

INFORMATION SYSTEM DEPARTMENT  
INFORMATION TECHNOLOGY FACULTY – HCM  
UNIVERSITY OF SCIENCE

ADVANCED DATABASE

Chapter 03

ENHANCED ERD (EERD)



KHOA CÔNG NGHỆ THÔNG TIN  
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

**fit@hcmus**

# Outline

- Supertypes and Subtypes
- Generalization and Specialization
- Supertype/Subtype Relationship Constraints
- Cluster Entity

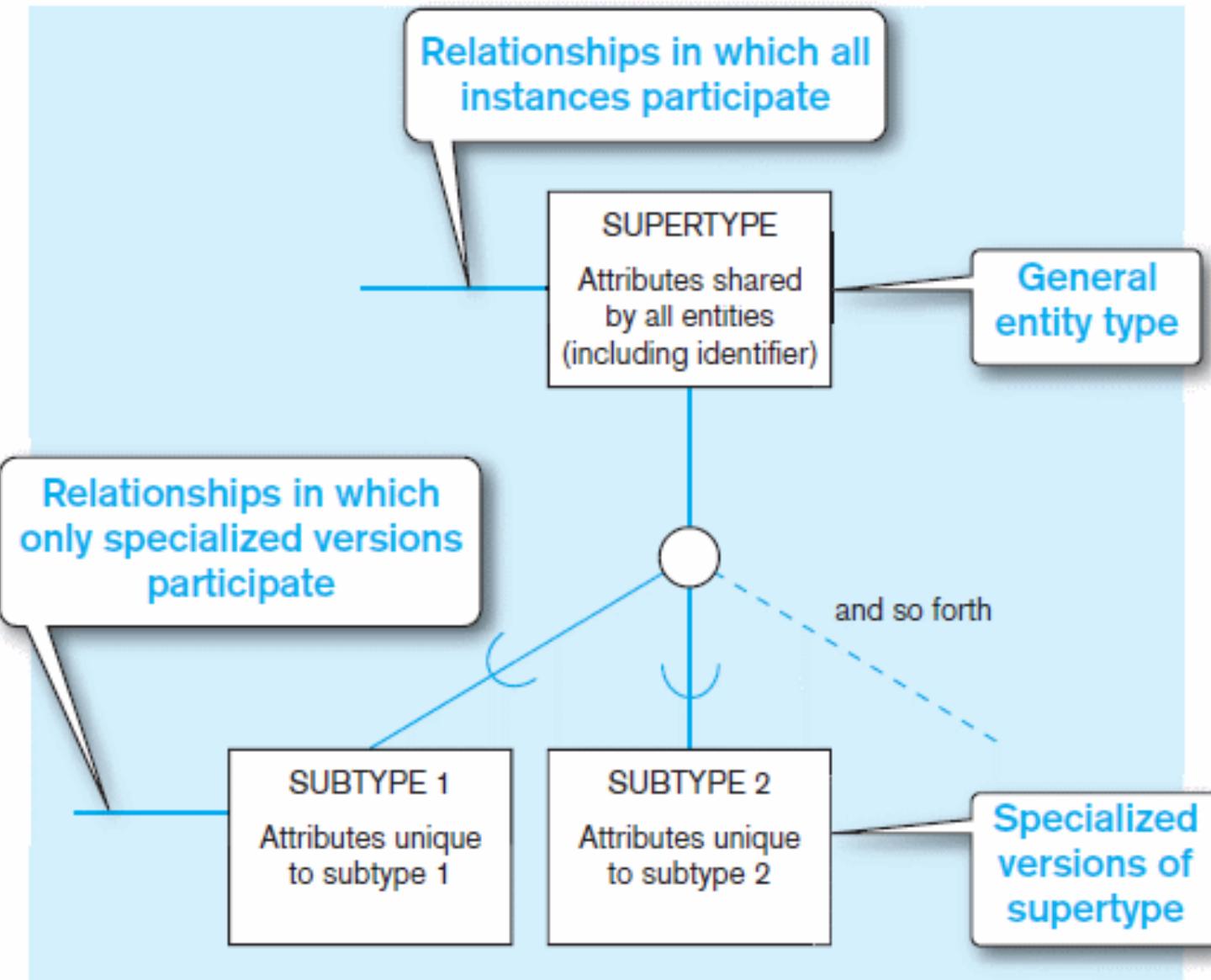
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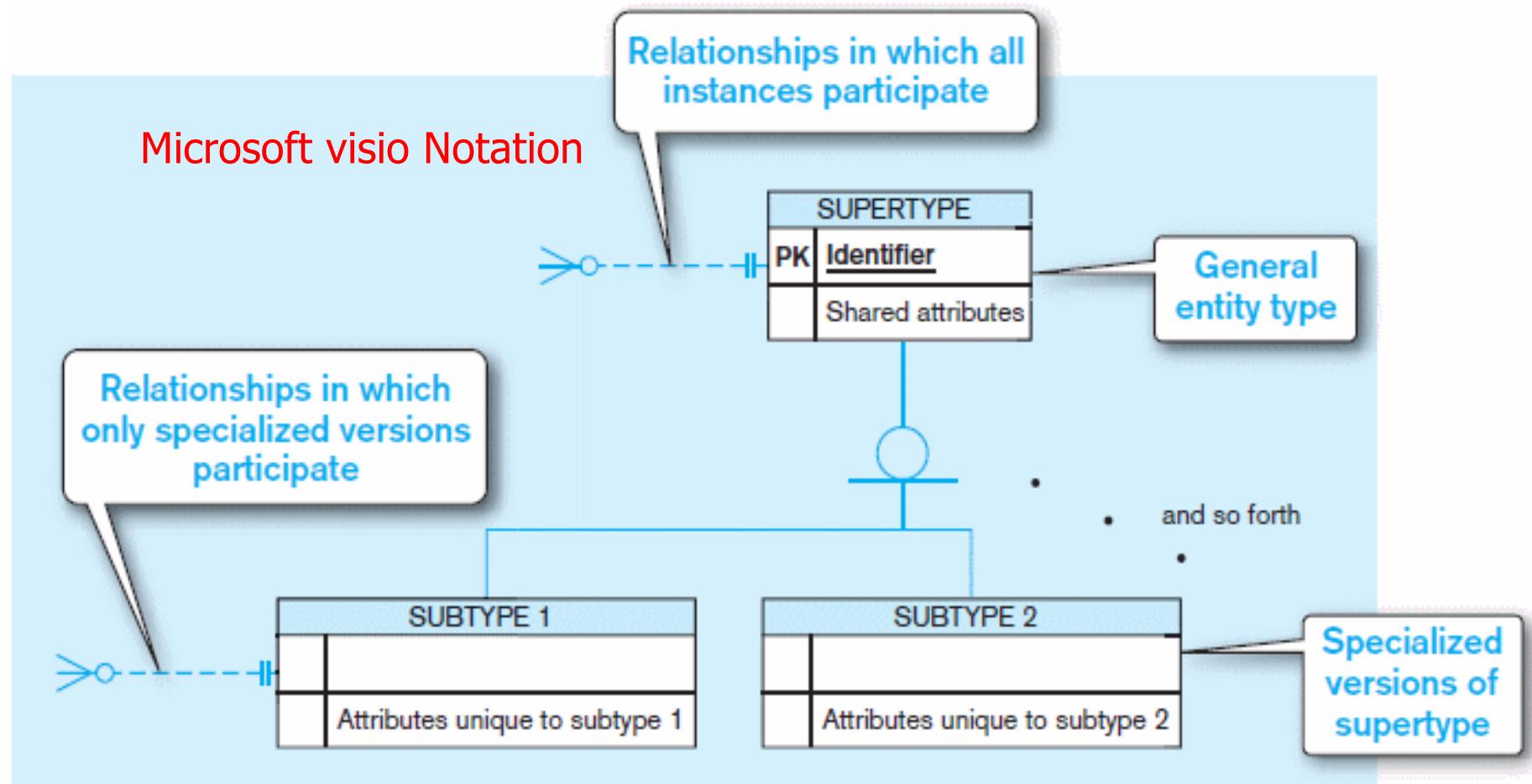
# Entity Supertypes and Subtypes

- **Entity Supertype:** A generic entity type that is related to several entity subtypes and contains the common characteristics of the entity subtypes.
- **Entity Subtype:** A subset of an entity supertype with unique characteristics different from other subgroups.
- **Example:**
  - The entity supertype EMPLOYEE can have several entity subtypes, such as CONSULTANT, SALARIED EMPLOYEE, or HOURLY EMPLOYEE, each with its own unique characteristics.

