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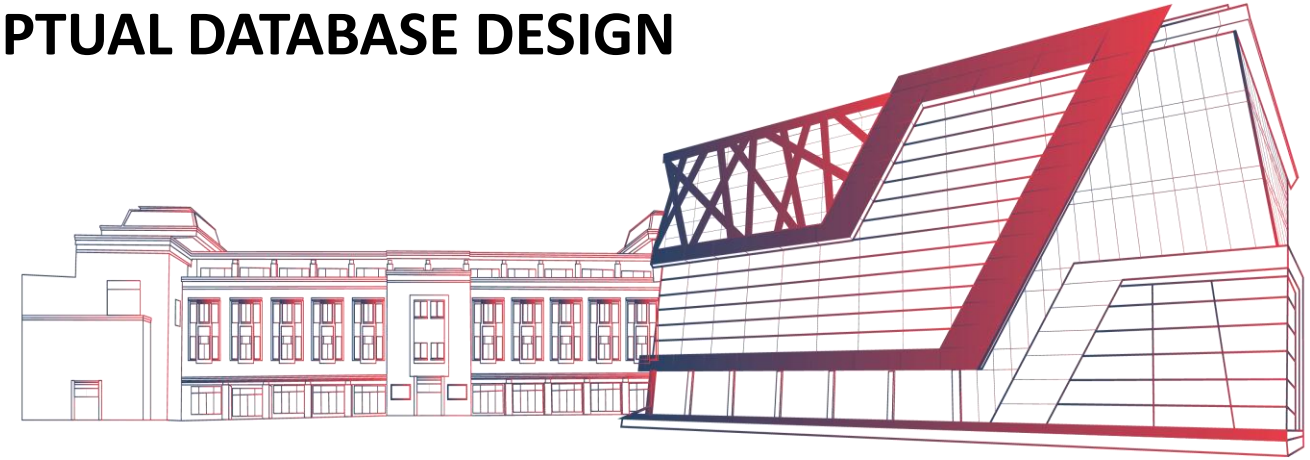
UNIT II

CONCEPTUAL DATABASE DESIGN



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Lecture 7

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ER Diagrams

Entity – Relationship Diagram

- **ER Modeling** is a **"*top-down*"** approach to database design.
- **Entity Relationship (ER) Diagram**

  A detailed, **"logical representation"** of the entities, associations and data elements for an organization or business.

- **Notation uses three main constructs:**
  - Data entities
  - Relationships
  - Attributes

Example COMPANY Database

- The company is organized into DEPARTMENTs. Each department has a name, number and an employee who *manages* the department. We keep track of the start date of the department manager.
- Each department *controls* a number of PROJECTs. Each project has a name, number and is located at a single location.

Example COMPANY Database (Cont.)

- We store each EMPLOYEE's social security number, address, salary, sex, and birthdate. Each employee *works for* one department but may *work on* several projects. We keep track of the number of hours per week that an employee currently works on each project. We also keep track of the *direct supervisor* of each employee.

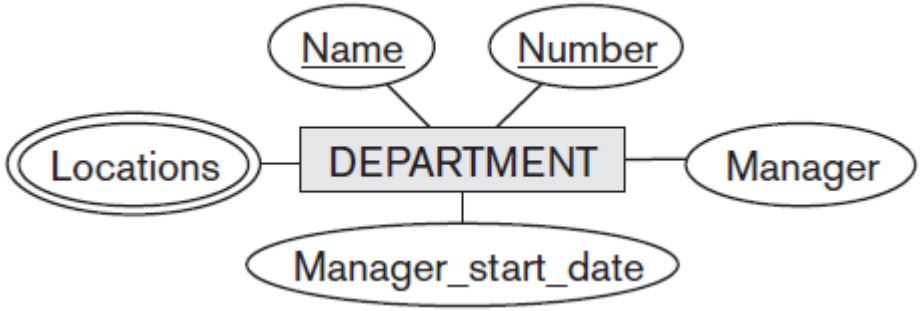
- Each employee may *have* a number of DEPENDENTs. For each dependent, we keep track of their name, sex, birthdate, and relationship to employee.

