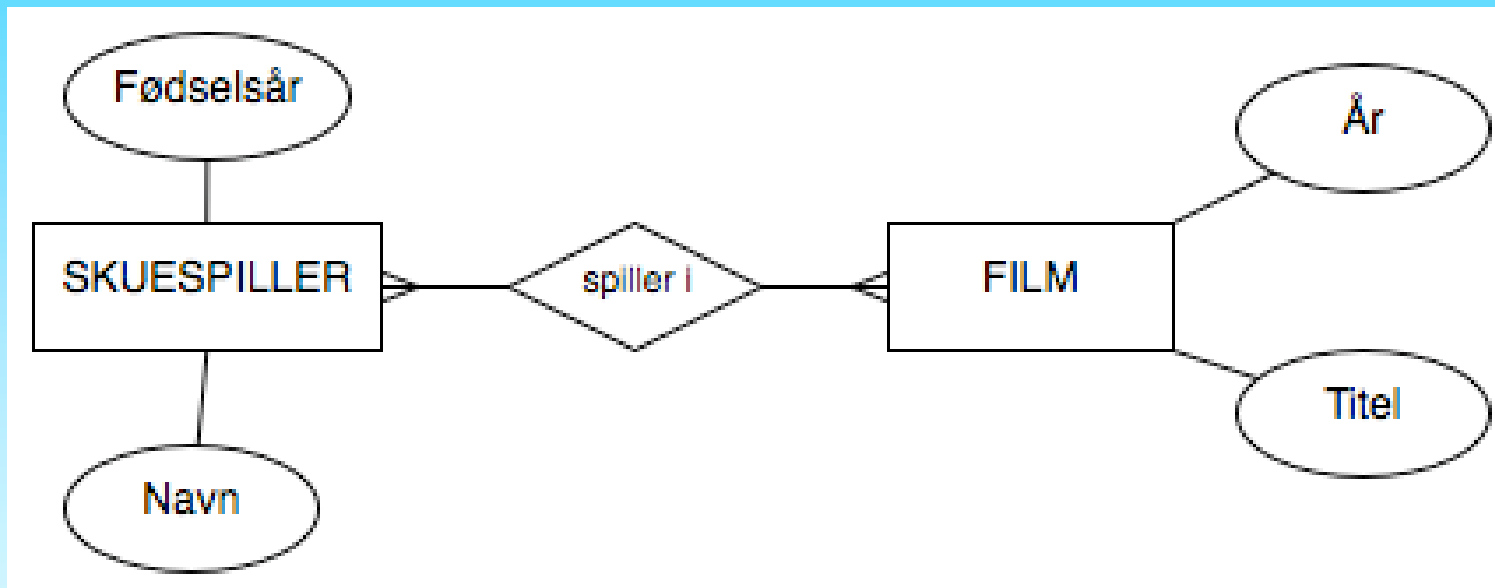


***Modern Database Management***  
***7<sup>th</sup> Edition, Chapter 3***

***Jeffrey A. Hoffer, Mary B. Prescottt,***  
***Fred R. McFadden***

***Slides edited by Rasmus Pagh***

# Simpelt E-R diagram



Hvordan ser de tilsvarende relationer ud?

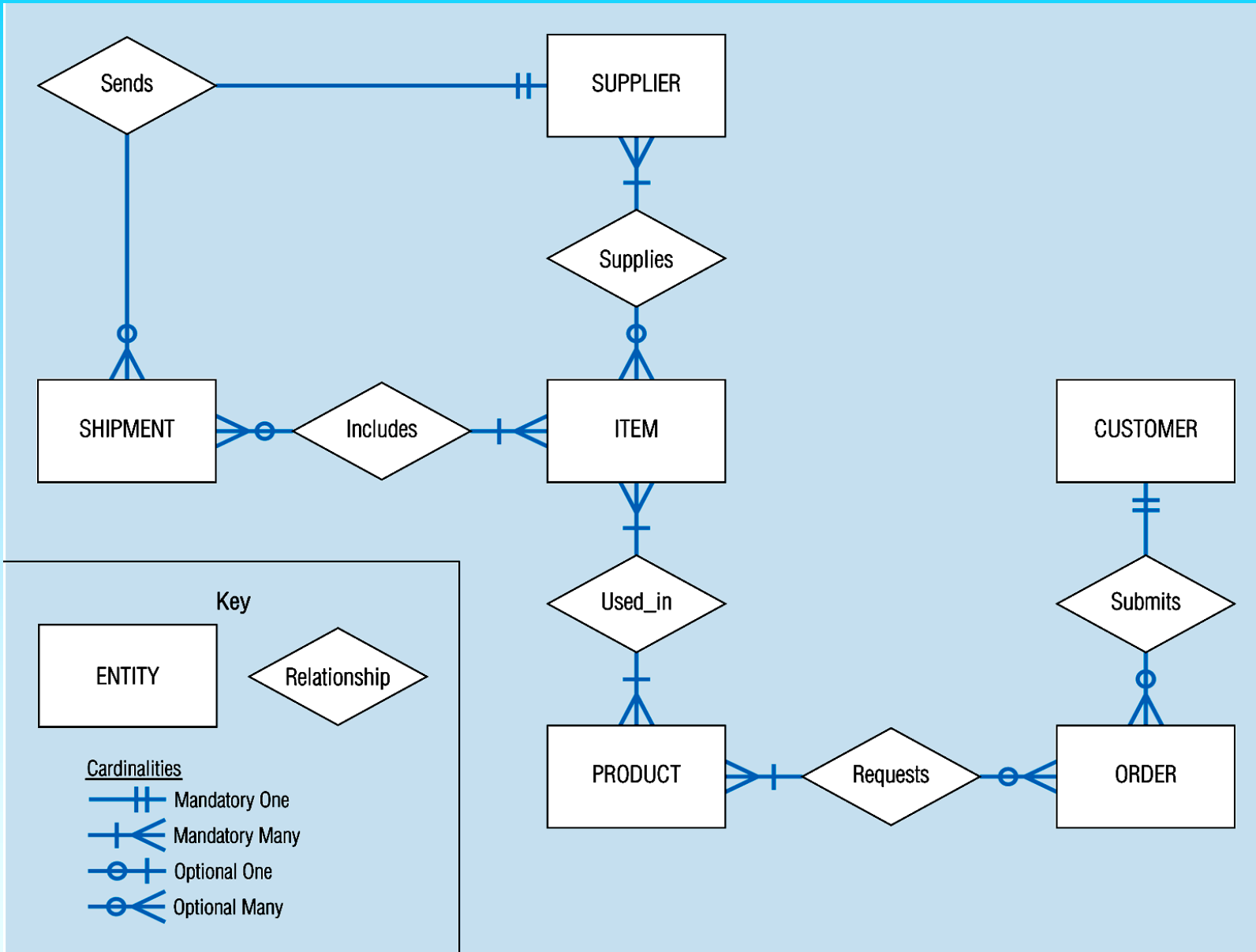
# What Should an Entity Type Be?

