

THE ENHANCED ER (EER) MODEL

CHAPTER 8 (6/E)

CHAPTER 4 (5/E)

LECTURE OUTLINE

- Extending the ER model
 - Created to design more accurate database schemas
 - Reflect the data properties and constraints more precisely
 - Address more complex requirements
 - Subclasses, Superclasses, and Inheritance
 - Specialization and Generalization
 - Modeling of UNION Types Using Categories

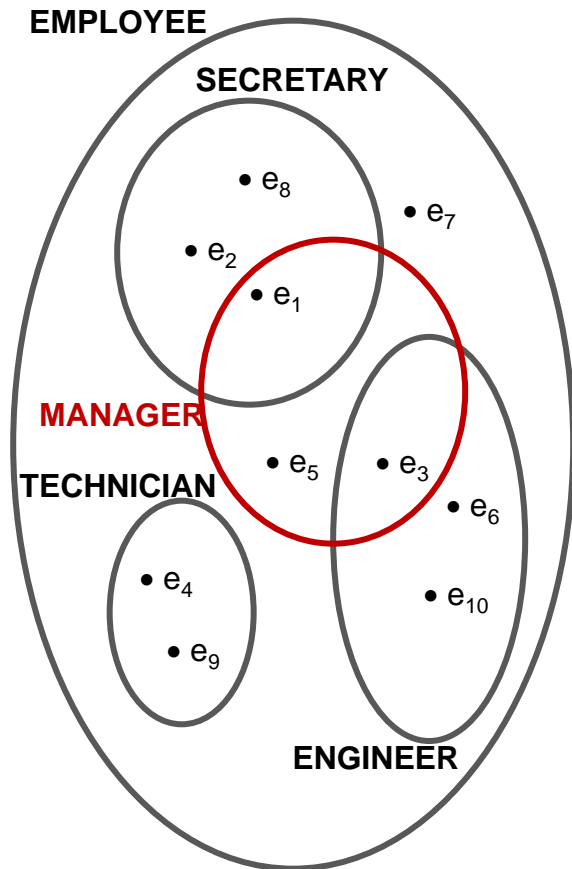
SPECIALIZATION AND INHERITANCE

- **Specialization**
 - Process of defining a set of subclasses of an entity type
 - Defined on the basis of some distinguishing characteristic of the entities in the superclass
- Describing the relationship
 - **Superclass/subclass** or **Class/subclass**
 - **Supertype/subtype** or **Type/subtype**
- Subclass can define:
 - Specific attributes
 - Specific relationship types
- Subclass can be a subclass wrt more than one superclass
- **Type inheritance**
 - Subclass entity has all attributes and participates in all relationships of superclass
 - **Multiple inheritance** if more than one superclass

GENERALIZATION

- **Generalization**
 - Process of defining a more general entity type from given entity types
- Reverse process of specialization
- Generalize into a single superclass
 - Original entity types are specialized subclasses
 - Entities in generalization must *all* come from subclasses

SPECIALIZED ENTITIES



- Every technician/secretary/engineer is an employee.
- Not every employee of superclass must be in a subclass (unless specified as **generalization**).
- All properties of employee (attributes *and* relationships) are inherited by specialized subclasses.
- Specialized entities might have additional attributes and be involved in additional relationships.
- Subclasses may be **disjoint** or **overlapping**.

CONSTRAINTS ON SUBCLASSES

- **Disjointness constraint**
 - Specifies that the subclasses of the specialization must be disjoint
- **Completeness constraint**
 - Specifies that every superclass entity must be in a subclass
 - Required of generalization
- Disjointness and completeness constraints are *independent* constraints

