Unit II: Data Modeling

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Overview

Entity- Relationship Model

- Constraints
  - Mapping cardinalities
  - Participation constraints
- Design issues
  - Keys
  - Weak entity sets
  - Extended E-R features

Constraints on binary relationship

Cardinality ratio

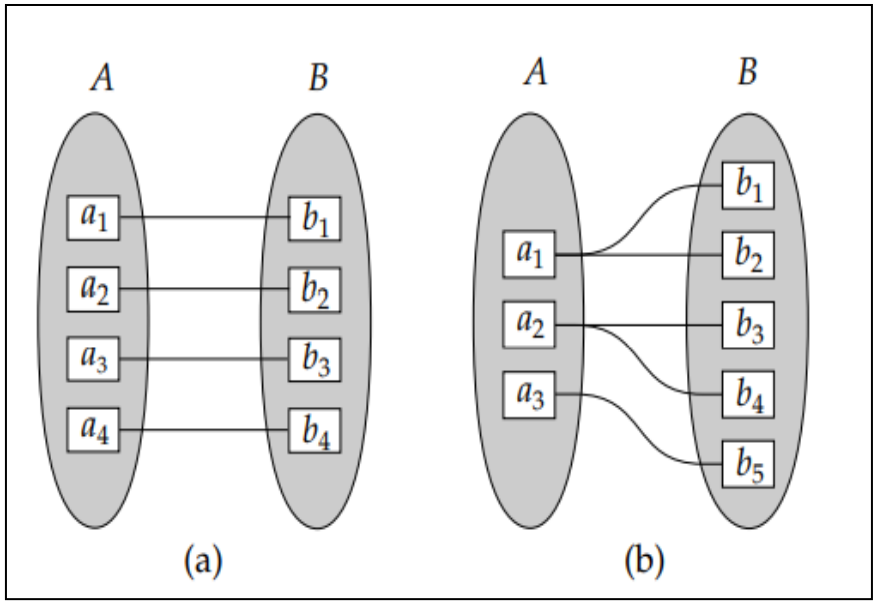
Participation

Cardinality ratio

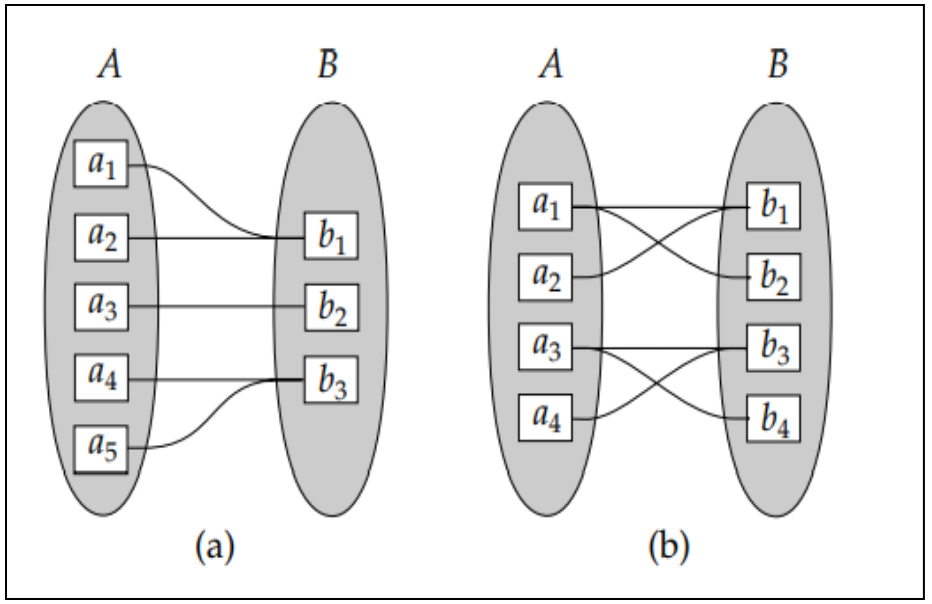
- Number of entities to which another entity can be associated via a relationship set

One to one	One to many	Many to one	Many to many
• Entity A is associated with atmost one entity in B • **MANGES** relation between department and manager	• Entity A is associated with any number of entities in B • **DEPARTMENT: EMPLOYEE**	• Entity A is associated with atmost one entity in B and entity in B can associate with any number of entities in A • **EMPLOYEE: DEPARTMENT** Many employees works in one department	• Entity A is associated with any number of entities in B and entity of B associate with any number of entities in A • **WORKS_ON: EMPLOYEE** Employee works on multiple projects and project can have several employees

Mapping cardinalities/Cardinality ratio



Mapping cardinalities. (a) One to one. (b) One to many.

