L09: ER modeling 2

CS3200 Database design (fa18 s2)
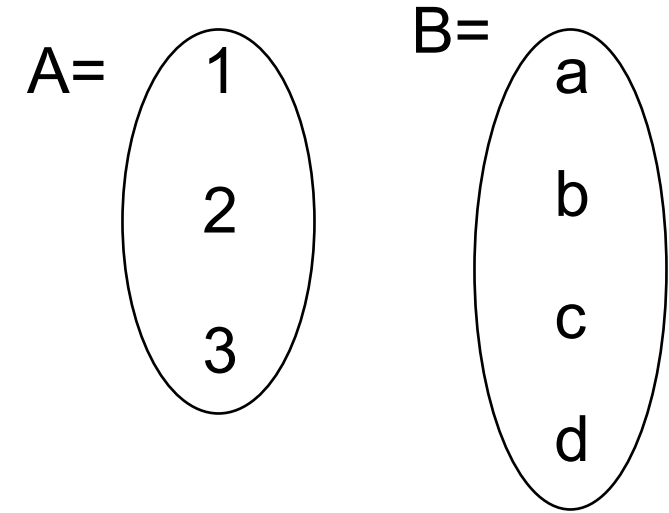
https://northeastern-datalab.github.io/cs3200/

Version 10/4/2018

Announcements!

- Now is a good time to reflect on the class. Please fill out our online Google anonymous feedback form before next class.

- Monday: No class

- We will post a textbook chapter on BB to read in parallel

What is a Relationship?

- A mathematical definition:

  - Let A, B be sets
    - A={1,2,3}, B={a,b,c,d}

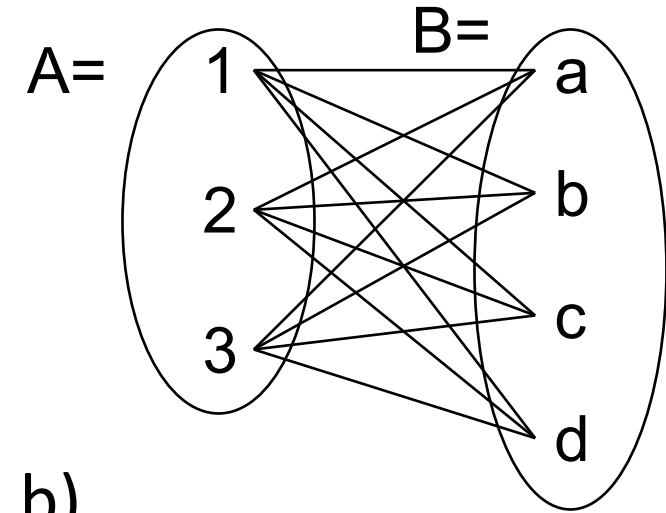A= (1 2 3)   B= (a b c d)

What is a Relationship?

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  - A x B (the <u>cross-product</u>) is the set of all pairs (a,b)
    - $A \times B = \{(1,a), (1,b), (1,c), (1,d), (2,a), (2,b), (2,c), (2,d), (3,a), (3,b), (3,c), (3,d)\}$

A=

B=

1

2

3

a

b

c

d

What is a Relationship?
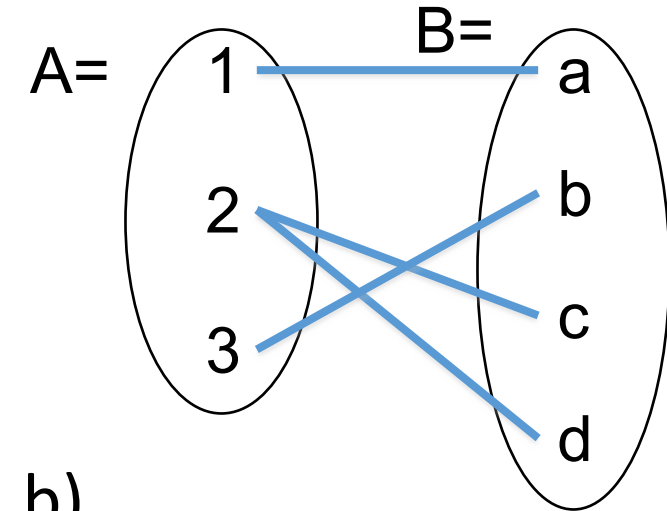
- A mathematical definition:

  A=

  – Let A, B be sets

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

  – A x B (the <u>cross-product</u>) is the set of all pairs (a,b)

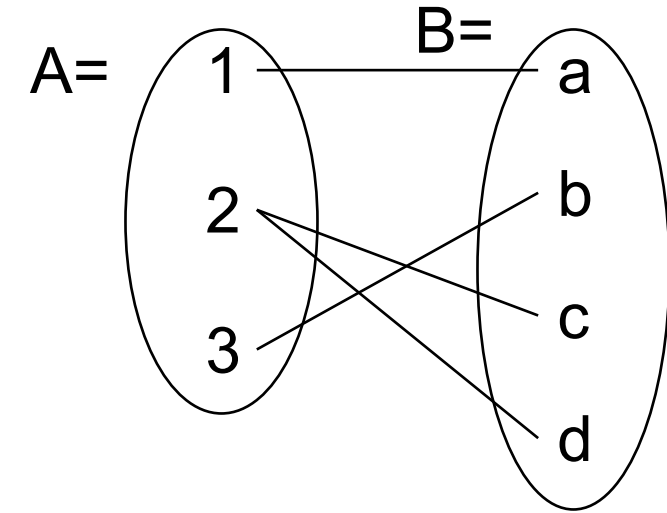   - $A \times B$ = {(1,a), (1,b), (1,c), (1,d), (2,a), (2,b), (2,c), (2,d), (3,a), (3,b), (3,c), (3,d)}

  – We define a <u>relationship</u> to be a subset of A x B
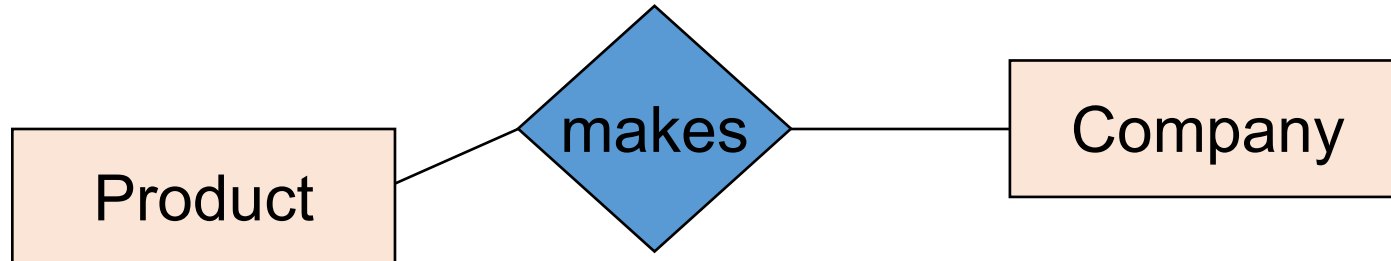
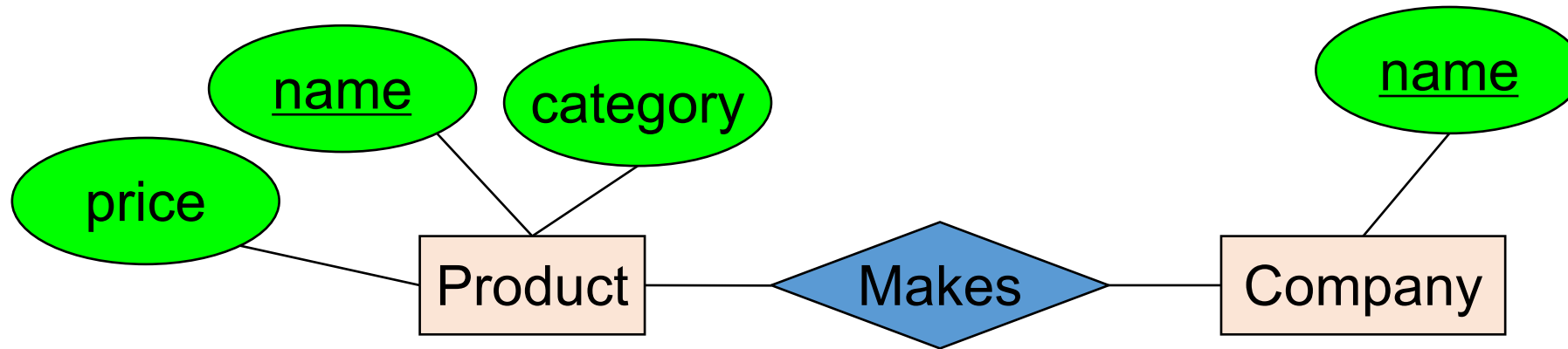   - R = {(1,a), (2,c), (2,d), (3,b)}

