Ch 3

Database Management System

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Overview

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

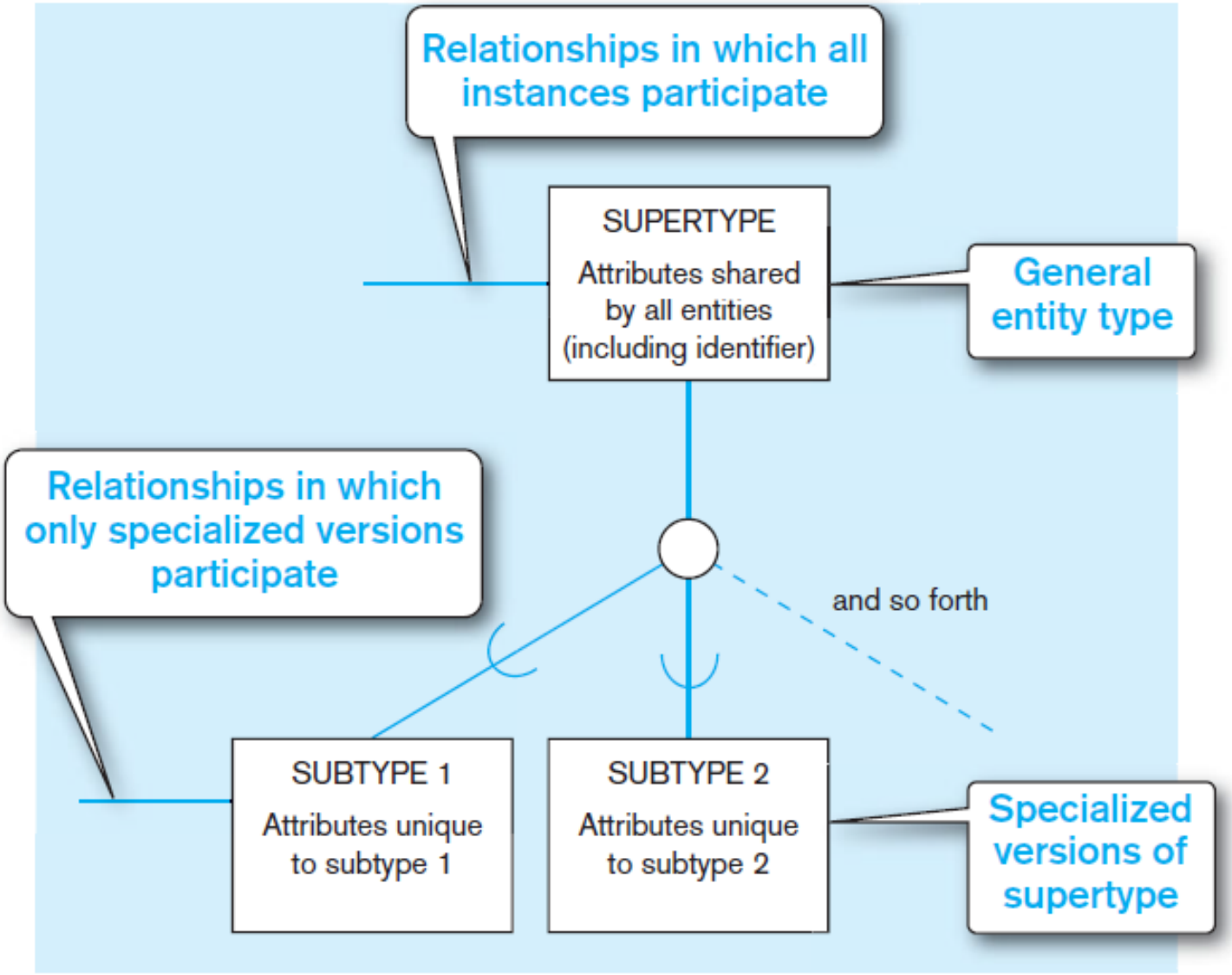
Supertypes and Subtype

- 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.



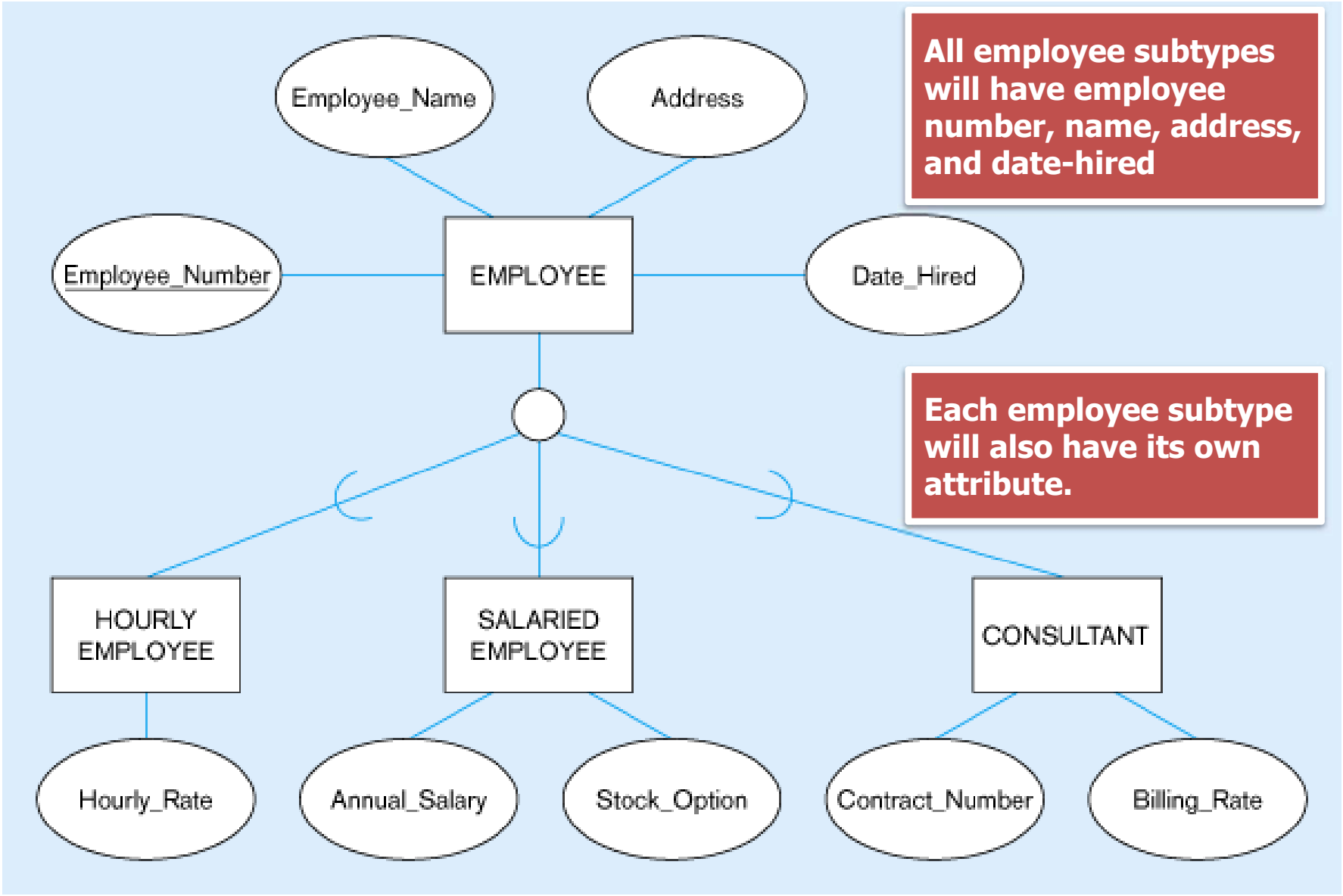
Motivation for Entity Subtypes and Supertypes: Null Created by Unique Attributes

- 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.