- **SHOULD BE:**
  - An object that will have many instances in the database
  - An object that will be composed of multiple attributes
  - An object that we are trying to model
- **SHOULD NOT BE:**
  - A user of the database system
  - An output of the database system (e.g. a report)

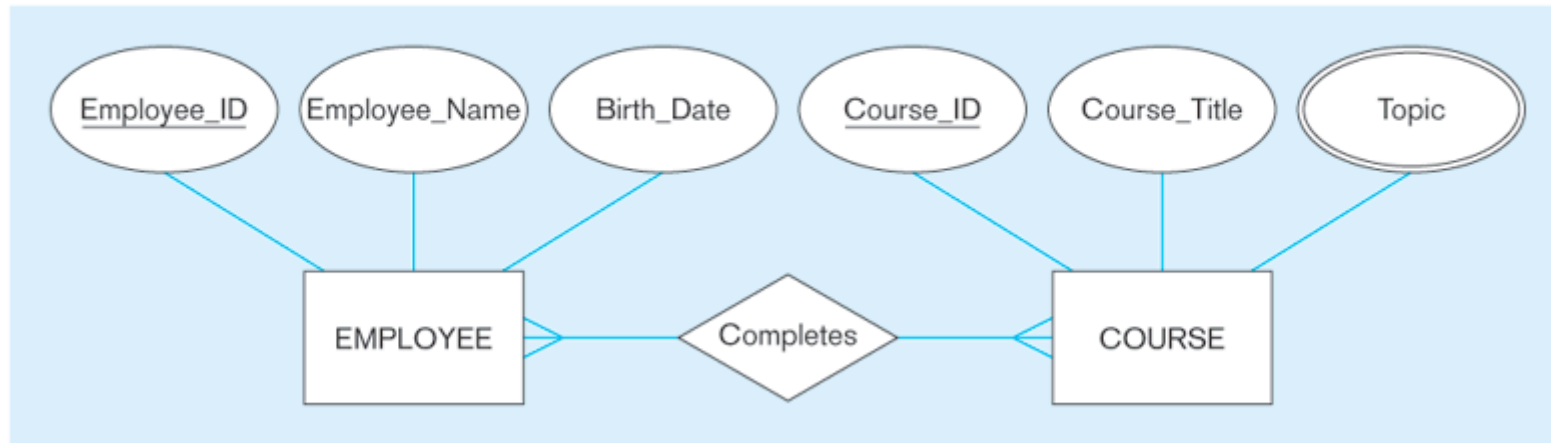
# Examples

- The actor "Bruce Willis" should not be an entity type - there is only one instance.
- "Middle-aged actors" is not an entity type - could be a query
- Year is not an entity because it does not have multiple attributes (that we want to model, anyway)
- The title of a film is not an entity type, unless we want to associate more info with each title (like relationships among movies with that title)

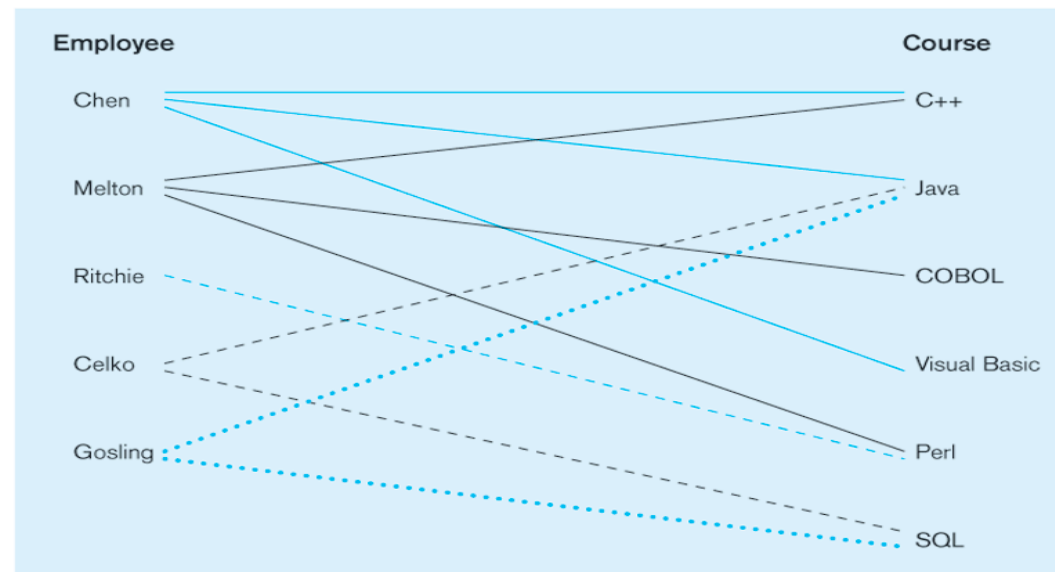
# Sample E-R Diagram (Figure 3-1)



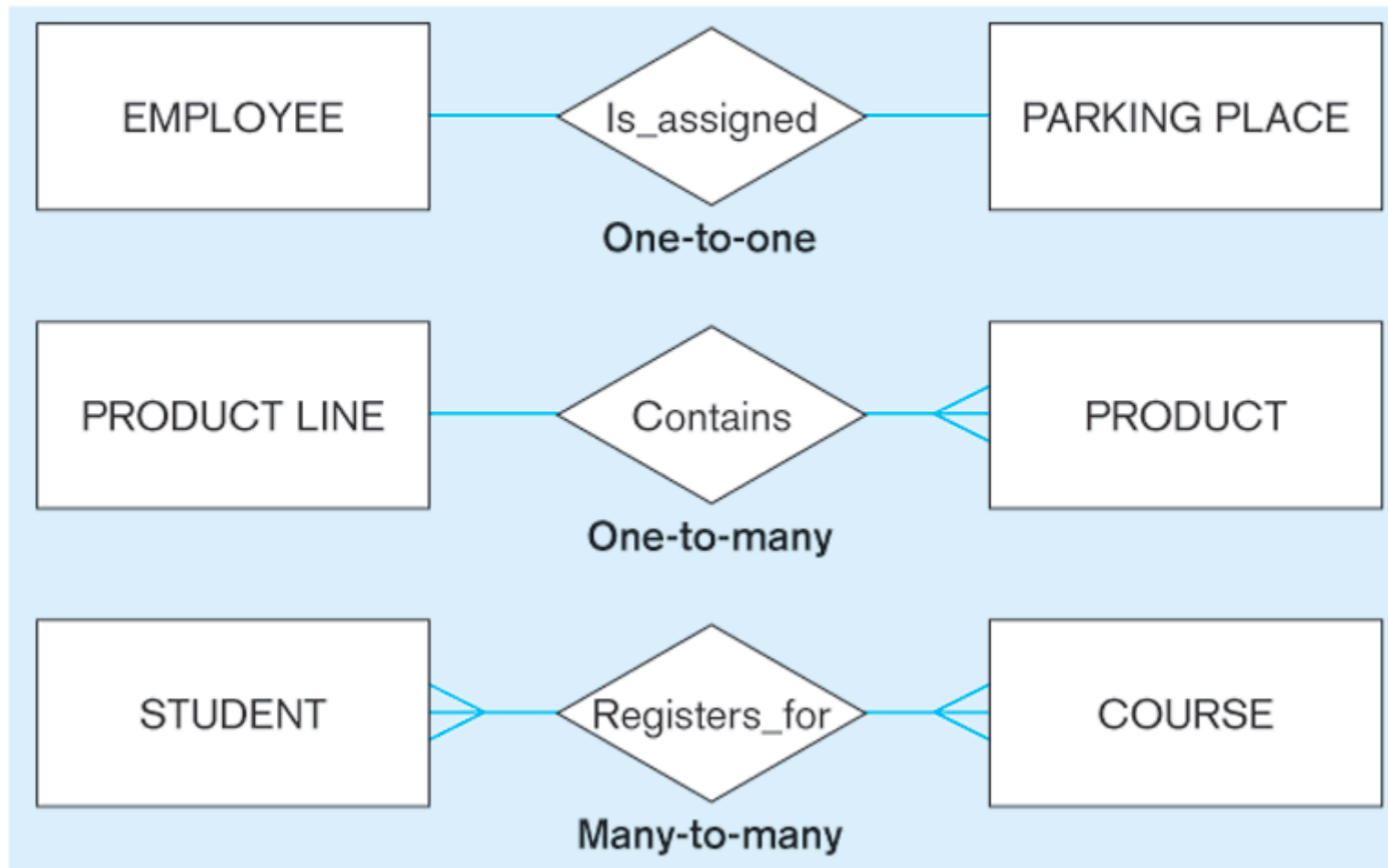
**Figure 3-10a** Relationship type and instances - Relationship type (Completes)



