

Database Systems and Web (15B11CI312)

Database Systems and Web

Lecture 4

Contents to be covered

- Relationships
- Degree of a relationship
- Binary Relationships and Cardinality Ratio
- Participation of an Entity Set in a Relationship Set
- Weak Entity Sets
- Case study

Relationships

- When two or more entities are associated with each other, we have an instance of a Relationship.

For Example, Student enrolls in a course

- Relationship enrolls has Student and Course as the participating entity sets.



- Formally, $\text{enrolls} \subseteq \text{Student} \times \text{Course}$

$(s,c) \in \text{enrolls} \Leftrightarrow \text{Student 's' has enrolled in Course 'c'}$

Tuples in enrolls – relationship instances

enrolls is called a relationship Type/Set.

Degree of a relationship

Degree : the number of participating entities.

- Degree 2: binary
- Degree 3: ternary

Example: Suppose employees of a bank may have jobs (responsibilities) at multiple branches, with different jobs at different branches. Then there is a ternary relationship set between entity sets employee, job, and branch

- Degree n: n-ary

Binary relationships are very common and widely used.

Binary Relationships and Cardinality Ratio

- The number of entities from E2 that an entity from E1 can possibly be associated thru R (and vice-versa) determines the cardinality ratio of R.

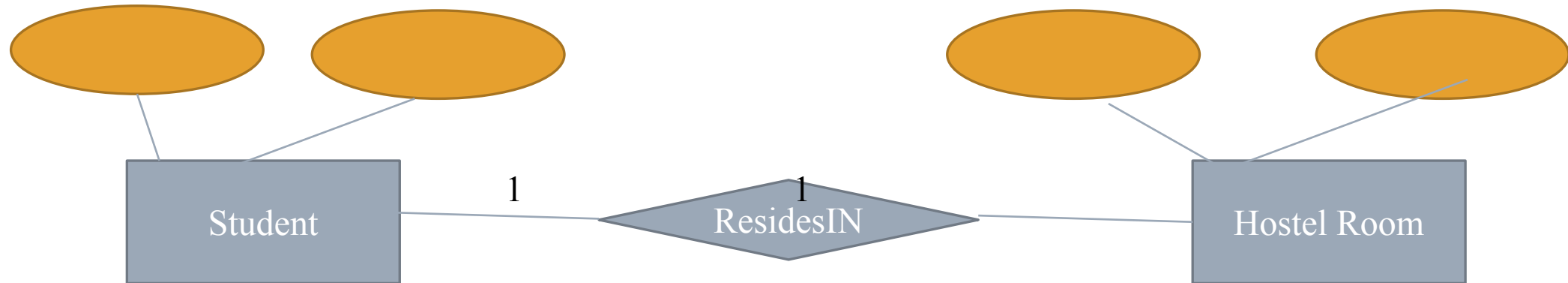


- We express cardinality constraints by drawing either a directed line (\rightarrow), signifying “one,” or an undirected line (—), signifying “many,” between the relationship set and the entity set.
- Four possibilities are usually specified:
 - one-to-one (1:1)
 - one-to-many (1:N)
 - many-to-one (N:1)
 - many-to-many (M:N)

