

Database Management Systems

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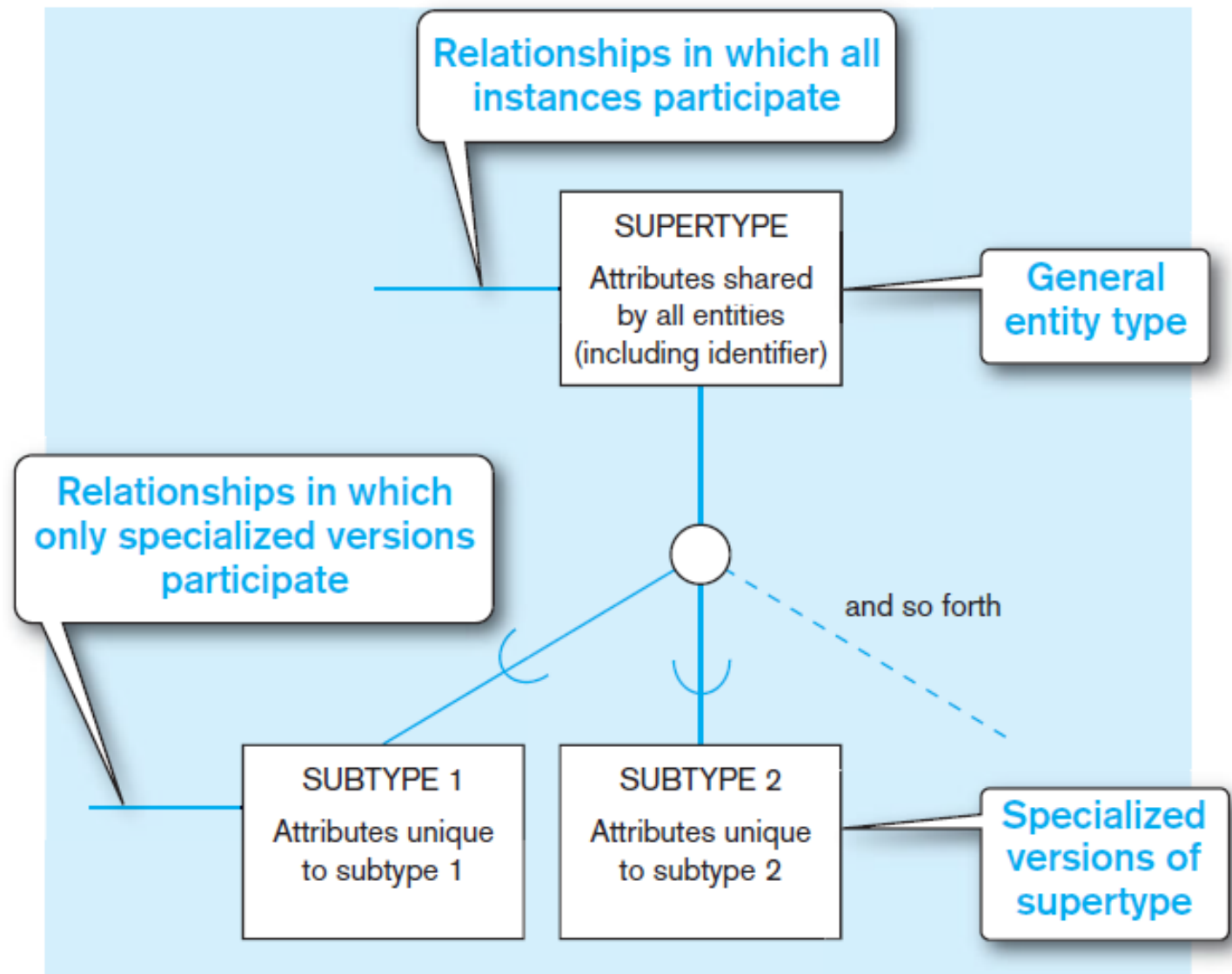
Overview

- Enhanced E-R Modeling
 - Supertype/Subtype Relationships
 - Generalization
 - Specialization
 - Completeness Constraints
 - Disjointness Constraints
 - Supertype/Subtype Discriminator
 - Supertype/Subtype Hierarchy

Supertypes and Subtype

- **Subtype**: A subgrouping of the entities in an entity type which has attributes that are distinct from those in other subgroupings
- **Supertype**: A generic entity type that has a relationship with one or more subtypes
- **Inheritance**:
 - Subtype entities inherit values of all attributes of the supertype
 - An instance of a subtype is also an instance of the supertype

Figure 3-1:
Basic notation for
supertype/subtype
relationships (Entity
supertypes and
subtypes are
organized in a
specialization
hierarchy).



Motivation for Entity Subtypes and Supertypes:

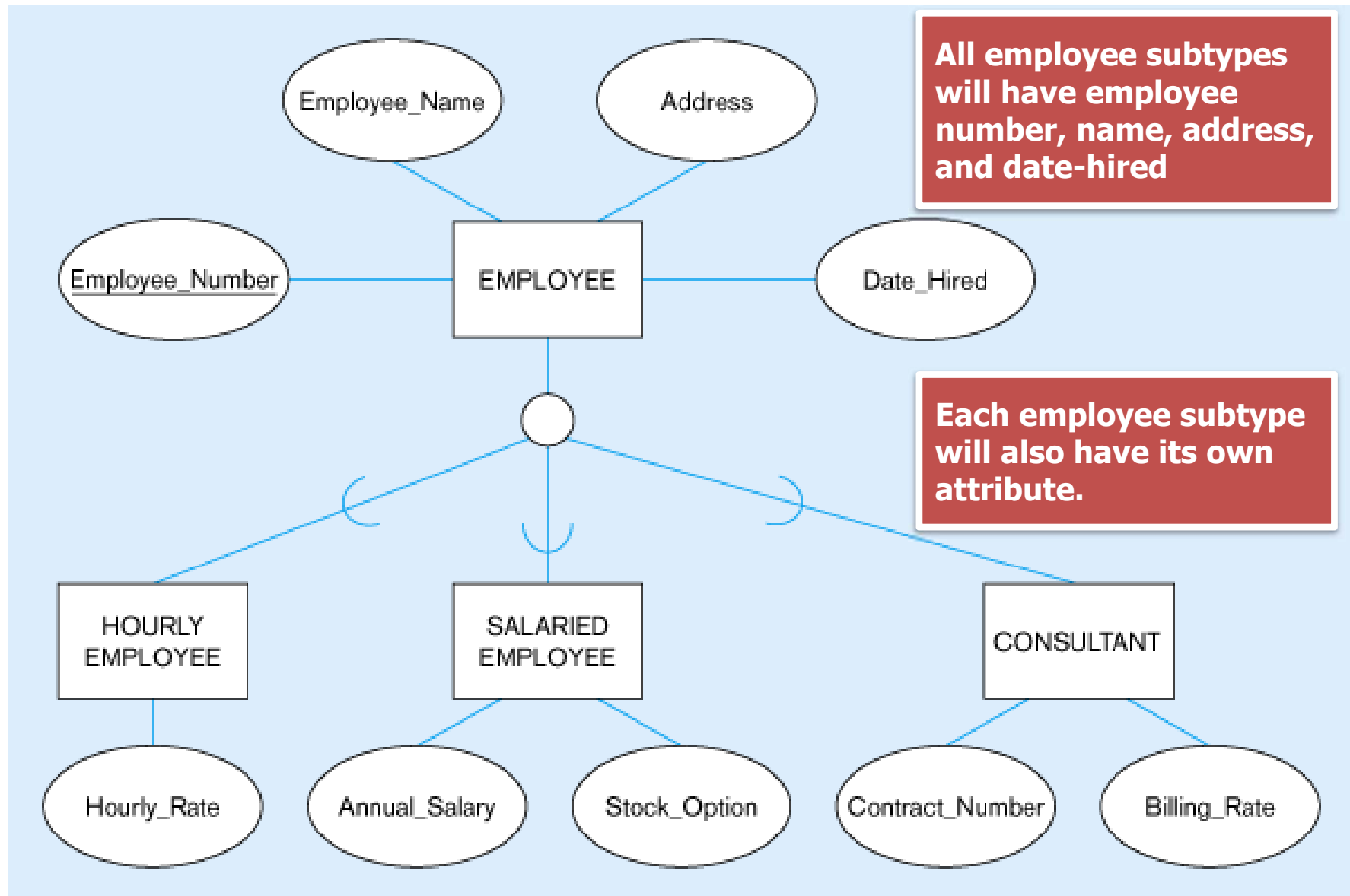
Null Created by Unique Attributes

- So the grouping of employees to create various types of employees provide two important details:
 - It **avoids unnecessary nulls** in the employee attributes when some employees have characteristics that are not shared by other employees.
 - It enables a particular employee type to **participate in relationship** that are unique to that employee type.

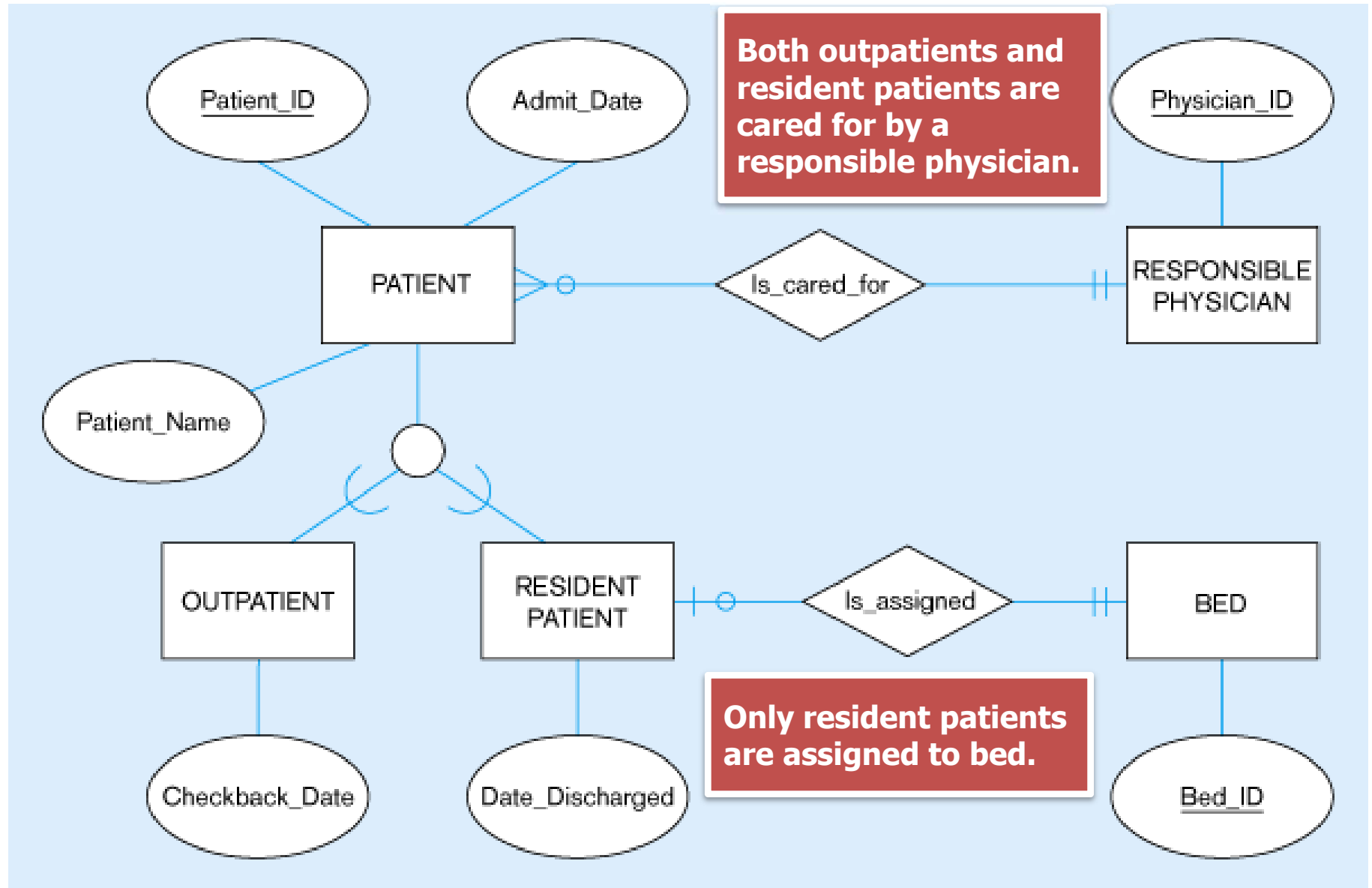
Specialized Hierarchy

- A specialization hierarchy (i.e. entity subtypes/supertypes) provides a mean to:
 - Support attribute **inheritance** (which enables an entity subtype to inherit the attributes and relationships of the supertype).
 - Define a special supertype attribute known as the **subtype discriminator**.
 - Define **disjoint/overlapping constraints** and **complete/partial constraints**.

