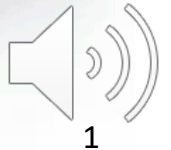


CZ2007 Introduction to Database Systems (Week 1)

Topic 1: Entity Relationship Diagram (1)



Dr. Ng Wee Keong

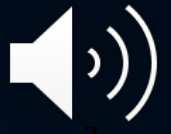
Associate Professor

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This Lecture

- Database and DBMS ←
- ER diagram
- Types of relationships
- Roles



Database and DBMS

- What is a database?
 - A collection of data specially organized for efficient retrieval by a computer
- What is a database system?
 - A piece of software that helps us efficiently manage/retrieve information from databases
- More formal name: Database Management System (DBMS)



DBMS in Practice

- Large web sites rely heavily on DBMS
 - Facebook
 - Twitter
- Many non-web companies, too
 - E.g., Banks
- Even small pieces of software on your computer
 - E.g., Google Chrome



Relational Model

- Numerous DBMS exist on the market
 - Oracle, SQL Server, DB2, MySQL...
- Most of them follow the relational model
- What does it mean?
- Answer: They store all data in relations



Relation

name →

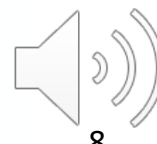
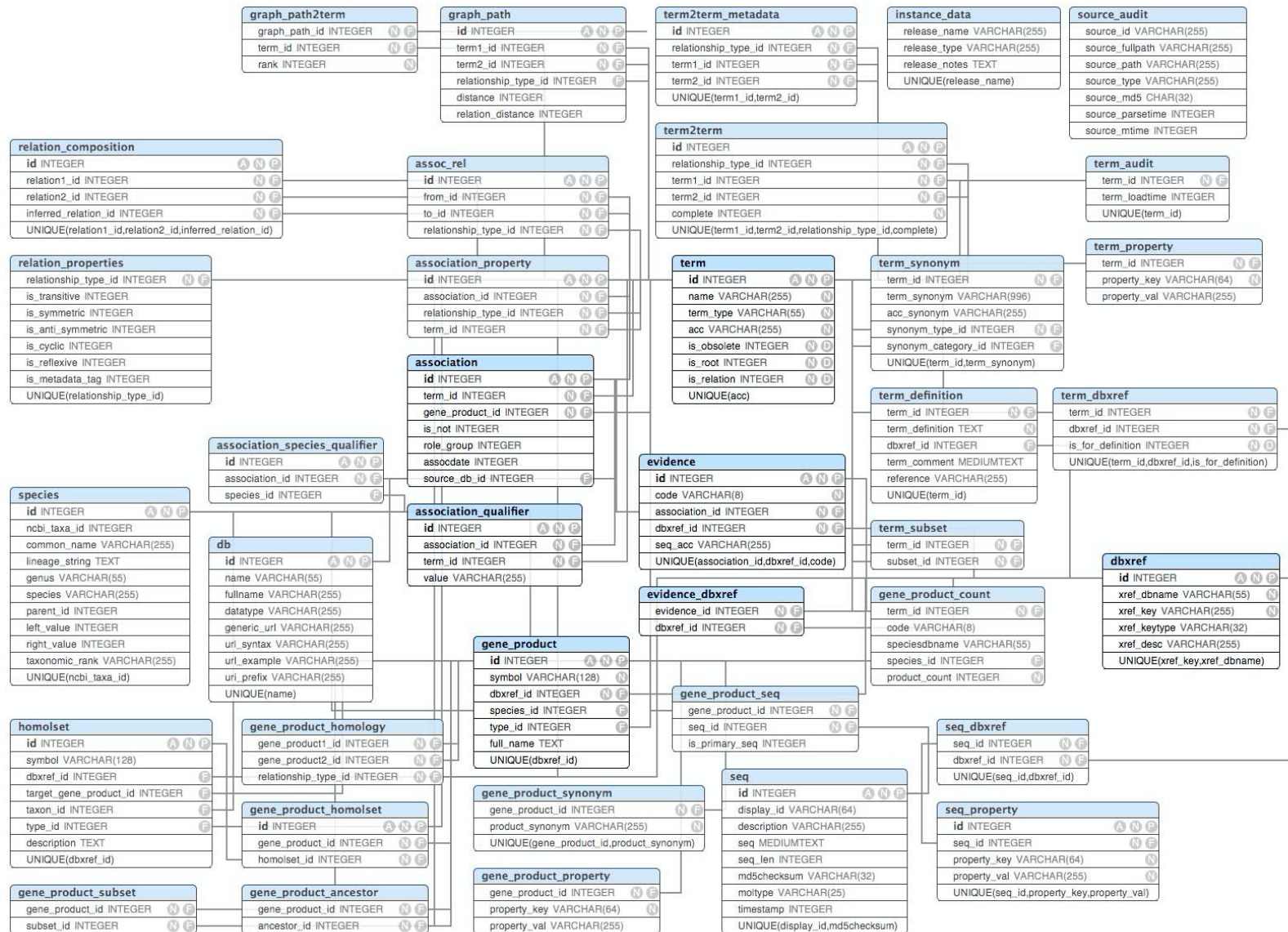
Product			
<u>Name</u>	Price	Category	Manufacturer
iPhone 6	888	Phone	Apple
iPad Air 2	668	Tablet	Apple
Galaxy	798	Phone	Samsung
EOS-1D X	1199	Camera	Canon

■ Some jargons:

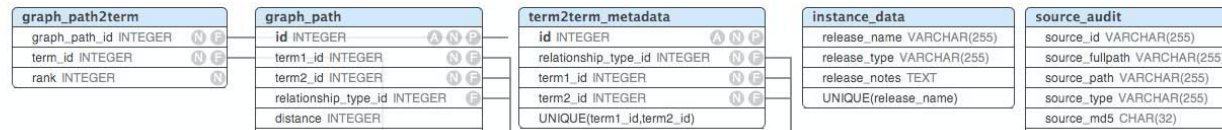
- ❑ A relation is often referred to as a **table**
- ❑ A row in a table is also called a **tuple** or a record
- ❑ A column in a table is also called an **attribute** of the table



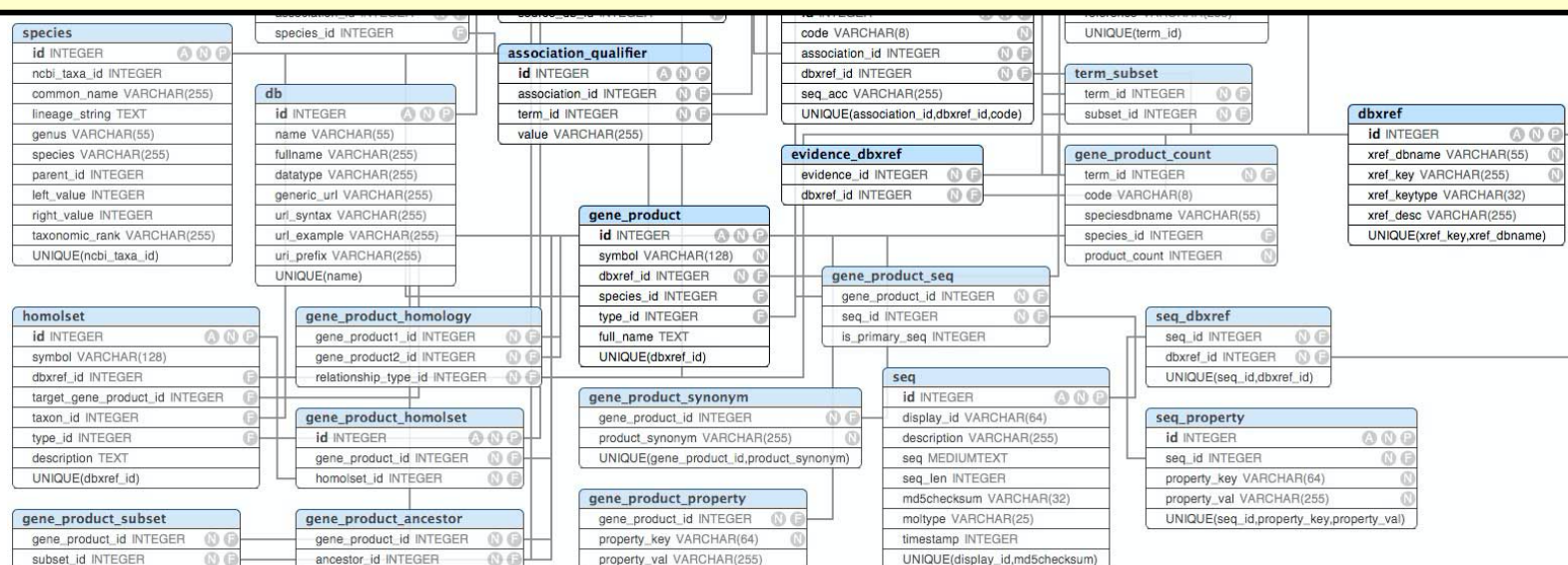
A real database may have a large number of tables...



A real database may have a large number of tables...

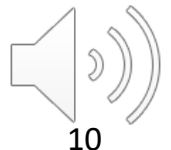


- Imagine that you are ask to design a database like this....
- How would you approach the problem?



