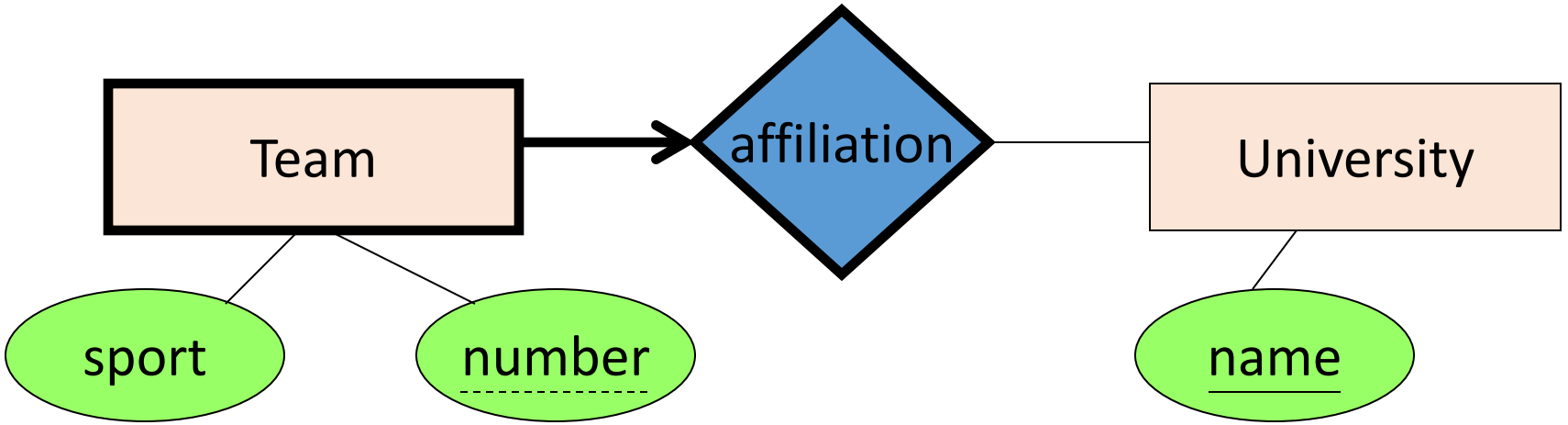
Review Concepts in Chp 3

Weak Entity Sets

Entity sets are *weak* when their key comes from other classes to which they are related.

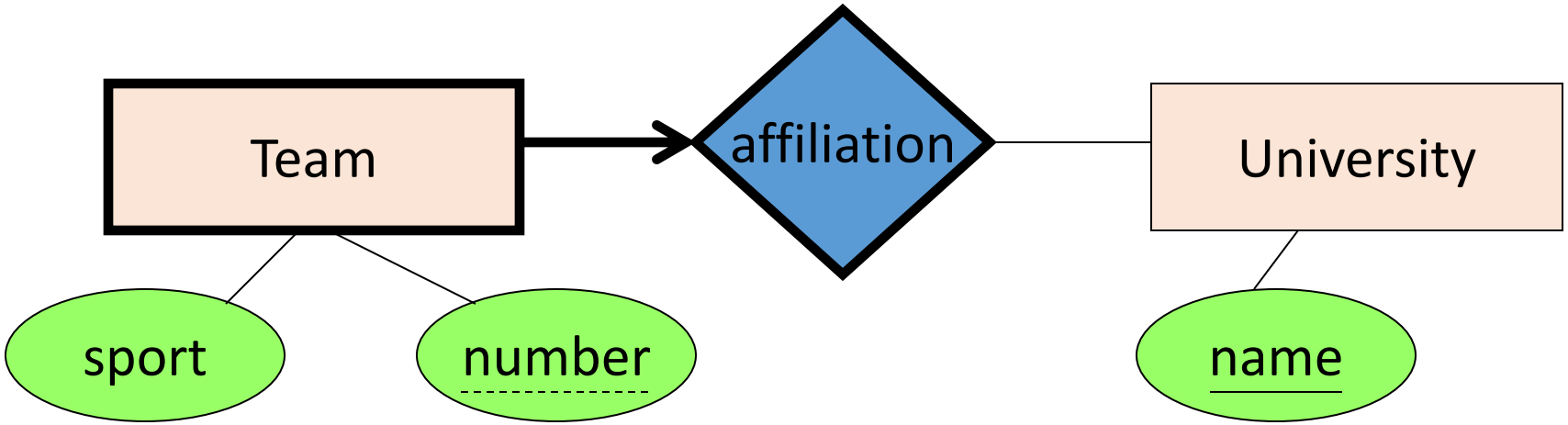


"Football team" v. "***The GSU*** Football team" *(E.g., GT has a football team too, sort of)*

Entity sets that do not have key attributes of their own are called weal entity sets.

Weak Entity Sets (cont.)

Entity sets are *weak* when their key comes from other classes to which they are related.



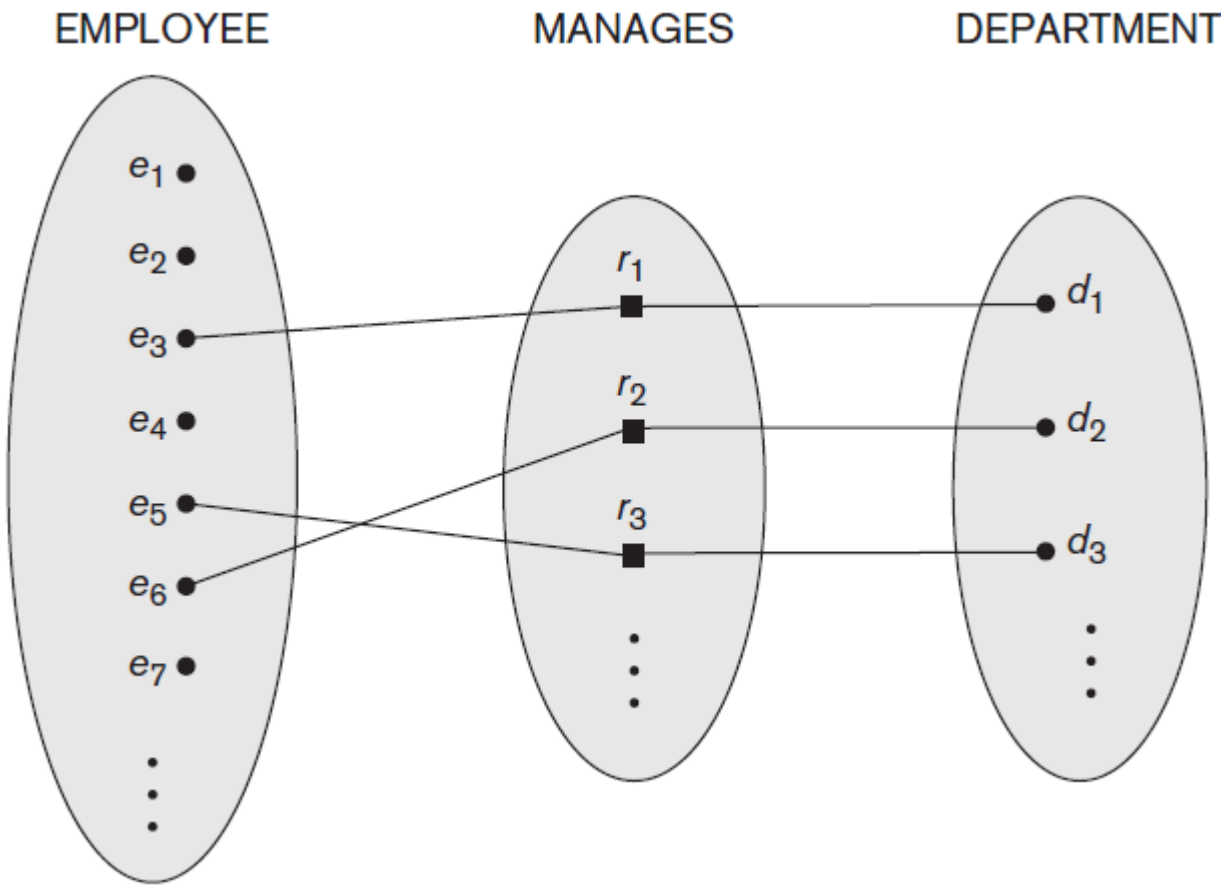
- *number* is a *partial key*. (denote with dashed underline).
- University is called the *identifying owner*.
- Participation in affiliation must be total. Why?

Two Types of Relationship Constraints (1)

- Cardinality ratios
  - Specifies the maximum number of relationship instances that an entity can participate in
  - E.g., in WORKS_FOR relationship, DEPARTMENT : EMPLOYEE is of cardinality ratio 1 : N
  - Means what?

