Data Modeling using the

Entity-Relationship Model

Fundamental of Database System (Edition 7)
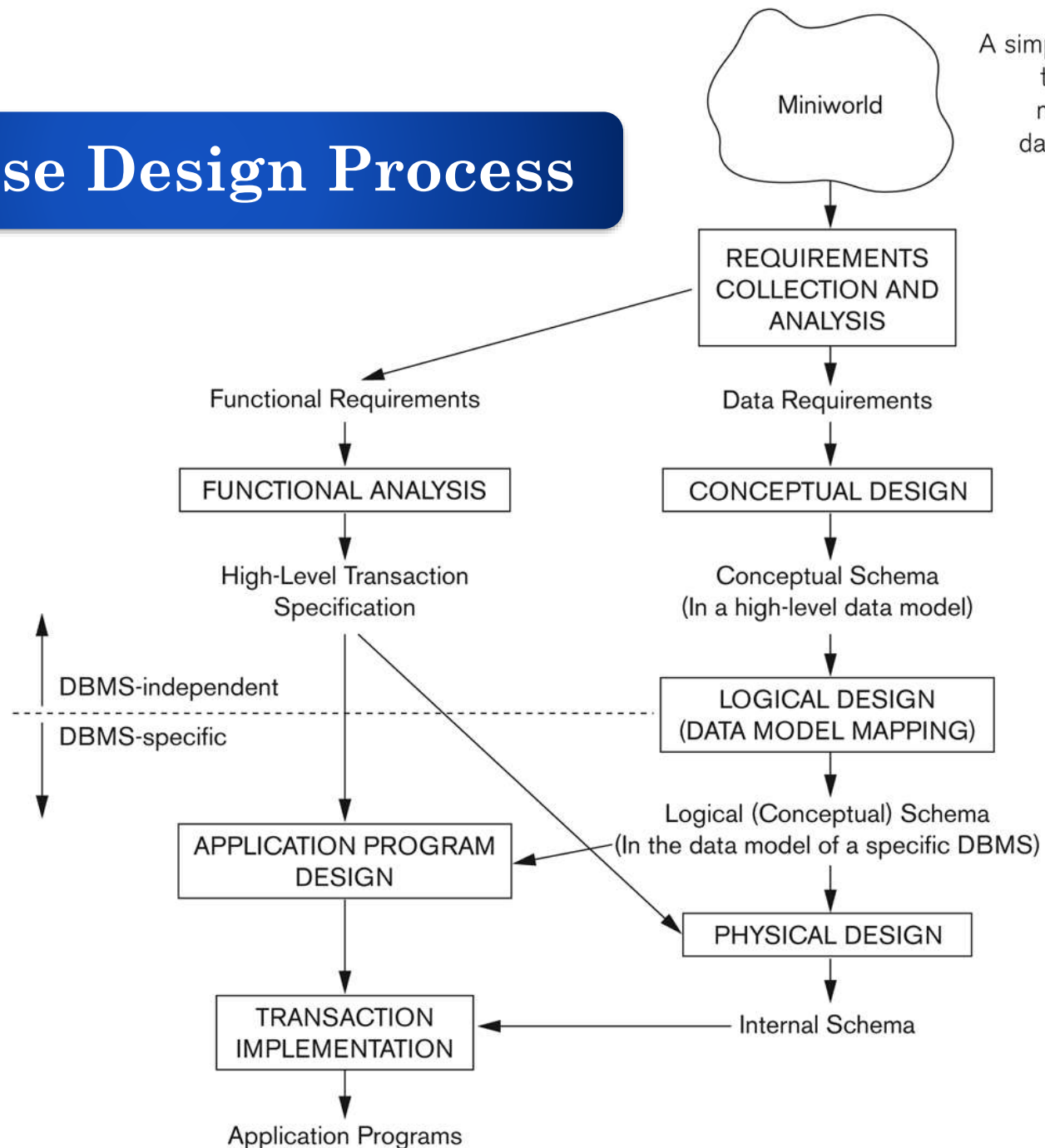
Chapter 3

ER Model (only do Chen notation …

skip the min-max notation)

Database Design Process

Figure 3.1
A simplified diagram to illustrate the main phases of database design.