Designing a Database for an Application

- Conceptually model the requirements of the application
 - What are the things that need to be stored?
 - How do they interact with one another?
- **Tool to use: Entity-Relationship (ER) Diagrams**
 - A pictorial and intuitive way for modelling
- Translate the conceptual model into a set of tables
- Construct the tables with a DBMS

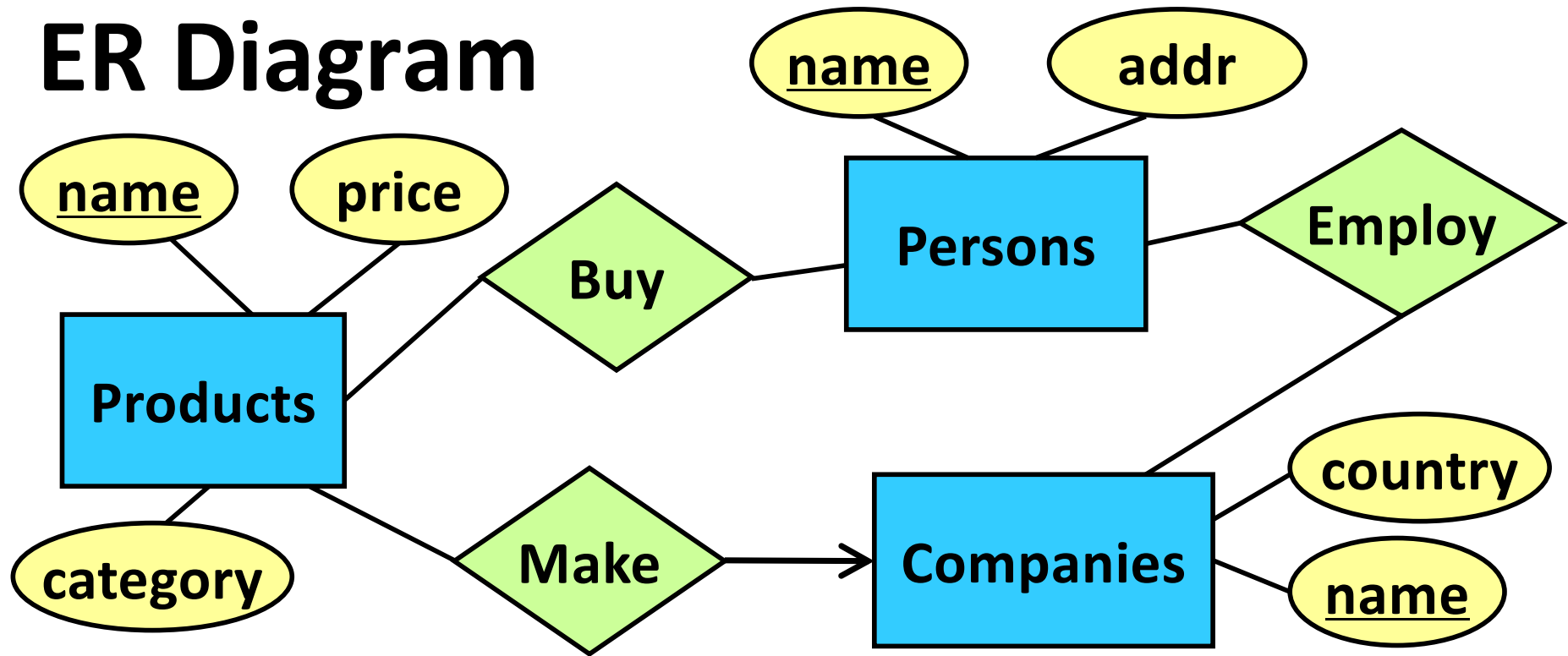


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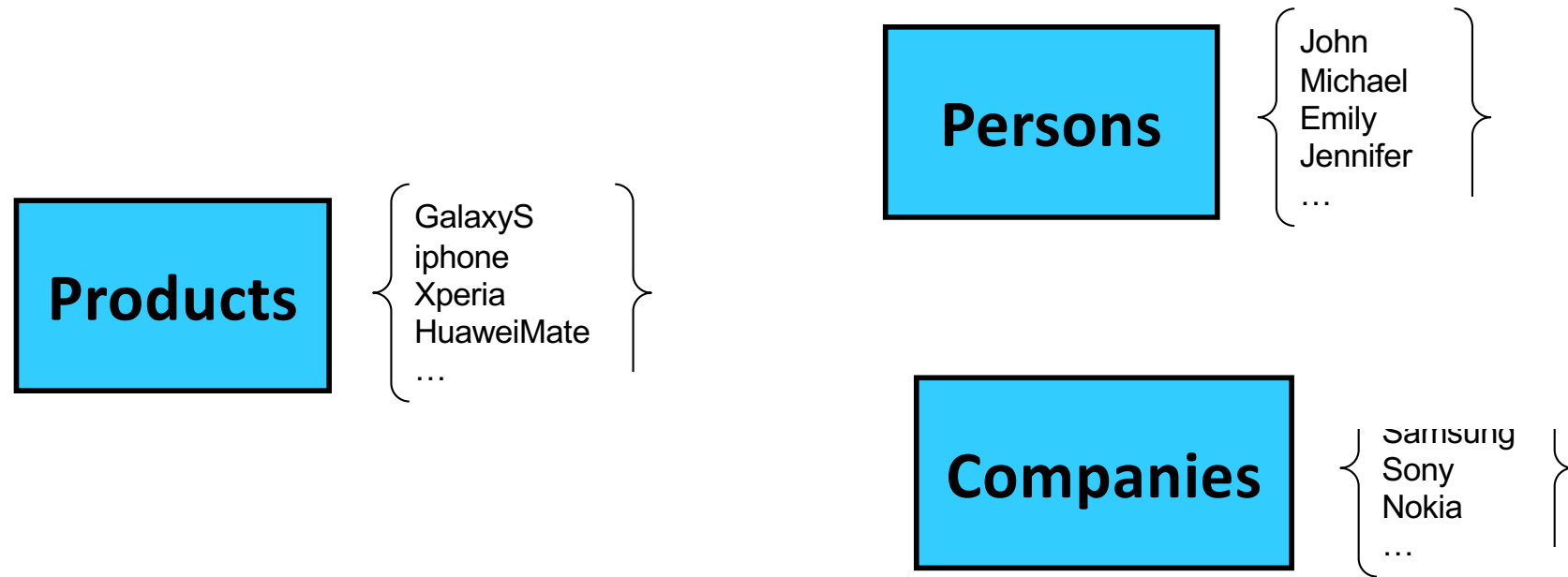
- Database and DBMS
- ER diagram ←
- Types of relationships
- Roles



