Week 8, Lecture 15

Database Systems -

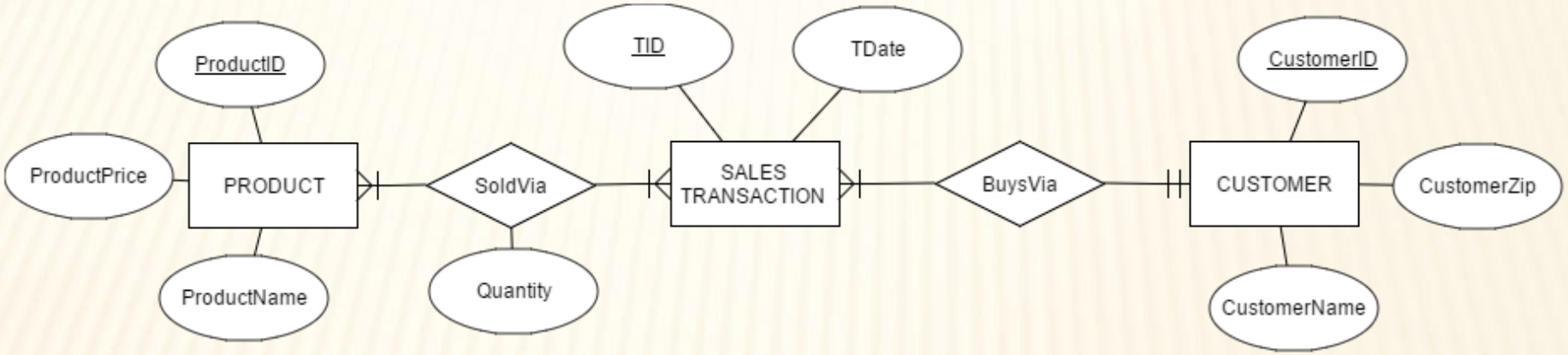
Introduction to Databases and Data Warehouses

CHAPTER 2 - Database Requirements and ER Modeling (Part 2)

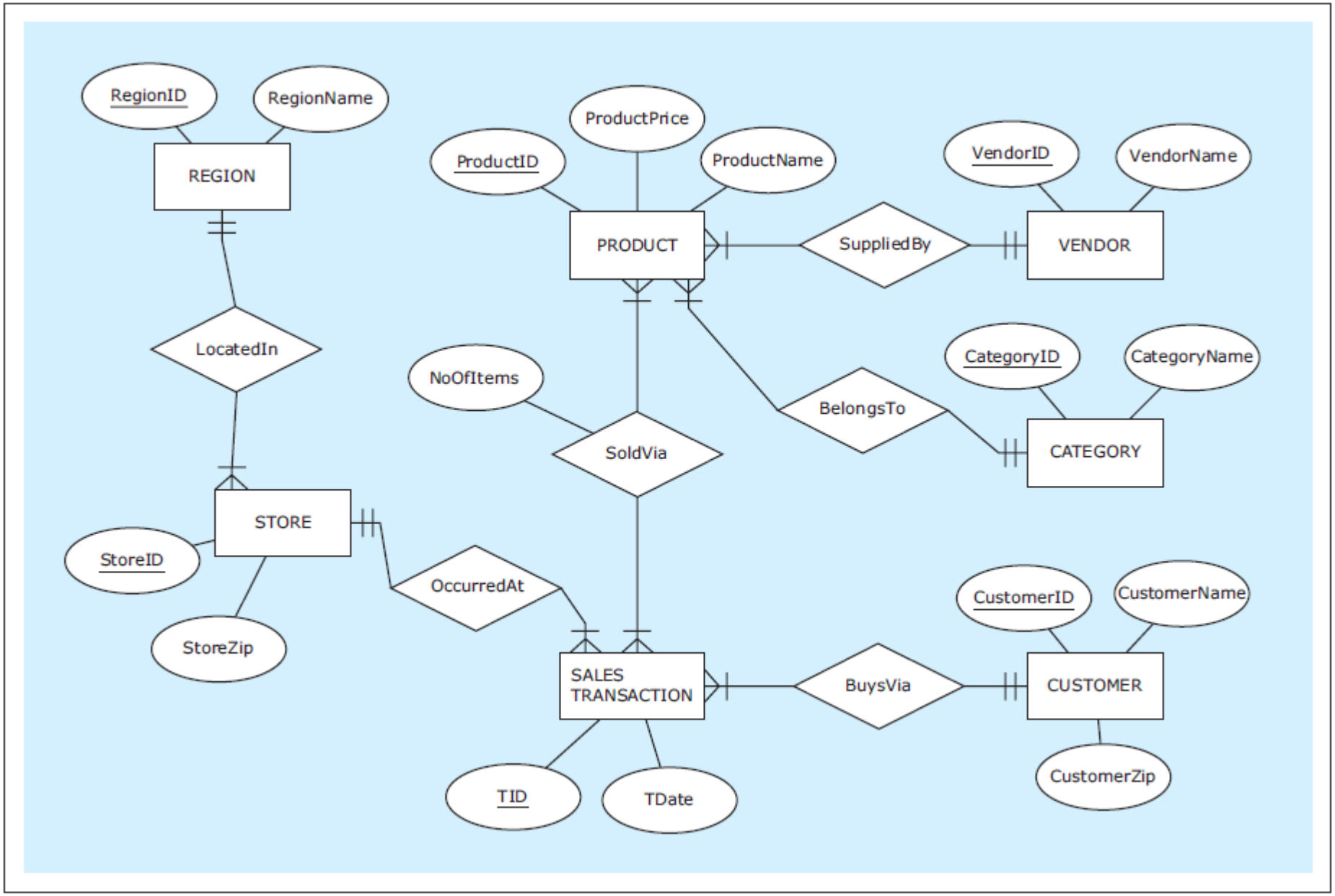
MAIN TOPICS

- Examples of Database requirements and ERD
- Composite Attributes
- Multiple Unique Attributes (Candidate keys)
- Multivalued attributes
- Derived Attributes
- Optional Attributes
- Example of entity with various types of attributes
- Exact Minimum, Maximum Cardinality in Relationships
- Relationship Degree
- Unary relationship and Relationship Role
- Multiple Relations between 2 entities
- Weak Entity
- Naming Conventions

