The Enhanced E-R Model

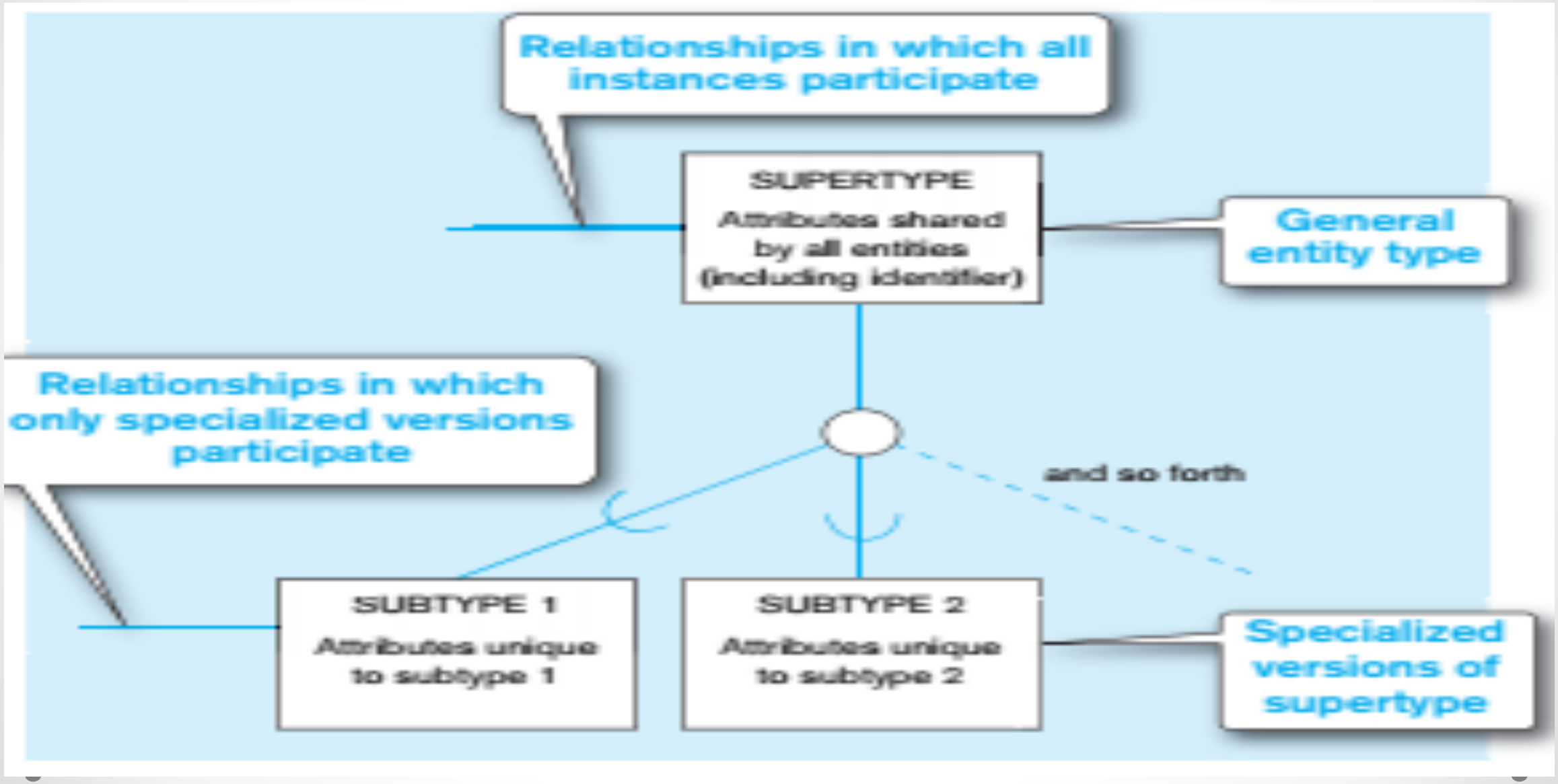
- Enhanced entity relationship (EER) model is used to identify the model that has resulted from extending the original E-R model with these new modeling construct.
- The most important modeling construct incorporated in the EER model is supertype/subtype relationships.
  - This enables us to model a general entity type (called the supertype) and then subdivide it into several specialized entity types (called the subtypes)
- Consider this: "An employee advises many students."