ER Diagram

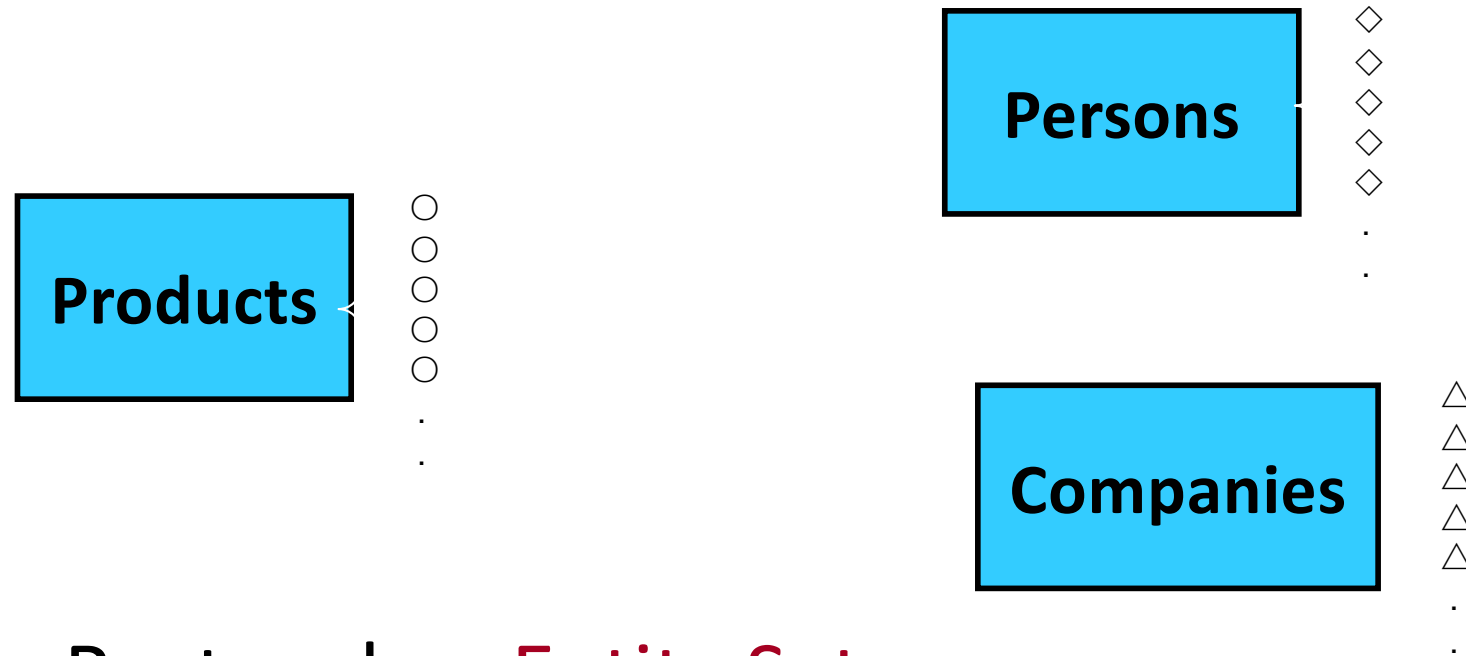


ER Diagram



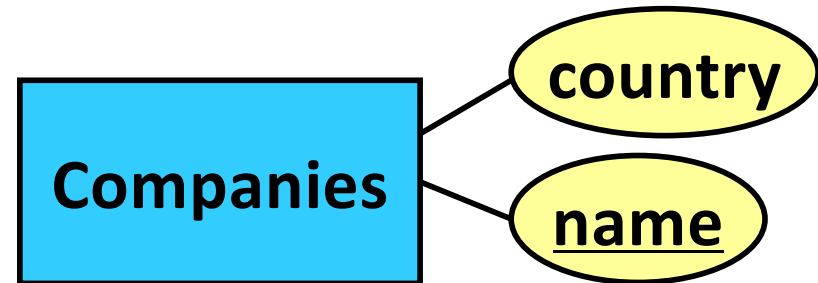
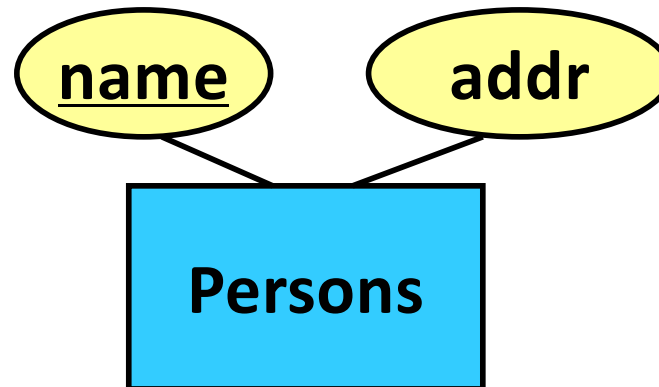
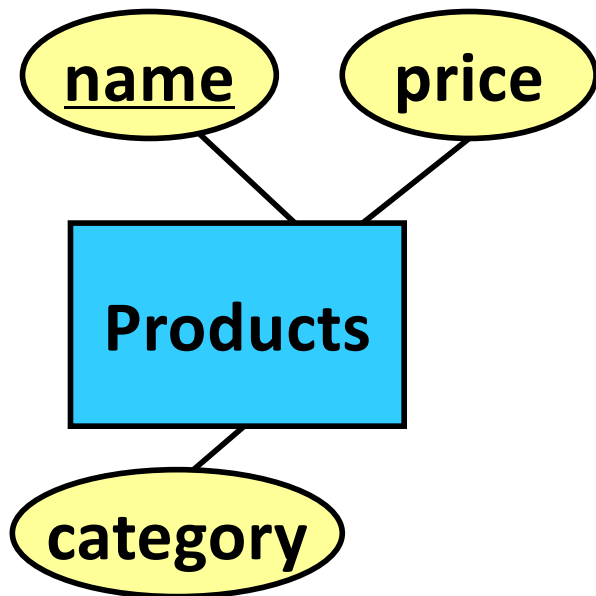
- Rectangle = **Entity Set**
- **Entity** = Real-world object
- **Entity Set** = Collection of similar objects
- Analogue: An object class

ER Diagram



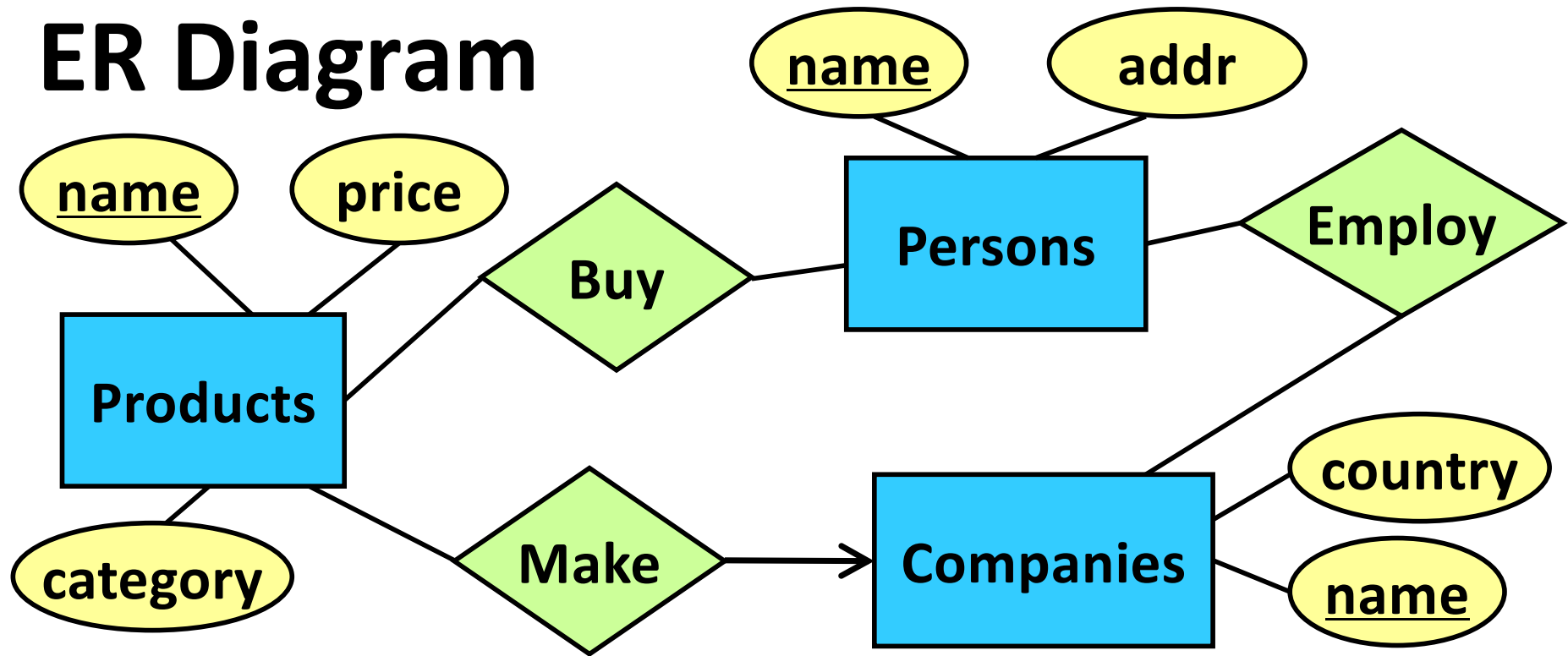
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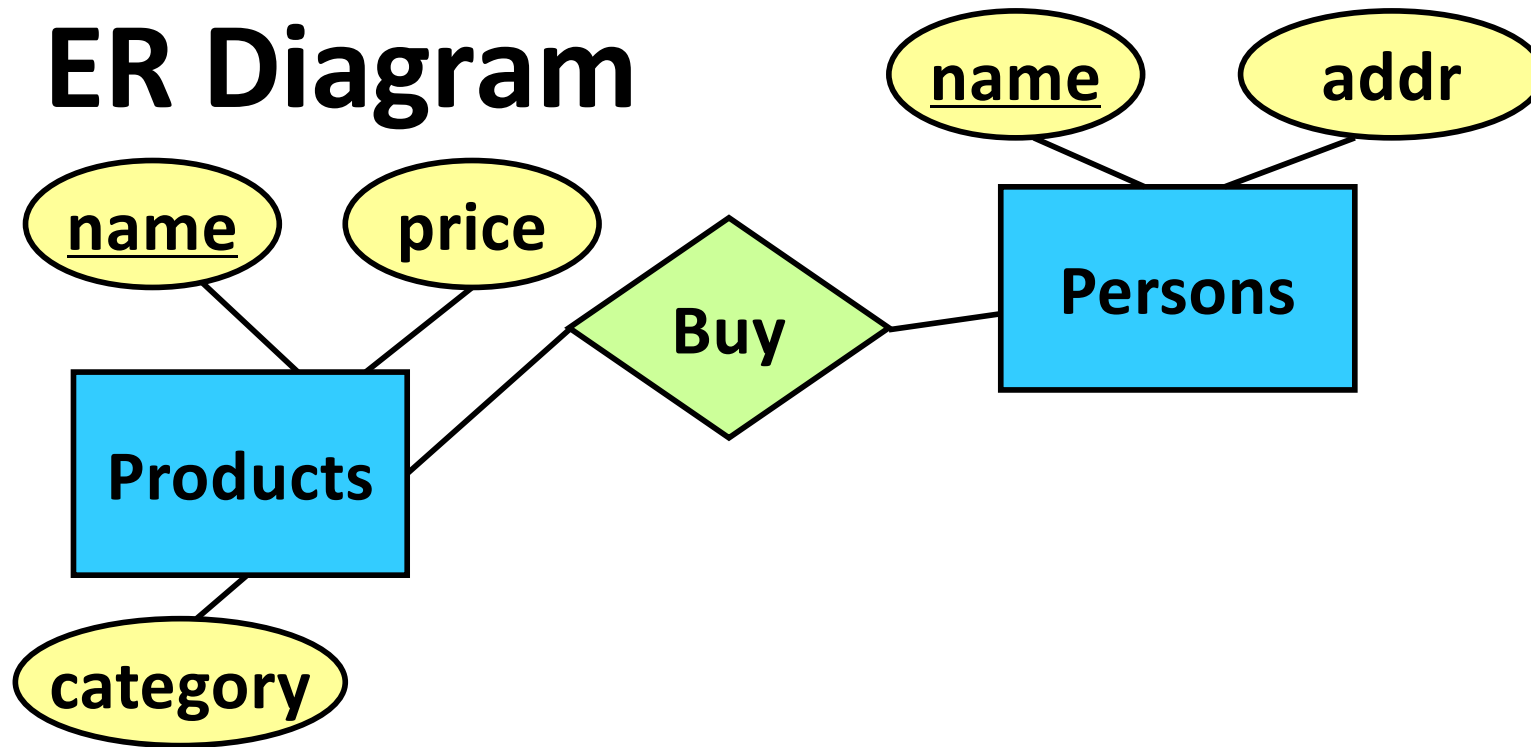
- Oval = **Attribute** = Property of an entity set

