ENSF 608: Understanding and Mapping the Relational Data Model

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Textbook: Fundamentals of Database Systems, 7th Ed., Elmasri & Navathe

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Mapping EER Model Constructs to Relations (1 of 5)

- **Step 8: Options for Mapping Specialization or Generalization.**
  - Convert each specialization with m subclasses $\{S_1, S_2, ..., S_m\}$ and generalized superclass *C*, where the attributes of *C* are $\{k, a_1, ... a_n\}$ and *k* is the (primary) key, into relational schemas using one of the four following options:
    - Option 8A: Multiple relations- Superclass and subclasses
    - Option 8B: Multiple relations- Subclass relations only
    - Option 8C: Single relation with one type attribute
    - Option 8D: Single relation with multiple type attributes

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Mapping EER Model Constructs to Relations (2 of 5)

- **Option 8A: Multiple relations- Superclass and subclasses**
  - Create a relation L for C with attributes $\text{Attrs}(L) = \{k, a_1, \ldots a_n\}$ and PK(L) = k. Create a relation L_i for each subclass S_i, $1 < i < m$, with the attributes $\text{Attrs}(L_i) = \{k\} \cup \{\text{attributes of } S_i\}$ and PK(L_i) = k. This option works for **any specialization** (total or partial, disjoint of over-lapping).
- **Option 8B: Multiple relations- Subclass relations only**
  - Create a relation L_i for each subclass S_i, $1 < i < m$, with the attributes $\text{Attr}(L_i) = \{\text{attributes of } S_i\} \cup \{k, a_1 \ldots, a_n\}$ and PK(L_i) = k. This option only works for a specialization whose subclasses are **total (every entity in the superclass must belong to (at least) one of the subclasses**).

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Mapping EER Model Constructs to Relations (3 of 5)

- **Option 8C: Single relation with one type attribute**
  - Create a single relation L with attributes $\text{Attrs}(L) = \{k, a_1, \ldots a_n\} \cup$ {attributes of S_1} $\cup \ldots \cup$ {attributes of S_m} $\cup \{t\}$ and $\text{PK}(L) = k$. The attribute t is called a type (or **discriminating**) attribute that indicates the subclass to which each tuple belongs
- **Option 8D: Single relation with multiple type attributes**
  - Create a single relation schema L with attributes $\text{Attrs}(L) = \{k, a_1, \ldots a_n\} \cup$ {attributes of S_1} $\cup \ldots \cup$ {attributes of S_m} $\cup \{t_1, t_2, \ldots, t_m\}$ and $\text{PK}(L) = k$. Each t_i, $1 < i < m$, is a Boolean type attribute indicating whether a tuple belongs to the subclass S_i.