SIMPLE SALES DB – REQUIREMENT IN ERD



ER diagram example: ZAGI Retail Company Sales Department Database



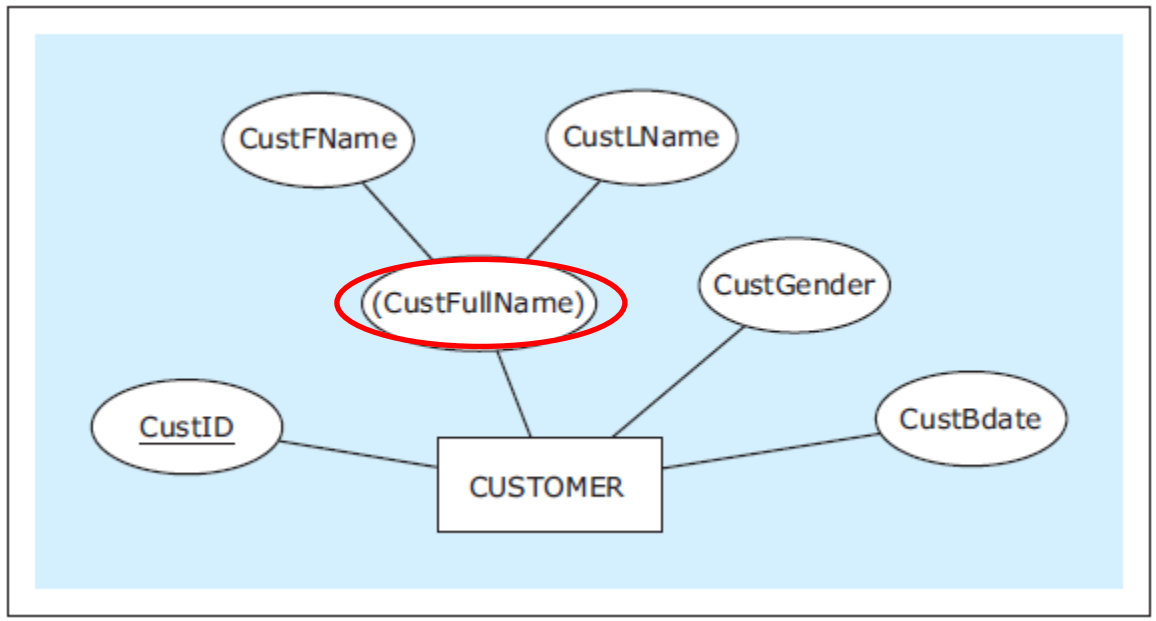
(See notes page for details)

COMPOSITE ATTRIBUTES

- **Composite attribute**
  - Attribute that is composed of several attributes
  - Not an additional attribute of an entity
  - Used to indicate:
    - A collection of attributes has an additional meaning, besides the individual meanings of each attribute

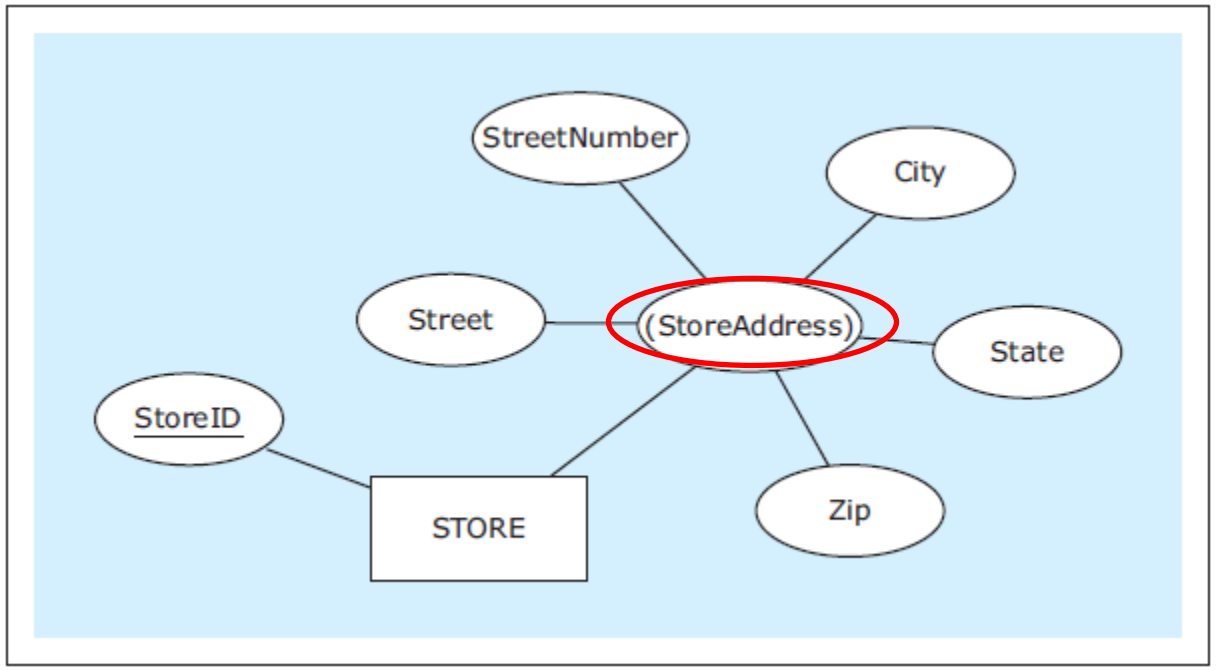
COMPOSITE ATTRIBUTES

An entity CUSTOMER with a composite attribute (CustFullName)



