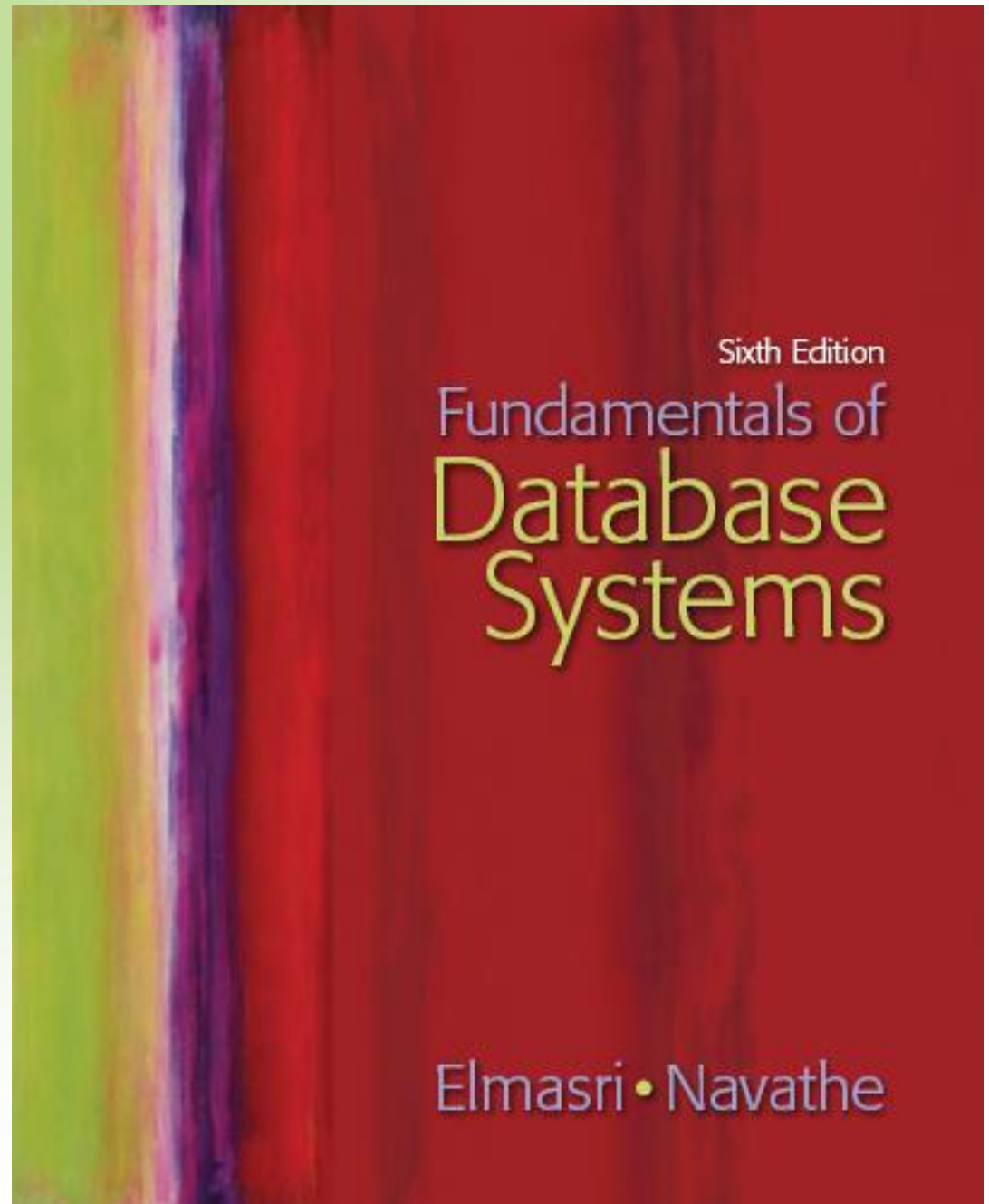


Chapter 9

Relational Database Design by ER- and to- Relational Mapping



Chapter 9 Outline

- Relational Database Design Using ER-to-Relational Mapping

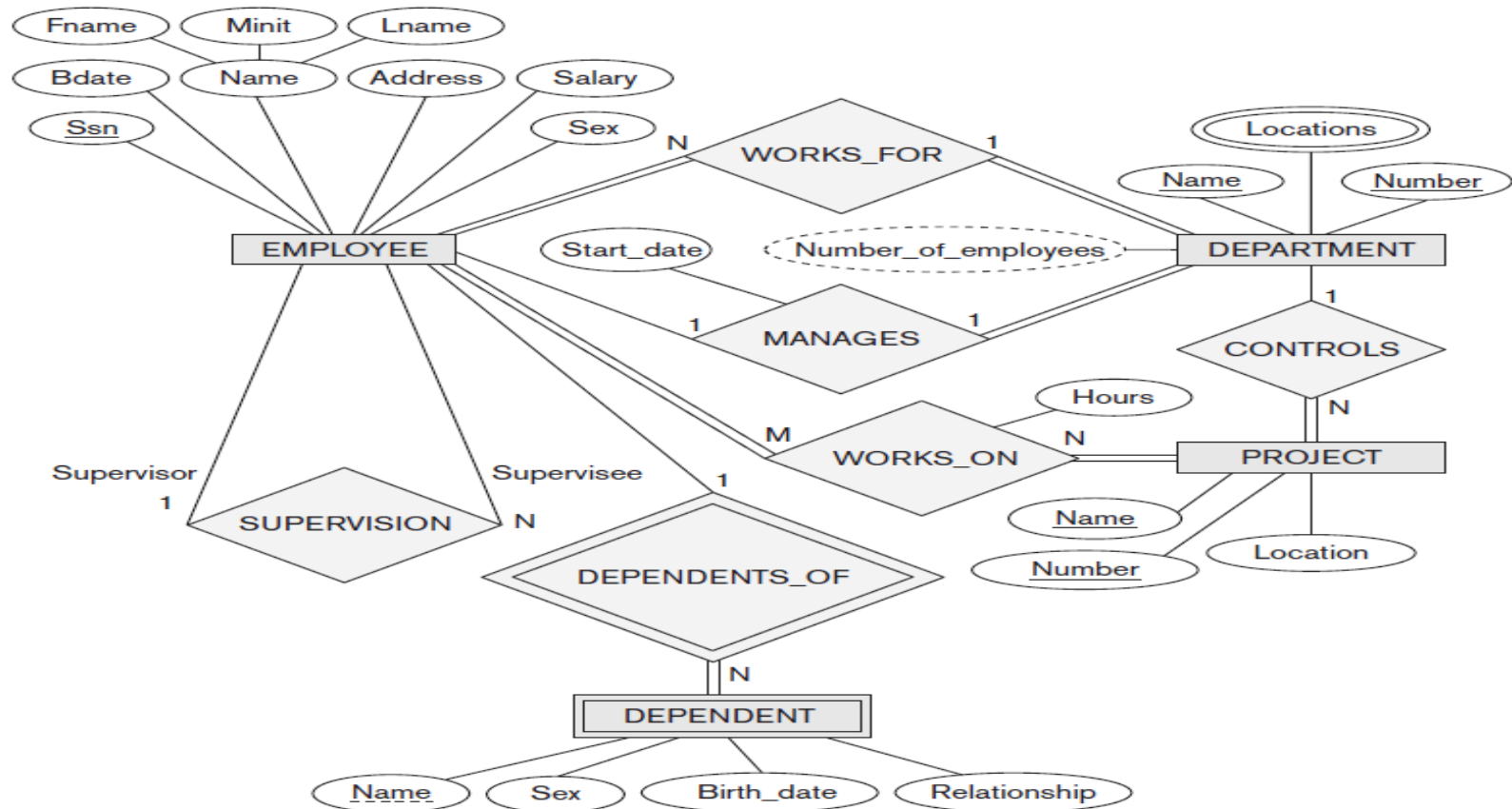
Relational Database Design by ER- and EER-to- Relational Mapping

- **Design a relational database schema**
 - Based on a conceptual schema design
- Seven-step algorithm to convert the basic ER model constructs into relations

Relational Database Design Using ER-to-Relational Mapping

Figure 9.1

The ER conceptual schema diagram for the COMPANY database.