EER DIAGRAM WITH SUBCLASSES

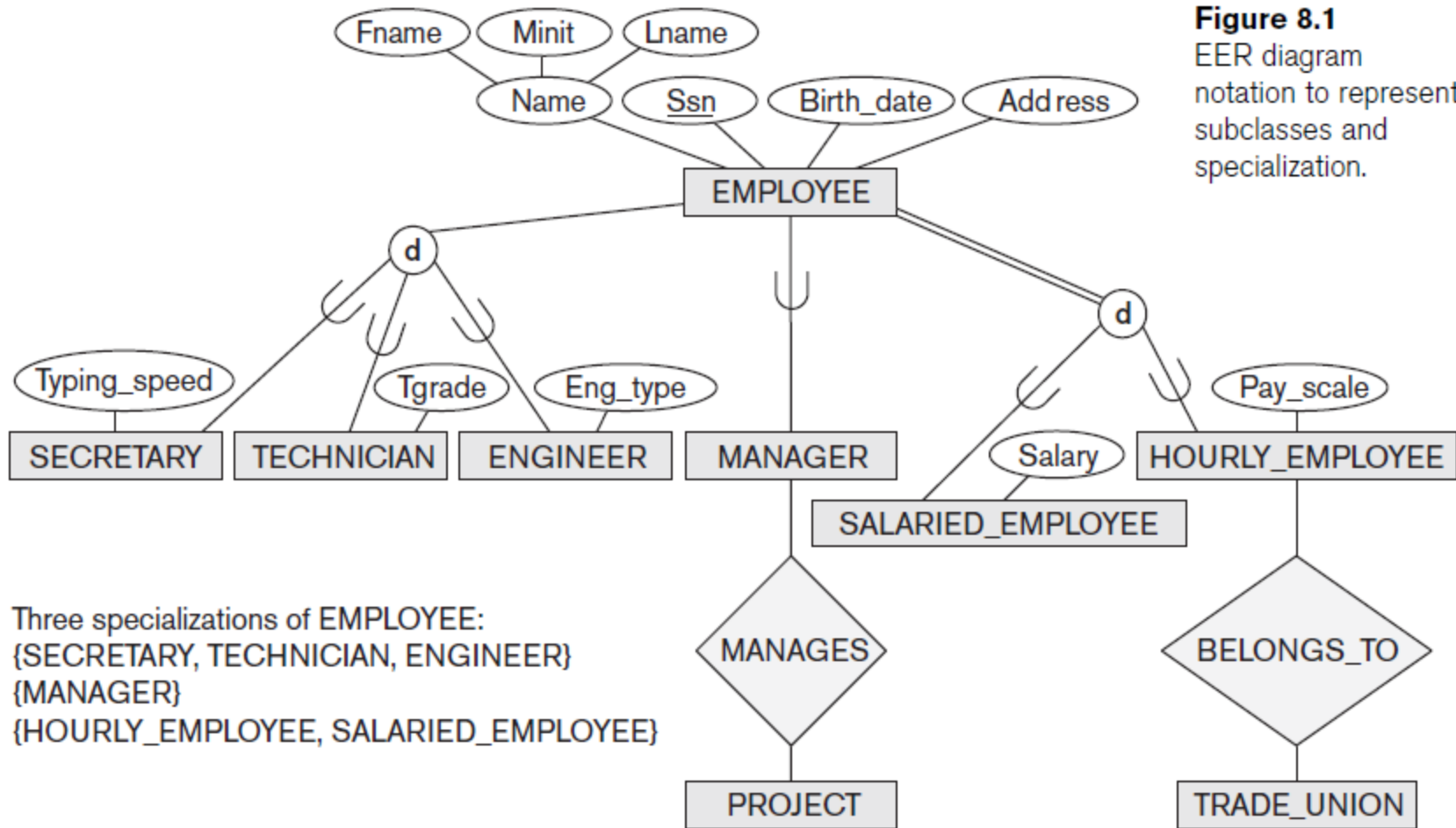


Figure 8.1
EER diagram notation to represent subclasses and specialization.

REFINING CONCEPTUAL SCHEMAS

- Using specialization
 - Starting with entity type, define subclasses by successive specialization
 - **Top-down conceptual refinement**
- Using generalization
 - Starting with entity type, define superclasses by successive generalization
 - **Bottom-up conceptual synthesis**

MODELING WITH UNION TYPES

- **Union type** or **category**
 - Represents a single superclass/subclass relationship with more than one superclass
 - Subclass represents a collection of objects that is a subset of the UNION of distinct entity types
 - Attribute inheritance works more selectively
 - Category can be **total** or **partial**
- Some modeling methodologies do not have union types
 - Usually (always?) clearer to use specification/generalization