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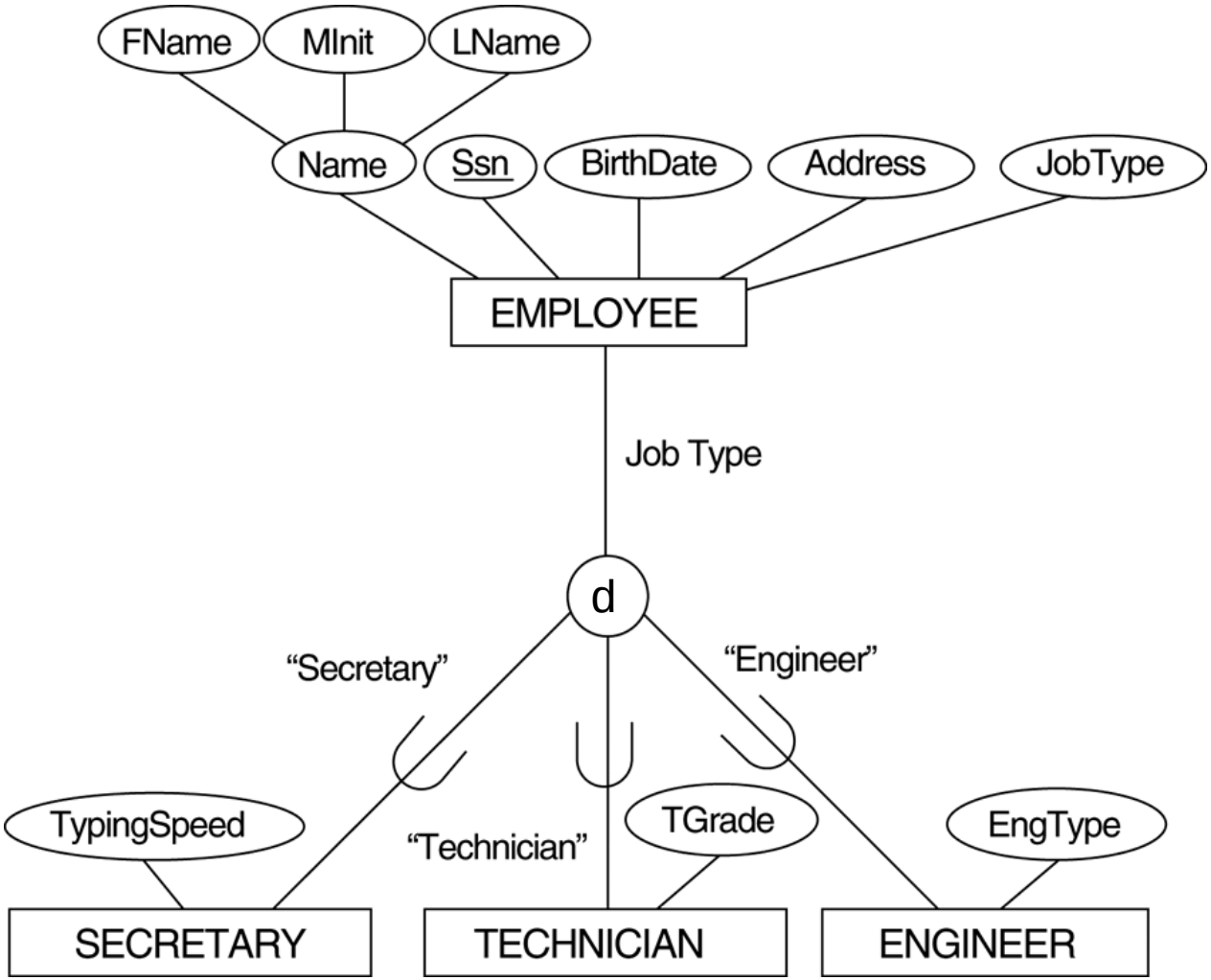
Figure 4.4 EER Diagram Notation for an Attribute-Defined Specialization on JobType



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Mapping the EER Schema in Figure 4.4 Using Option 8A vs 8C

