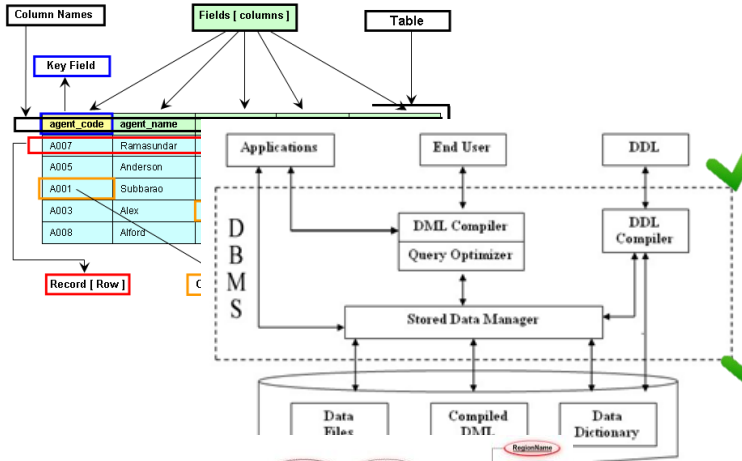
# DATABASE CONCEPTS &
# ER MODEL

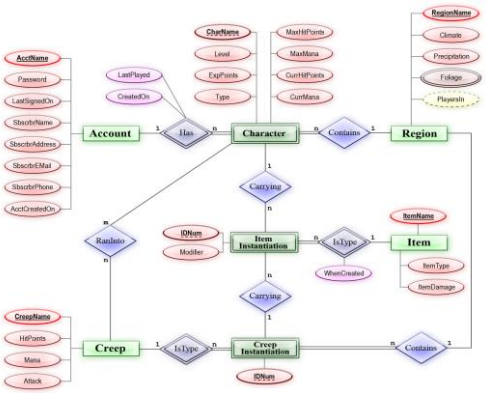
Instructor:

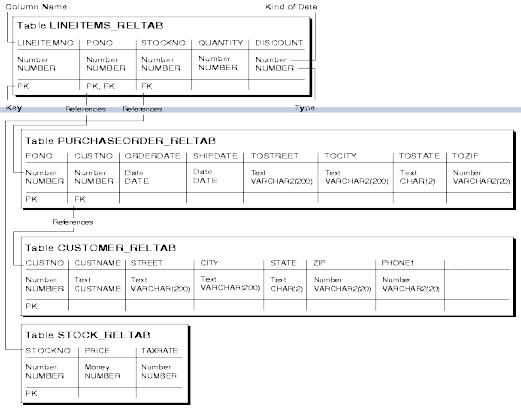
# Learning Goals

**By the end of this lecture students should be able to:**

- Understand an overview of the basic RDBMS Concepts
- Understand an insight into the architecture and components of a Database System.
- Describe how entities, attributes and relationships are used to model data;
- Converting ER Model to relational schema



# Table of contents

- SQL Overview SQL Overview
- The Relational Database
- RDBMS Concepts
- ER Model

Section 1

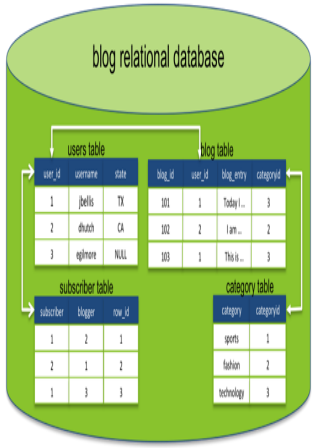
# SQL OVERVIEW

# What is SQL?

**S**tructured

**Q**uery

**L**anguage




- **Which is a computer language for:**
  - ✓ storing,
  - ✓ manipulating and
  - ✓ retrieving data stored in relational database.
- SQL is the standard language for Relation Database System, like **MySQL**, **MS Access**, **Oracle**, **Sybase**, **Informix**, **Postgres** and **SQL Server** use SQL as standard database language.
- SQL is an ANSI (American National Standards Institute) standard.

# SQL Process

SQL Query

Query Language Processor

Parser + Opimizer

DBMS Engine

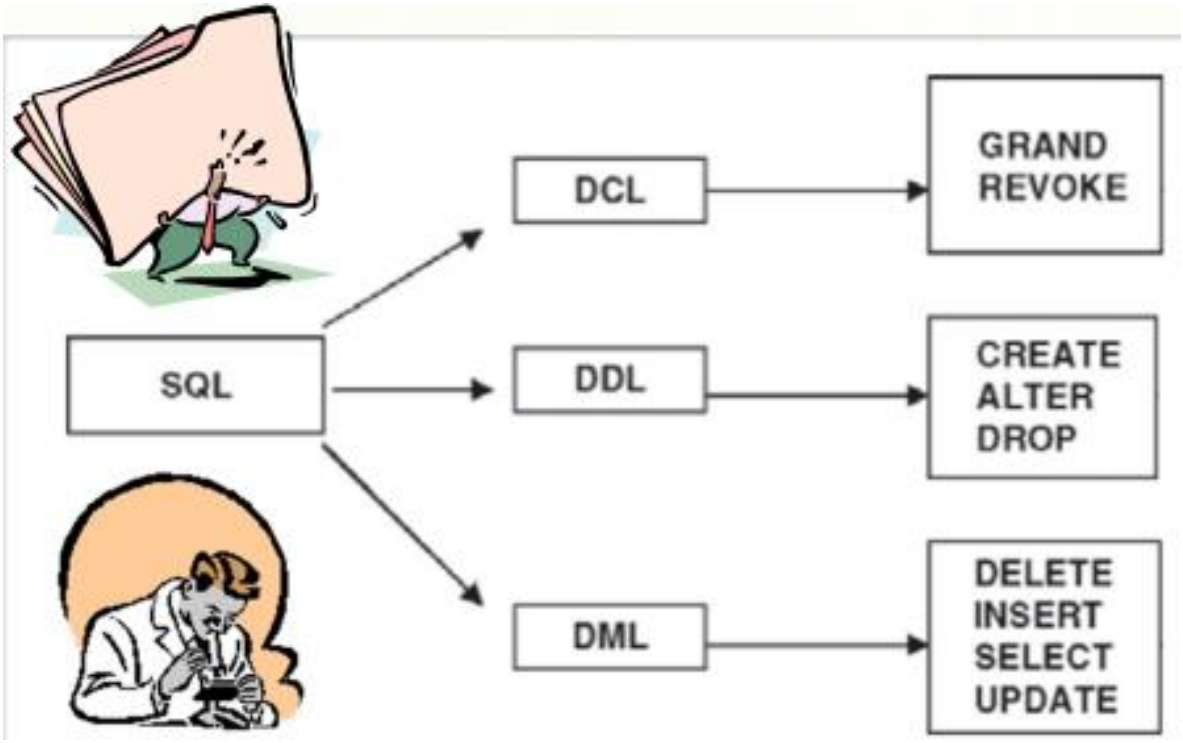
File Manager
+
Transaction manager

Physical Database

# SQL Commands

SQL consists of **three components:**

- Data Definition Language (DDL)
- Data Manipulation Language (DML) and
- Data Control Language (DCL)

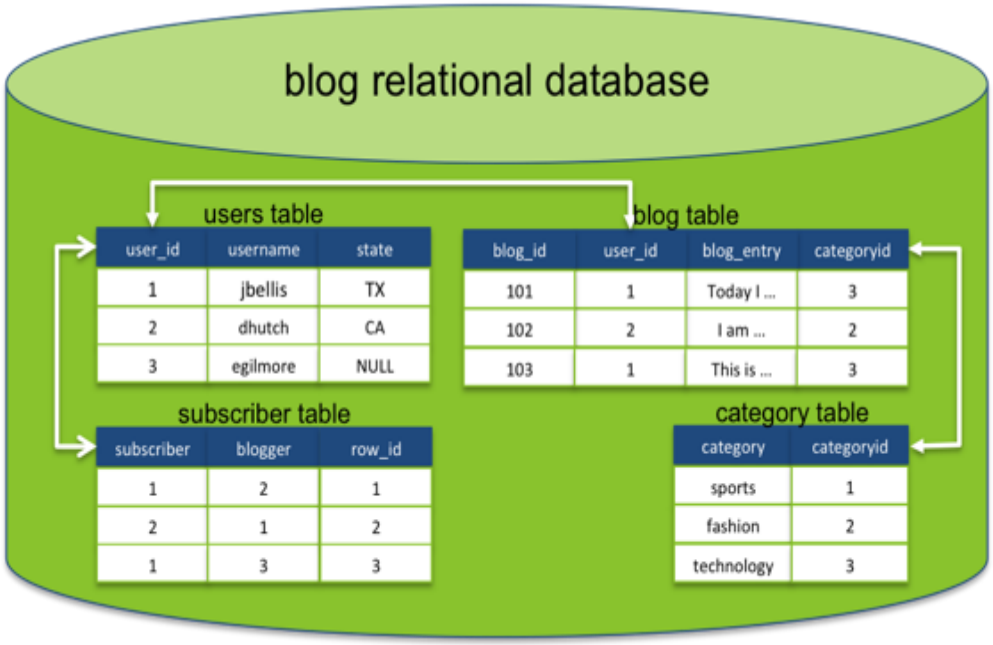


Section 2

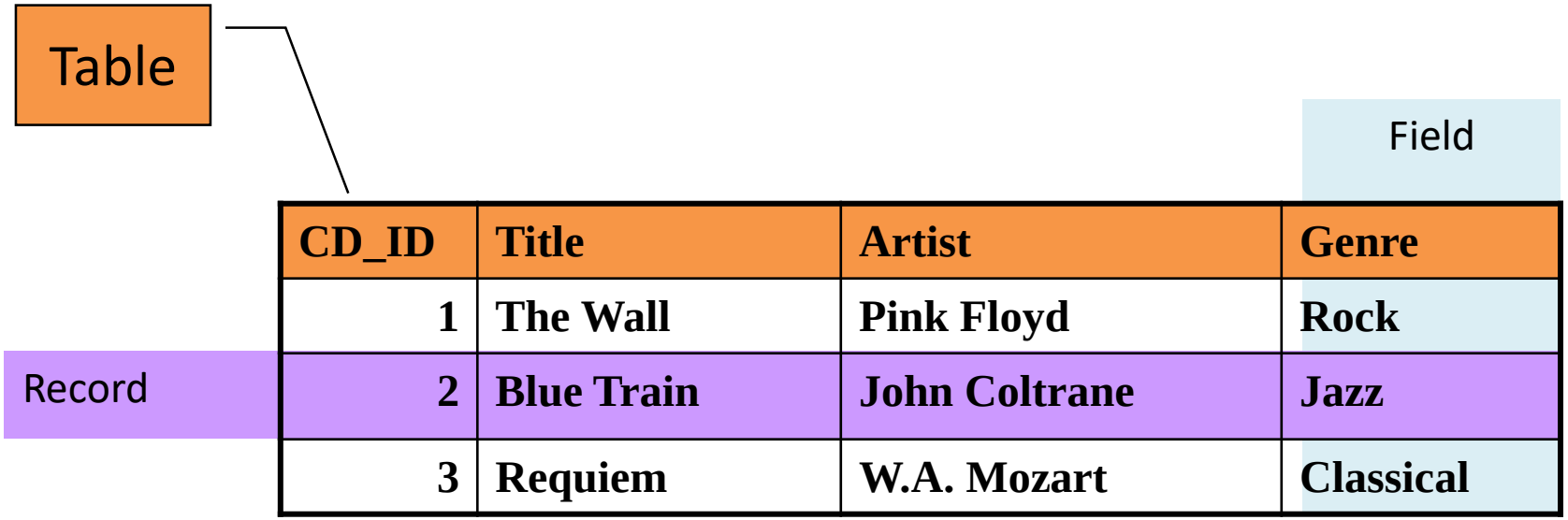
# THE RELATIONAL DATABASE

# Relational Database Concepts (1/3)

- "A DBMS that manages data as collection of **tables** in which all data relationships are represented by common values in related tables."
- "A DBMS that follows all the twelve rules of CODD is called RDBMS"