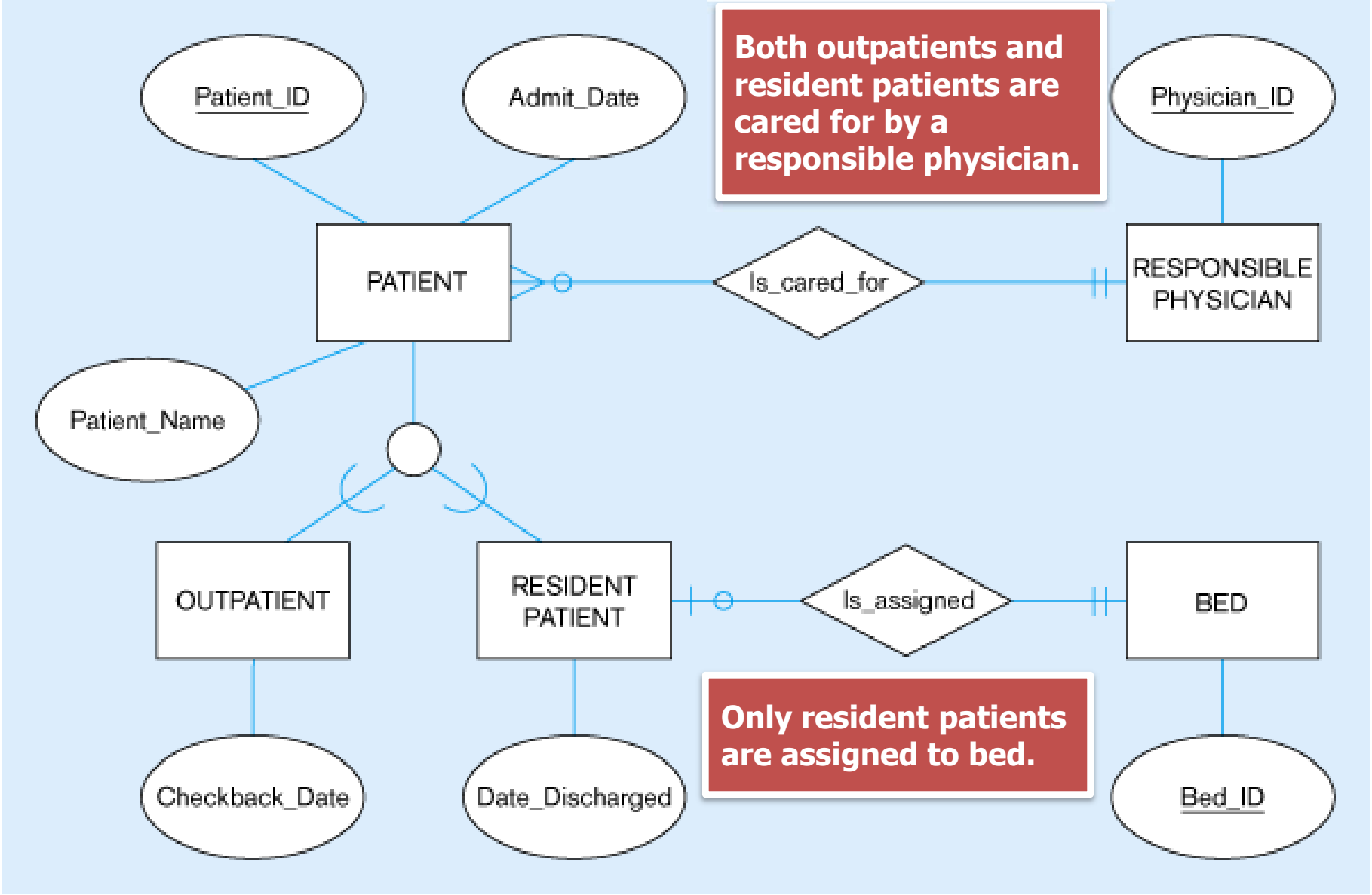
Specialized Hierarchy

- 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

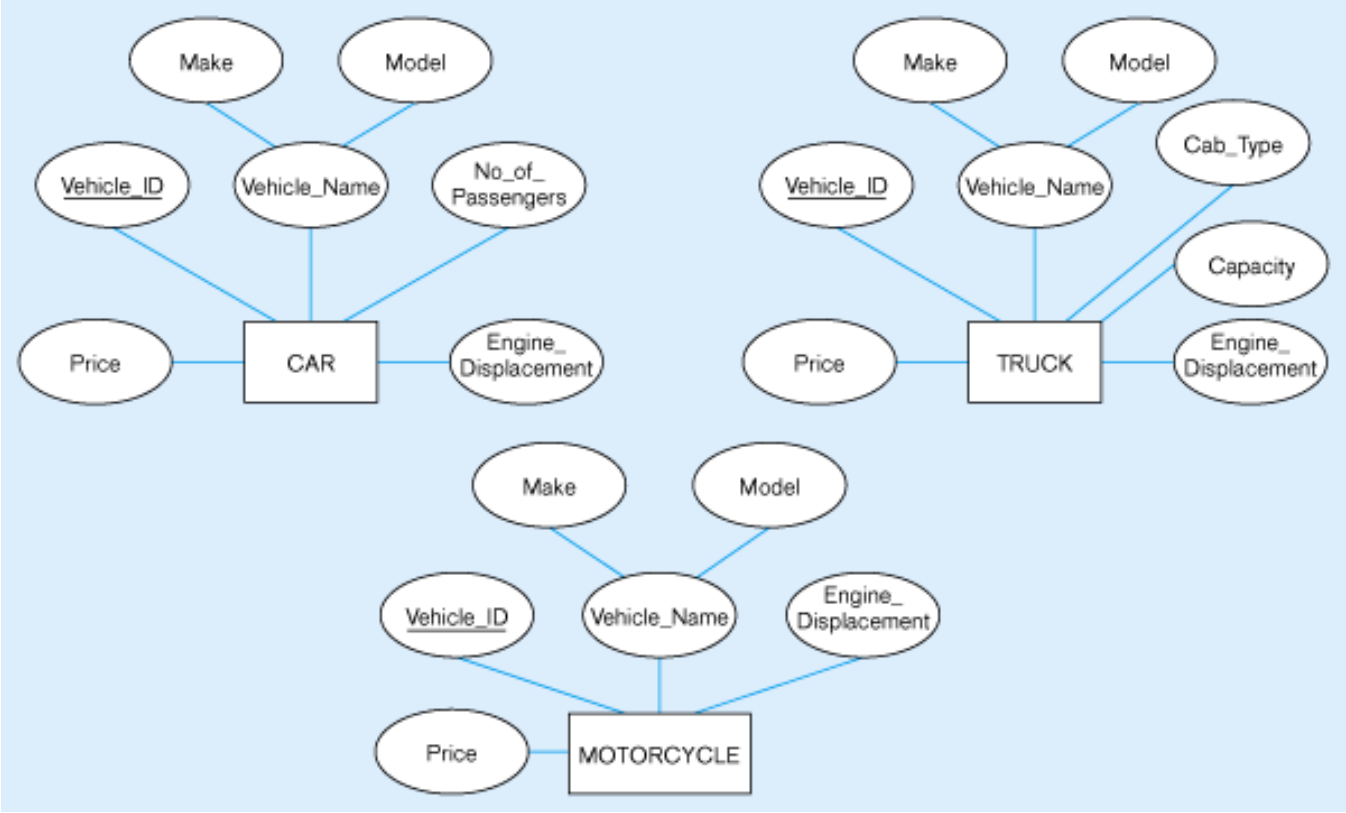


Supertype/Subtype Relationships in a Hospital