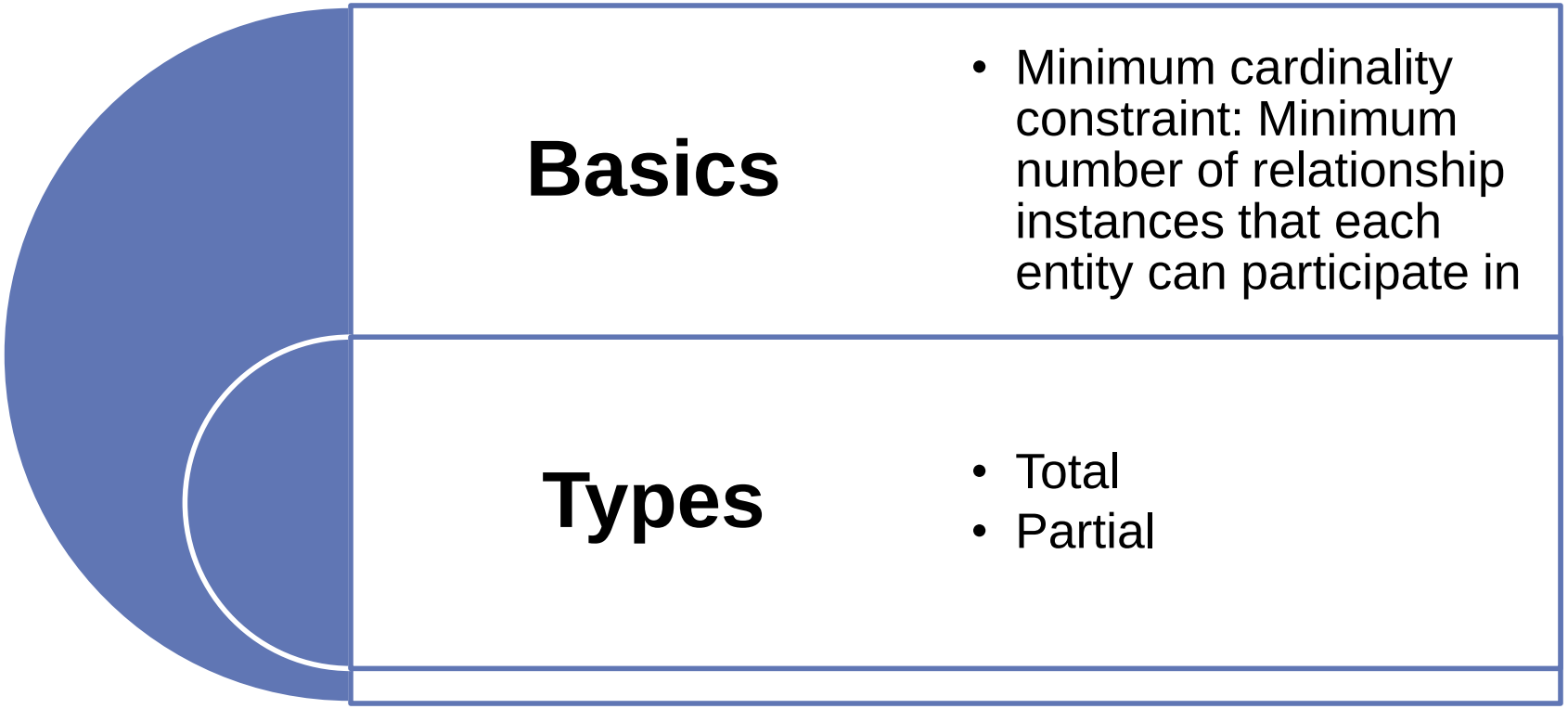


Mapping cardinalities. (a) Many to one. (b) Many to many.

Reference: Silberschatz−Korth−Sudarshan, Database System Concepts, Fourth Edition

Entity- Relationship Model

Participation constraints



Entity- Relationship Model

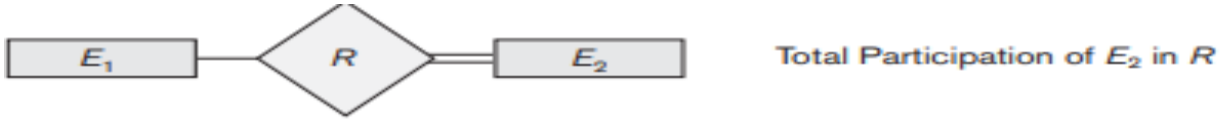
Participation constraints

Total participation

- Existence dependency: Each entity in entity set is involved in atleast one relationship in a relationship set
- Example: Participation of EMPLOYEE in WORKS_FOR relationship instance

Partial participation

- Each entity in entity set may or may not occur in atleast one relationship in a relationship set
- Example: Some set of employee entities related to department entity via manages but not all



Total Participation of E_2 in R

Reference: *Fundamental of Database Systems*. R. Elmasri, S.B. Navathe, Pearson Education, Seventh edition

Relationship type of degree higher than two

Constraints on ternary (or higher degree) relationships

Cardinality ratio of binary

1,M,N specified on each participating arc

(min,max) notation

Each entity is related to at least *min* and at most *max* relationship instances

Design Issues

Why?

Relationship among various entities

Design Issues (contd.)

Basic Issues

- Use of entity set versus attributes
- Use of entity set versus relationship sets
- Binary versus n-ary relationship set
- Placement of relationship attributes

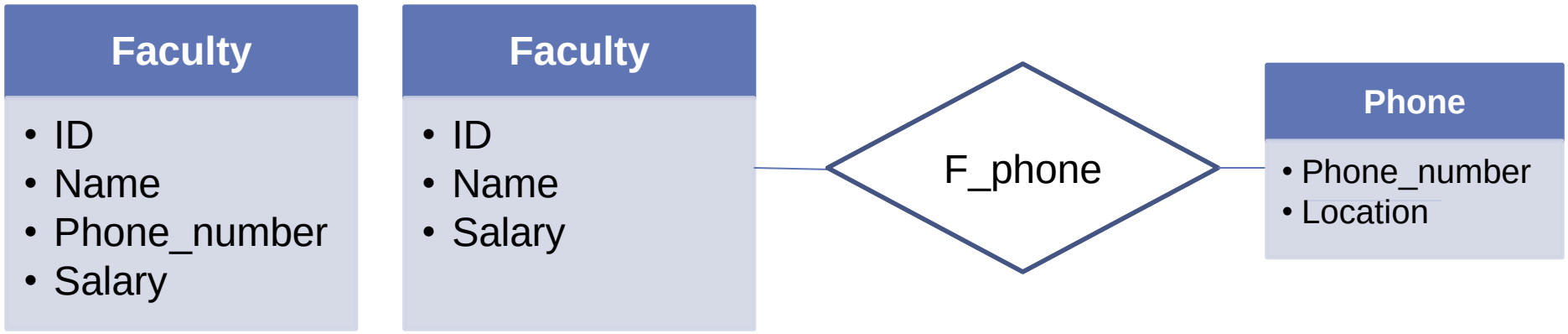
Design Issues (contd.)

Use of entity set versus attributes

- Two questions:
  - What constitutes an attribute?
  - What constitutes an entity set?
- Answer:
  - Structure of real-world enterprise being modeled
  - Semantics associated with attributes