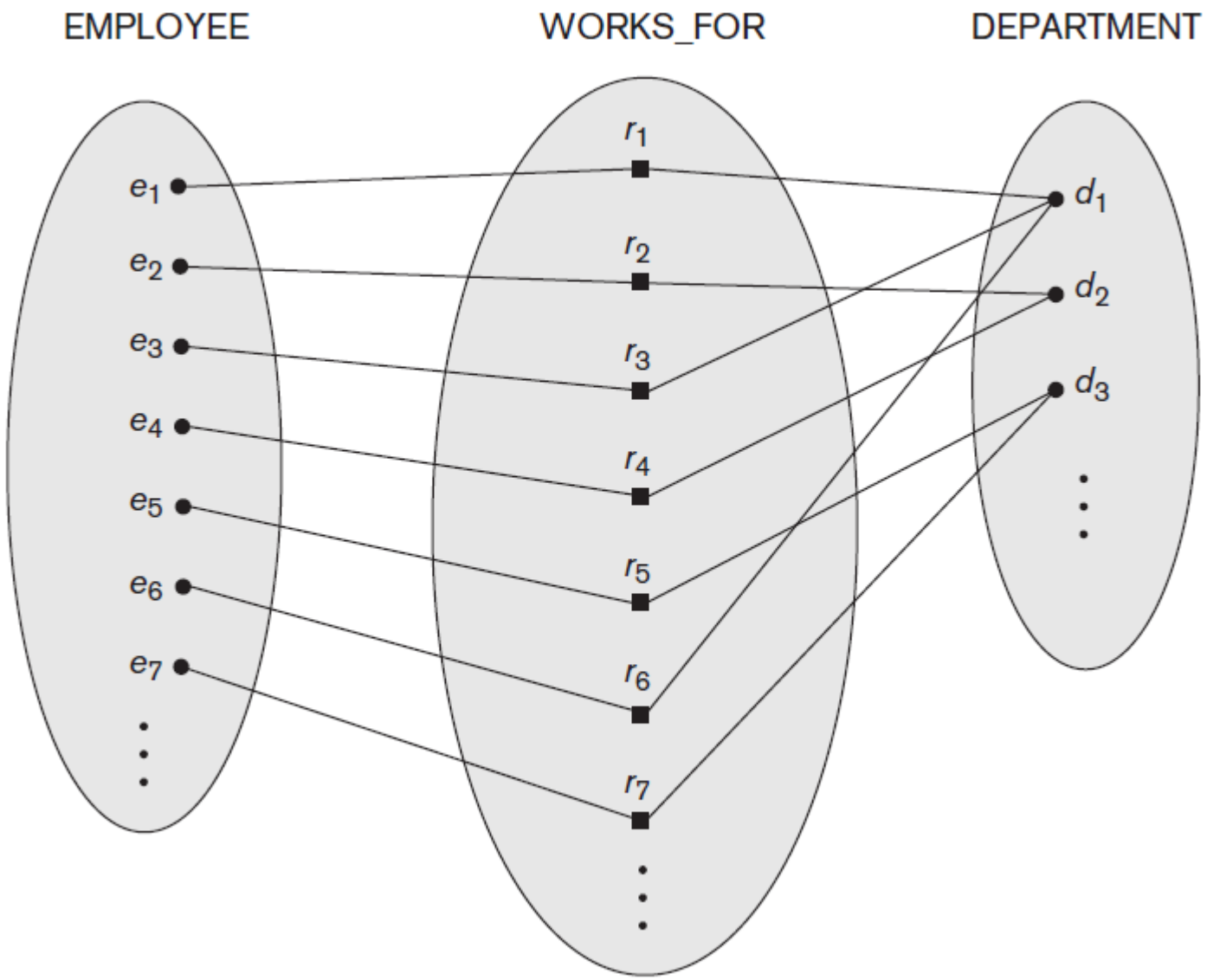
- Possible cardinality ratios
  - 1 : 1
  - 1 : N
  - N : 1
  - M : N

A Running Example of 1 : 1



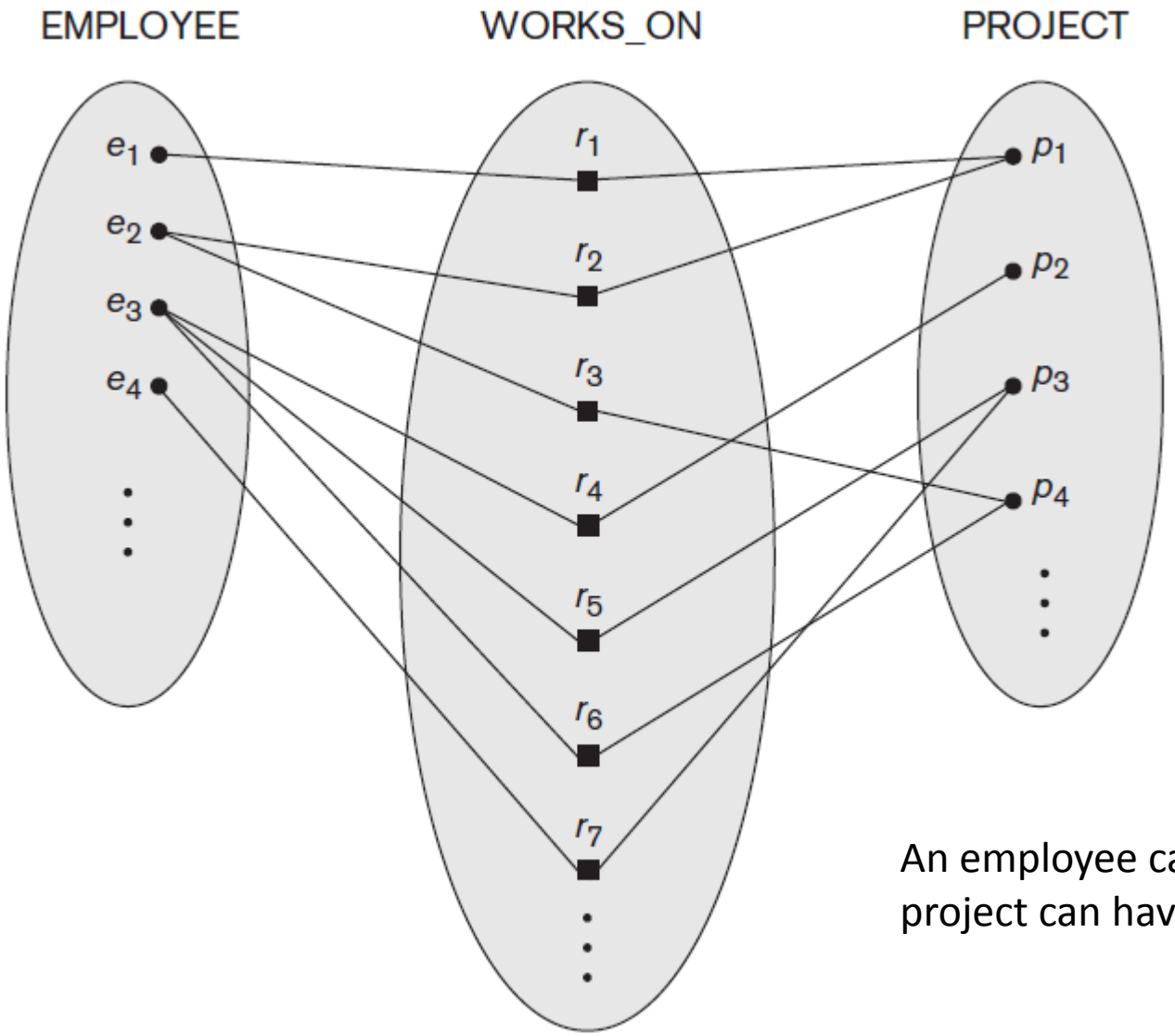
An employee can manage at most one department and a department can have at most one manager.

A Running Example of 1 : N



Constraint: each employee must work for exactly one department

A Running Example of M : N



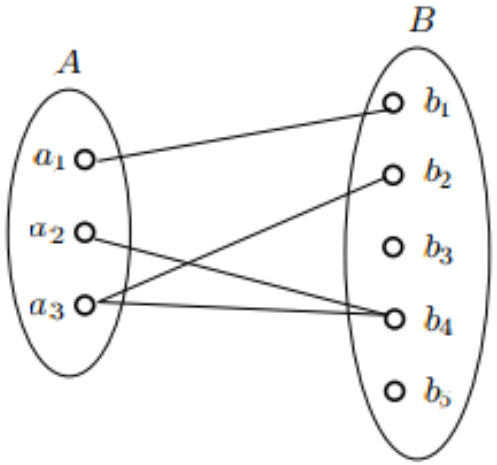
An employee can work on several projects and a project can have several employees

Two Types of Relationship Constraints (2)

- Participation constraints
  - Specifies the **minimum** number of relationship instances that each entity can participate in (also called minimum cardinality constraint)
    - *Total participation*
    - *Partial participation*

Two Types of Relationship Constraints (2) (cont.)