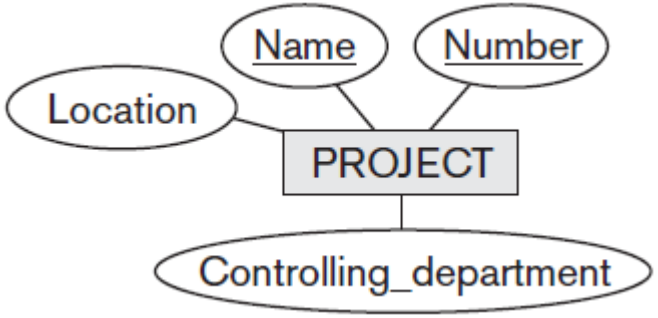
Initial Design of Entity Types - COMPANY Database Schema

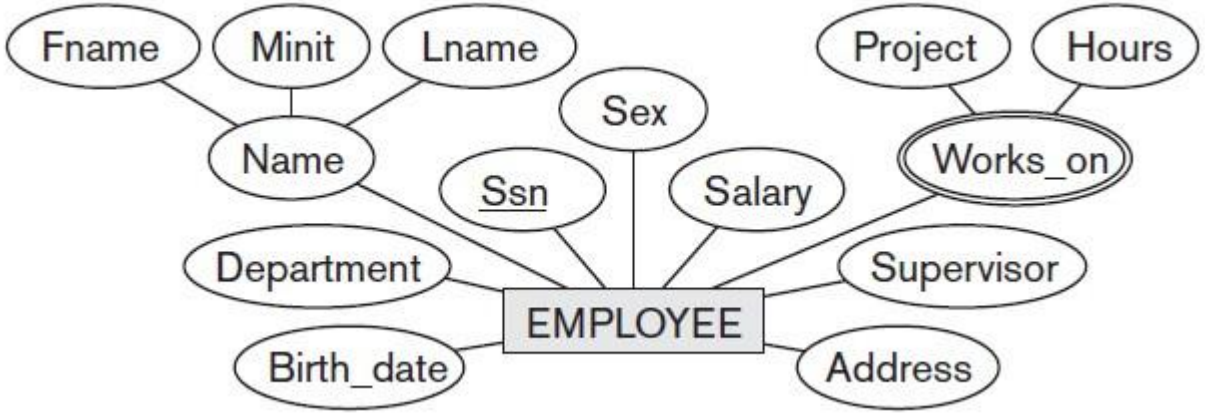
- Based on the requirements, we can identify four initial entity types in the COMPANY database:
  - DEPARTMENT
  - PROJECT
  - EMPLOYEE
  - DEPENDENT
- Their initial design is shown on the following slide
- The initial attributes shown are derived from the requirements description

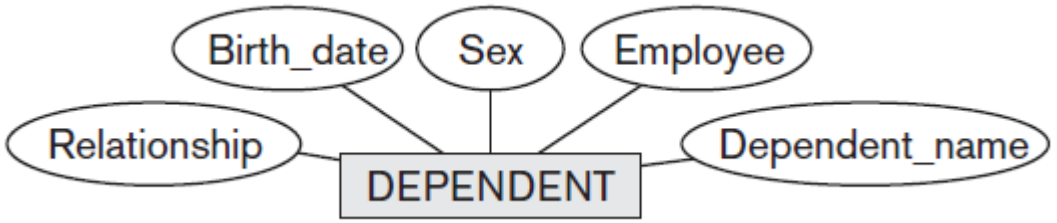
Initial Design of Entity Types:

EMPLOYEE, DEPARTMENT, PROJECT, DEPENDENT









Refining Initial Design - Introducing RELATIONSHIPS

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- The initial design is typically not complete
- Some aspects in the requirements will be represented as **relationships**
- Listed below with their participating entity types:
  - ▶WORKS_FOR (between EMPLOYEE, DEPARTMENT)
  - ▶MANAGES (also between EMPLOYEE, DEPARTMENT)
  - ▶CONTROLS (between DEPARTMENT, PROJECT)
  - ▶WORKS_ON (between EMPLOYEE, PROJECT)
  - ▶SUPERVISION (between EMPLOYEE (as subordinate), EMPLOYEE (as supervisor))
  - ▶DEPENDENTS_OF (between EMPLOYEE, DEPENDENT)

