

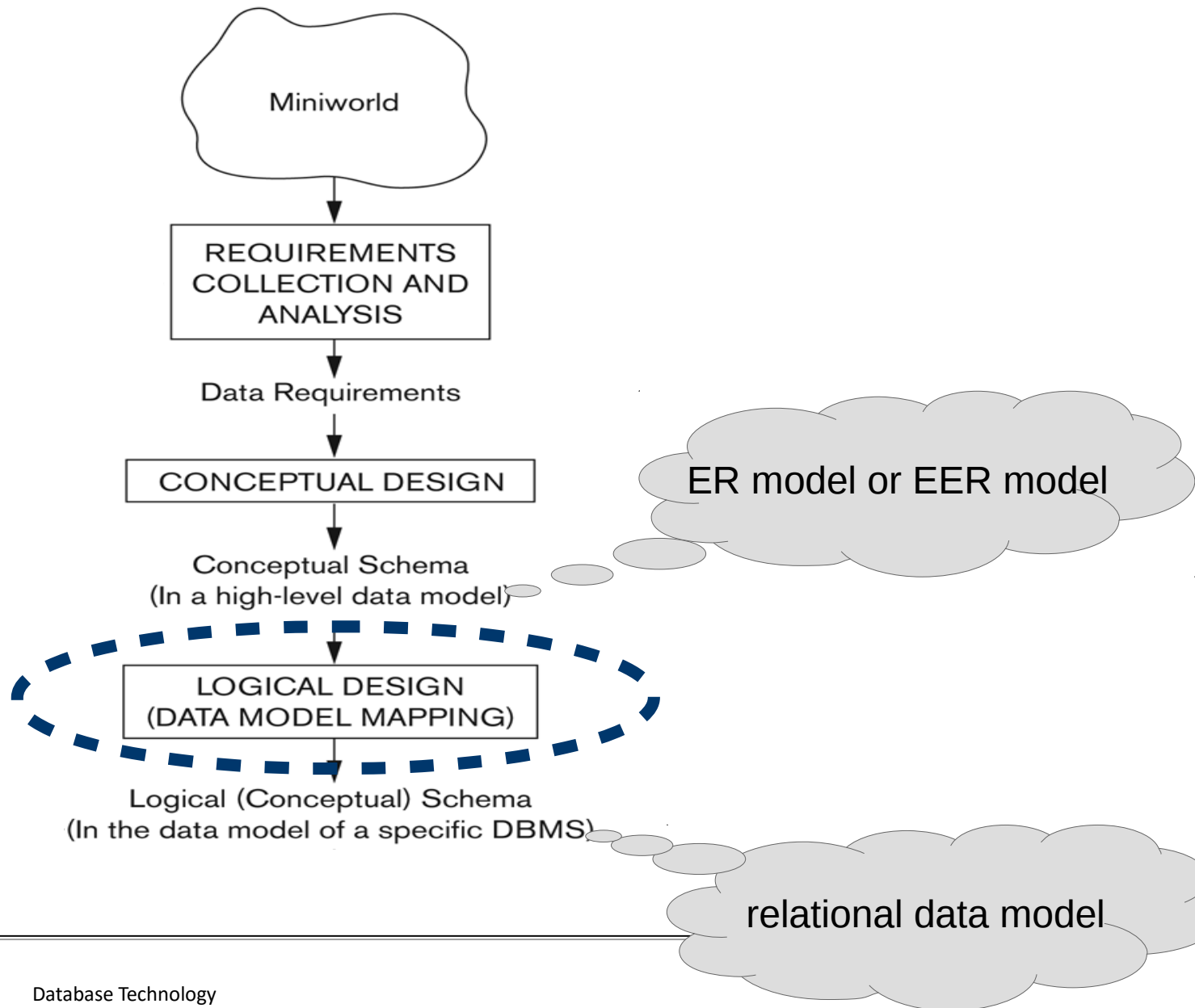
Database Technology

Topic 5: Mapping of EER Diagrams to Relational Databases