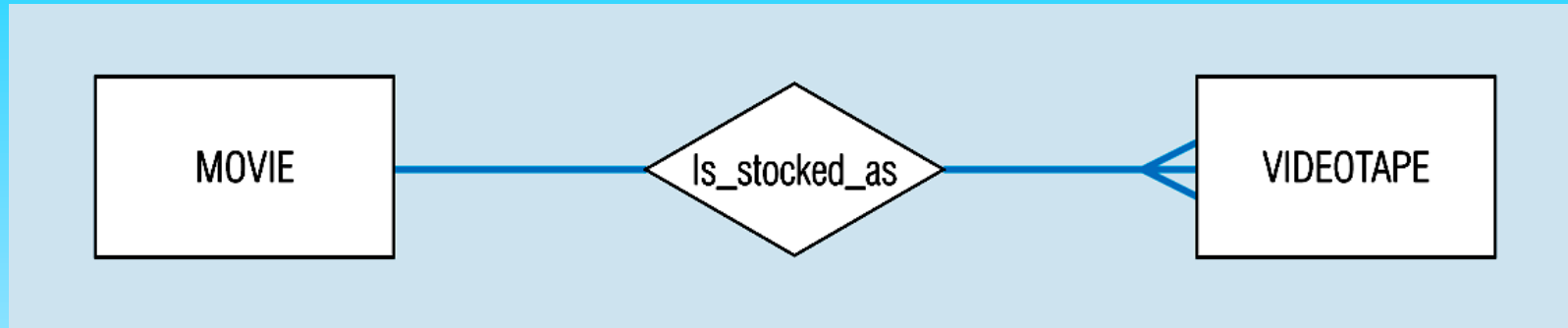
**Figure 3-10b** Relationship type and instances - Relationship instances



**Figure 3-12b** Examples of relationships of different degrees - Binary relationships



## Basic relationship with only maximum cardinalities – Figure 3-16a



**Default minimum is 0, default maximum is 1.**

## Mandatory minimum cardinalities – Figure 3-17a

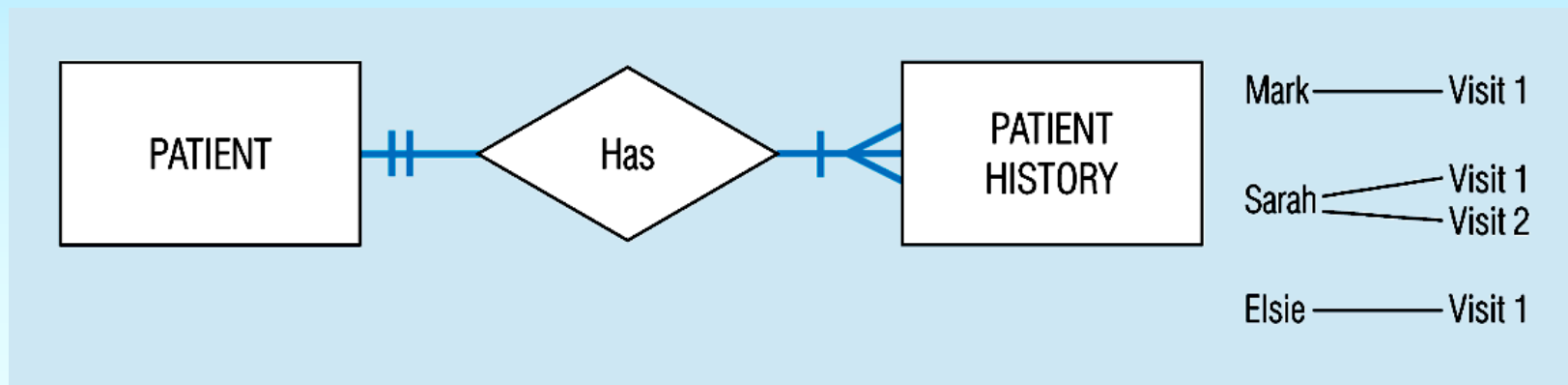
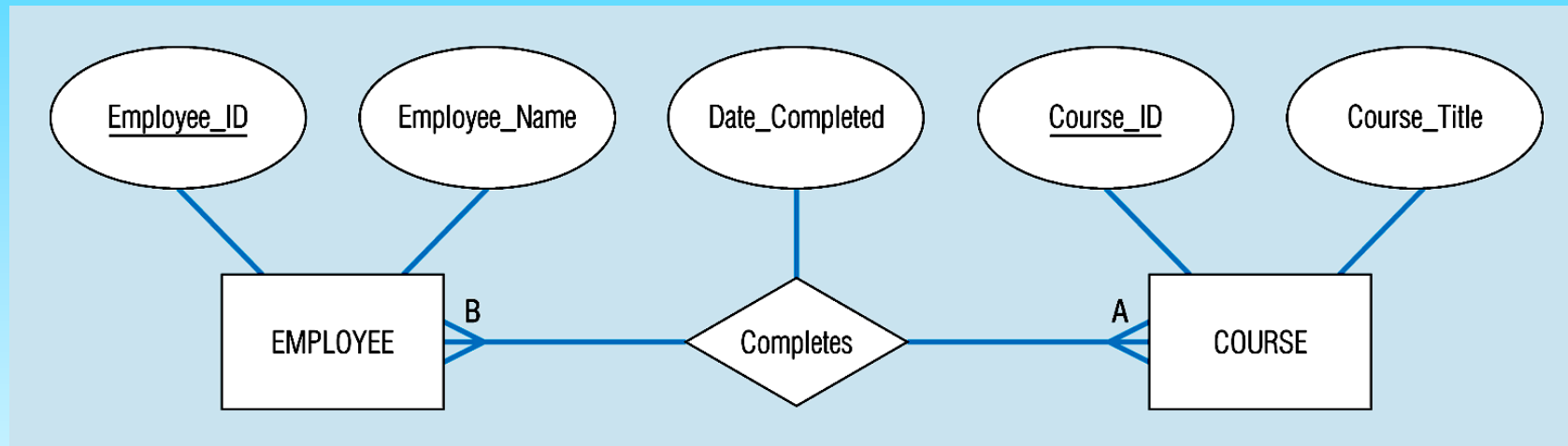




Figure 3-11a A binary relationship with an attribute



Here, the date completed attribute pertains specifically to the employee's completion of a course...it is an attribute of the *relationship*.

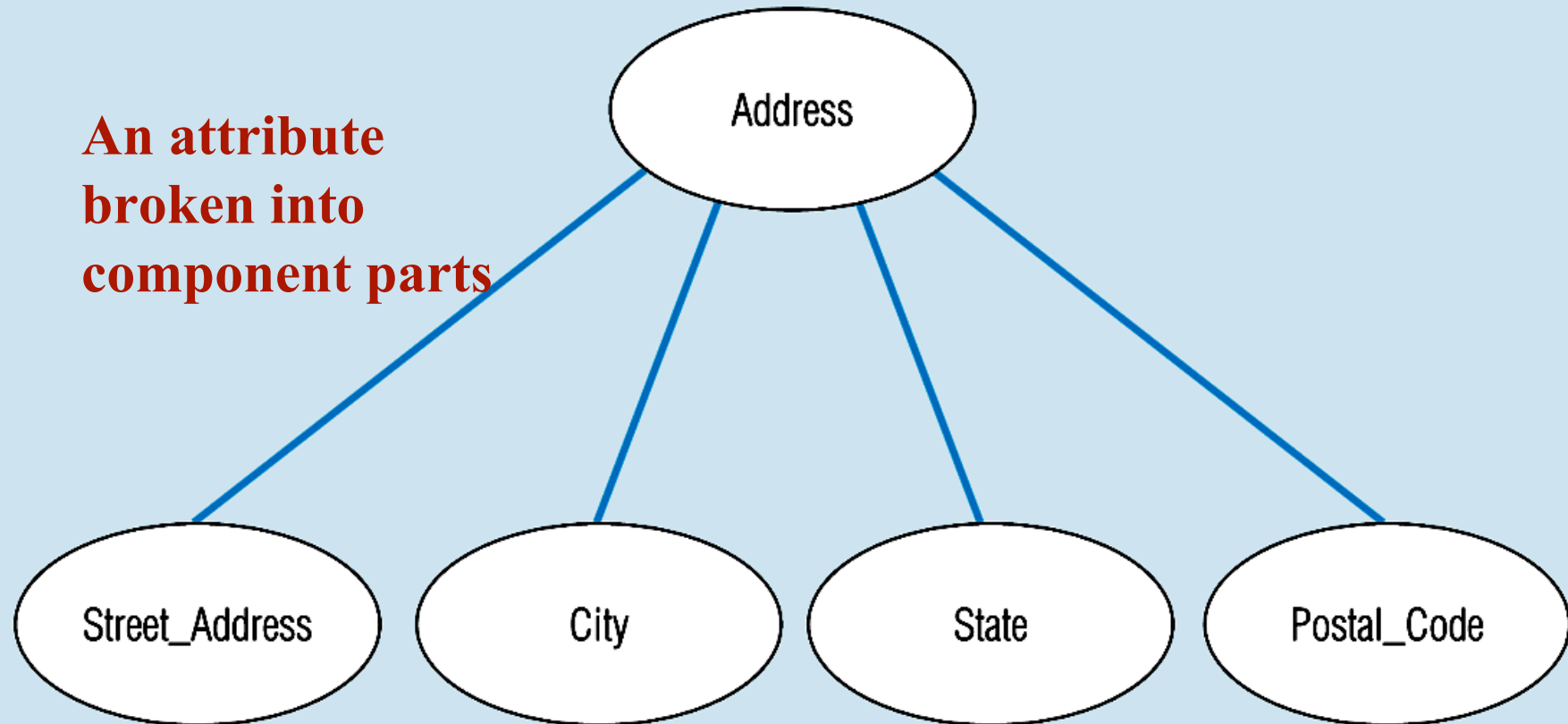
**NOTE: Only one value for each relationship instance.**