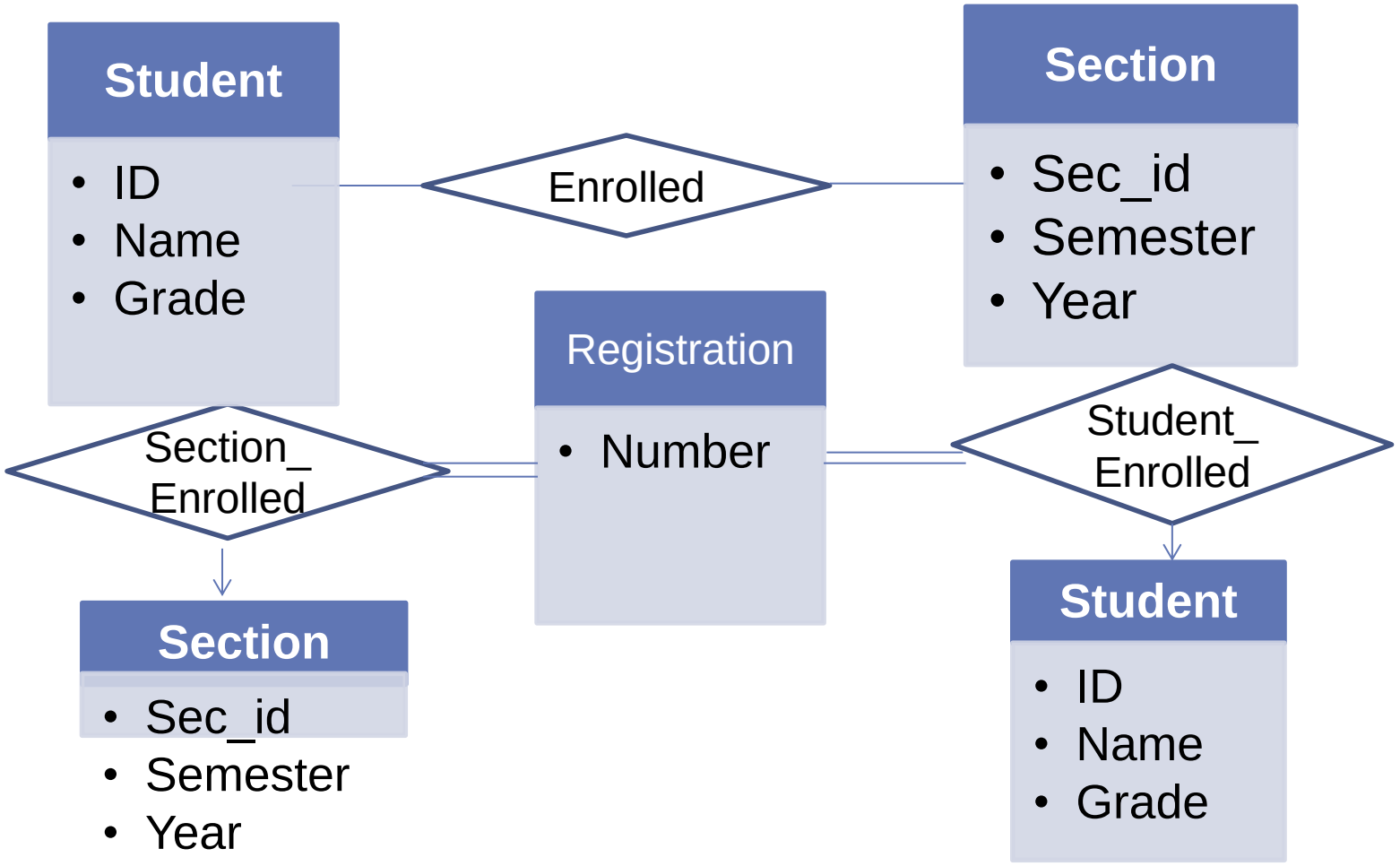
Design Issues (contd.)

Use of entity set versus attributes



Design Issues (contd.)

Use of entity set versus relationship sets



Design Issues (contd.)

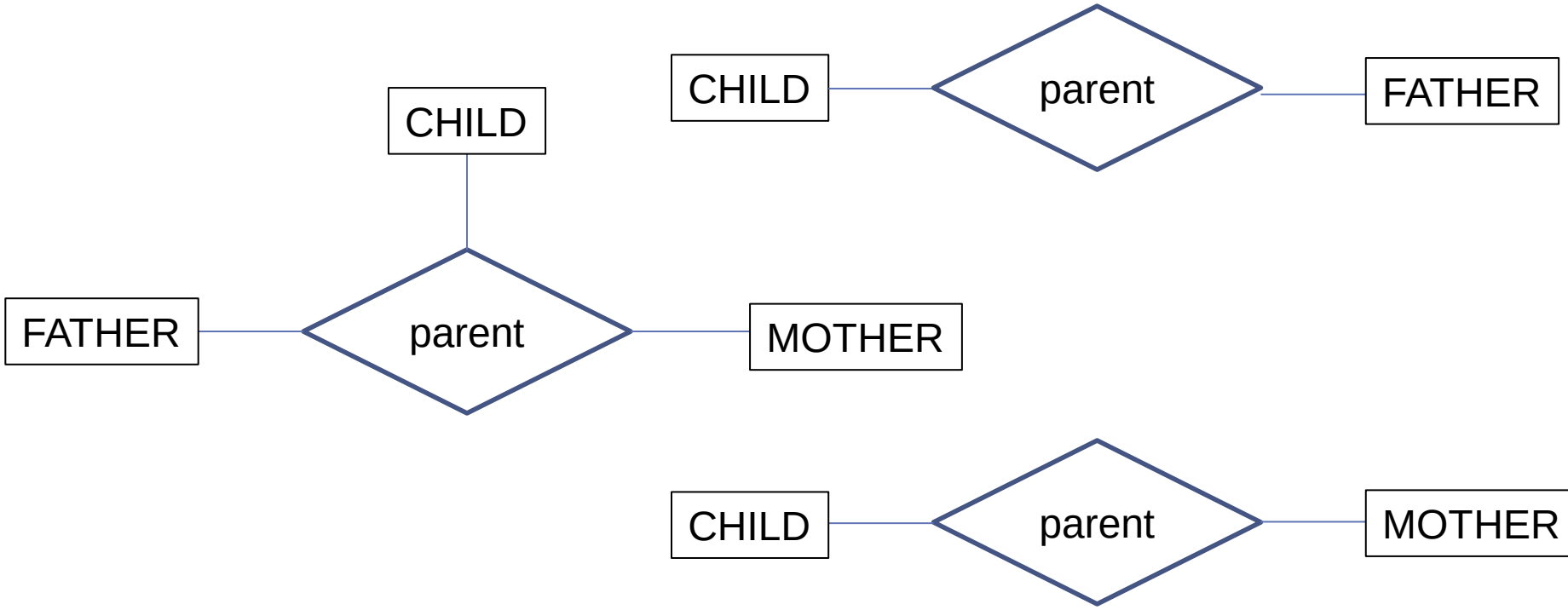
Use of entity set versus relationship sets

- Designate a relationship set to describe an action that occurs between entities

Design Issues (contd.)