Miniworld

REQUIREMENTS COLLECTION AND ANALYSIS

Functional Requirements

Data Requirements

FUNCTIONAL ANALYSIS

CONCEPTUAL DESIGN

High-Level Transaction Specification

Conceptual Schema
(In a high-level data model)

DBMS-independent

DBMS-specific

LOGICAL DESIGN
(DATA MODEL MAPPING)

Logical (Conceptual) Schema
(In the data model of a specific DBMS)

APPLICATION PROGRAM DESIGN

PHYSICAL DESIGN

TRANSACTION IMPLEMENTATION

Internal Schema

Application Programs

ER MODEL CONCEPTS

Entities

- specific objects in the mini-world with an independent existence
- E.g. EMPLOYEE John , Research DEPARTMENT

Attributes

- They are properties used to describe an entity.
- Each attribute has a data type
  - integer, string, subrange, enumerated type, …
- Key attribute

Entities with the same basic attributes are grouped into an **Entity type.**

Types of Attributes

Simple
- Each entity has a single atomic value for the attribute.
- For example, SSN.

Composite
- The attribute is composed of several components.
  - **Address**(House#, Street, City, State, Zip, Country),
  - **Name**(FirstName, MiddleName, LastName).

Multi-valued
- An entity may have multiple values for that attribute.
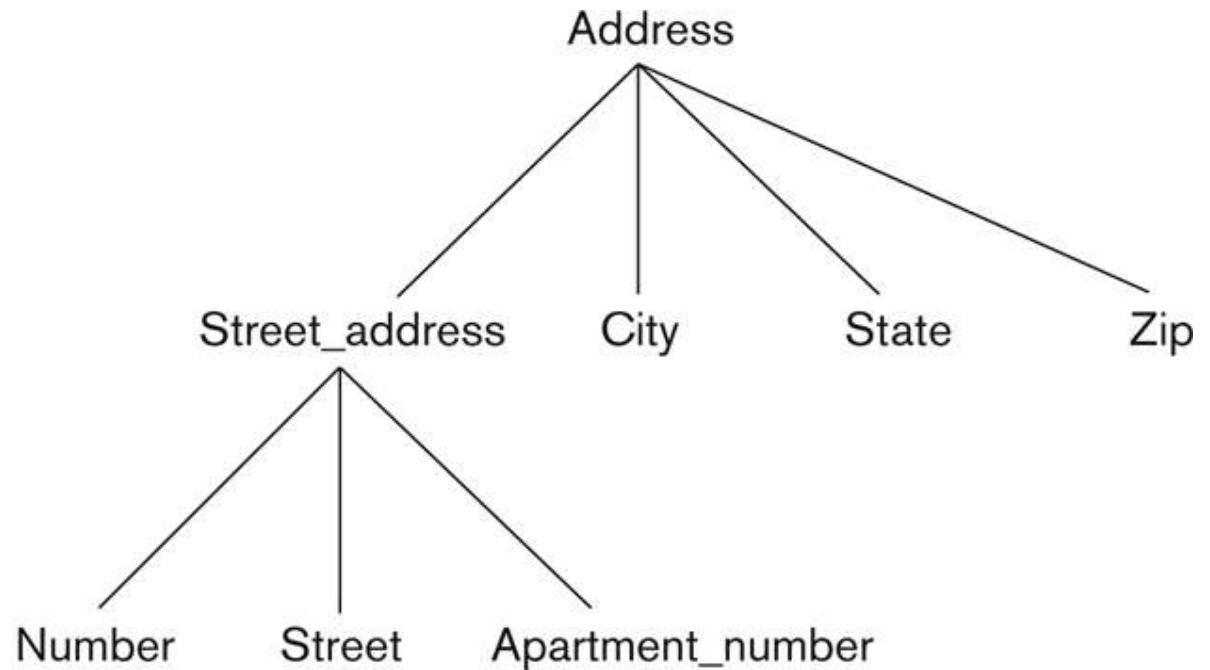- For example: **PreviousDegrees** of a STUDENT.

