DATABASE SYSTEMS
IS211

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Lecture 14

Database Design

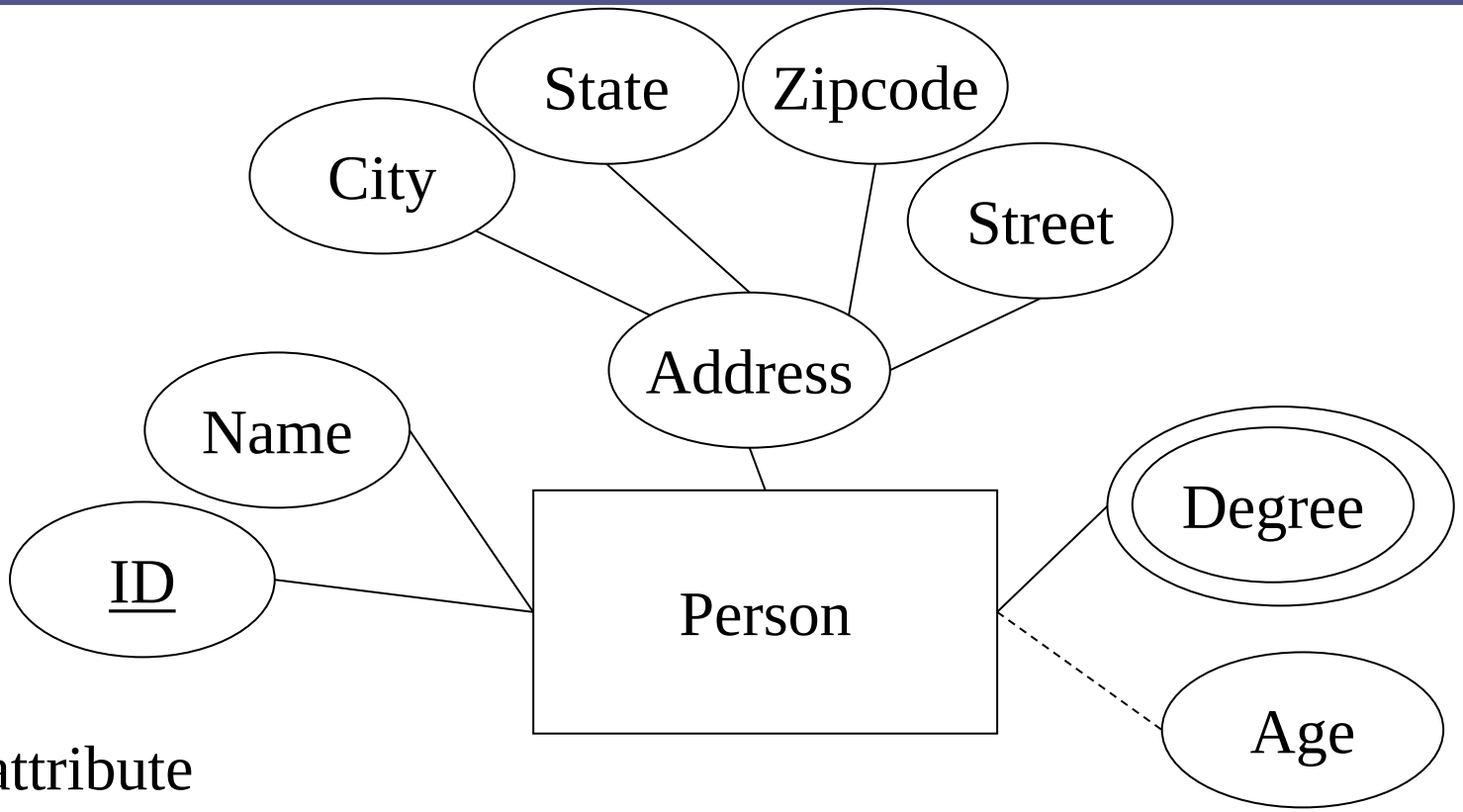
Database Design

CONCEPTUAL DATA MODELS

Entity Relationship (E-R) Model

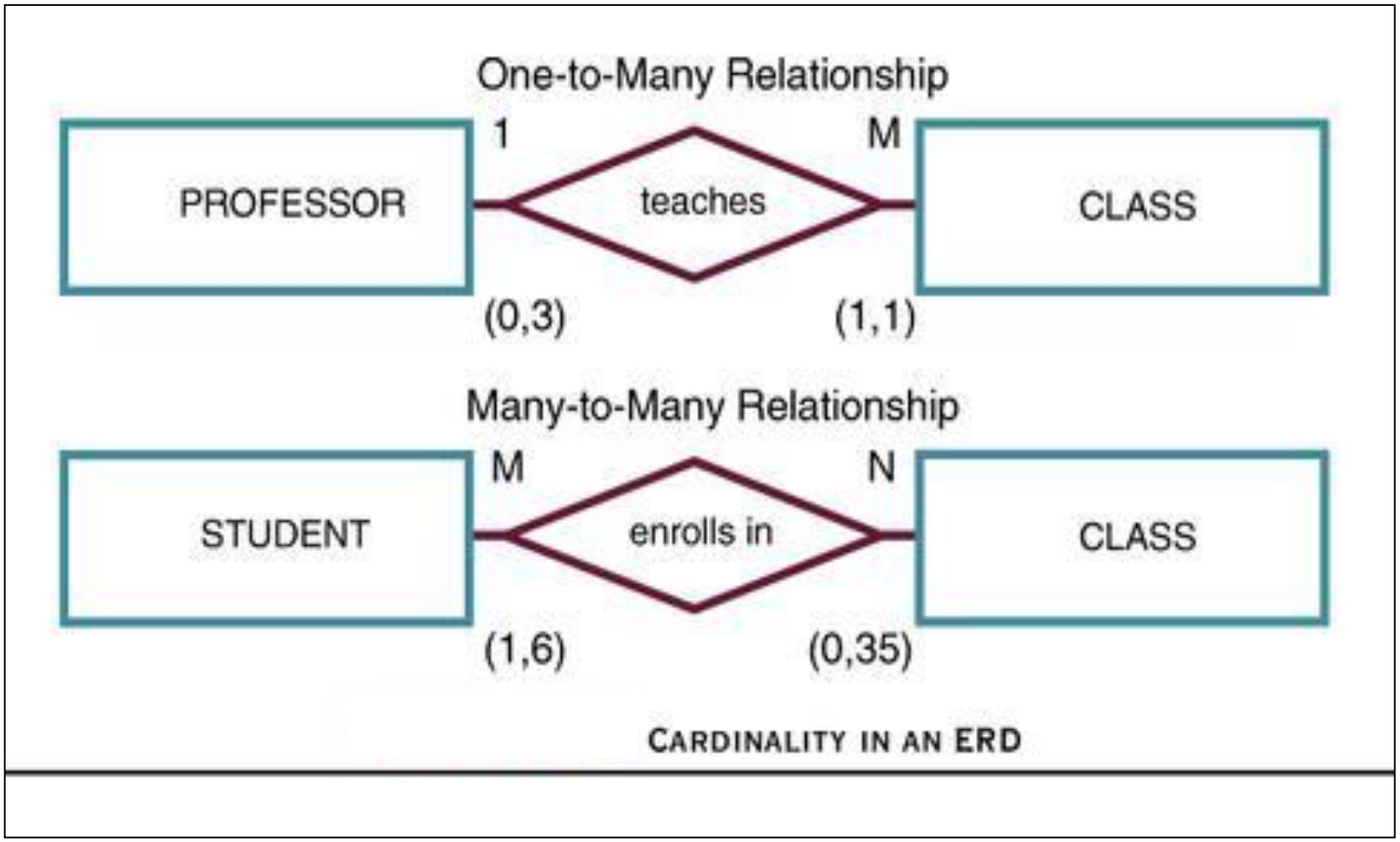
- E-R Model Components
  - **Entities**
  - **Attributes**
  - **Relationships**

Types of Attributes



Person is an entity
Name is a simple attribute
ID is a simple attribute and identifier
Address is a composite attribute
Degree is a multivalued attribute
Age is a derived attribute