ER Diagram



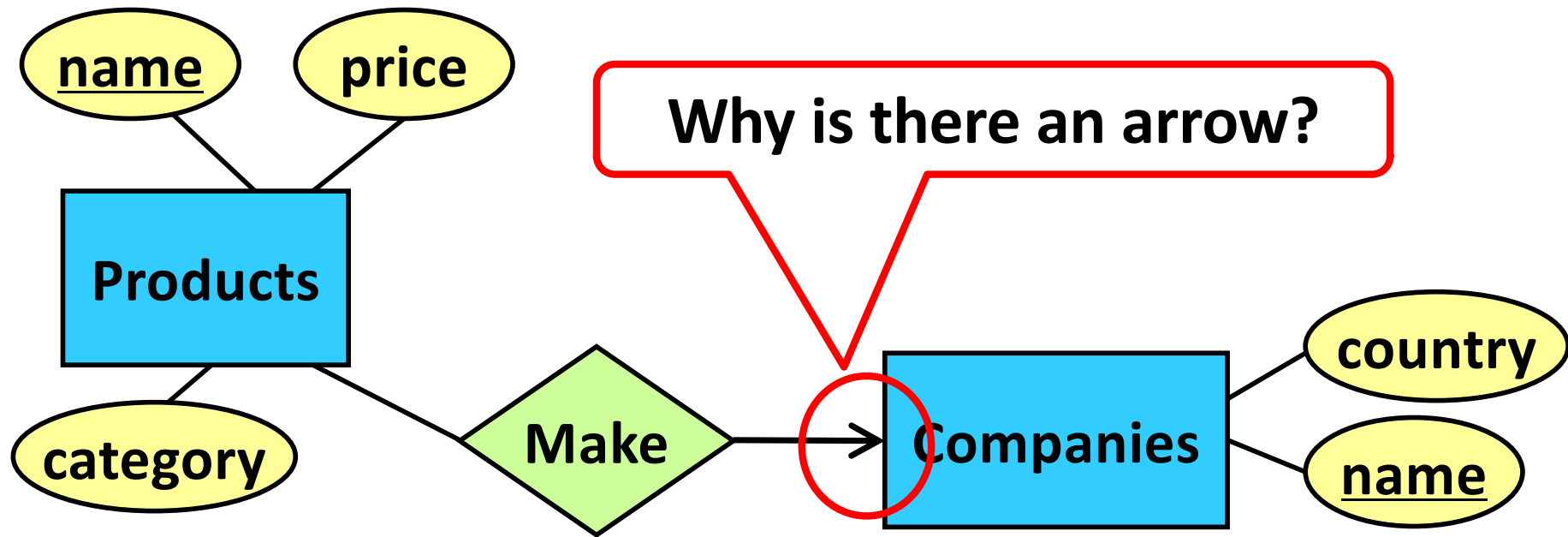
- Diamond = **Relationship** = Connection between two entity sets

ER Diagram



- Diamond = **Relationship** = Connection between two entity sets
- Persons buy products

ER Diagram



- Diamond = **Relationship** = Connection between two entity sets
- Companies make products

This Lecture

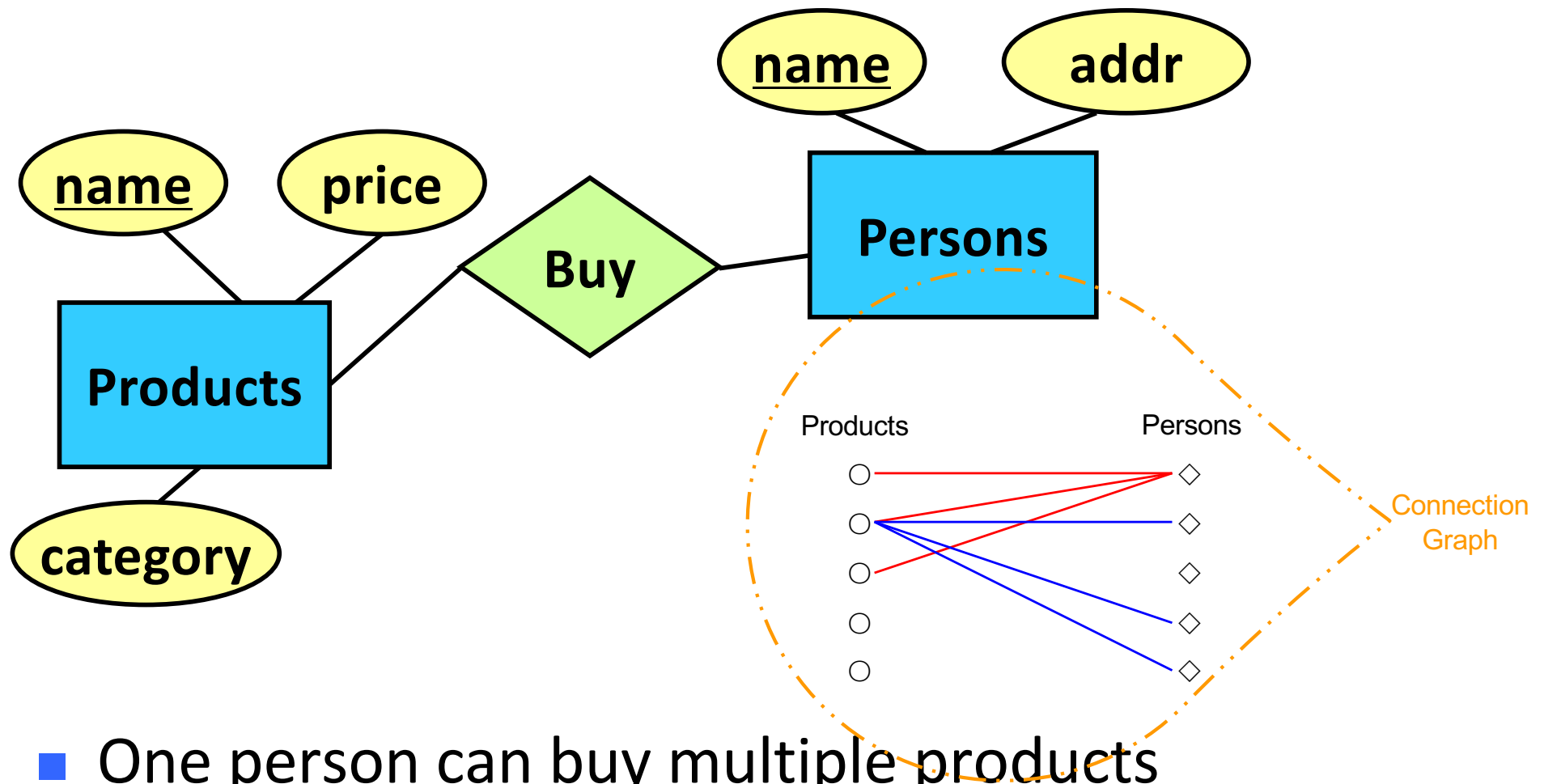
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Types of Relationships

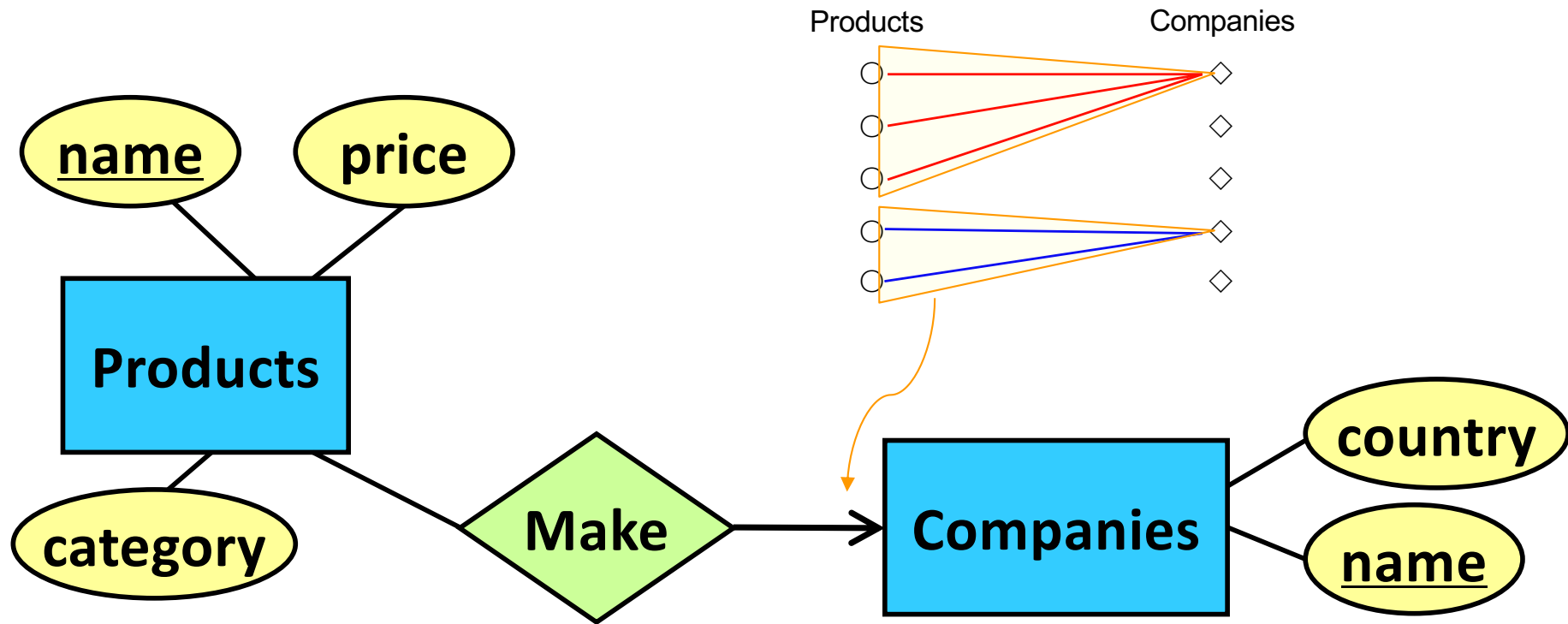
- Many-to-Many Relationships
- Many-to-One Relationships
- One-to-One Relationships