EXAMPLE OF A COMPOSITE ATTRIBUTE

Figure 3.4
A hierarchy of composite attributes.

TYPES OF ATTRIBUTES

- The composite and multi-valued attributes may be nested arbitrarily to any number of levels,

  - PreviousDegrees of a STUDENT is a composite multi-valued attribute

    {PreviousDegrees (College, Year, Degree, Field)}

    - Multiple PreviousDegrees values can exist
    - Each has four subcomponent attributes:
      - College, Year, Degree, Field

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ENTITY TYPE CAR WITH TWO KEYS AND A CORRESPONDING ENTITY SET

(a)
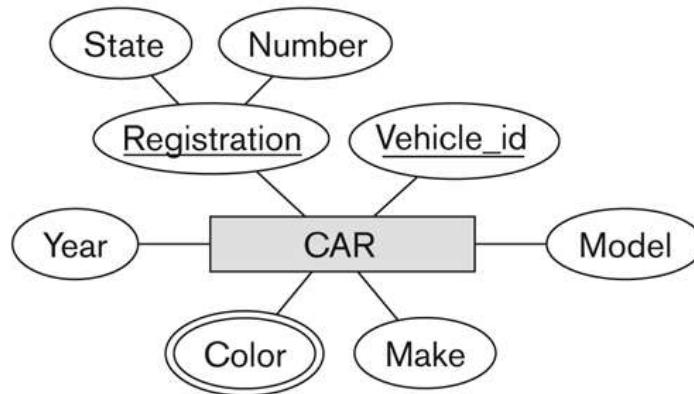
Figure 3.7
The CAR entity type with two key attributes, Registration and Vehicle_id. (a) ER diagram notation. (b) Entity set with three entities.

State   Number

Registration   Vehicle_id

Year — CAR — Model

Color   Make

Entity set is the current *state* of the entities that is stored in the database

(b)

CAR
Registration (Number, State), Vehicle_id, Make, Model, Year, {Color}

CAR_1
((ABC 123, TEXAS), TK629, Ford Mustang, convertible, 2004 {red, black})

CAR_2
((ABC 123, NEW YORK), WP9872, Nissan Maxima, 4-door, 2005, {blue})

CAR_3
((VSY 720, TEXAS), TD729, Chrysler LeBaron, 4-door, 2002, {white, blue})

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INITIAL DESIGN OF ENTITY TYPES

Entity types in the COMPANY database:
EMPLOYEE
DEPARTMENT
PROJECT
DEPENDENT
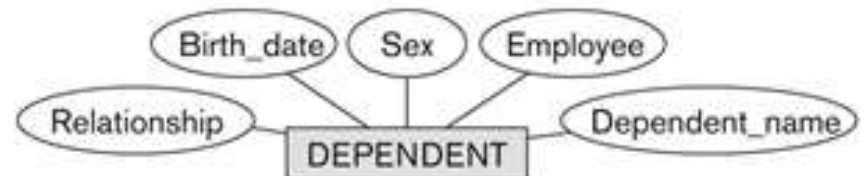
REFINING THE INITIAL DESIGN BY INTRODUCING RELATIONSHIPS