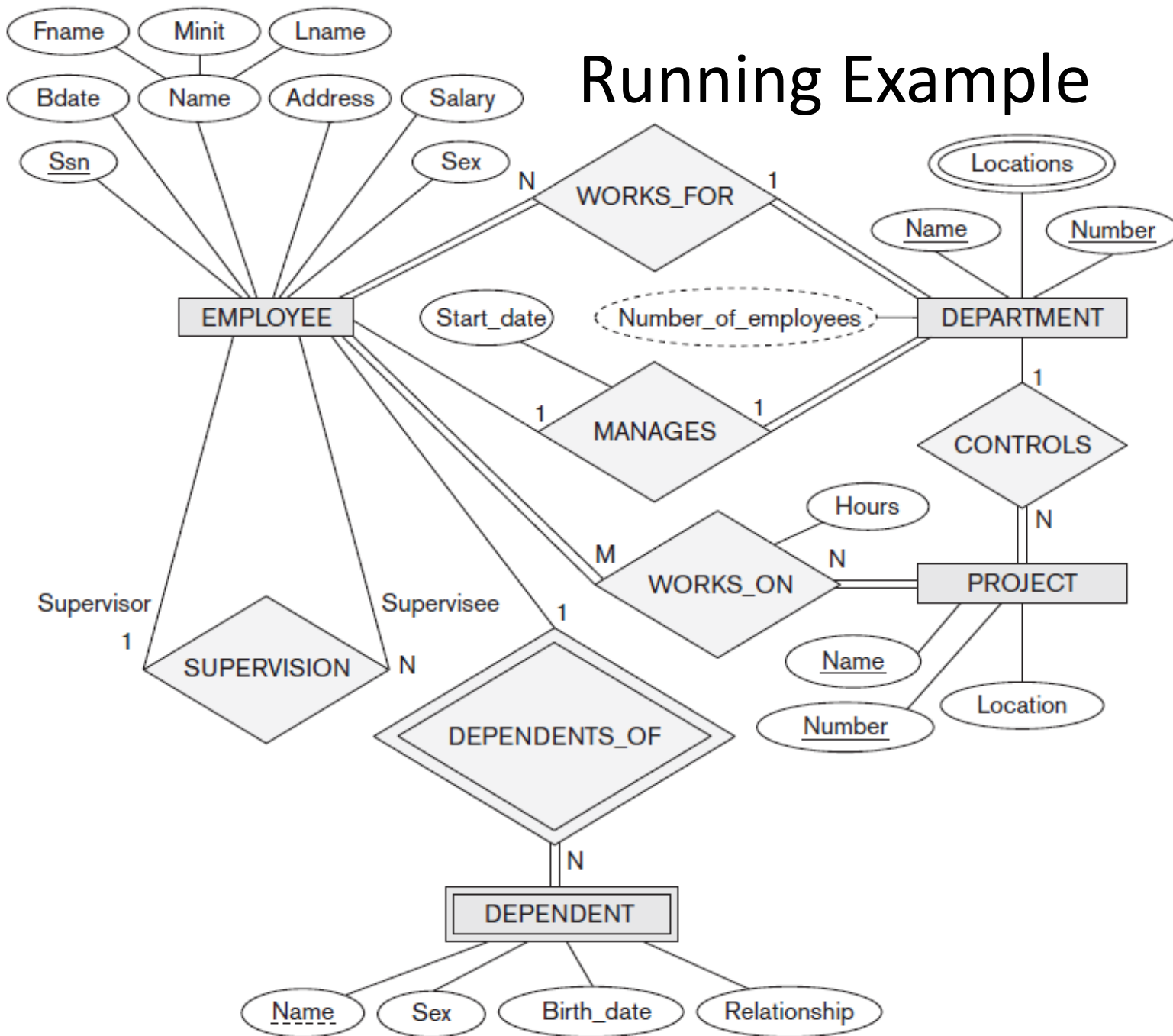
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Recall: DB Design Process