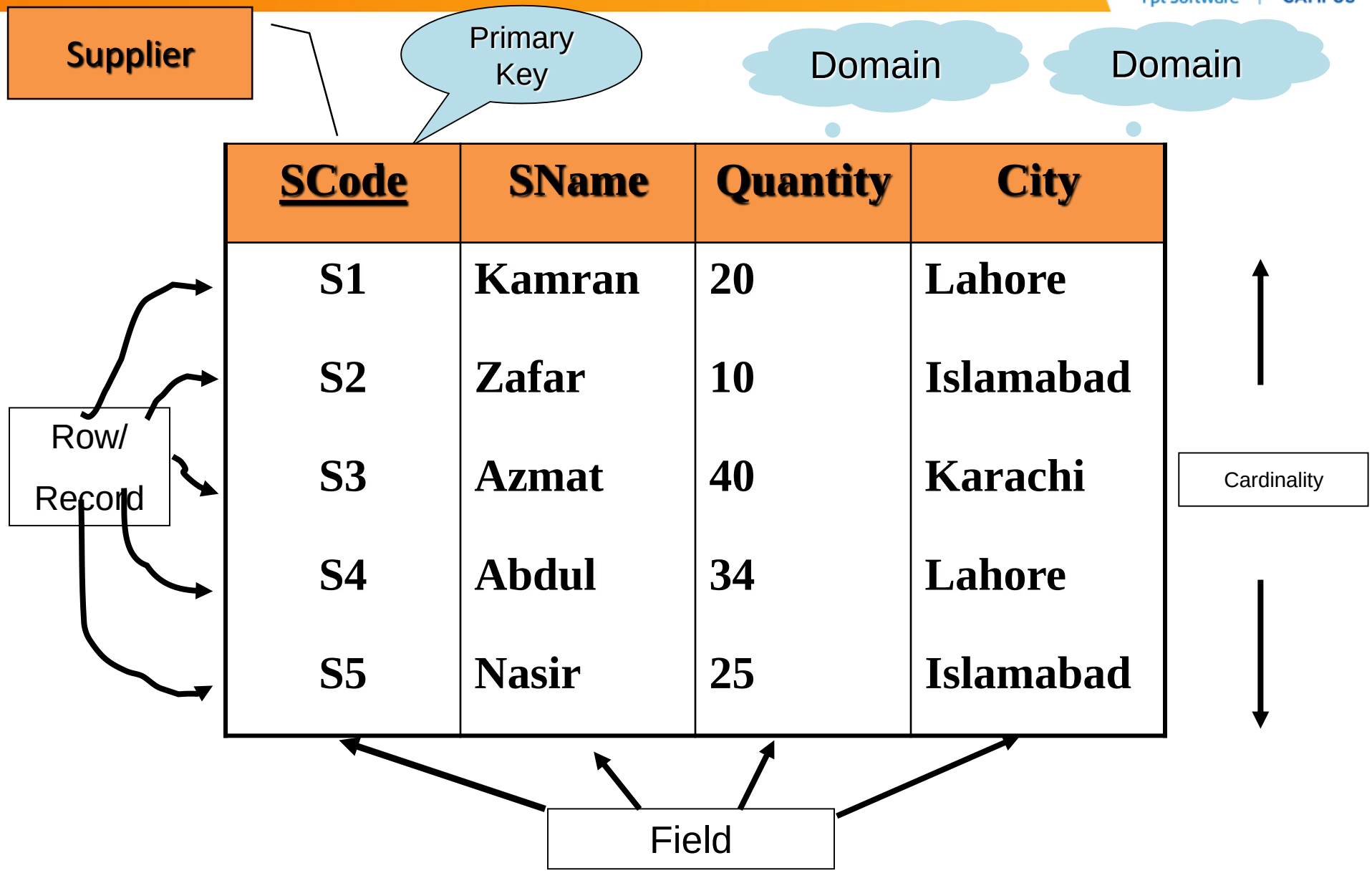


# Relational Database Concepts (2/3)




| CD_ID | Title | Artist | Genre |
|---|---|---|---|
| 1 | The Wall | Pink Floyd | Rock |
| 2 | Blue Train | John Coltrane | Jazz |
| 3 | Requiem | W.A. Mozart | Classical |

# Relational Database Concepts (3/3)



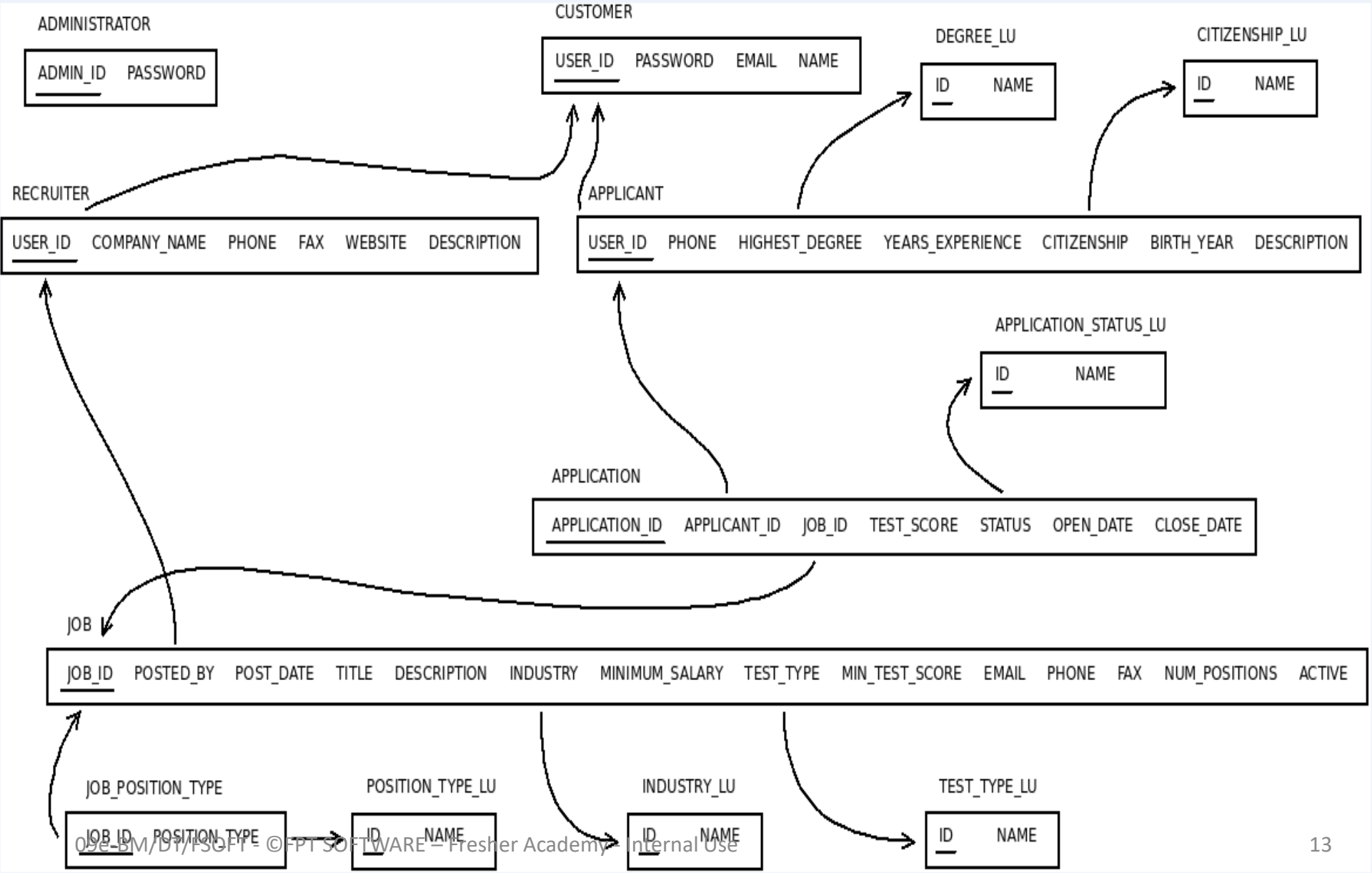
# Schema (1/2)

- The name of a relation and the set of attributes for a relation is called a **schema**.
  - Example: the schema for previous slide is

**Supplier** (SCode, SName, Quantity, City)

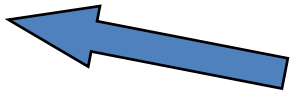
- **Relation schema** = name(attributes) + other structure info., e.g., keys, other constraints.
- Order of attributes is arbitrary, but in practice we need to assume the (*standard*) order given in the relation schema.
- **Relational database schema** = collection of relation schemas.