Representing Supertypes and Subtypes

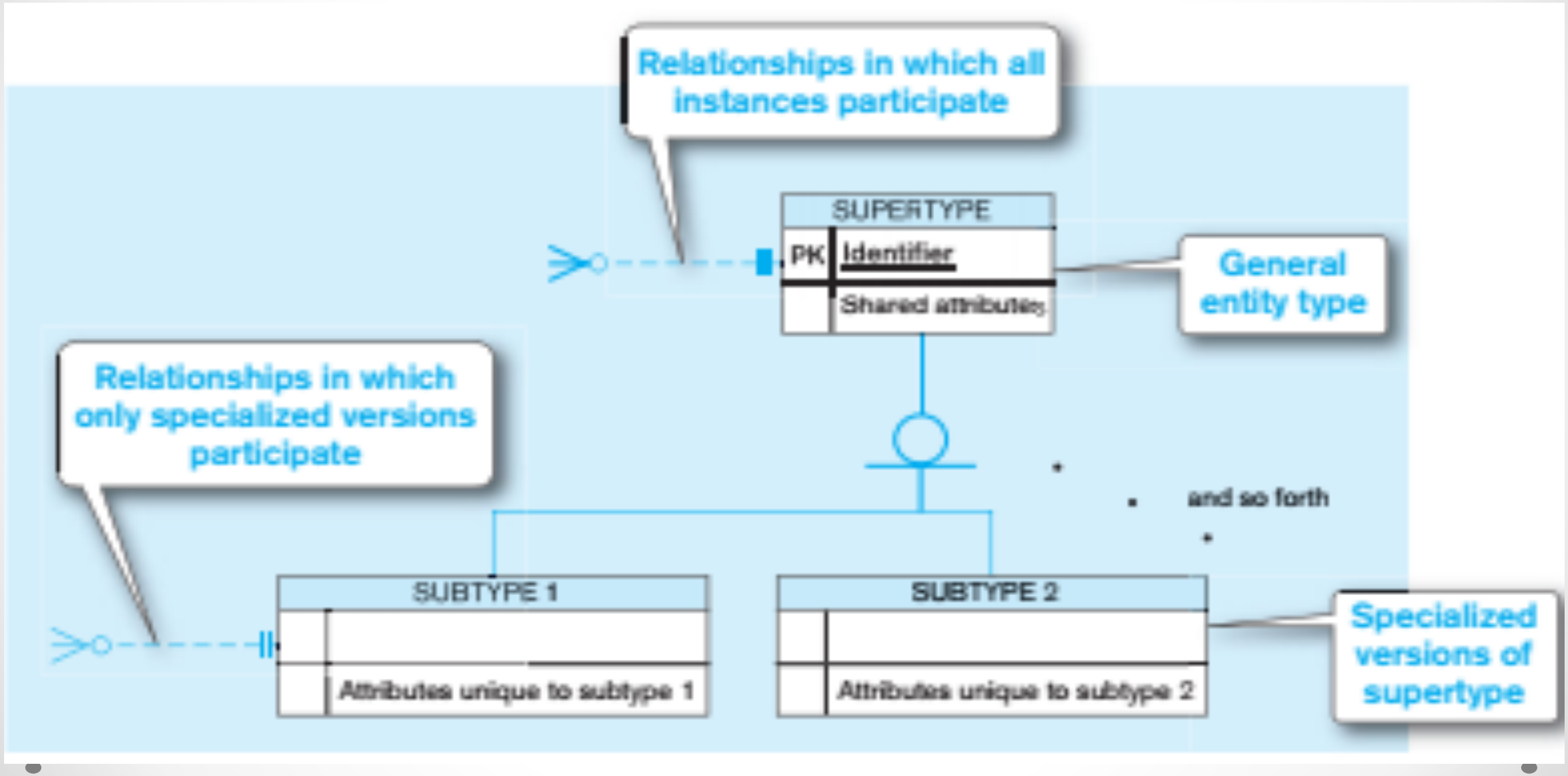
- A **subtype** is a subgrouping of the entities in an entity type that is meaningful to the organization.
- A **supertype** is a generic entity type that has a relationship with one or more subtypes.
  - The supertype is connected with a line to a circle, which in turn is connected with a line to each subtype that has been defined.
  - The U-shaped symbol on each line connecting a subtype to the circle emphasizes that the subtype is a subset of the supertype.
  - It also indicates the direction of the subtype/supertype relationship

- Attributes that are shared by all entities (including the identifier) are associated with the supertype.
- Attributes that are unique to a particular subtype are associated with that subtype.
- The same is true for relationships.

Basic notation for supertype/subtype relationships - EER notation



Microsoft Visio Notation



- **Attribute Inheritance**
  - A subtype is an entity type in its own right.
  - An entity instance of a subtype represents the same entity instance of the supertype.
  - Attribute inheritance is the property by which subtype entities inherit values of all attributes and instance of all relationships of the supertype.
- **When to use supertype/subtype relationships**
  - There are attributes that apply to some (but not all) instances of an entity type.
  - The instances of a subtype participate in a relationship unique to that subtype.

- **Specialization and Generalization**
  - In data modeling, **generalization** is the process of defining a more general entity type from a set of more specialized entity types.
    - a bottom-up process.
  - **Specialization** is a top-down process, the direct reverse of generalization.
  - both are valuable techniques for developing supertype/subtype relationship.
  - Which to use? - depends the nature of the problem domain, previous modeling efforts, and personal preference .

SPECIFYING CONSTRAINTS IN SUPERTYPE/SUBTYPE RELATIONSHIPS

Completeness Constraints

- Addresses the question of whether an instance of a supertype must also be a member of at least one subtype.
- Has two rules:
  - Total specialization - specifies that each entity instance of the supertype must be a member of some subtype in the relationship. See figure 1.
  - Partial specialization - specifies that an entity instance of the supertype is allowed not to belong to any subtype. See figure 2.

Disjointness Constraints

- Addresses whether an instance of a supertype may simultaneously be a member of two (or more) subtypes.
- Two rules:
  - Disjoint rule - if an entity instance (of the supertype) is a member of one subtype, it cannot simultaneously be a member of any other subtype. See figure 3.
  - Overlap rule - entity instance can simultaneously be a member of two (or more) subtypes. See figure 4.