Binary versus n-ary relationship set

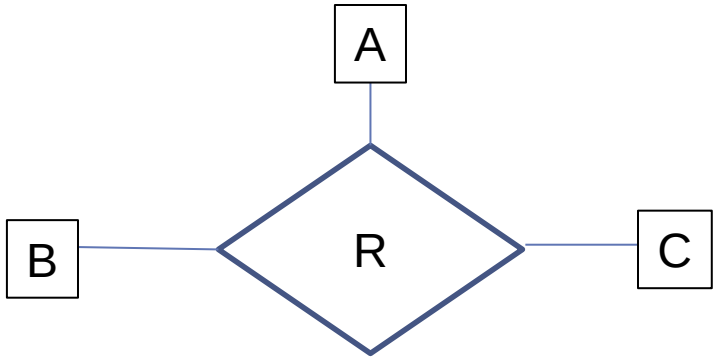
- Nonbinary relationships can be represented by several binary relationships



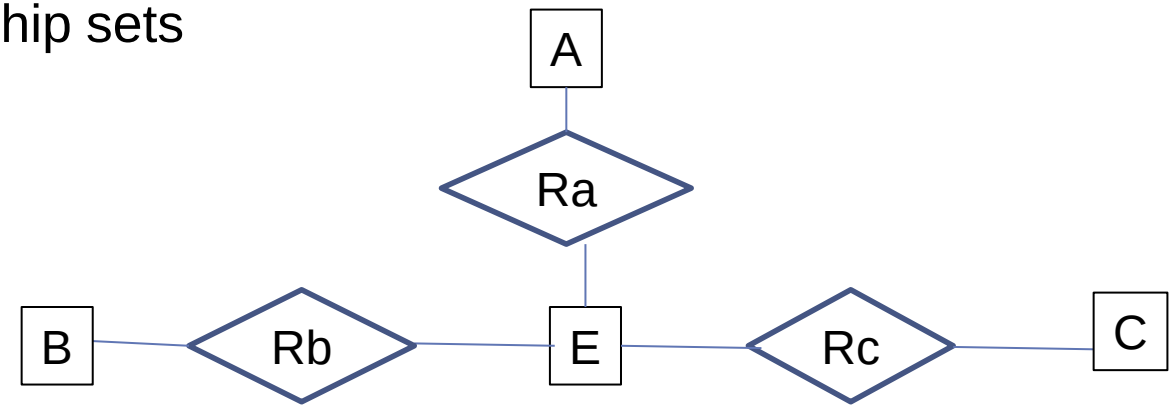
Design Issues (contd.)

Binary versus n-ary relationship set

- Ternary relationship set R, relating entity sets A, B and C



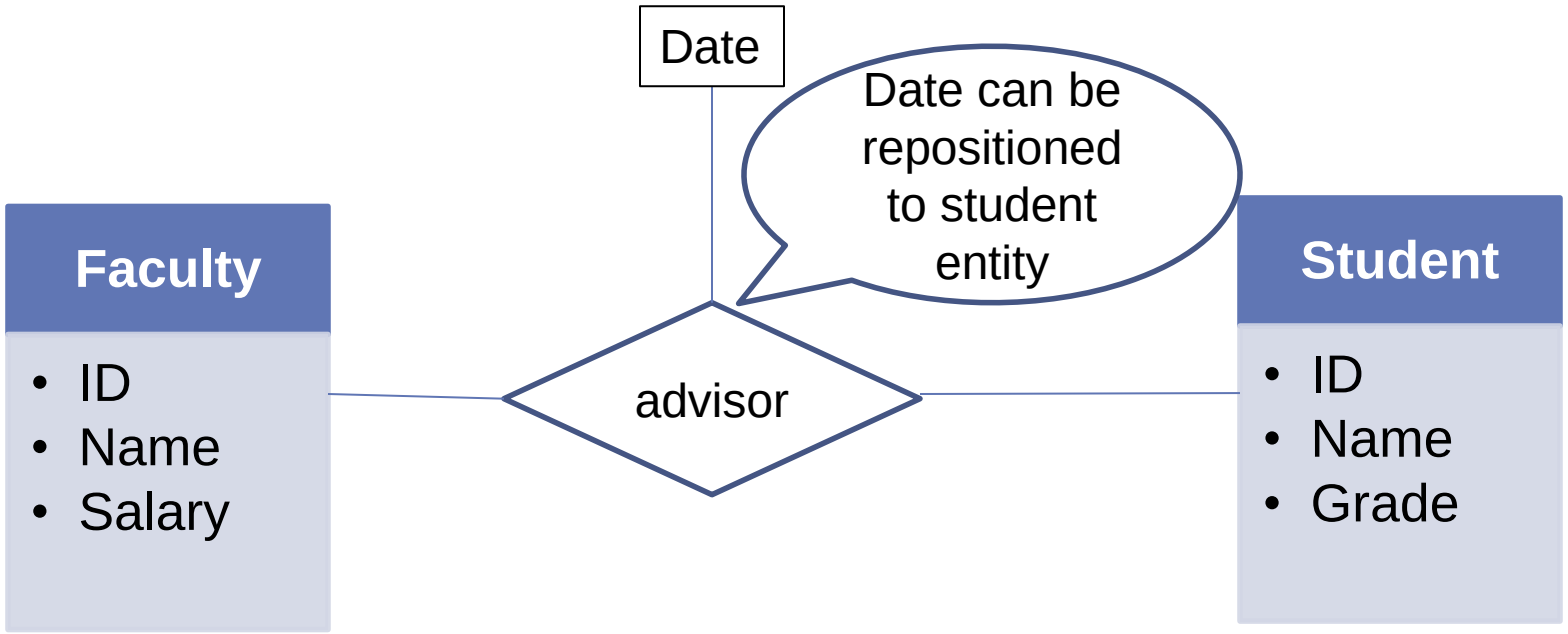
- Replace the relationship set R by an entity set E, and create three relationship sets



Design Issues (contd.)