Degree, Cardinality and participation of Relationships

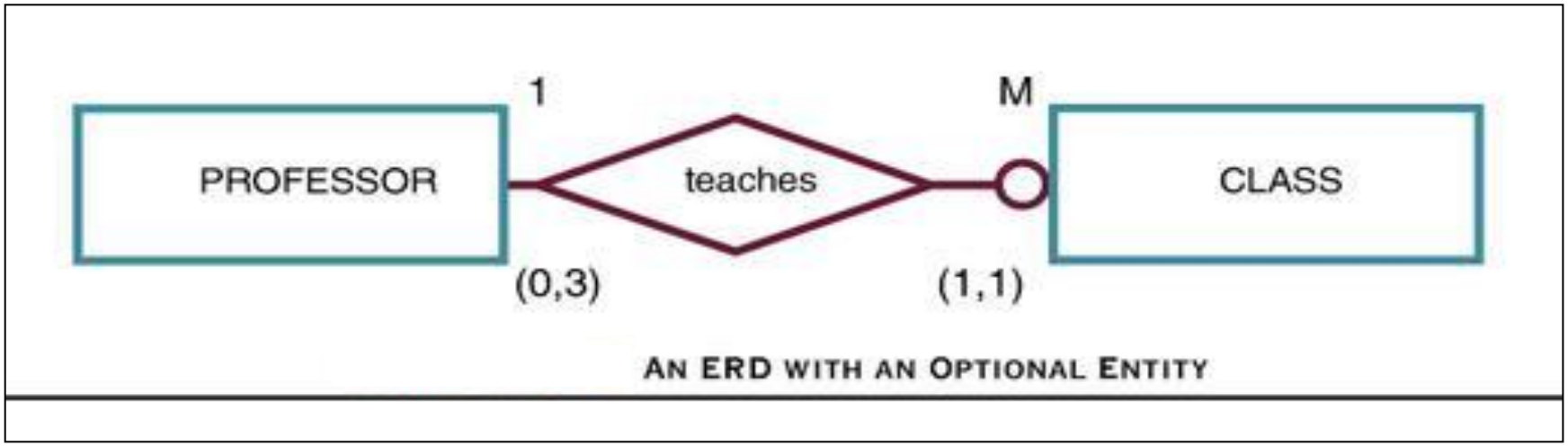


CARDINALITY IN AN ERD

Relationship

Relationship Participation

- The participation is optional if one entity occurrence does not require a corresponding entity occurrence in a particular relationship.
- An optional entity is shown by a small circle on the side of the optional entity.