UNION TYPES

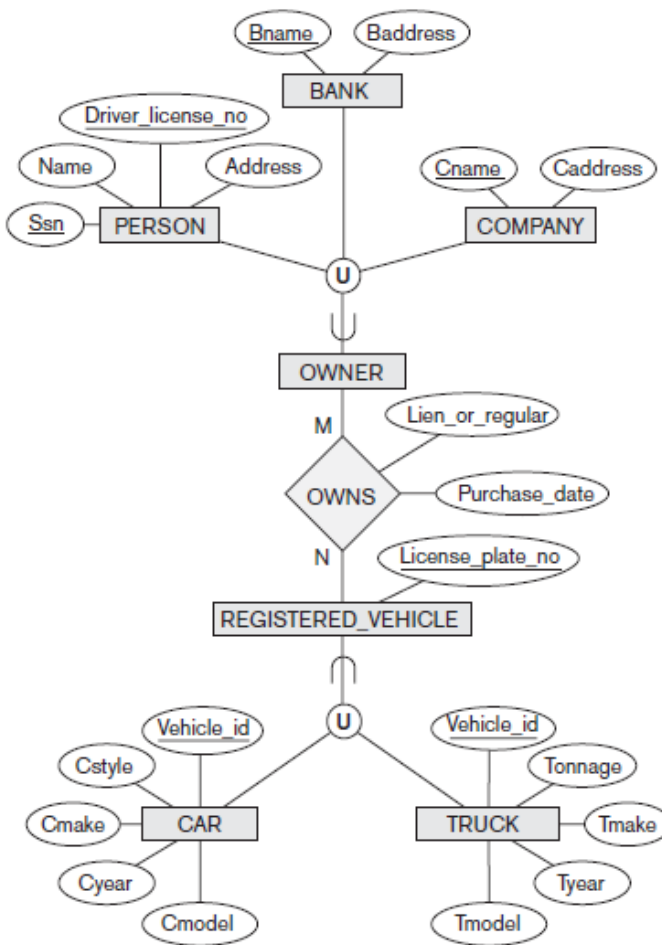
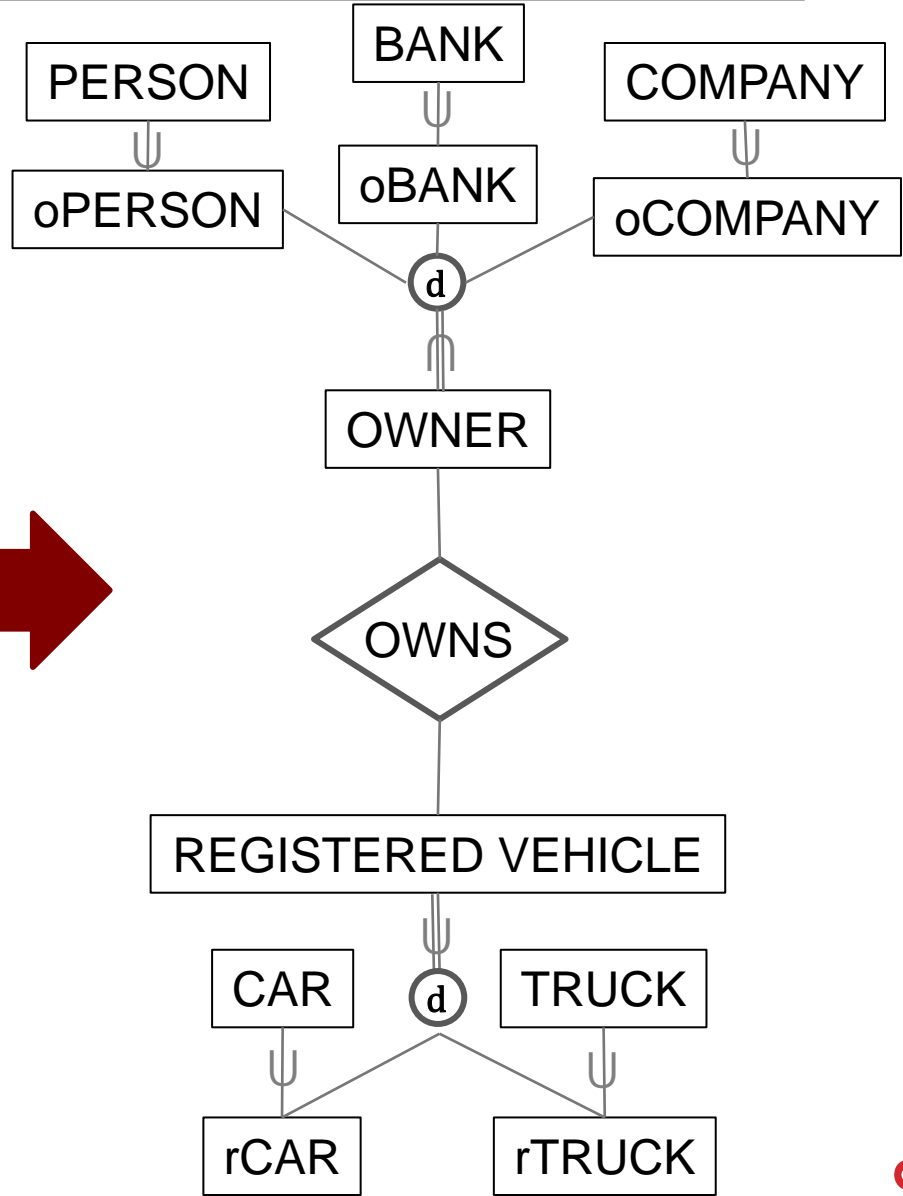