- Let *R* be a relationship set between entity sets *A* and *B*.
- The participation of *A* is **total** if every entity of A must participate in at least one relationship in *R*
- Otherwise, the participation of A is **partial**

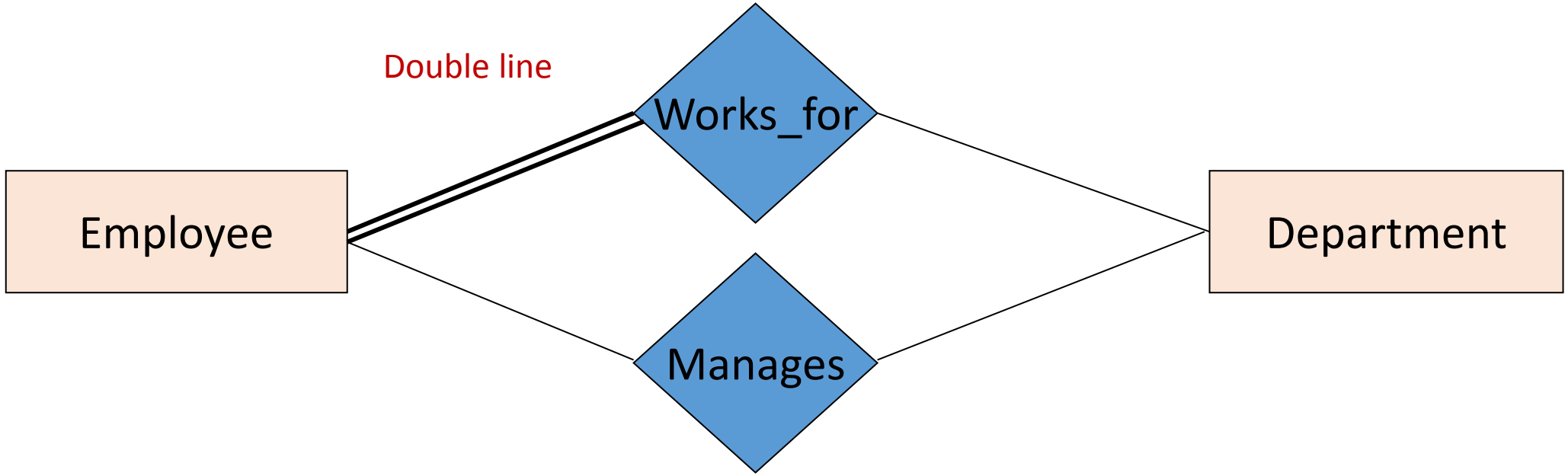


What's the participation of A?

What's the participation of B?

Two Types of Relationship Constraints (2) (cont.)

- E.g., “every employee must work for a department”

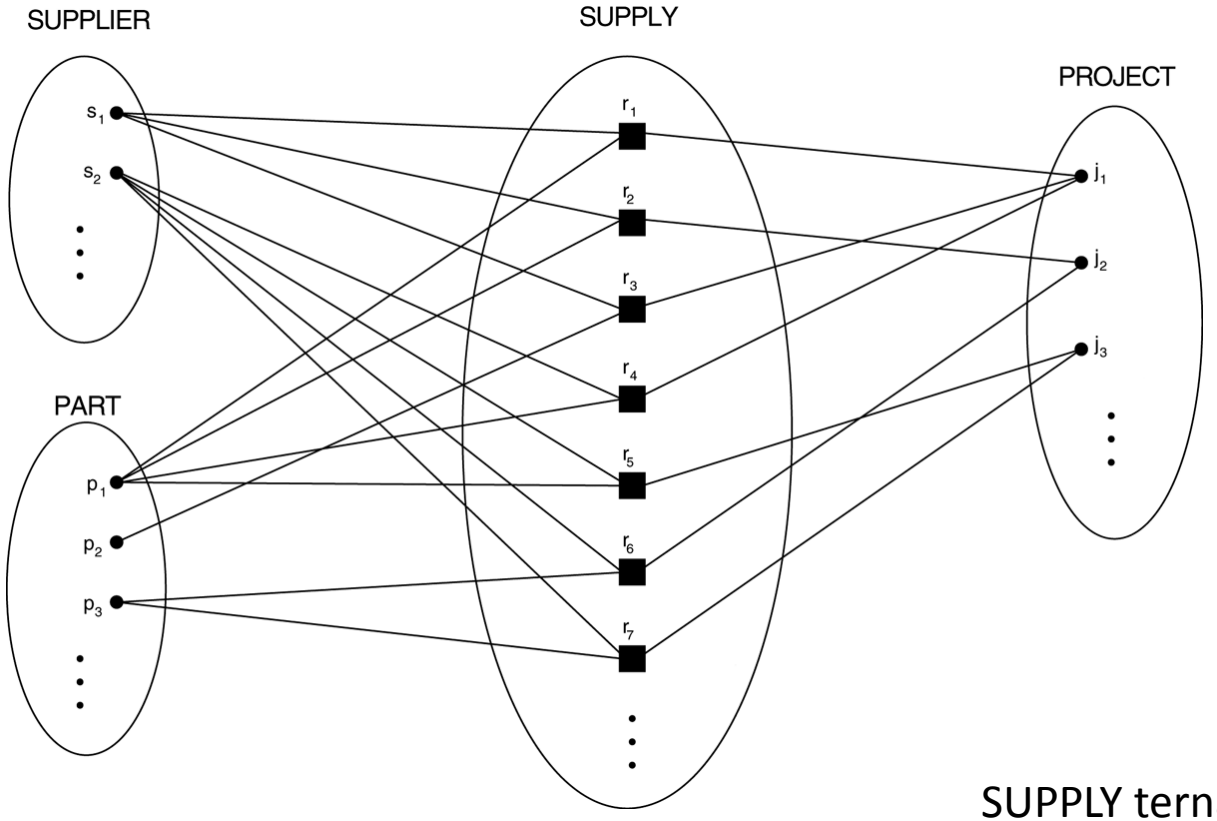


- We do not expect every employee to mange a department

We can include in an ER diagram a participation constraint in which participation of Employee in Works_for is **total**

N-ary Relationship

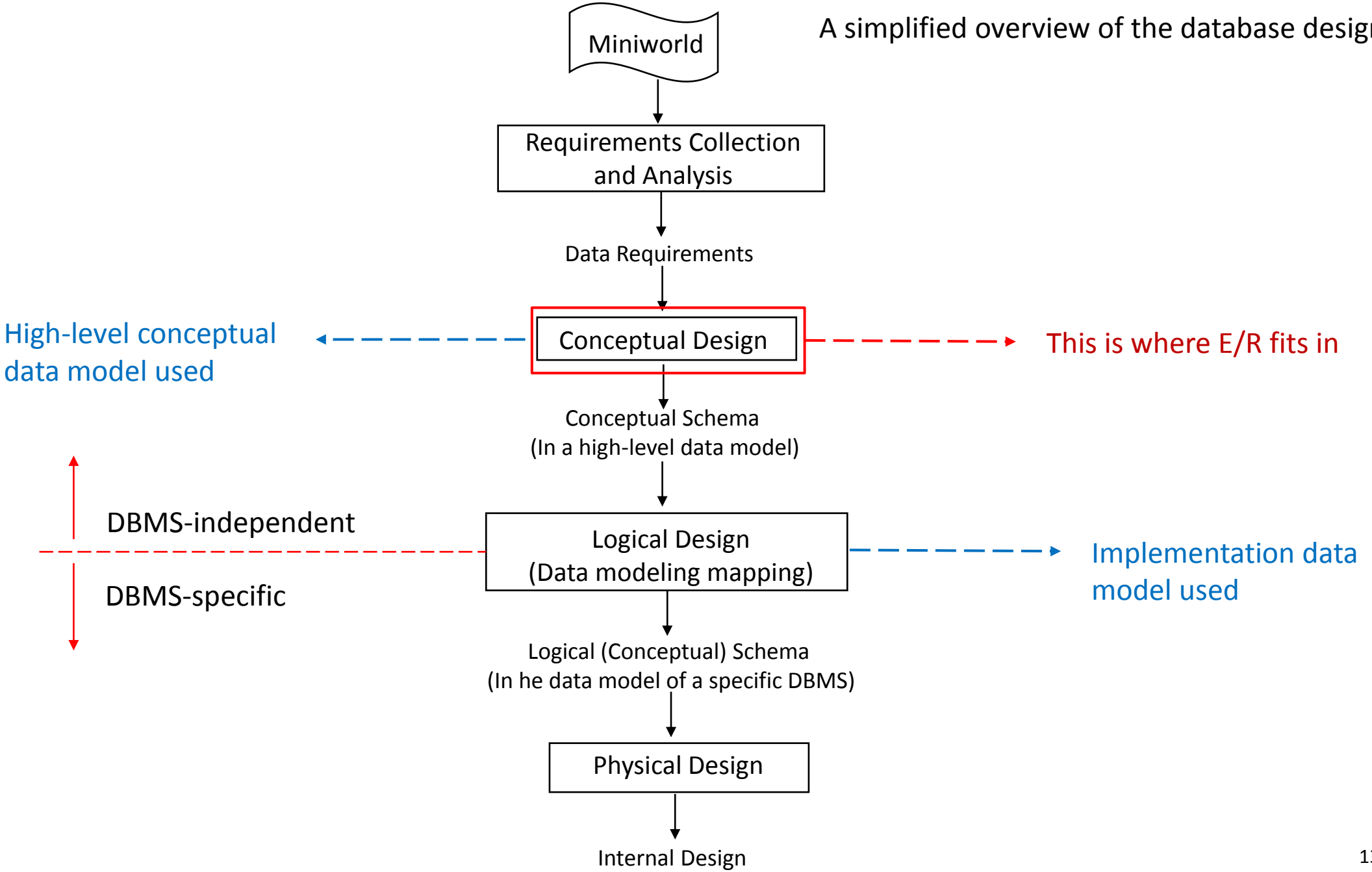
- Relationship *R* is called N-ary Relationship if
  - The number of *participating* **entity sets** is *n*