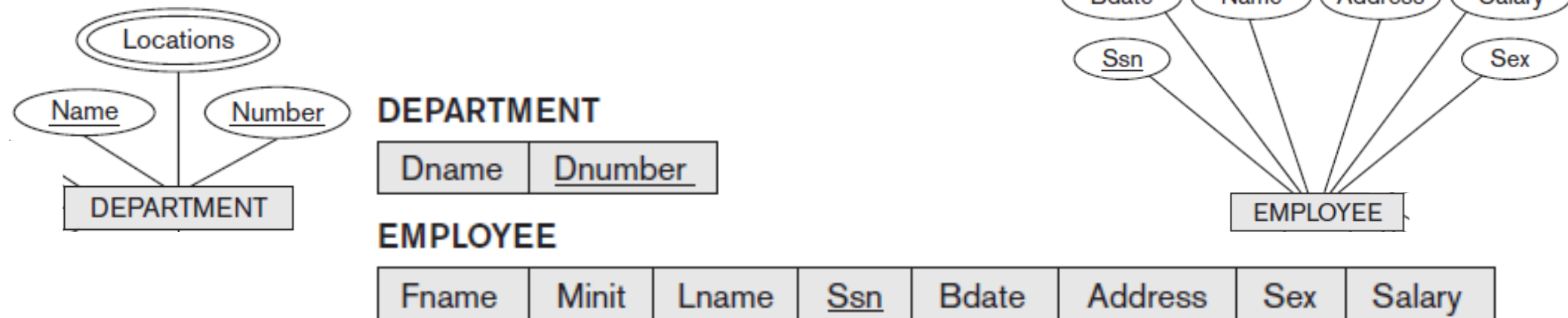
Running Example



Algorithm for Mapping from the ER Model to the Relational Model

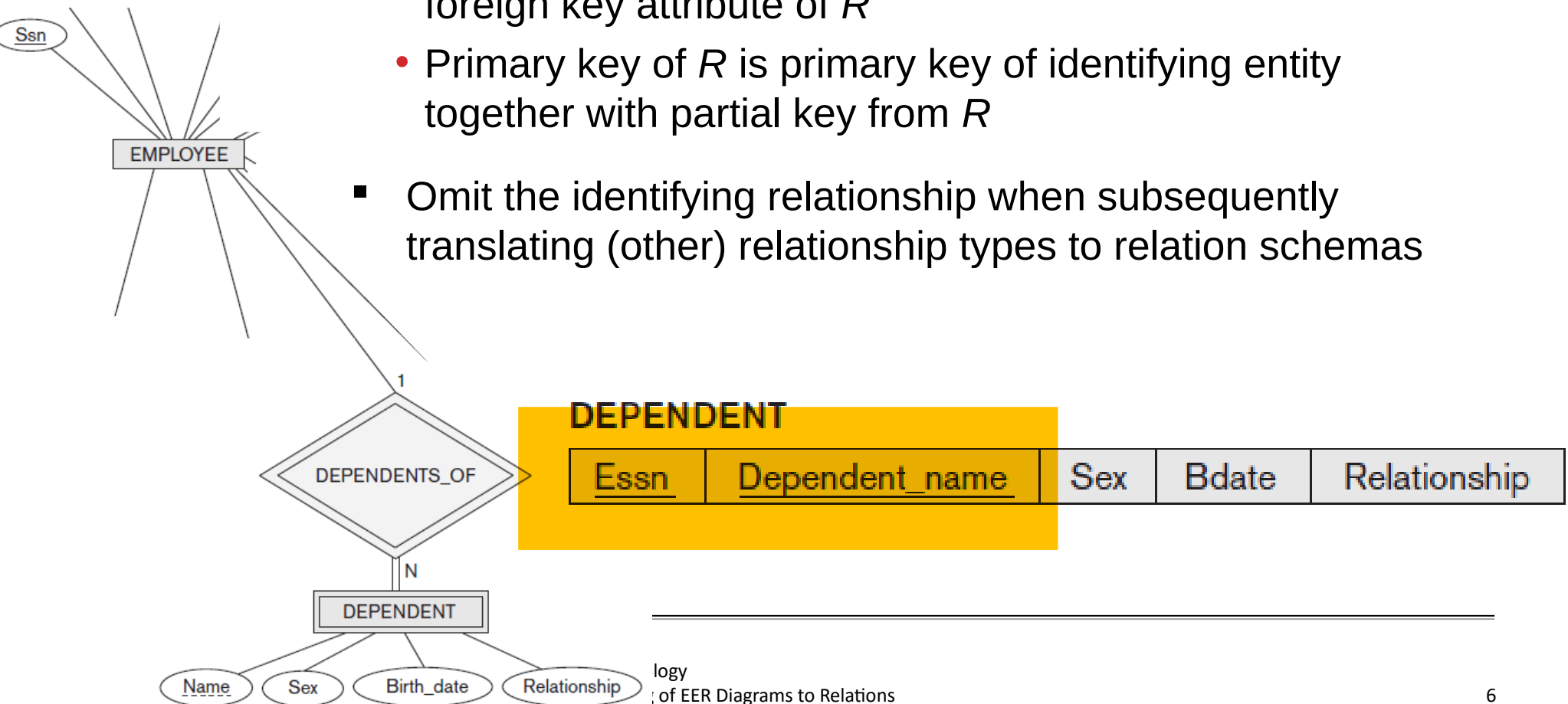
Step 1: Map Regular Entity Types

- 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* attribute of *Employee*)