Cardinality Ratios

One-to-one Relationship

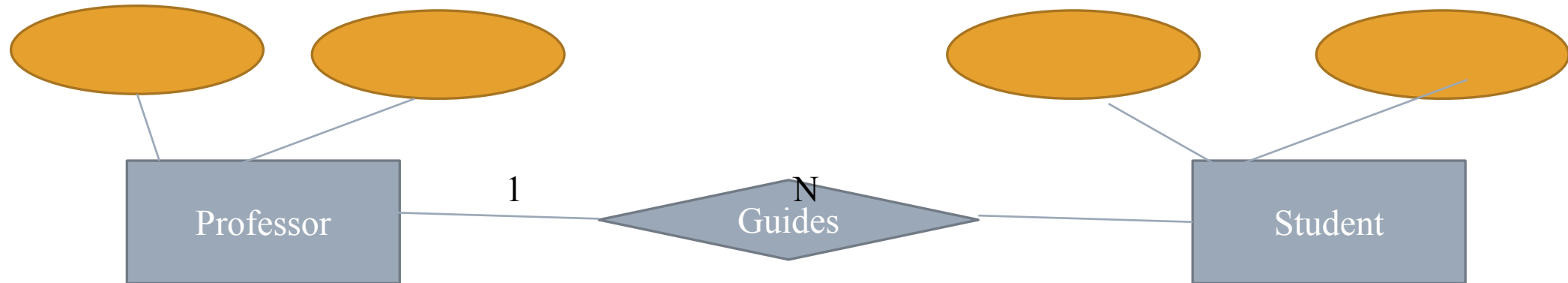
An E1 entity may be associated with at most one E2 entity and similarly an E2 entity may be associated with at most one E1 entity.



Cardinality Ratios

One-to-many:

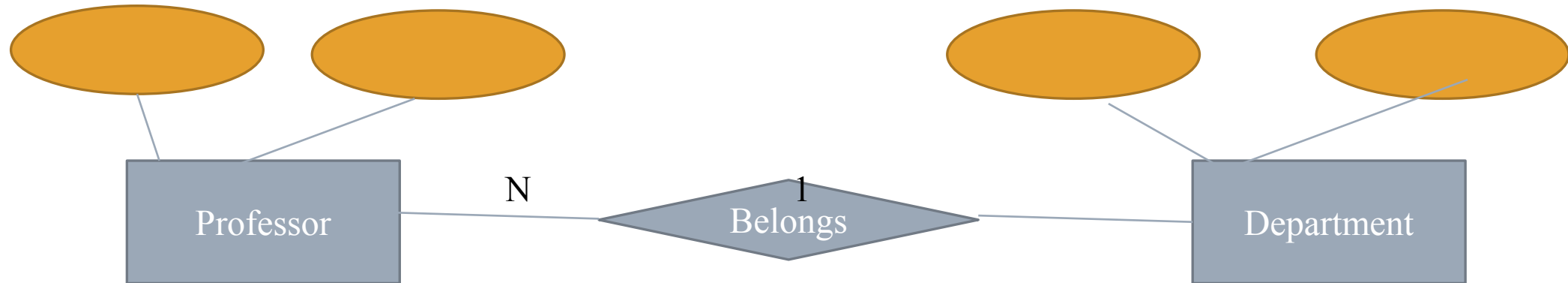
An E1 entity may be associated with many E2 entities whereas an E2 entity may be associated with at most one E1 entity.



Cardinality Ratios

Many-to-one

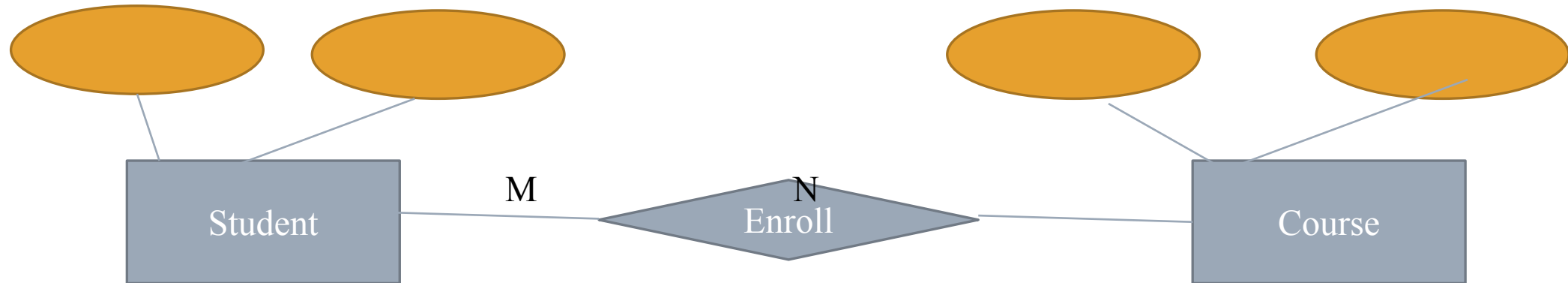
An E1 entity may be associated with at most one E2 entities whereas an E2 entity may be associated with many E1 entity.