Subtype Discriminators

- A subtype discriminator is an attribute of a supertype whose values determine the target subtype or subtypes
- Disjoint subtype. See figure 5.
- Overlap subtype. See figure 6.

Supertype/Subtype Hierarchies

- A supertype/subtype hierarchy is a hierarchical arrangement of supertypes and subtypes, where each subtype has only one supertype
- See figure 7.

ENTITY CLUSTERING

- It is a useful way to present a data model for a large and complex organization.
- **Entity cluster** is a set of one or more entity types and associated relationships grouped into a single abstract entity type.
- **Entity clustering** is a hierarchical decomposition of a macro-level view of the data model into finer and finer views, eventually resulting in the full, detailed data model.
- See figure 8.

Source:

Hoofer, Jeffrey A., et. al. Modern *Database Management*, 10th Edition. Upper Saddle River, New Jersey. Prentice Hall. ©2011

Figure 1. Total specification

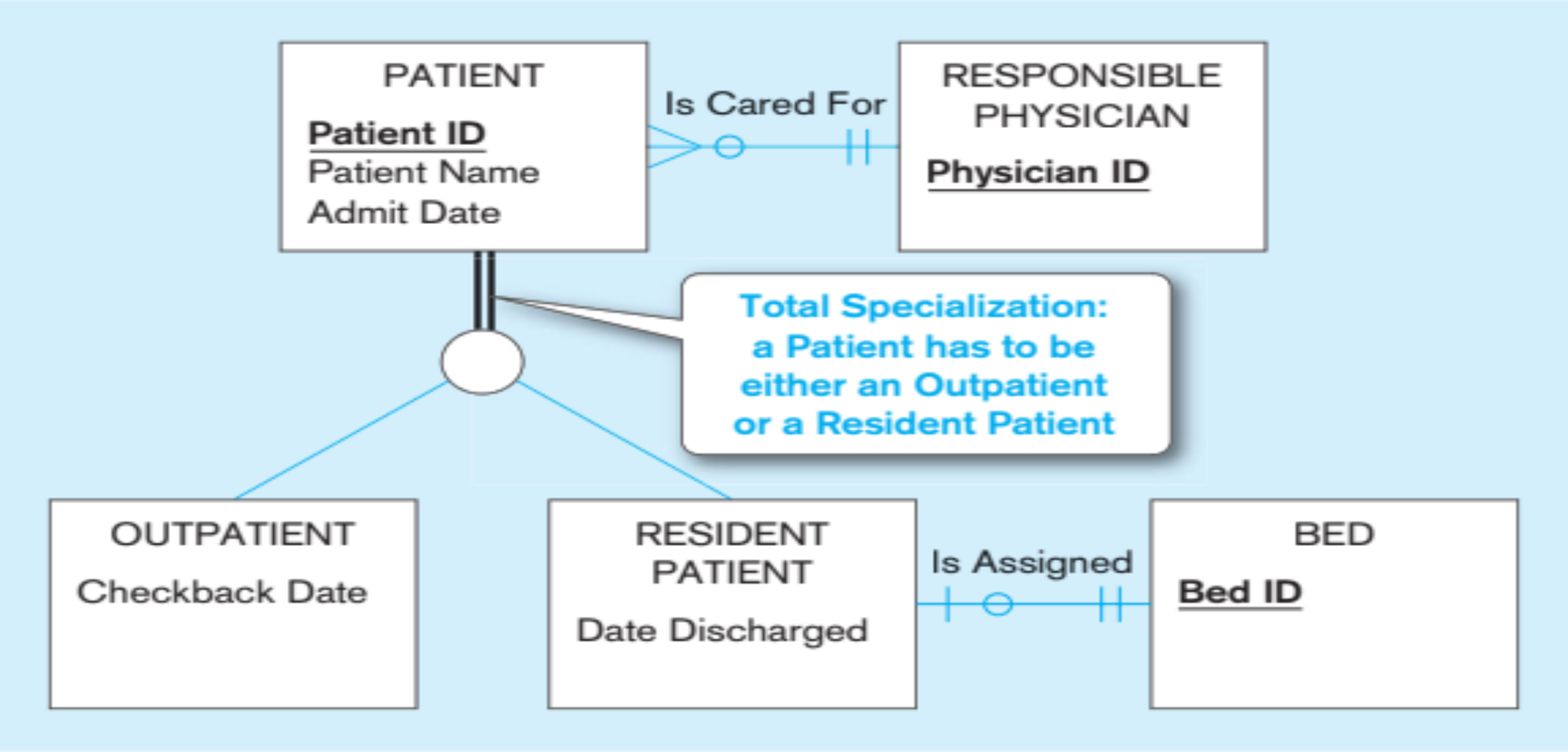


Figure 2. Partial Specialization