 - Ignore multivalued attributes at this point (e.g., *Locations* attribute)
 - 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

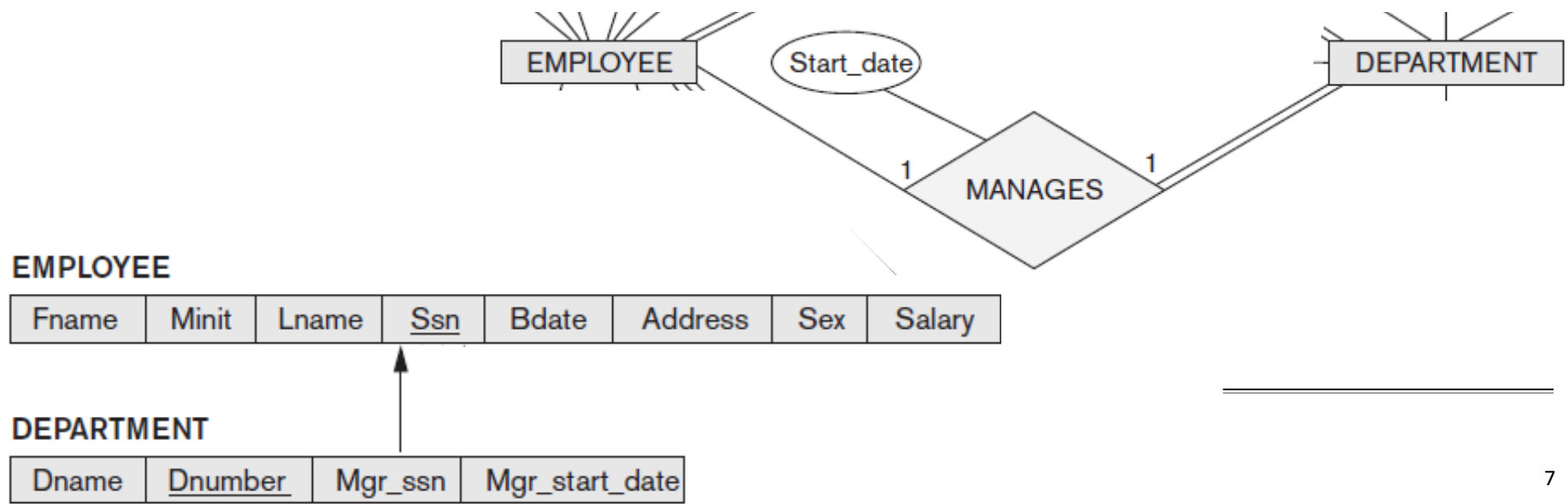


Step 3: Binary 1:1 Relationship Types

- 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

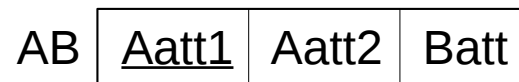
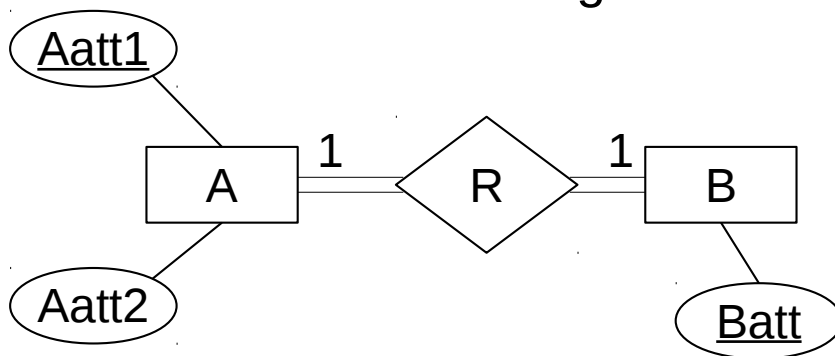