AN ERD WITH AN OPTIONAL ENTITY

- A relationship can have attributes
- Specially in many to many relarionship

Entities

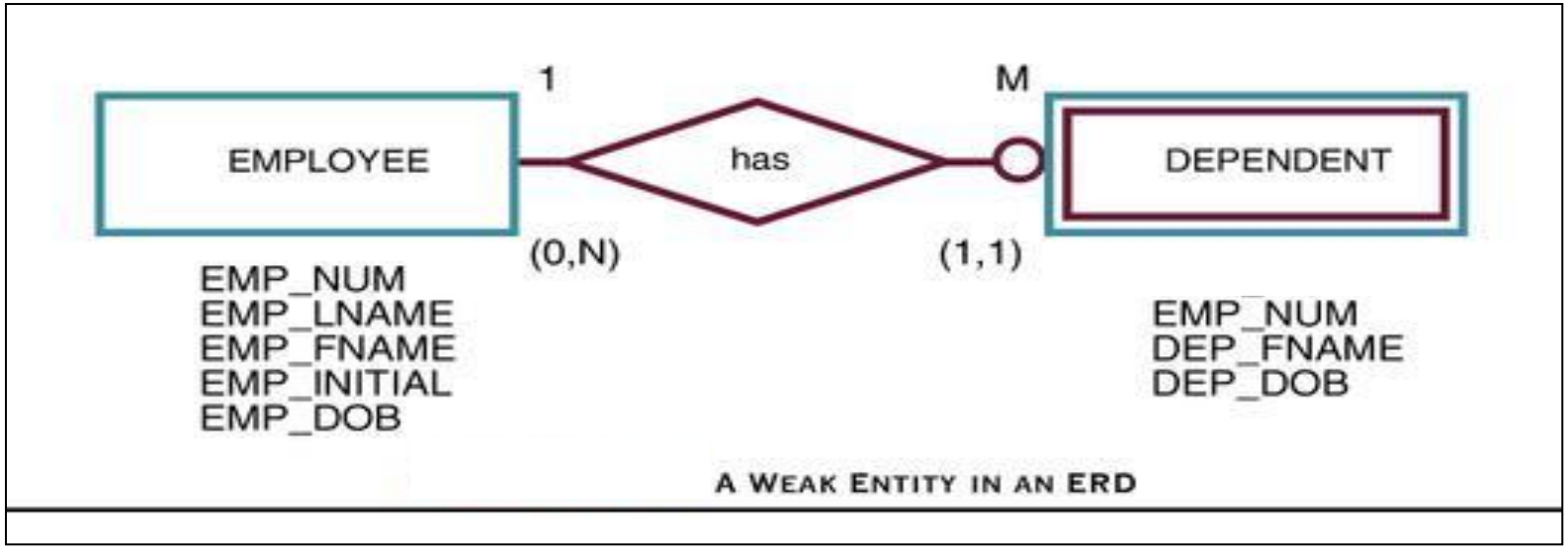
Weak Entity

Recursive Entity

Associative Entity

Weak Entities

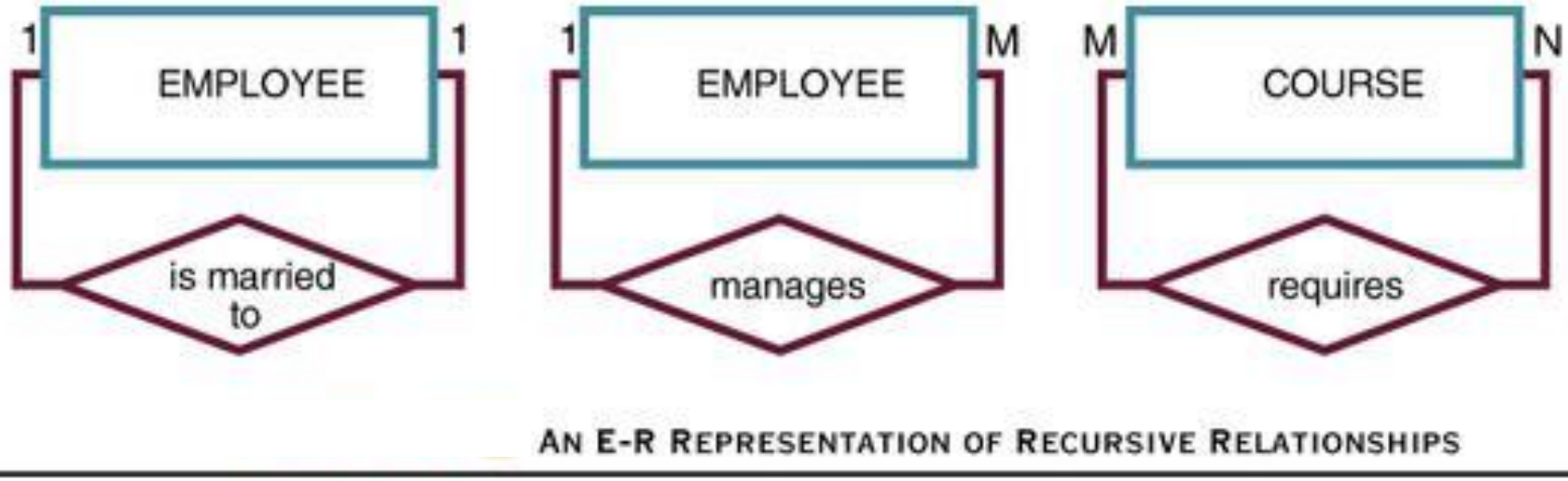
- A weak entity is an entity that
  - Is existence-dependent and
  - Has a primary key that is partially or totally derived from the parent entity in the relationship.