# Problemsession (5-10 min)

- Vi vil designe en database til en lille butik med information om kunderne, ordrer og kredit:
  - Navne og adresser
  - Telefonnummer
  - Kundetyper (privat eller forretning)
  - Varer
  - Aktuelle ordrer
  - Kundenumre
  - Maximum kredit
  - Aktuel kredit

**Tegn et muligt E-R diagram for databasen.**

Figure 3-7 – A **composite** attribute



**Figure 3-12a** Examples of relationships of different degrees - Unary relationships

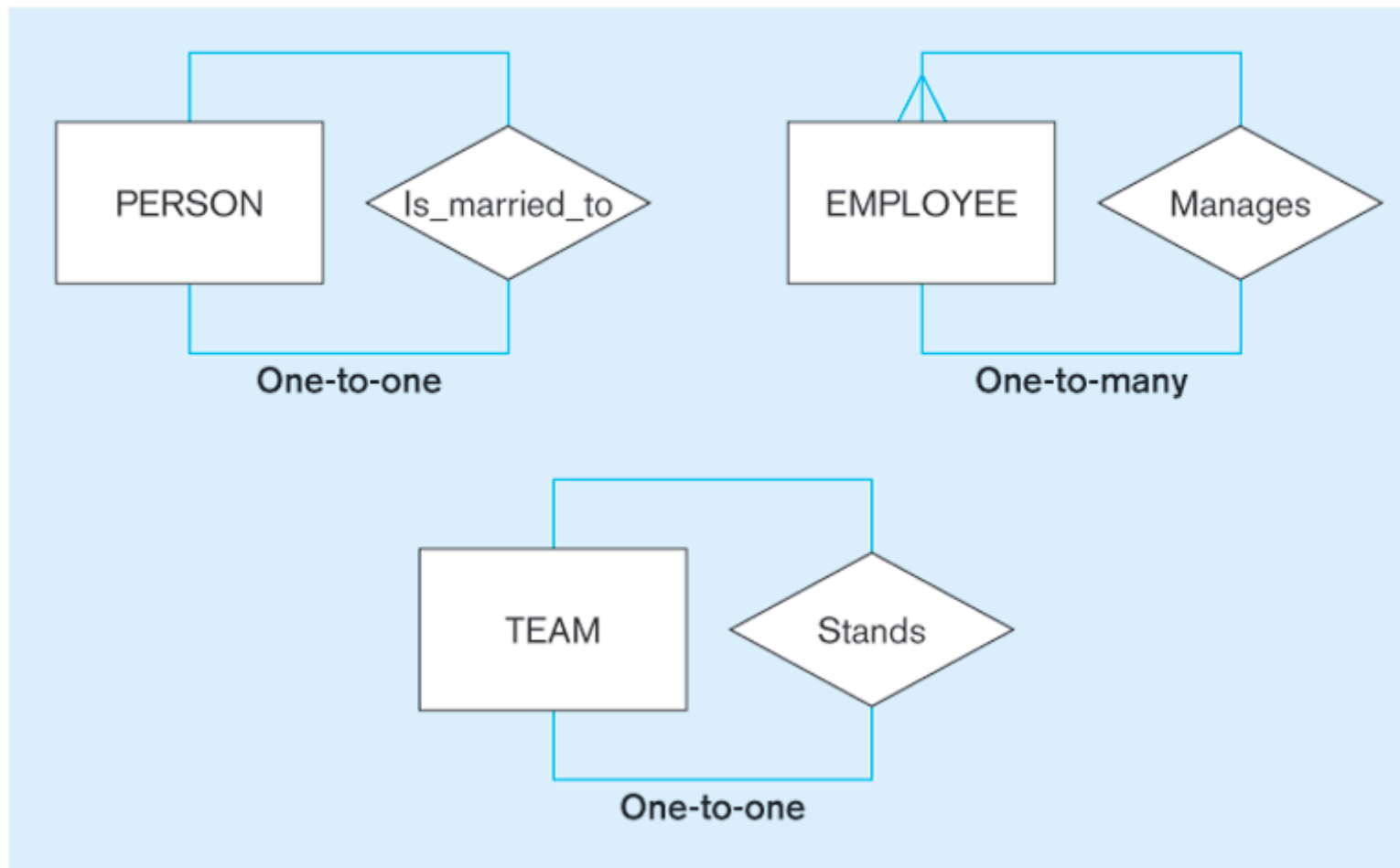
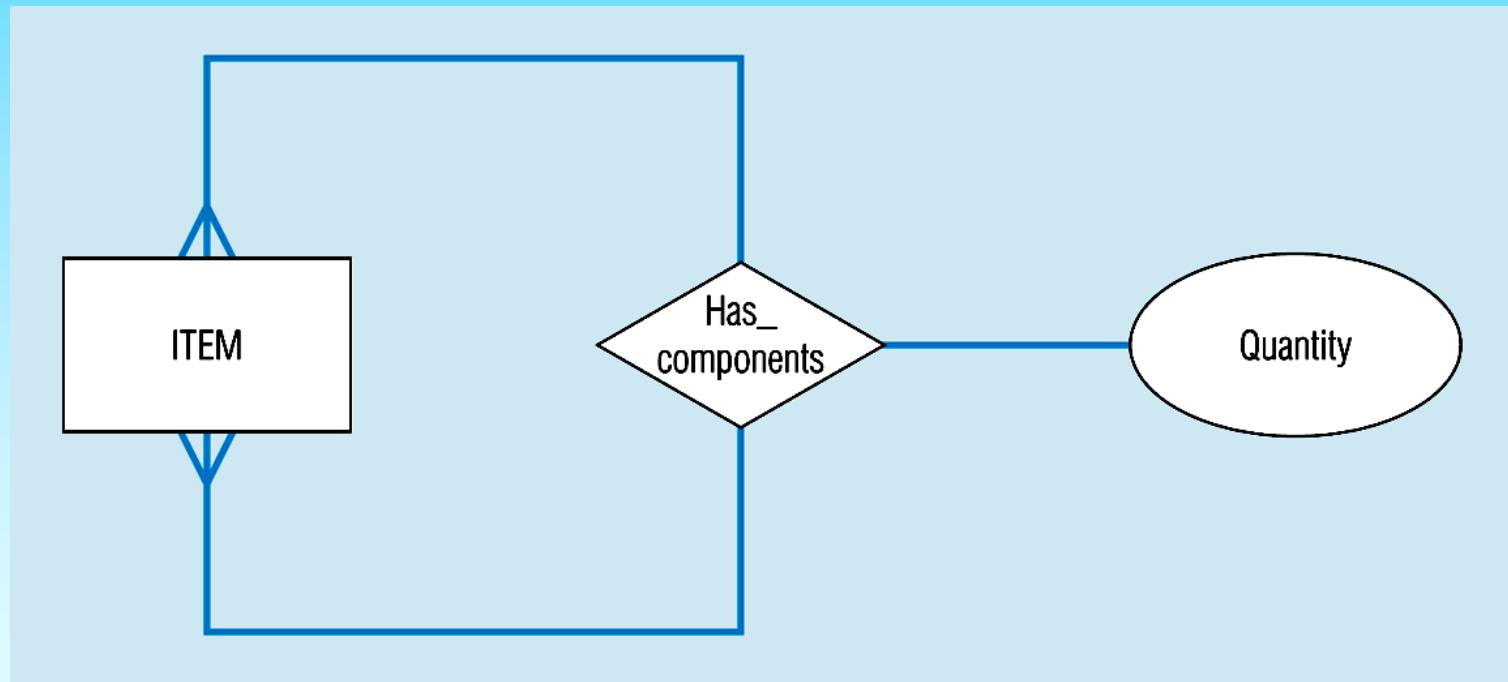
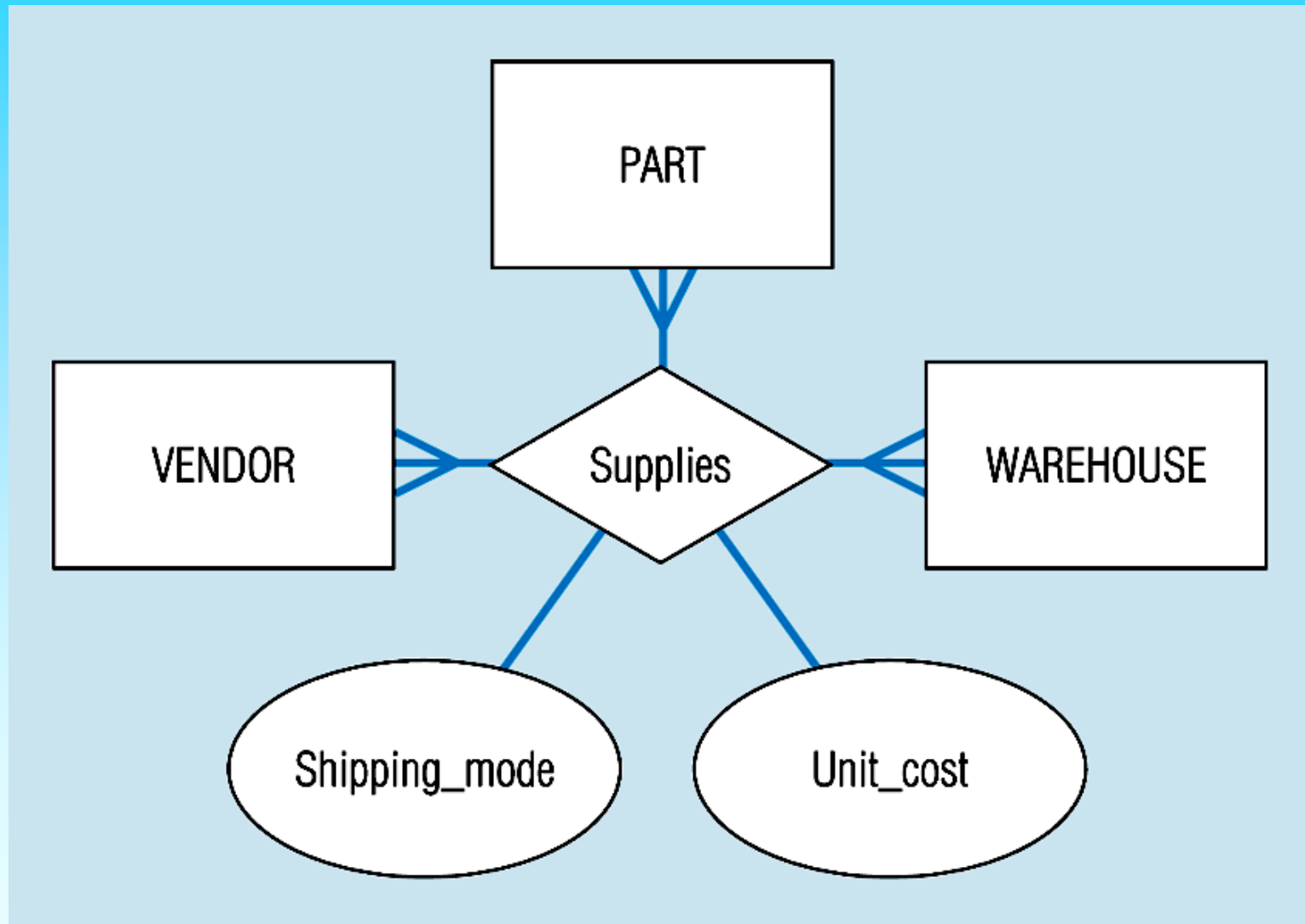