Placement of relationship attributes…Cardinality ratio

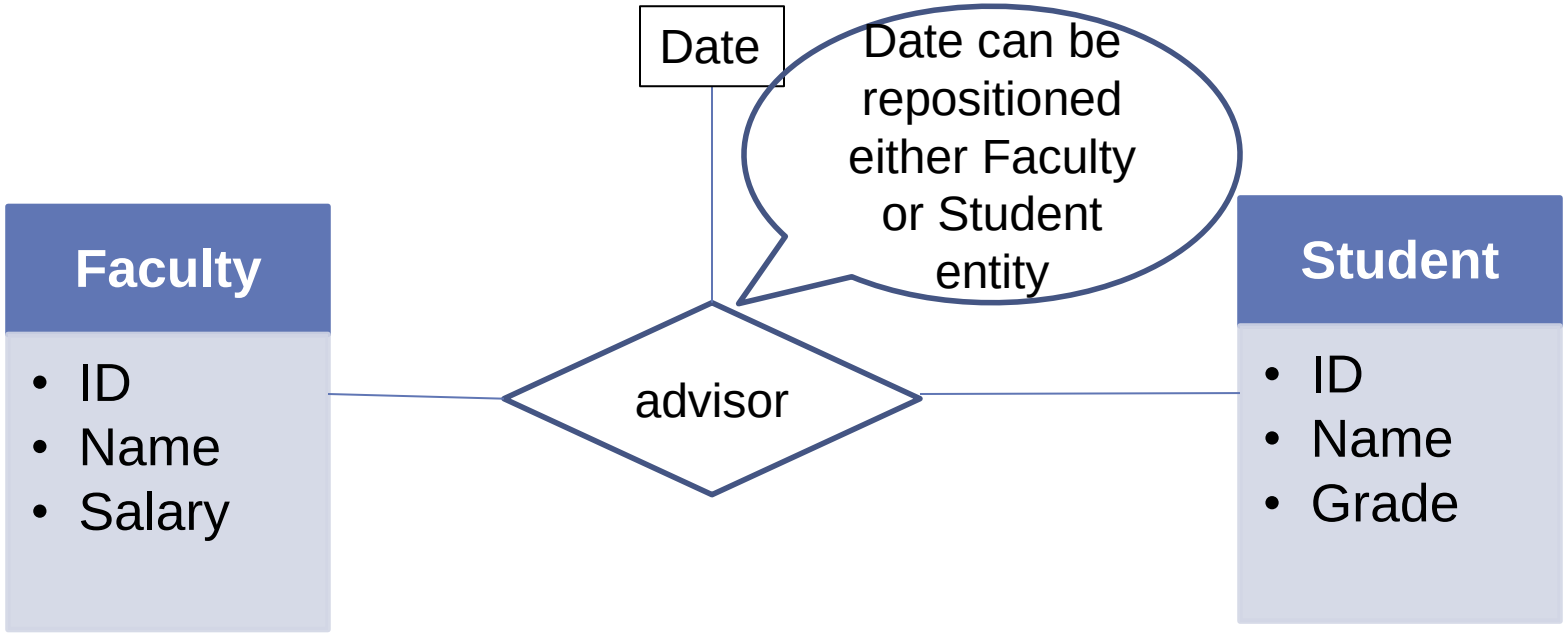
- Attributes of a one-to-many or many-to-one relationship sets can be repositioned to only the entity set on the many side of the relationship



Design Issues (contd.)

Placement of relationship attributes

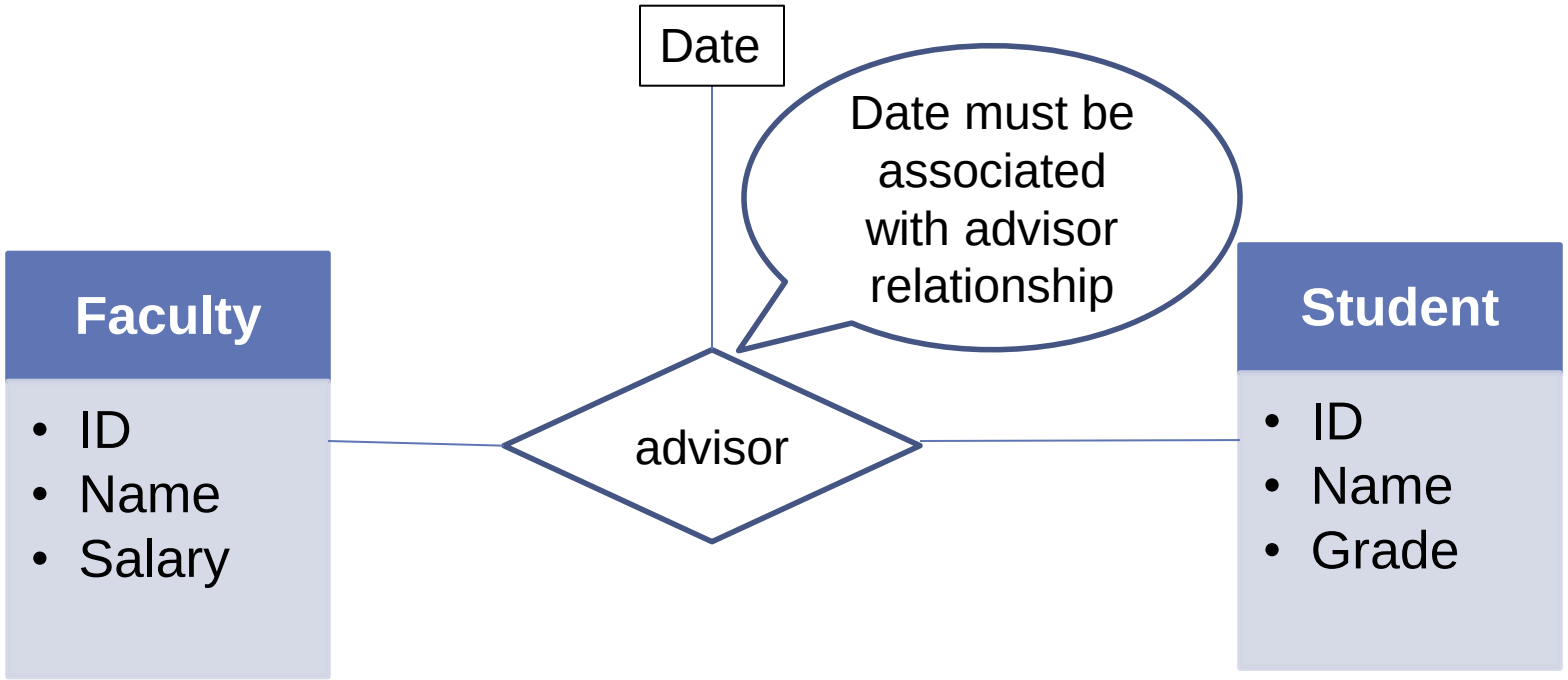
- In one-to-one relationship, relationship attribute can be associated with either one of the participating entities



Design Issues (contd.)