Employee Supertype with Three Subtypes

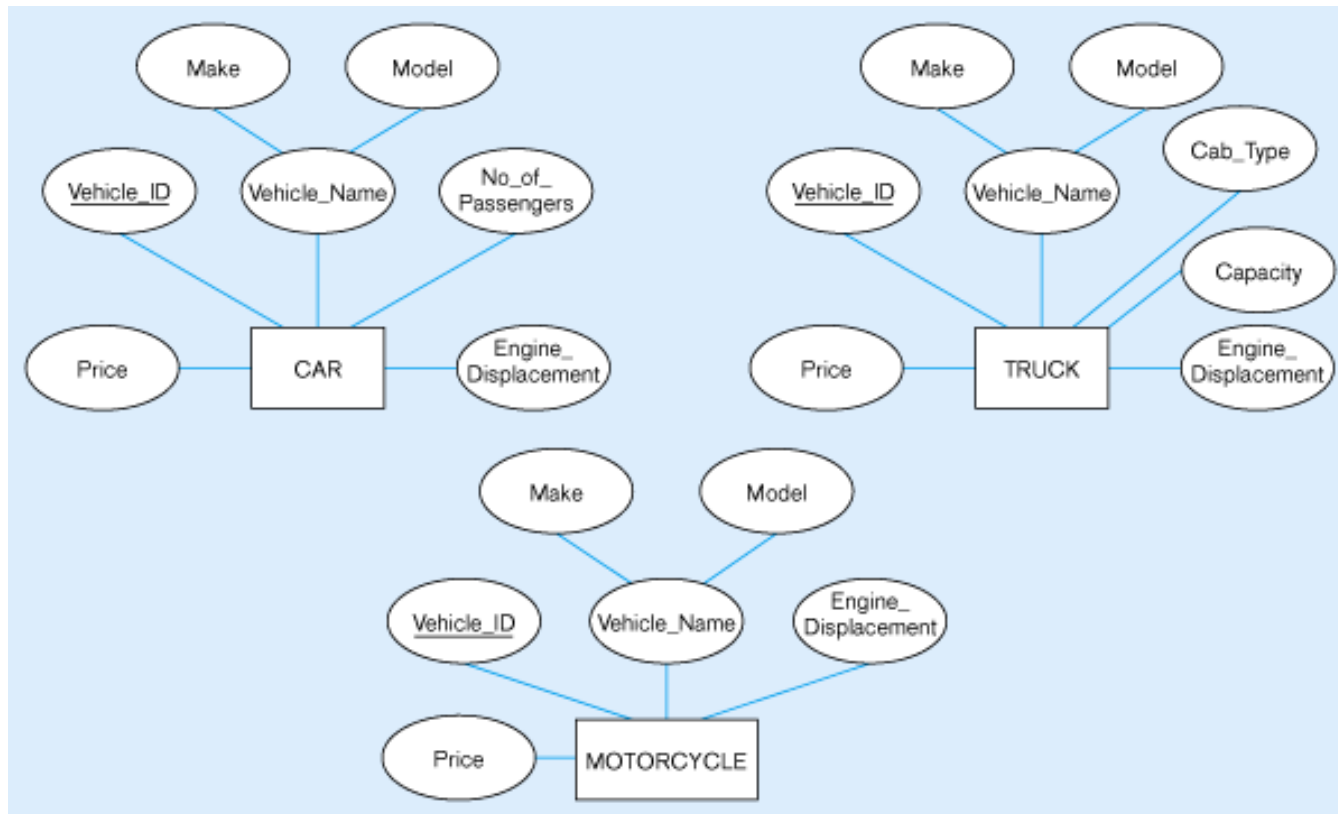


Supertype/Subtype Relationships in a Hospital



Generalization

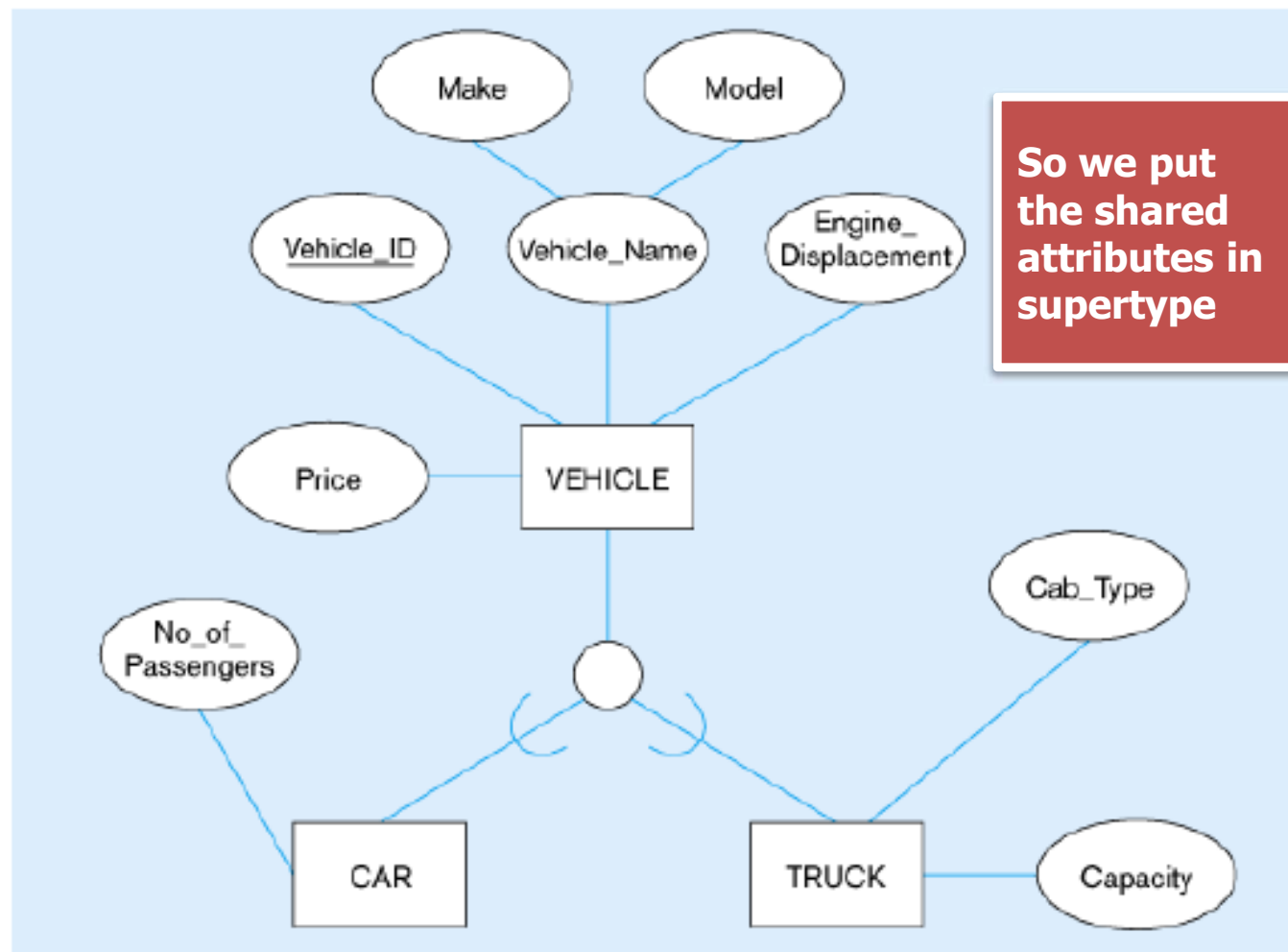
- Generalization**: The process of defining a more general entity type from a set of more specialized entity types. **BOTTOM-UP**