- The existence of a weak entity is indicated by a double rectangle.
- The weak entity inherits all or part of its primary key from its strong counterpart.



A WEAK ENTITY IN AN ERD

Recursive Entities

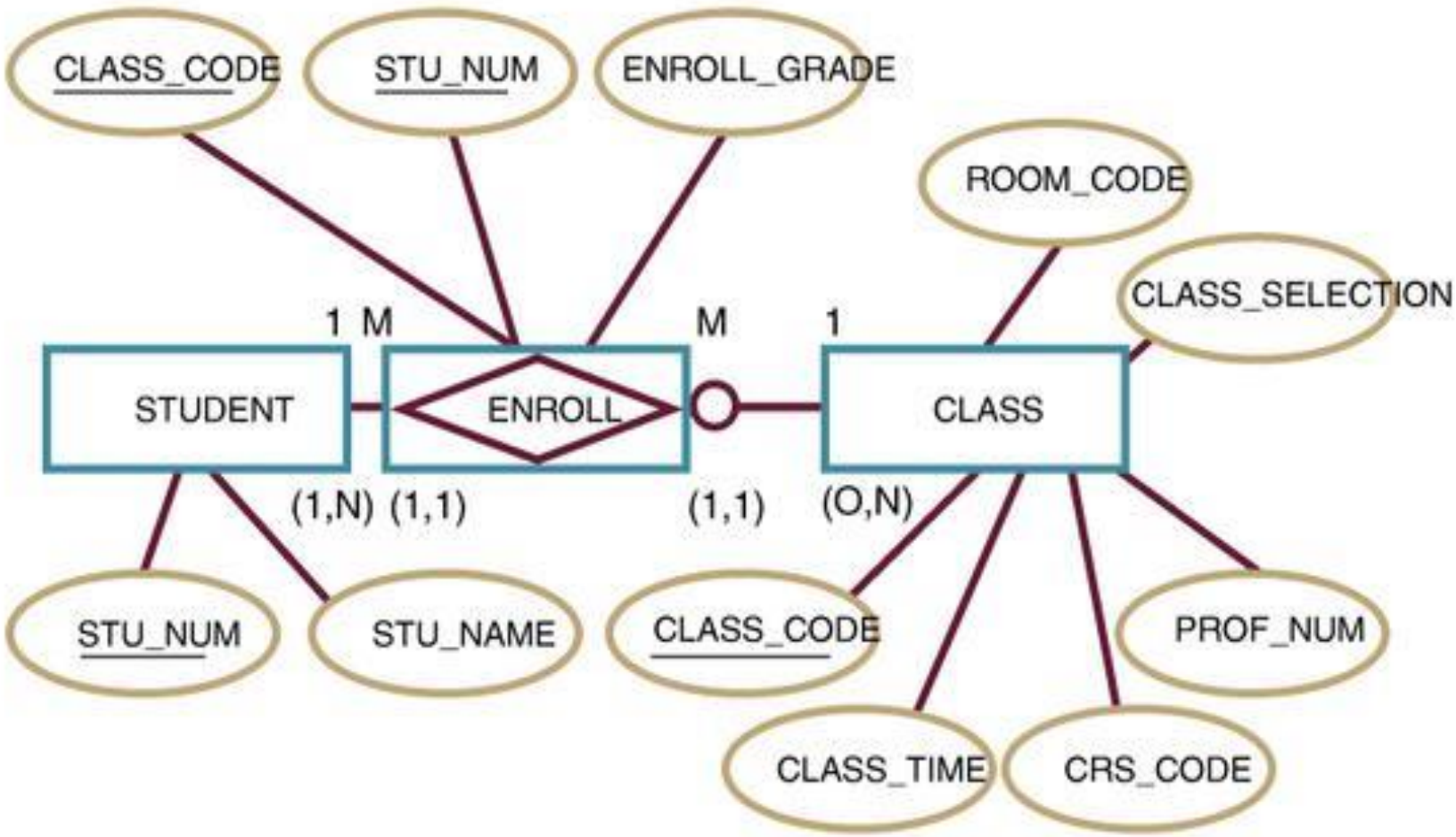
- A recursive entity is one in which a relationship can exist between occurrences of the same entity set.
- A recursive entity is found within a unary relationship.



