

## Conceptual Database Design & ER-Model

- ◆ ER-Model
- ◆ ER-Diagrams
- ◆ EER Model & Diagrams

## EER Model: Enhanced ER Model

- The **EER** model introduced the concepts of *superclass* and *subclass* entity types in the ER model
  - **MEMBER (superclass):**
    - LIFE-MEMBER, REGULAR-MEMBER, and SEASON-MEMBER (Subclasses)
  - **LIBRARIAN (superclass):**
    - HEAD LIBRARIANS, SALARY LIBRARIANS, and HOURLY LIBRARIANS (subclasses)

## Why EER Model ?

- To add more semantic clarity to the design
- E.g., if only salary-librarians can belong to the librarian guild, then this can be expressed as
  - BelongTo: <SALARY-LIBRARIAN, LIB-GUILD>
  - and not as
  - BelongTo: <LIBRARIAN, LIB-GUILD>
- Minimize NULL values

## Specialization, Generalization, Inheritance

- Specialization: identifying subclasses, and their distinguishing characteristics (attributes & relationships)  
(Top-down design)
- Generalization: aggregate entities to a superclass entity type by identifying their common characteristics  
(Bottom-up design)

## Specialization, Generalization, Inheritance

- ❑ Inheritance: IS\_A (instance) relationship that supports attribute inheritance and relationship participation
  - Single inheritance results in a hierarchy
  - Multiple inheritance results in a lattice



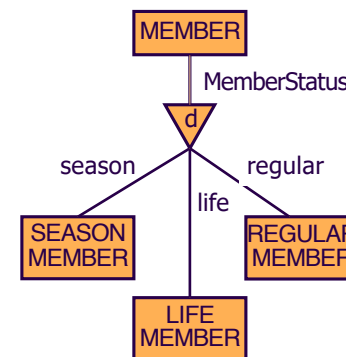
## Inclusion Constraints

- ❑ The disjoint constraint: the subclasses of a superclass are disjoint.
  - This means that an entity can be a member of only one subclass.
  - The entities for each class can be *user-defined* or specified with a *predicate-defined subclass*.
  - In a predicate-defined subclass, we use a selection condition on one or more attributes to define the entities of the subclass. E.g., MembershipStatus
- ❑ The non-disjoint constraints: specify that the subclasses are overlapping and an entity may be a member of more than one subclass.

## Completeness Constraints

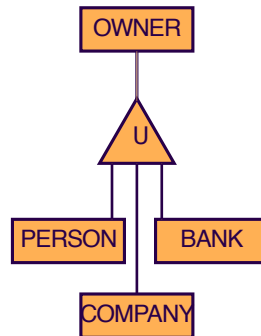
- ❑ A total specialization: specifies that every entity in the superclass must be a member of some of its subclasses
  - E.g., a librarian must belong to one of the subclasses of LIBRARIAN.
- ❑ A partial specialization: specifies that an entity may not belong to any subclass
  - E.g., an honorary member may not belong to any of the specializations (subclasses) of MEMBER.
- ❑ Superclass via generalization is always total

## EER Diagram: Example 1



## Union Types or Categories

- Collection of entities of distinct entity types
- Category OWNER is a subclass of the set **union** of the entity types: PERSON, BANK, COMPANY
- Multiple Inheritance with superclasses of different types
- An instance in category must exist only in one of the superclasses
- Category can be:
  - Total** or **Partial** (with predicate definition)



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## EER Diagrams



IS-A



Disjoint



Non-Disjoint  
overlapping



Category  
class union



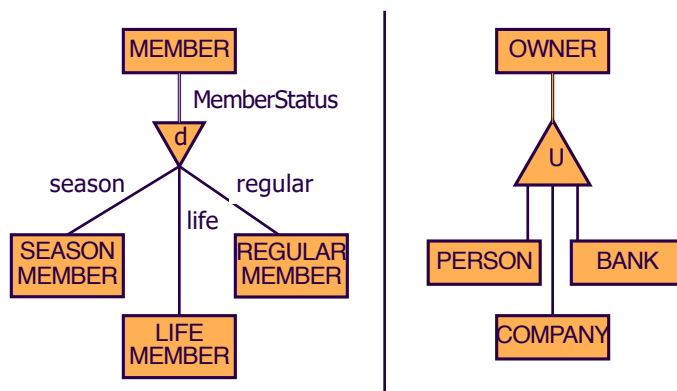
Total  
generalization

(see book for alternative notations)

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## EER Diagram: Examples



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## & OMT (Object Modeling Technique)

- Describe software modules and their interactions including data requirements via diagrams
- They include *class diagrams* which are similar to EER diagrams — *same concepts different names*
  - Entity = object; Entity type = class*
- In UML, a class is a box with three sections:
  - Class name, Object attributes, Object operations*
- relationships are called *associations*, relationship instances are called *links* that have *link attributes*
- Relationship constraints are called *multiplicities*
- Two types of relationships: *association & aggregation* with directionality of access

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## Library UML Diagram