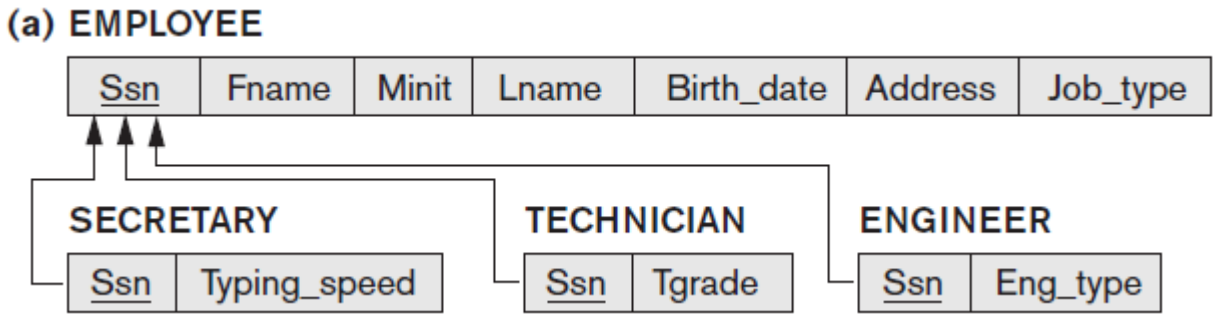

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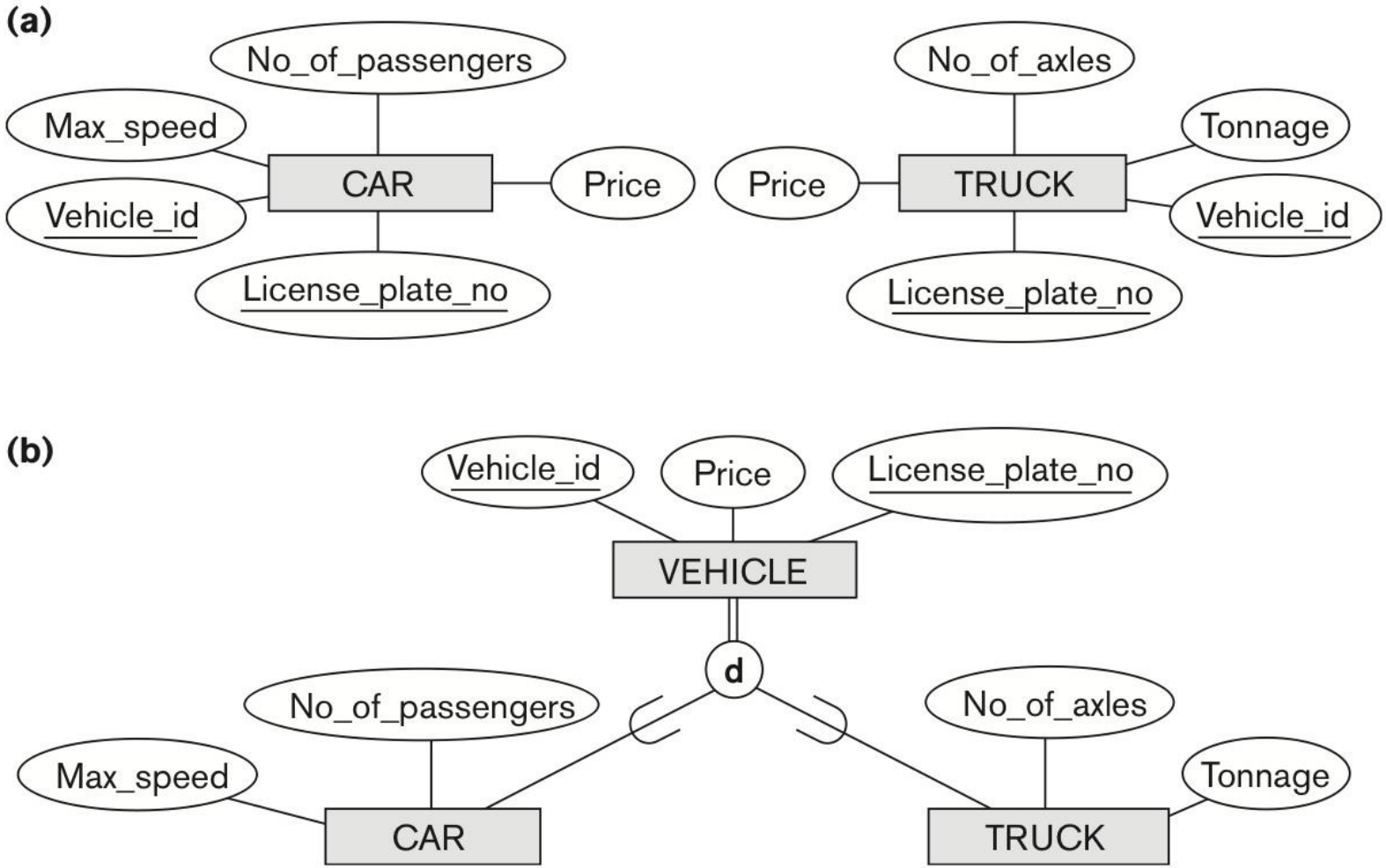
Figure 4.3 (b) Generalizing CAR and TRUCK into the Superclass VEHICLE



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Mapping the EER Schema in Figure 4.3b Using Option 8B