# Supertypes/Subtypes Relationship

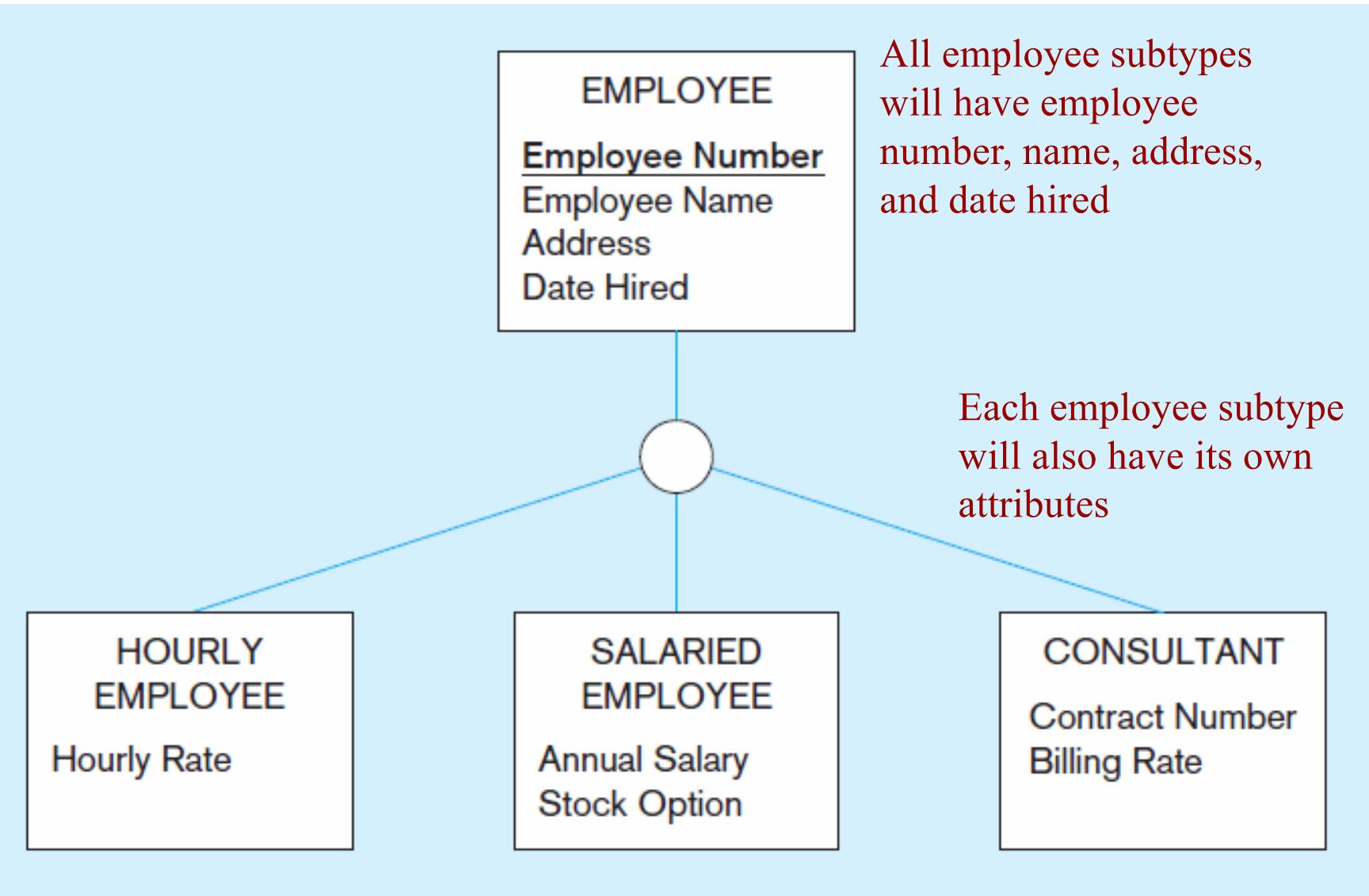


# Supertypes/Subtypes Relationship



Different modeling tools may have different notation for the same modeling constructs

# Supertypes/Subtypes Relationship



Employee supertype with three subtypes

# Inheritance

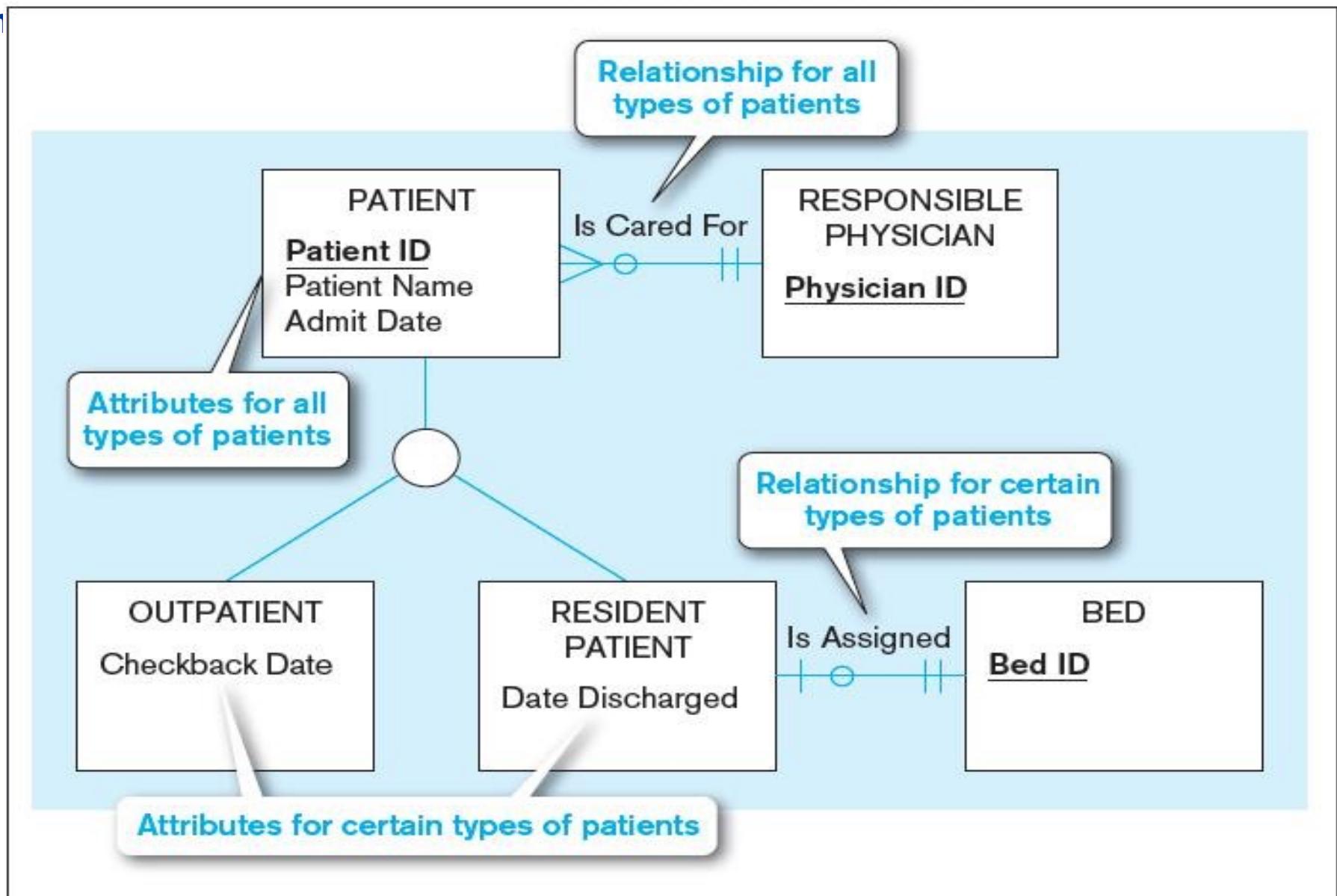
## □ Attribute Inheritance

- Subtype entities inherit values of all attributes of the supertype.
- An instance of a subtype is also an instance of the supertype.

## □ Relationship Inheritance

- Relationships at the **supertype** level indicate that all subtypes will participate in the relationship.
- The instances of a **subtype** may participate in a relationship unique to that subtype. In this situation, the relationship is shown at the subtype level.