Some aspects in the requirements will be represented as **relationships**

ER model

main concepts

Entities

Attributes

Relationships

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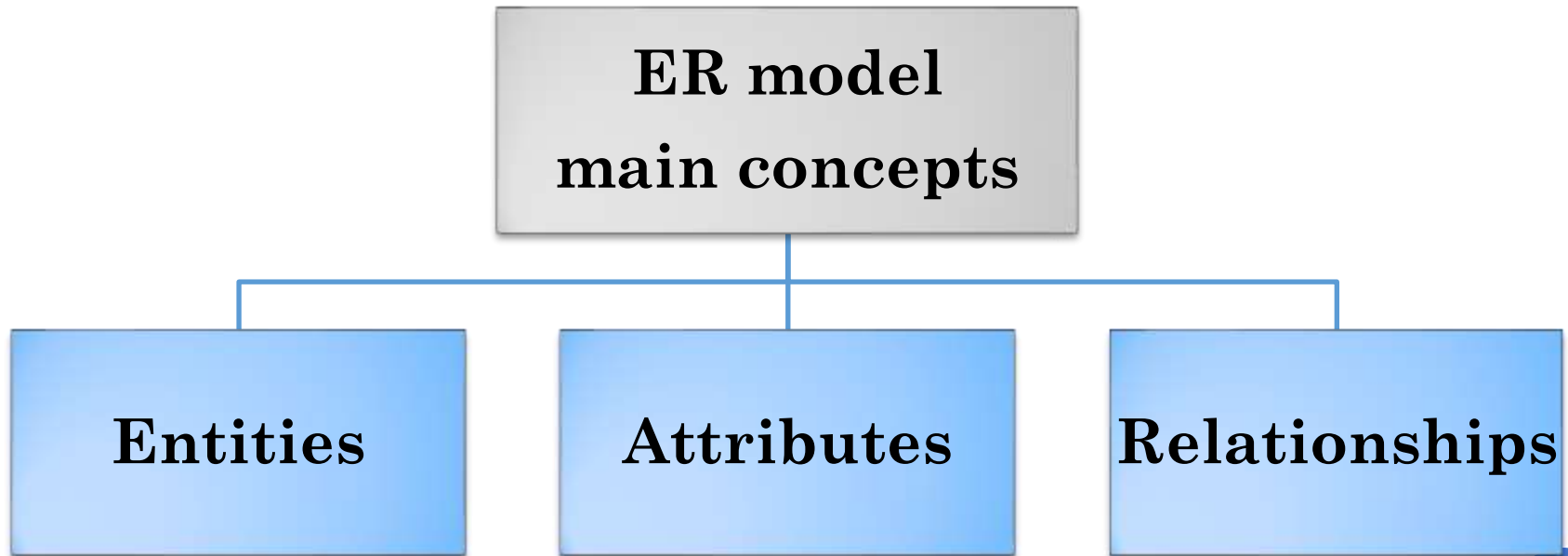
RELATIONSHIPS

A **relationship** relates two or more distinct entities with a specific meaning.

- For example, EMPLOYEE John *works on* the PX PROJECT,
- EMPLOYEE Franklin *manages* the Research DEPARTMENT.