Placement of relationship attributes

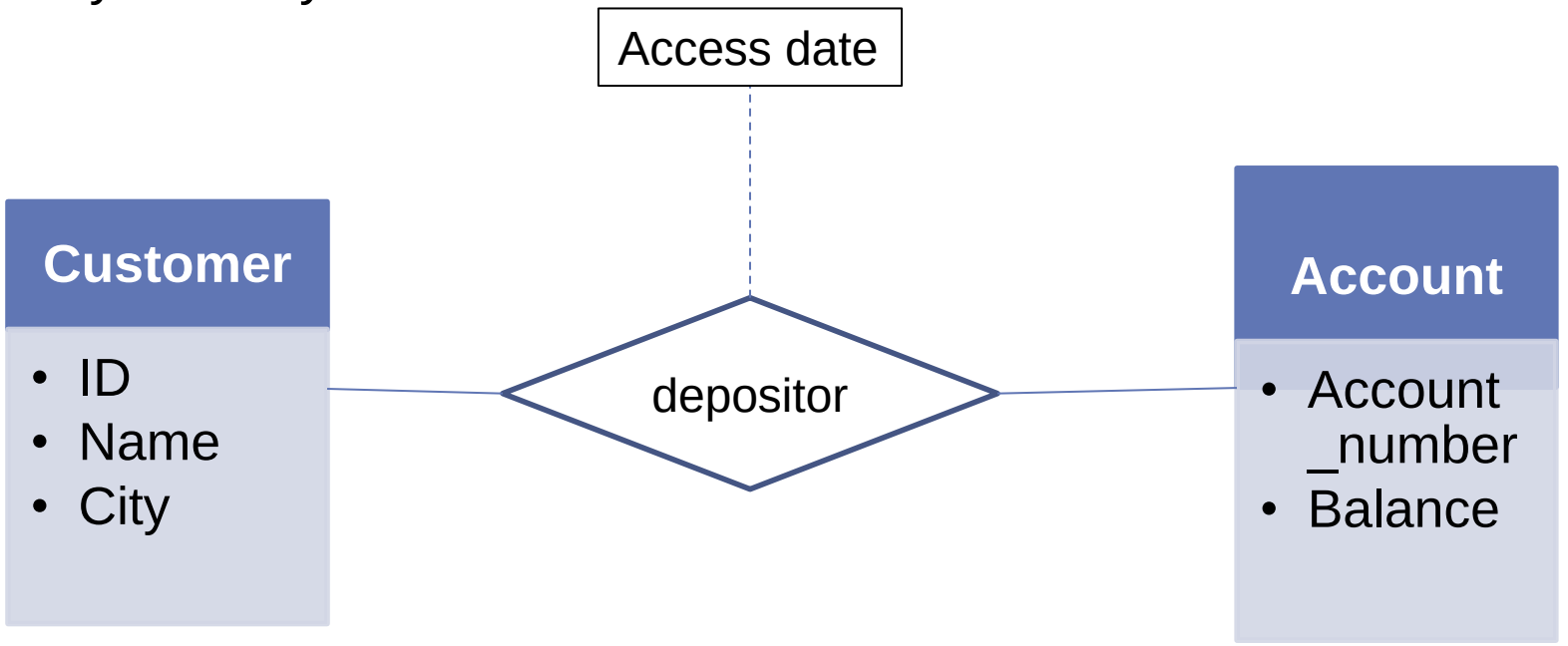
- For many-to-many relationship, attributes must be associated with relationship sets rather than one of the participating entities



Design Issues (contd.)

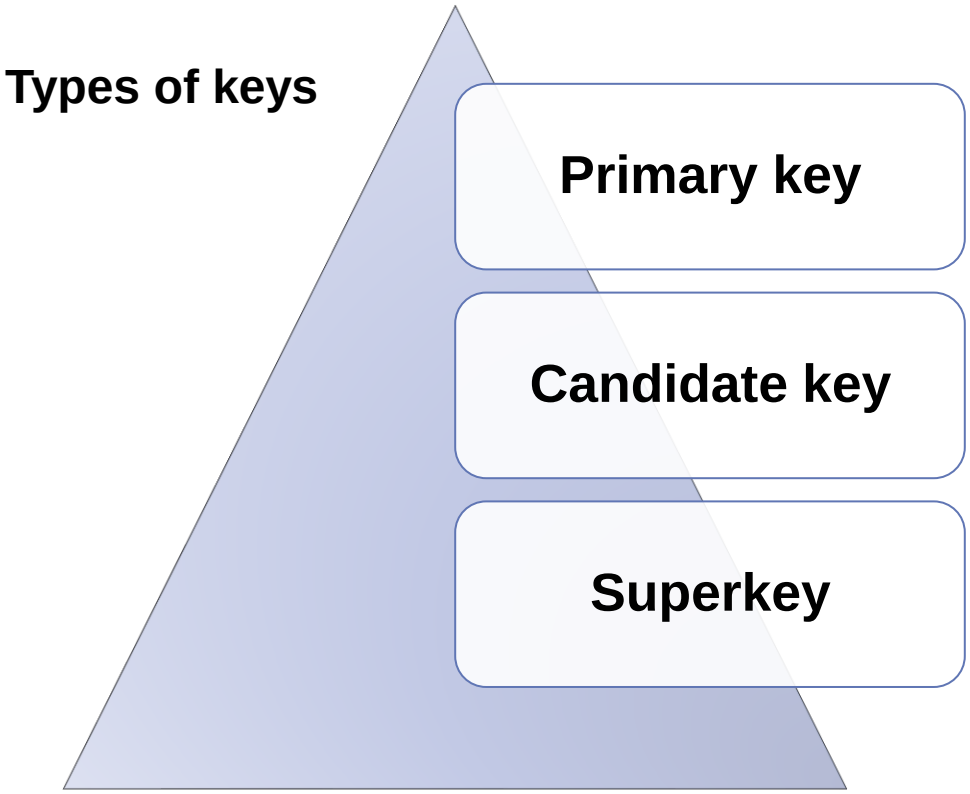
Placement of relationship attributes

- How attribute placement of relationship can be specified?
  - One-to-one
  - One-to-many
  - Many-to-many



Keys

- Identify a set of attributes to distinguish entities from each other
- Uniquely identify relationship
- Represents a constraint



Keys (contd.)

Superkey

Set of one or more attributes, taken collectively, identify uniquely an entity in entity set

Example:

student_id attribute of student entity

Combination of student_id and student_name

Candidate key

Minimal superkeys

Superkeys for which no proper subset of superkey

Example:

{student_id}

{student_name, student_city}

Primary key

Candidate key used to identify entities within an entity set

Attributes are never or very rarely changed

Example:

student_id

Keys (contd.)