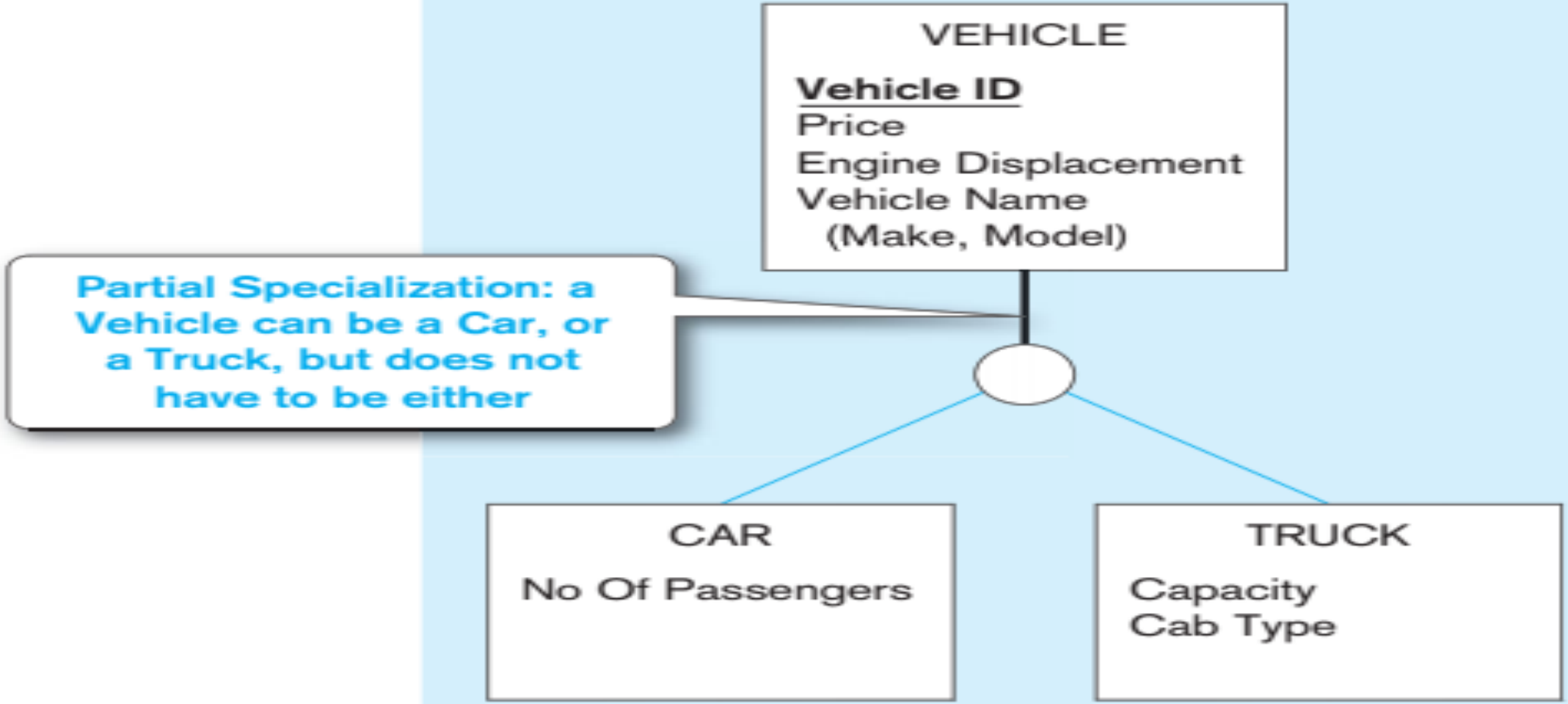


Figure 3. Disjoint rule

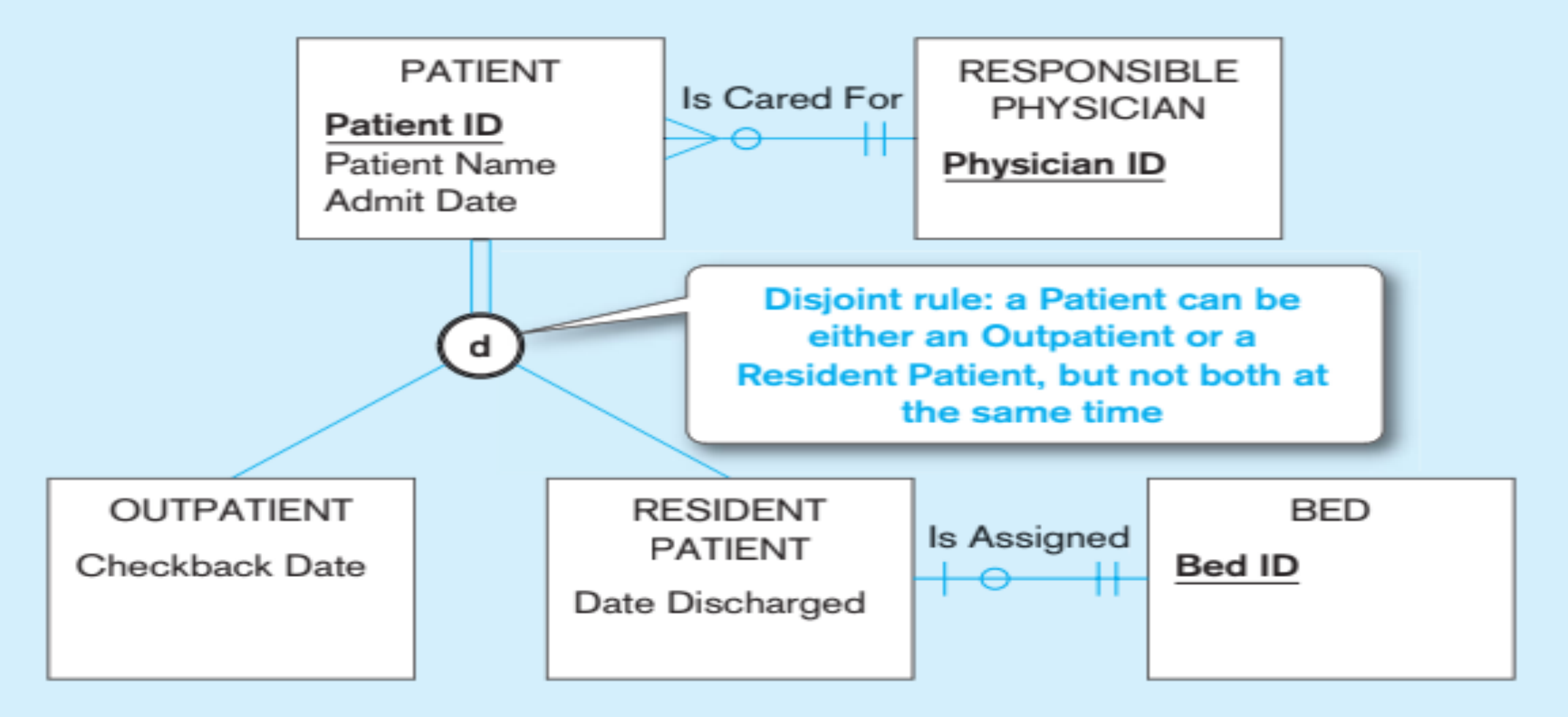


Figure 4. Overlap rule

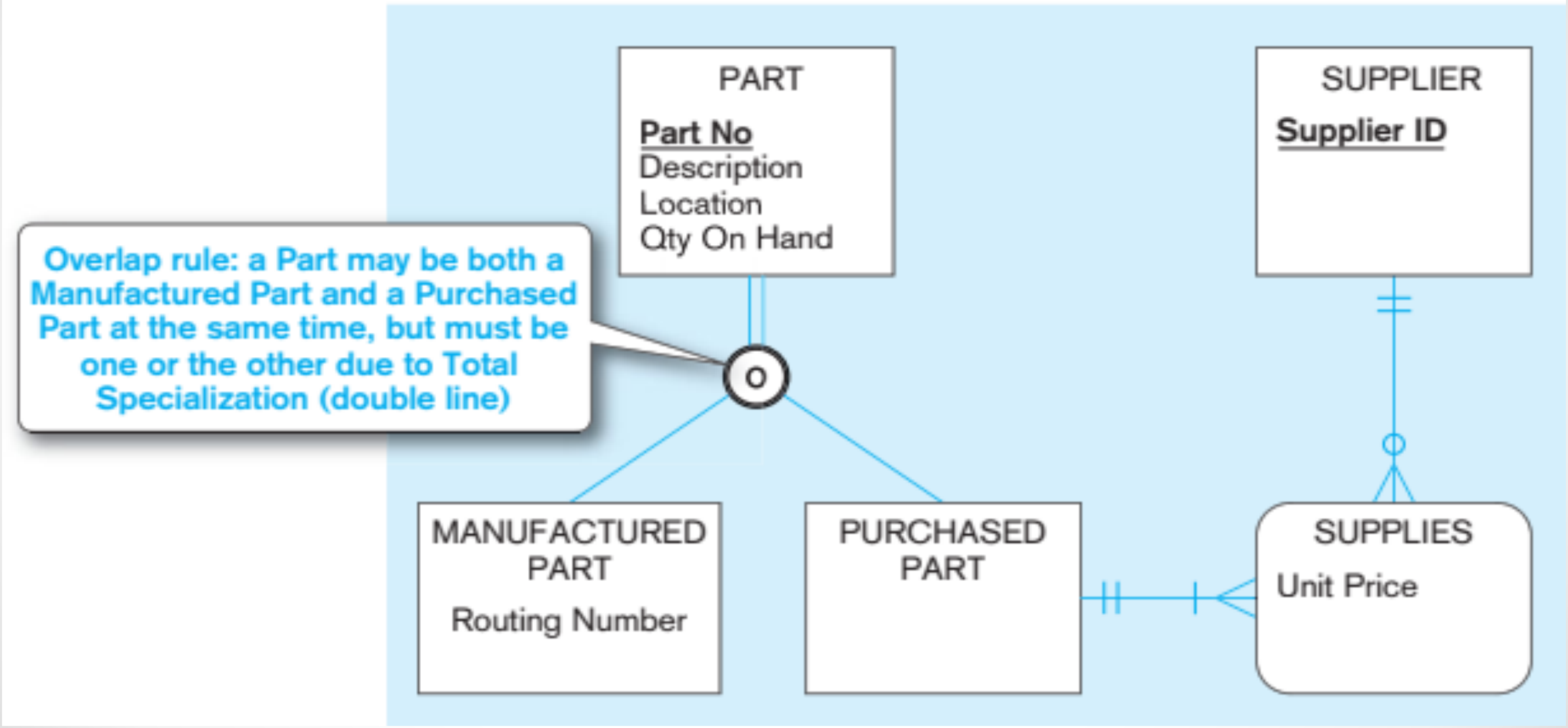


Figure 5. Disjoint Subtype Discriminator

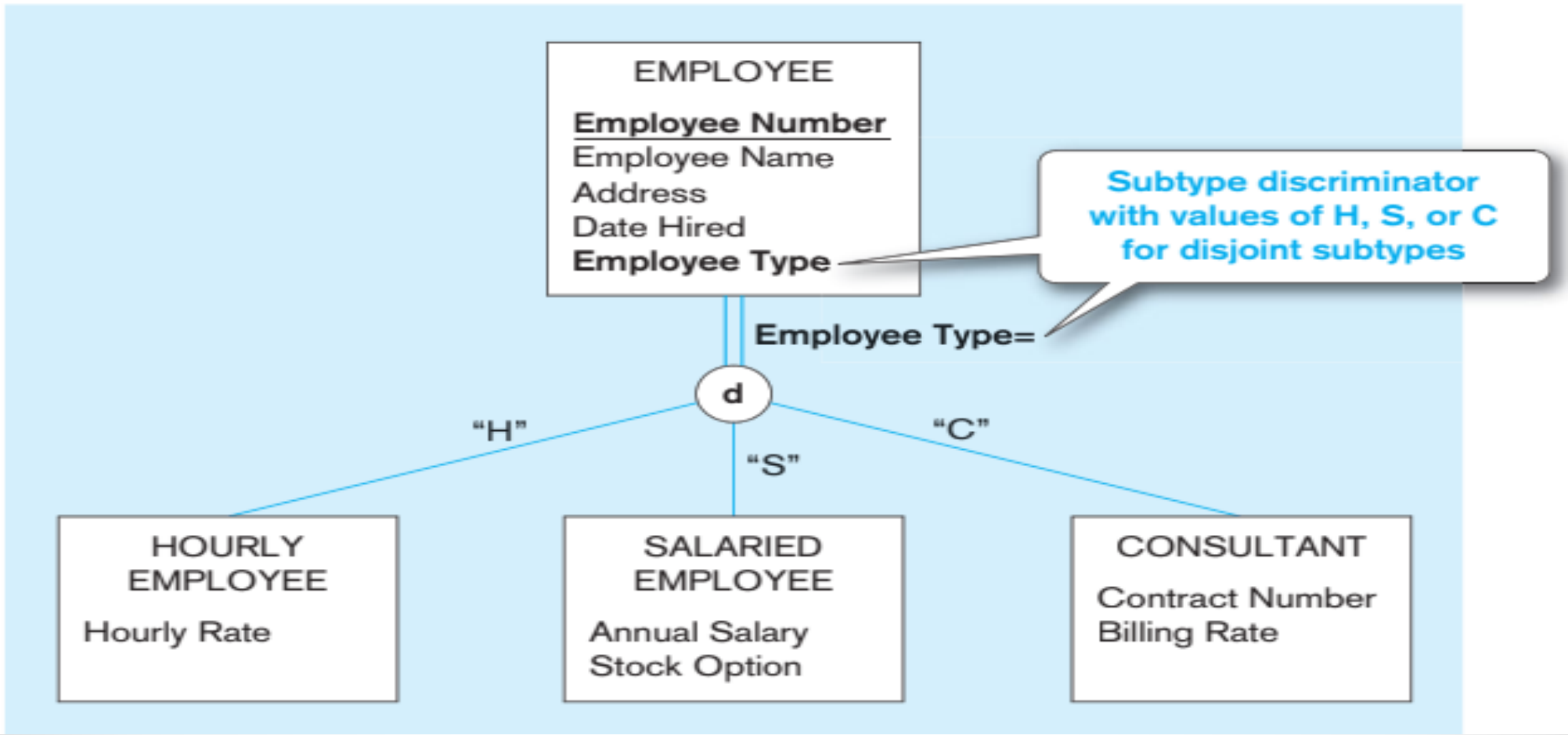