What is a Relationship?

- A mathematical definition:
  - Let A, B be sets
  - A x B (the cross-product) is the set of all pairs
  - A relationship is a subset of A x B

A= ... B=
1 — a
2   b
3   c
    d

- Makes is a relationship: it is a subset of Product $\times$ Company:

Product — makes — Company

What is a Relationship?

A **relationship** between **entity sets P and C** is a *subset of all possible pairs of entities in P and C*, with tuples uniquely identified by *P and C's keys*

What is a Relationship?

Company

name
GizmoWorks
GadgetCorp

Product

name	category	price
Gizmo	Electronics	$9.99
GizmoLite	Electronics	$7.50
Gadget	Toys	$5.50

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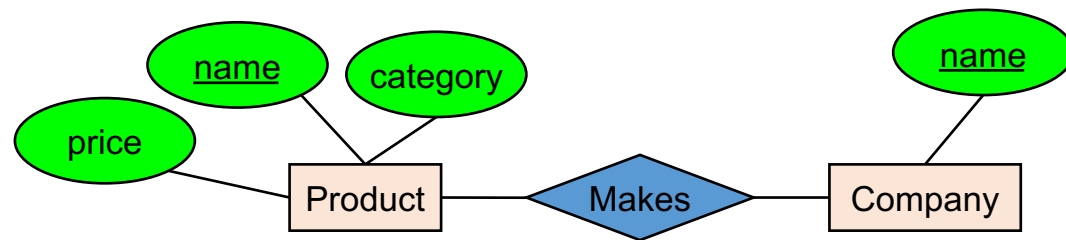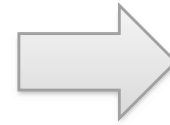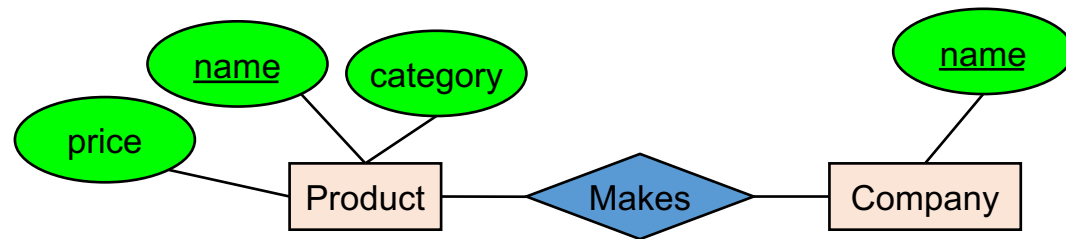
What is a Relationship?