# Schema (2/2)


ADMINISTRATOR
ADMIN_ID PASSWORD
CUSTOMER
USER_ID PASSWORD EMAIL NAME
DEGREE_LU
ID NAME
CITIZENSHIP_LU
ID NAME
RECRUITER
USER_ID COMPANY_NAME PHONE FAX WEBSITE DESCRIPTION
APPLICANT
USER_ID PHONE HIGHEST_DEGREE YEARS_EXPERIENCE CITIZENSHIP BIRTH_YEAR DESCRIPTION
APPLICATION_STATUS_LU
ID NAME
APPLICATION
APPLICATION_ID APPLICANT_ID JOB_ID TEST_SCORE STATUS OPEN_DATE CLOSE_DATE
JOB
JOB_ID POSTED_BY POST_DATE TITLE DESCRIPTION INDUSTRY MINIMUM_SALARY TEST_TYPE MIN_TEST_SCORE EMAIL PHONE FAX NUM_POSITIONS ACTIVE
JOB_POSITION_TYPE
JOB_ID POSITION_TYPE
POSITION_TYPE_LU
ID NAME
INDUSTRY_LU
ID NAME
TEST_TYPE_LU
ID NAME

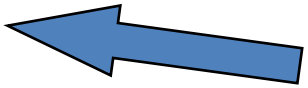
# Schema versus Instance

**Student**(studno,name,address)
**Course**(courseno,lecturer)



Schema

**Student**(123,Bloggs,Woolton)
(321,Jones,Owens)



Instance

| sid | Name | Login | age | GPA |
|---|---|---|---|---|
| 53666 | Jones | Jones@ca | 18 | 3.4 |
| 53444 | smith | Smith@ecs | 18 | 3.2 |
| 53777 | Blake | Blake@aa | 19 | 3.8 |

➔ Cardinality = 3, arity = 5 , all rows distinct

➔ Do all values in each column of a relation instance have to be distinct?

# What is RDBMS?

- **RDBMS** stands for:

  Relational Database Management System

- **RDBMS** is the basis for SQL, and for all modern database systems like:
  - ✓ MS SQL Server,
  - ✓ IBM DB2,
  - ✓ Oracle,
  - ✓ MySQL,
  - ✓ and Microsoft Access.

- A Relational database management system (RDBMS) is a database management system (DBMS) that is based on the relational model as introduced by E. F. Codd.

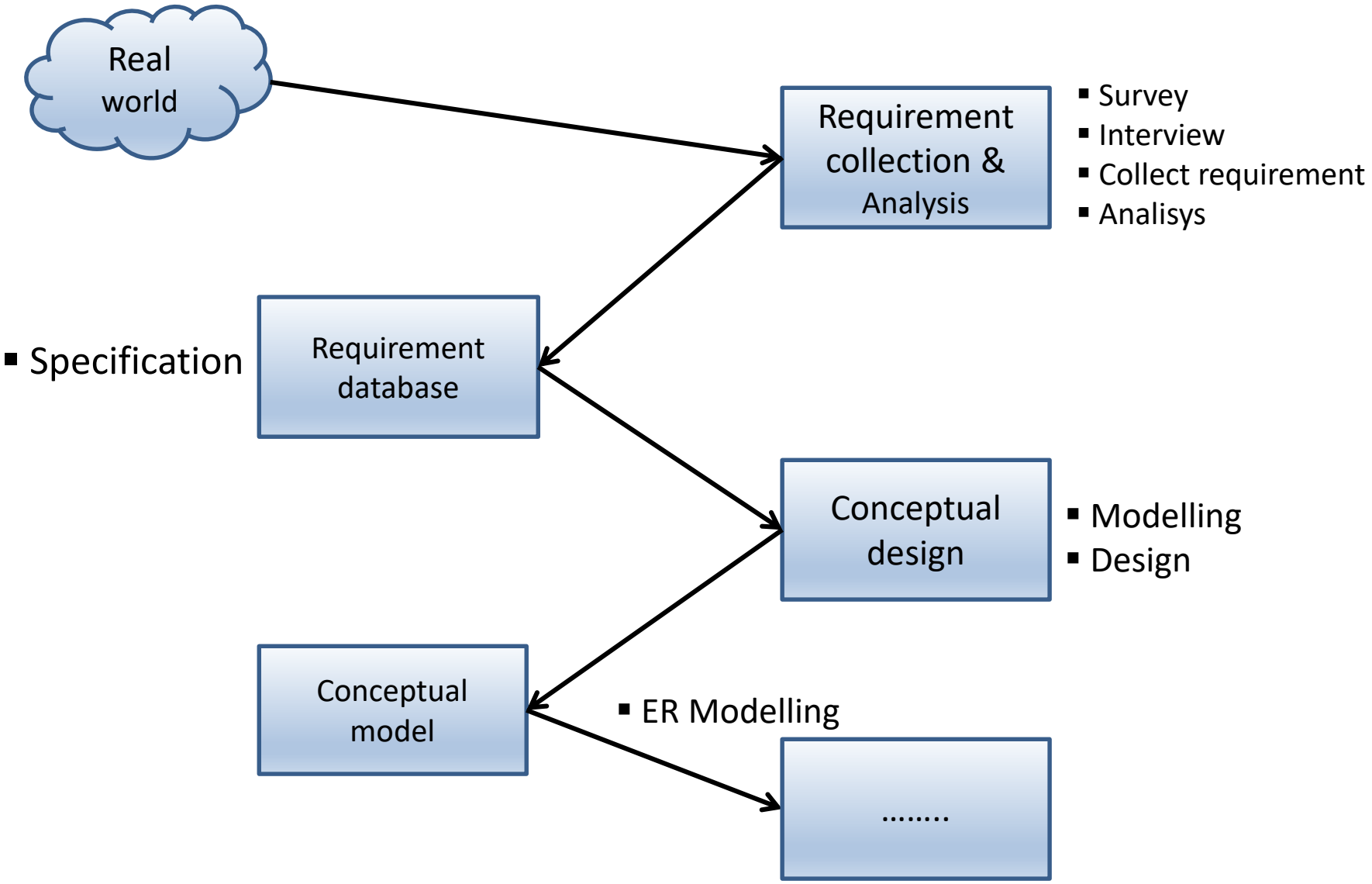
# DBMS vs. RDBMS

| DBMS | RDBMS |
|---|---|
| The concepts of relationships is missing in a DBMS. If it exits it is very less. | It is based on the concept<br>Of relationships |
| Speed of operation is very slow | Speed of operation is very Fast |
| Hardware and Software requirements are minimum | Hardware and Software requirements are High |
| Platform used is normally DOS | Platform used can be any DOS, UNIX,VAX,VMS, etc |
| Uses concept of a file | Uses concept of table |
| DBMS normally use 3GL | RDBMS normally use a 4GL |
| Examples are dBase, FOXBASE, etc | Examples are ORACLE, INGRESS, SQL Server 2000 etc |