(b) CAR

Vehicle_id	License_plate_no	Price	Max_speed	No_of_passengers

TRUCK

Vehicle_id	License_plate_no	Price	No_of_axles	Tonnage

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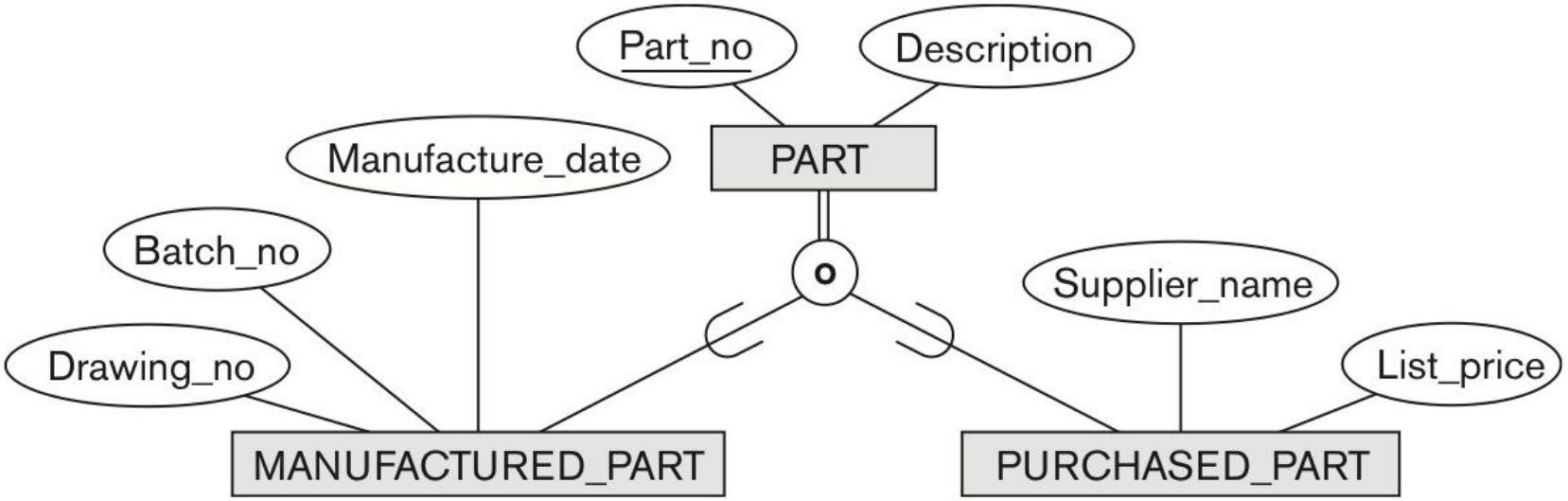
Figure 4.5 An Overlapping (Non-Disjoint) Specialization



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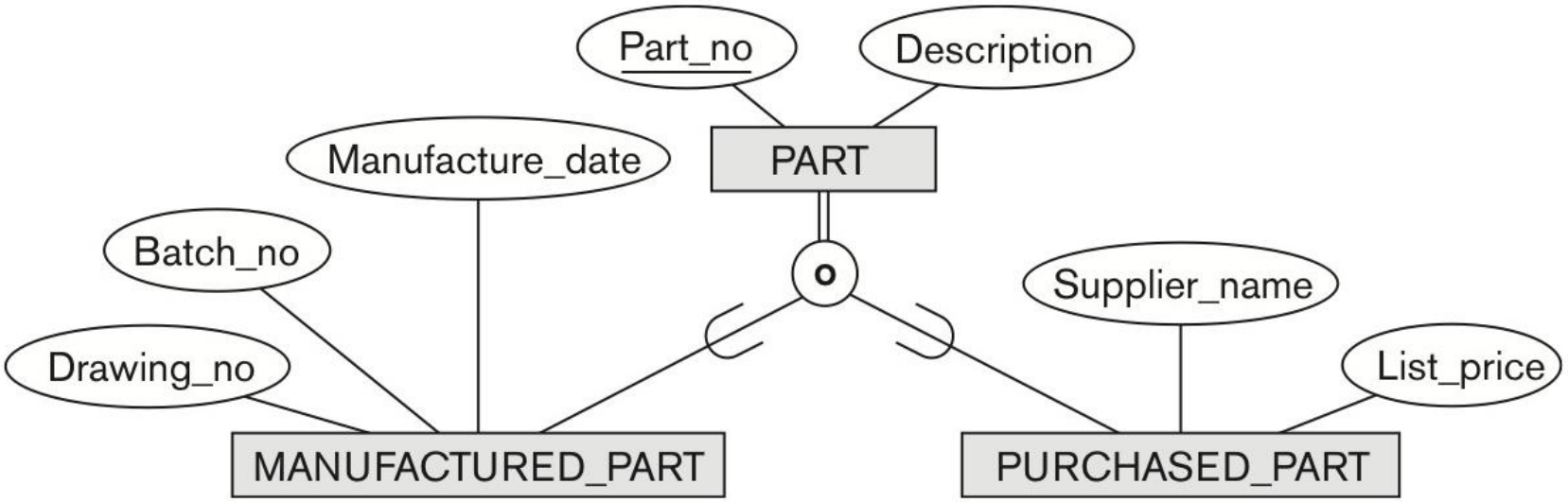
Mapping Figure 4.5 Using Option 8D with Boolean Type Fields Mflag and Pflag



(d) PART

Part_no	Description	Mflag	Drawing_no	Manufacture_date	Batch_no	Pflag	Supplier_name	List_price