SUPPLY ternary relationship

Chapter 9: Relational Database Design by ER- and EER-to-Relational Mapping

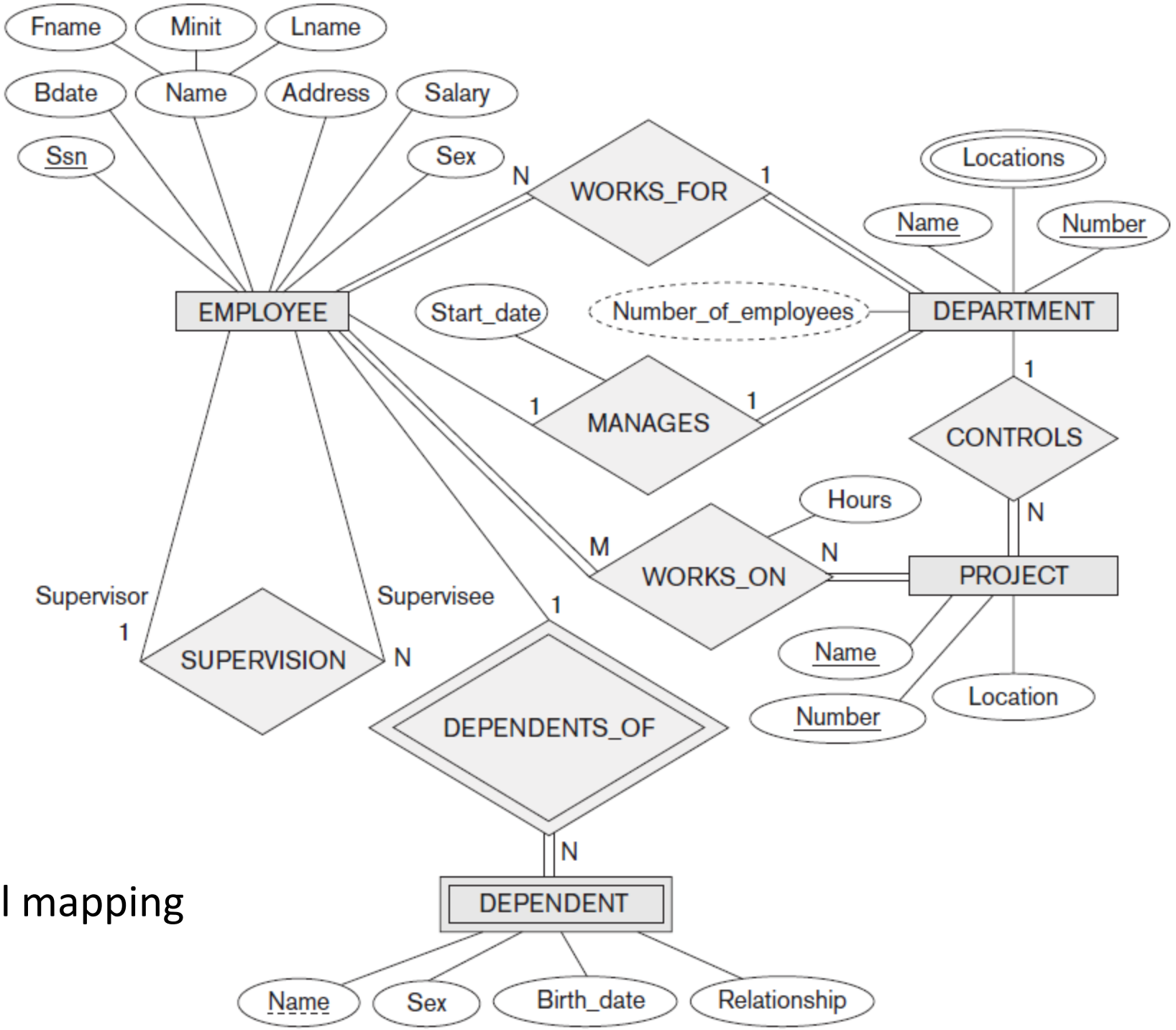
A simplified overview of the database design process



Objectives

- Convert the basic **ER model** — entity sets (strong and weak), binary relationships (with various structural constraints), *n*-ary relationships, and attributes (simple, composite and multivalued) — into **relations**

- Map **EER model** — specialization/generalization — into **relations**



ER-to-Relational mapping

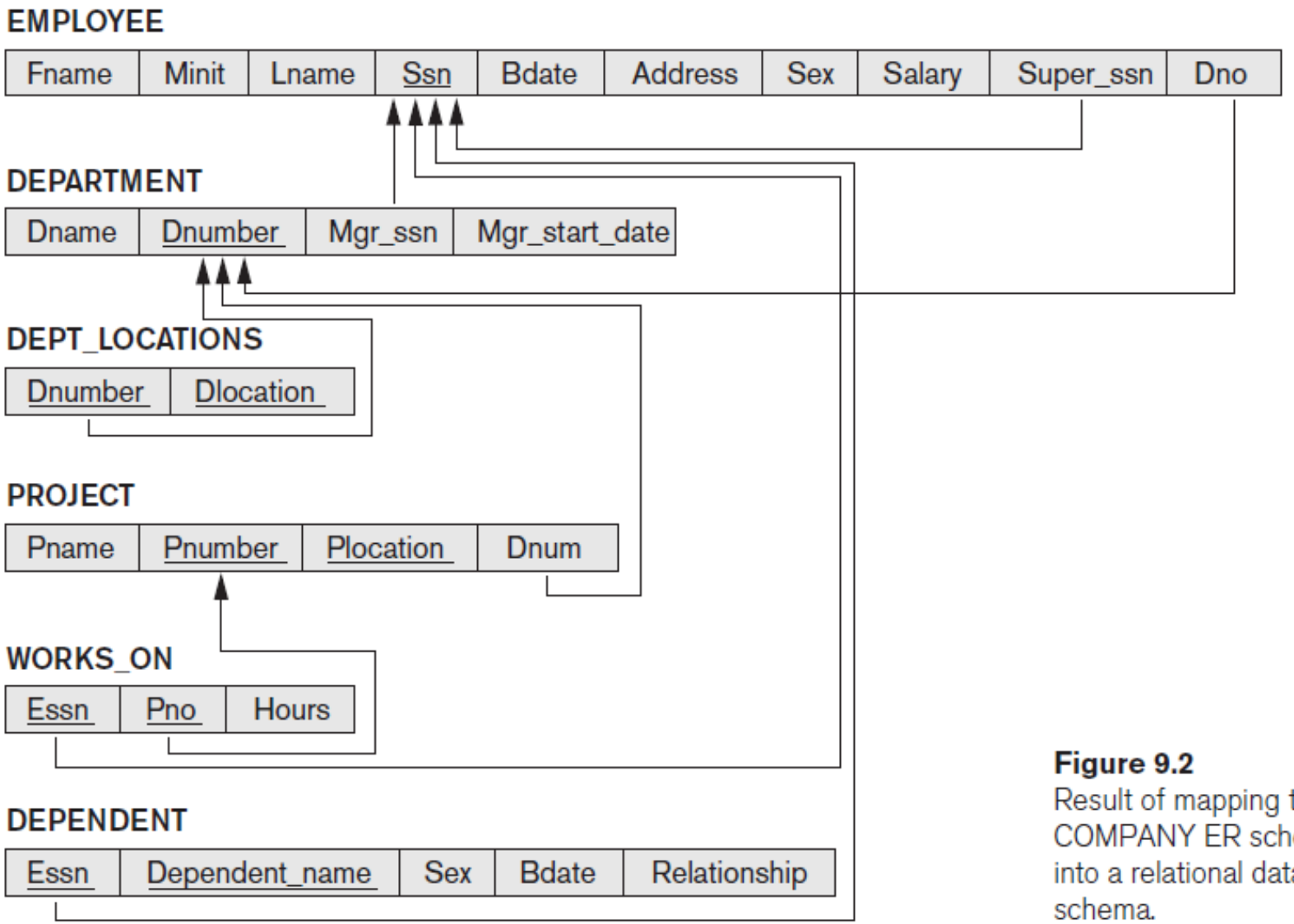
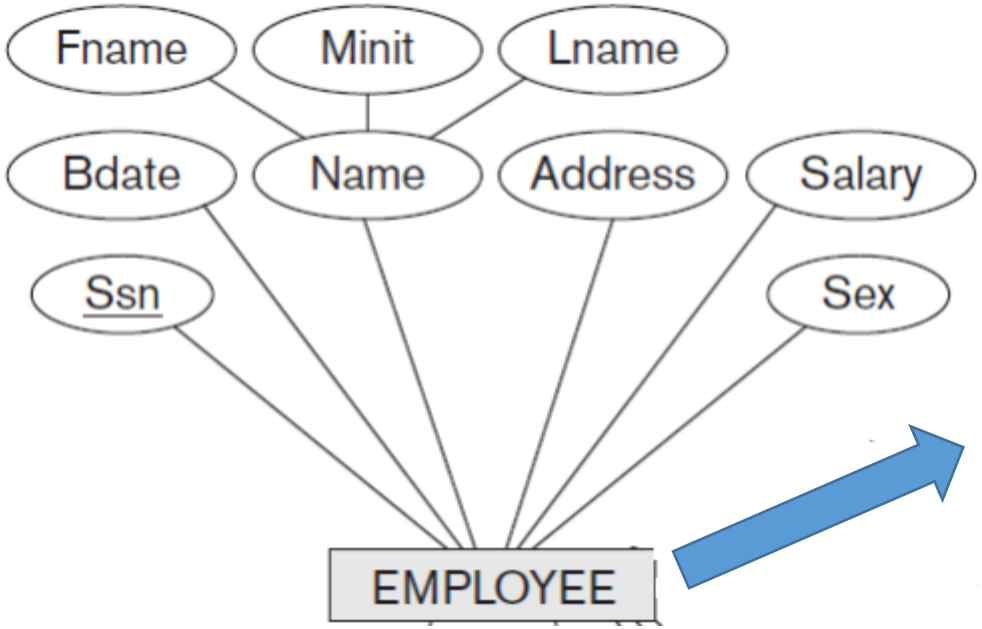