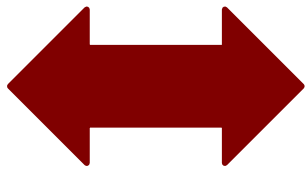
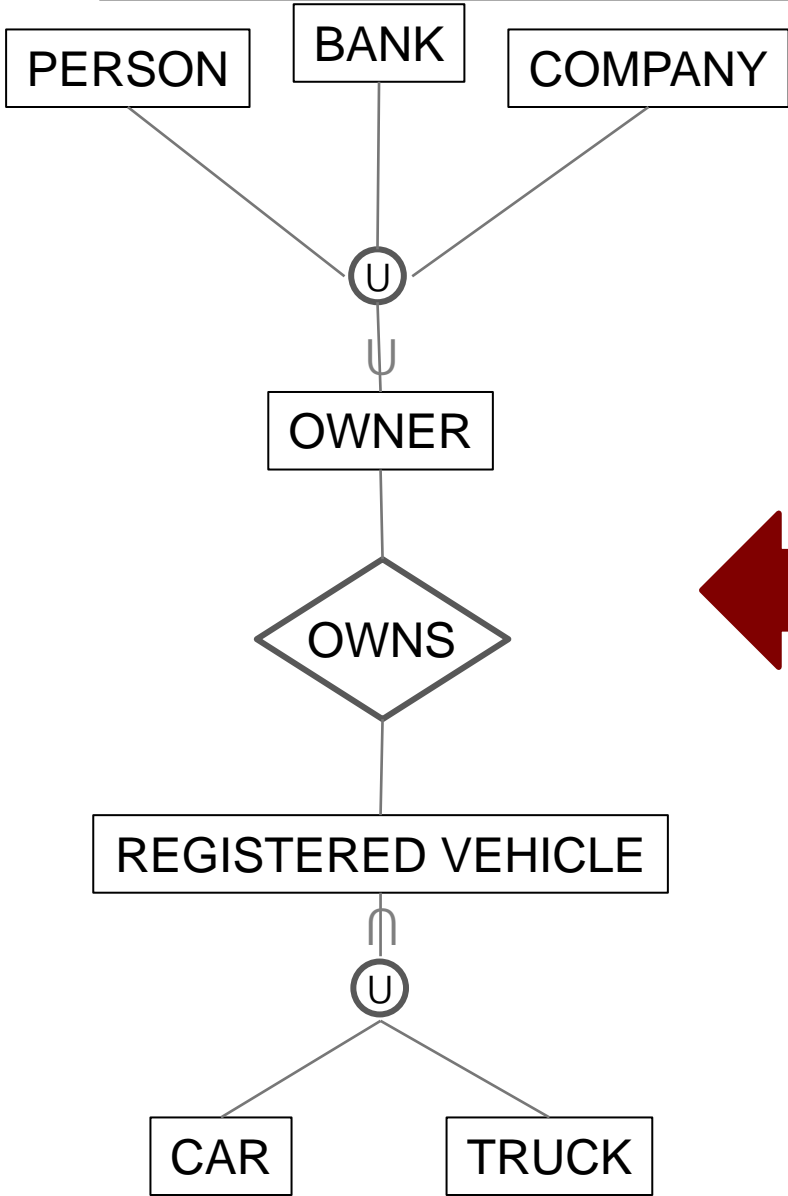


