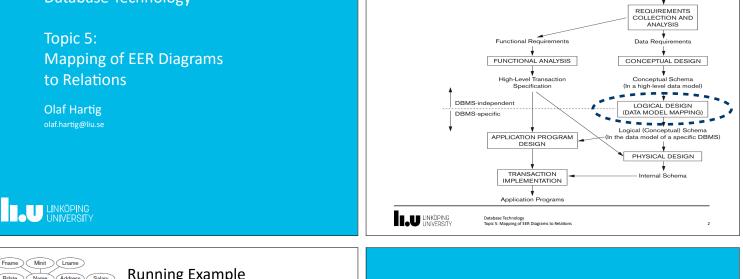
### **Database Technology**

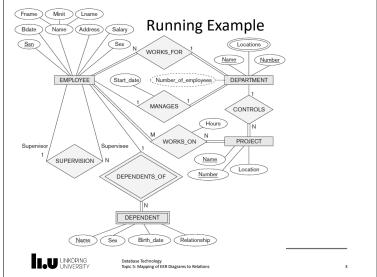
Topic 5: **Mapping of EER Diagrams** to Relations

**Olaf Hartig** 





Recall: DB Design Process



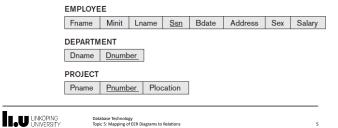
Algorithm for Mapping from the ER Model to the Relational Model

Miniworld

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#### Step 1: Map Regular Entity Types

- For each regular entity type, create a relation schema R that includes all the single-valued attributes of E
  - "Flatten" composite attributes (e.g., Name of Employee)
  - Example renames some attributes (e.g., Dname), but not needed
  - Pick one of the keys as primary key, declare others to be unique
  - Resulting relations are called entity relations
  - · Each tuple represents an entity instance



#### Step 2: Map Weak Entity Types

- For each weak entity type, create a relation schema R
  - · Include all single-valued attributes of the weak entity type and of the identifying relationship as attributes of R
  - Include primary key attribute of identifying entity as foreign key attribute of R
  - Primary key of R is primary key of identifying entity together with partial key from R
- Omit the identifying relationship when subsequently translating (other) relationship types to relation schemas





Database Technology Topic 5: Mapping of EER Diagrams to Relation

#### Step 3: Binary 1:1 Relationship Types

- For each binary 1:1 relationship type R, identify relation schemas that correspond to entity types participating in R
- Apply one of three possible approaches:

#### 1. Foreign key approach

- Add primary key of one participating relation as foreign key attribute of the other, which will also represent R
  - If only one side is total, choose it to represent R (why?)
- Declare foreign key attribute as unique



\*Add single-valued attributes of relationship type as attributes of R



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#### Step 3: Binary 1:1 Relationship Types

- For each binary 1:1 relationship type R, identify relation schemas that correspond to entity types participating in R
- Apply one of three possible approaches:

#### 2. Merged relationship approach

- · Possible if both participations are total
- Combine the two relation schemas into one, which will also represent R
- · Make one of the primary keys unique instead

#### 3. Cross-reference or relationship relation approach

- Create new relation schema for R with two foreign key attributes being copies of both primary keys
- Declare one of the attributes as primary key, the other one as unique

■Add single-valued attributes of relationship type as attributes of R

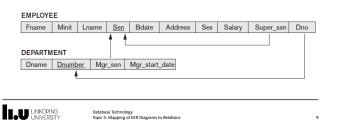


Database Technology Topic 5: Mapping of EER Diagrams to Relation

#### Step 4: Binary 1:N Relationship Types

#### Foreign key approach

- Identify relation schema S that represents participating entity type at N-side of 1:N relationship type
- Include primary key of other entity type (1-side) as foreign key in S
- Relationship relation approach (next slide)
- Include single-valued attributes of relationship type as attributes



#### Step 4: Binary 1:N Relationship Types

- Foreign key approach
- Relationship relation approach
  - Create new relation schema for relationship type with two foreign key attributes being copies of both primary keys
  - Declare the foreign key attribute for the relation schema corresponding to the participating entity type on the N-side as primary key
- Include single-valued attributes of relationship type as attributes



Database Technology Topic 5: Mapping of EER Diagrams to Relations

#### Quiz

Consider the given ER diagram and relational DB schema



Artist(name,birth,death), Work(title,medium)

The Paints relationship can be represented by:

- A. introducing a third schema: Paints(name, title, date)
- B. extending the Work schema to be Work(title, medium, name, date)
- C. extending the Artist schema to be Artist(name,birth,death,title,date)
- D. either A or B above
- E. any of A, B, or C above



# Step 5: Binary M:N and Higher Order Relationship Types

- For each binary M:N relationship type or ternary or higher order relationship type, create a new relation S
  - Include primary key of participating entity types as foreign key attributes in S
  - Make all these attributes the primary key of S
- Include any simple attributes of relationship type in S





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#### Step 6: Map Multivalued Attributes

- For each multivalued attribute create new relation R
  - · Add attribute to hold multivalued attribute values
    - If multivalued attribute is composite, include its simple components
  - Add attribute(s) for primary key of relation schema for entity type or relationship type to be foreign key for *R*
  - Primary key of R is the combination of all its attributes



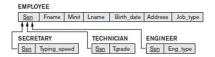
### Mapping Constructs from the EER Model



### Options for Mapping Specialization/Generalization

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- For any specialization (total or partial, disjoint or overlapping)
  - 1. Separate relation per supertype and subtypes



- 2. Single relation with Boolean type attributes for every subtype
  - · Add all attributes of all subtypes



## Options for Mapping Specialization/Generalization (cont'd)

- For total specializations (and generalizations) only
  - · Separate relation per subclass relations only
  - Overlapping subtypes will result in multiple tuples per entity
- For disjoint specializations only
  - · Single relation with one type attribute
  - Type or discriminating attribute indicates subtype of tuple
  - Might require many NULL values if several specific attributes exist in subtypes



#### **Summary and Example**

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#### Summary

EMPLOYEE

Algorithm for ER-to-relational mapping

RELATIONAL MODEL **ER MODEL** Entity type Entity relation 1:1 or 1:N relationship type Foreign key (or *relationship* relation) Relationship relation and two foreign keys M:N relationship type *n*-ary relationship type Relationship relation and n foreign keys Simple attribute Attribute Composite attribute Set of simple component attributes Multivalued attribute Relation and foreign key Value set Domain Key attribute Primary (or secondary) key

Extensions for mapping constructs from EER model



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19

