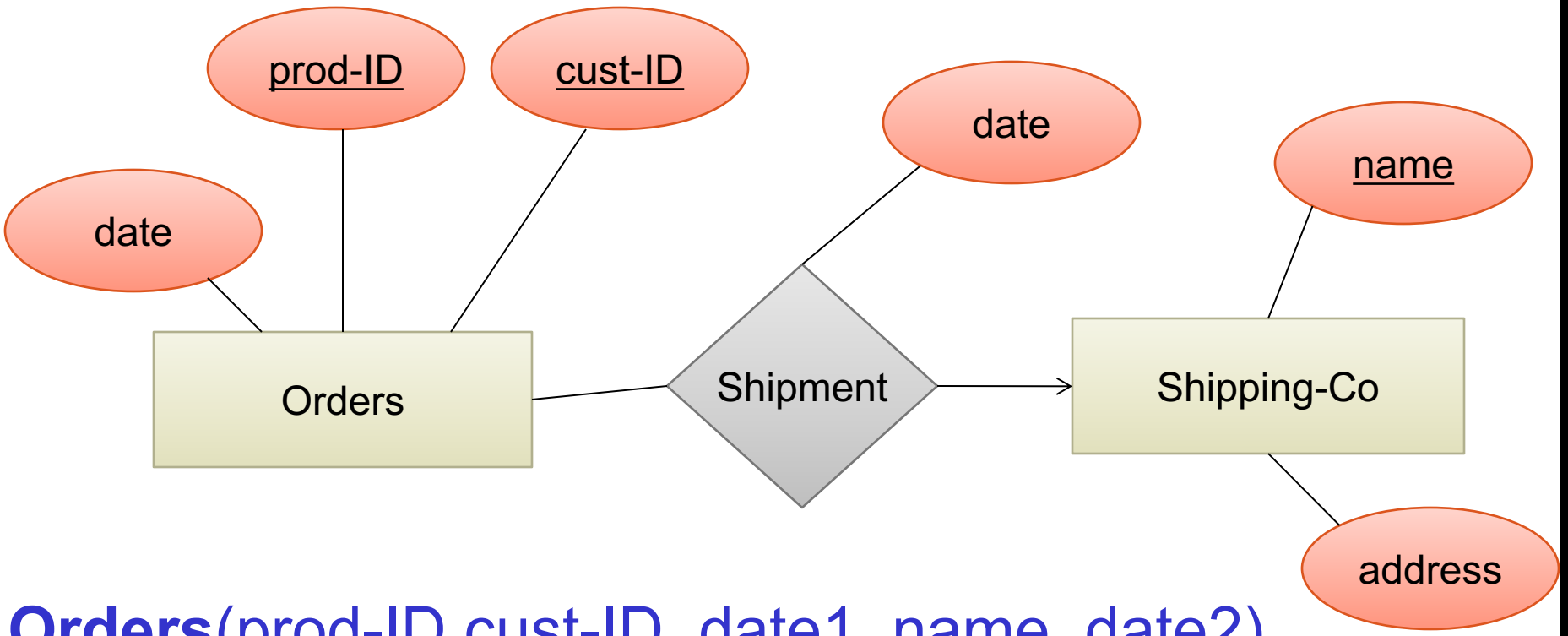
prod-ID	cust-ID	name	date
Gizmo55	Joe12	UPS	4/10/2011
Gizmo55	Joe12	FEDEX	4/9/2011

N-1 RELATIONSHIPS TO RELATIONS



Represent this in relations

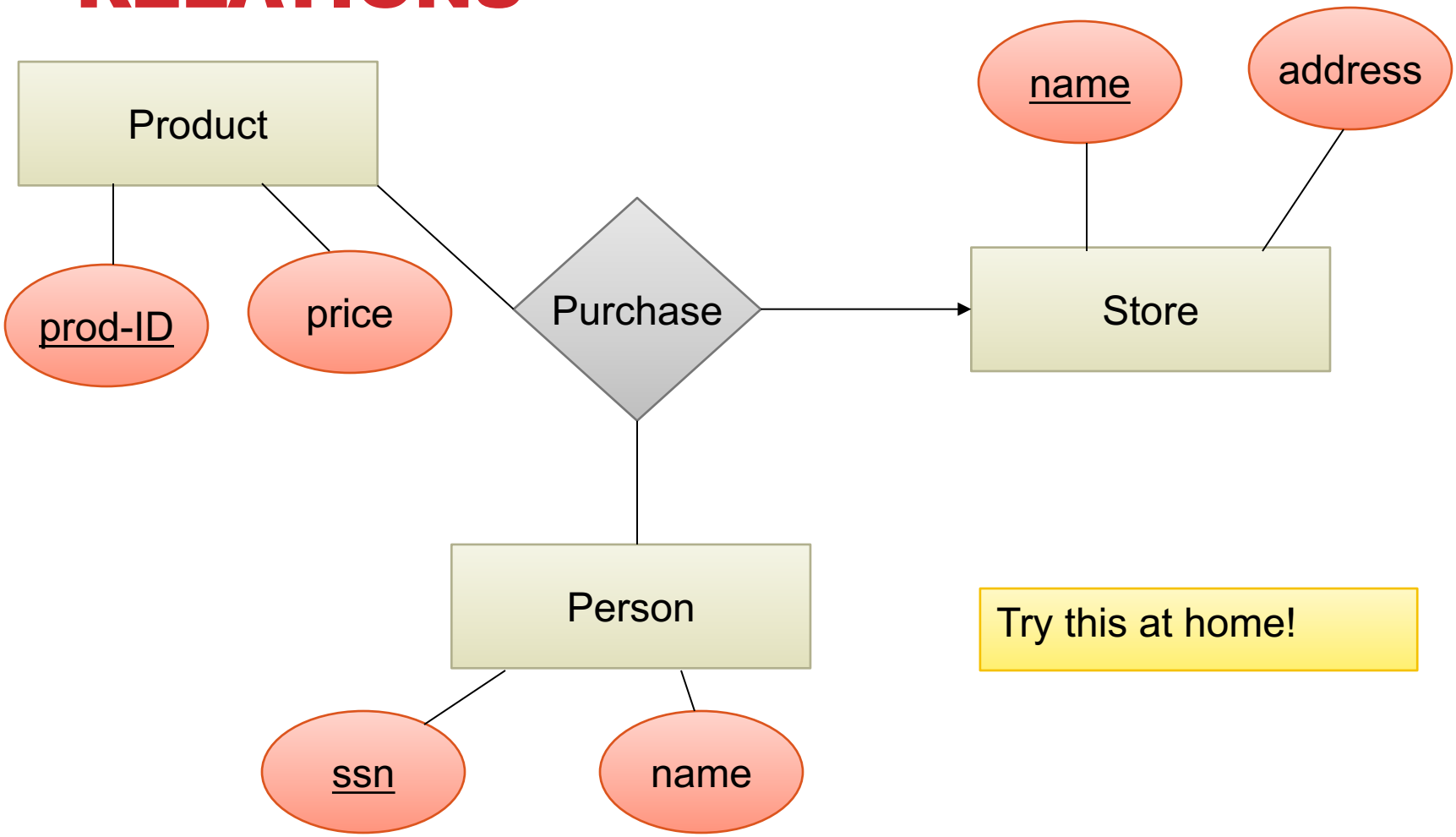
N-1 RELATIONSHIPS TO RELATIONS



Orders(prod-ID,cust-ID, date1, name, date2)
Shipping-Co(name, address)

Remember: no separate relations for many-one relationship

MULTI-WAY RELATIONSHIPS TO RELATIONS



Purchase(prod-ID, ssn, name)