Many-to-Many Relationship



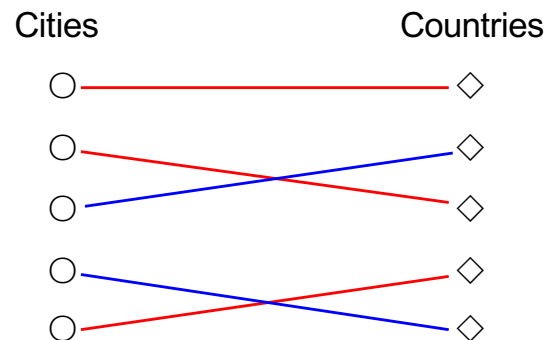
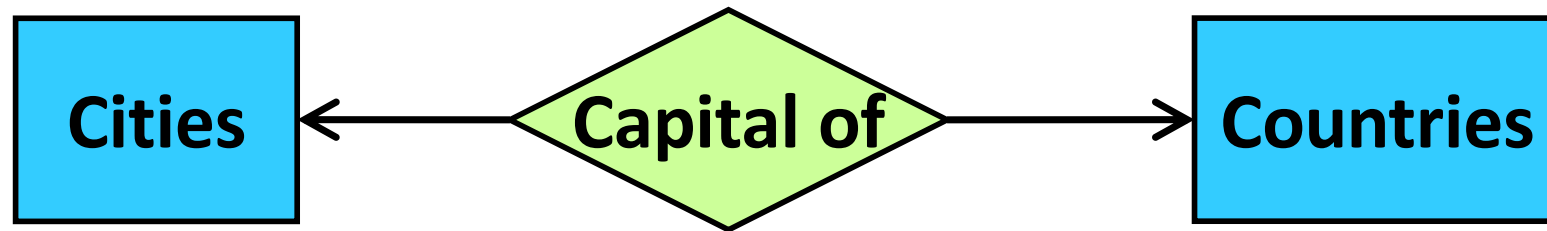
- One person can buy multiple products
- One product can be bought by multiple persons

Many-to-One Relationship



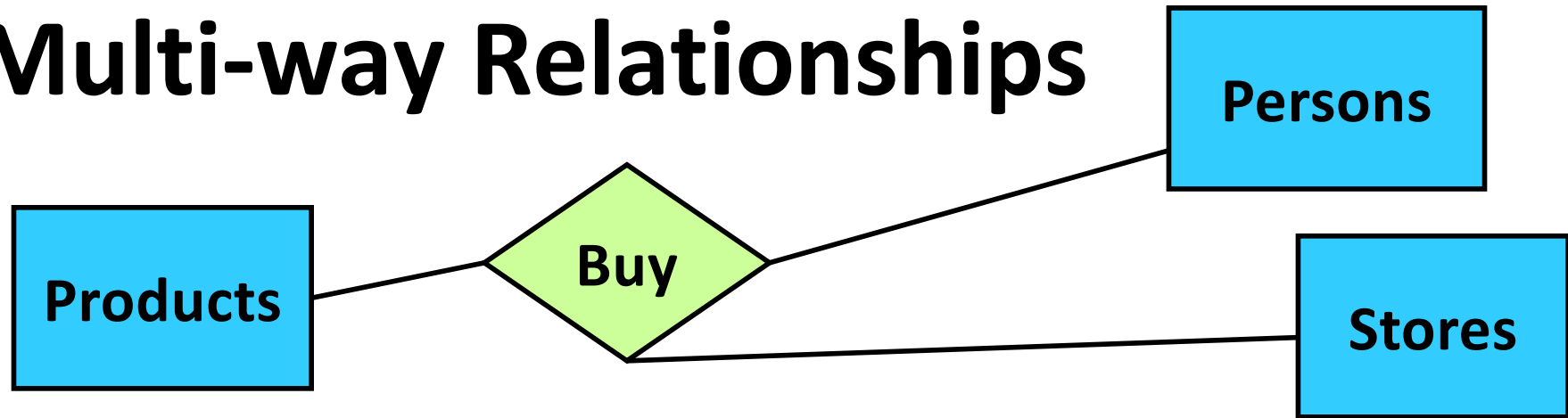
- One company can make multiple products
- But one product can only be made by one company

One-to-One Relationship



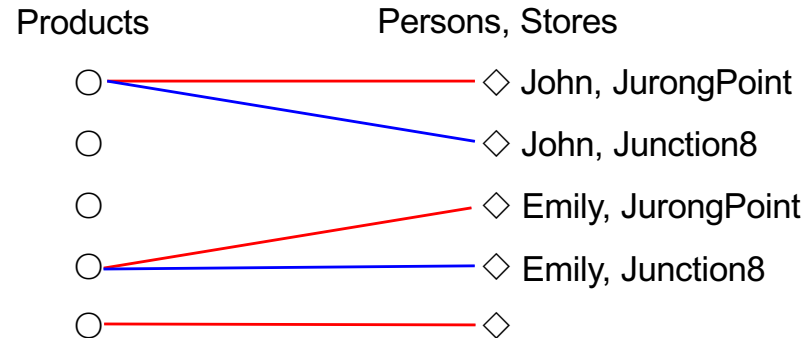
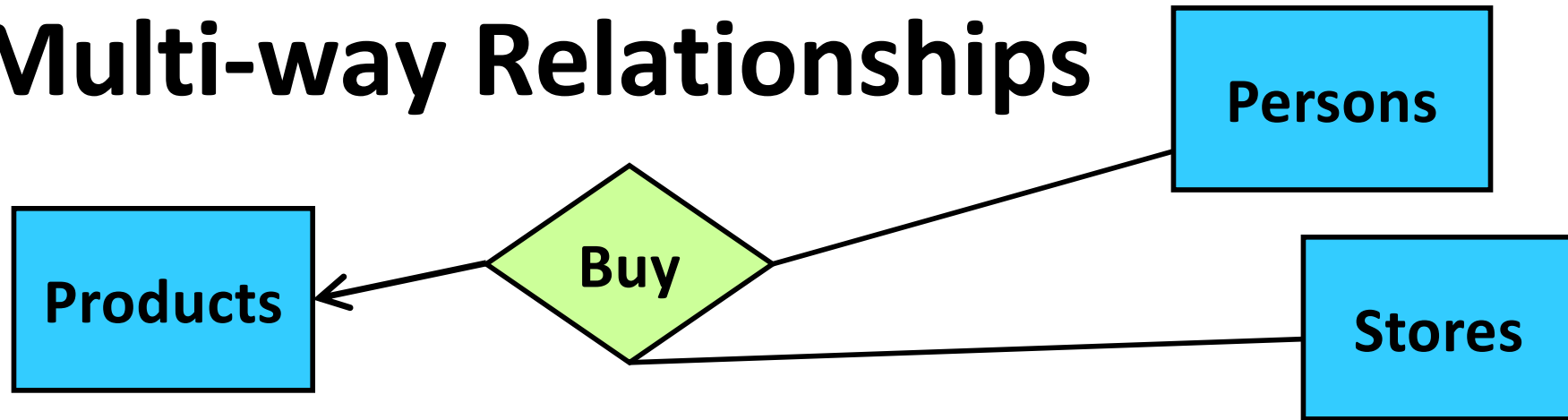
- A city can be the capital of only one country
- A country can have only one capital city

Multi-way Relationships



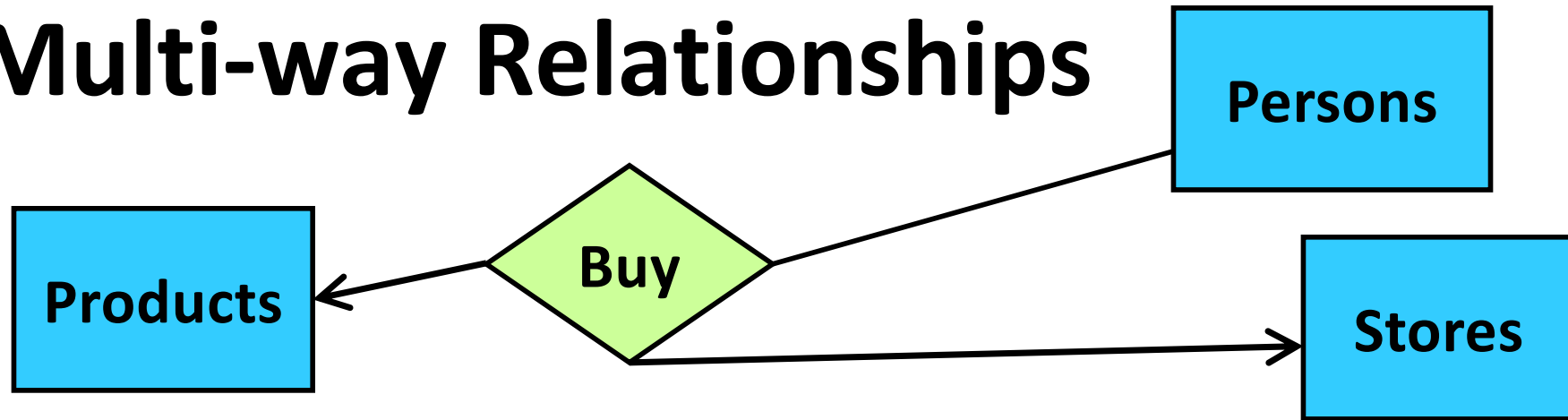
- What if we want to record the store from which the person buys the product?
- We can use a 3-way relationship
- Drawback: The arrows would be complicated