Relationships of the same type are grouped into a **relationship type**.
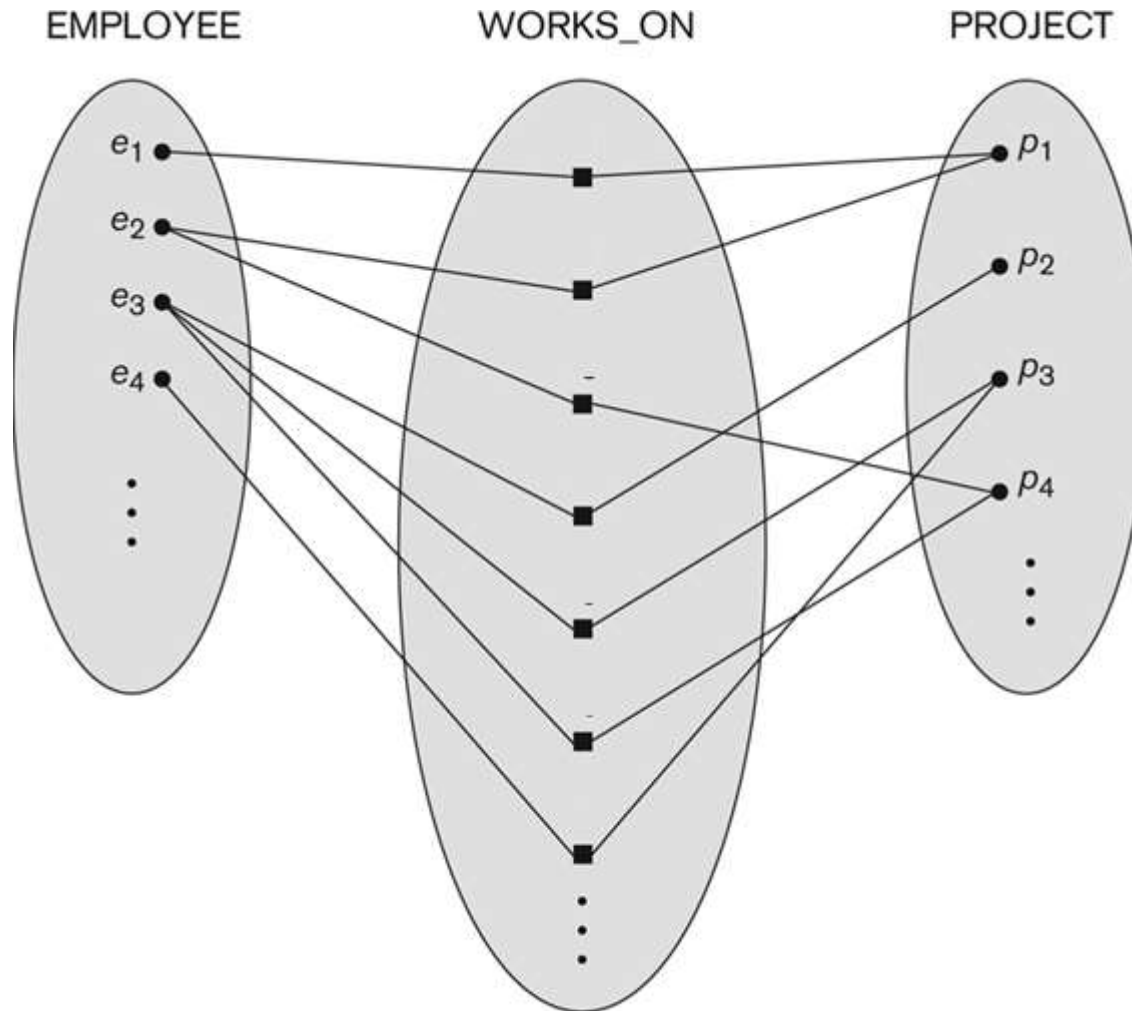
Degree of a relationship type is the no of participating entity types.

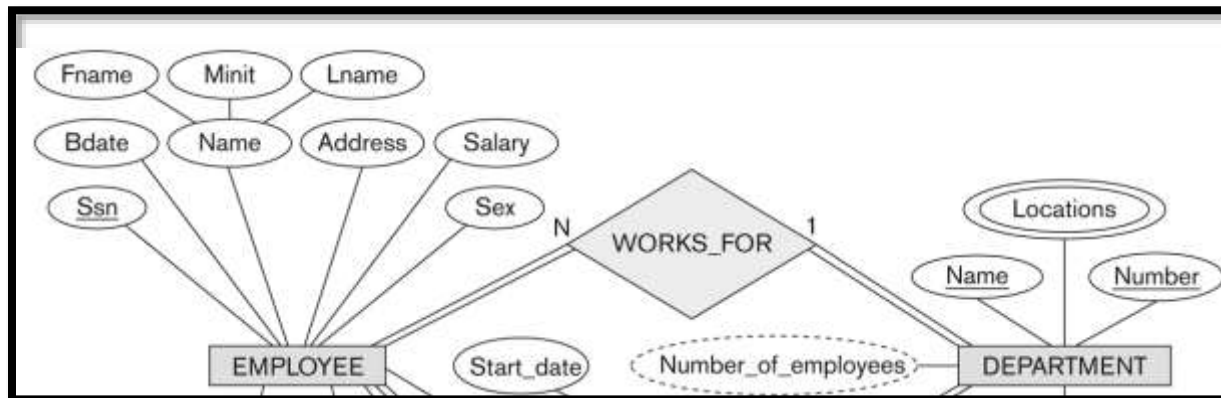- Both MANAGES and WORKS_ON are *binary* relationships.