Step 3: Binary 1:1 Relationship Types

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



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

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

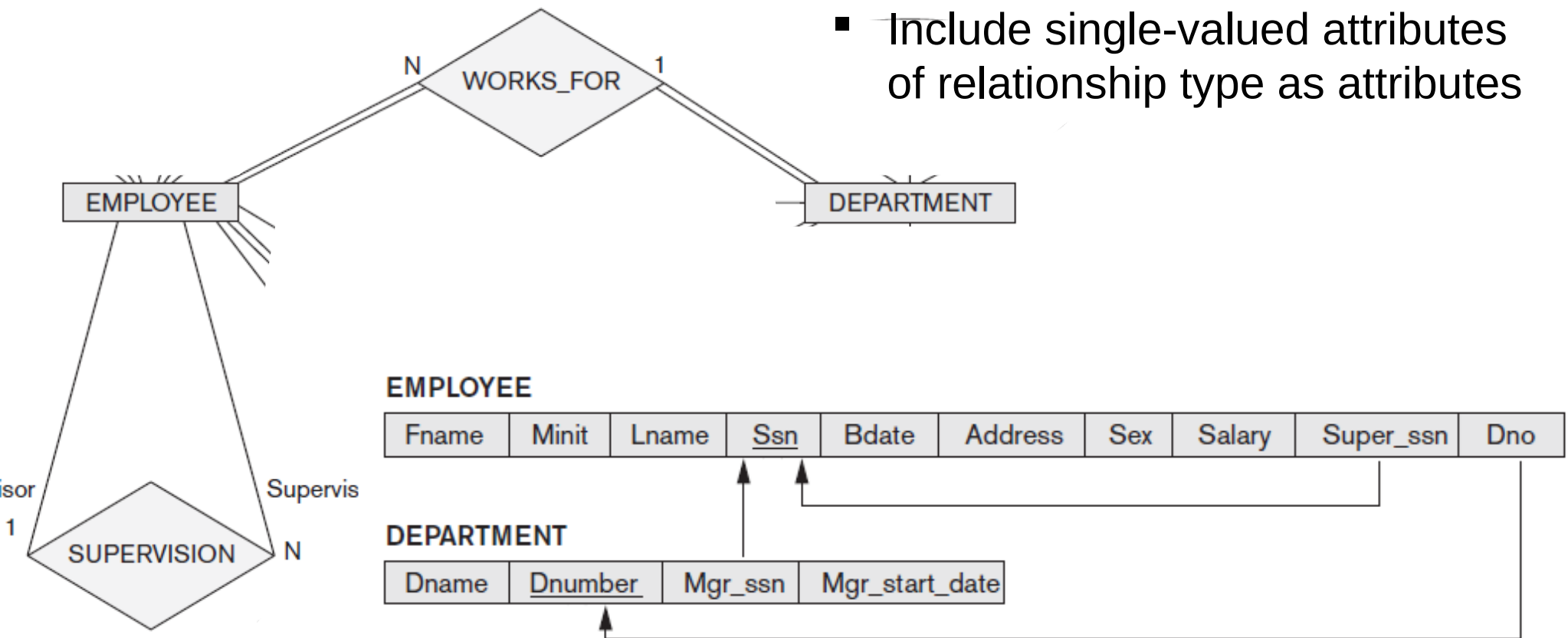
Step 4: Binary 1:N Relationship Types