Multi-way Relationships



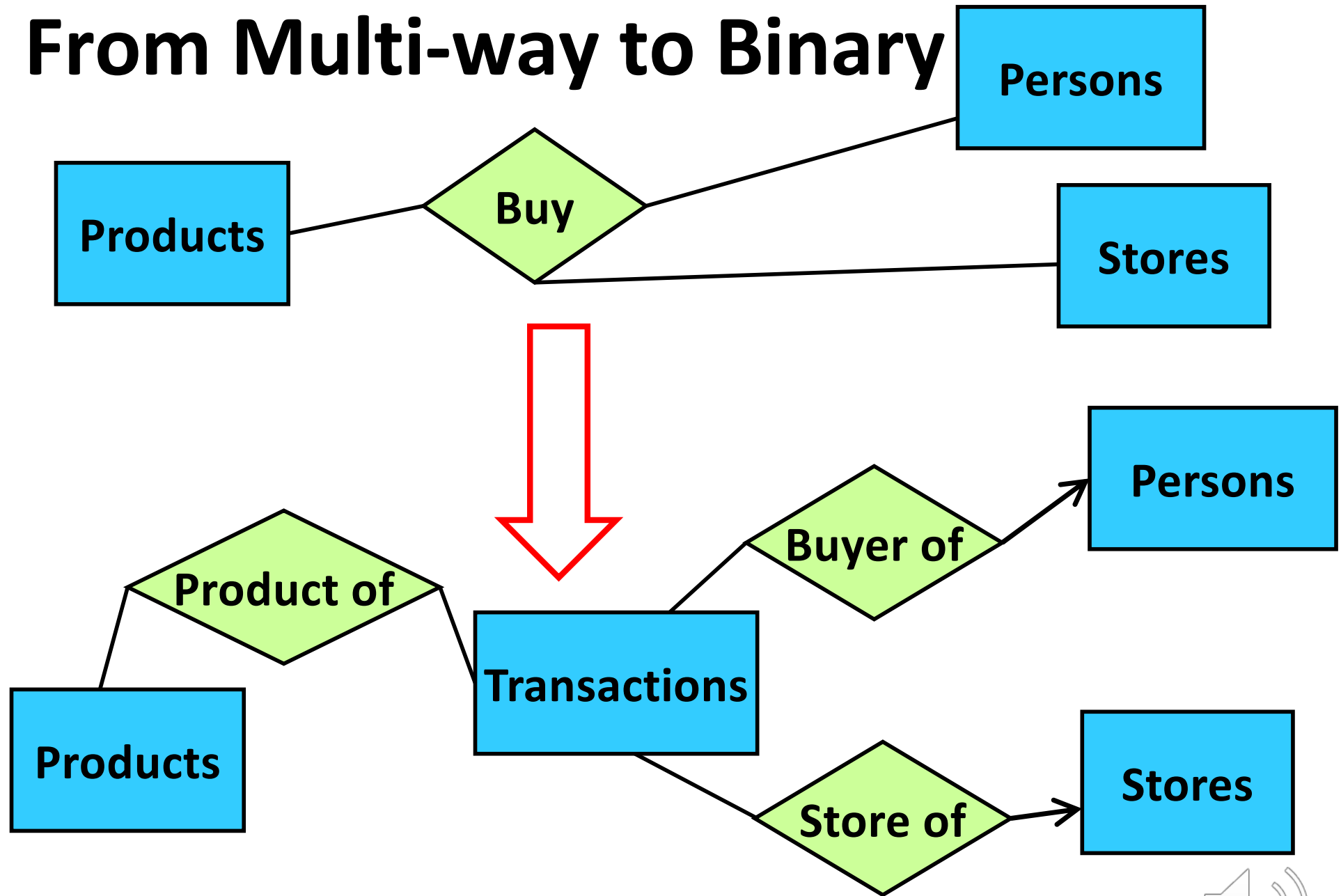
- What does this mean?
- One <person, store> pair can correspond to one product
- But one product can correspond to many <person, store> pairs
- Meaning: A person only buys one product from one shop

Multi-way Relationships

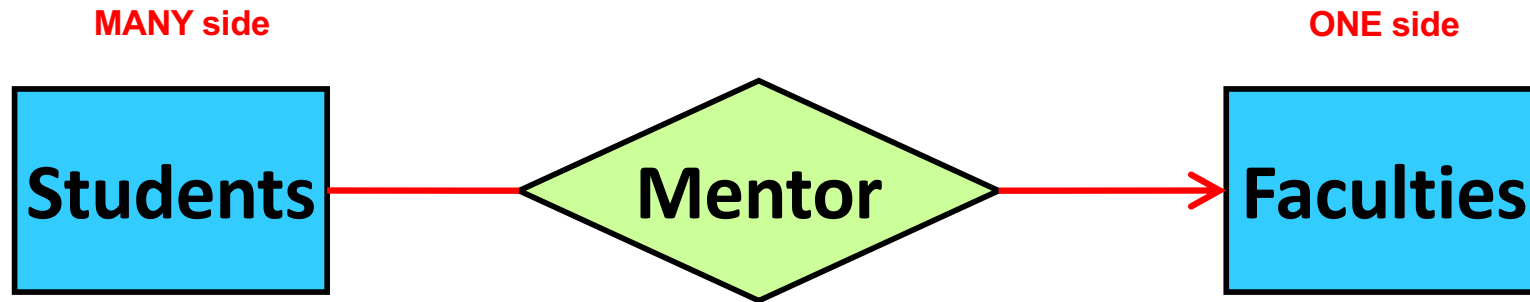


- What does this mean?
- From $\langle \text{person}, \text{store} \rangle$ to product: many to one
- From $\langle \text{person}, \text{product} \rangle$ to store: many to one
- Note: not required in the quiz/exam

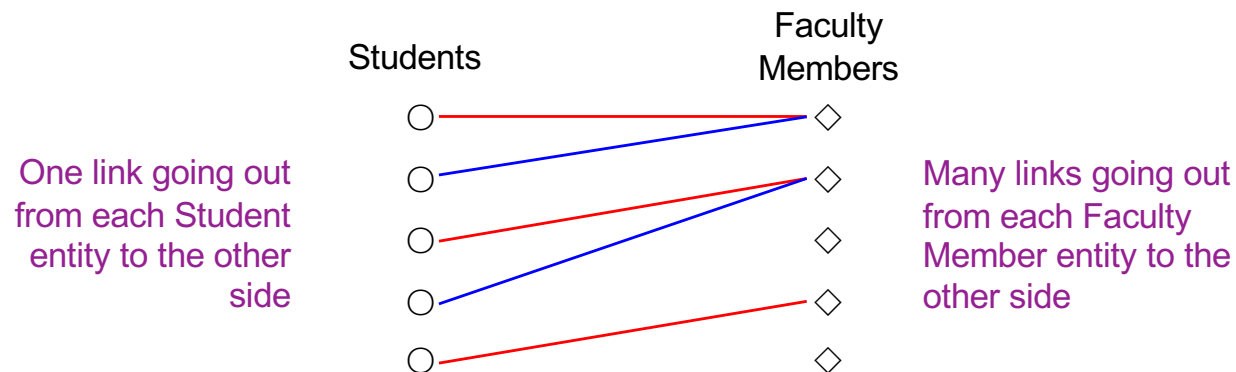
From Multi-way to Binary



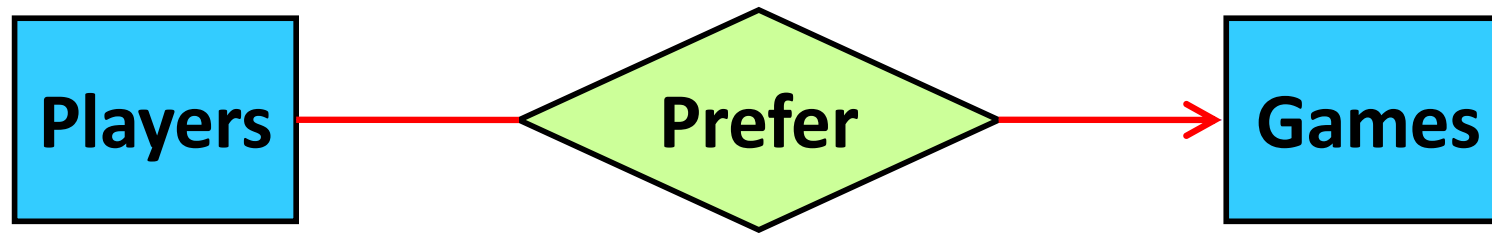
Example



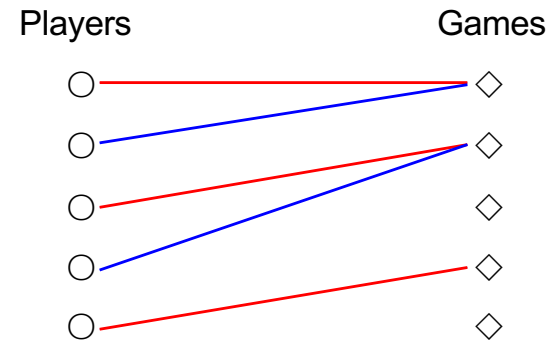
- Each student is mentored by one faculty member
- Each faculty member can mentor multiple students