Section 3

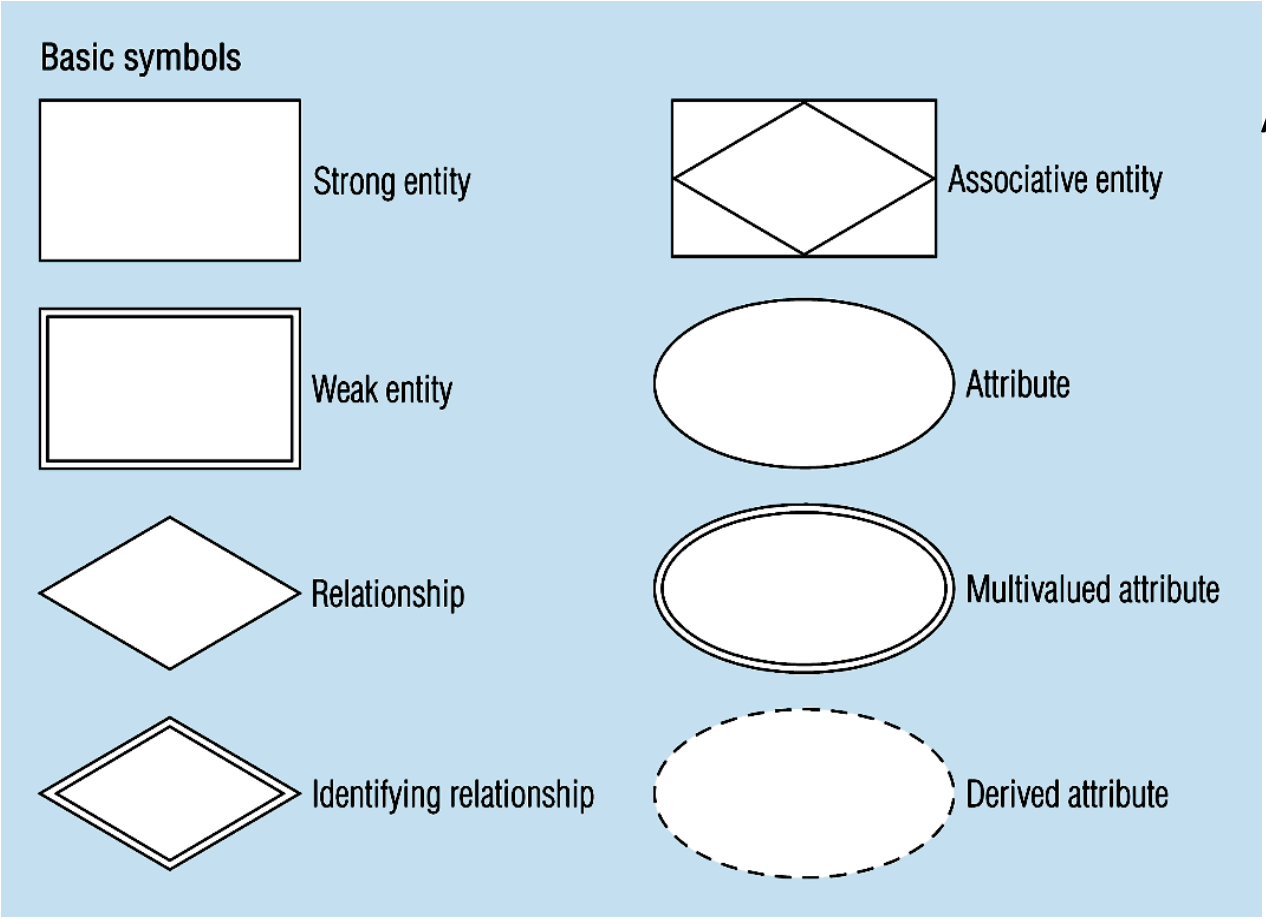
# ER MODEL

# Design Process



# Basic E-R Notation

Entity symbols



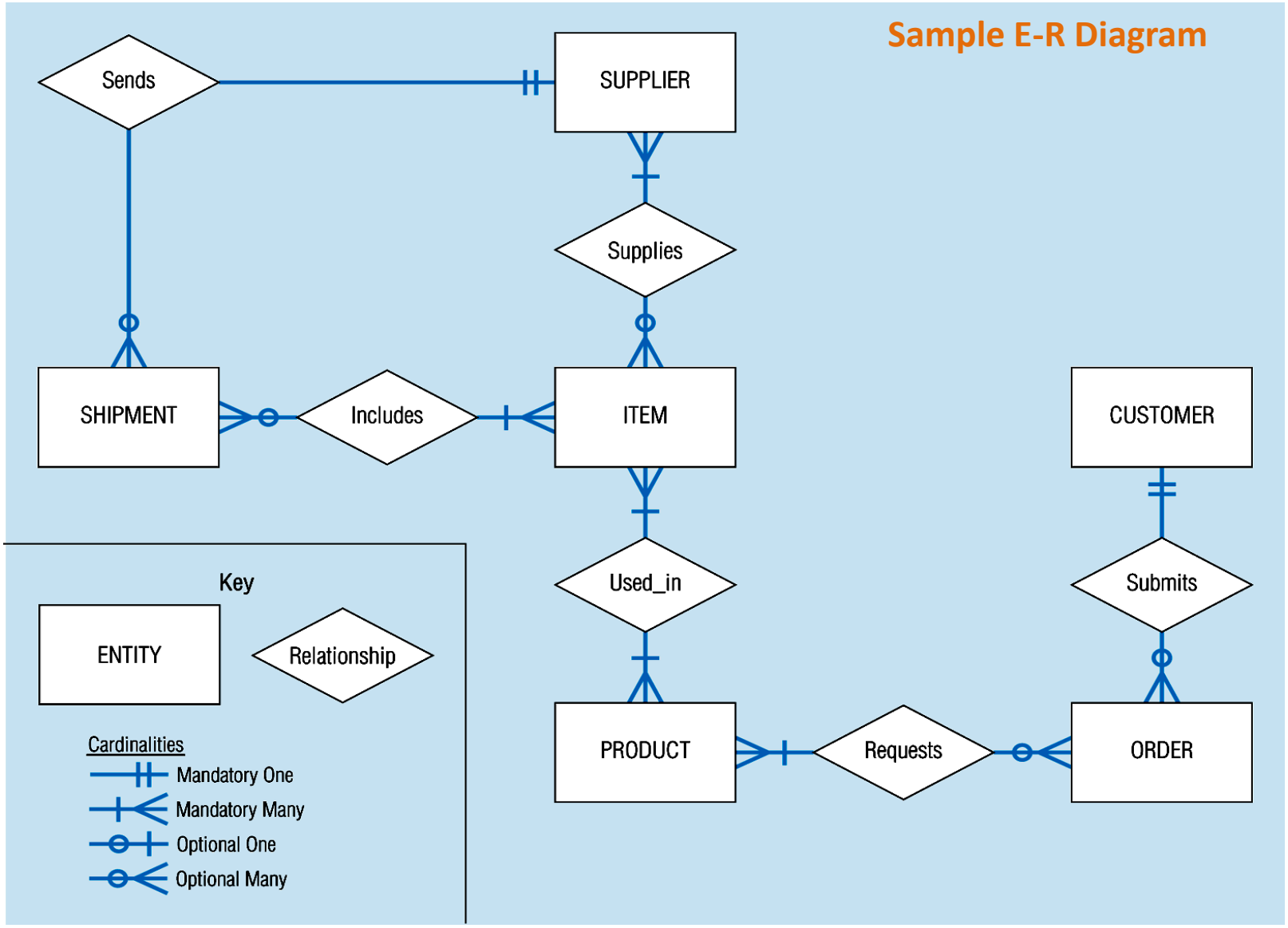

A special entity that is also a relationship

Relationship symbols

Attribute symbols

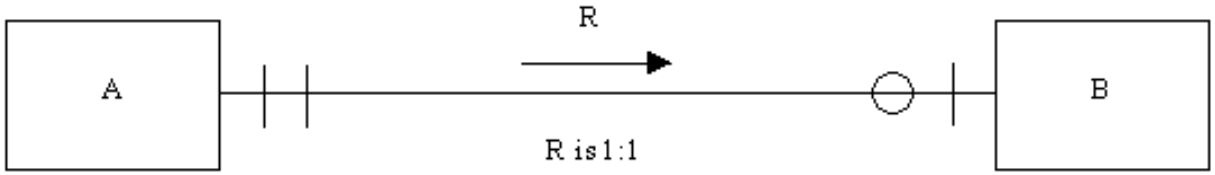
# ER Model Overview

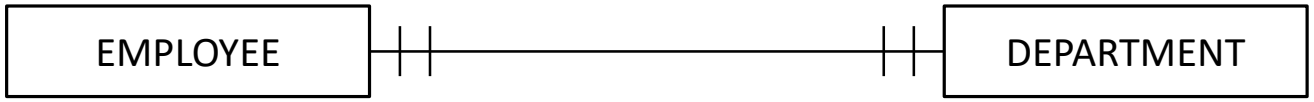
## Sample E-R Diagram



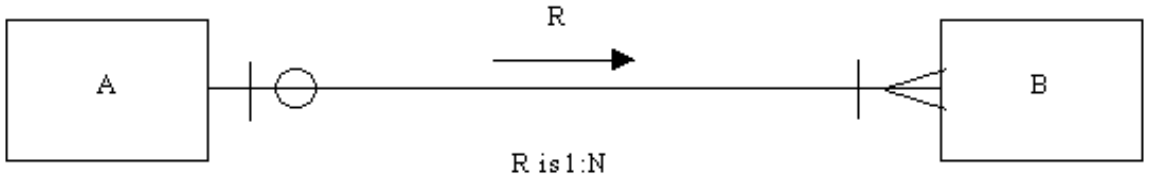
# Cardinality of Relationships (1/2)