In relationship sets

- Structure of primary key for relationship set depends on mapping cardinality of the relationship set

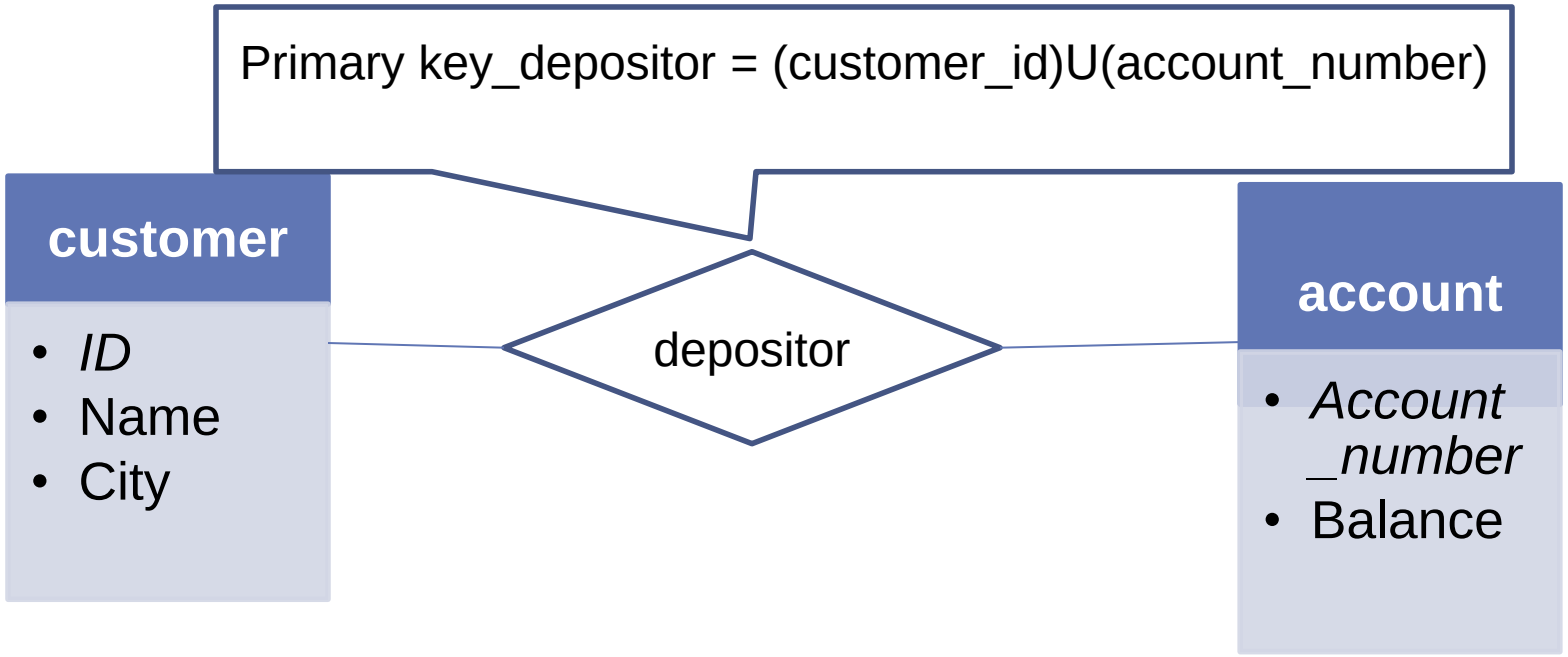
Many to many relationship set	• Primary key of depositor is the union of primary key of customer and account
Many to one relationship set (from customer to account)	• Primary key of depositor is the primary key of customer
Many to one relationship set (from account to customer)	• Primary key of depositor is the primary key of account

Keys (contd.)

In relationship sets

Many to many relationship set

Primary key of depositor is the union of primary key of customer and account

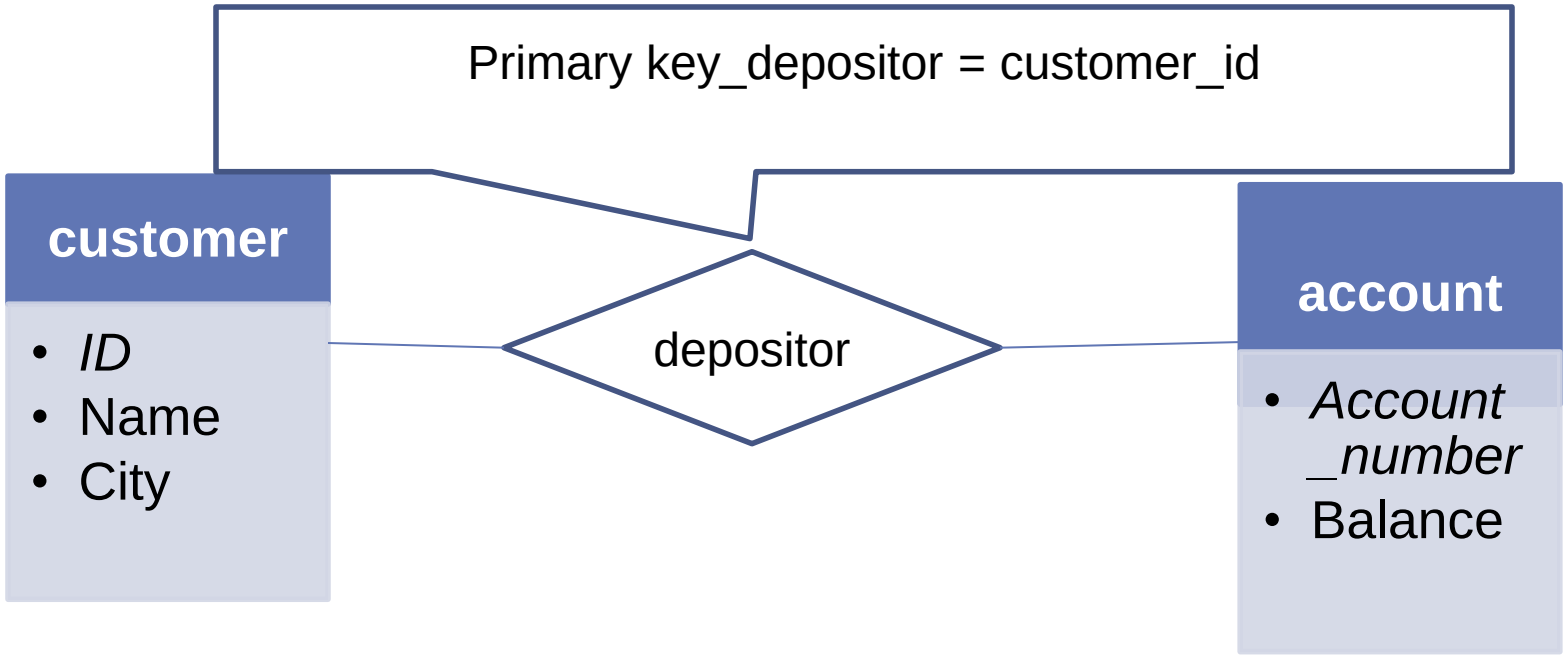


Keys (contd.)