Figure 3-13a – A unary relationship with an attribute.  
This has a many-to-many relationship

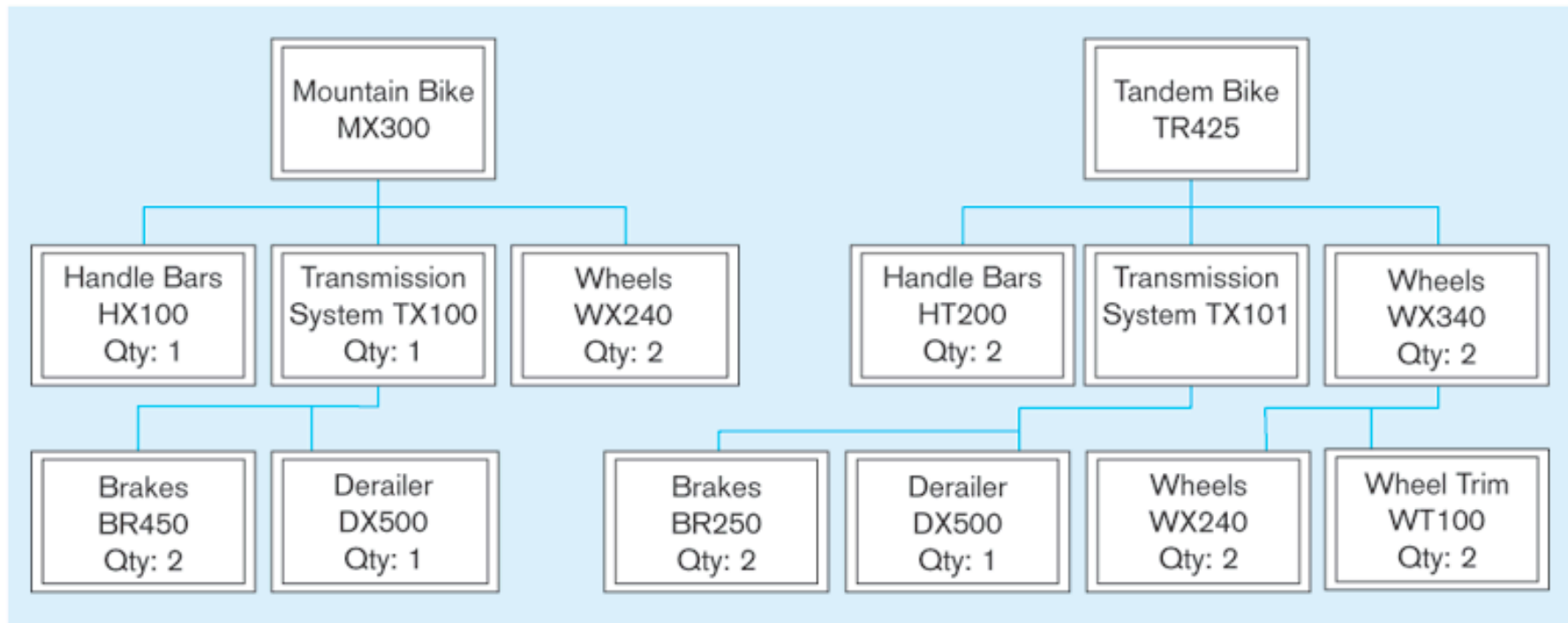


Representing a bill-of -materials structure

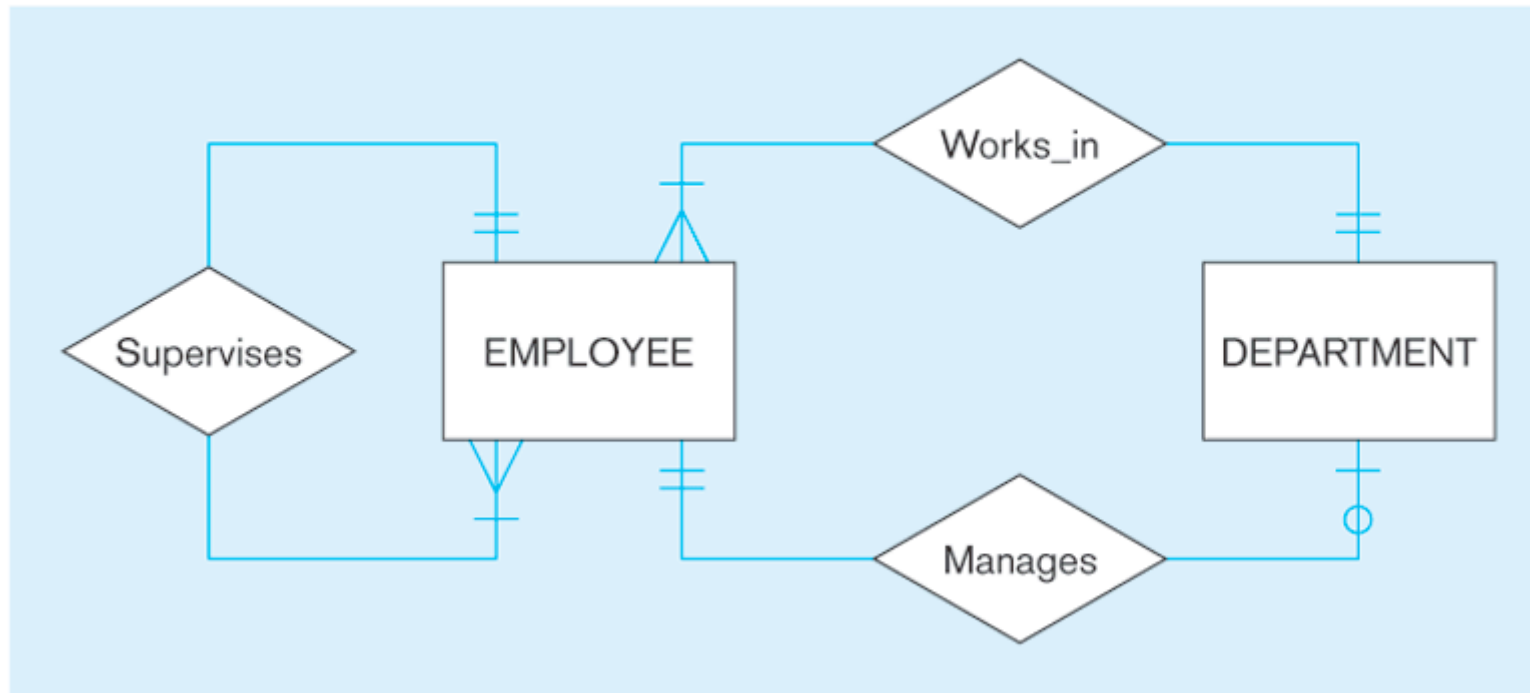
Figure 3-12c -- A ternary relationship (with attributes)



**Figure 3-13b** Representing a bill-of-materials structure -  
Two ITEM bill-of-materials structure instances



**Figure 3-21a** Examples of multiple relationships - Employees and departments



Entities can be related to one another in more than one way



# Identifiers

- Candidate Key - An attribute (or combination of attributes) that uniquely identifies individual instances of an entity type.
- Identifier (or “Key”) – one particular candidate key that was chosen to uniquely identify entity instances.

# Identifier design criteria

- Should not change in value
- Should not be null
- No “intelligent identifiers” (e.g. containing locations or people that might change)
- Substitute new, simple keys for long, composite keys