Figure 6. Overlap Subtype Discriminator

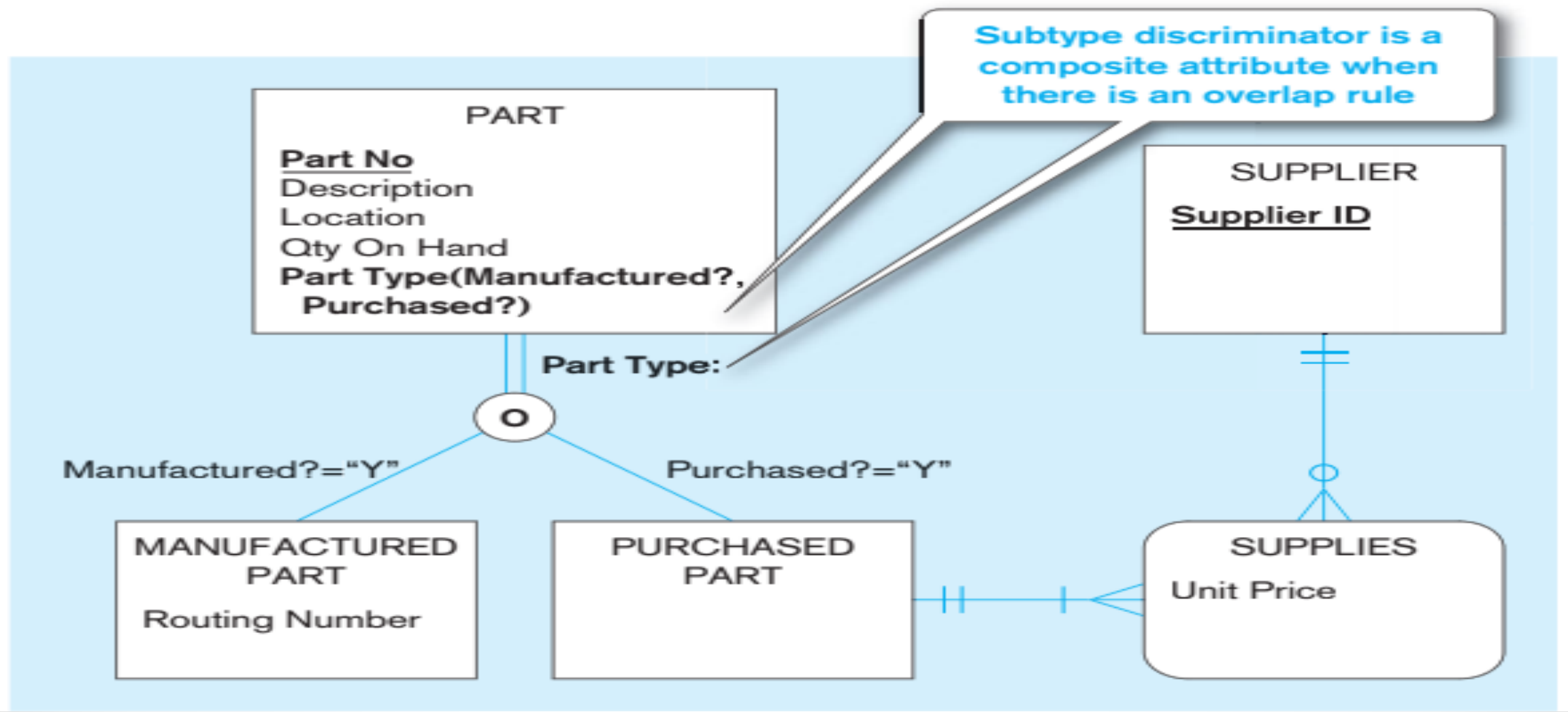


Figure 7. Supertype/subtype Hierarchy

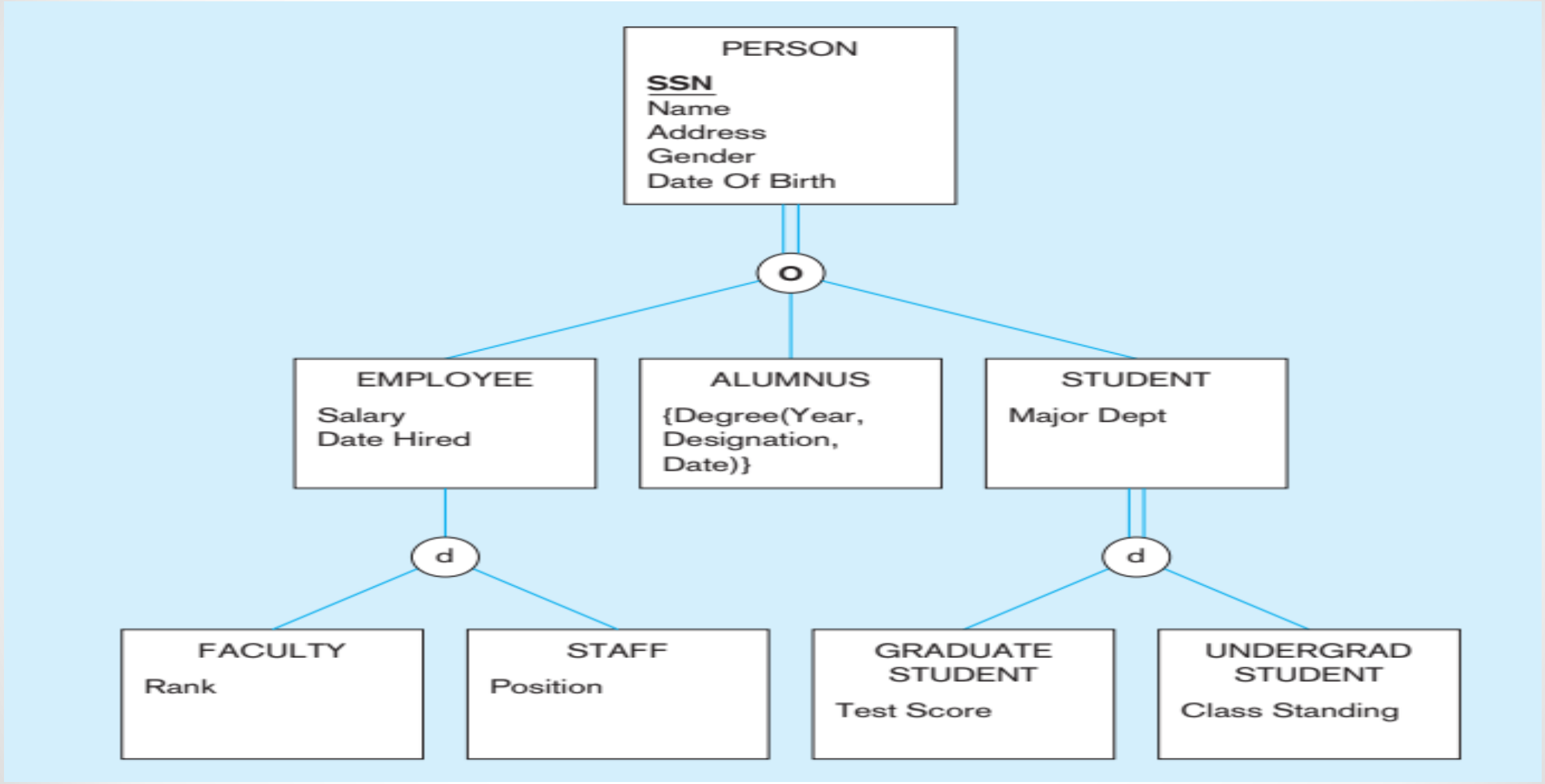
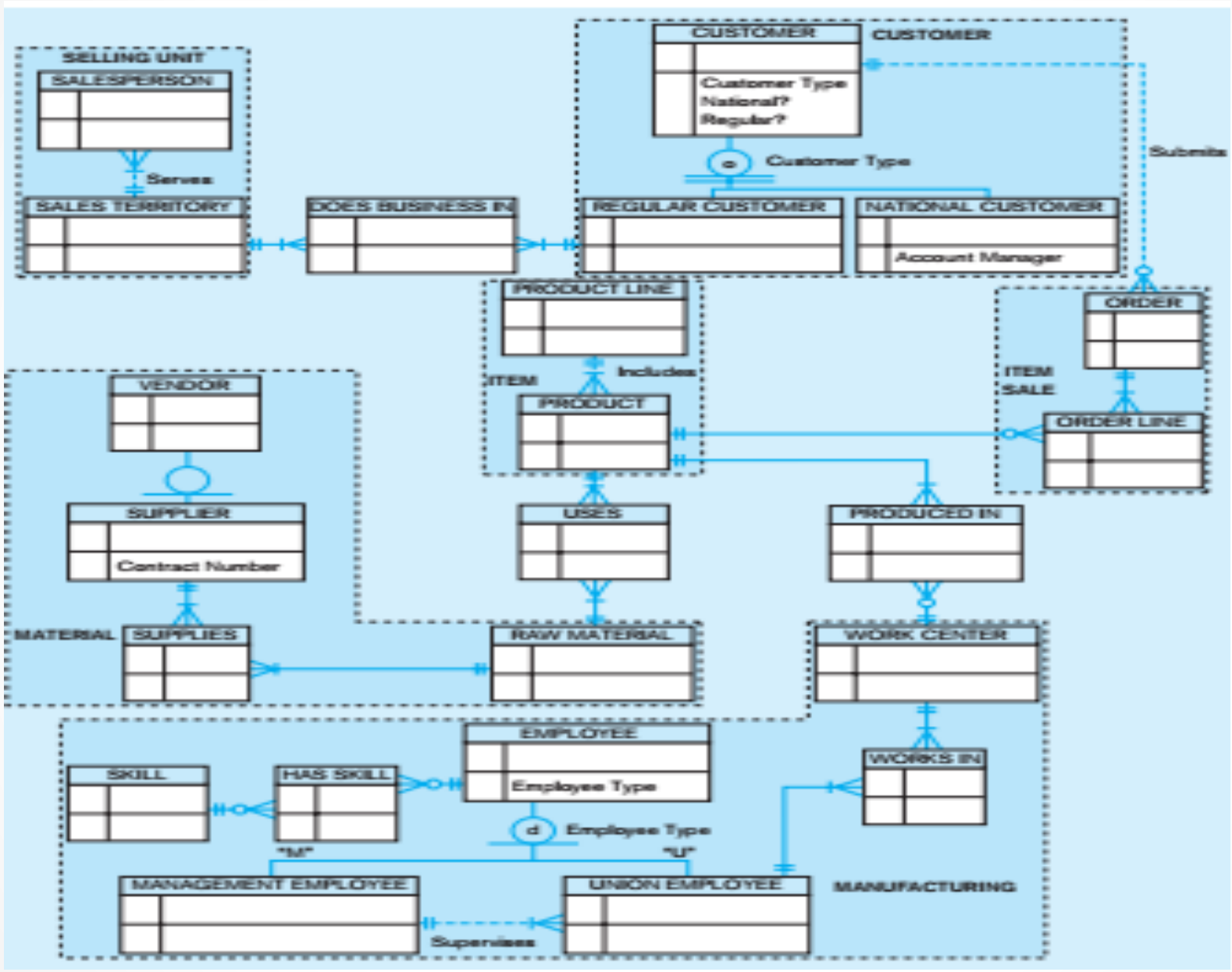


Figure 8. Entity Clustering



Entity Clusters