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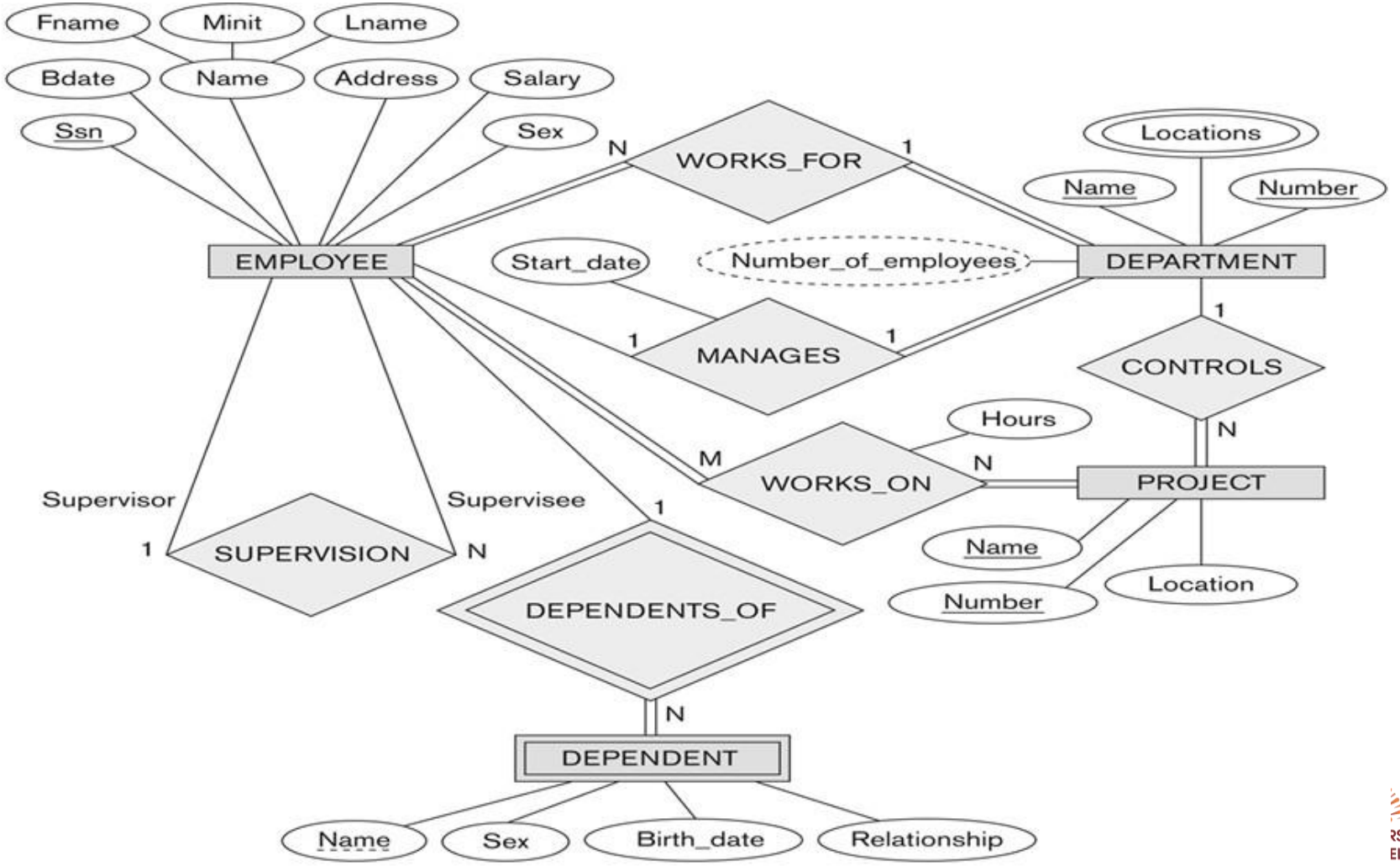