AN E-R REPRESENTATION OF RECURSIVE RELATIONSHIPS

Associative Entities

- The associative entity serves as a bridge between the related entities.
- The associative entity *usually* splits up the many-to-many relationship between the related entities into two one-many relationships.
- An associative entity is composed of the primary keys of each of the entities to be connected.
- The associative entity may contain additional attributes that are peculiar to the relationship.
- The associative entity has independent meaning to the end-users.



A COMPOSITE ENTITY IN THE ERD

Summary of Notations for ER

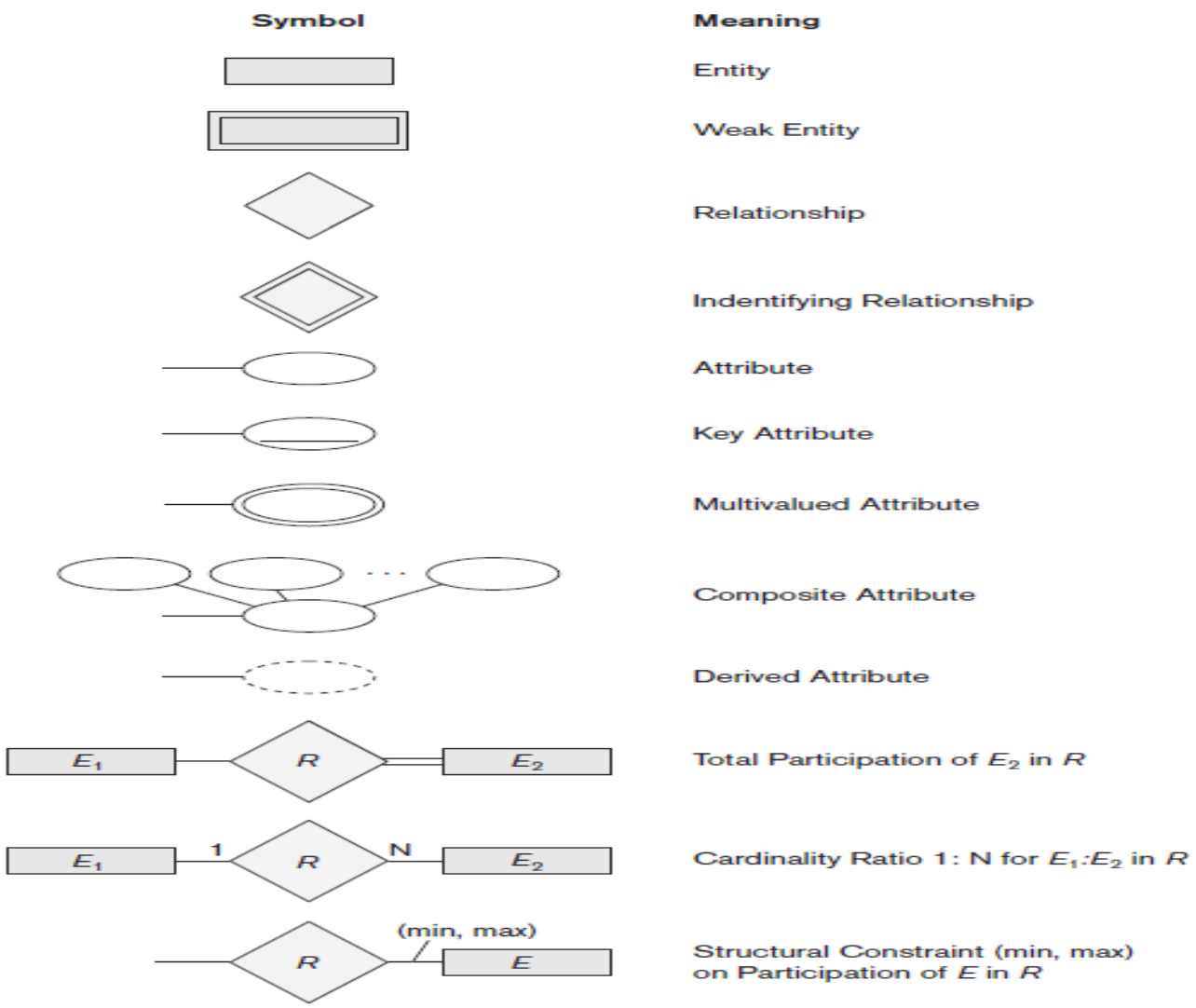


Figure 7.14
Summary of the notation for ER diagrams.