Generalization

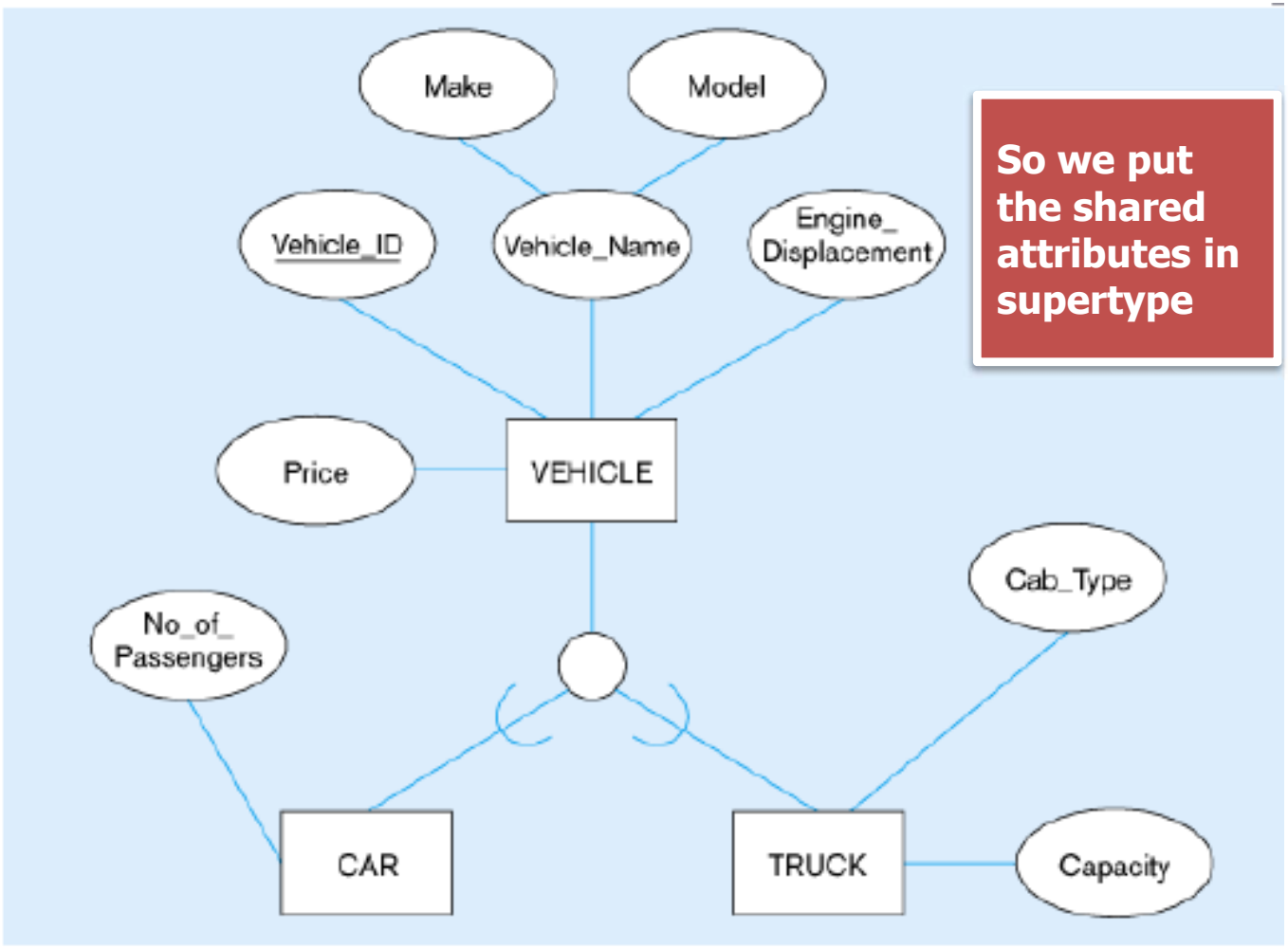
- Generalization: The process of defining a more general entity type from a set of more specialized entity types. **BOTTOM-UP**