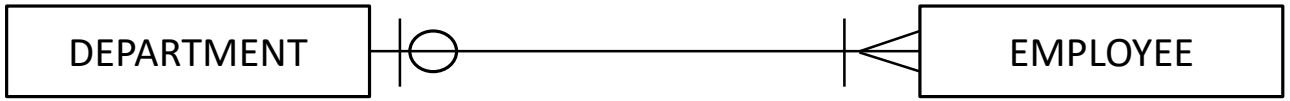
- **One – to – one:**



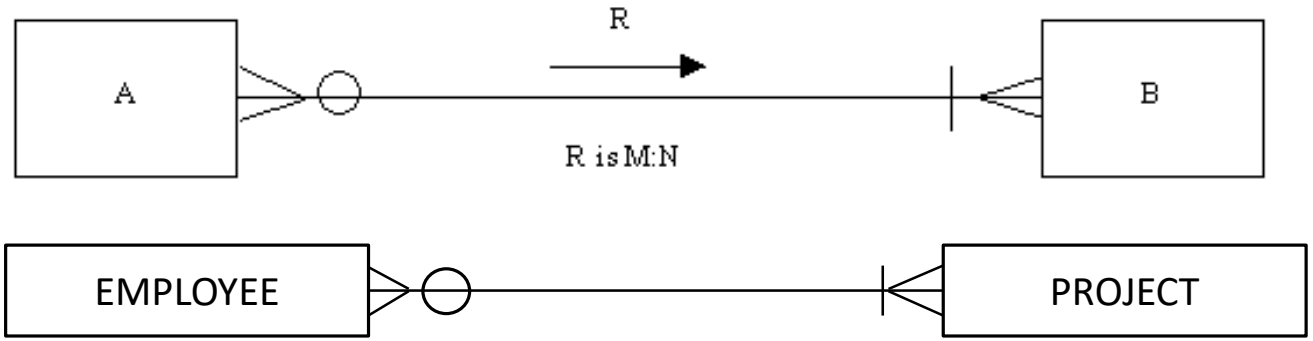

- **One – to – many:**



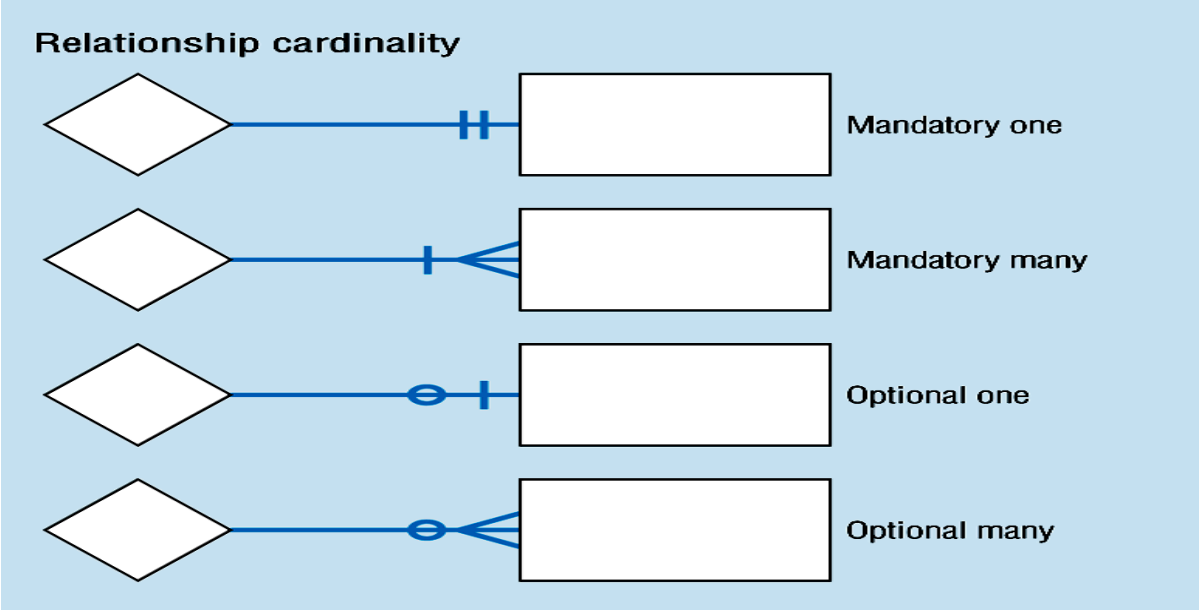



# Cardinality of Relationships (2/2)

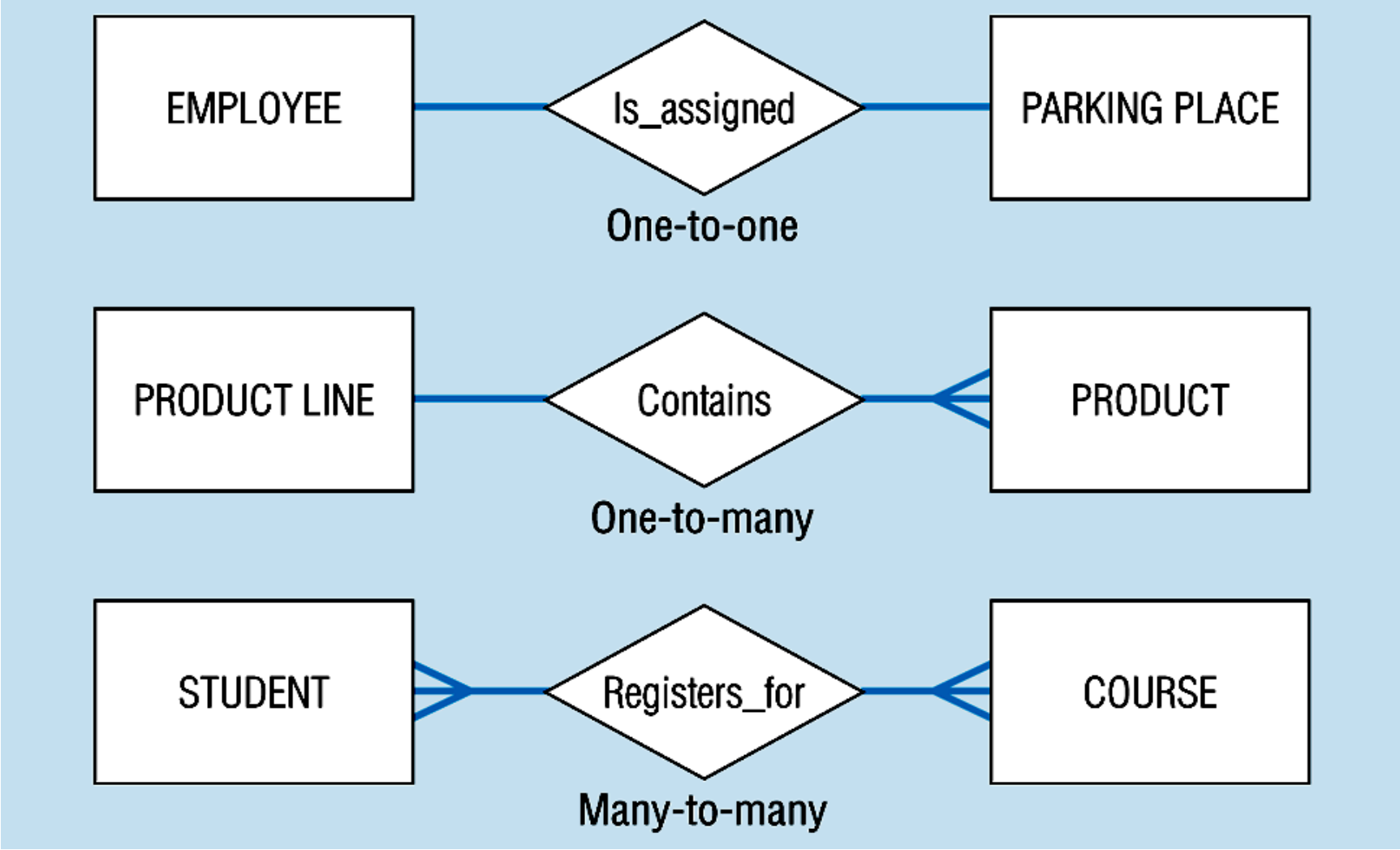
- **Many – to – many:**




- **In which:**

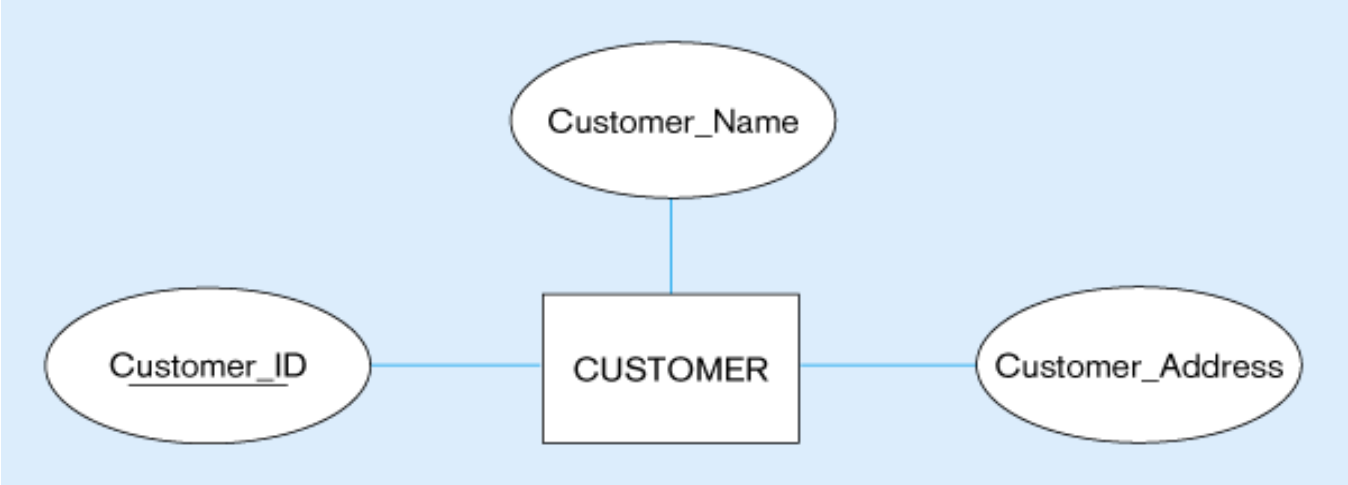


# Binary relationships

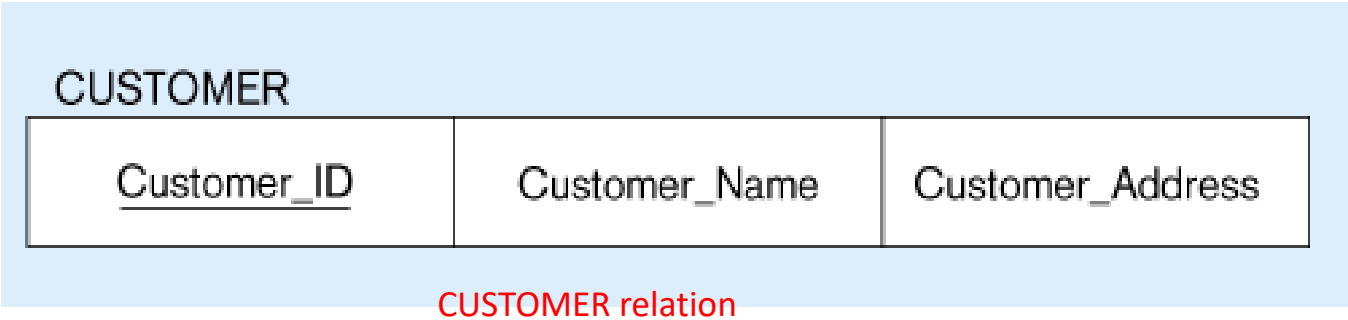


# Converting ER Model to relational schema

## Rule 1 - Convert entity type with simple attributes



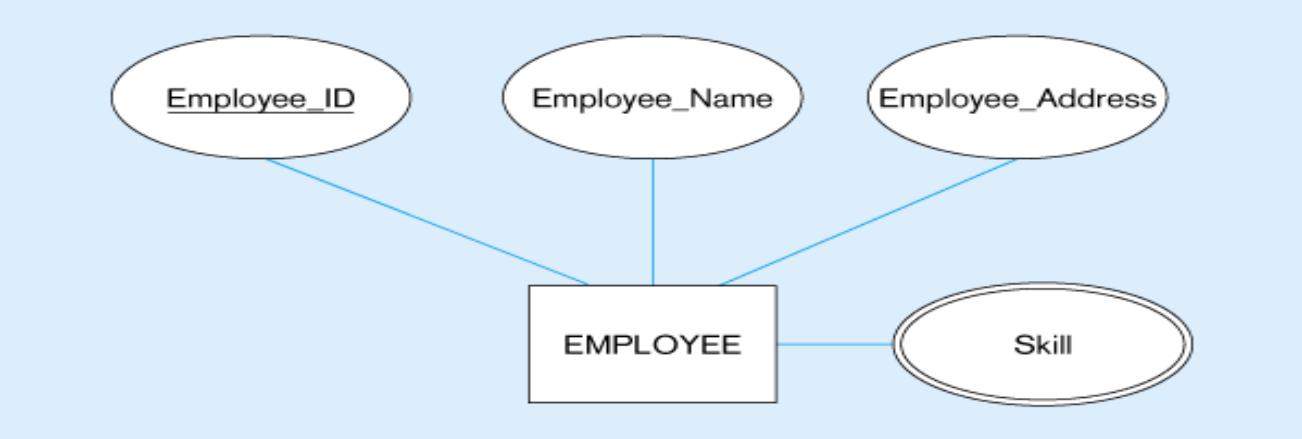

CUSTOMER entity type with simple attributes



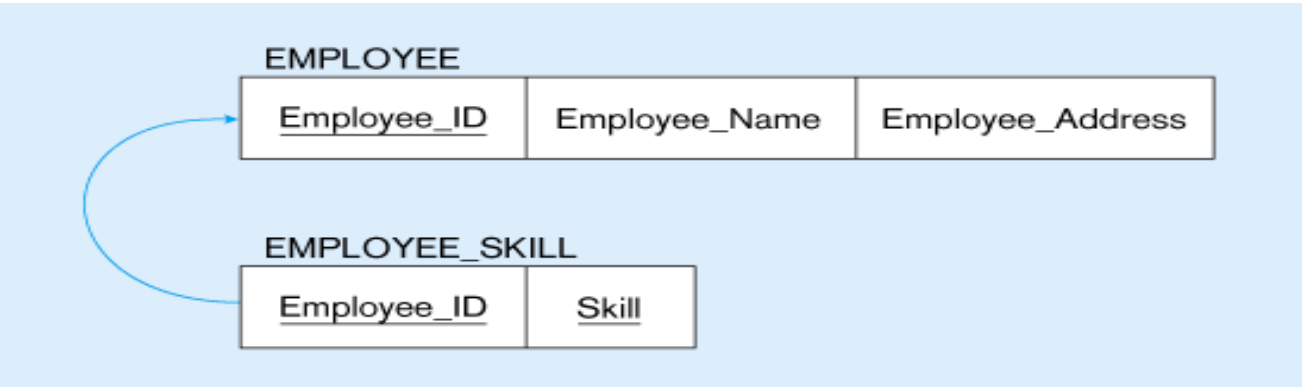