# Inheritance



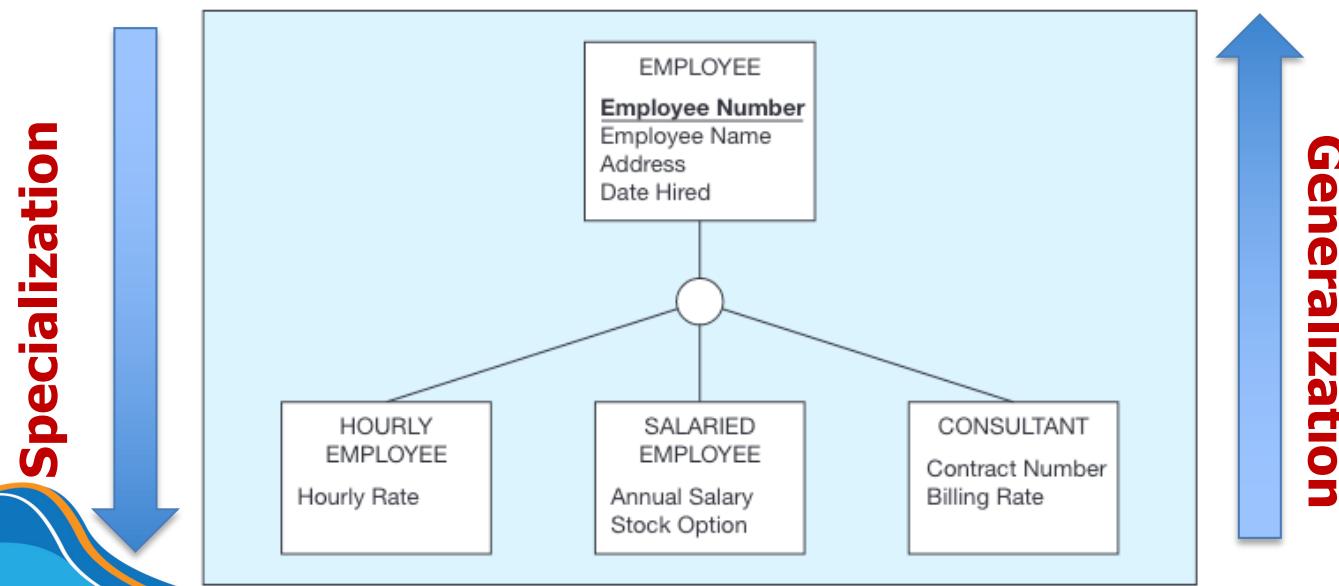
Supertype/subtype relationships in a hospital

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# Generalization and Specialization

- **Generalization:** A **bottom-up process** of identifying a more generic entity supertype from a set of more specialized entity subtypes.
- **Specialization:** A **top-down process** of identifying more specific entity subtypes (at lower-levels) from a higher-level entity supertype.



# Example of Generalization

Three entity types: CAR, TRUCK, and MOTORCYCLE

CAR

Vehicle ID

Price

Engine Displacement

Vehicle Name

(Make, Model)

No Of Passengers

TRUCK

Vehicle ID

Price

Engine Displacement

Vehicle Name

(Make, Model)

Capacity

Cab Type

MOTORCYCLE

Vehicle ID

Price

Engine Displacement

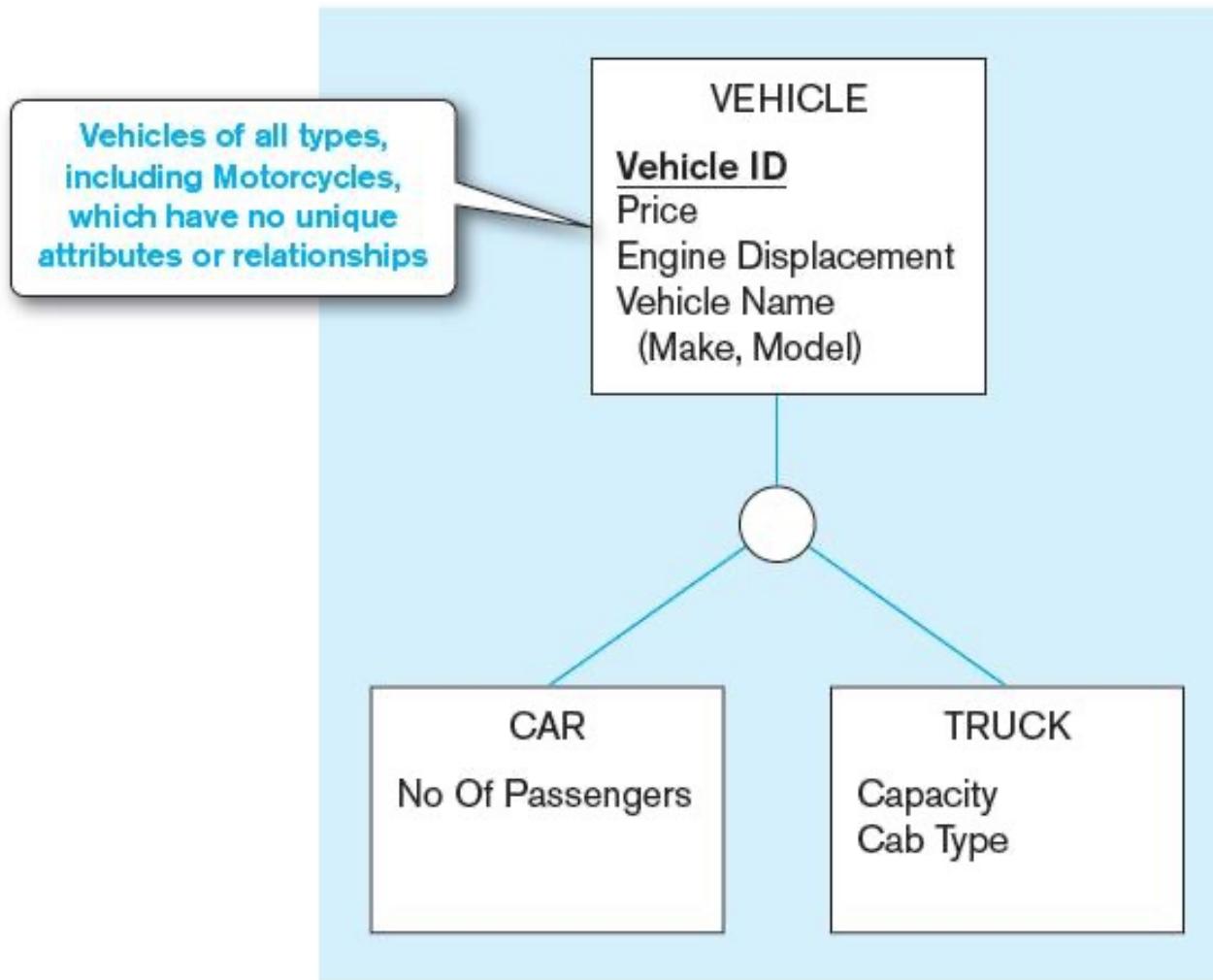
Vehicle Name

(Make, Model)