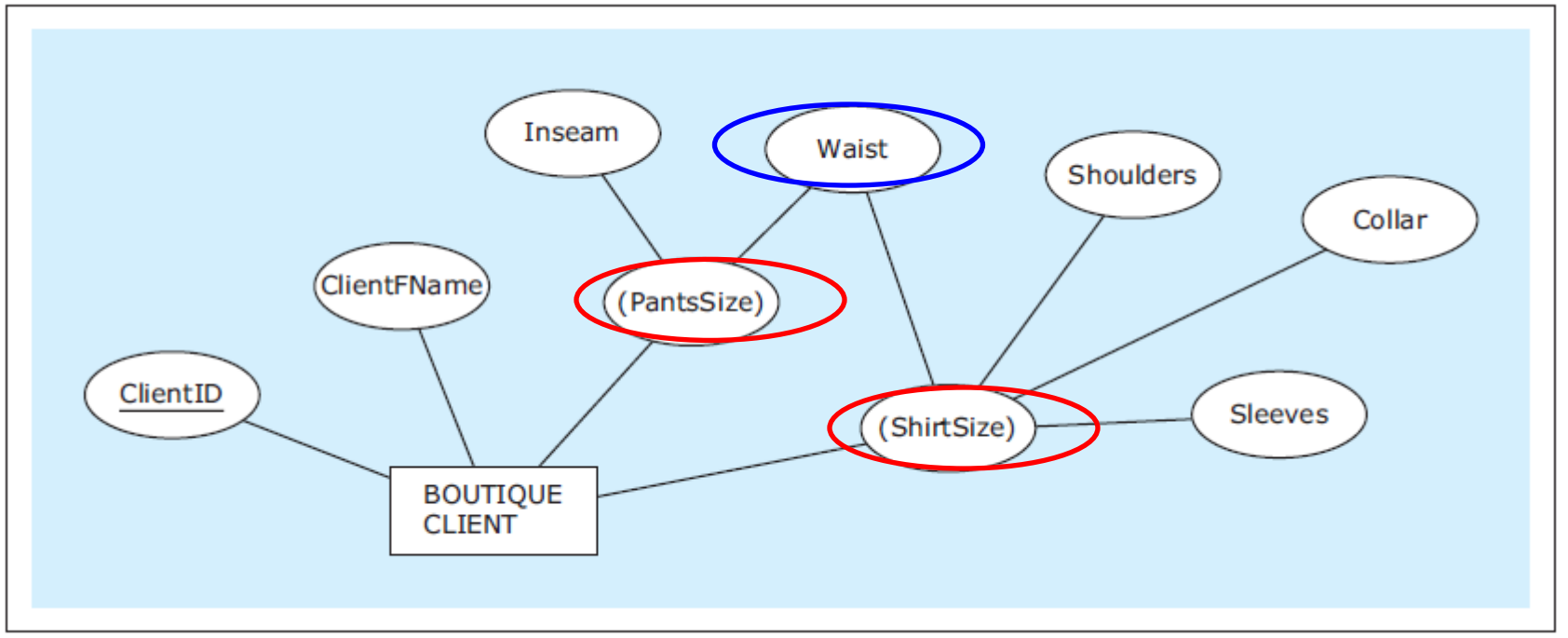
COMPOSITE ATTRIBUTES

Another entity STORE with a composite attribute (StoreAddress)



COMPOSITE ATTRIBUTES

Composite attributes sharing components: Waist

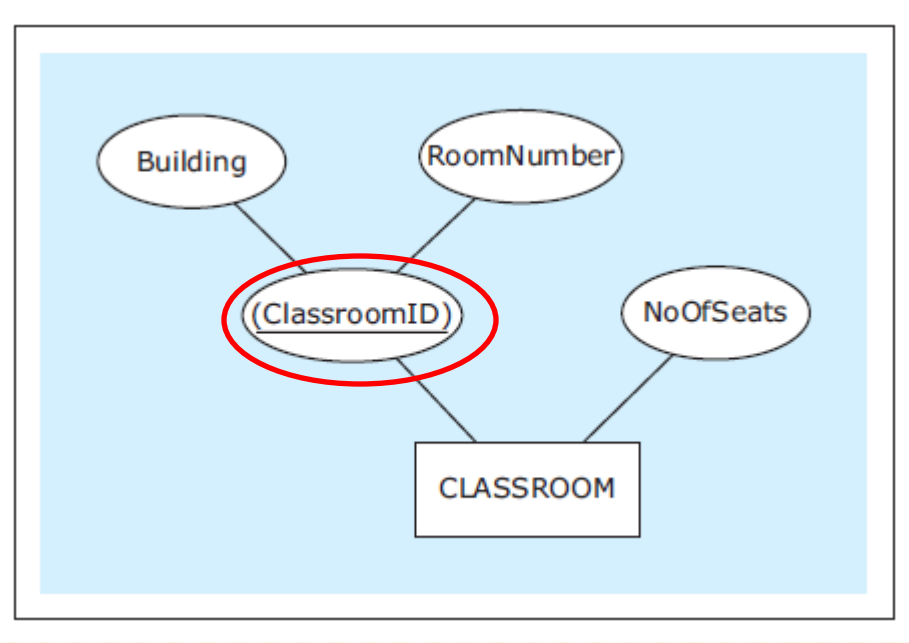


COMPOSITE UNIQUE ATTRIBUTES

- Composite unique attribute
  - Composite attribute + unique attribute
    - Composed of several attributes
    - Unique value for each entity instance

COMPOSITE UNIQUE ATTRIBUTES

An entity with a unique composite attribute



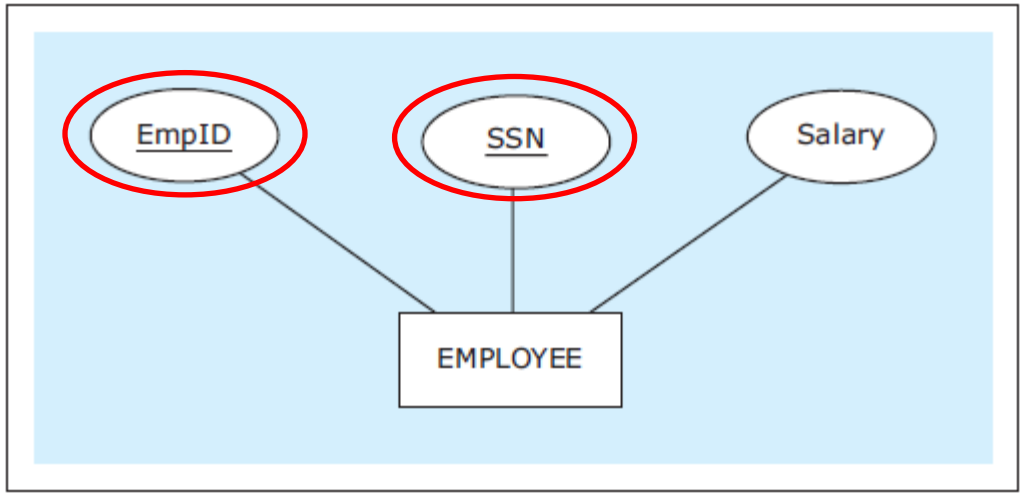
ATTRIBUTES – Multiple Unique Attributes

- **Multiple unique attributes (candidate keys)**
  - More than one unique attribute in an entity
  - Each unique attribute is a candidate key
    - Candidate for a **primary key (primary identifier)**
    - One is chosen as the primary key of a table
      - more in Chapter 3