All these types of vehicles have common attributes

Three entity types: CAR, TRUCK, and MOTORCYCLE

Generalization of VEHICLE Supertype

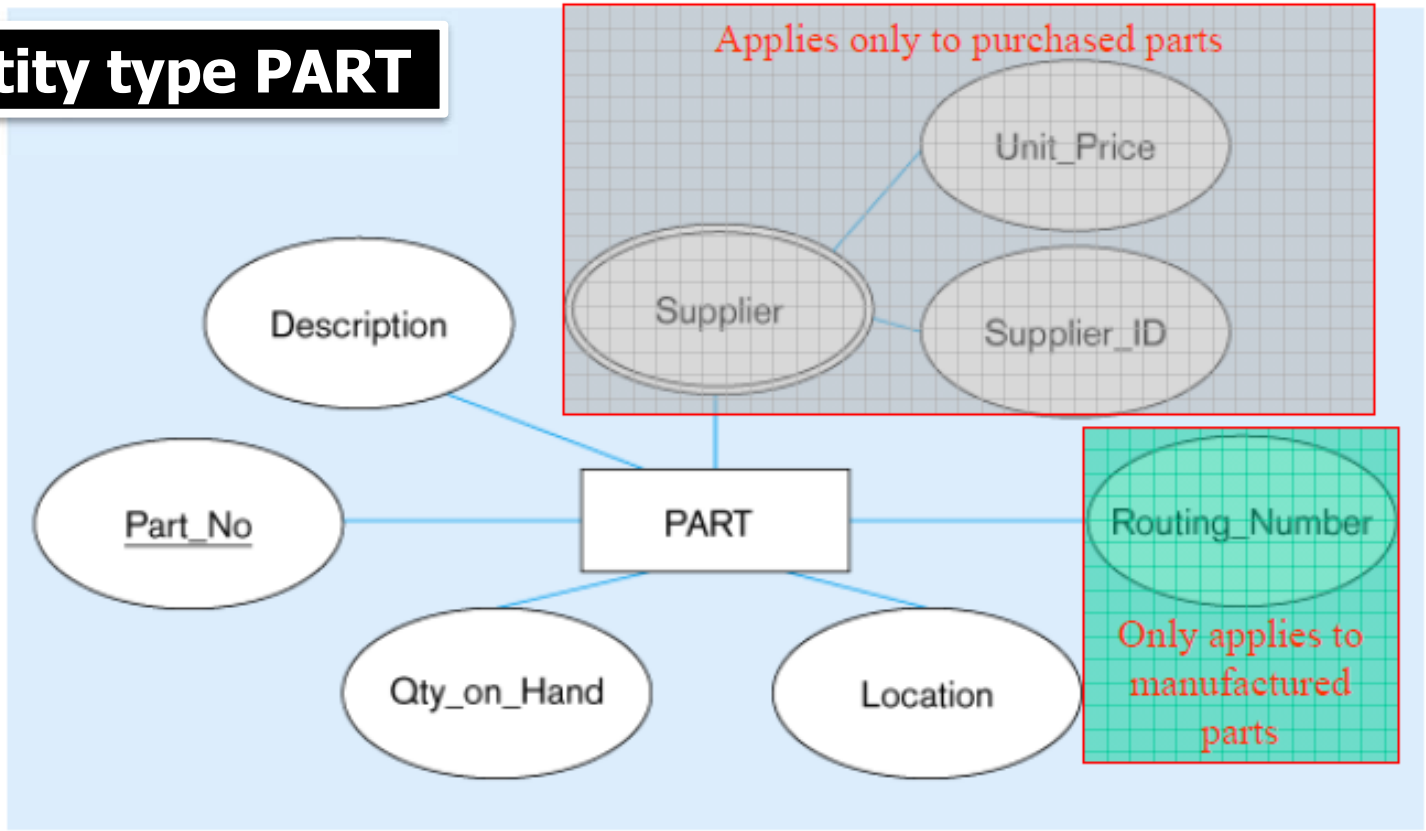


Note: no subtype for motorcycle, since it has no unique attributes

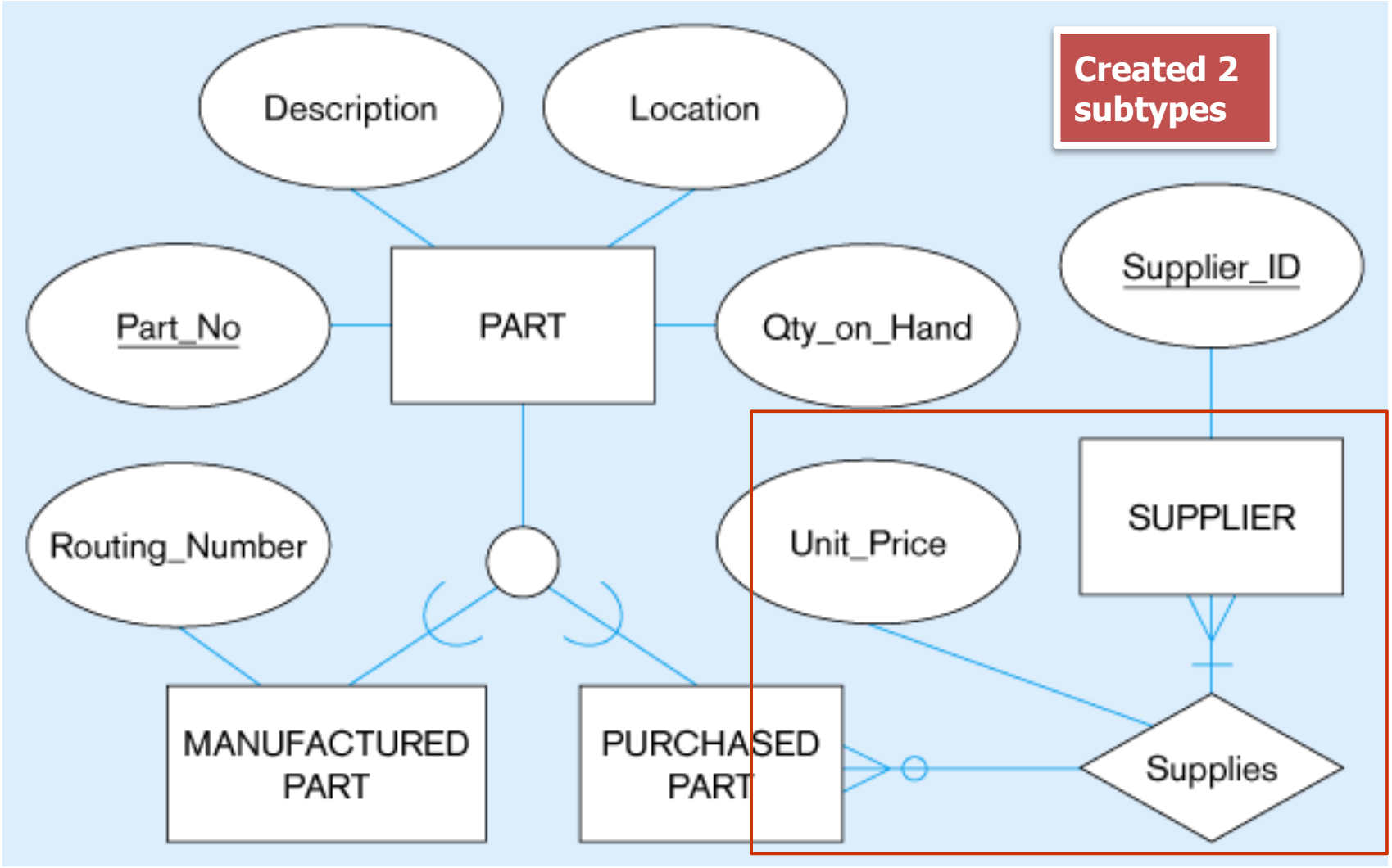