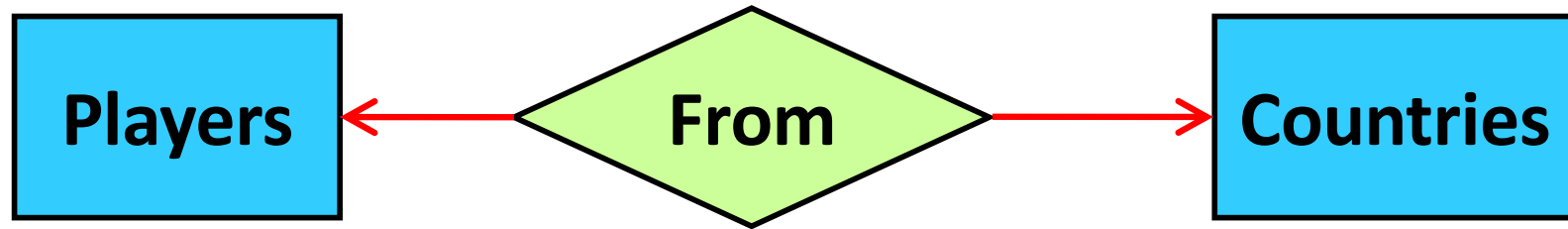
Exercise



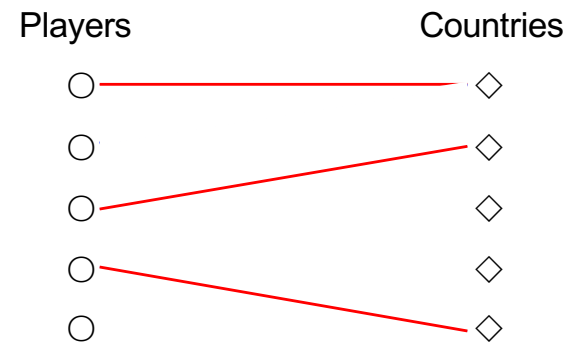
- Each player prefers only one game, but not vice versa
- Many-to-many? ❌
- Many-to-one? ✅
- One-to-one? ❌



Exercise



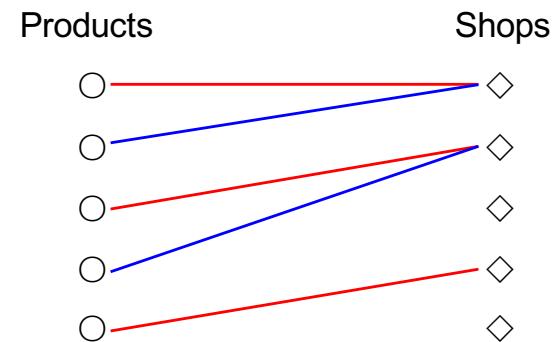
- Any two players are from exactly two different countries
- Many-to-many? **✗**
- Many-to-one? **✗**
- One-to-one? **✓**



Exercise



- No two shops sell the same product
- Many-to-many? ✗
- Many-to-one? ✓
- One-to-one? ✗

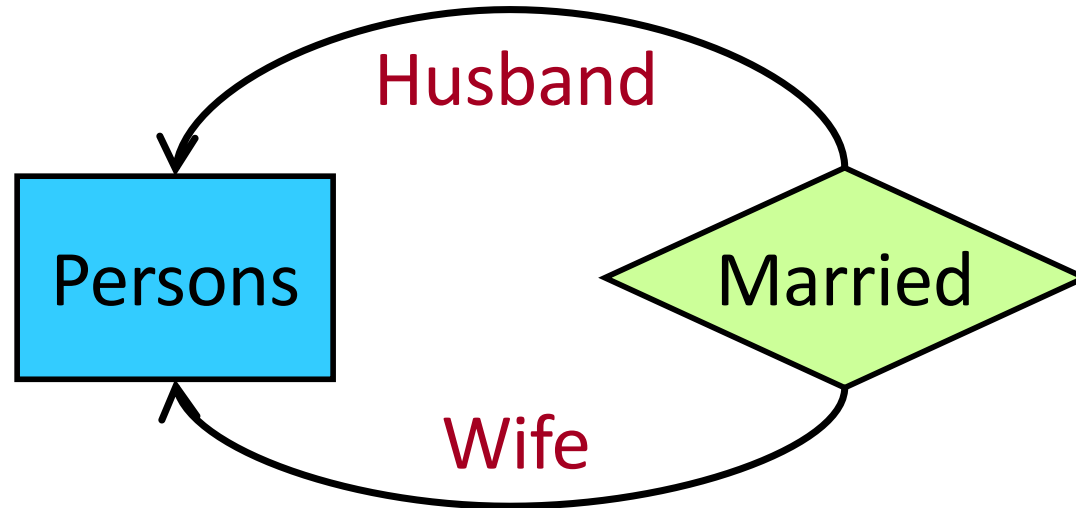


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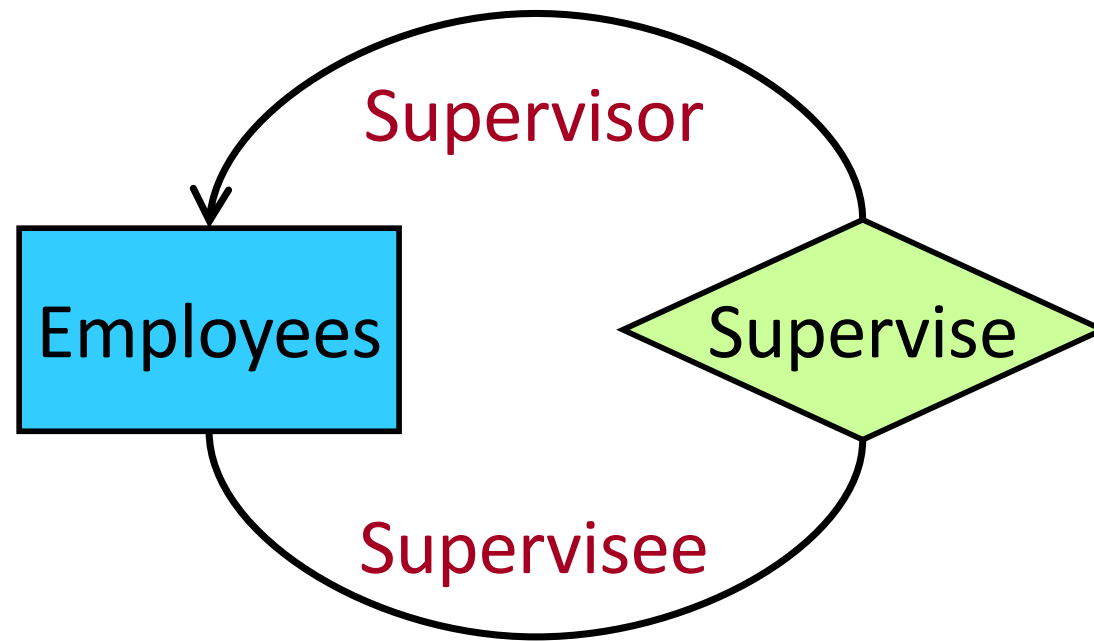
Roles



- Sometimes an entity set may appear more than once in a relationship
- Example: some persons are married to each other
- The role of the person is specified on the edge connecting the entity set to the relationship

Husband	Wife
Bob	Alice
David	Cathy
...	...

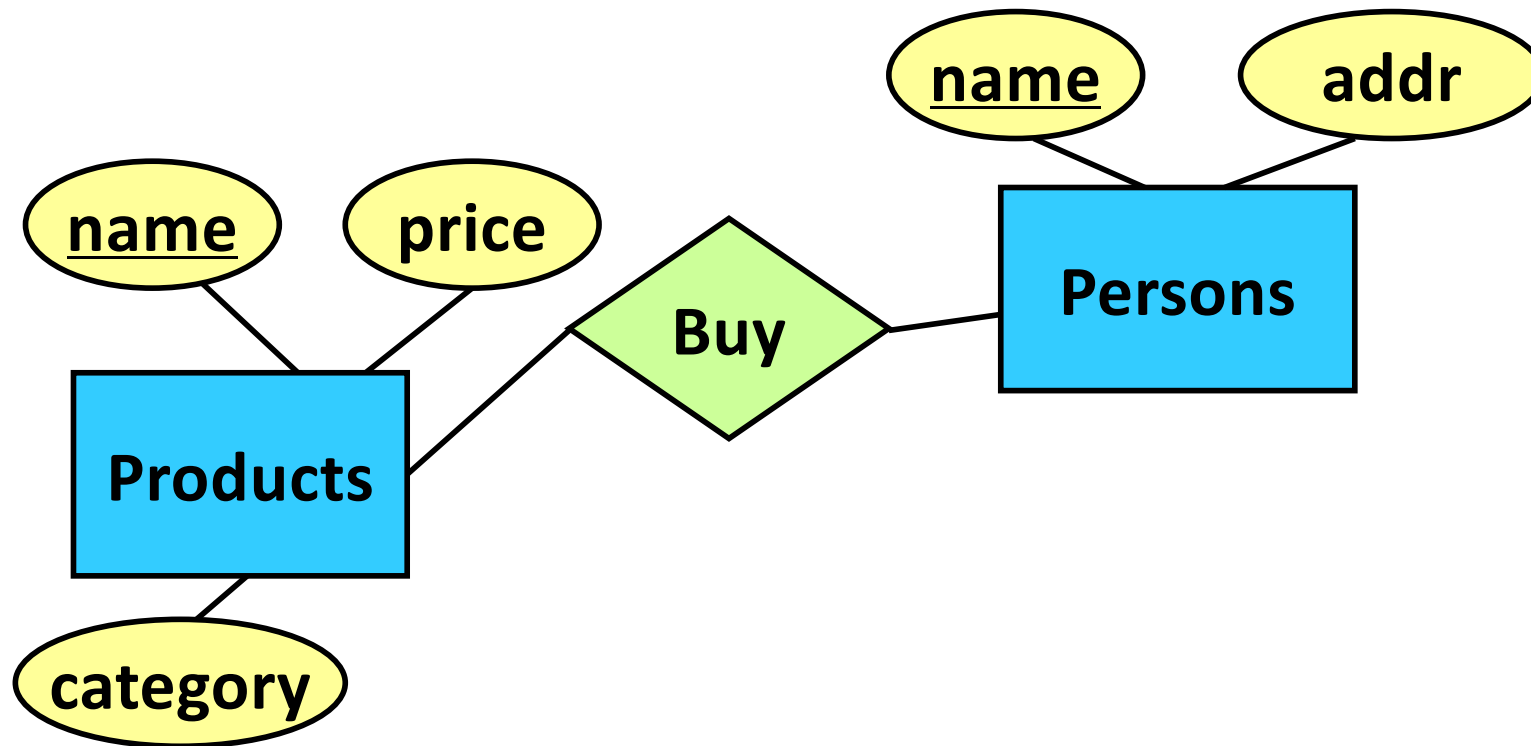
Roles



- Example: some employee supervises other employees
- Without the roles, it is unclear whether it is many-to-one from supervisees to supervisors, or the other way around