ER-to-Relational Mapping Algorithm

- COMPANY database example
 - Assume that the mapping will create tables with **simple single-valued attributes**
- Step 1: Mapping of Regular Entity Types
 - For each regular entity type, create a relation R that includes all the simple attributes of E
 - Called **entity relations**
 - Each tuple represents an entity instance

ER-to-Relational Mapping Algorithm (cont'd.)

- Step 2: Mapping of Weak Entity Types
 - For each weak entity type, create a relation R and include all simple attributes of the entity type as attributes of R
 - Include primary key attribute of owner as foreign key attributes of R

Mapping Regular and Weak Entities

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary
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DEPARTMENT

Dname	<u>Dnumber</u>
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PROJECT

Pname	<u>Pnumber</u>	Plocation
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DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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ER-to-Relational Mapping Algorithm (cont'd.)

- Step 3: Mapping of Binary 1:1 Relationship Types
 - For each binary 1:1 relationship type
 - Identify relations that correspond to entity types participating in R
 - Possible approaches:
 - **Foreign key approach**
 - **Merged relationship approach**
 - **Crossreference or relationship relation approach**

<u>Dnumber</u>	Dname
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It is better to put in the relation with total participation the primary key of the other relation as a foreign key

1:1 Mapping: Merged Relation Approach

<u>SSN</u>	Fname	Mname	Lname	Salary	Bdate	Address
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<u>Dnumber</u>	Dname
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This is possible when both participations are total

1:1 Mapping: Cross Reference

<u>SSN</u>	Fname	Mname	Lname	Salary	Bdate	Address
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<u>Dnumber</u>	Dname
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Create new relation containing the two primary key of the two relations and then choose one of them to be primary key

Mapping 1:M Relationship

- Step 4: Mapping of Binary 1:N Relationship Types
 - For each regular binary 1:N relationship type
 - Identify relation that represents participating entity type at *N*-side of relationship type
 - Include primary key of other entity type as foreign key in *S*
 - Include simple attributes of 1:N relationship type as attributes of *S*

Mapping 1:M Relationship (cont'd.)

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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PROJECT

Pname	<u>Pnumber</u>	<u>Plocation</u>	Dnum
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DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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Mapping M:N Relationship

- Step 5: Mapping of Binary $M:N$ Relationship Types
 - For each binary $M:N$ relationship type
 - Create a new relation S
 - Include primary key of participating entity types as foreign key attributes in S
 - Include any simple attributes of $M:N$ relationship type

Mapping M:N Relationship (cont'd.)

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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PROJECT

Pname	<u>Pnumber</u>	<u>Plocation</u>	Dnum
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WORKS_ON

<u>Essn</u>	<u>Pno</u>	Hours
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DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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ER-to-Relational Mapping Algorithm (cont'd.)

- Step 6: Mapping of Multivalued Attributes
 - For each multivalued attribute
 - Create a new relation
 - Primary key of R is the combination of A and K
 - If the multivalued attribute is composite, include its simple components

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
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PROJECT

Pname	<u>Pnumber</u>	<u>Plocation</u>	Dnum
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WORKS_ON

<u>Essn</u>	<u>Pno</u>	Hours
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DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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Figure 9.2

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

Summary

- Map conceptual schema design in the ER model to a relational database schema
 - Algorithm for ER-to-relational mapping
 - Illustrated by examples from the COMPANY database