ATTRIBUTES – Multiple Unique Attributes

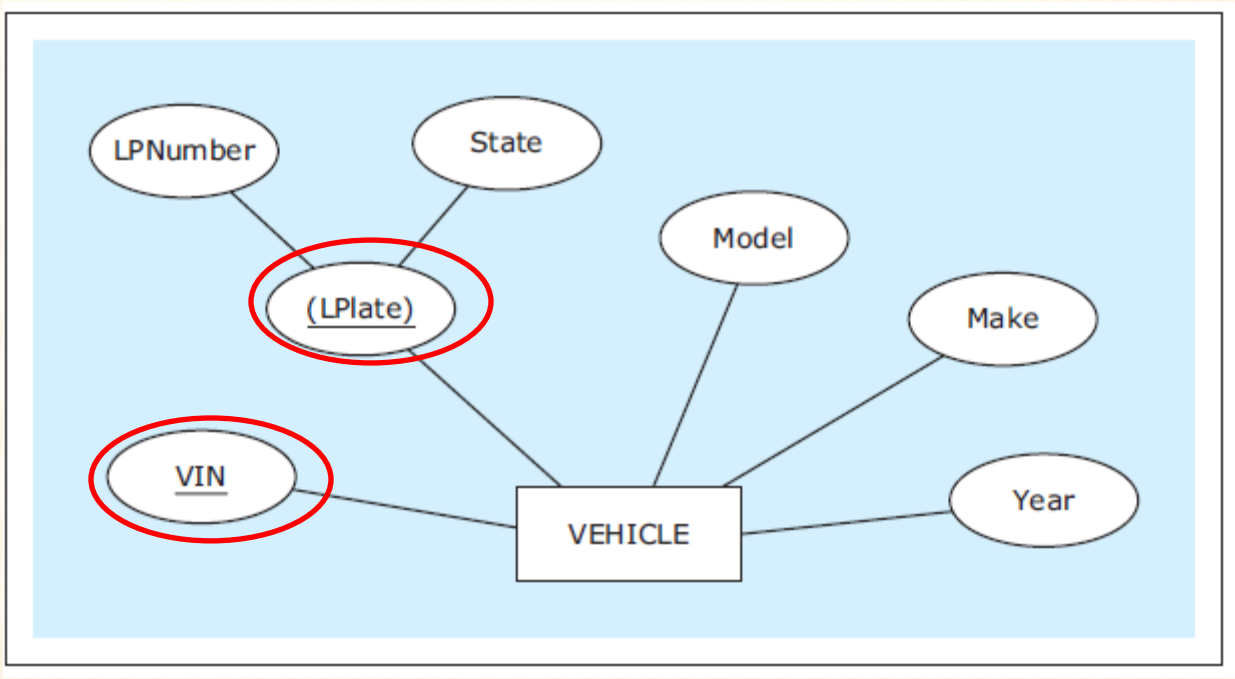
An entity with multiple unique attributes (candidate keys)

- EmpID, SSN



ATTRIBUTES – Multiple Unique Attributes

An entity with a regular and composite candidate key



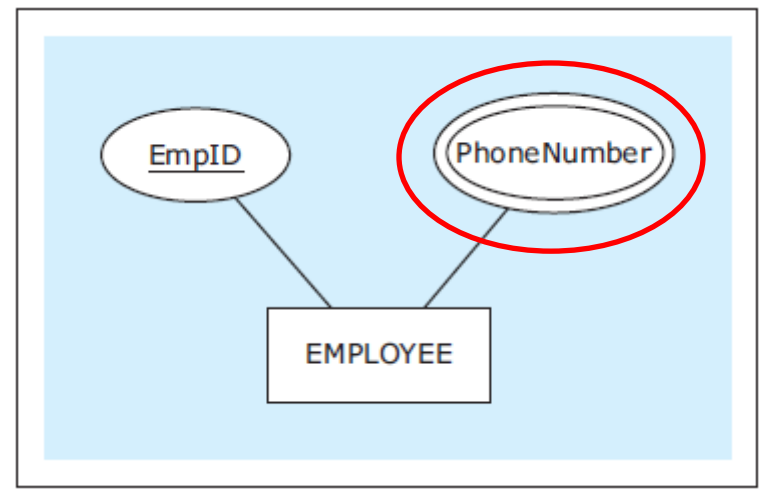
ATTRIBUTES – Multi-Valued Attribute

- **Multivalued attribute**
  - Instances of an entity can have multiple values for the same attribute
  - Used to
    - Assign a variable number of values to a particular attribute of an entity

ATTRIBUTES– Multi-Valued Attribute

A multivalued attribute

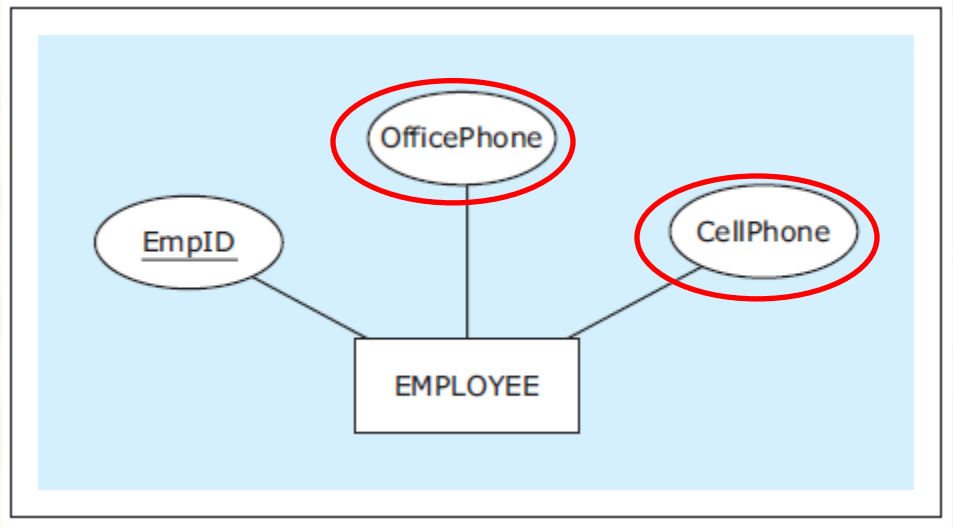
- Double-lined
- A variable number of phone numbers
  - 2, 3, etc
  - 1?



ATTRIBUTES– Multi-Valued Attribute

A scenario that does not use multivalued attributes

- Exactly 2 phone numbers per employee



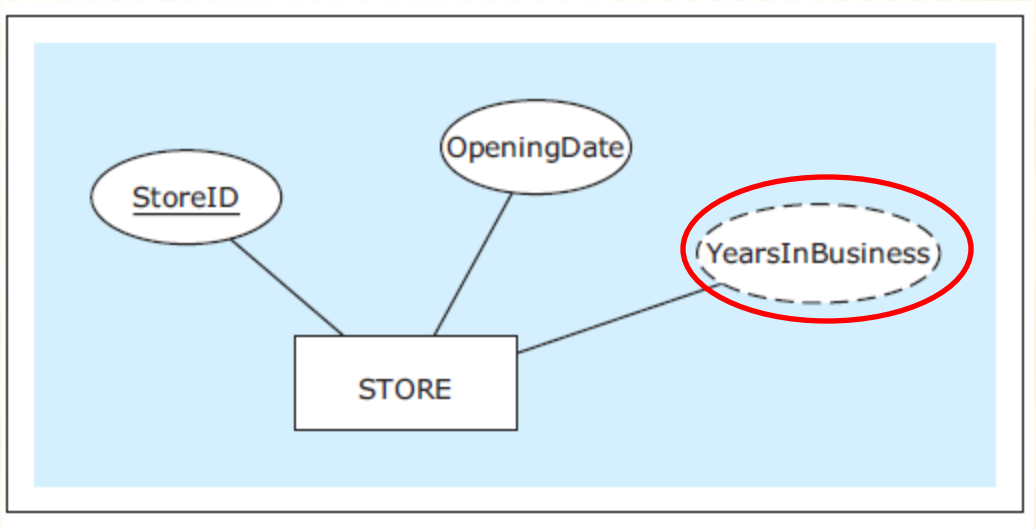
ATTRIBUTES – Derived Attribute

- **Derived attribute**
  - Attribute values are calculated from
    - Stored values of other attributes and/or additional available data
  - Attribute values are not permanently stored in a database