All these types of vehicles have common attributes

Three entity types: CAR, TRUCK, and MOTORCYCLE

Generalization of VEHICLE Supertype

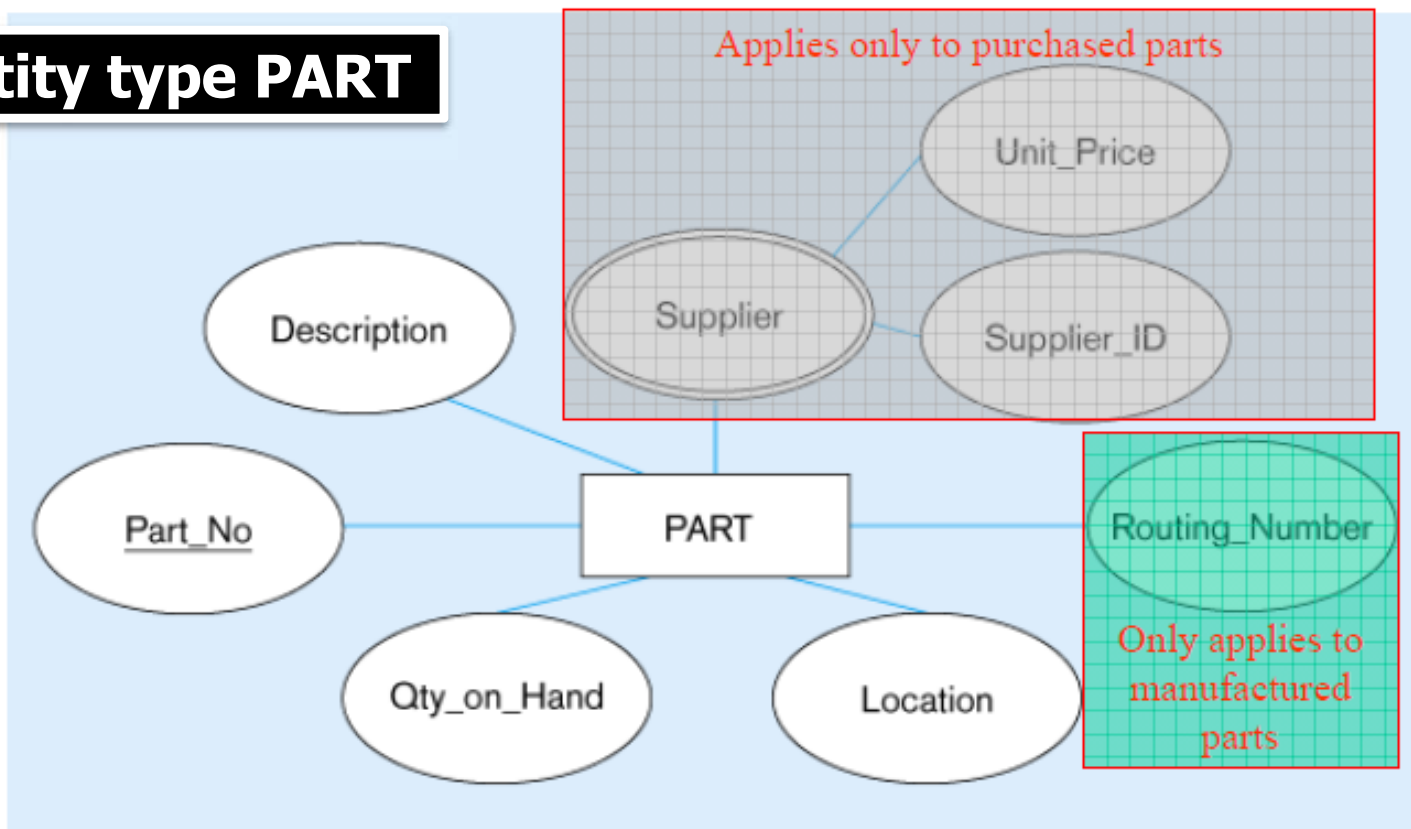


Note: no subtype for motorcycle, since it has no unique attributes

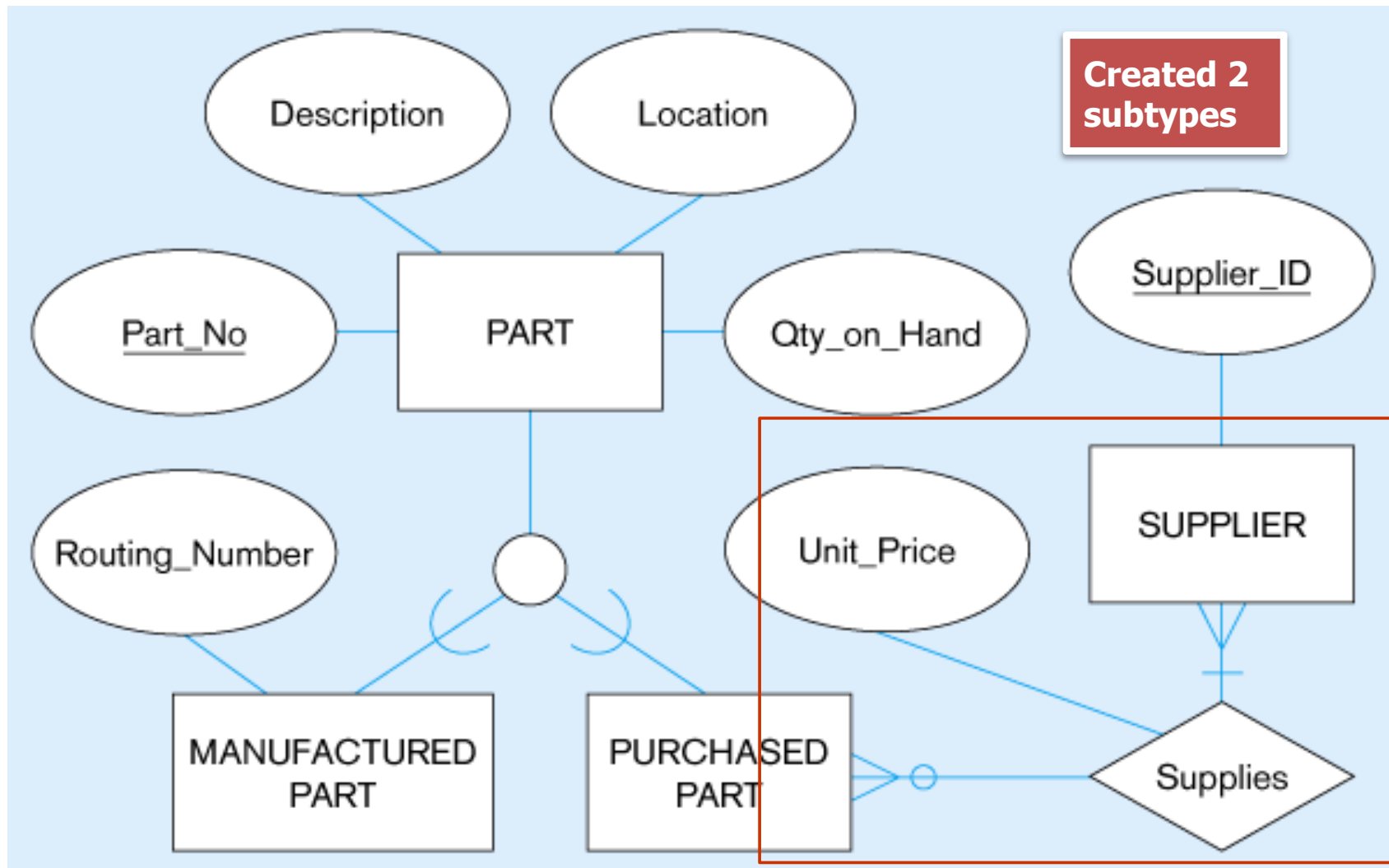
Specialization

- **Specialization**: The process of defining one or more subtypes of the supertype, and forming supertype/subtype relationships. **TOP-DOWN**