Figure 3-9a – Simple key attribute

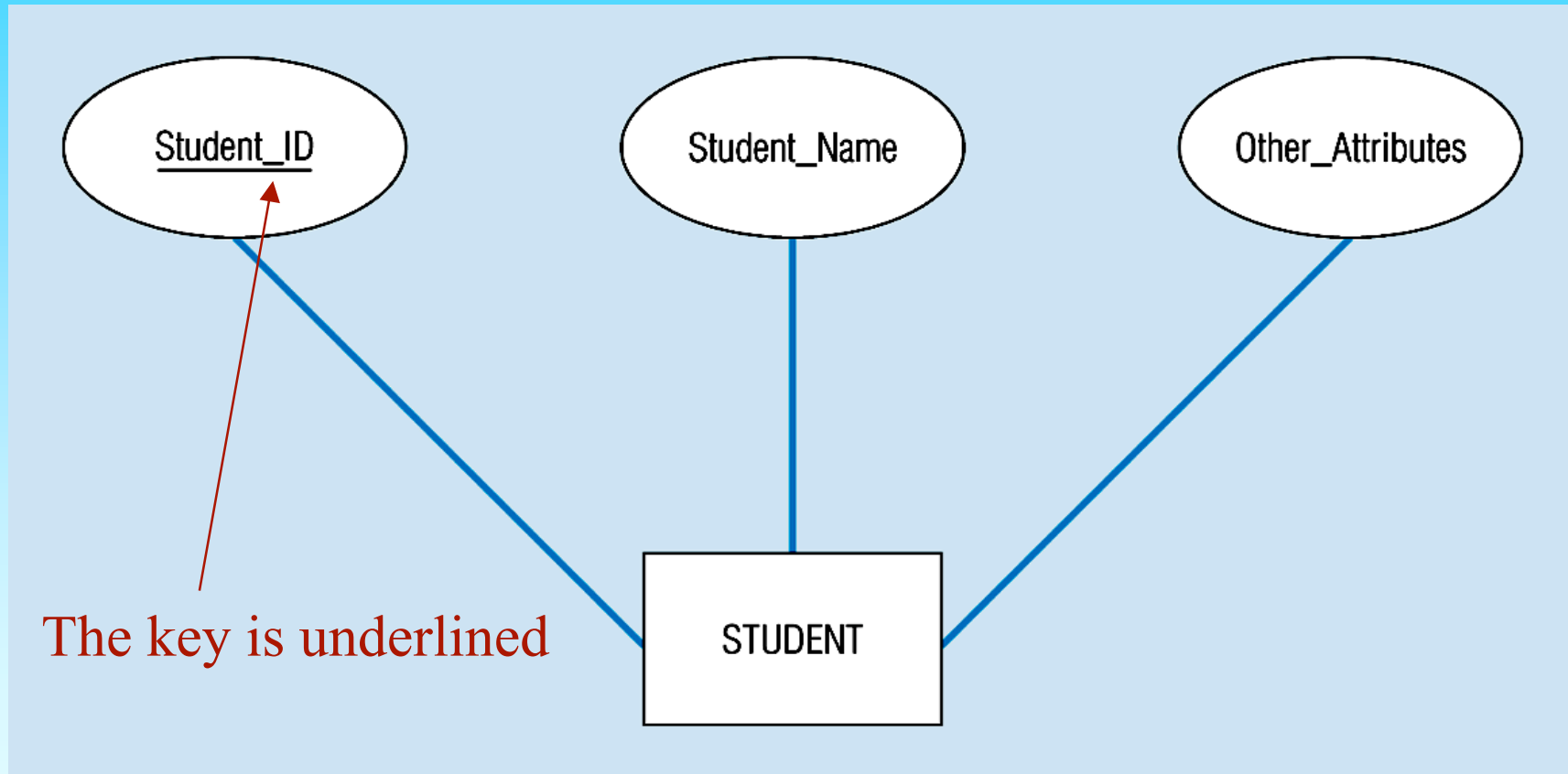


Figure 3-9b – Composite key attribute

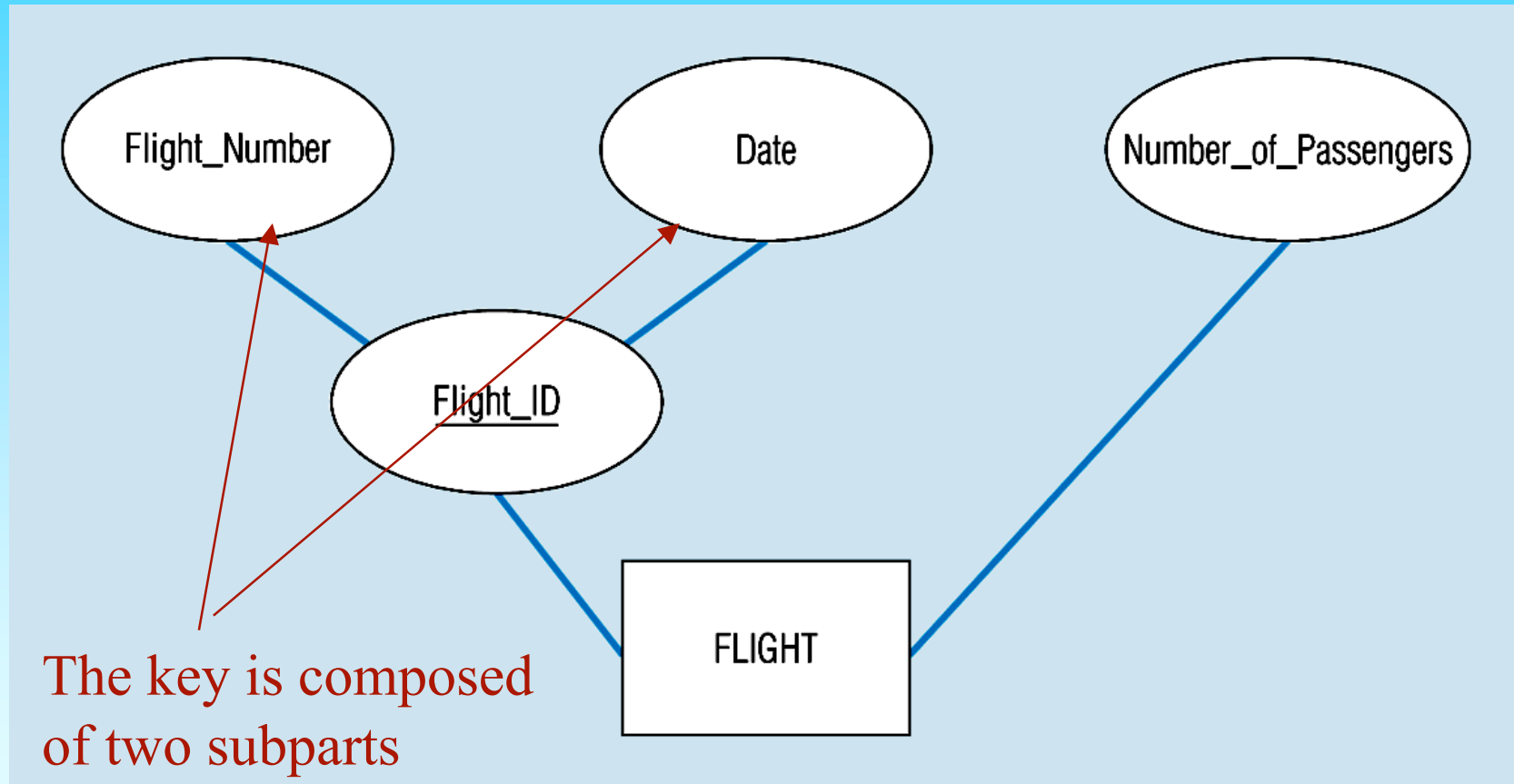


Figure 3-8 – Entity with a multivalued attribute (Skill) and derived attribute (Years\_Employed)