Figure 8.8
Two categories (union types): OWNER and REGISTERED_VEHICLE.

REWRITING UNION AS SPECIALIZATION



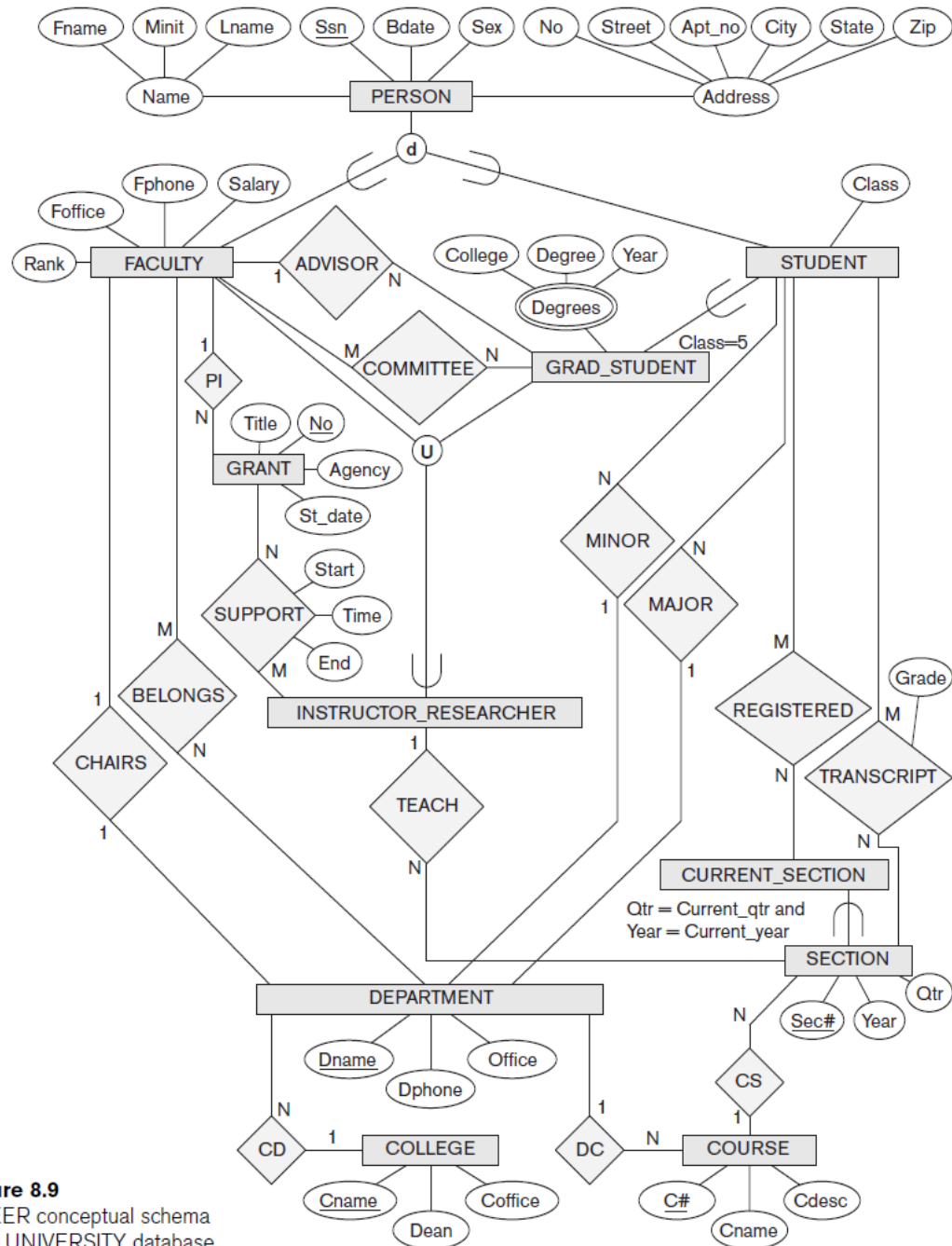


Figure 8.9
An EER conceptual schema
for a UNIVERSITY database.

DESIGN CHOICES

- Many specializations/generalizations can be defined to make the conceptual model accurate
 - Constrain as disjoint/overlapping or total/partial as needed
 - Driven by rules in miniworld being modeled
- If all the subclasses of a specialization/generalization have few specific attributes and no specific relationships
 - Can be merged into the superclass *C*
 - Include in *C* one or more “type” attributes that specify the (virtual) subclasses to which each entity belongs
- Union types should generally be avoided

LECTURE SUMMARY

- Enhanced ER or EER model
 - Extensions to ER model that improve its representational capabilities
 - Subclass and its superclass
 - Category or union type
 - EER diagrams