CUSTOMER relation

# Converting ER Model to relational schema

## Rule 2 - Convert Multivalue attribute



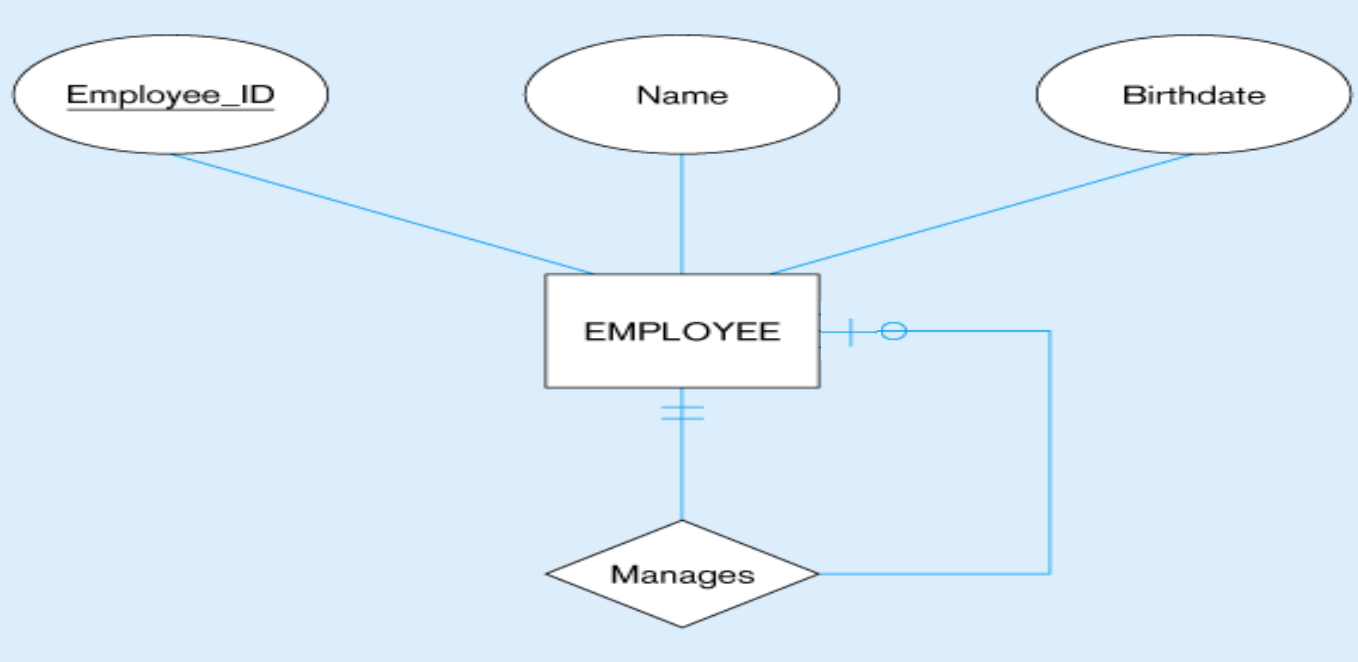

Multivalued attribute becomes a separate relation with foreign key



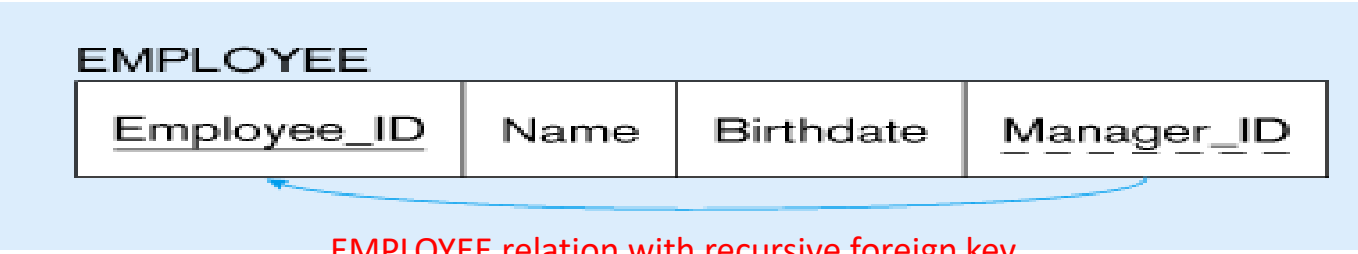

1–to–many relationship between original entity and new relation

# Converting ER Model to relational schema

## Rule 3 - Convert Unary relationship one to one



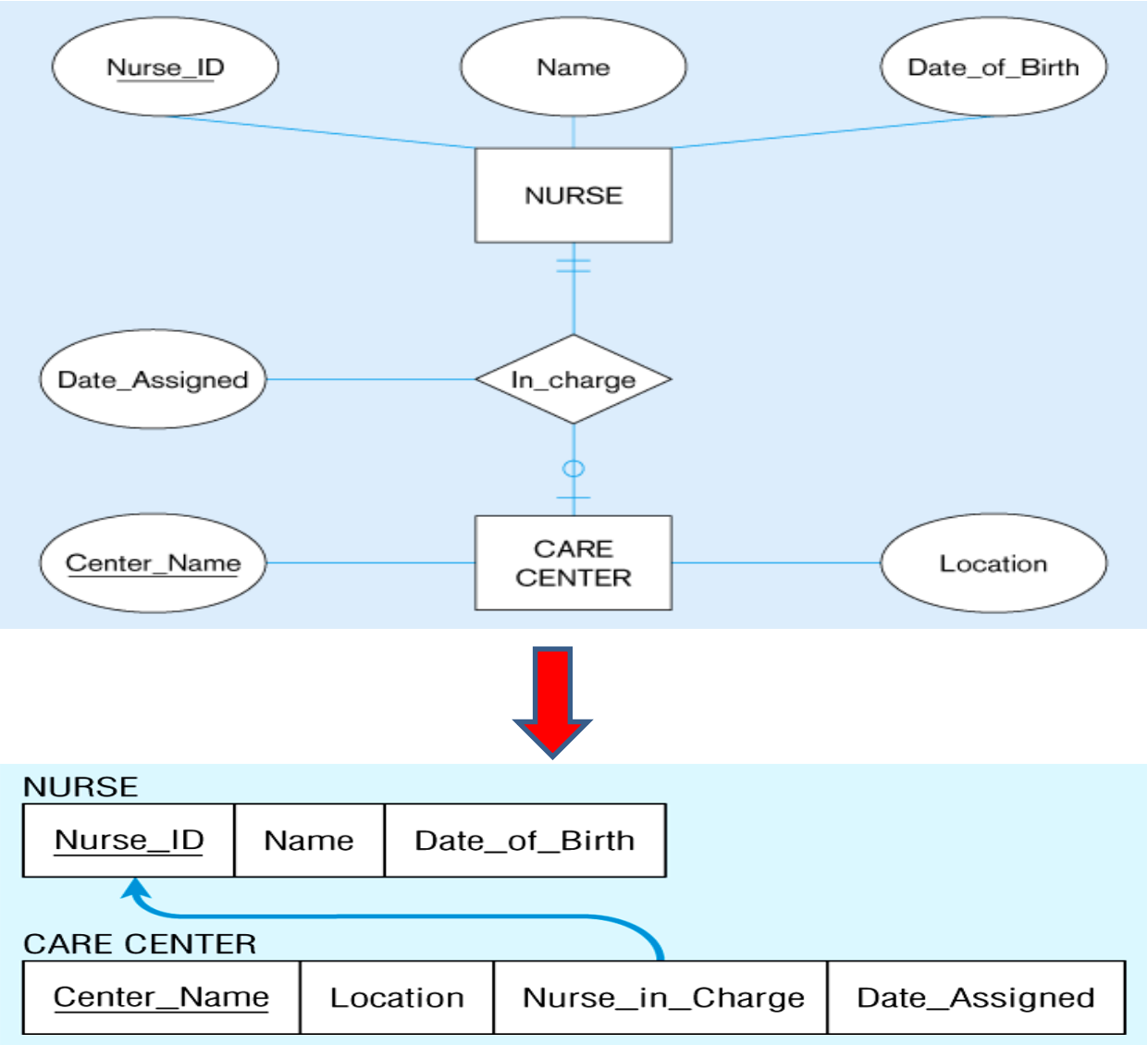

EMPLOYEE entity with Manages relationship




EMPLOYEE relation with recursive foreign key

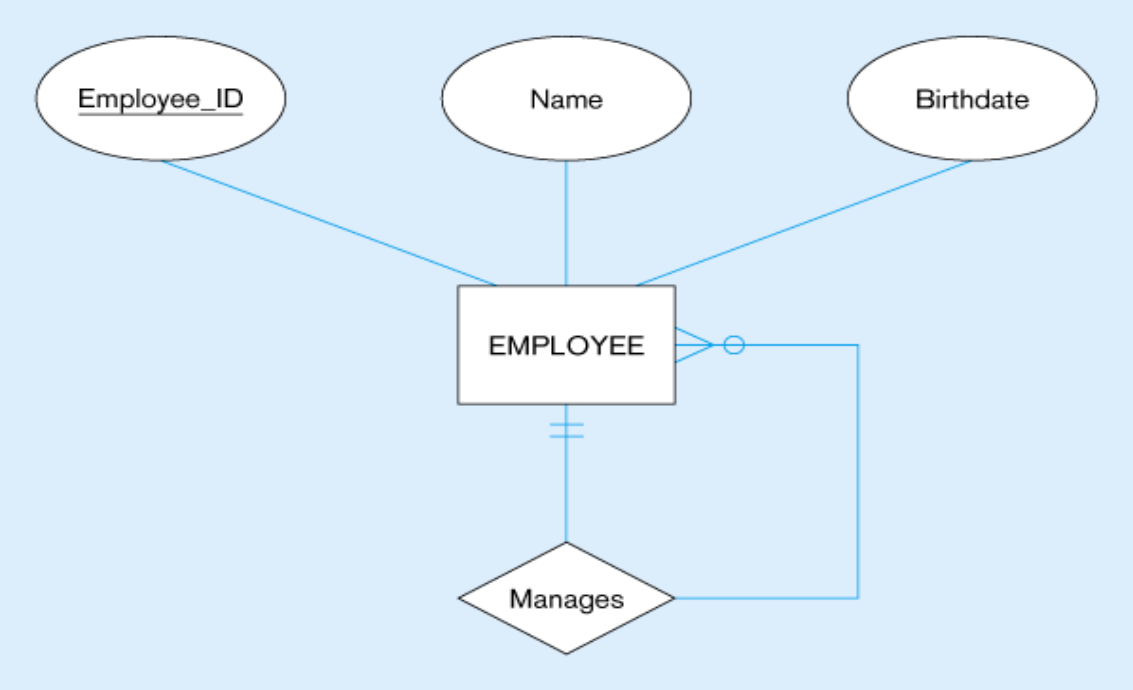
# Converting ER Model to relational schema