- **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

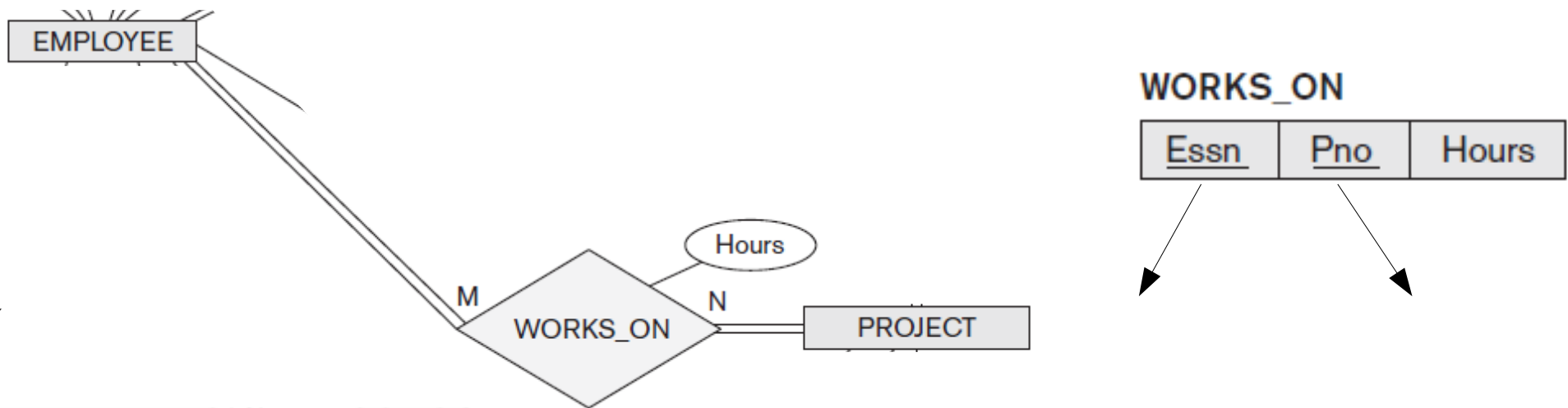


Step 4: Binary 1:N Relationship Types

- **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

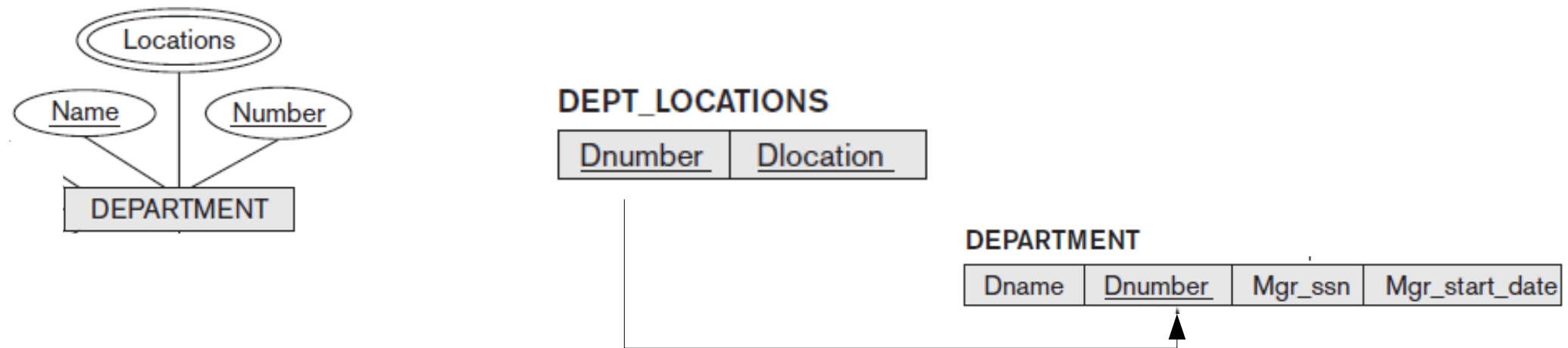
Step 5: Binary $M:N$ and Higher Order Relationship Types