Specialization

- 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



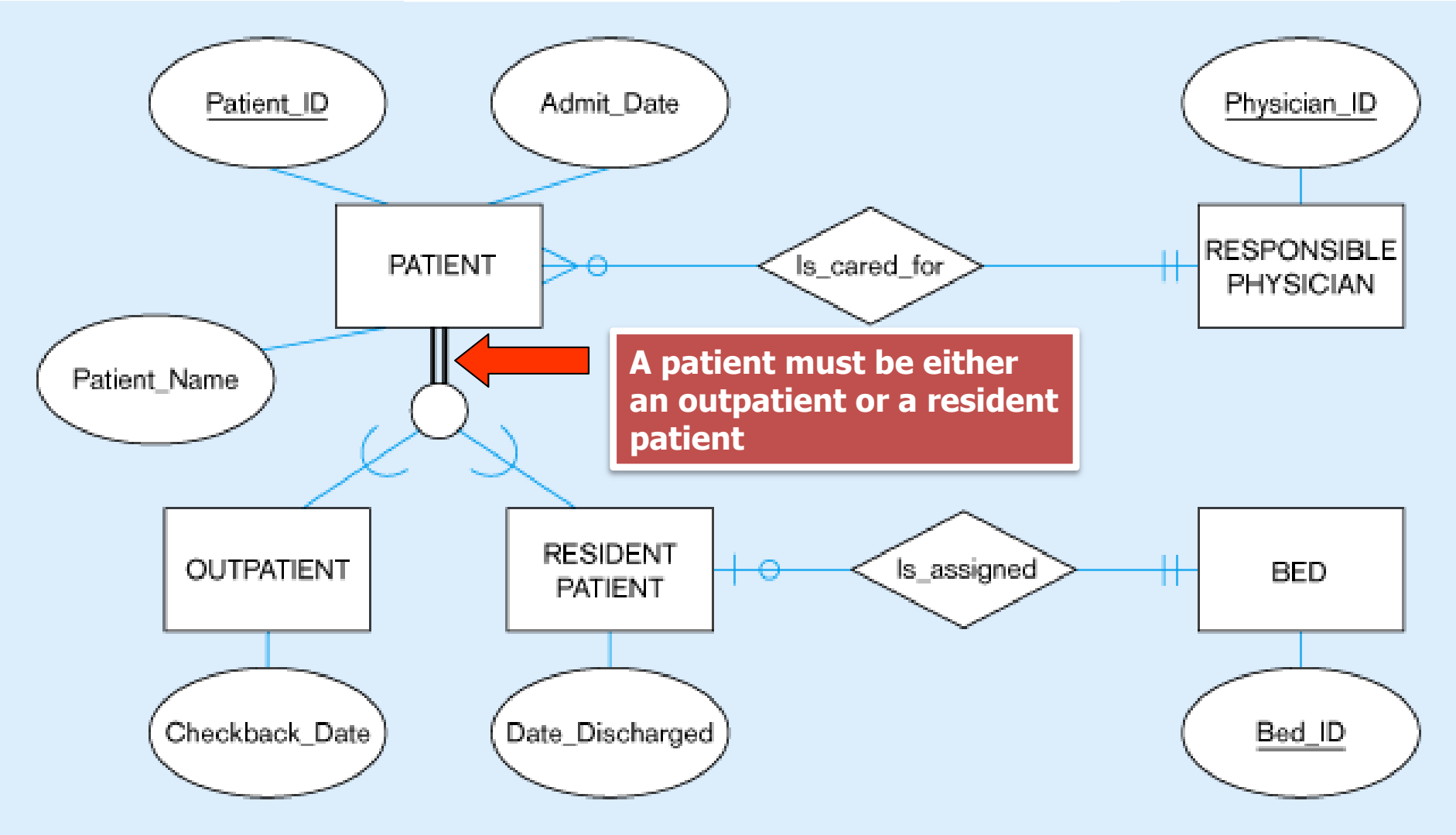
Note: multivalued attribute was replaced by a relationship to another entity

Constraints in Supertype/Completeness Constrain

- 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)