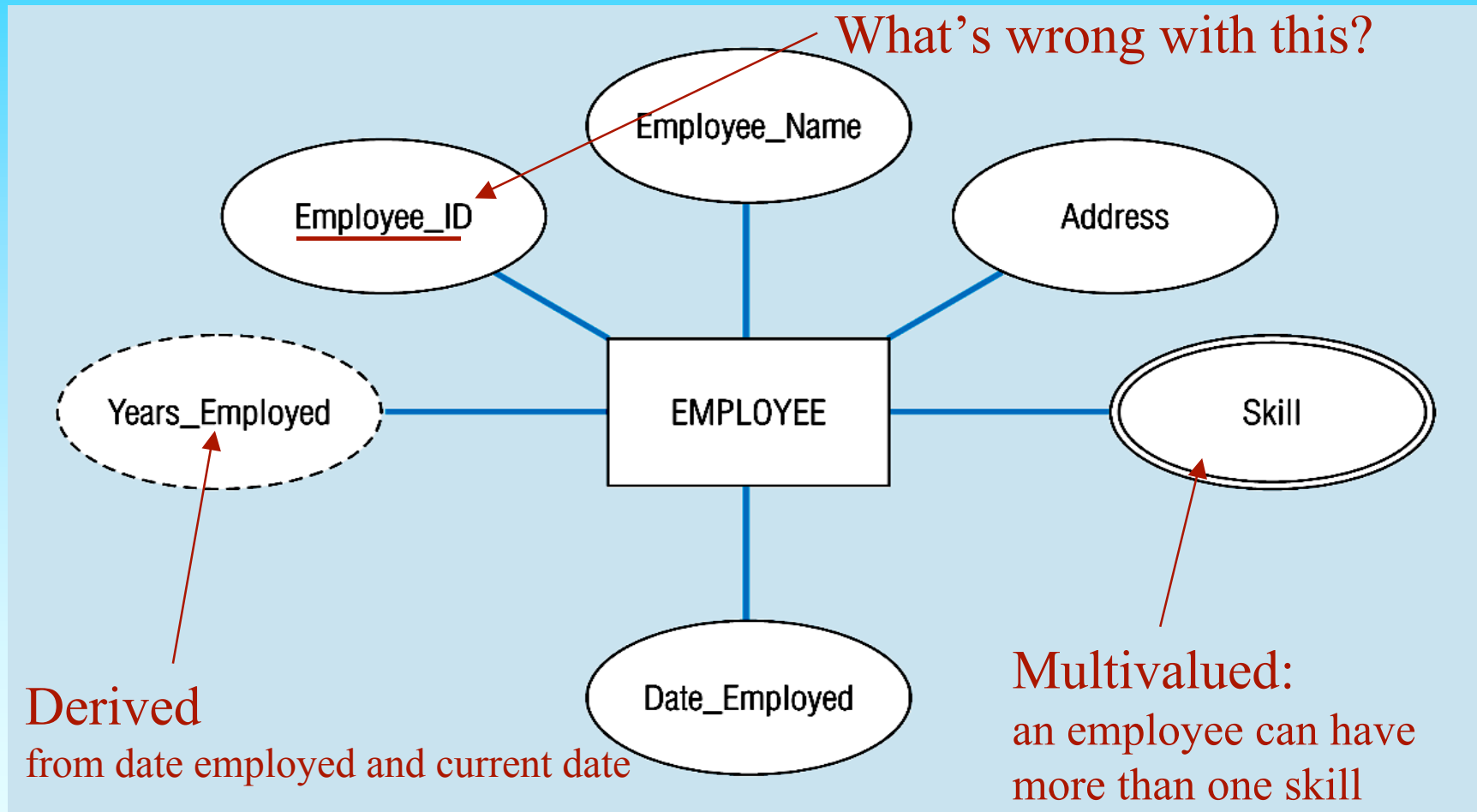
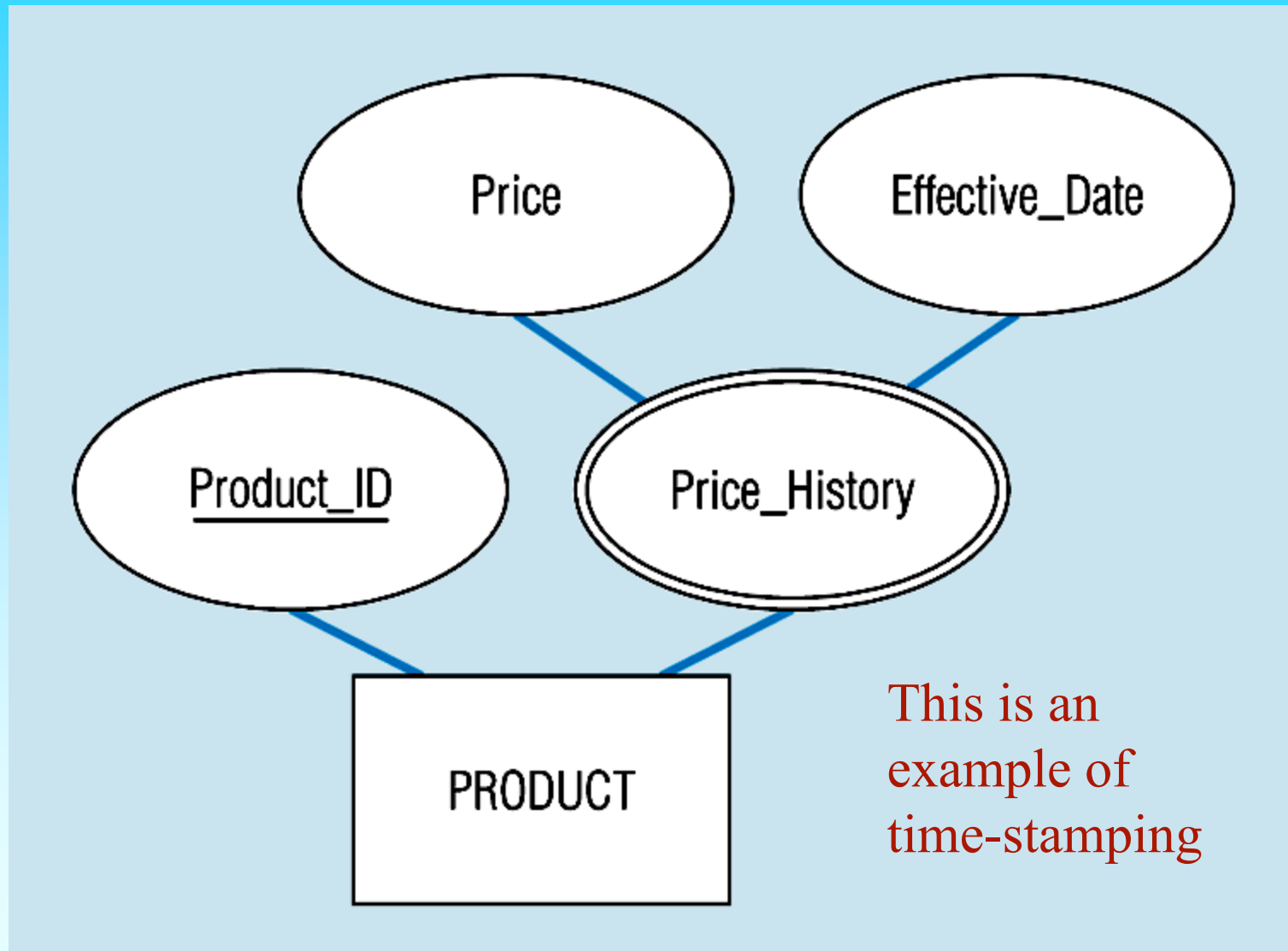
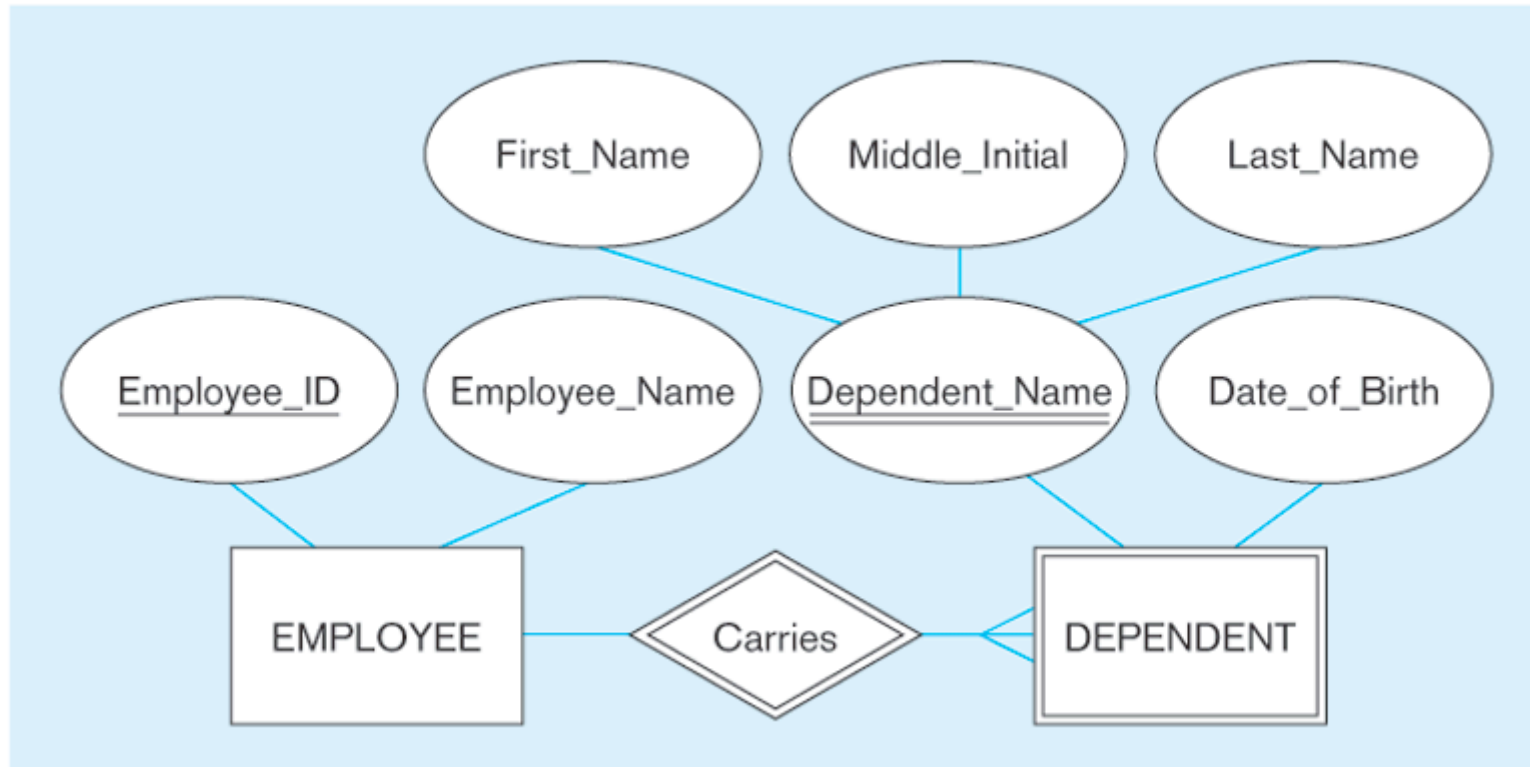


Figure 3-19 – An attribute that is both multivalued and composite



**Figure 3-5a** Example of a weak entity and its identifying relationship - E-R notation



Problem: Dependent\_name not unique  
(not even together with Date\_of\_Birth)

# Strong vs. Weak Entity Types, and Identifying Relationships

- Strong entity type
  - exist independently of other types of entities
  - has its own unique identifier
  - represented with single-line rectangle
- Weak entity type
  - dependent on a strong entity... cannot exist on its own
  - does **not** have a unique identifier
  - represented with double-line rectangle
- Identifying relationship
  - links strong entity type to weak entity type
  - represented with double line diamond



# Discussion of weak entities

- Always possible to add “artificial” identifier to avoid them.
- However, sometimes more natural to form a composite key involving a foreign key given by the identifying relationship.
- Saves a bit of space too...

# Associative Entities

- It's an **entity type** – it has attributes, identifier.
- AND it's a **relationship** – it links entities together.
- Should be seen as a way of visualizing the above, **but**: Behaves in all ways just like an entity type.

**Figure 3-11b** An associative entity - An associative entity (CERTIFICATE)