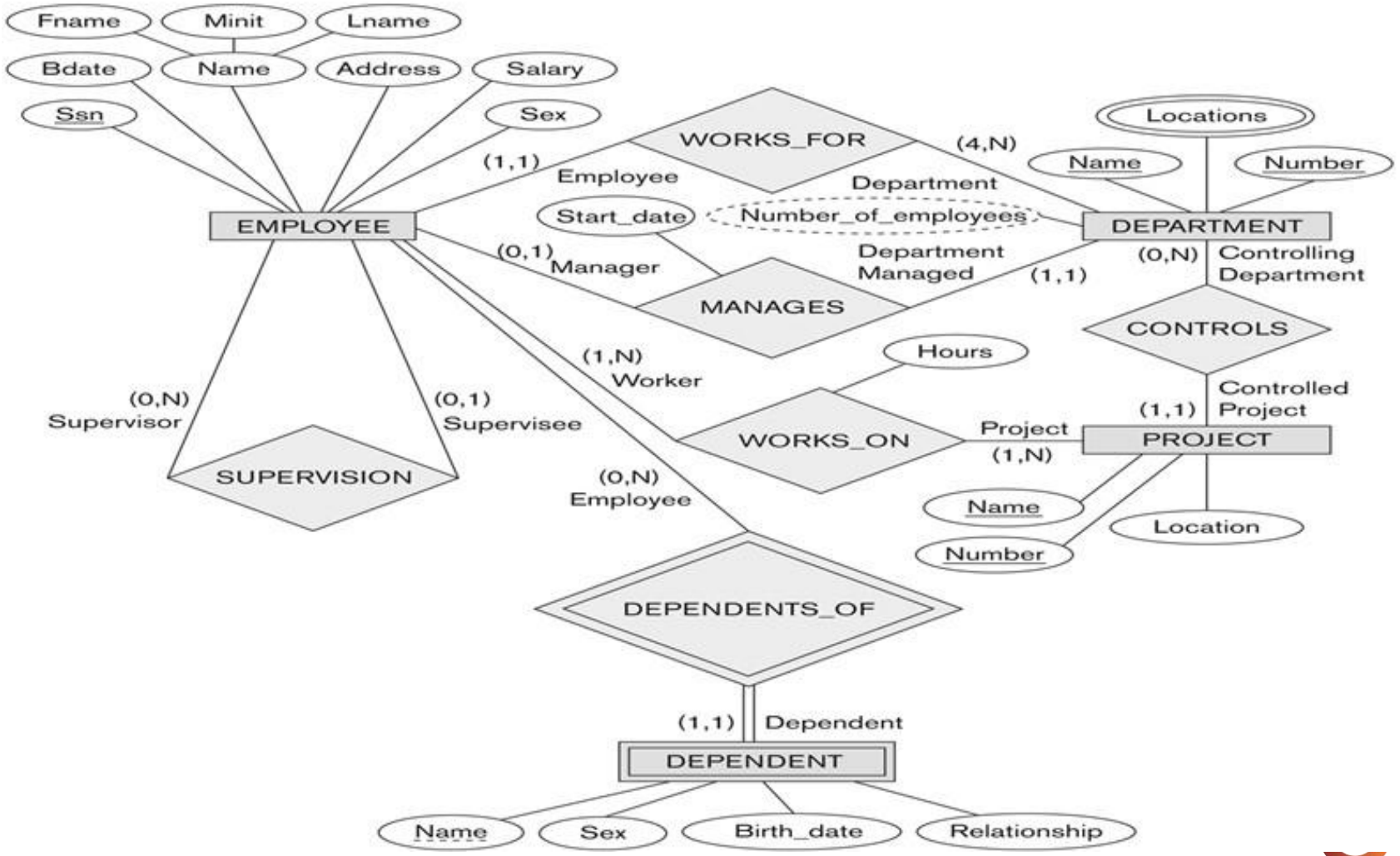