## Rule 4 – Convert binary relationship one to one

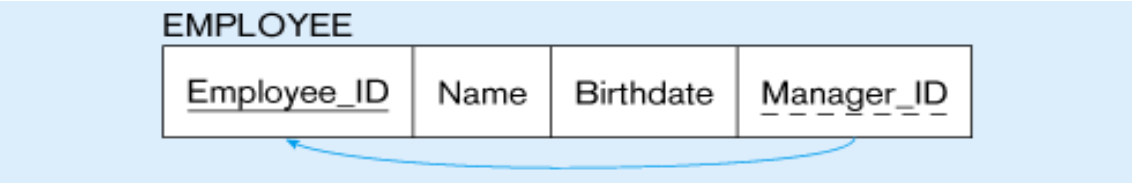


# Converting ER Model to relational schema

## Rule 5 – Convert Unary relationship one to many



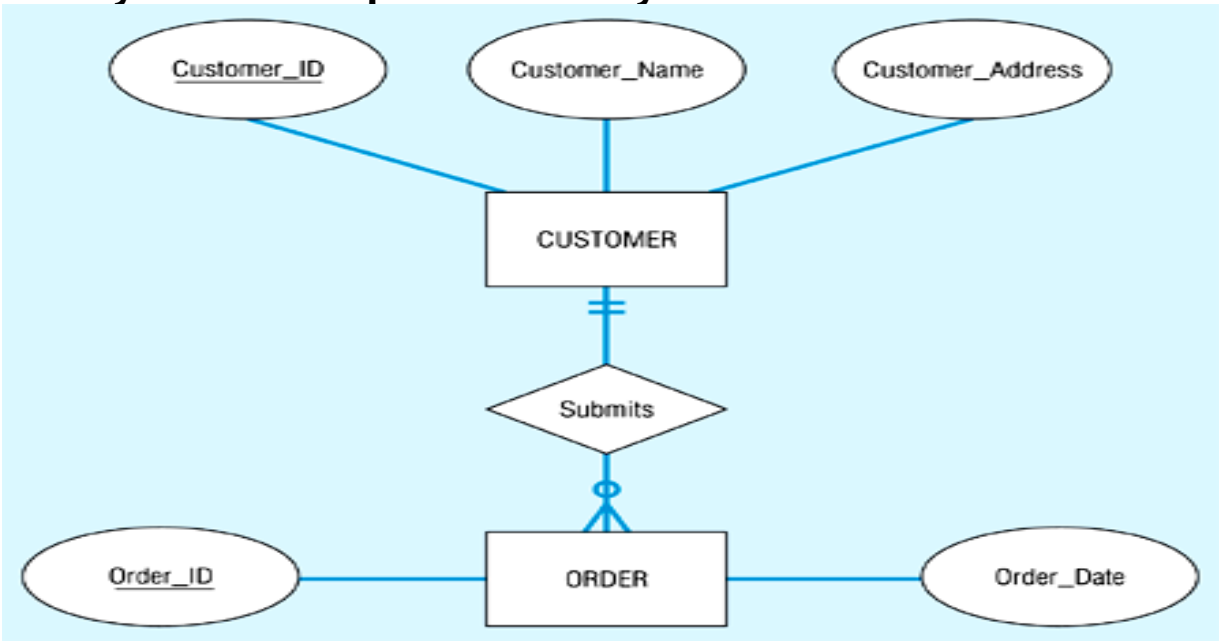

EMPLOYEE entity with Manages relationship



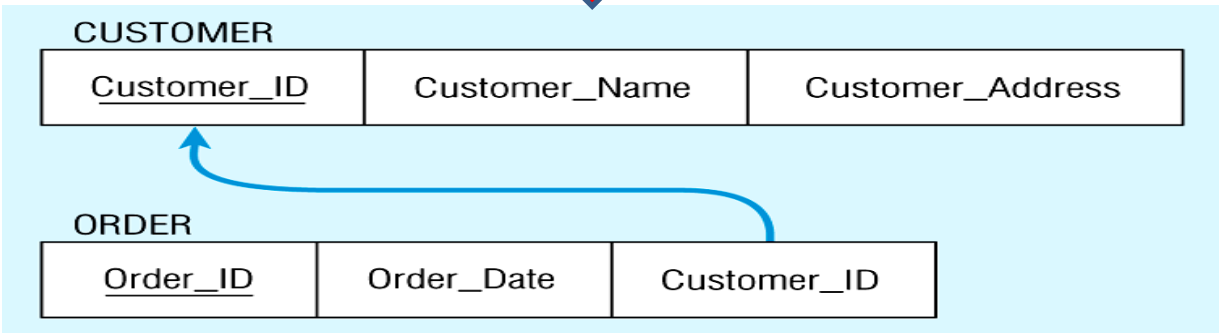

EMPLOYEE relation with recursive foreign key

# Converting ER Model to relational schema

## Rule 6 – Convert Binary relationship one to many



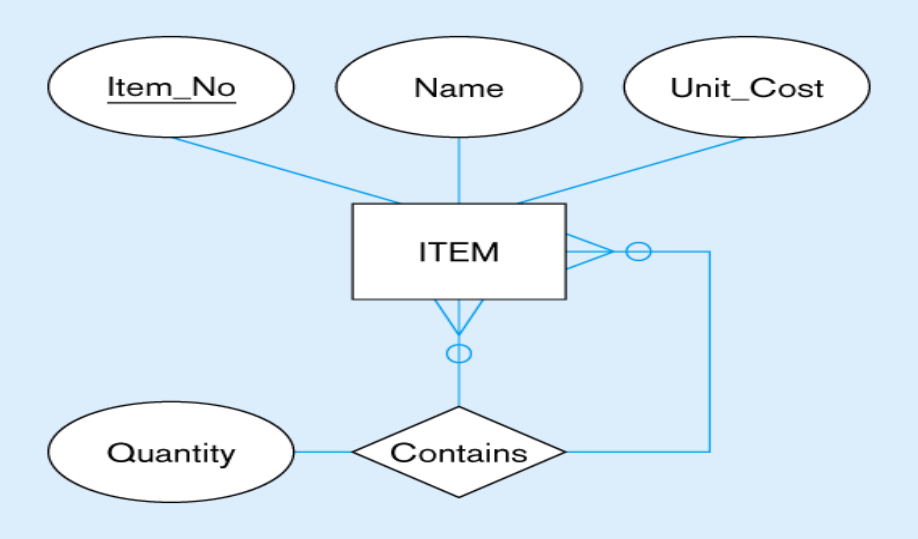

Note the mandatory one



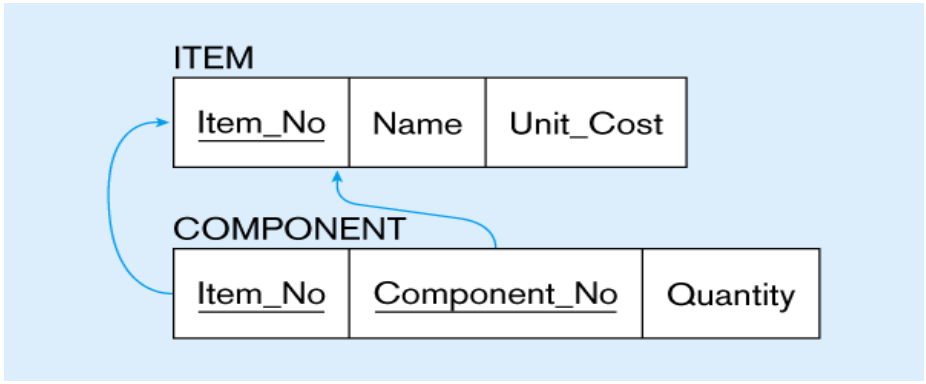

Again, no null value in the foreign key…this is because of the mandatory minimum cardinality

# Converting ER Model to relational schema

## Rule 7 – Convert Unary relationship many to many



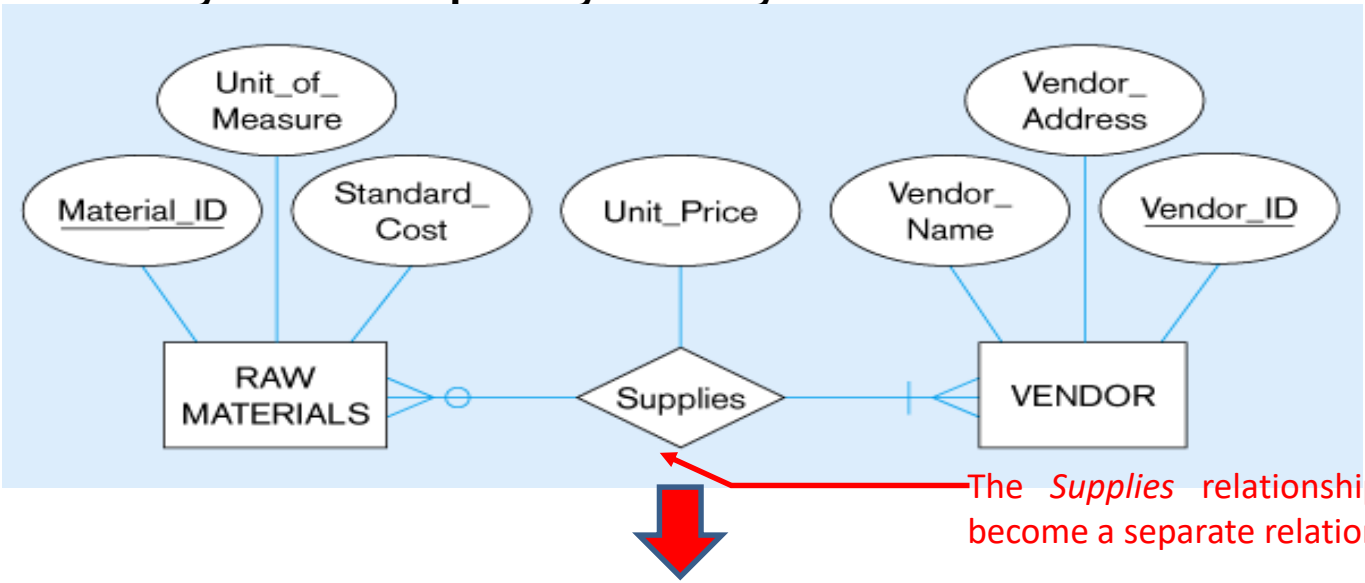

Bill-of-materials relationships (M:N)