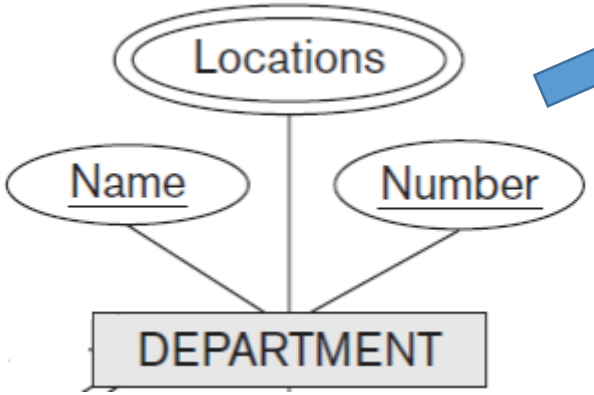
Figure 9.2
Result of mapping the COMPANY ER schema into a relational database schema.

Step 1—Mapping of Regular Entity Sets

- Mapping of regular **entity sets**
  - For each **regular entity set *E*** in ER schema, create a **relations *R*** that includes all the simple **attributes of *E***
  - Choose one of the **key attributes of *E*** as the **primary key** for ***R***
- See an example:

Step 1—Mapping of Regular Entity Sets (example)





EMPLOYEE

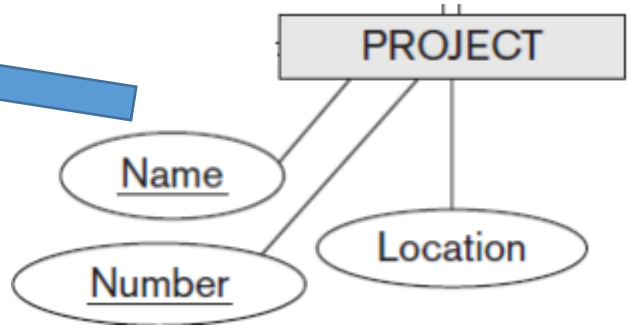
Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

Dname	Dnumber

PROJECT

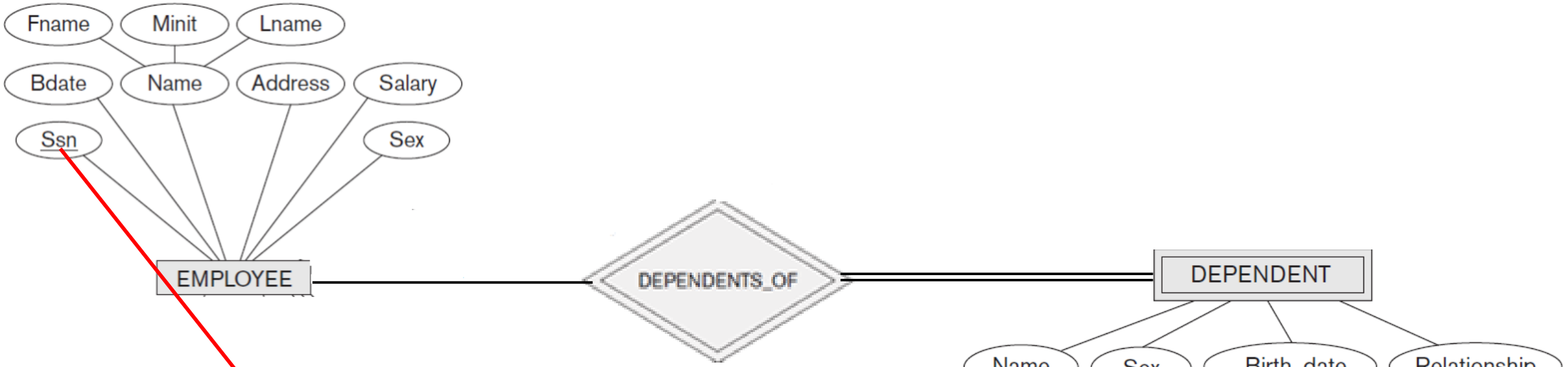
Pname	Pnumber	Plocation



Step 2—Mapping of Weak Entity Sets

- Mapping of weak **entity sets**
  - For each **weak entity set *W*** in ER schema with **owner entity set *E***, create a **relations *R***
  - Include all simple **attributes of *W*** as **attributes of *R***
  - Include **the primary key of the relation** that correspond to the **owner entity types**, as **foreign key of *R***
  - The **primary key of *R*** is the *combination* of the **primary key(s) of the owner(s)** and the **partial key of the weak entity type *W***
- See an example:

Step 2—Mapping of Weak Entity Sets (example)



DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

As foreign key

Step 3—Mapping of Binary 1:1 Relationship Types

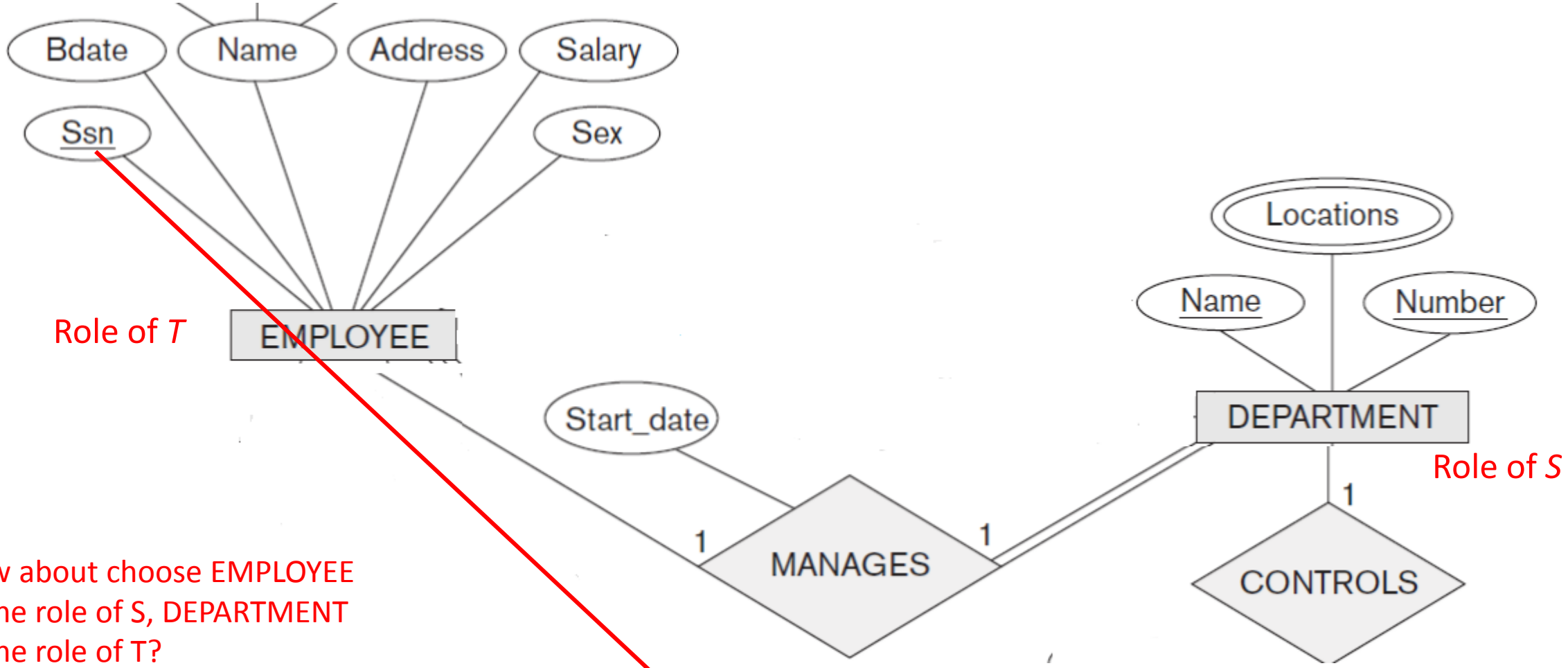
- For each **binary 1:1 relationship *R*** in ER schema, identify the **relation *S* and *T*** that *correspond to* the **entity sets participating in *R***

- Foreign key approach

Step 3—Mapping of Binary 1:1 Relationship Types (cont.)