(a) Entity type PART



Specialization to MANUFACTURED PART and PURCHASED PART



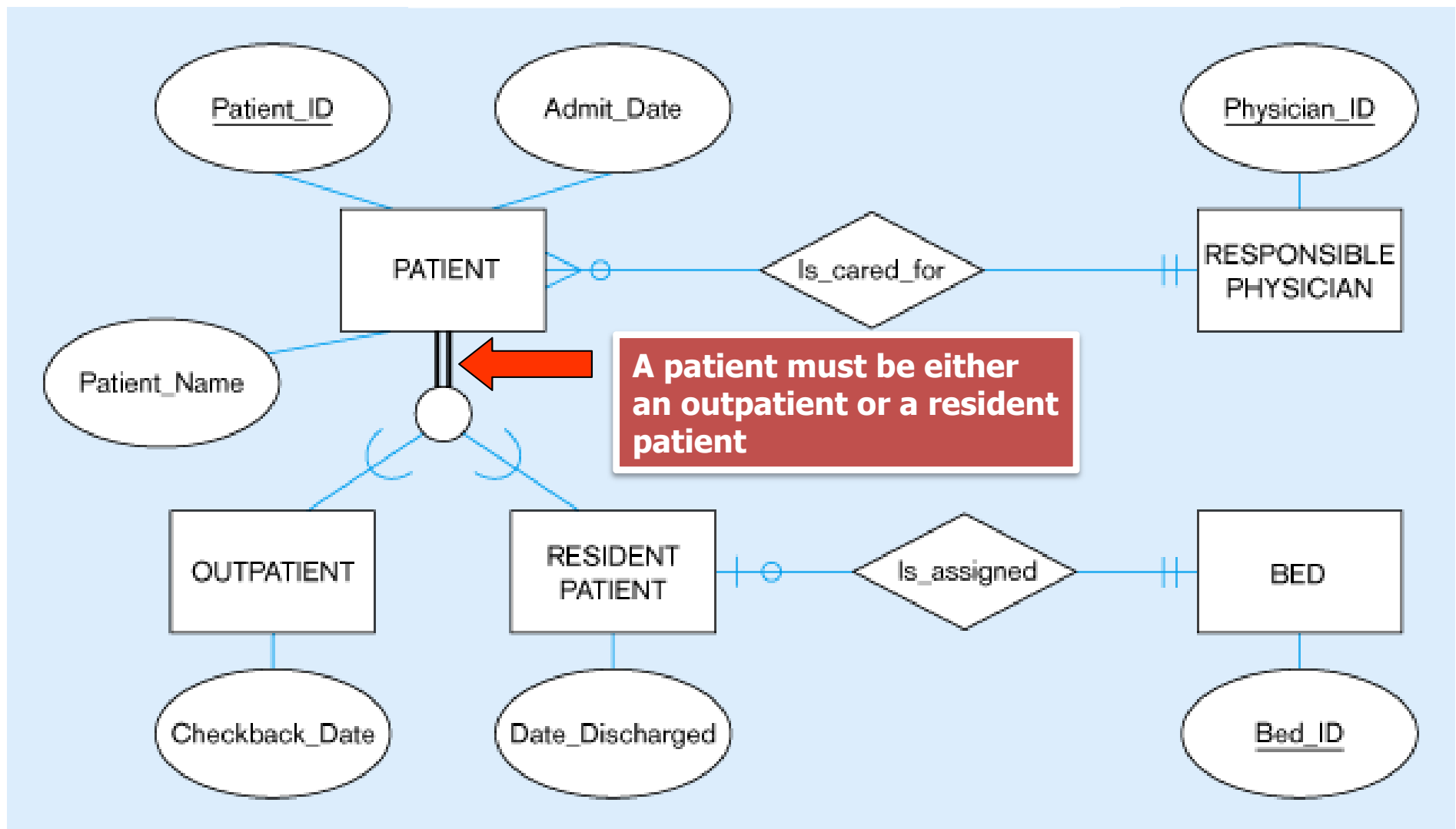
Note: multivalued attribute was replaced by a relationship to another entity

Constraints in Supertype/Completeness Constraint

- Completeness Constraint: Whether an instance of supertype **must** also be a member of at least one subtype
 - Total Specialization Rule: Yes (notation: double line)
 - Partial Specialization Rule: No (notation: single line)