ERD DEVELOPMENT EXAMPLE

University System

- Every year at start of each semester a student enrolls on different courses which may have prerequisites, also student should have grade for each course separately.
- Every student has a unique id, name and GPA. For each course there a unique Id, name and description.
- Each course must be related to only one department, and is taught by only one professor. Every Professor has an id, name, email, address and multiple telephone numbers.
- Each student has his/her own advisor “Professor” to help in identifying path of interest, but some advisors mayn't advise any students.

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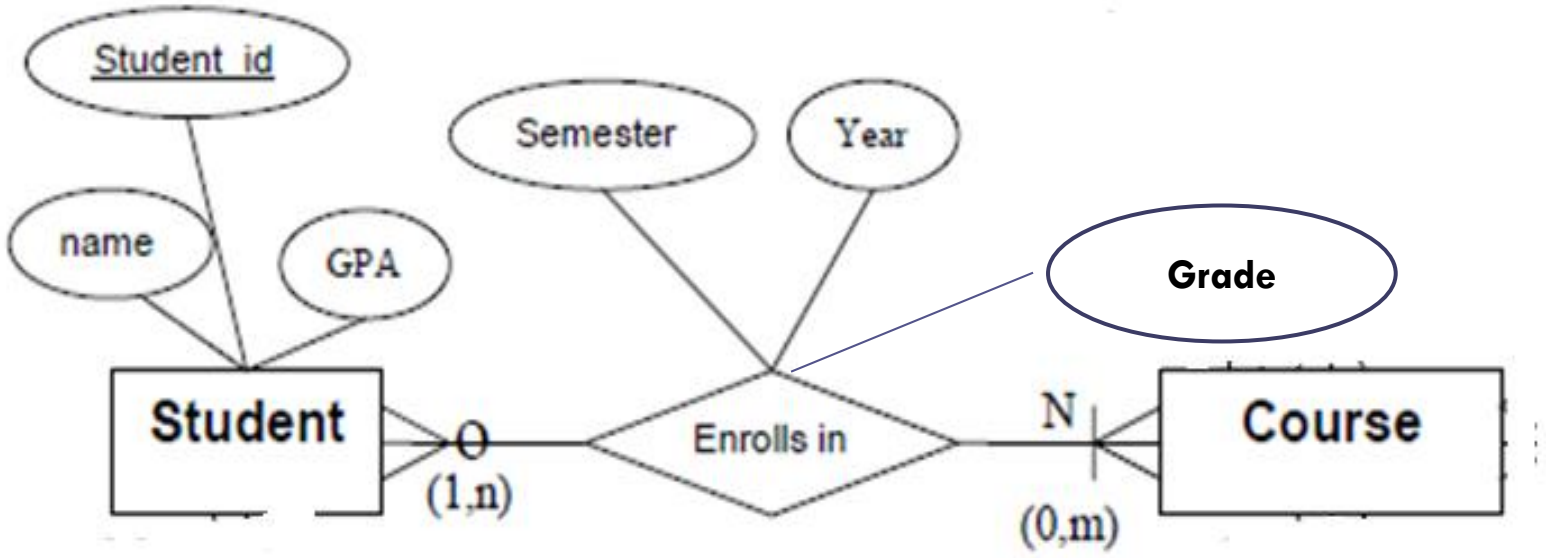