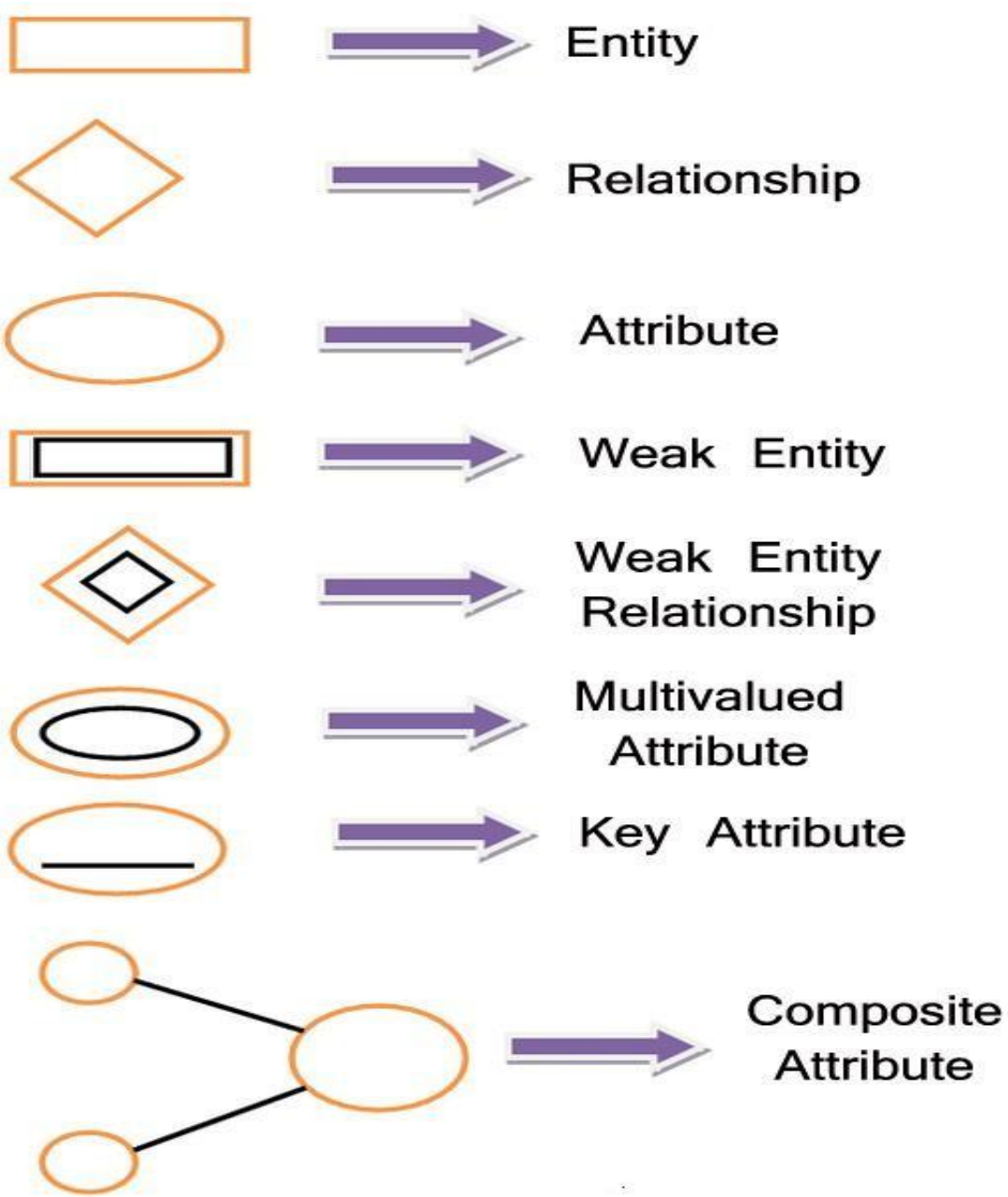
ER Diagram – Relationship Types & Constraints