- Choose one of the **relations**, say ***S***
- Include the **primary key of *T*** as a **foreign key of *S***
- Better to choose an entity set with ***total participation*** in *R* in the role of ***S***
- Include all the simple attributes of the 1:1 relationship *R* as attributes of ***S***.

- See an example:



How about choose EMPLOYEE in the role of S, DEPARTMENT in the role of T?

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

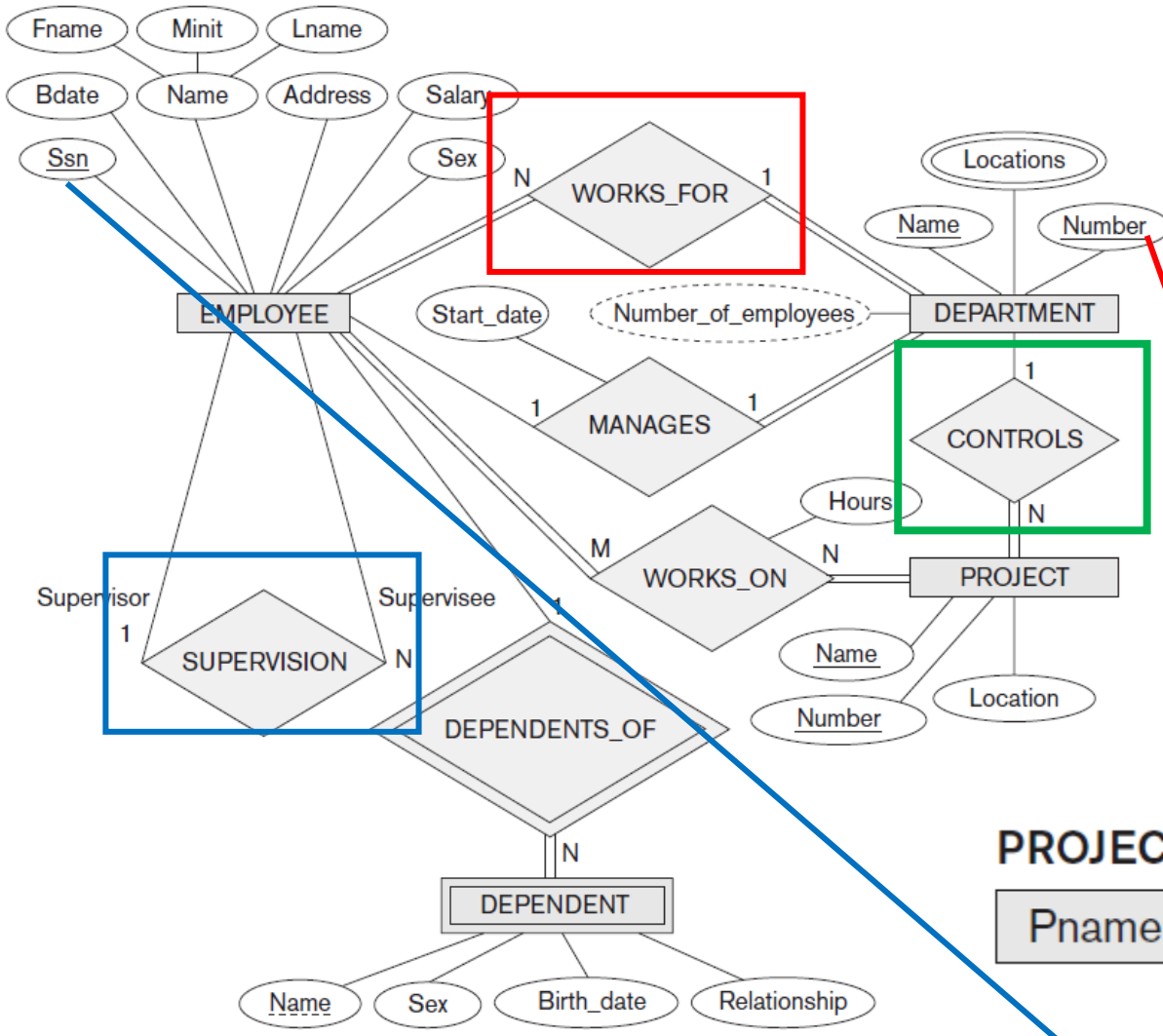
Step 4—Mapping of Binary 1:N Relationship Types

- For each **1:N relationship *R***, identify the **relation *S*** that represents the participating entity at **the *N*-side**

- Include as **foreign key in *S*** the **primary key of the relation *T*** that represents **the other entity** set participating in *R*

- Include any simple attributes of the 1:N relationship **as attributes of *S***

- See an example:



PROJECT

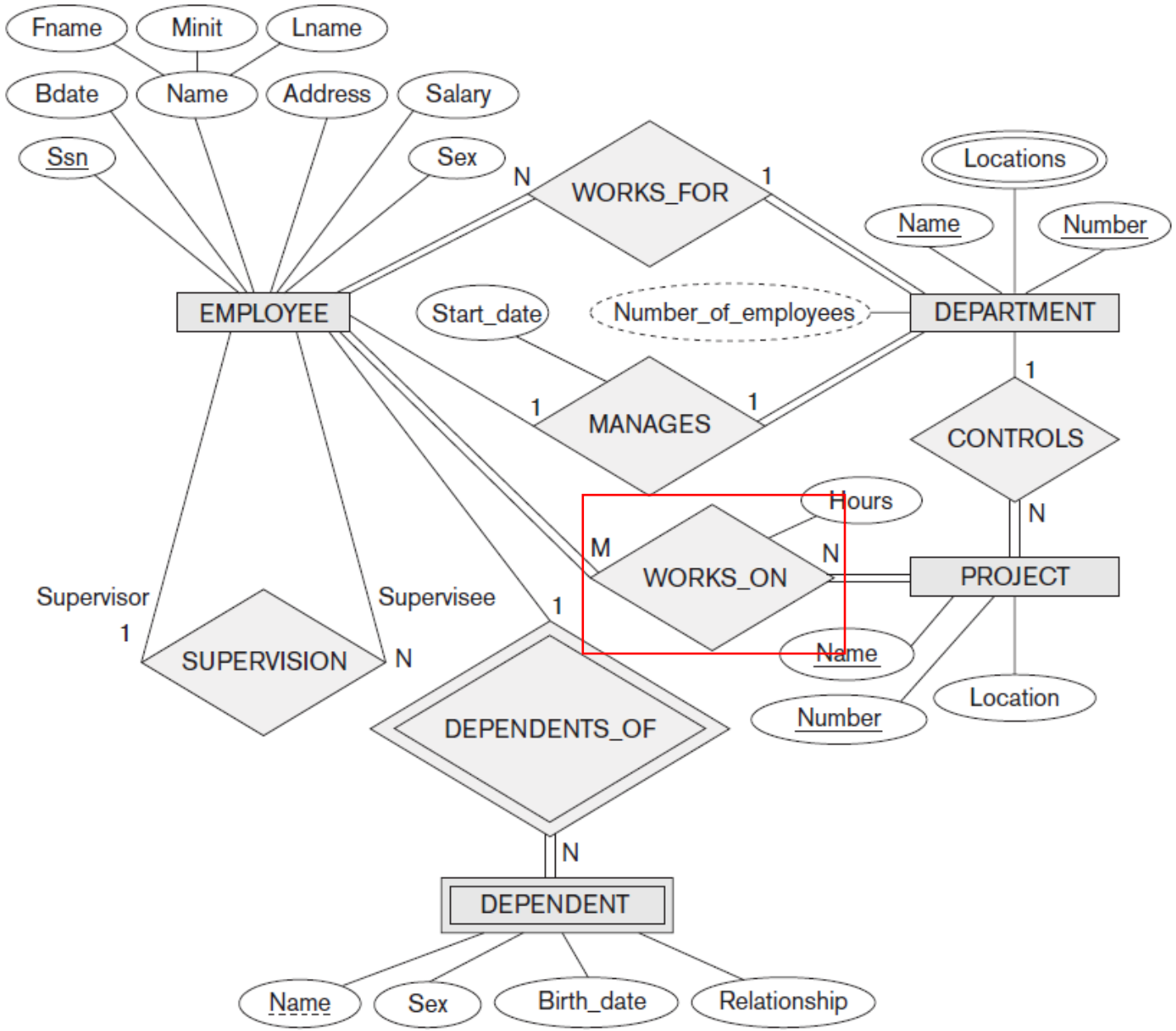
Pname	Pnumber	Plocation	Dnum

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

Step 5—Mapping of Binary M:N Relationship Types

- **Relationship relation** (cross-reference) approach
- For each M:N relationship *R*, create a new **relation S** to represent R
- Include as **foreign key in *S*** the **primary keys of the relations** that represent the **participating entity sets**
- There combination will form the primary key of *S*
- Also include any simple attributes of the M:N relationship as attributes of *S*
- See an example:

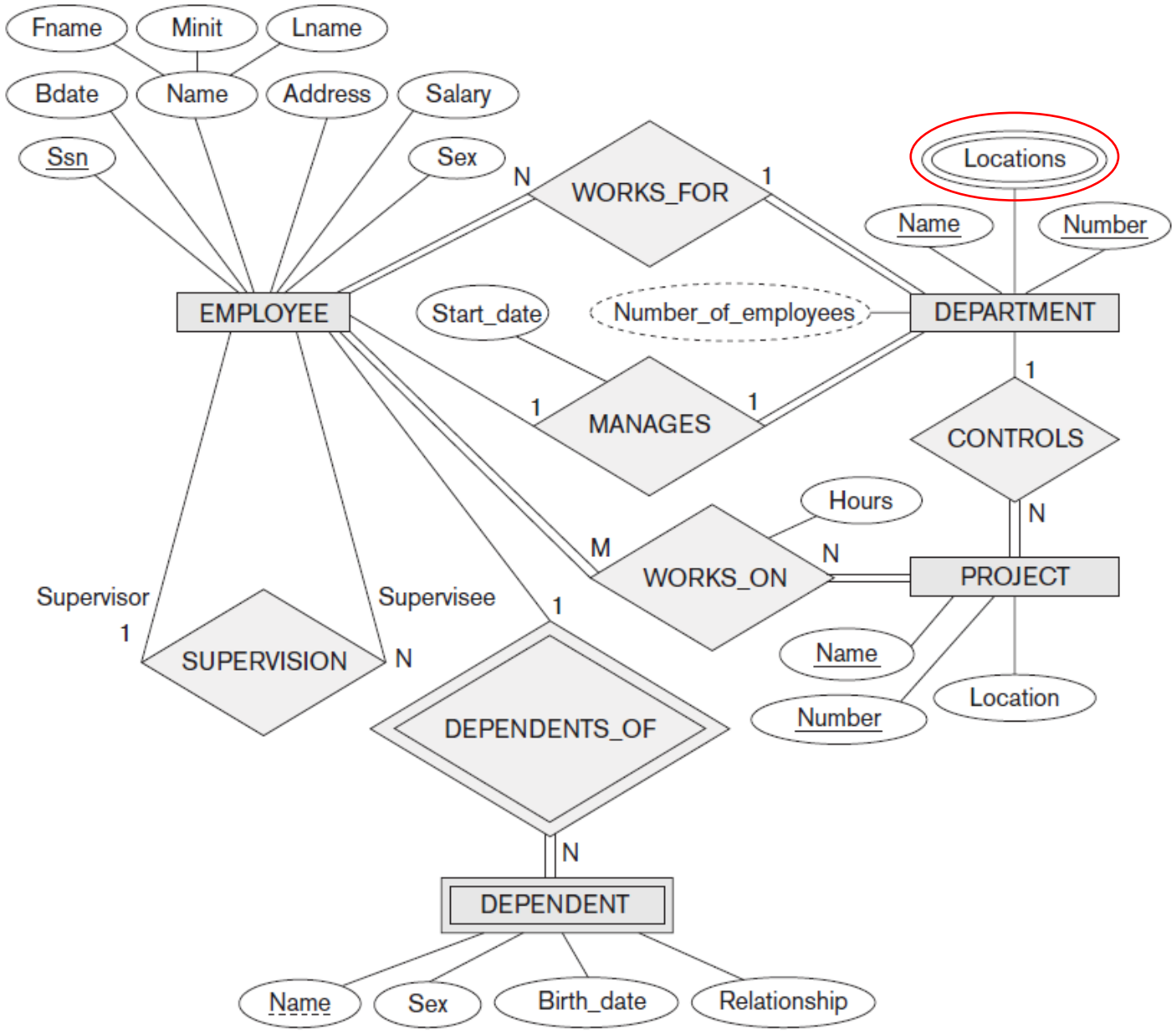


WORKS_ON

Essn	Pno	Hours

Step 6—Mapping of Multivalued Attributes

- For each multivalued attribute *A*, create a new relation *R*
- *R* will include an attribute corresponding to *A*
- Include as a **foreign key in *R*** the **primary key *K* of the relation** that represents the **entity set** that has ***A* as a multivalued attribute**
- The **primary key** of *R* is the **combination** of *A* and *K*
- See an example:



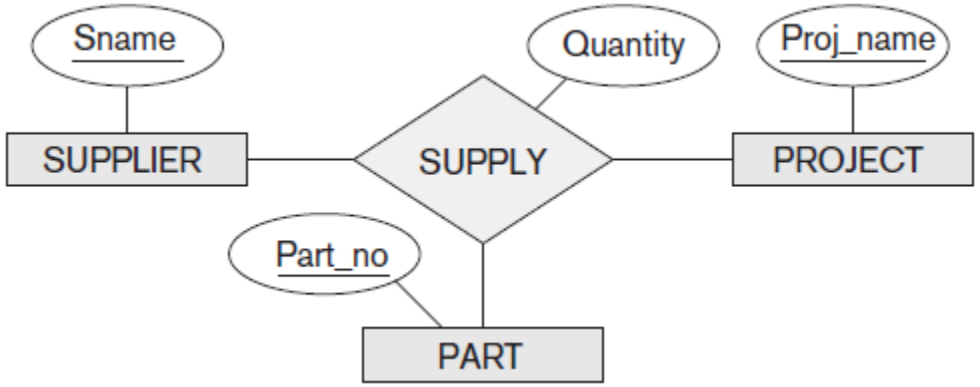
DEPT_LOCATIONS

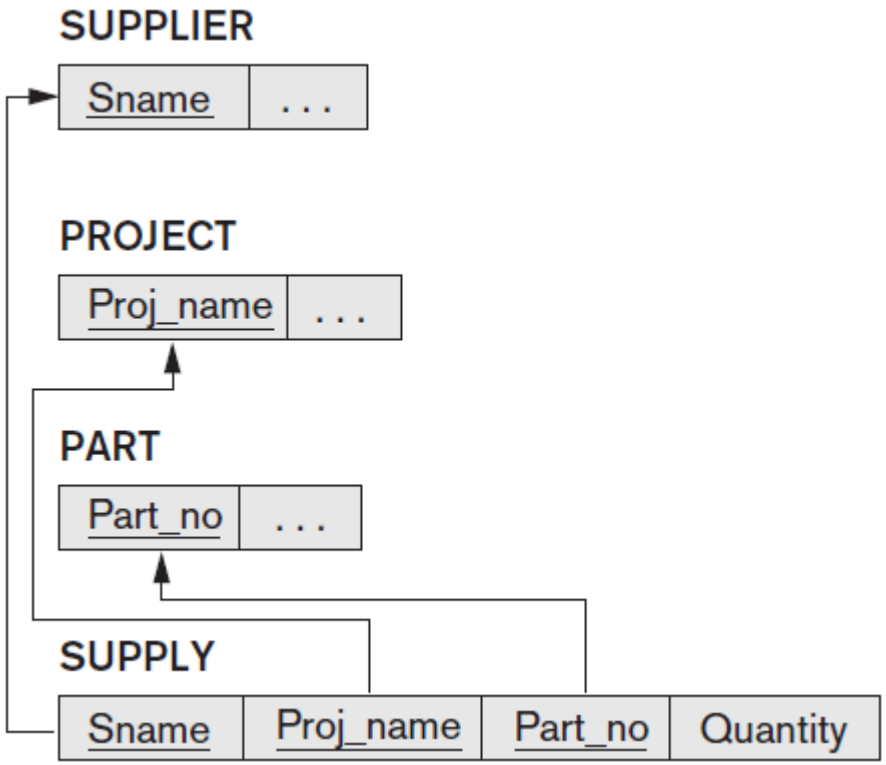
Dnumber	Dlocation

Step 7—Mapping of *N*-ary Relationship Types

- For each ***n*-ary relationship type *R***, where *n*>2, create a **new relationship relation *S*** to represent *R*
- Include as **foreign key** in *S* the **primary keys** of the relations represent the participating entity sets
- Also include any simple attributes of the *n*-ary relationship type as attributes of *S*
- The primary key of *S* is usually a combination of all the foreign keys that reference the relations representing the participating entity types
- See an example:

Step 7—Mapping of *N*-ary Relationship Types (cont.)