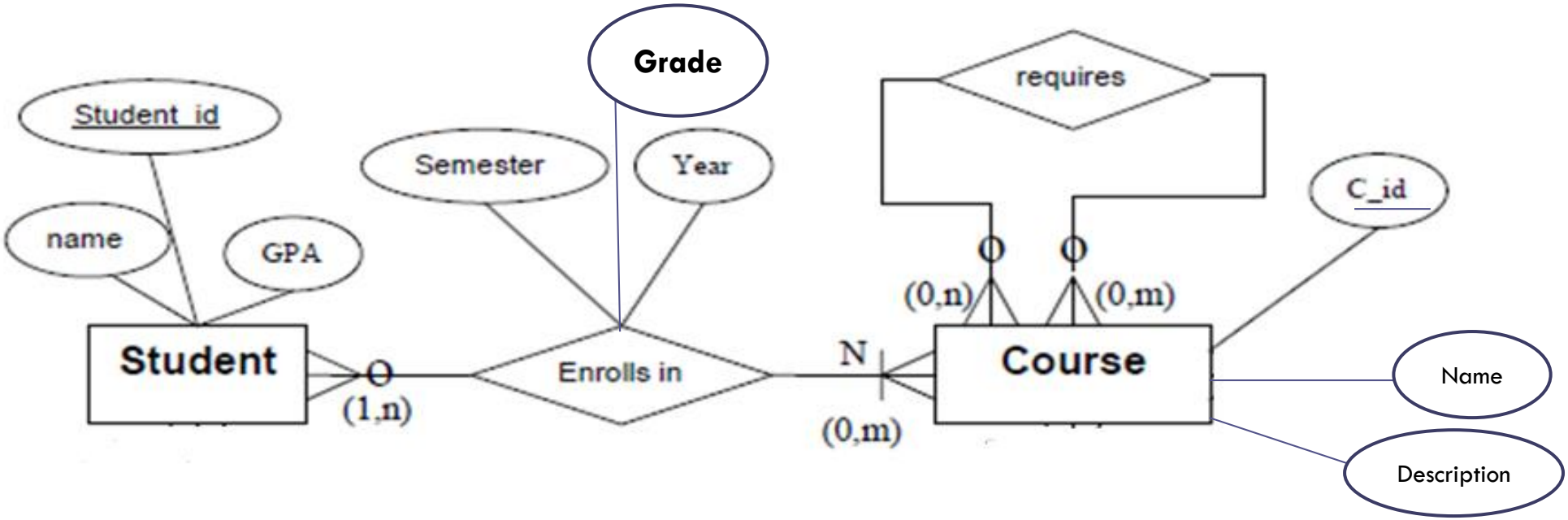
Grade
requires
Student_id
Semester
Year
C_id
name
GPA
(0,n)
(0,m)
Student
(1,n)
Enrolls in
N
(0,m)
Course
Name
Description

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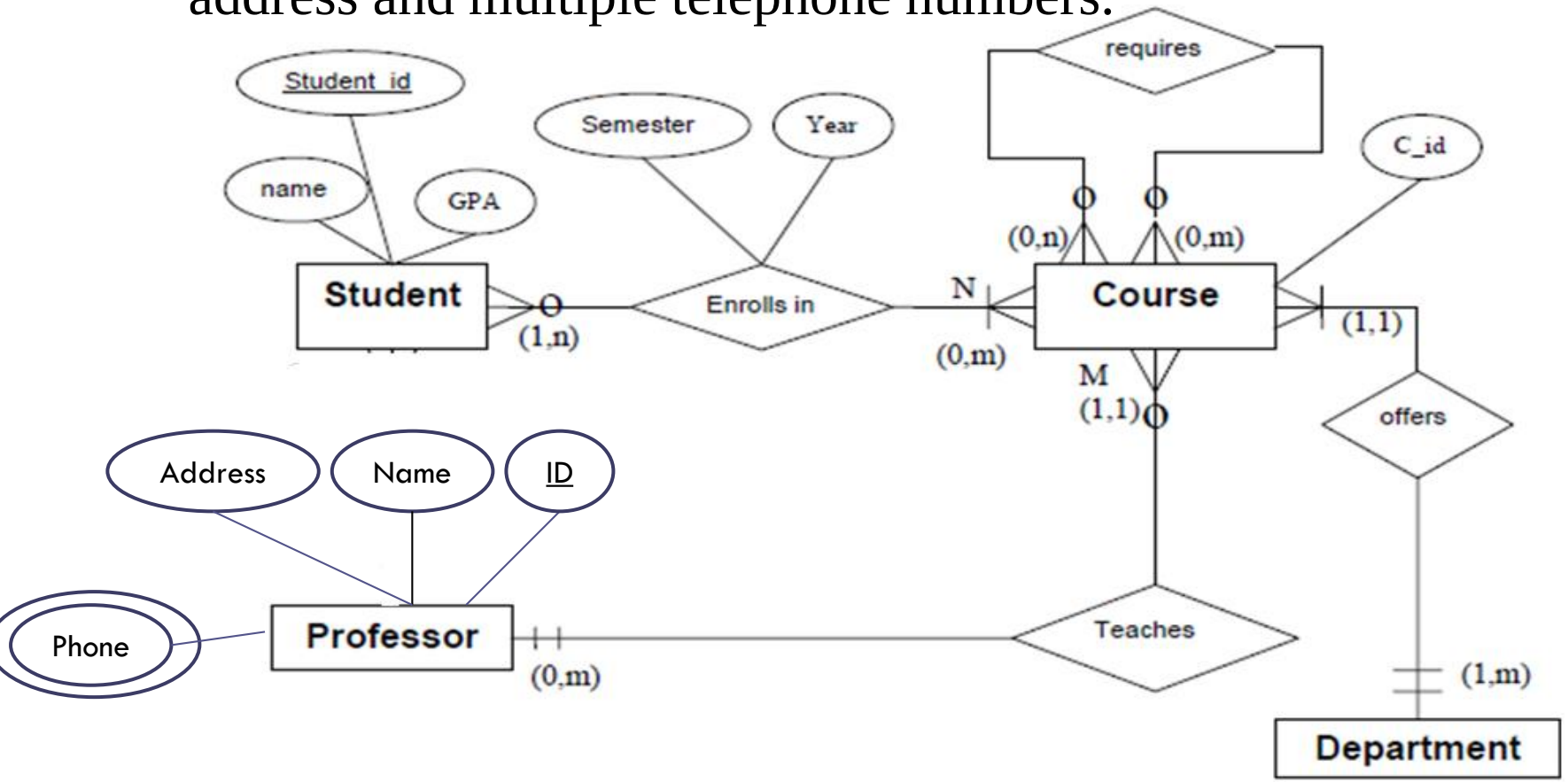