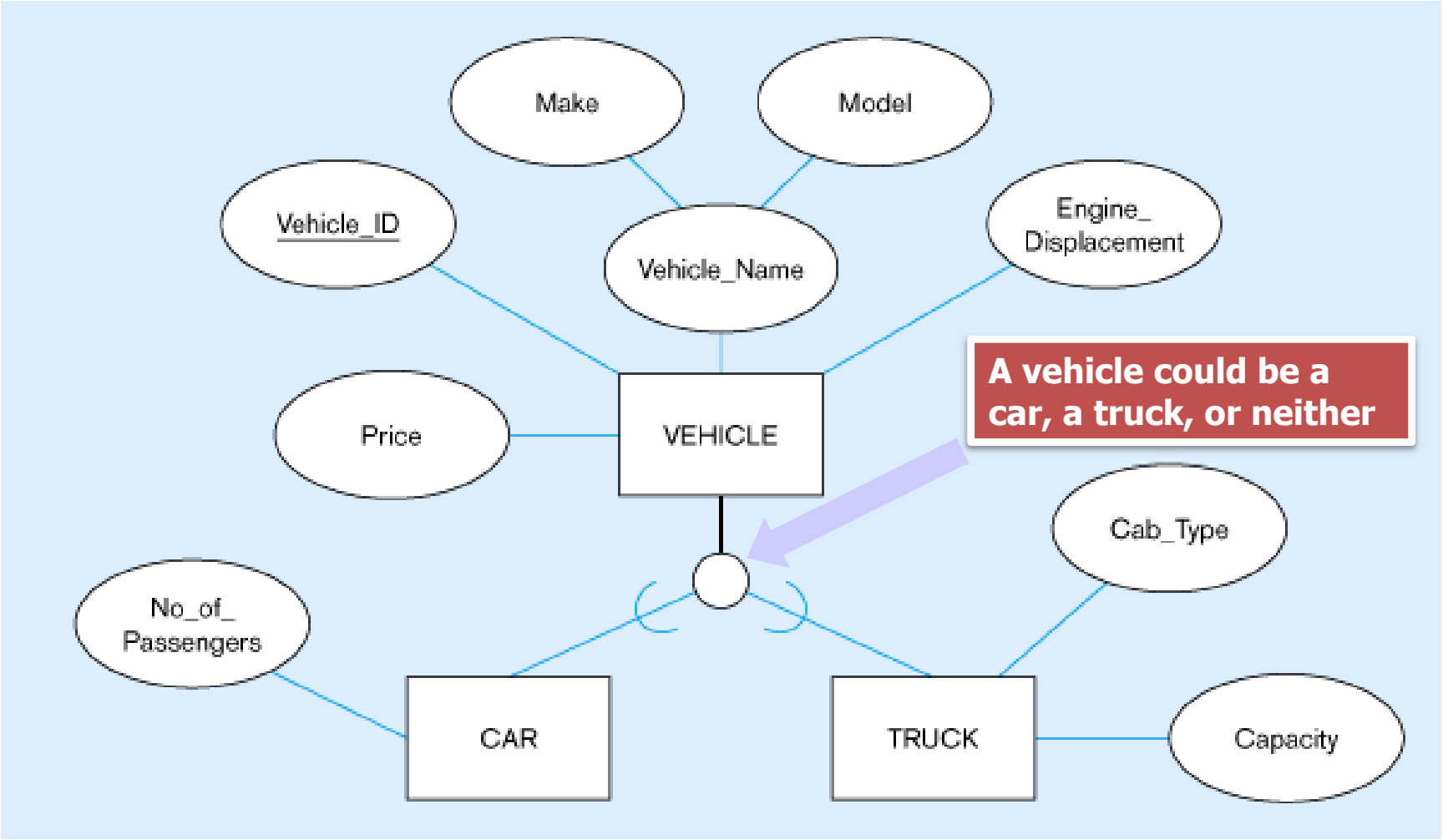
Examples of Completeness Constraints

(a) Total Specialization Rule



Examples of Completeness Constraints

(b) Partial Specialization Rule

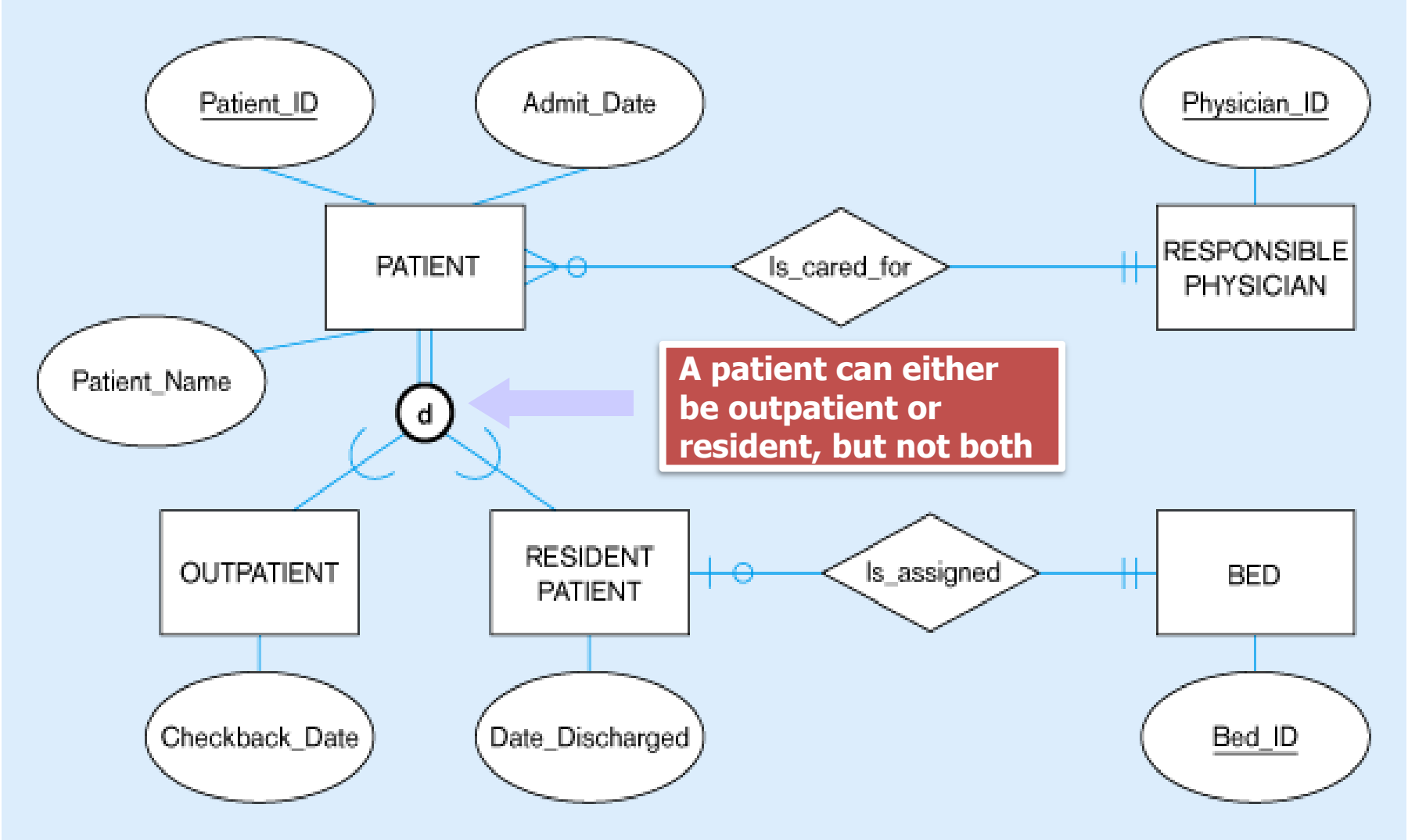


Constraints in Supertype/Disjointness Constraint

- 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)