All these types of vehicles have common attributes

# Example of Generalization

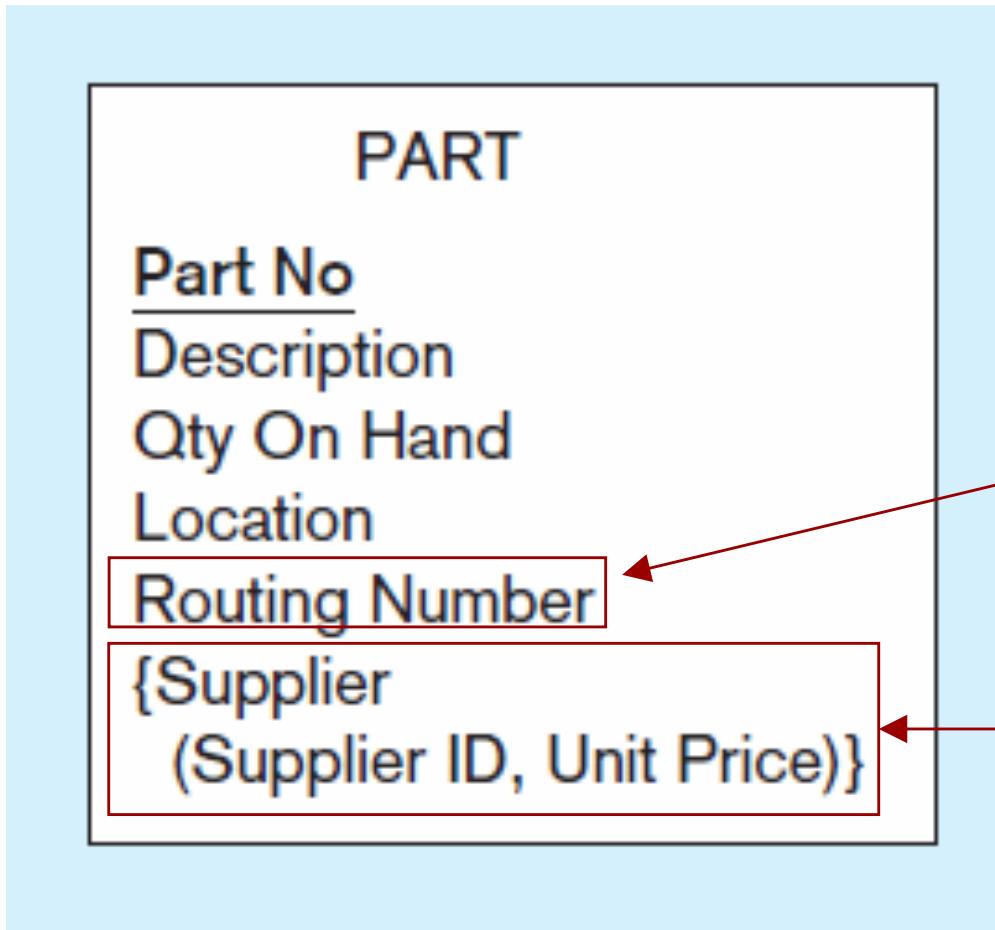
Note: no subtype for motorcycle, since it has no unique attributes



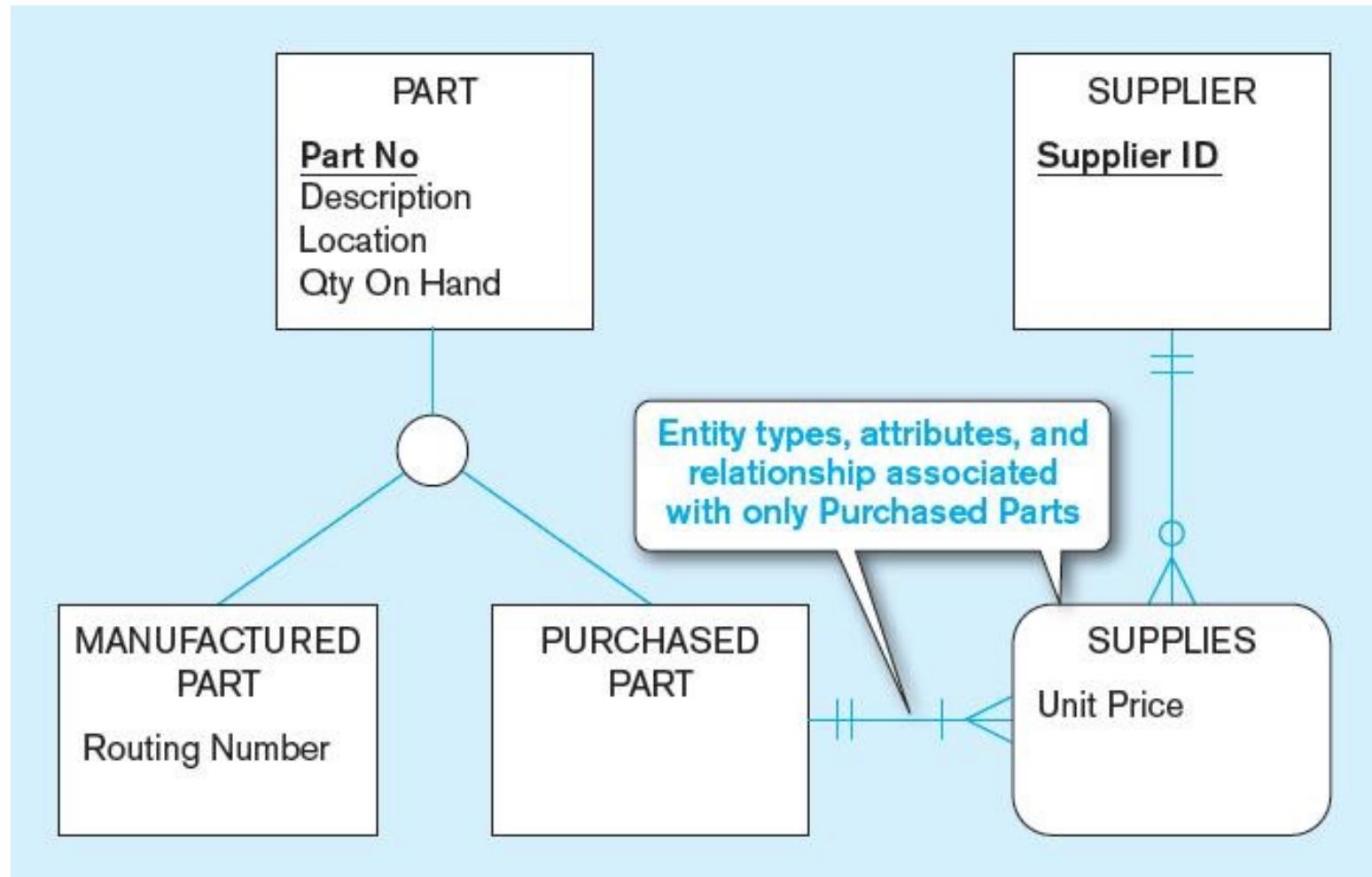
So, we put the shared attributes in a supertype

# Example of Specialization

## Entity type PART



# Example of Specialization



Note: multivalued composite attribute was replaced by an associative entity relationship to another entity

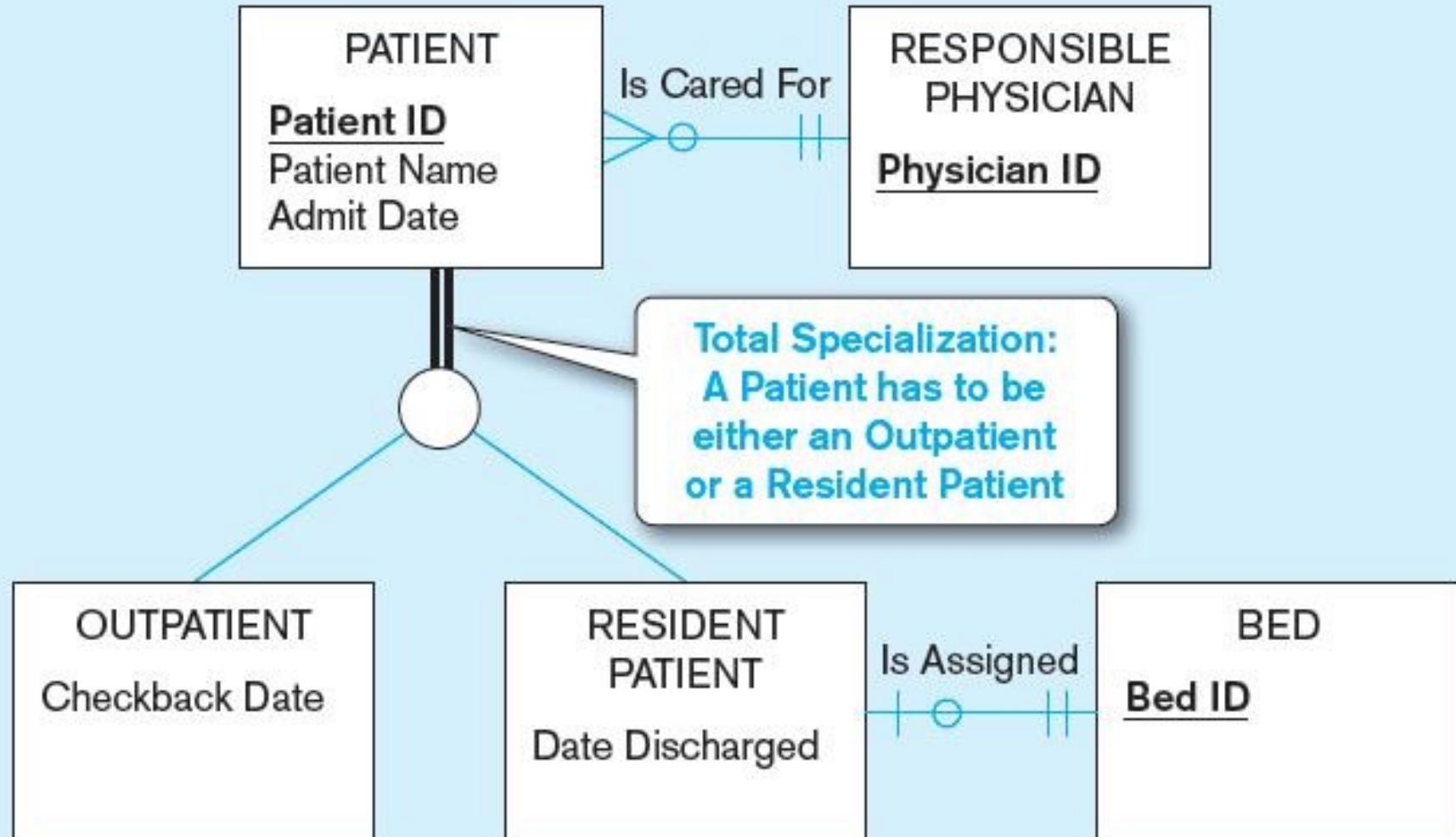
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# Supertype/ Subtype Relationship