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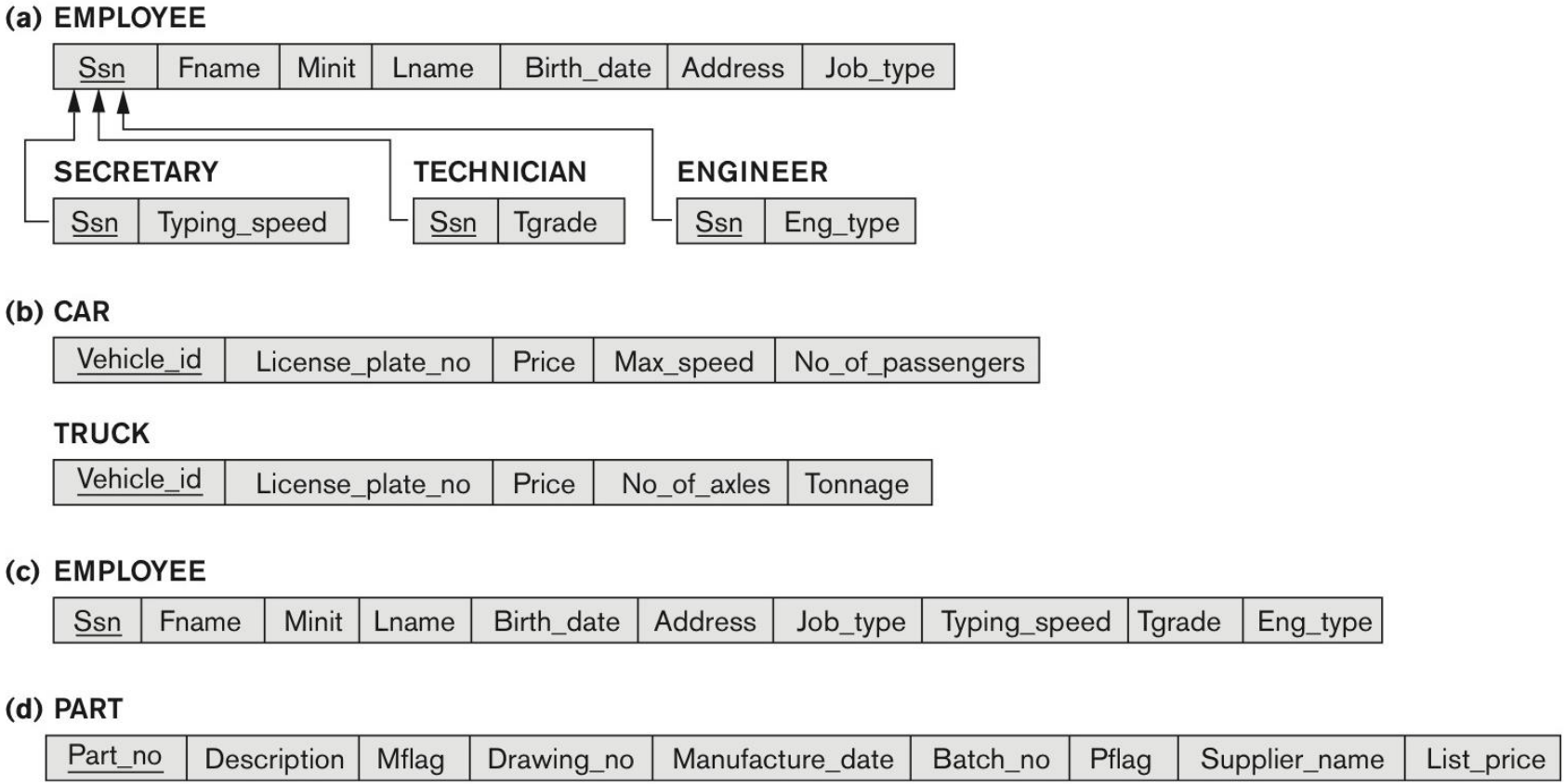
Figure 9.5: Different Options for Mapping Generalization Hierarchies - Summary



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Mapping EER Model Constructs to Relations (4 of 5)

- Mapping of Shared Subclasses (Multiple Inheritance)
  - A shared subclass, such as STUDENT_ASSISTANT, is a subclass of several classes, indicating multiple inheritance. These classes must all have the same key attribute; otherwise, the shared subclass would be modeled as a category.
  - We can apply any of the options discussed in Step 8 to a shared subclass, subject to the restriction discussed in Step 8 of the mapping algorithm. In the next slide, both 8C and 8D are used for the shared class STUDENT_ASSISTANT.