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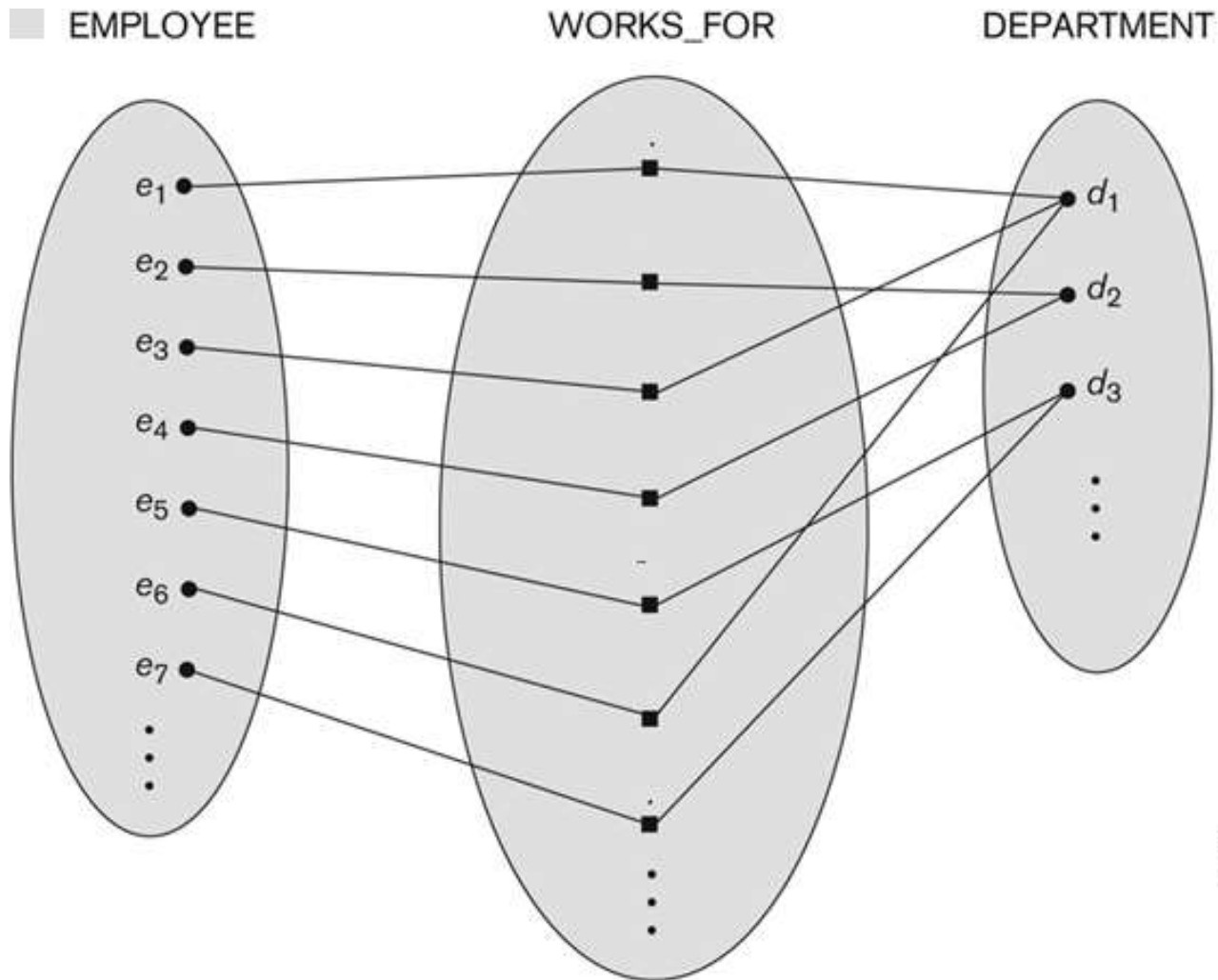
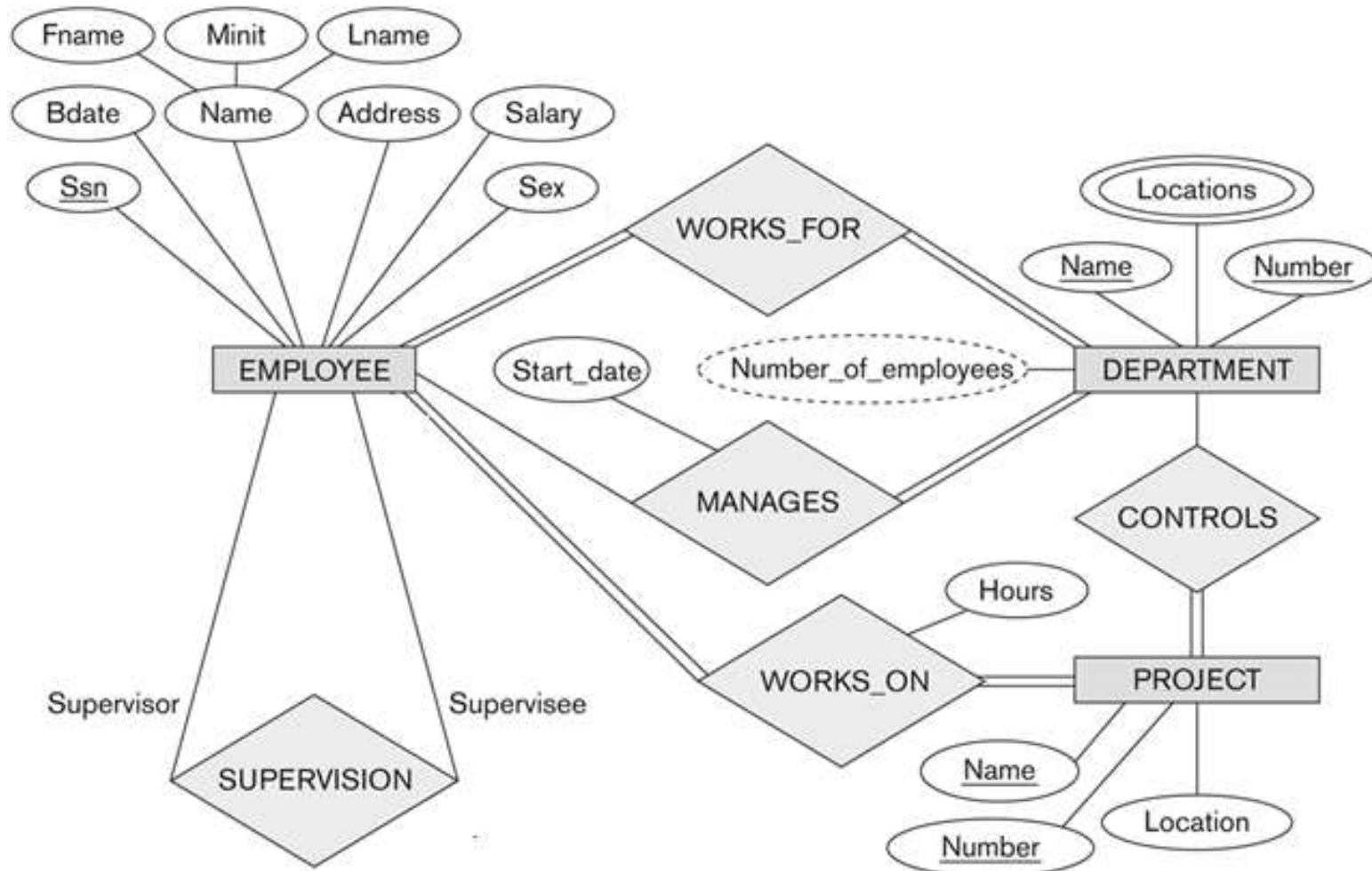# RELATIONSHIP TYPE VS. RELATIONSHIP SET

Relationship Type:

- Is the schema description of a relationship
- Identifies the relationship name and the participating entity types
- Also identifies certain relationship constraints

Relationship Set:

- The current *state* of a relationship type

ER DIAGRAM in **Chen Notation**

Recursive Relationship

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