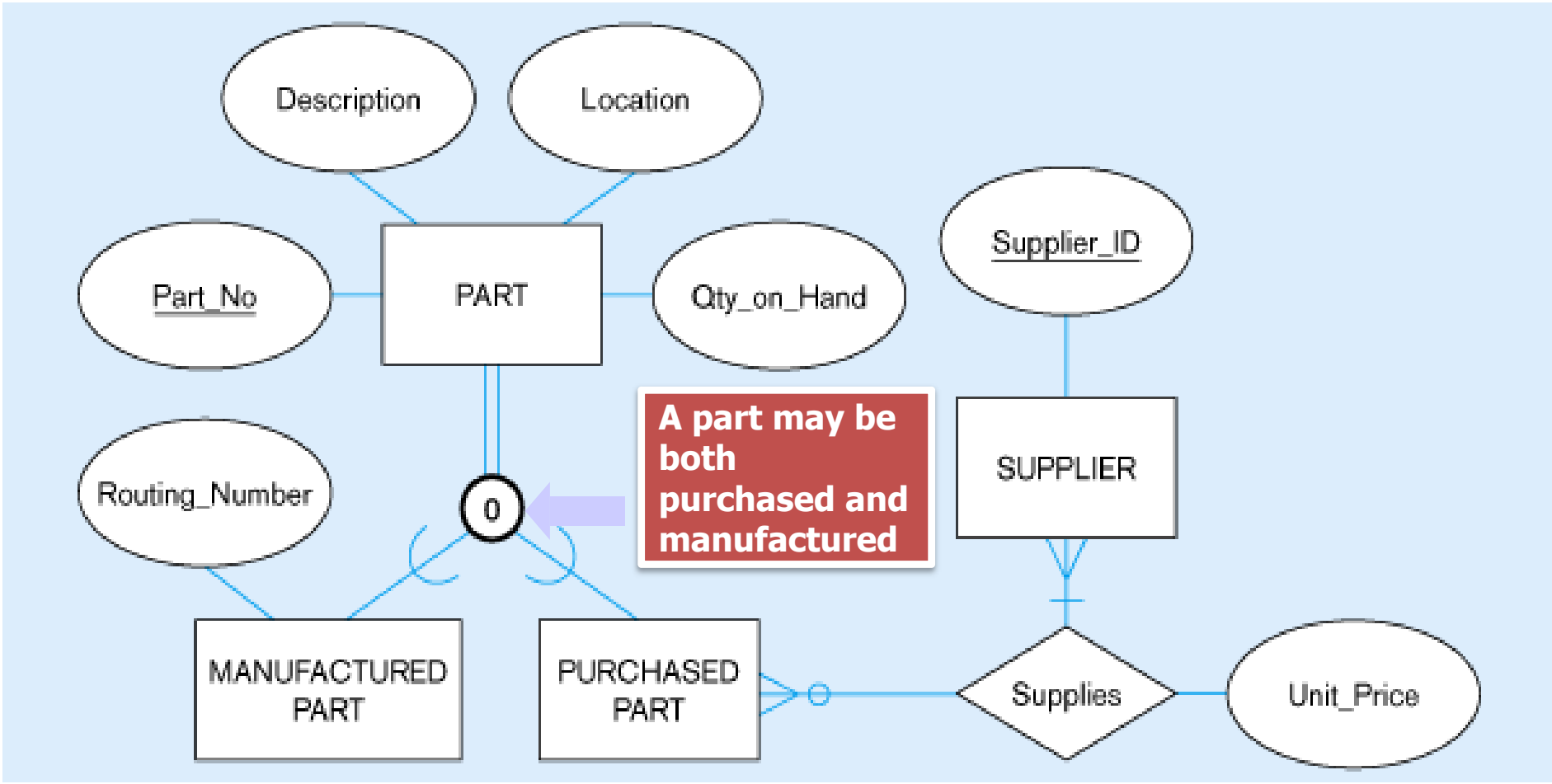
Examples of Disjointness Constraints

(a) Disjoint Rule



Examples of Disjointness Constraints

(b) Overlap Rule

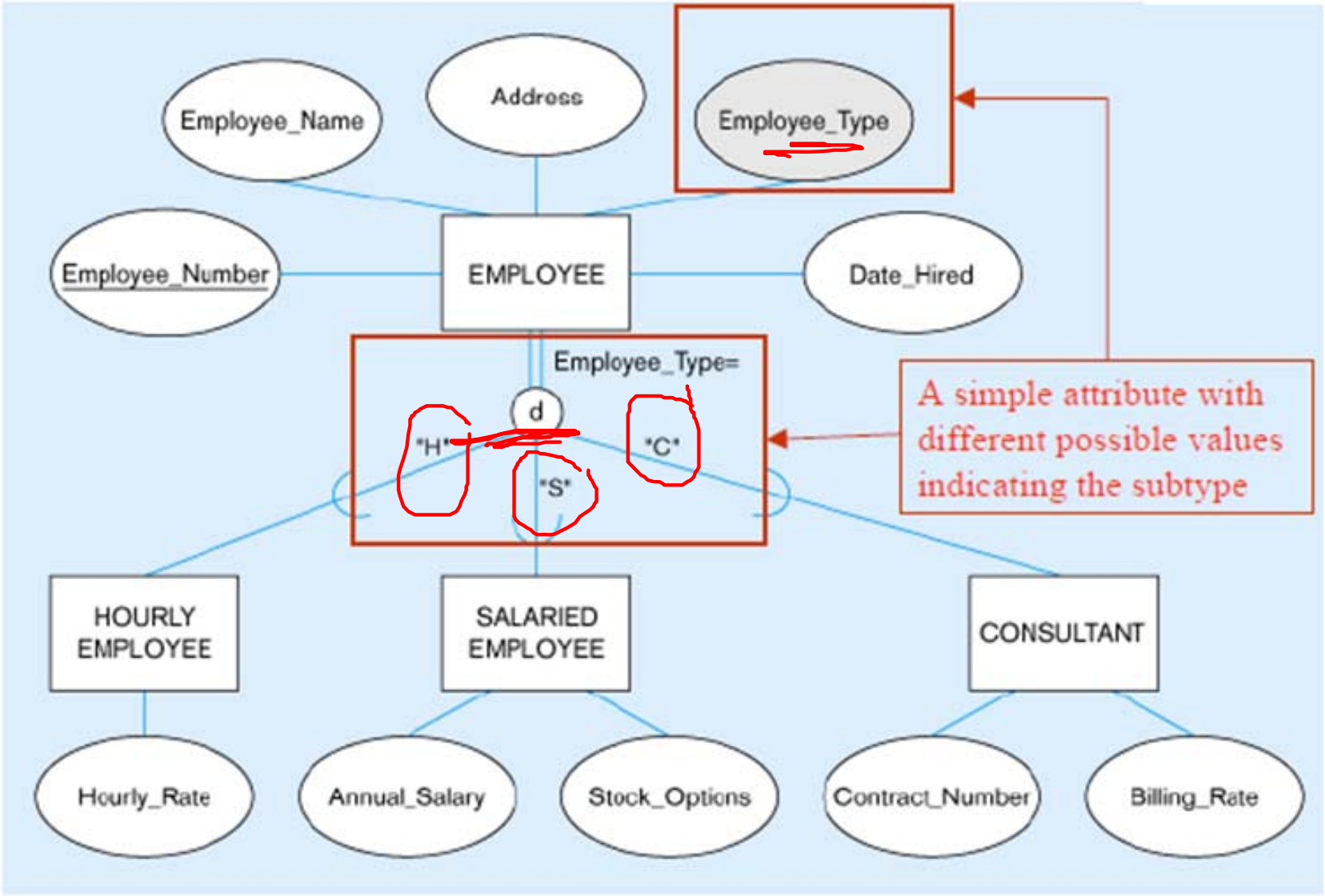


Constraints in Supertype/Subtype Discriminators

- 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