ATTRIBUTES– Derived Attribute

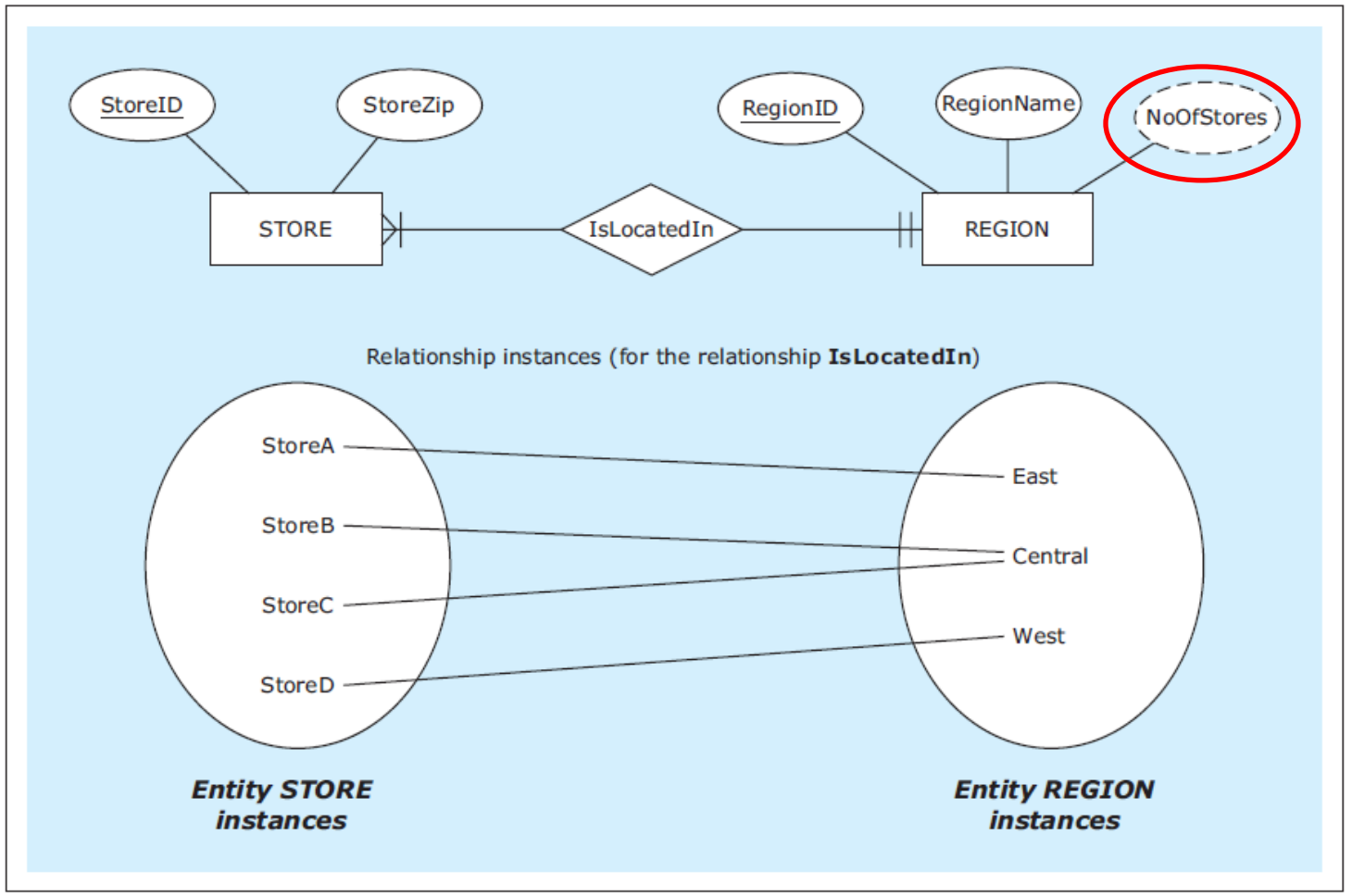
A derived attribute example

- Dash-lined



ATTRIBUTES– Derived Attribute

Another derived attribute example: NoOfStores

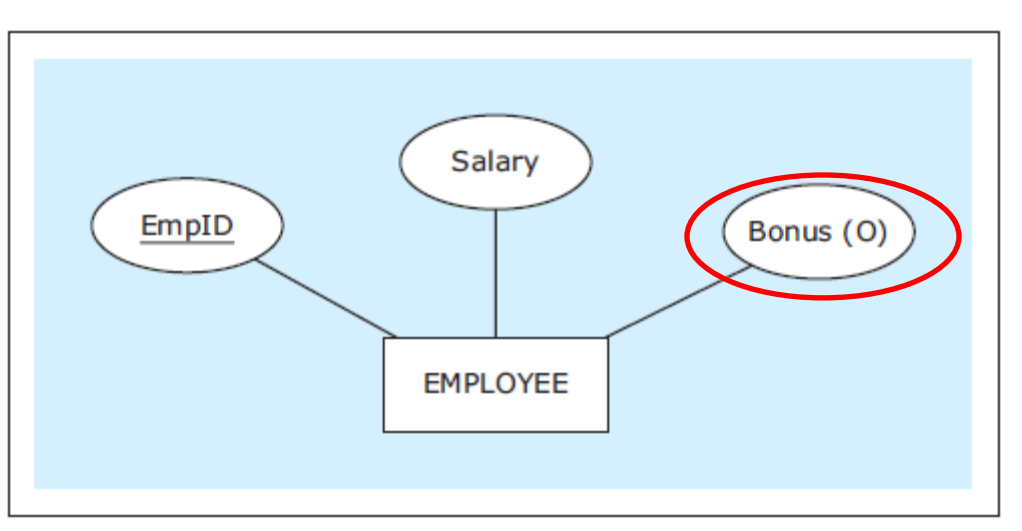


ATTRIBUTES – Optional Attribute

- **Optional attribute**
  - Attribute that is allowed to not have a value
  - Not the majority of attributes
    - Most attributes are required attributes
      - Must have a value for each entity instance