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Figure 4.7 A Specialization Lattice with Multiple Inheritance for a UNIVERSITY Database

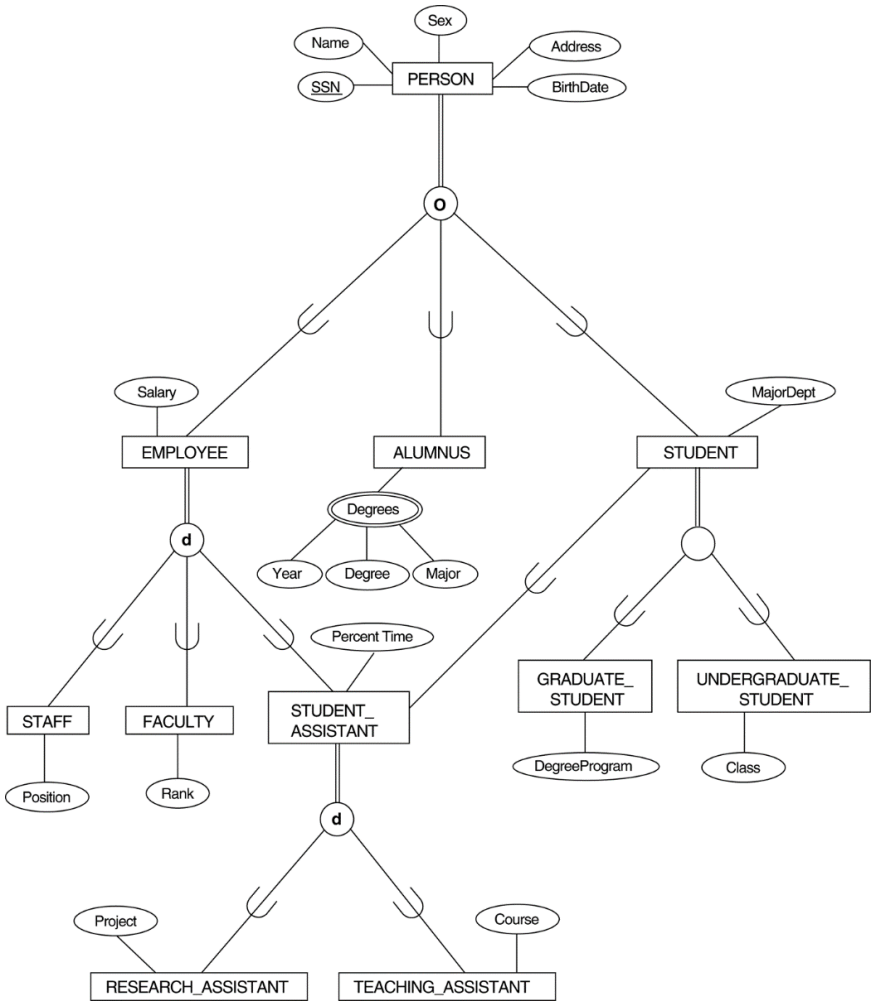

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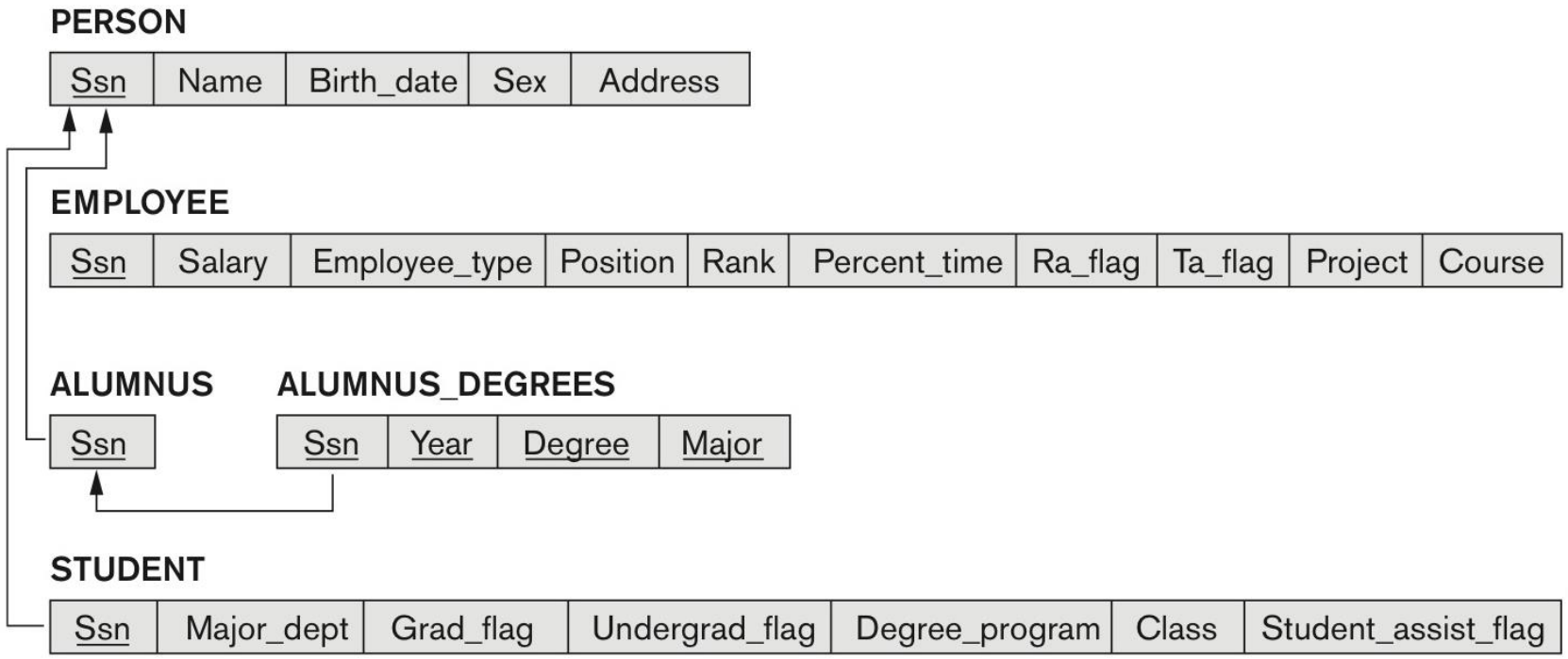
Figure 9.6 Mapping the EER Specialization Lattice in Figure 4.7 Using Multiple Options



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Mapping EER Model Constructs to Relations (5 of 5)

- **Step 9: Mapping of Union Types (Categories).**
  - For mapping a category whose defining superclass have different keys, it is customary to specify a new key attribute, called a surrogate key, when creating a relation to correspond to the category.
  - In the next example, we can create a relation OWNER to correspond to the OWNER category and include any attributes of the category in this relation. The primary key of the OWNER relation is the surrogate key, which we called OwnerId.

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Figure 4.8 Two Categories (Union Types): OWNER and REGISTERED_VEHICLE