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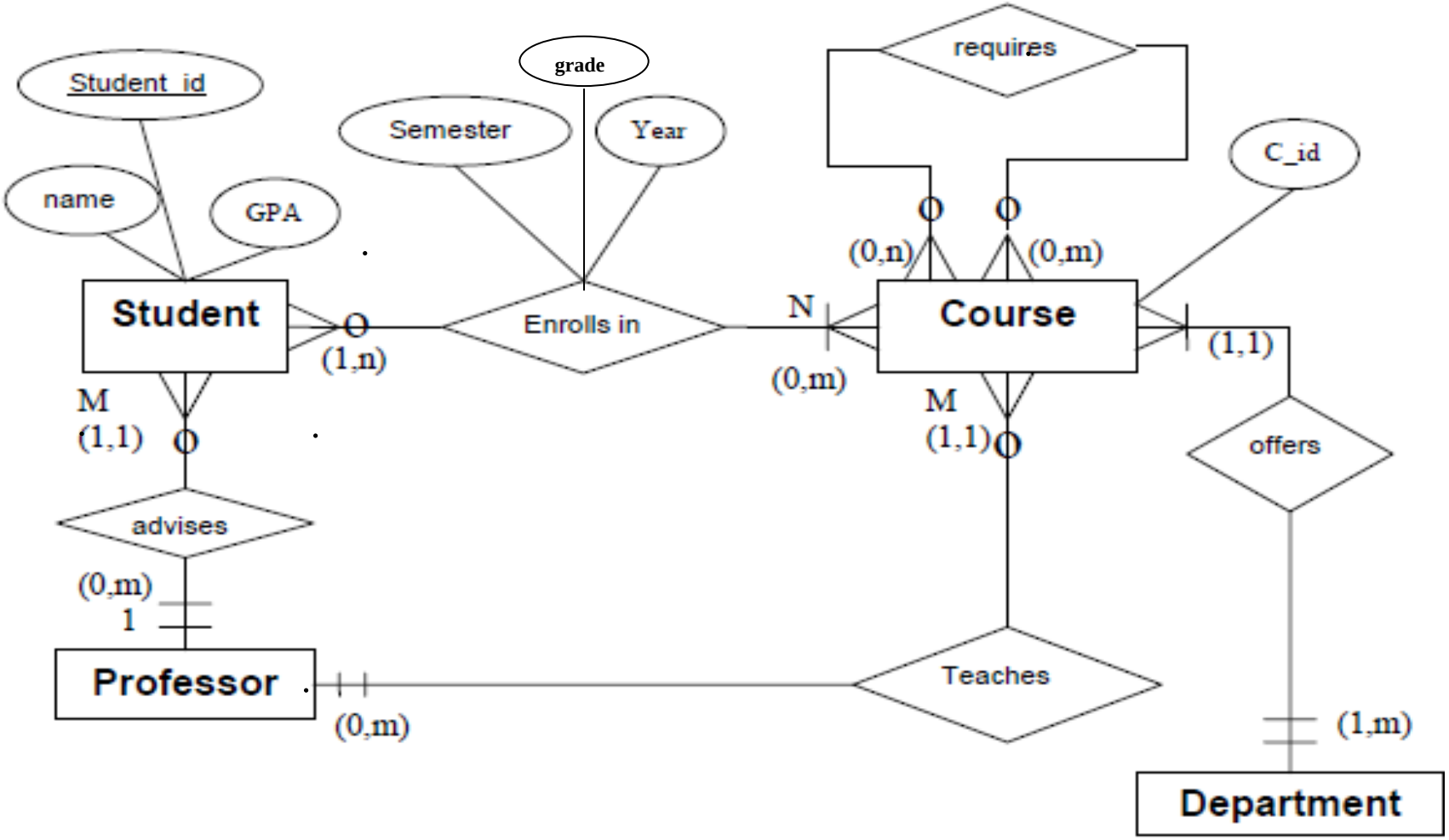

Exercise

- ABC Company wants to create an information system for HR system, The COMPANY database keeps track of a company's employees, departments, and projects. The requirements gathered are:
- The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations.
- A department controls a number of projects, each of which has a unique name, a unique number, and a single location.
- We store each employee's name, Social Security number, address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).

- We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee.
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Answer

Example Attribute of a Relationship Type:

Hours of WORKS_ON and Start_Date of MANAGES