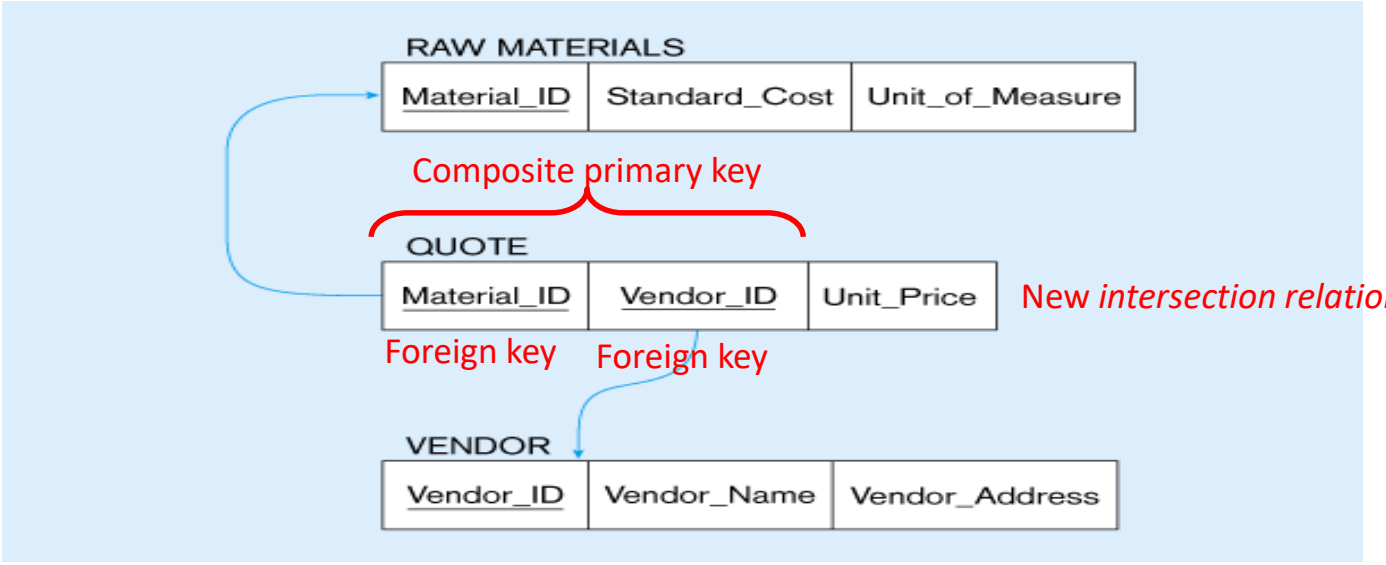



ITEM and COMPONENT relations

# Converting ER Model to relational schema

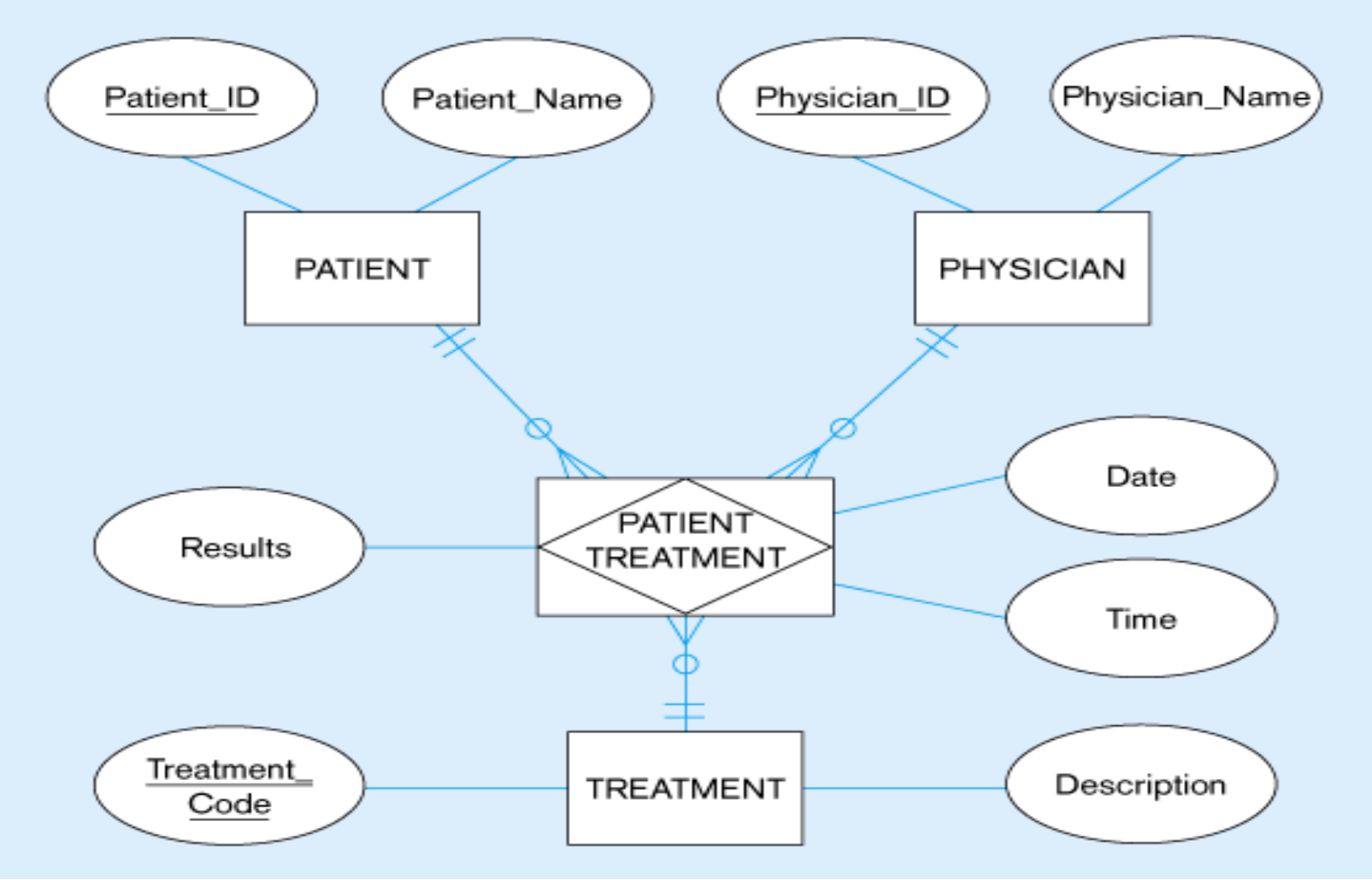
## Rule 8 – Convert Binary relationship many to many



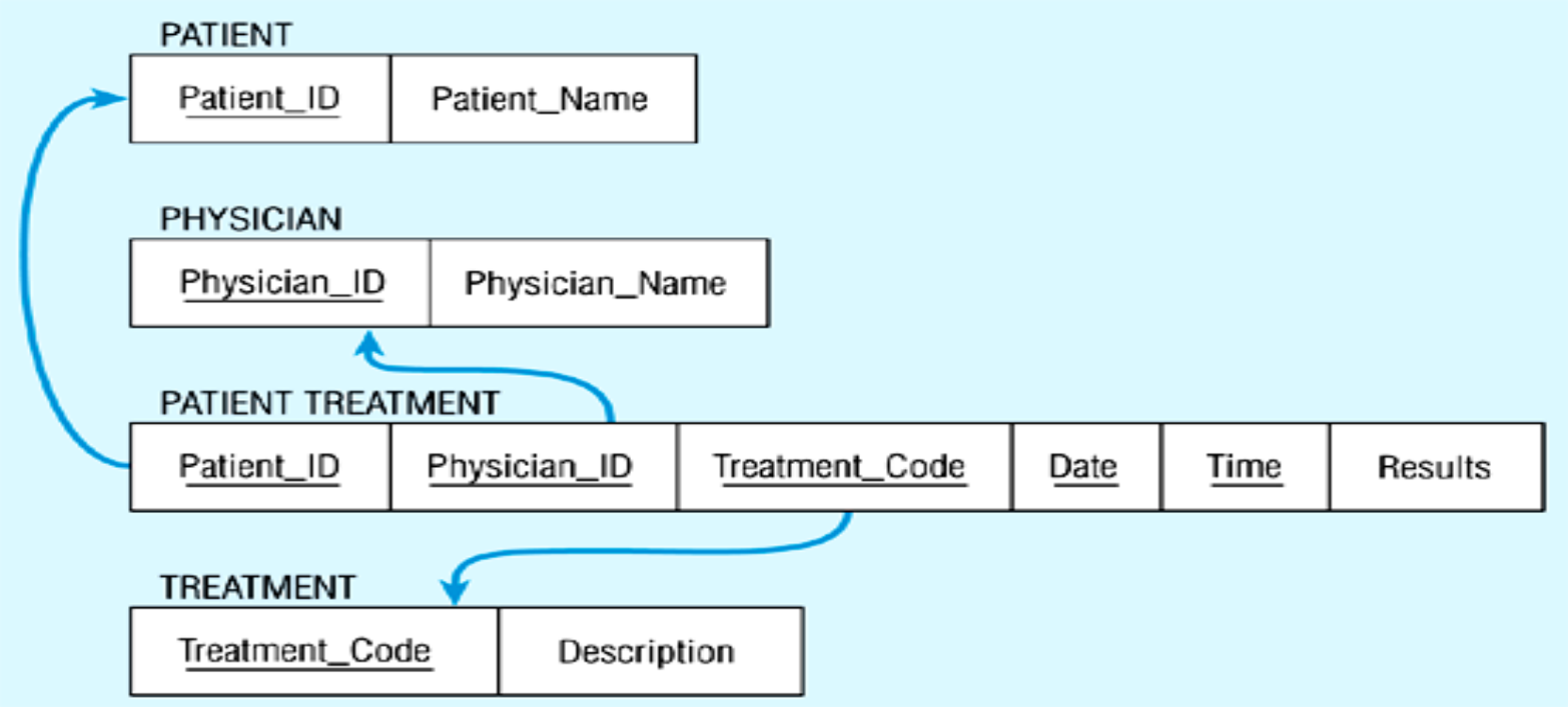
# Converting ER Model to relational schema

## Another - Convert Ternary relationship



# Converting ER Model to relational schema

## Another- Convert Ternary relationship (2)



# Summary

- ✓ SQL Overview
  - SQL, SQL Process, SQL Command
- ✓ The Relational Database
  - Table, Field, Record, Schema
- ✓ RDBMS Concepts
  - RDBMS, RDBMS vs DBMS
- ✓ ER Model
  - Design Process, **Notation,** Converting ER Model to relational schema

# Thank you