- 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



Step 6: Map Multivalued Attributes

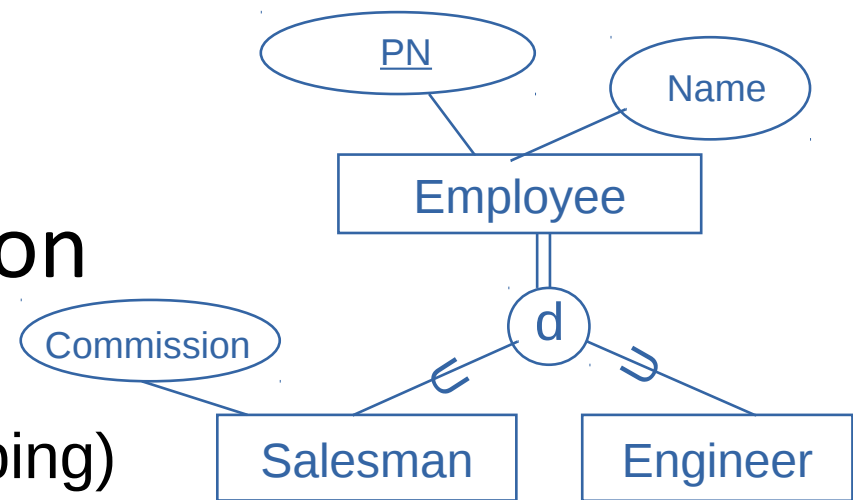
- For each multivalued attribute create new relation R
 - Add attribute to hold multivalued attribute values
 - If multivalued attribute is composite, include its simple components
 - Add attribute(s) for primary key of relation schema for entity type or relationship type to be foreign key for R
 - Primary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



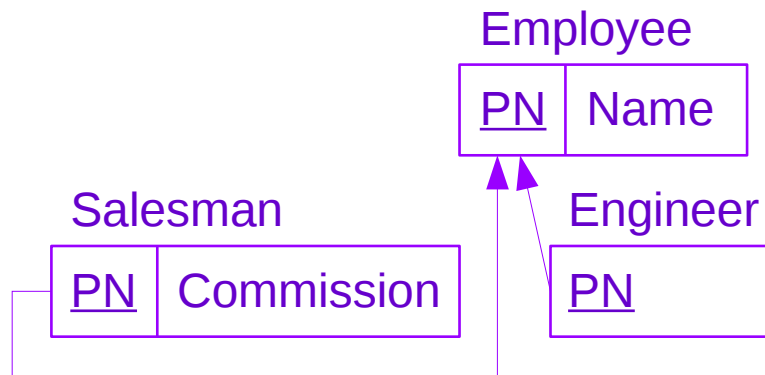
Mapping Constructs from the EER Model

Options for Mapping Specialization/Generalization

- For *any* specialization (total or partial, disjoint or overlapping)



1. Separate relation per supertype and subtypes

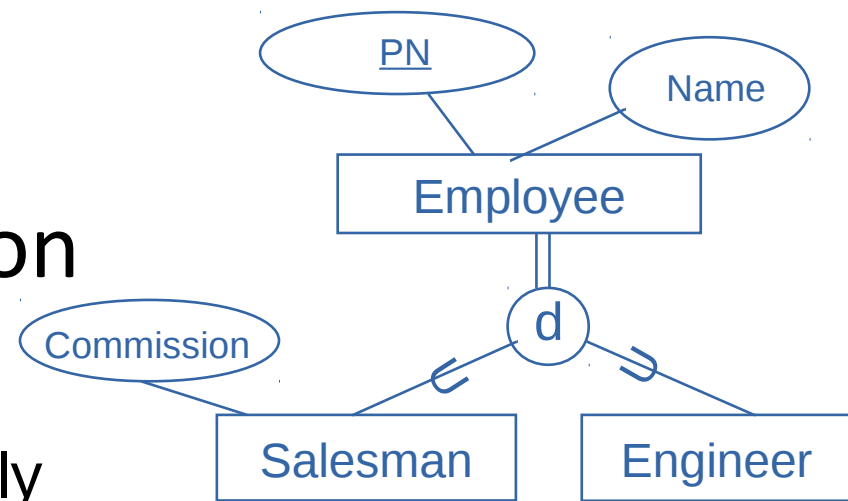


2. Single relation with Boolean type attributes for every subtype

- Add all attributes of all subtypes



Options for Mapping Specialization/Generalization



- For *total specializations only*
 - Separate relation per subclass 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

Summary

- Algorithm for ER-to-relational mapping

ER MODEL

Entity type

1:1 or 1:N relationship type

M:N relationship type

n -ary relationship type

Simple attribute

Composite attribute

Multivalued attribute

Value set

Key attribute

RELATIONAL MODEL

Entity relation

Foreign key (or *relationship* relation)