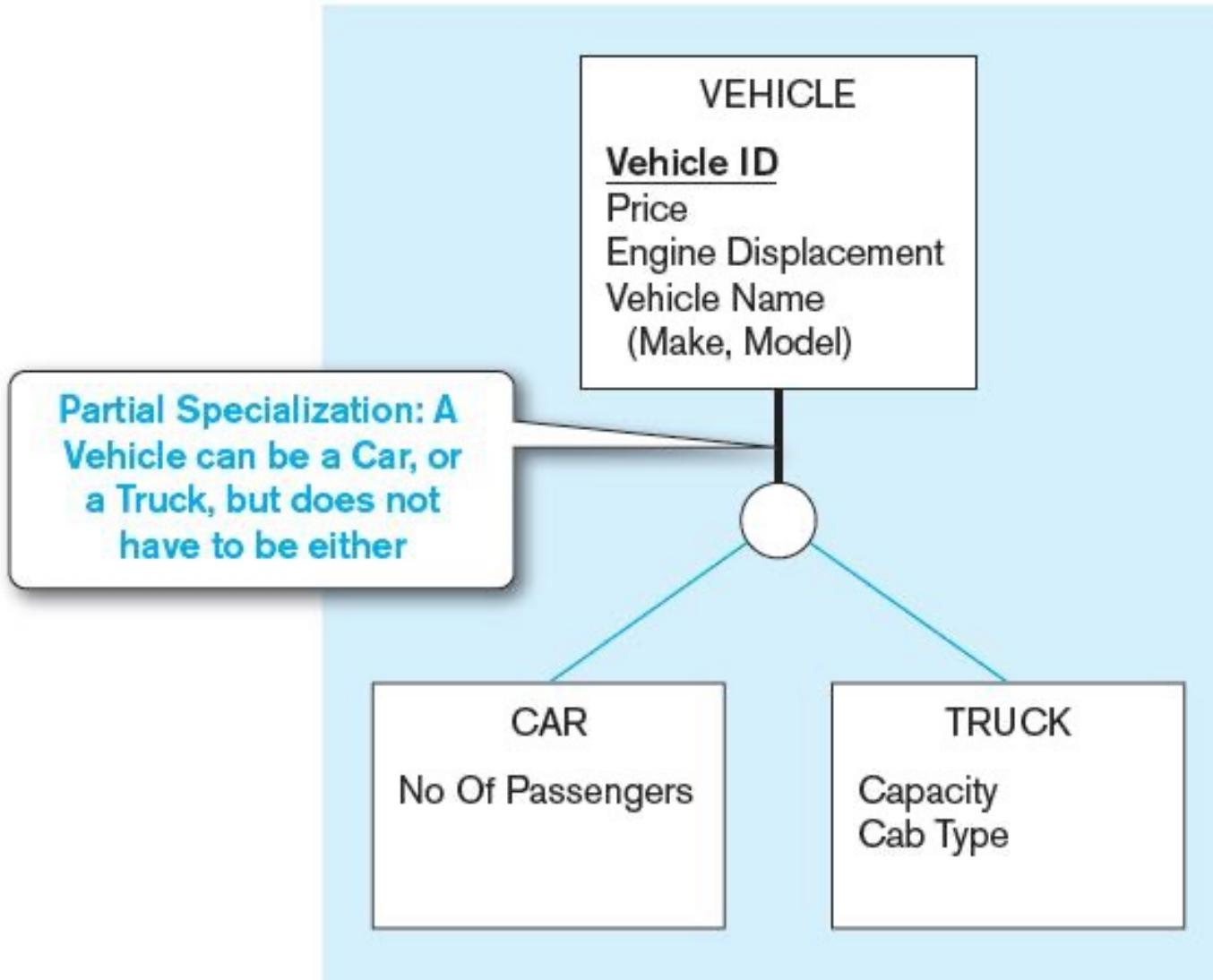
- **Completeness Constraints:** Whether an instance of a supertype must also be a member of at least one subtype
  - **Total Specialization Rule:** Yes (double line)
  - **Partial Specialization Rule:** No (single line)
  
- **Disjointness Constraints:** Whether an instance of a supertype may simultaneously be a member of two (or more) subtypes
  - **Disjoint Rule:** An instance of the supertype can be only ONE of the subtypes
  - **Overlap Rule:** An instance of the supertype could be more than one of the subtypes