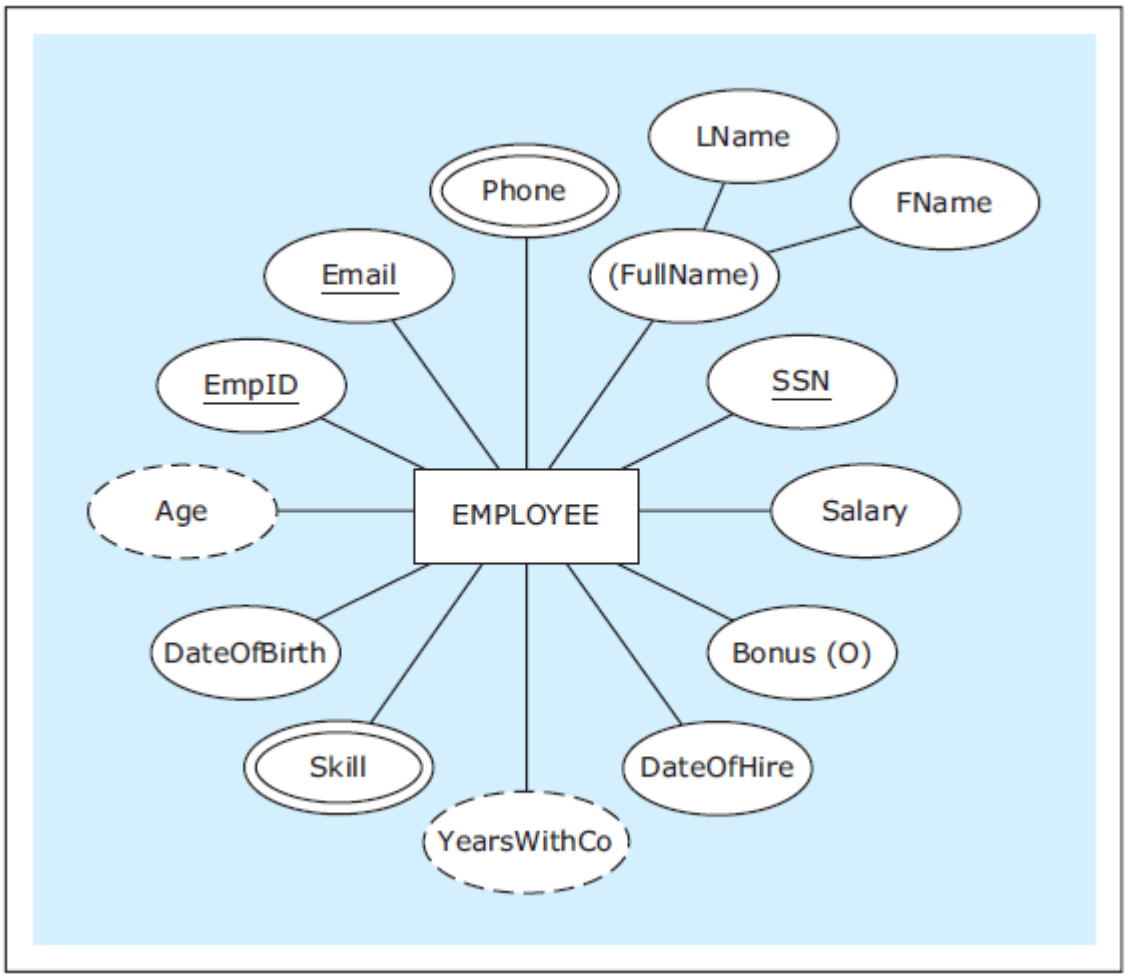
ATTRIBUTES – Optional Attribute

An optional attribute example: Bonus (O)



ATTRIBUTES – Various Type Example

EXAMPLE: An entity with various types of attributes



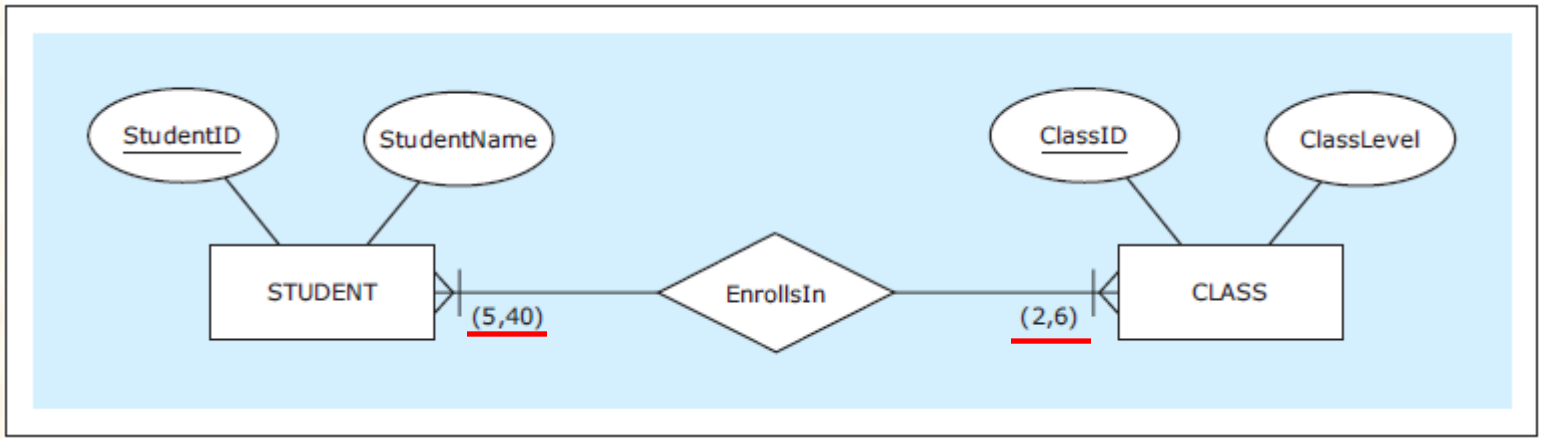
RELATIONSHIPS – Exact Cardinality

- **Exact minimum and maximum cardinality in relationships**
  - In some cases the exact minimum and/or maximum cardinality in relationships is known in advance
  - Exact minimum/and or maximum cardinalities can be depicted in ER diagrams