Company

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GizmoWorks
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Product

name	category	price
Gizmo	Electronics	$9.99
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Company C × Product P

C.name	P.name	P.category	P.price
GizmoWorks	Gizmo	Electronics	$9.99
GizmoWorks	GizmoLite	Electronics	$7.50
GizmoWorks	Gadget	Toys	$5.50
GadgetCorp	Gizmo	Electronics	$9.99
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A **relationship** between **entity sets P and C** is a
subset of all possible pairs of entities in P and C,
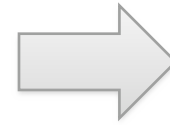with tuples uniquely identified by *P and C's keys*

What is a Relationship?

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name
GizmoWorks
GadgetCorp

Product

name	category	price
Gizmo	Electronics	$9.99
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Makes

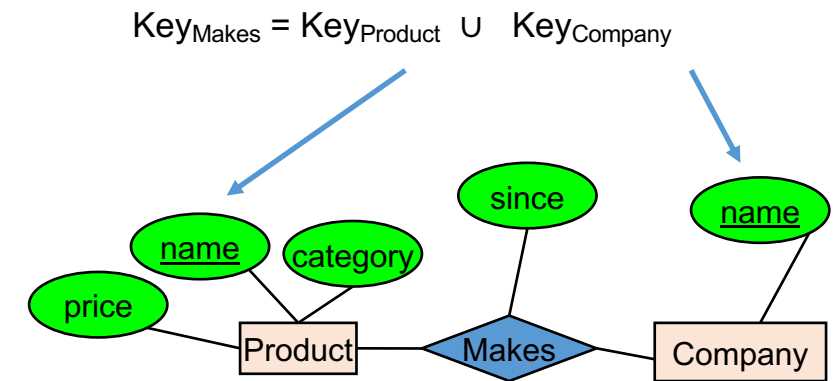| C.name	P.name
GizmoWorks	Gizmo
GizmoWorks	GizmoLite
GizmoWorks	Gadget
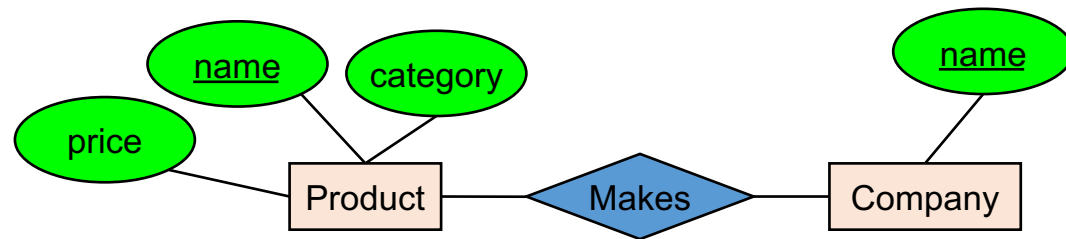
A **relationship** between **entity sets P and C** is a *subset of all possible pairs of entities in P and C*, with tuples uniquely identified by *P and C's keys*

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What is a Relationship?

- There can only be one relationship (instance) for every unique combination of entities
  - Exception: attributed relationships

- This also means that the relationship is uniquely determined by the keys of its entities

$$\text{Key}_{\text{Makes}} = \text{Key}_{\text{Product}} \cup \text{Key}_{\text{Company}}$$