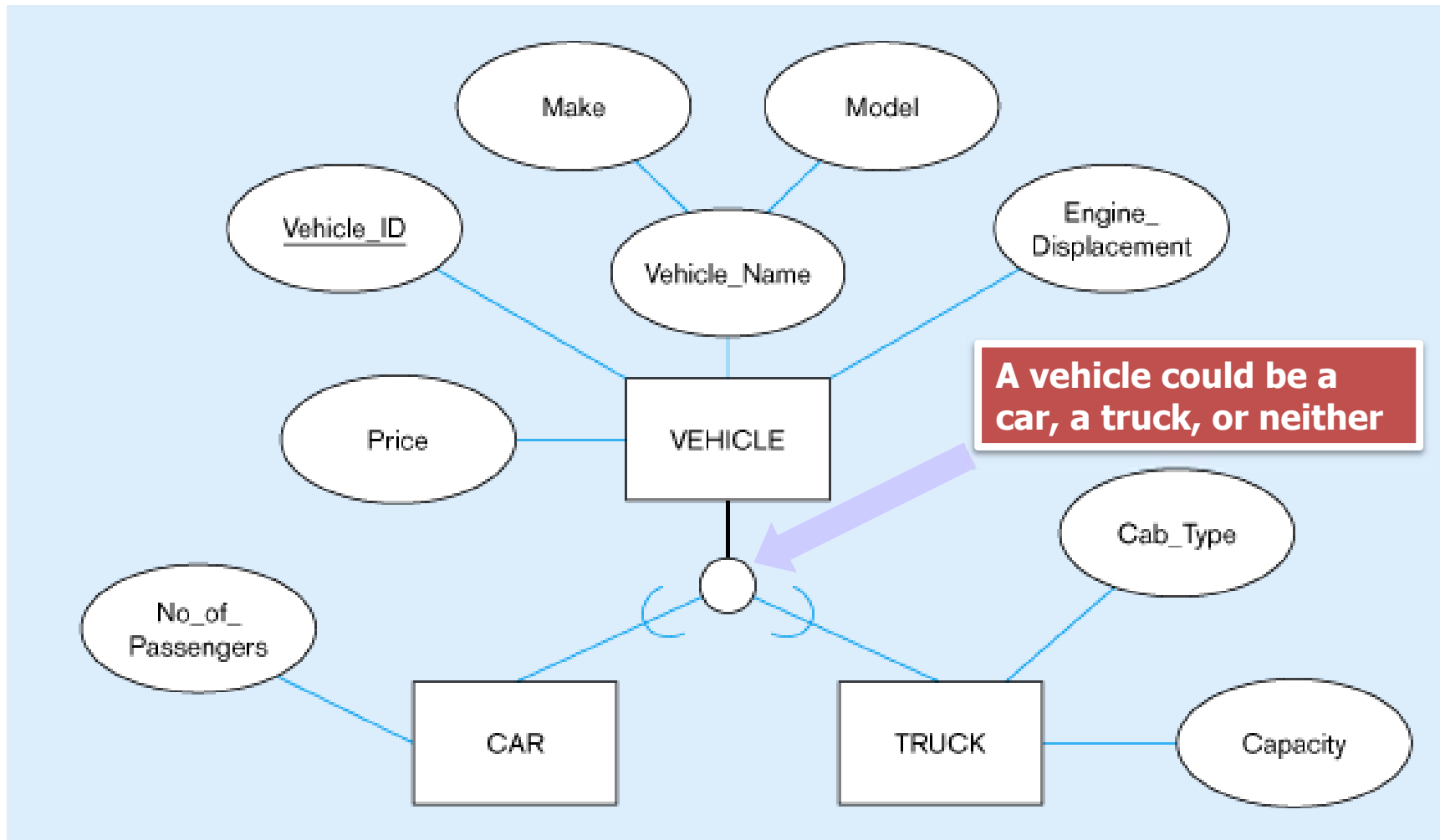
Examples of Completeness Constraints

(a) Total Specialization Rule



Examples of Completeness Constraints

(b) Partial Specialization Rule



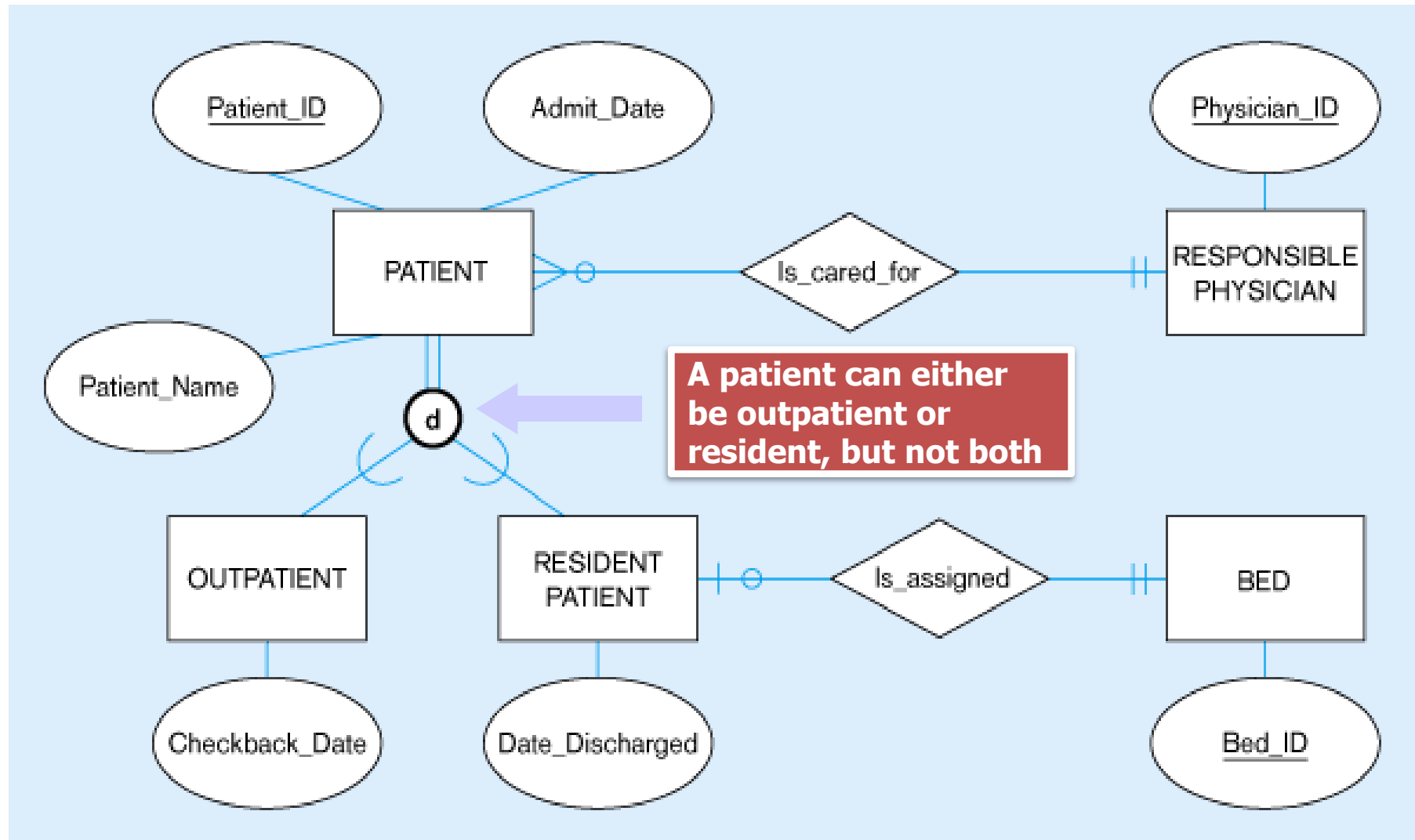
Constraints in Supertype/Disjointness

Constraint

- **Disjointness Constraint**: Whether an instance of 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 (**notation: d alphabet**)
 - Overlap Rule: An instance of the supertype could be more than one of the subtypes (**notation: o alphabet**)