RELATIONSHIPS – Exact Cardinality

A relationship with specific minimum and maximum cardinalities

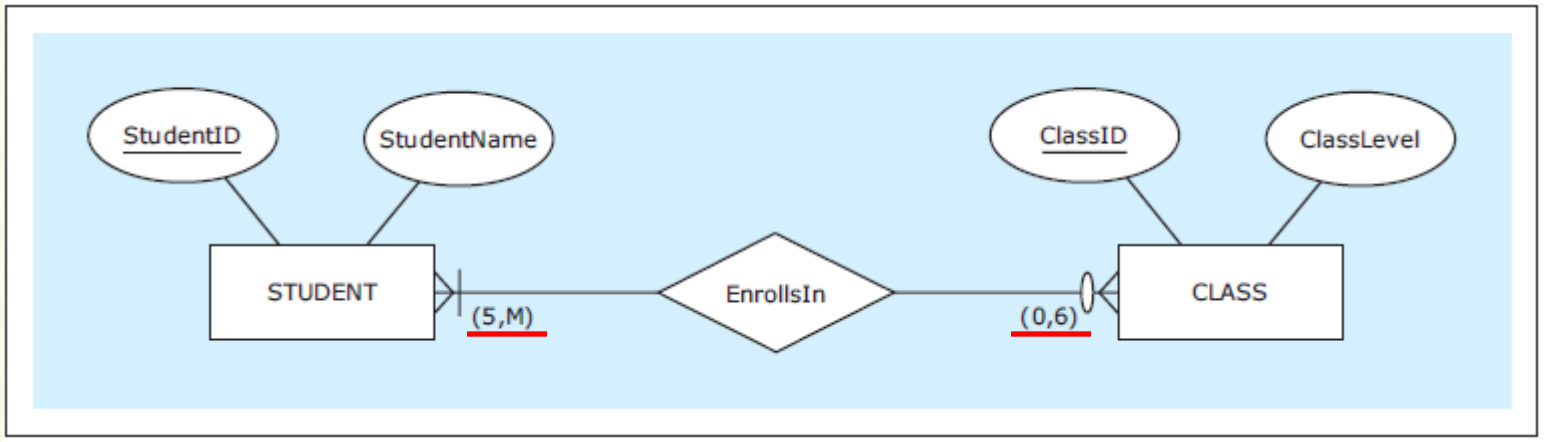
- (minimum, maximum)



RELATIONSHIPS – Exact Cardinality

A relationship with a mixture of specific and non-specific cardinalities

- M: non-specific

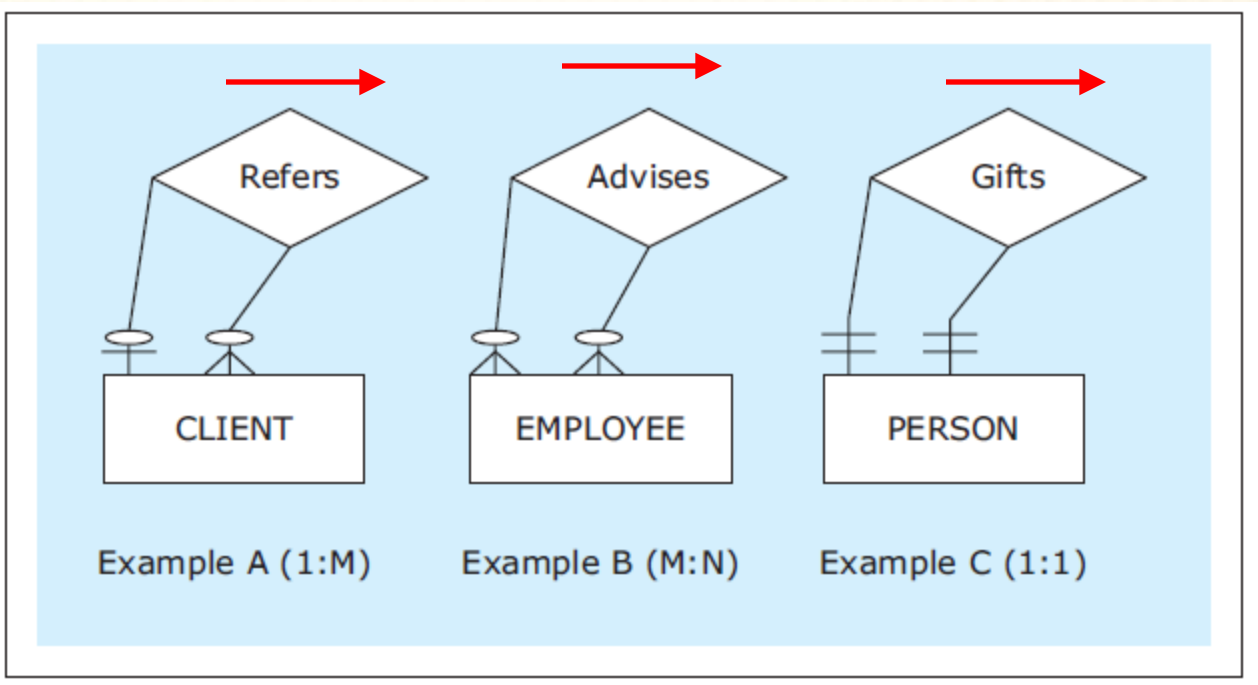


RELATIONSHIPS - Degree

- **Degree of a relationship**
  - Reflects how many entities are involved in the relationship
- **Binary relationship**
  - Relationship between two entities
  - *degree 2 relationship*
  - Most relationships
- **Unary relationship (recursive relationship)**
  - An entity is involved in a relationship with itself
  - *degree 1 relationship*