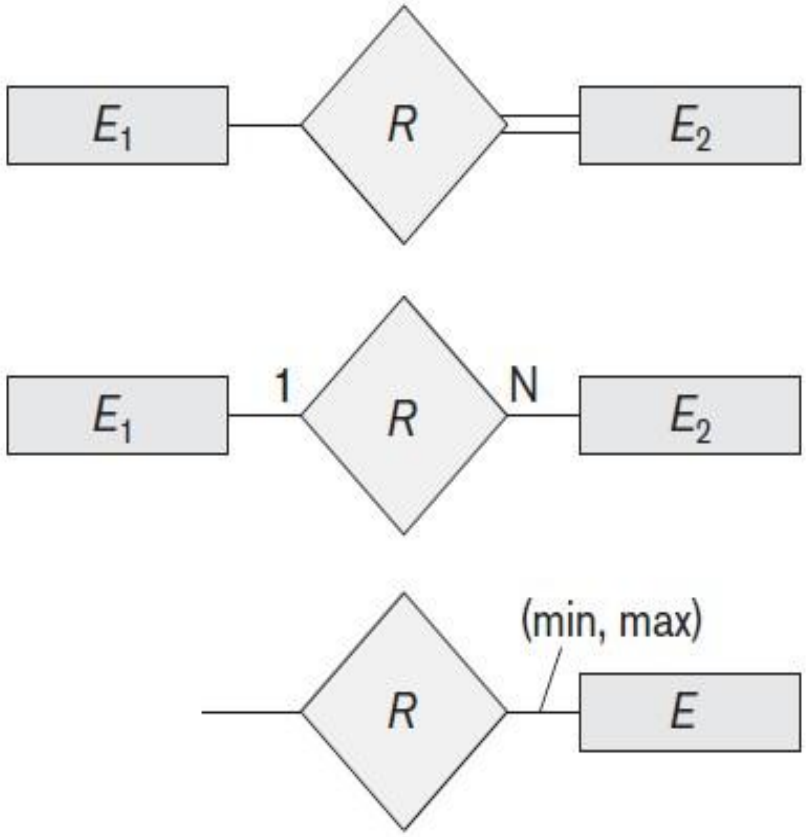
COMPANY ER Schema Diagram – (min, max) Notation