# Completeness Constraints



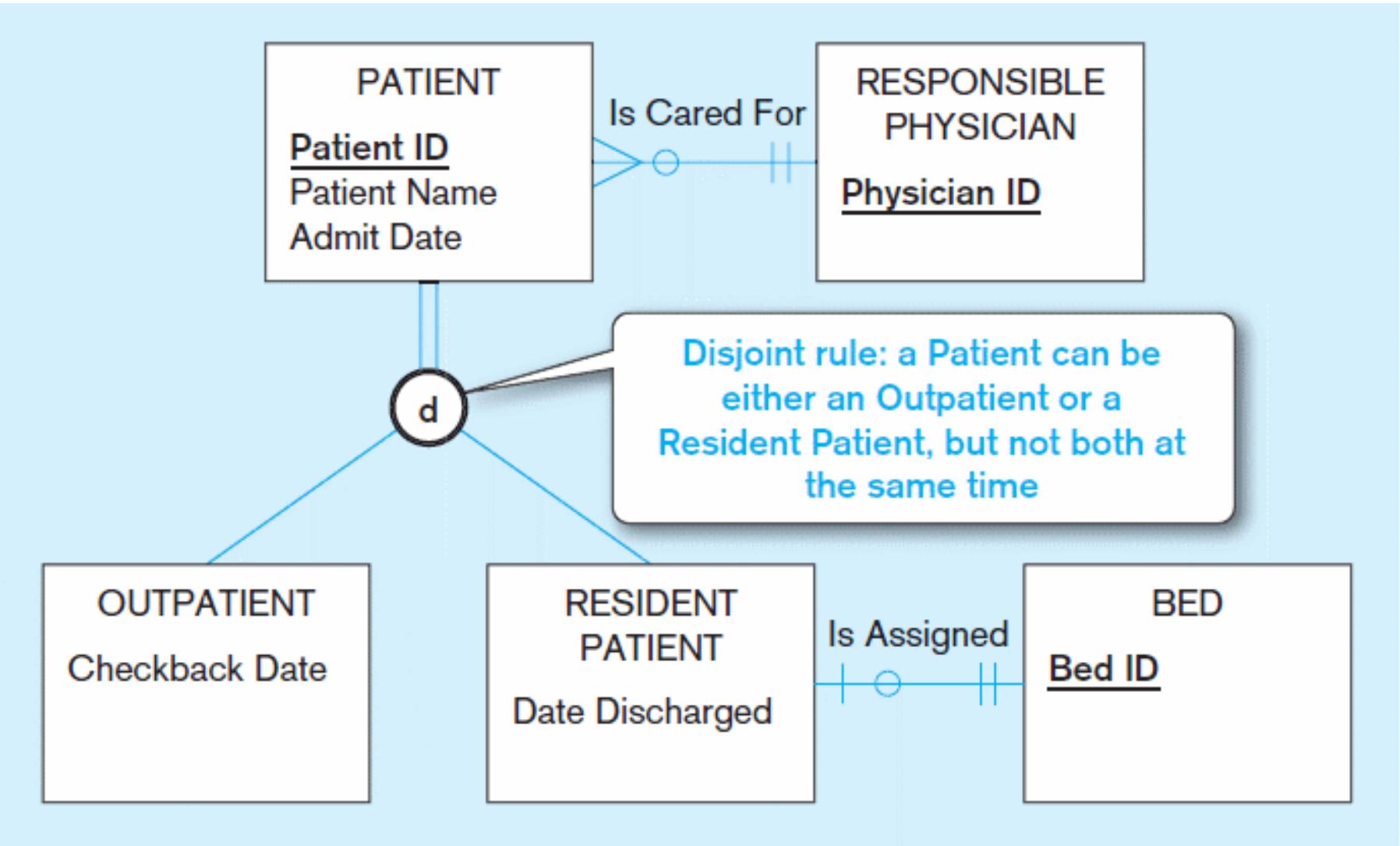
Total specialization rule

# Example of Specialization



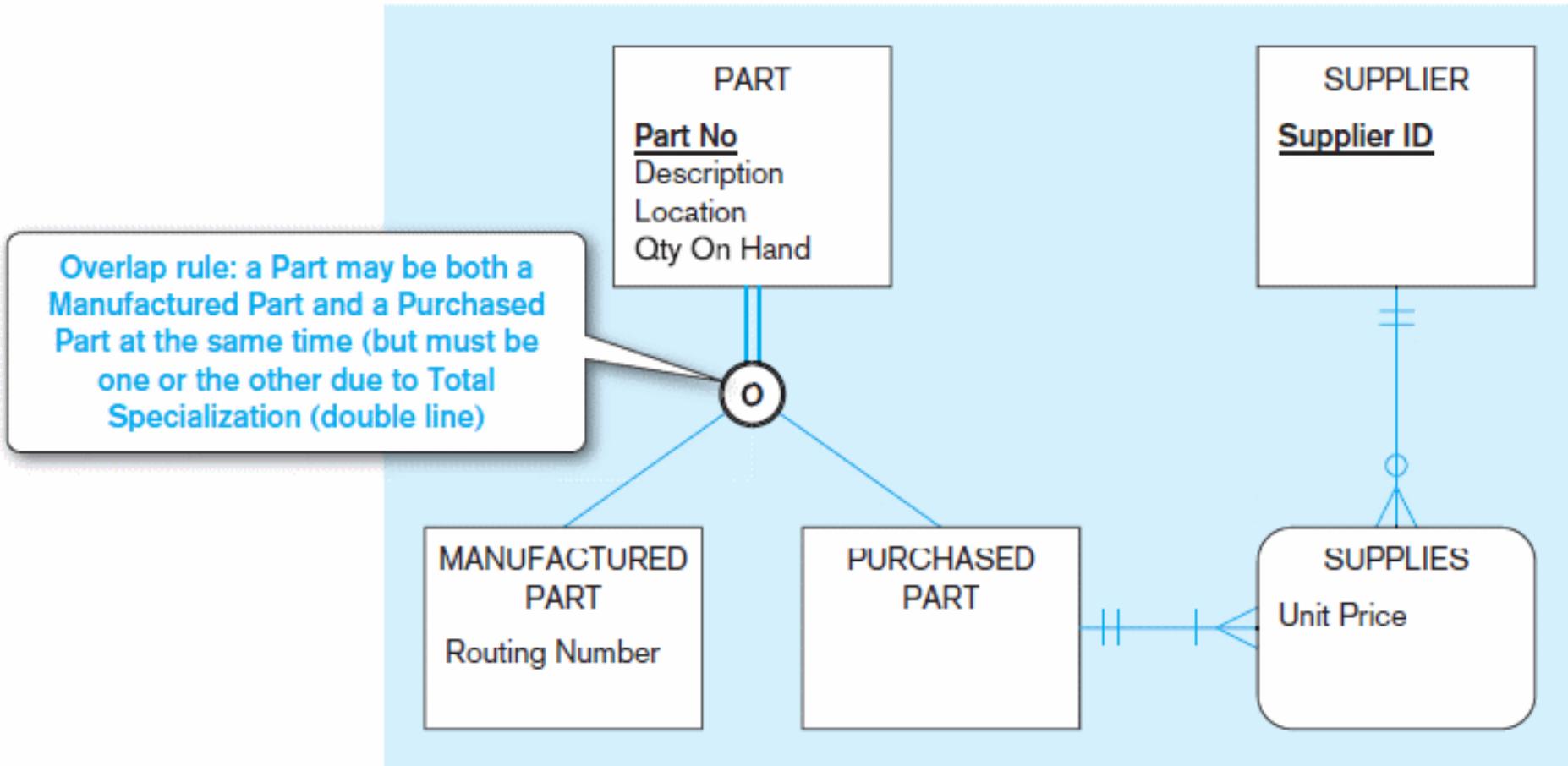
Partial specialization rule

# Disjointness Constraints



Disjoint rule

# Disjointness Constraints

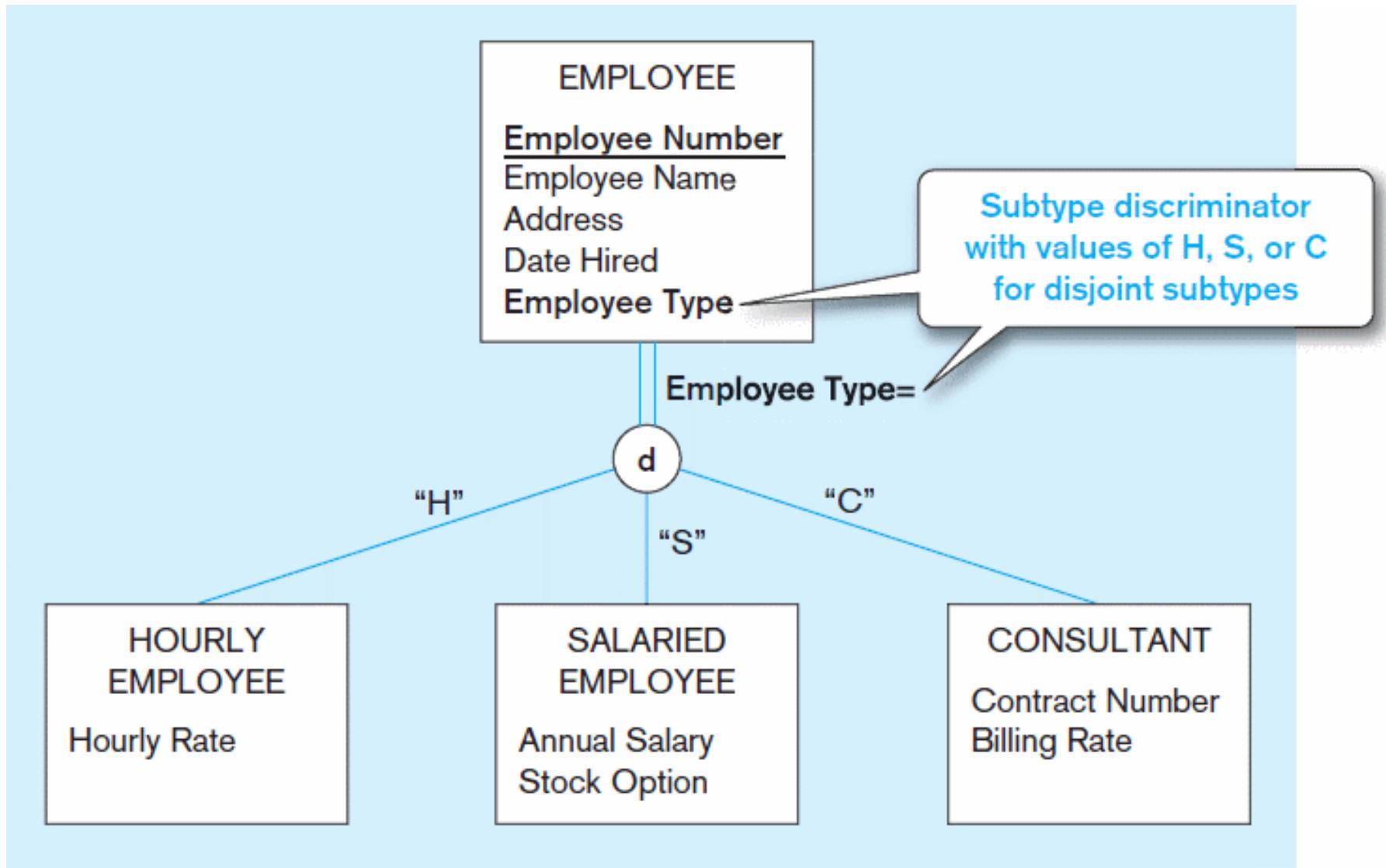


Overlap rule

# Subtype Discriminator

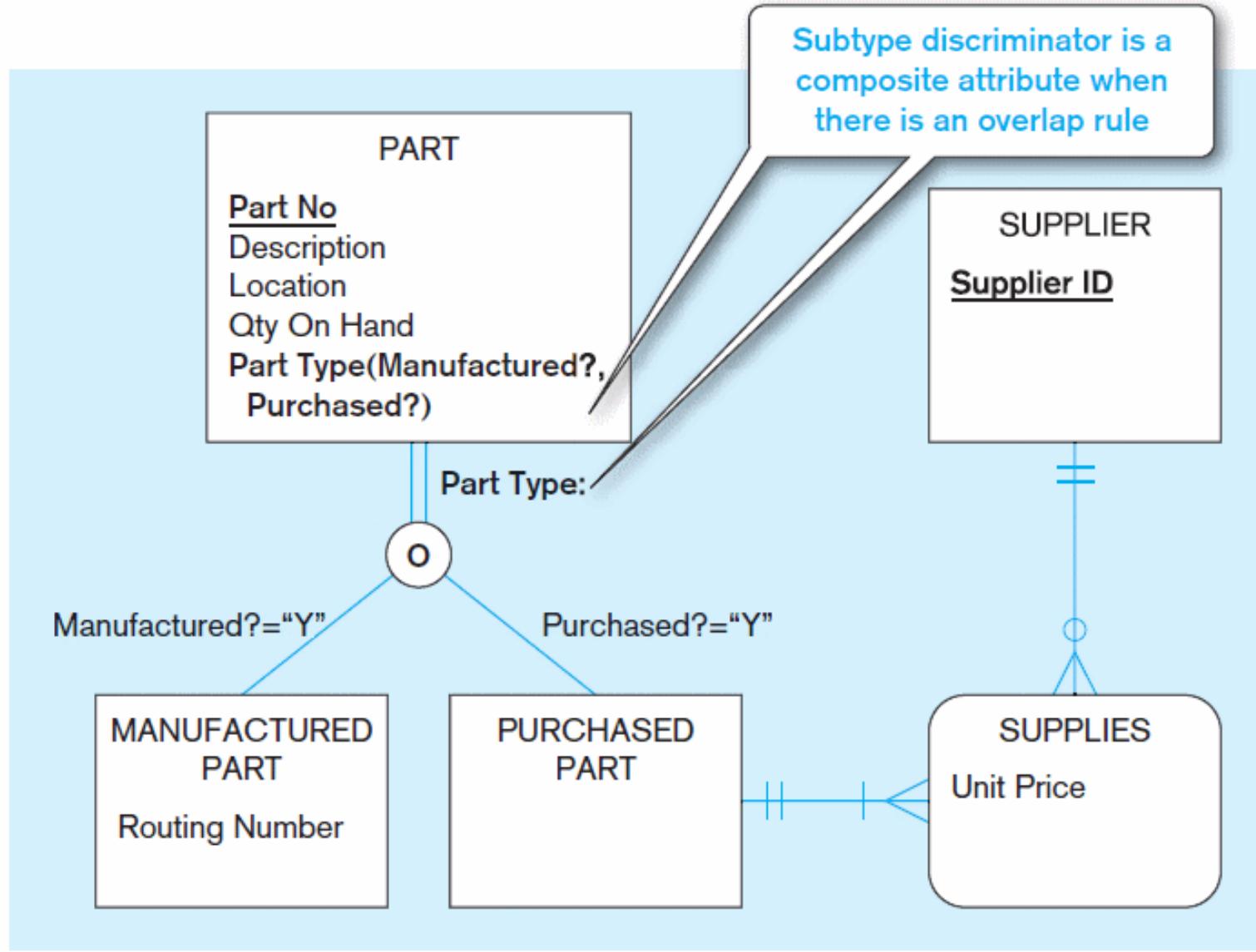
- An **attribute** of the **supertype** whose values determine the target subtype(s)