Cardinality Ratios

Many-to-many:

Many E1 entities may be associated with many E2 entity and also a single E1 entity may be associated with many E2 entities.



Participation of an Entity Set in a Relationship Set

Total participation (indicated by double line): every entity in the entity set participates in at least one relationship in the relationship set

For Example : participation of course in teach is total
every course must have a professor

Partial participation: some entities may not participate in any relationship in the relationship set

Example: participation of professor in teach is partial



Participation of an Entity Set in a Relationship Set

One more example

Roles

- Entity sets of a relationship need not be distinct
- The labels “manager” and “worker” are called roles; they specify how employee entities interact via the works for relationship set.
- Roles are indicated in E-R diagrams by labeling the lines that connect diamonds to rectangles.
- Role labels are optional, and are used to clarify semantics of the relationship.

Weak Entity Sets

An entity set that does not have a primary key is referred to as a **weak entity set**.

The existence of a weak entity set depends on the existence of a **identifying entity set**

- It must relate to the identifying entity set via a total, one-to-many relationship set from the identifying to the weak entity set
- Identifying relationship depicted using a double diamond

The discriminator (or partial key) of a weak entity set is the set of attributes that distinguishes among all the entities of a weak entity set.

The primary key of a weak entity set is formed by the primary key of the strong entity set on which the weak entity set is existence dependent, plus the weak entity set's discriminator.

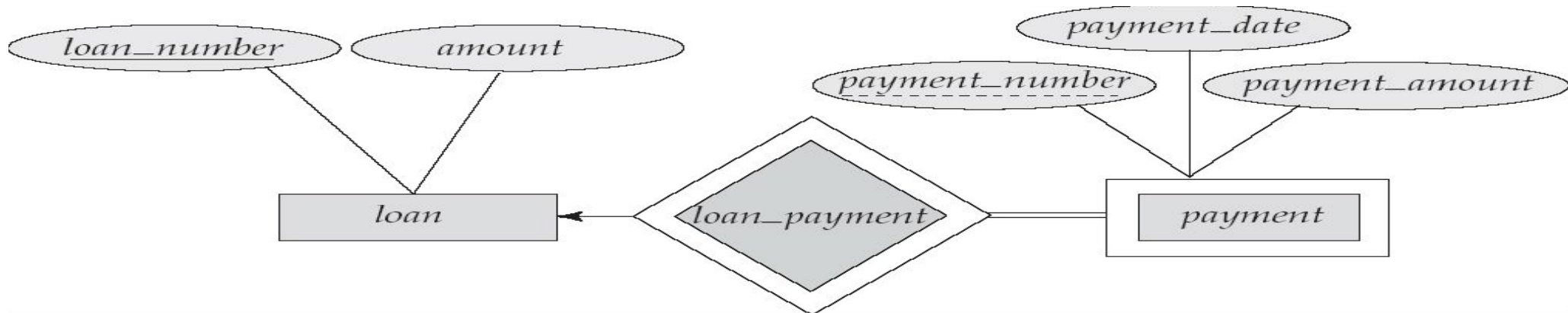
Weak Entity Sets

We depict a weak entity set by double rectangles.

We underline the discriminator of a weak entity set with a dashed line.

payment_number – discriminator of the payment entity set

Primary key for payment – (loan_number, payment_number)



ER Example for company database

Consider the ER diagram shown in previous slide for a company database.

- a. List the (nonweak) entity types in the ER diagram.
- b. Is there a weak entity type? If so, give its name, partial key, and identifying relationship.
- c. What constraints do the partial key and the identifying relationship of the weak entity type specify in this diagram?
- d. List the names of all relationship types, and specify the (min, max) constraint on each participation of an entity type in a relationship type. Justify your choices.
- e. List concisely the user requirements that led to this ER schema design.

Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