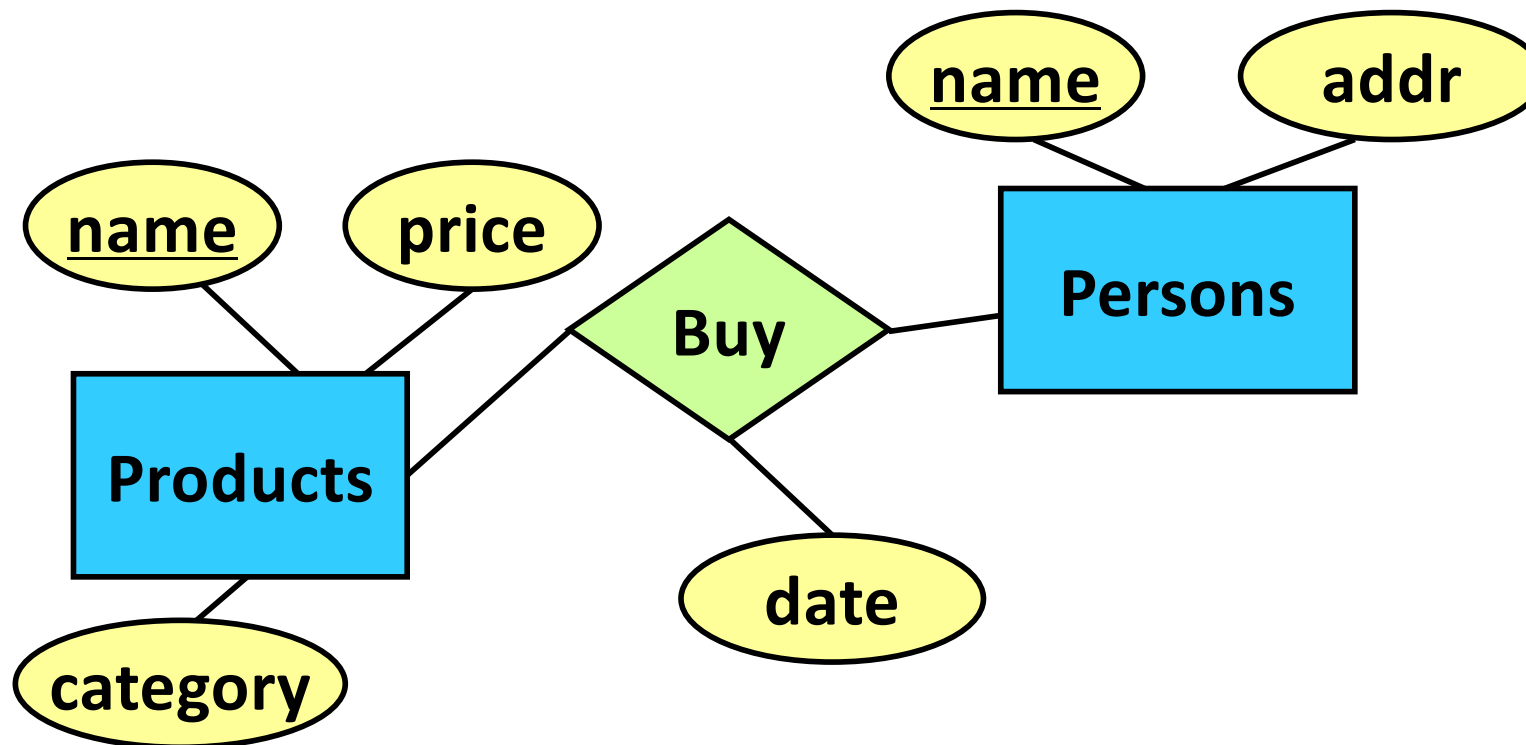
One More Thing about Relationships

- A relationship can have its own attribute



One More Thing about Relationships

- A relationship can have its own attribute
- If we want to record the date of the purchase

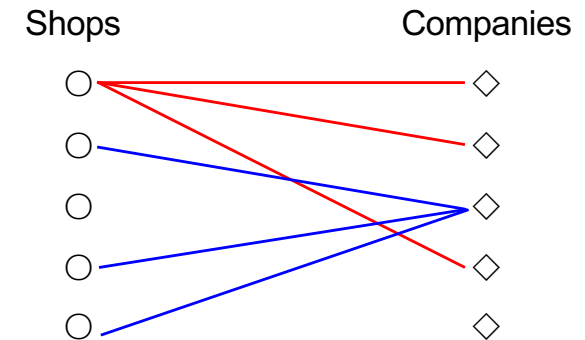


Exercise

- Consider two entity sets, Shops and Companies
- Each shop sells products from at least one company
- Each company has its product sold in at least one shop
- A shop may be the flagship shop of at most one company
- Each company has at least one flagship shops
- Draw some relationships between Shops and Companies to capture the above statements



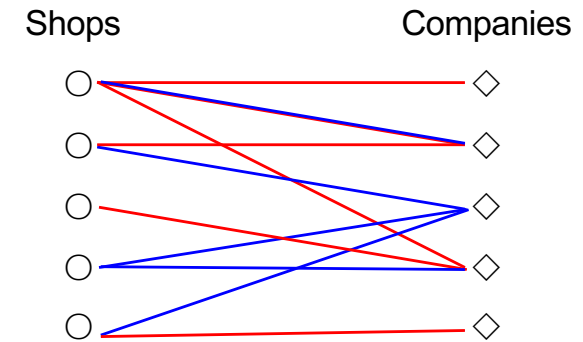
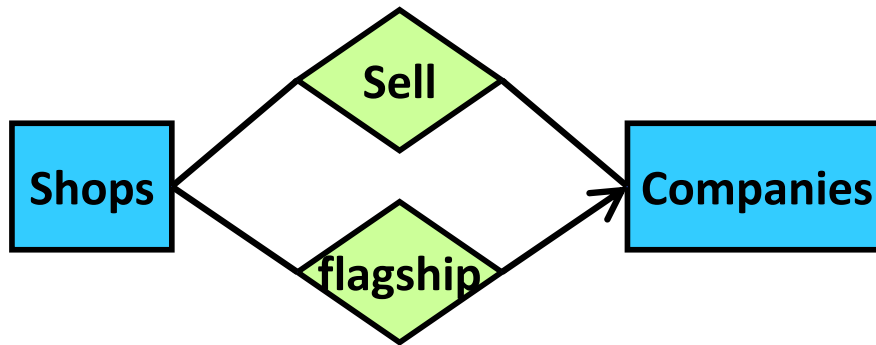
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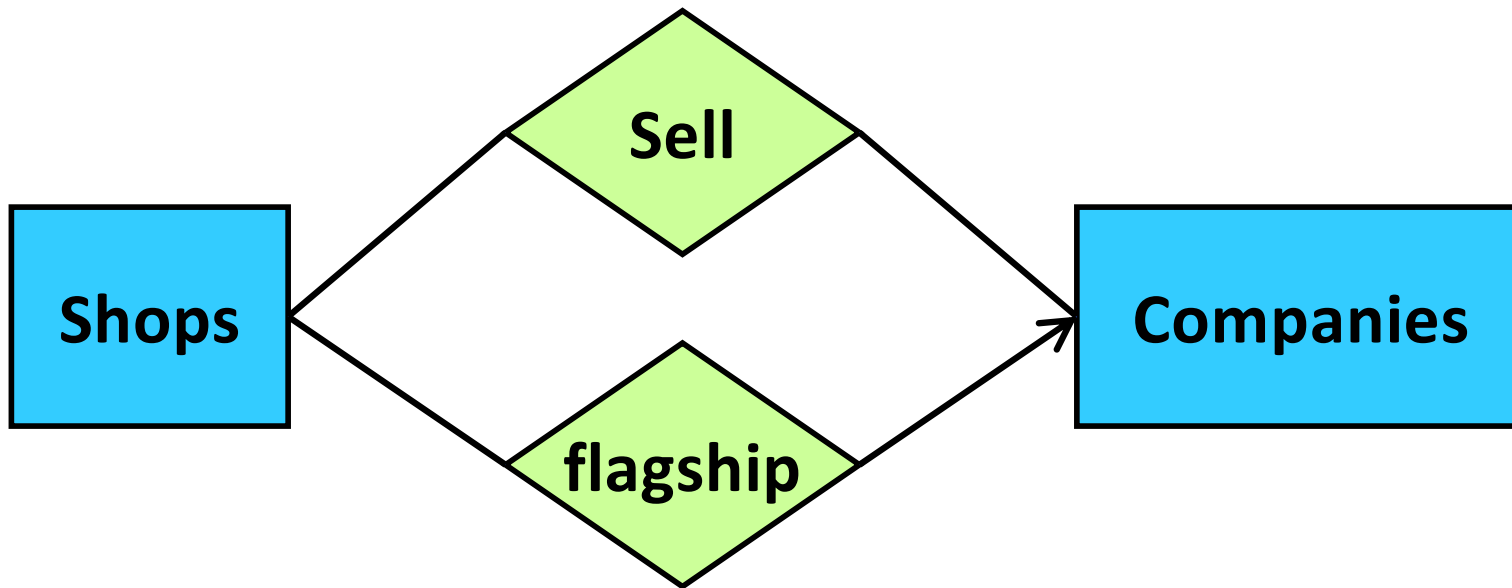


Exercise



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- There can be multiple relationships between two entity sets

To continue in

Topic 1: Entity Relationship Diagram (2)