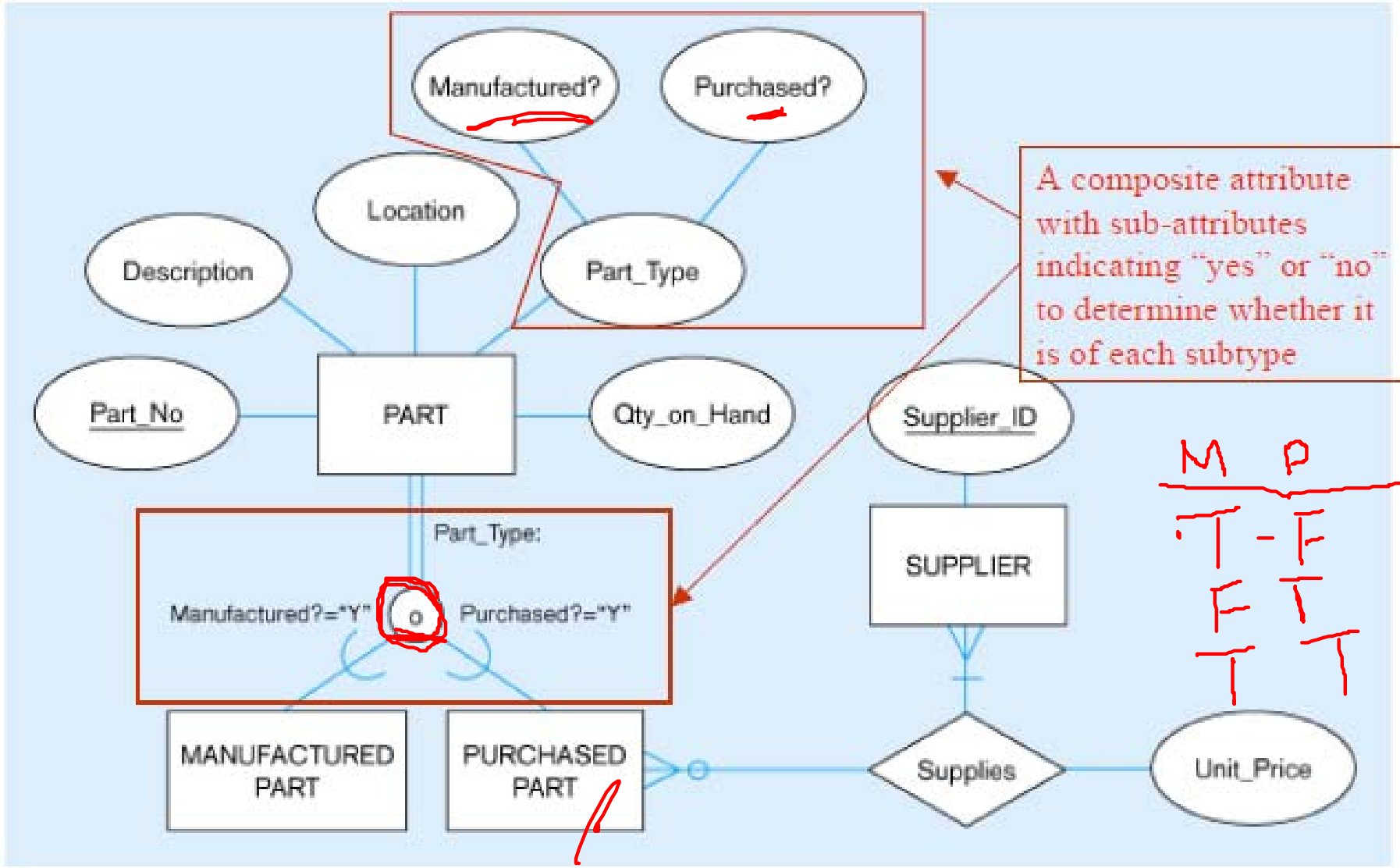
Introducing a Subtype Discriminator

(a) Disjoint Rule

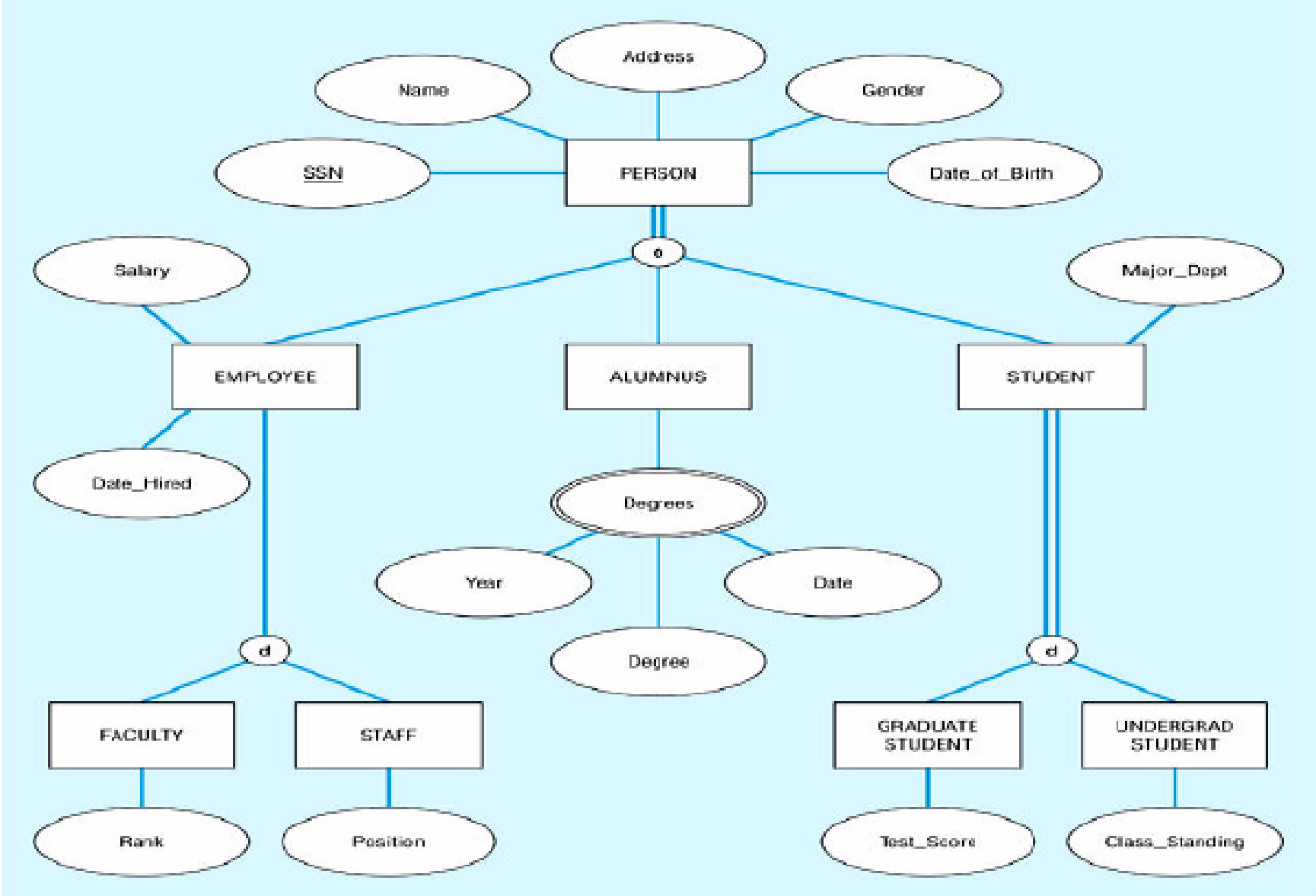


Introducing a Subtype Discriminator (cont…)

(b) Overlap Rule



Example of Supertype/Subtype Hierarchy



Summary

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