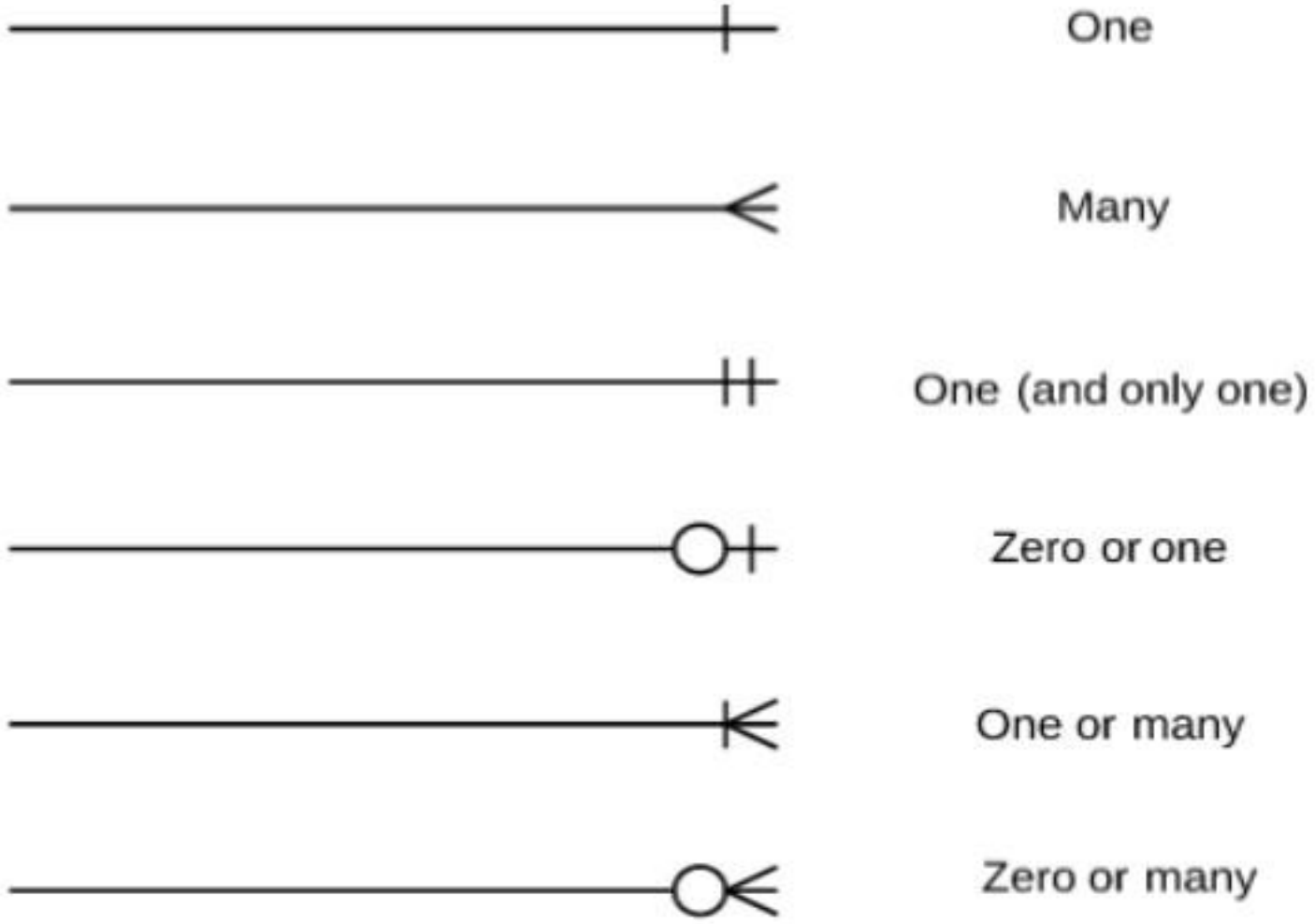
Summary of ER Diagram Notations



Summary of ER Diagram Notations



Alternate ER Diagram Notations



Steps of ER Diagram Creation

- IDENTIFY ENTITIES
- REMOVE DUPLICATE ENTITIES
- LIST THE ATTRIBUTES FOR EACH ENTITY
- MARK THE PRIMARY KEY
- DEFINE THE RELATIONSHIPS
- DEFINE THE CARDINALITY and CONSTRAINTS OF THE RELATIONSHIPS

Data Modeling Tools

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- A number of popular tools are available that cover conceptual modeling and mapping into relational schema design.
  - Examples: ERWin, S-Designer (Enterprise Application Suite), ER- Studio etc.

- **POSITIVES**
  - Serves as documentation of application requirements, easy user interface - mostly graphics editor support

- **NEGATIVES**
  - Most tools lack a proper distinct notation for relationships with relationship attributes
  - Mostly represent a relational design in a diagrammatic form rather than a conceptual ER-based design

Automated Database Design Tools

COMPANY	TOOL	FUNCTIONALITY
Embarcadero Technologies	ER Studio	Database Modeling in ER and IDEF1X
	DB Artisan	Database administration, space and security management
Oracle	Developer 2000/Designer 2000	Database modeling, application development
Popkin Software	System Architect 2001	Data modeling, object modeling, process modeling, structured analysis/design
Platinum (Computer Associates)	Enterprise Modeling Suite: Erwin, BPWin, Paradigm Plus	Data, process, and business component modeling
Persistence Inc.	Pwertier	Mapping from O-O to relational model
Rational (IBM)	Rational Rose	UML Modeling & application generation in C++/JAVA
Resolution Ltd.	Xcase	Conceptual modeling up to code maintenance
Sybase	Enterprise Application Suite	Data modeling, business logic modeling
Visio	Visio Enterprise	Data modeling, design/reengineering Visual Basic/C++

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Thanks!!