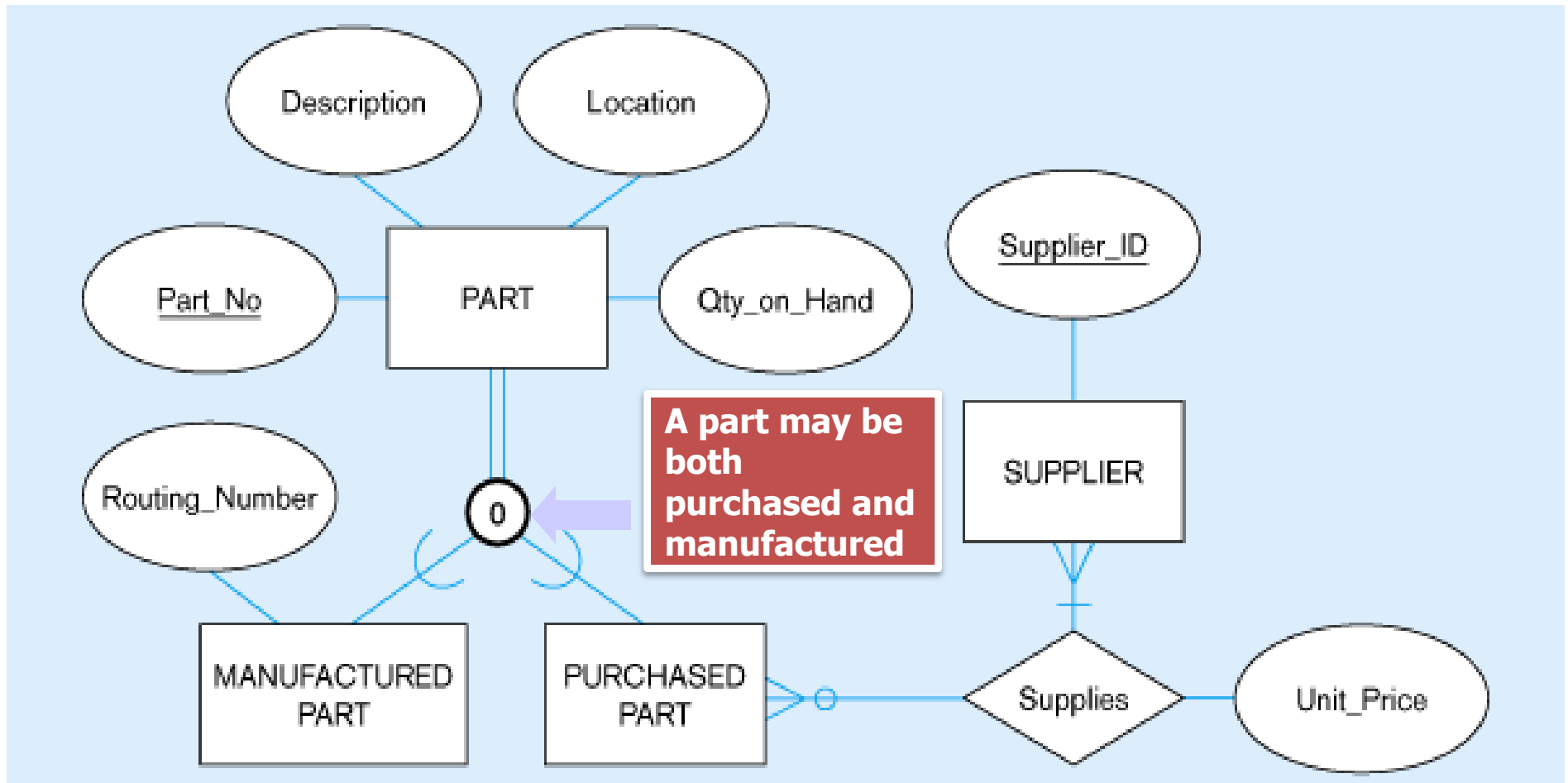
Examples of Disjointness Constraints

(a) Disjoint Rule



Examples of Disjointness Constraints

(b) Overlap Rule



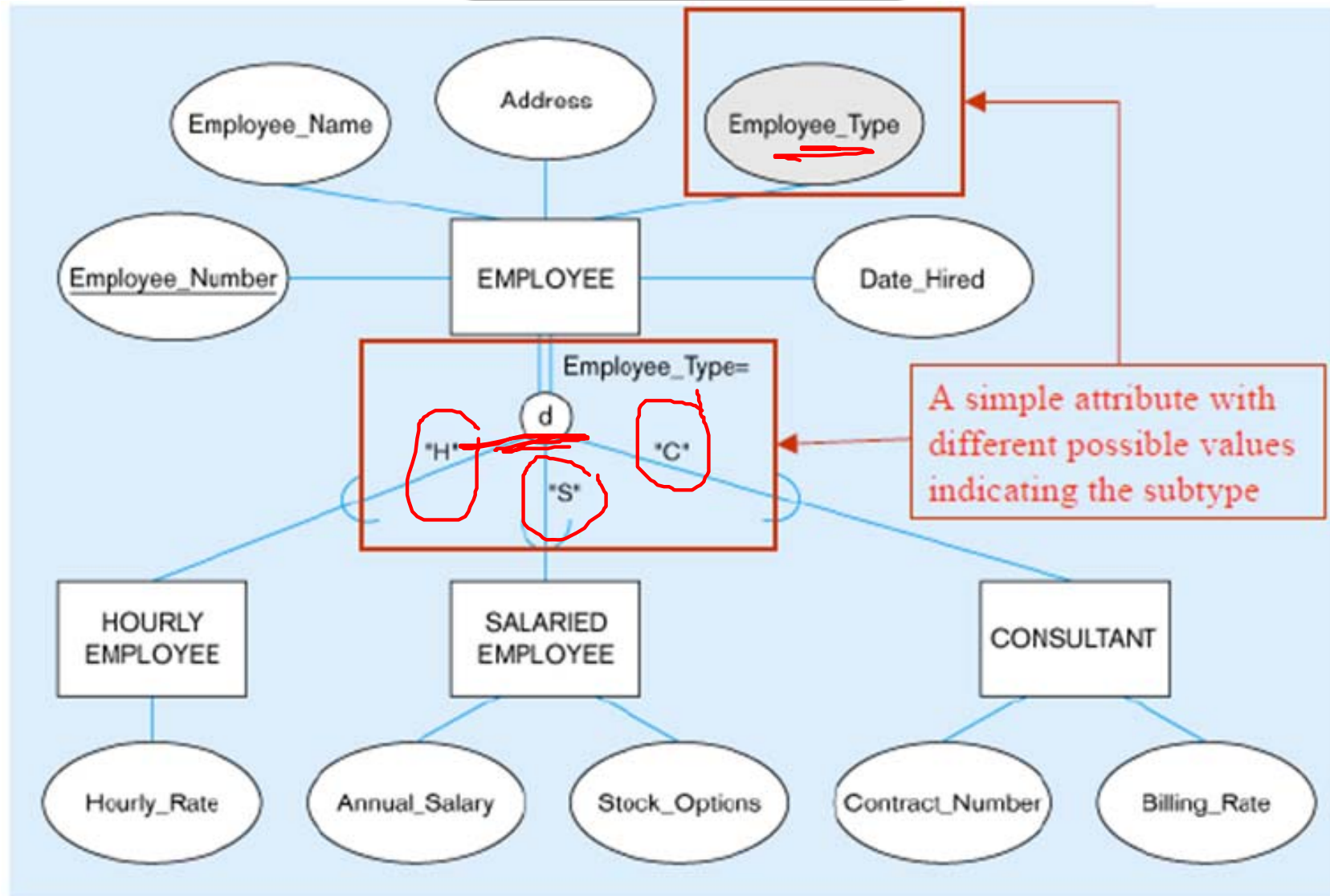
Constraints in Supertype/Subtype

Discriminators

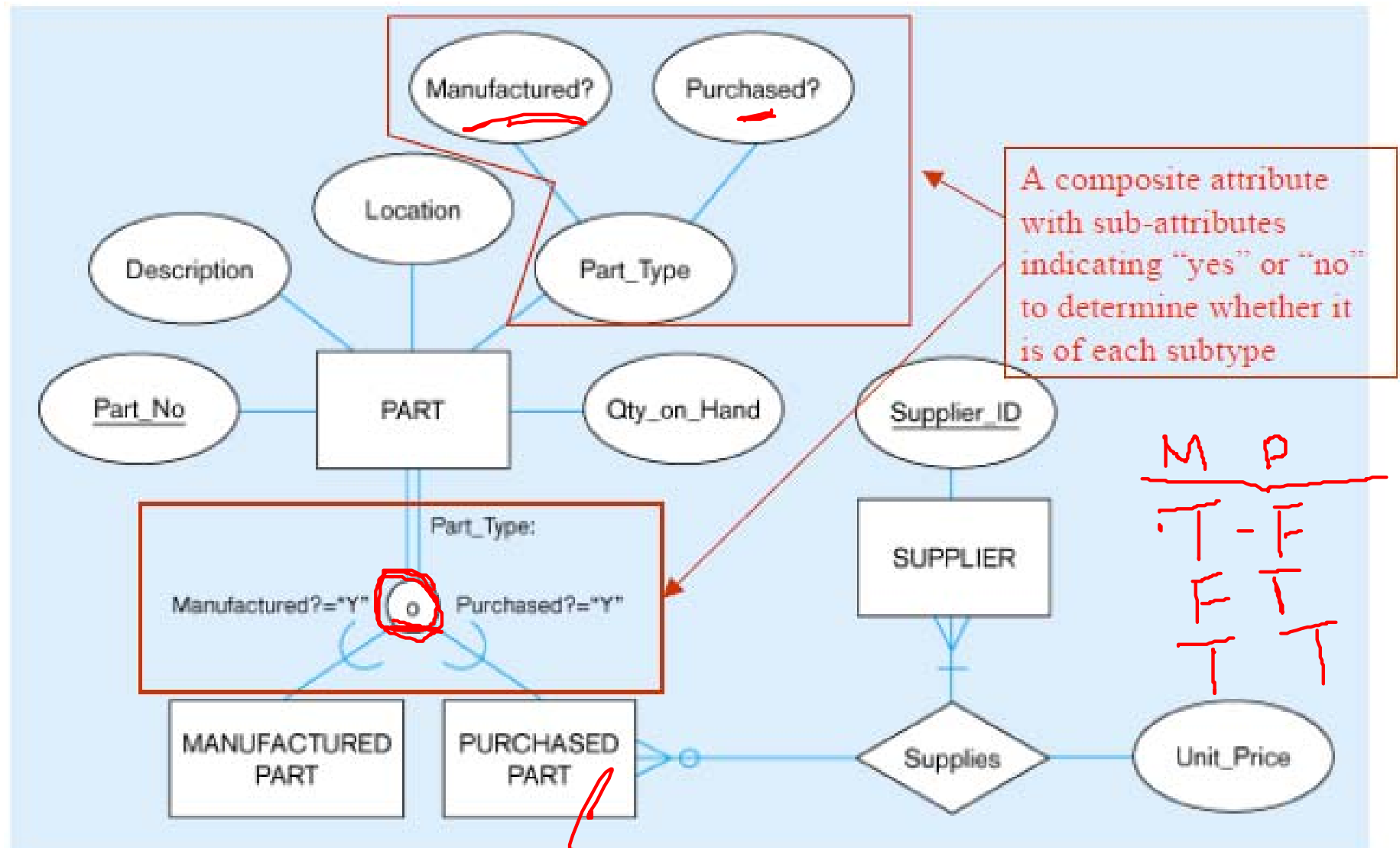
- **Subtype Discriminator:** An attribute of the supertype whose values determine the target subtype(s)
 - Disjoint: a simple attribute with alternative values to indicate the possible subtypes