- Example: the "key" for Makes (to right) is {Product.name, Company.name}

Relationships and Attributes

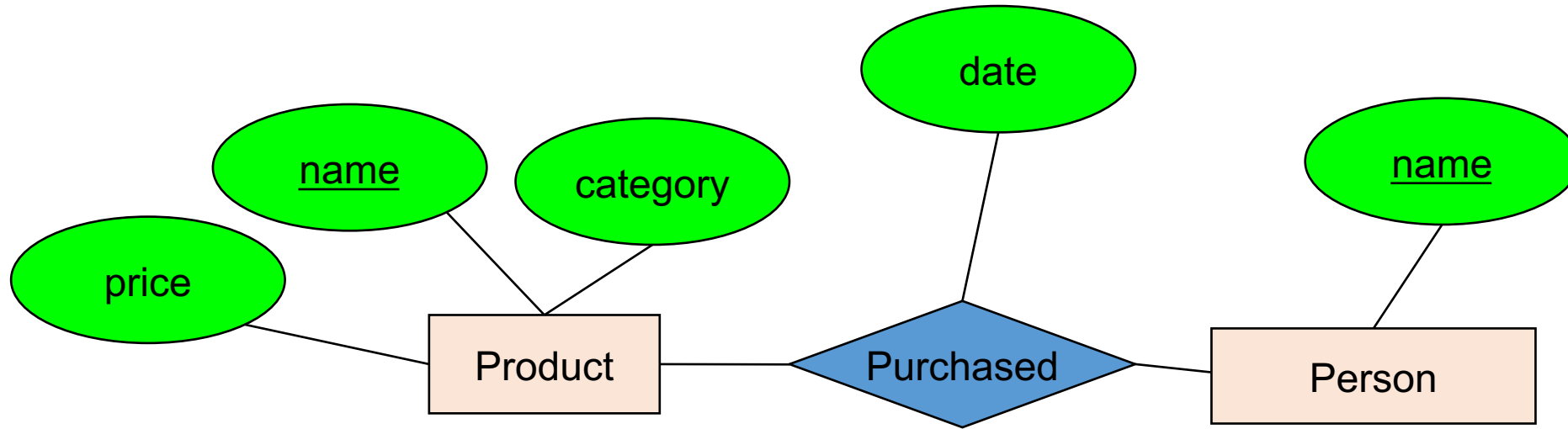- Relationships may have attributes as well.
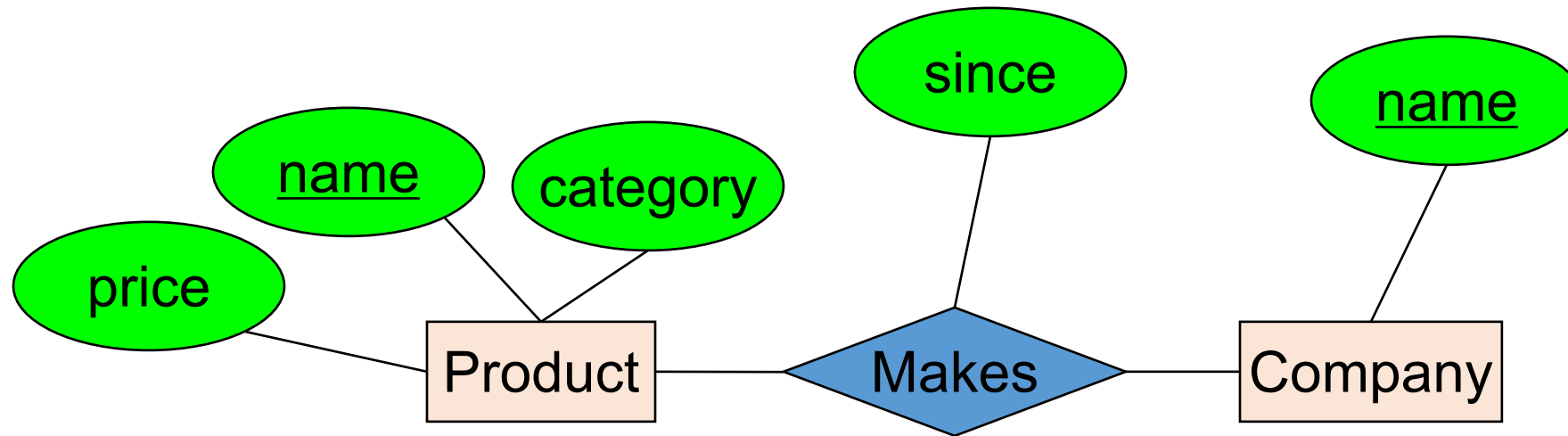
For example: "since" records when company started making a product

Note: "*since*" is implicitly unique per pair here! Why?