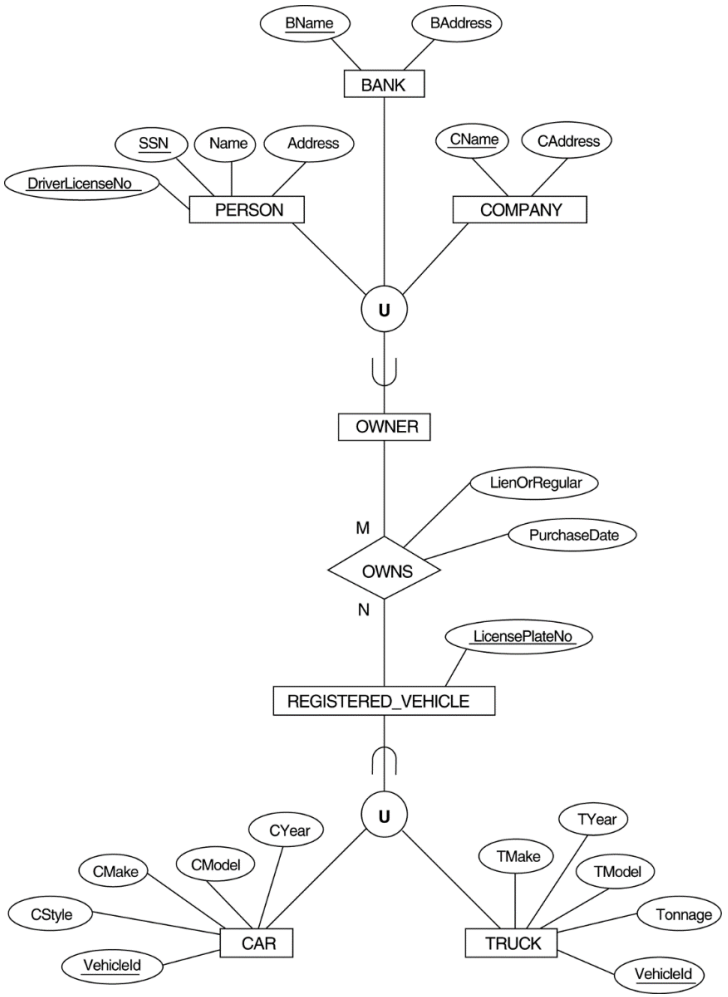

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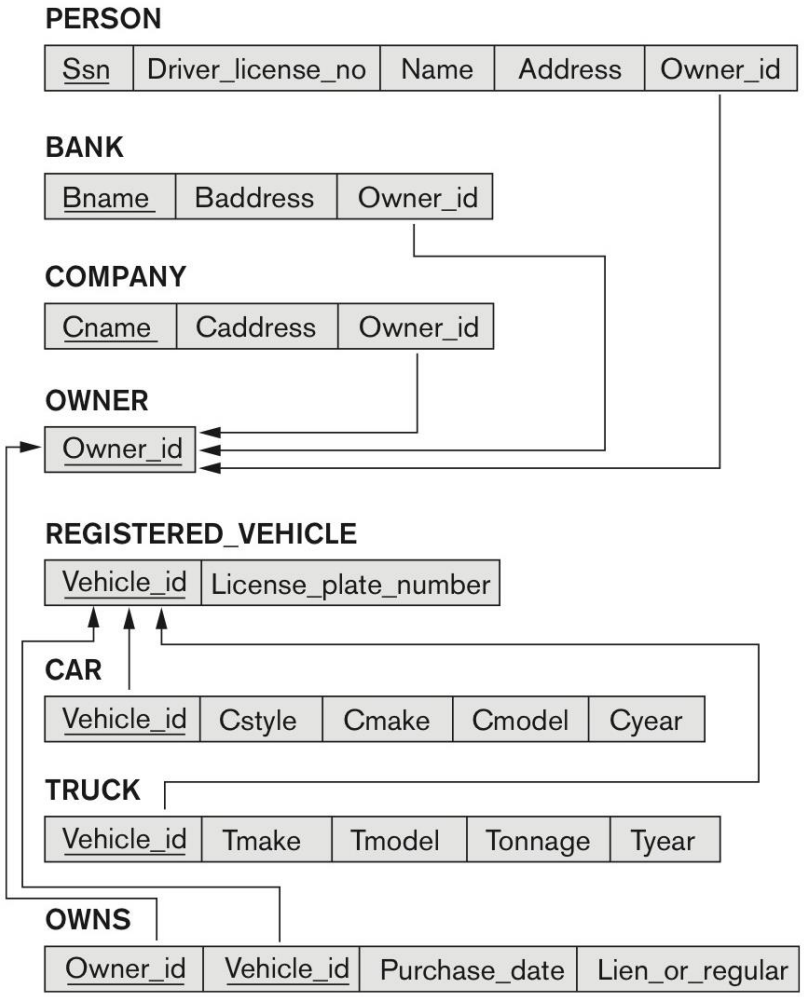
Figure 9.7 Mapping the EER Categories (Union Types) in Figure 4.8 to Relations



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Topic 4 Summary

- Presented Relational Model Concepts
  - Definitions
  - Characteristics of relations
- Discussed Relational Model Constraints and Relational Database Schemas
  - Domain constraints
  - Key constraints
  - Entity integrity
  - Referential integrity
- Described the Relational Update Operations and Dealing with Constraint Violations

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Topic 4 Summary

- **ER-to-Relational Mapping Algorithm**
  - Step 1: Mapping of Regular Entity Types
  - Step 2: Mapping of Weak Entity Types
  - Step 3: Mapping of Binary 1:1 Relation Types
  - Step 4: Mapping of Binary 1:N Relationship Types.
  - Step 5: Mapping of Binary M:N Relationship Types.
  - Step 6: Mapping of Multivalued attributes.
  - Step 7: Mapping of *N*-ary Relationship Types.
- **Mapping EER Model Constructs to Relations**
  - Step 8: Options for Mapping Specialization or Generalization.
  - Step 9: Mapping of Union Types (Categories).

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