Relationship relation and *two* foreign keys

Relationship relation and n foreign keys

Attribute

Set of simple component attributes

Relation and foreign key

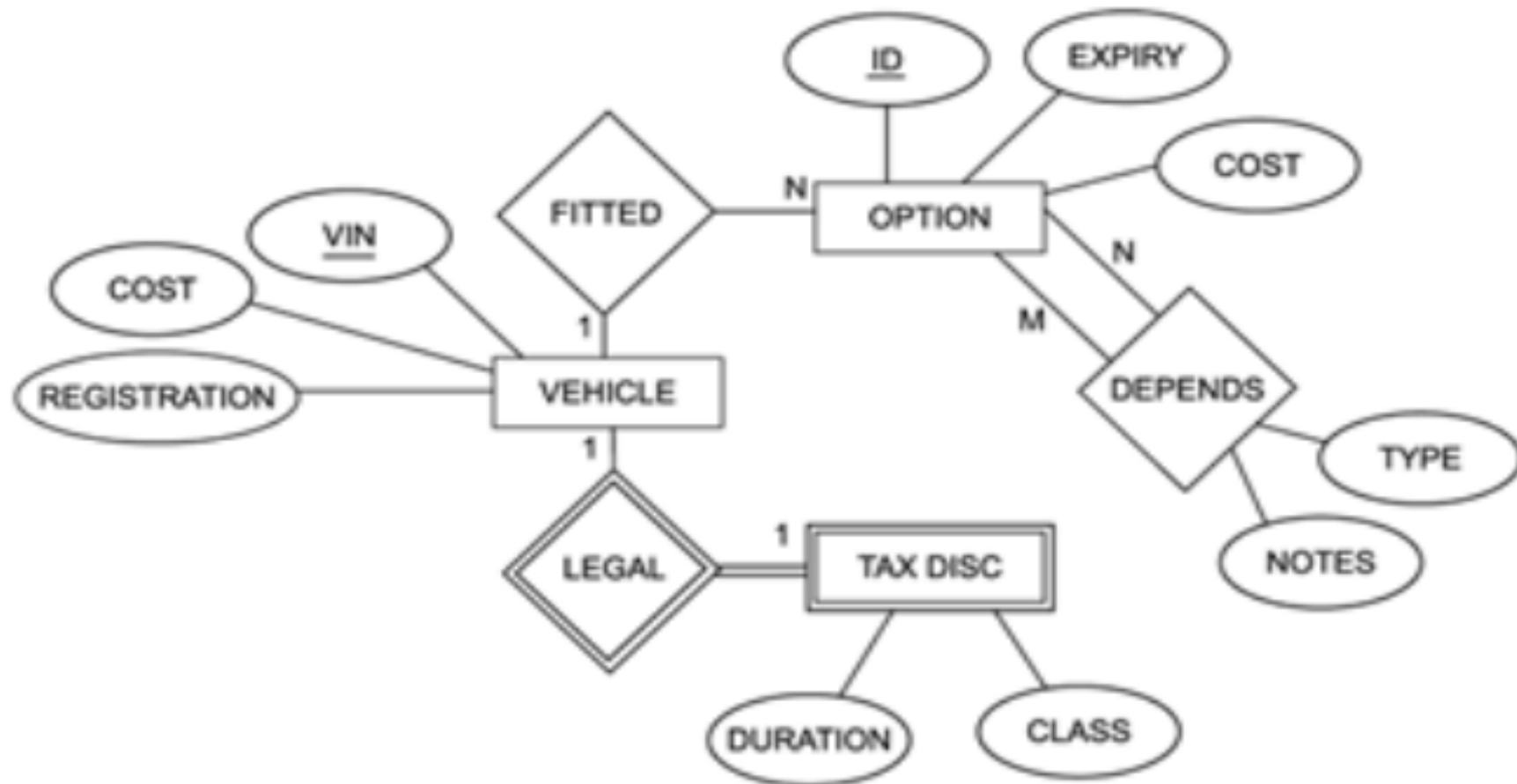
Domain

Primary (or secondary) key

- Extensions for mapping constructs from EER model

Exercise

Translate the following ER Diagram into a relational database schema.



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