Note #2: Why not "how long"?

Decision: Relationship vs. Entity?
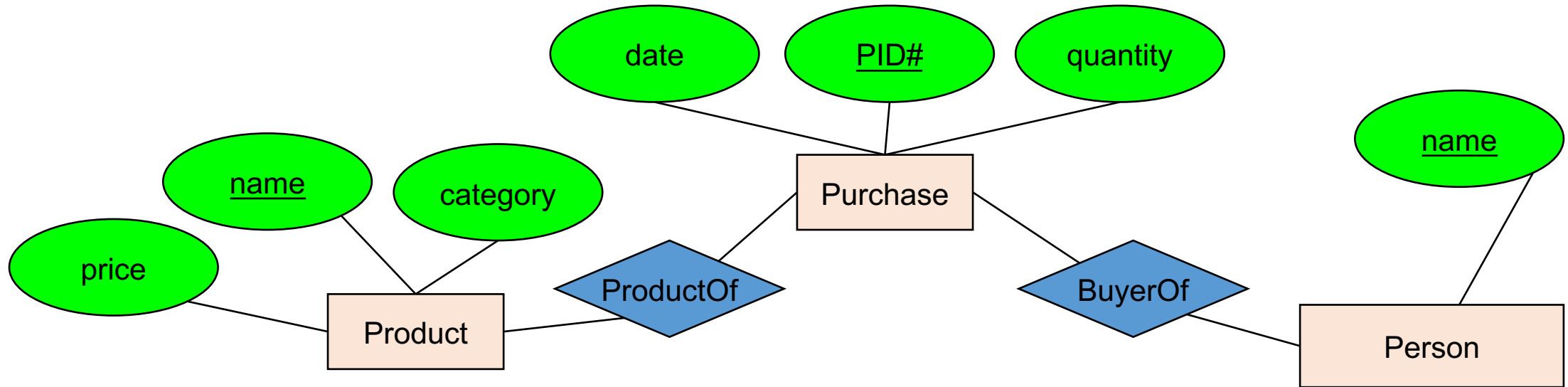
- Q: What does this say?

- A: A person can only buy a specific product once (on one date)

Modeling something as a relationship makes it unique; what if not appropriate?

Decision: Relationship vs. Entity?
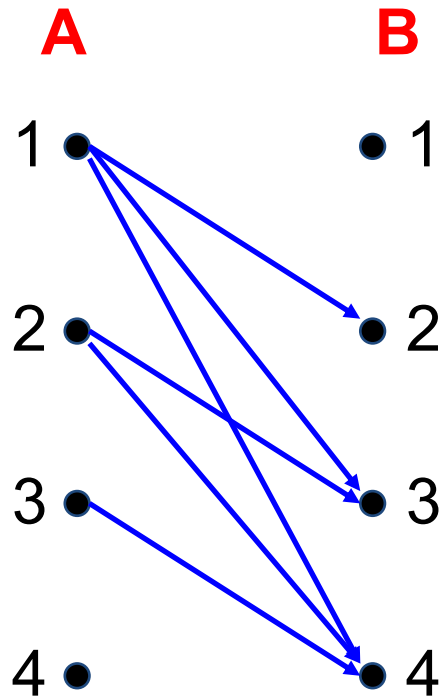
- What about this way?

- Now we can have multiple purchases per product, person pair!

We can always use **a new entity** instead of a relationship. For example, to permit multiple instances of each entity combination!

Relations

Definition: Let A and B be sets. A binary relation from A to B is a subset of A×B.

Example: R = {(1, 2), (1, 3), (1, 4), (2, 3), (2,4), (3,4)}

(R = {(a, b) | a < b} with a, b from A=B={1, 2, 3, 4})

Definition of <u>Function</u>: For nonempty sets *A* and *B*, a function *f* from *A* to *B*, denoted *f:A→B*, is a relation from *A* to *B* in which <u>every element of *A* appears exactly once</u> as the first component of an ordered pair in the relation.