  - **Disjoint** – a *simple* attribute with alternative values to indicate the possible subtypes
  - **Overlapping** – a *composite* attribute whose subparts pertain to different subtypes. Each subpart contains a Boolean value to indicate whether or not the instance belongs to the associated subtype

# Subtype Discriminator



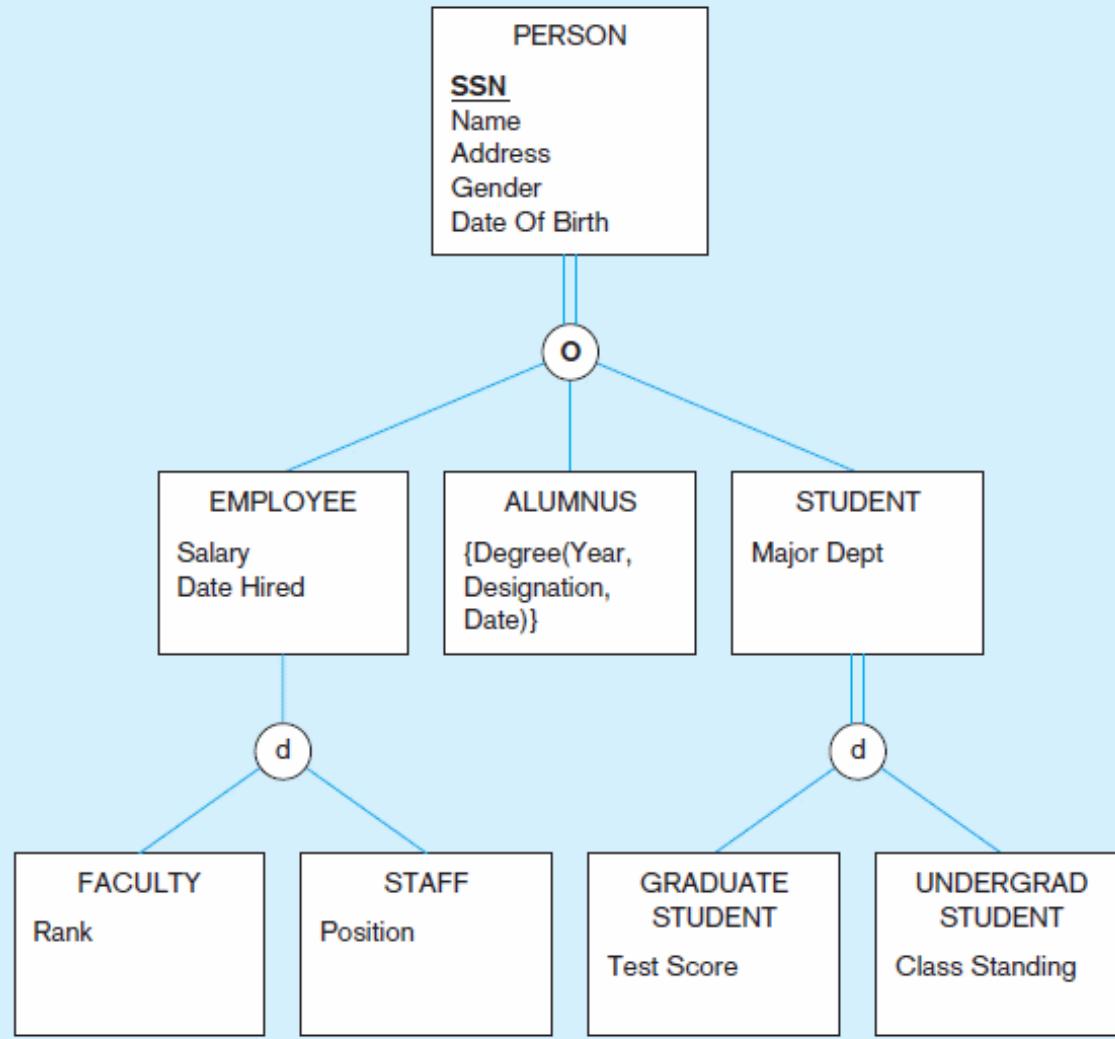
Example of **disjointness constraint** (*disjoint* rule)