In relationship sets

Many to one relationship set (from customer to account)

Primary key of depositor is the primary key of customer

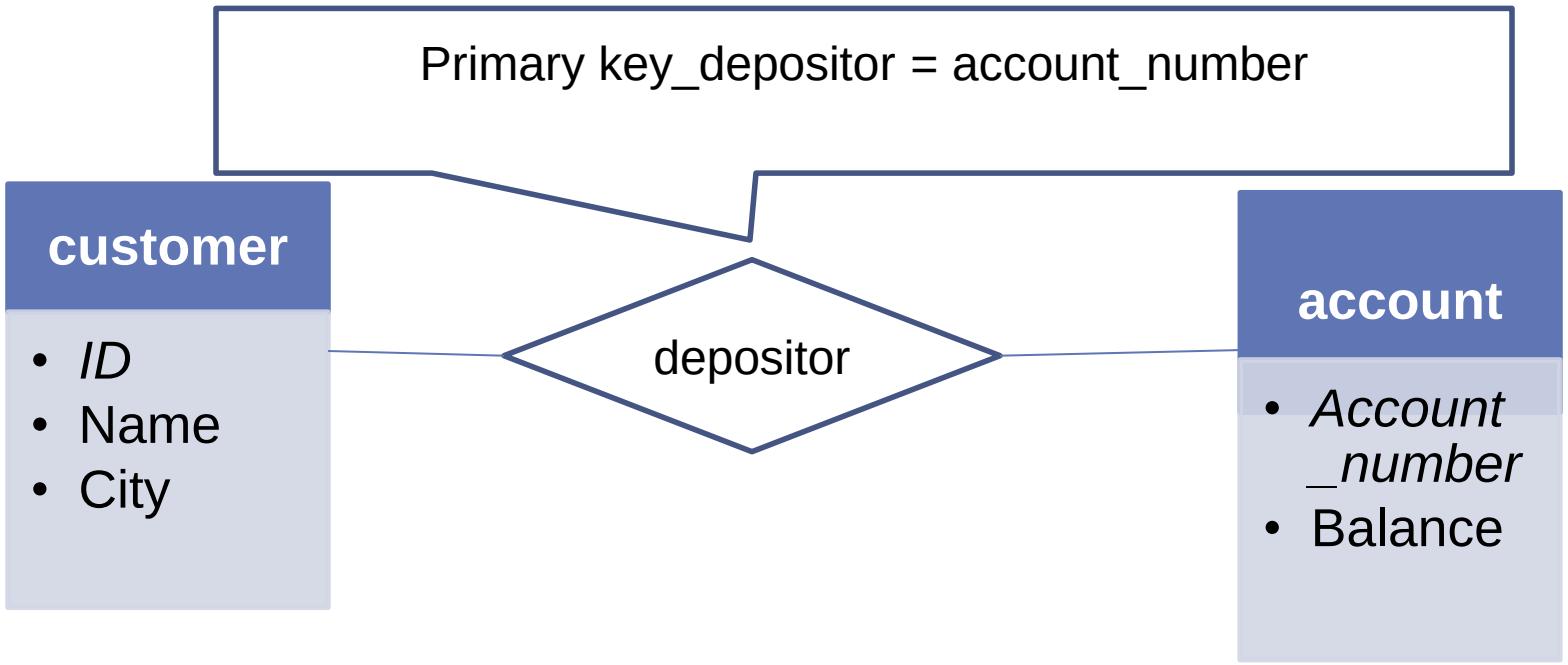


Keys (contd.)

In relationship sets

Many to one relationship set (from account to customer)

Primary key of depositor is the primary key of account



Weak entity sets

Entity set may not have attributes to form a primary key

Strong entity set: Entity set that has a primary key

Must be associated with another entity set, **identifying/owner entity set**

Weak entity set is said to be existence dependent on identifying entity set

Identifying relationship

Relationship between weak entity set and identifying entity set

Many to one from weak to identifying

Participation of weak entity set is total

Weak entity sets (contd.)

Primary key of weak entity set = primary key of identifying entity set + weak entity set discriminator

Weak entity set participate in relationships other than identifying relationship

Weak entity set may participate as owner in identifying relationship with another entity set

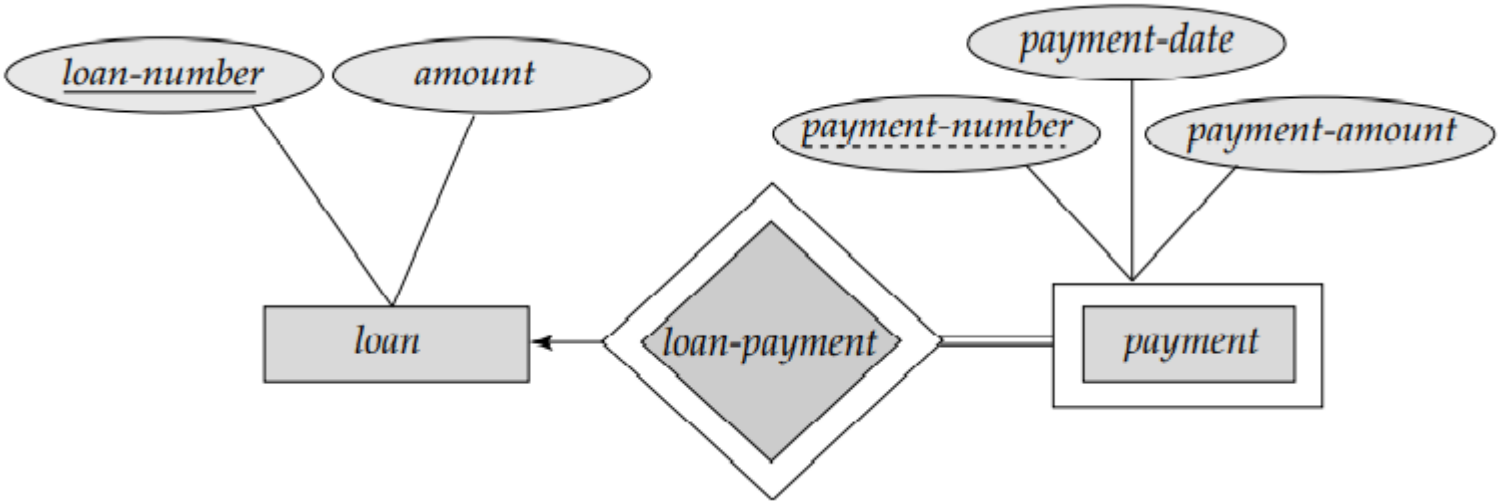
Weak entity set may have more than one identifying entity set

Weak entity set

Identifying relationship

Weak entity sets (contd.)

Example



Reference: Silberschatz−Korth−Sudarshan, Database System Concepts, Fourth Edition

Extended Entity-Relationship model

EER Model