 - Overlapping: a composite attribute whose subparts pertain to different subtypes. Each subpart contains a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

Introducing a Subtype Discriminator

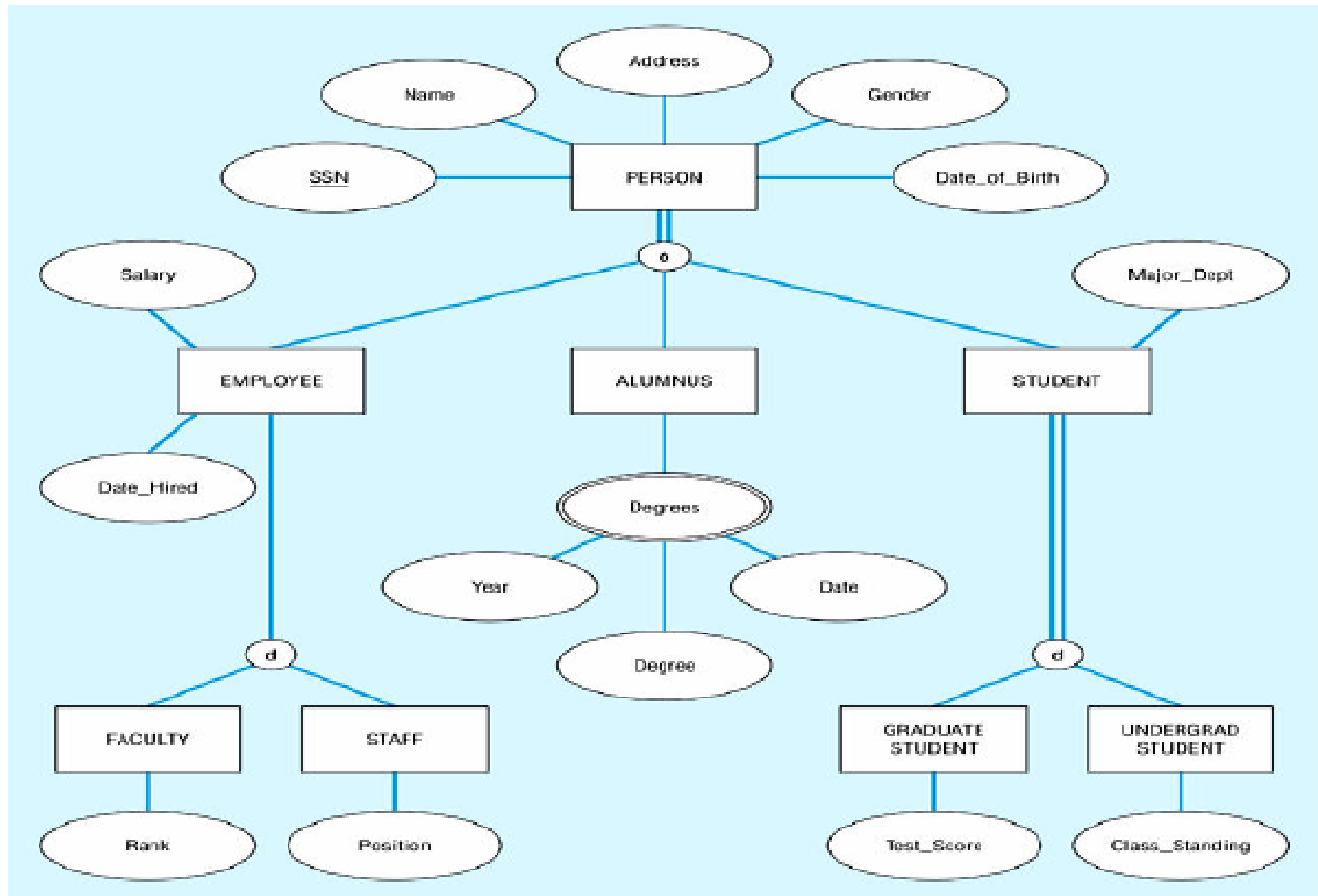
(a) Disjoint Rule



Introducing a Subtype Discriminator (cont...)

(b) Overlap RuleA₁ A₂ A₃

Example of Supertype/Subtype Hierarchy



Summary

- Learn how to model enhanced E-R diagram, supertype, subtype, discriminators, constraints etc.