# Subtype Discriminator



Example of **disjointness constraint (overlap rule)**

# Subtype Discriminator



Example of specialization hierarchy with  
**overlapping subtype**

# Outline

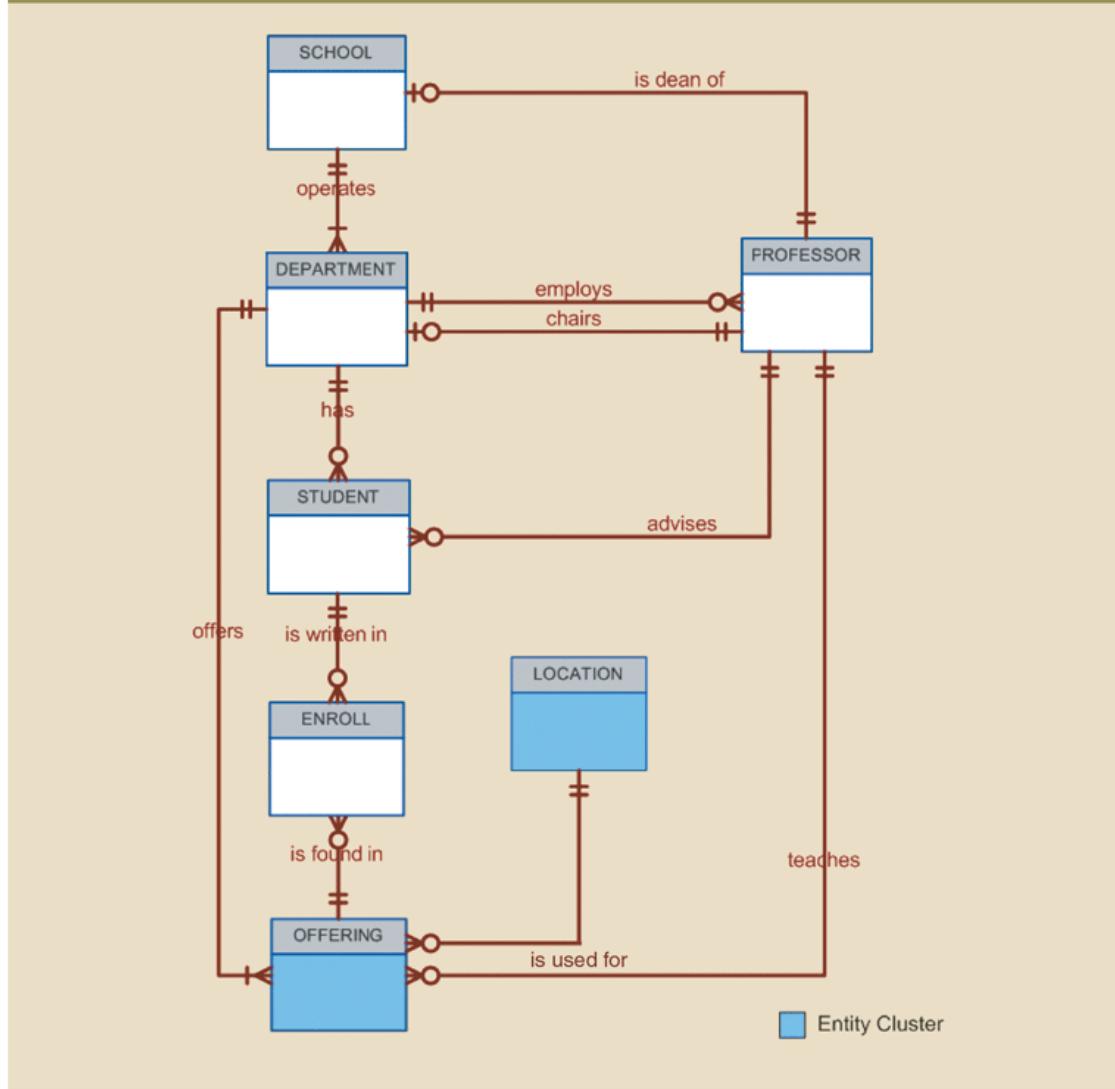
- Supertypes and Subtypes
- Relationships and Subtypes
- Generalization and Specialization
- Supertypes/Subtypes Relationship Constraints
- Cluster Entity

# Entity Cluster

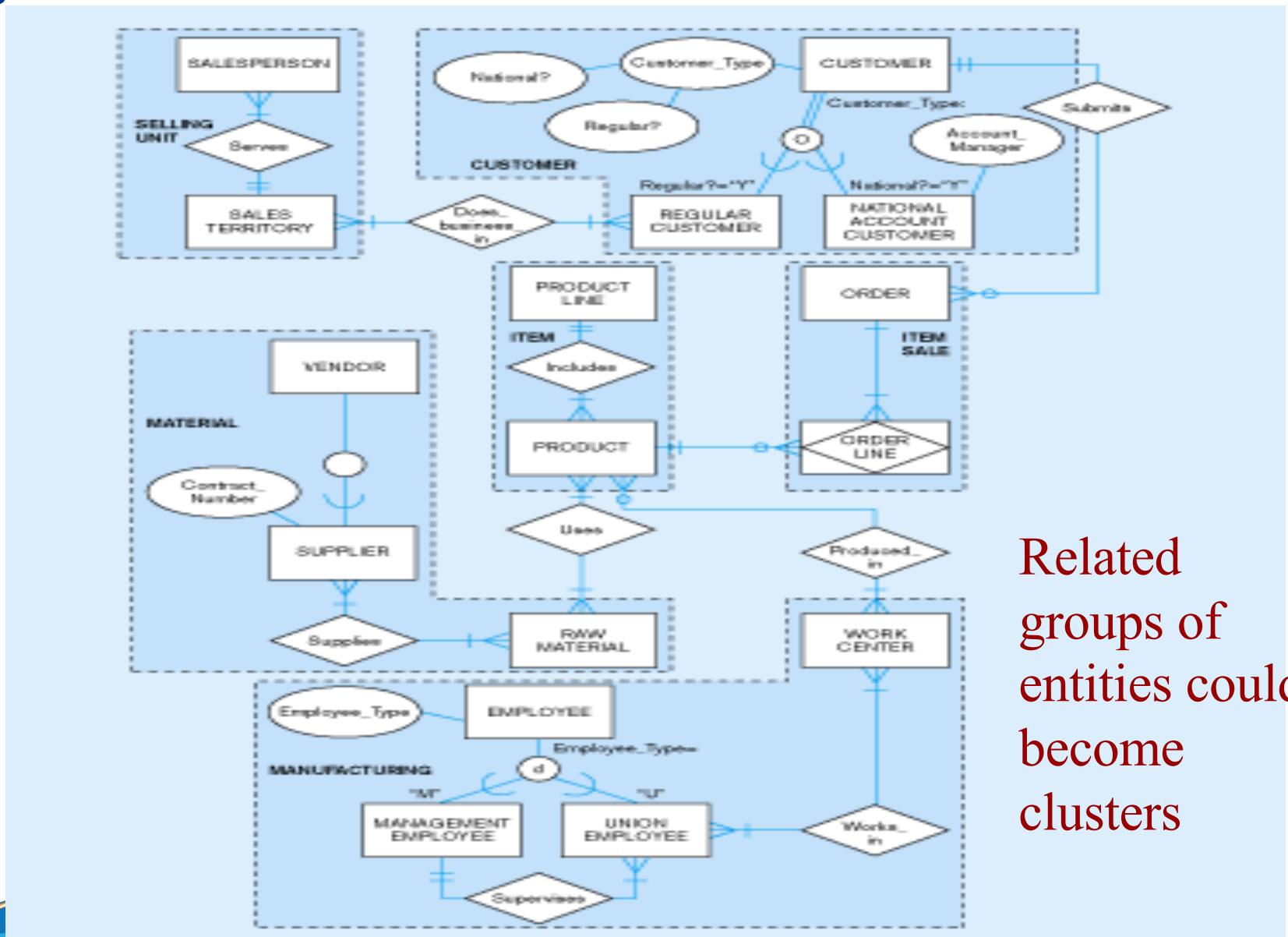
- EER diagrams are difficult to read when there are too many entities and relationships
- Solution: group entities and relationships into ***entity clusters***
- **Entity cluster:** set of one or more entity types and associated relationships grouped into a single abstract entity type

# Entity Cluster

FIGURE 5.6 TINY COLLEGE ERD USING ENTITY CLUSTERS



# Entity Cluster



# References

(Coronel and Morris, 2015, **chapter 4, 5**)

**Database System: Design, Implementation, and Management, 12th Edition, Carlos Coronel & Steven Morris, 2015.**

(Hoffer et al., 2019, **Part II, chapter 3**)

**Modern Database Management, 13th Edition, Jeffrey A. Hoffer, V. Ramesh, Heikki Topi, 2019.**

# THE END