Summary

Table 9.1 Correspondence between ER and Relational Models

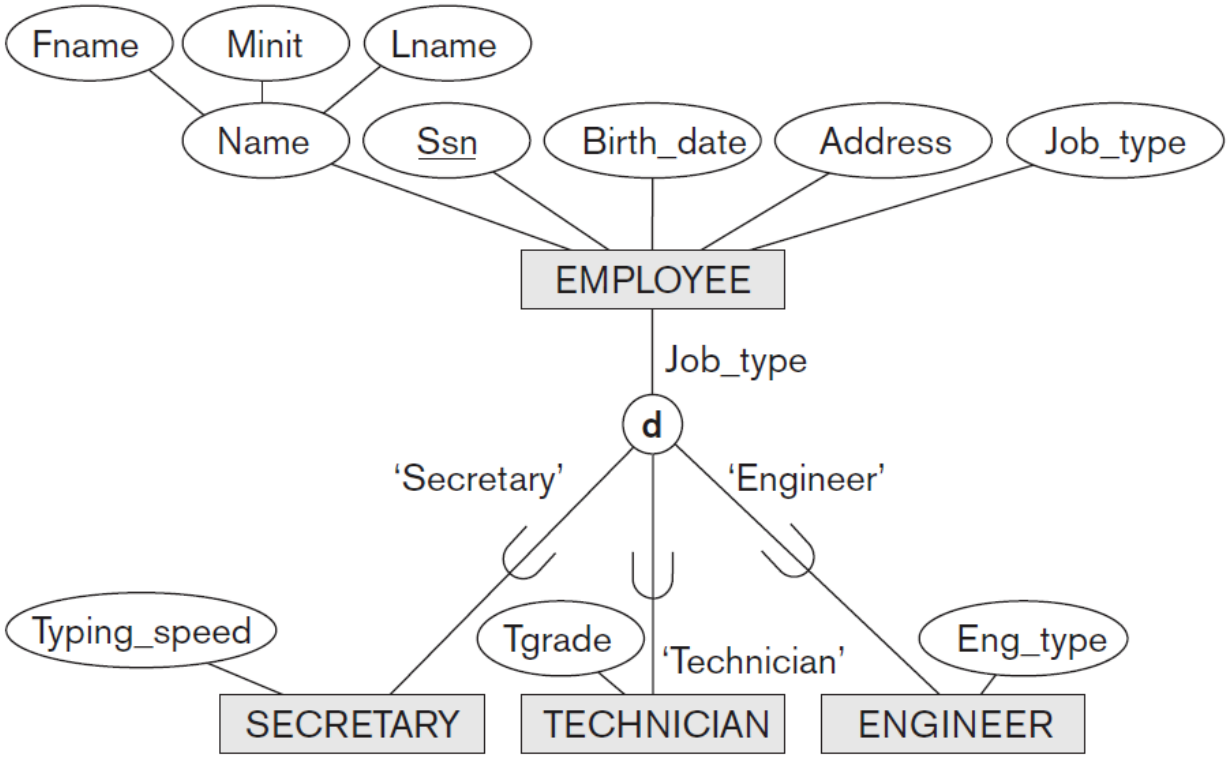
ER MODEL	RELATIONAL MODEL
Entity type	*Entity* relation
1:1 or 1:N relationship type	Foreign key (or *relationship* relation)
M:N relationship type	*Relationship* relation and *two* foreign keys
n-ary relationship type	*Relationship* relation and *n* foreign keys
Simple attribute	Attribute
Composite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

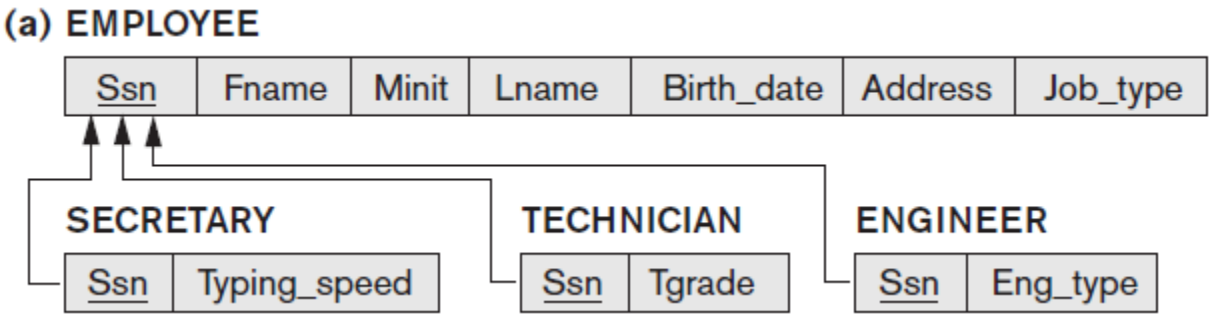
Mapping EER Model to Relations

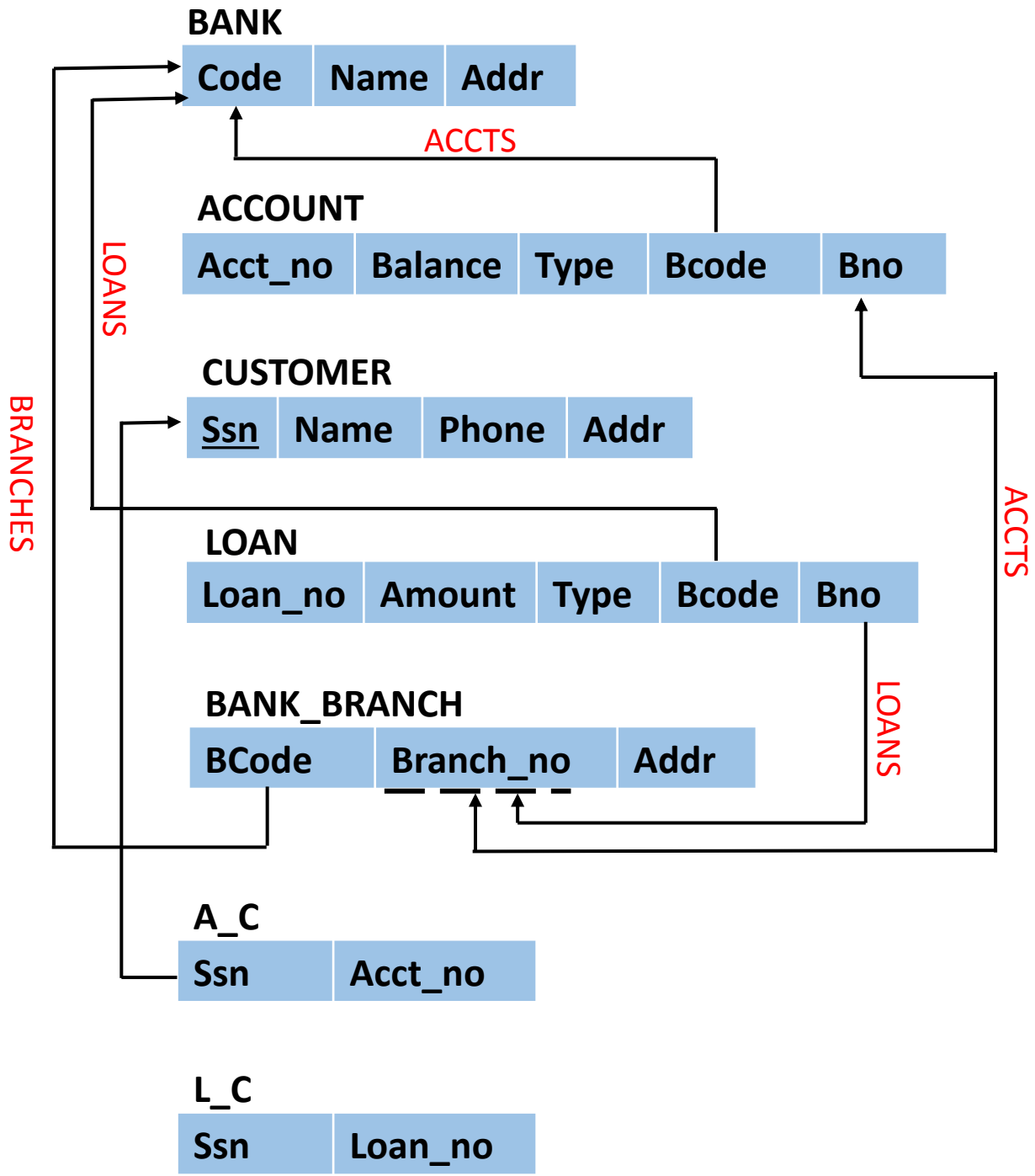
Step 8—Mapping Specialization or Generalization

- Convert **each specialization** with m subclasses $\{S_1, S_2, \ldots, S_m\}$ and **superclass *C***, where the attributes of C are $\{k, a_1, \ldots, a_n\}$ and k is the primary key, into relation schemas using one of the following options:
  - Option 8A:
    - 1) Create a relation L for C with attributes Attrs(L) = $\{k, a_1, \ldots, a_n\}$ and PK(L) = k.
    - 2) Create a relation L_i for each subclass S_i, $1 \leq i \leq m$, with the attributes Attrs(L_i) = $\{k\} \cup$ {attributes of S_i} and PK(L_i) = k.
  - This option works for any specialization (total or partial, disjoint or overlapping).
- See an example:

Step 8—Mapping Specialization or Generalization (example)







An ER diagram for a BANK database schema.