RELATIONSHIPS – Unary Relationship

Unary relationship examples

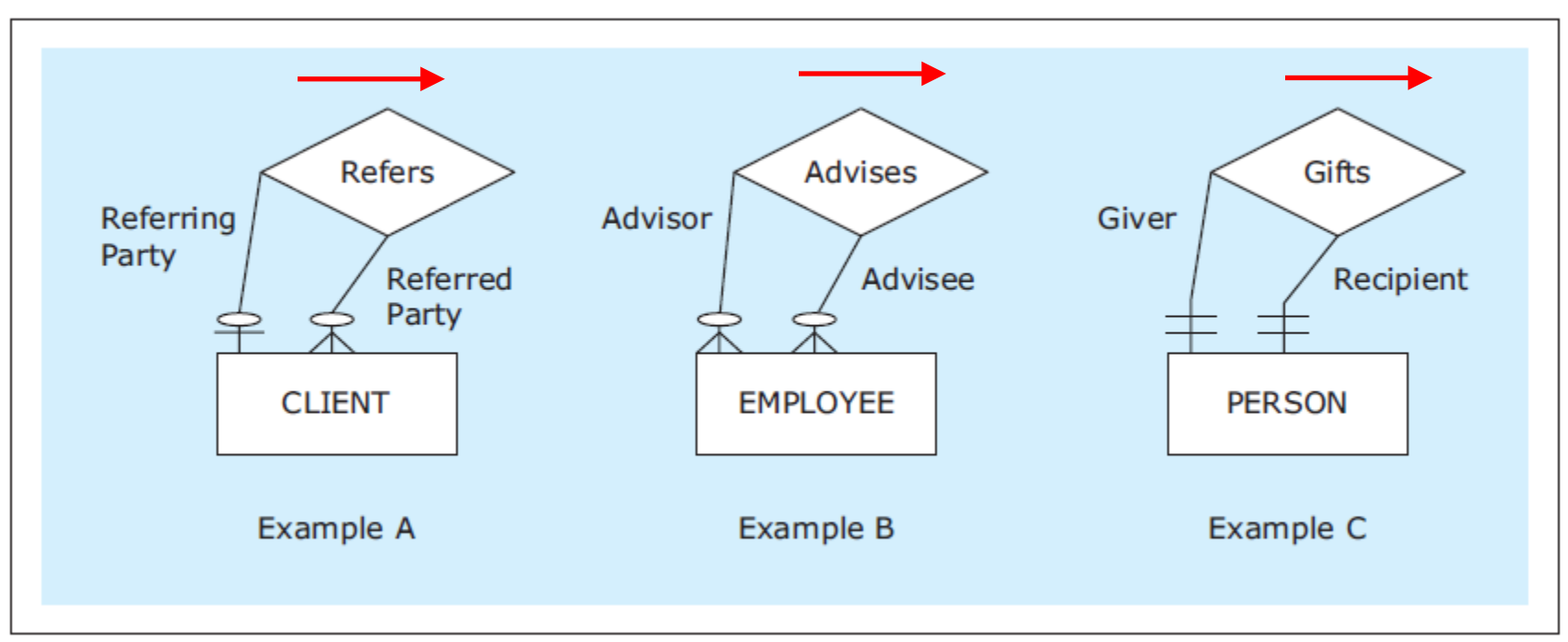


RELATIONSHIPS – Relationship Role

- Relationship roles
  - Additional syntax used in ER diagrams at the discretion of a data modeler
  - Used to clarify the role of each entity in a relationship
  - Can be used in any relationship
  - Typically most useful in unary relationships

RELATIONSHIPS – Relationship Role

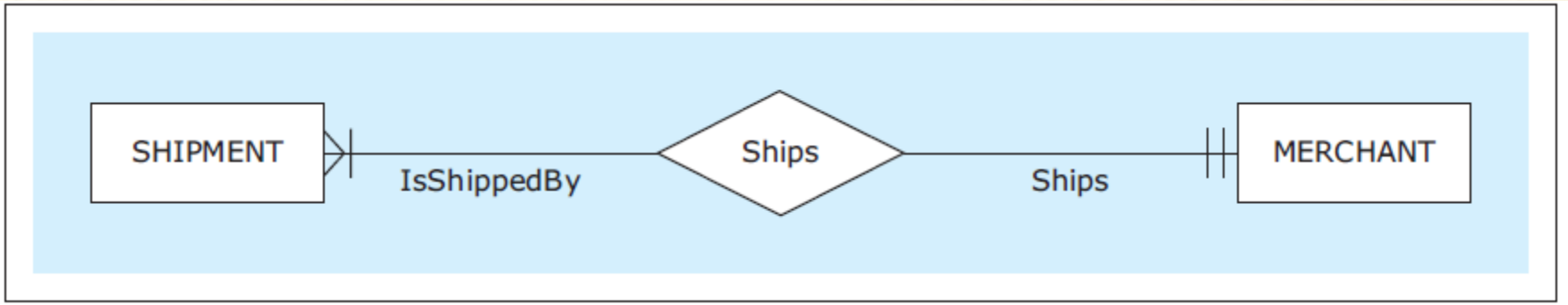
Unary relationships with role names



RELATIONSHIPS – Relationship Role

A binary relationship with role names

- Unnecessary role names

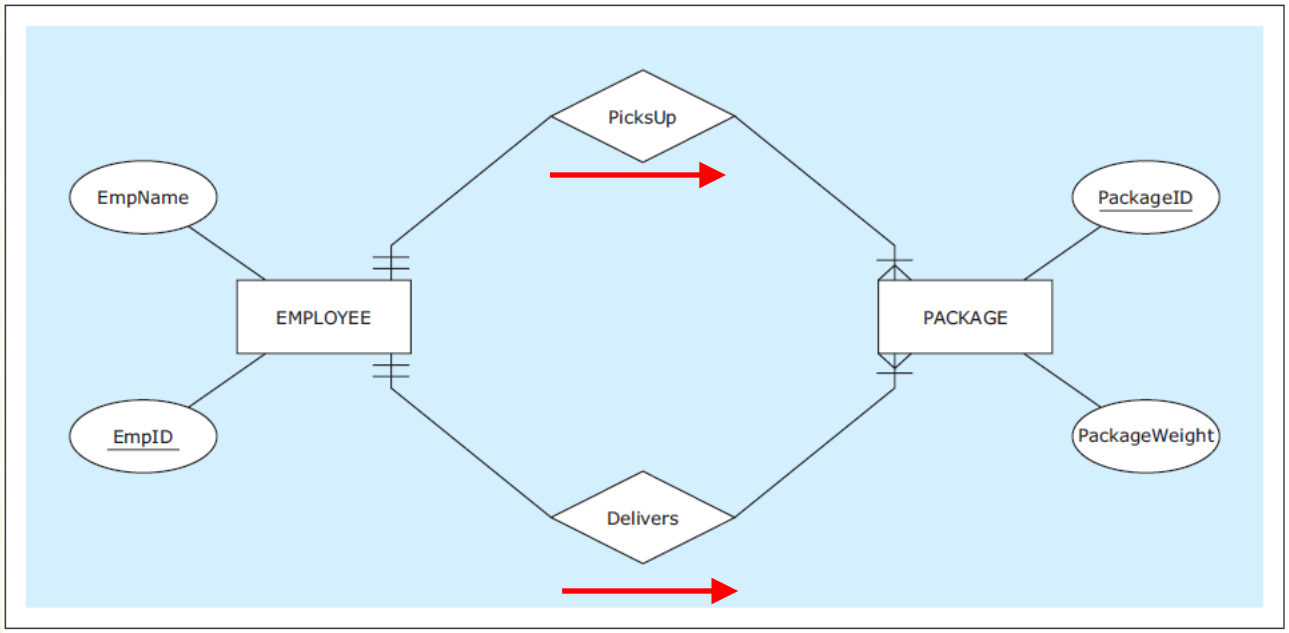


Multiple Relationships Between Same Entities

- **Multiple relationships between same entities**
  - More than one relationship between same entities in an ER diagram

Multiple Relationships Between Same Entities

Multiple relationships between the same entities



WEAK ENTITY

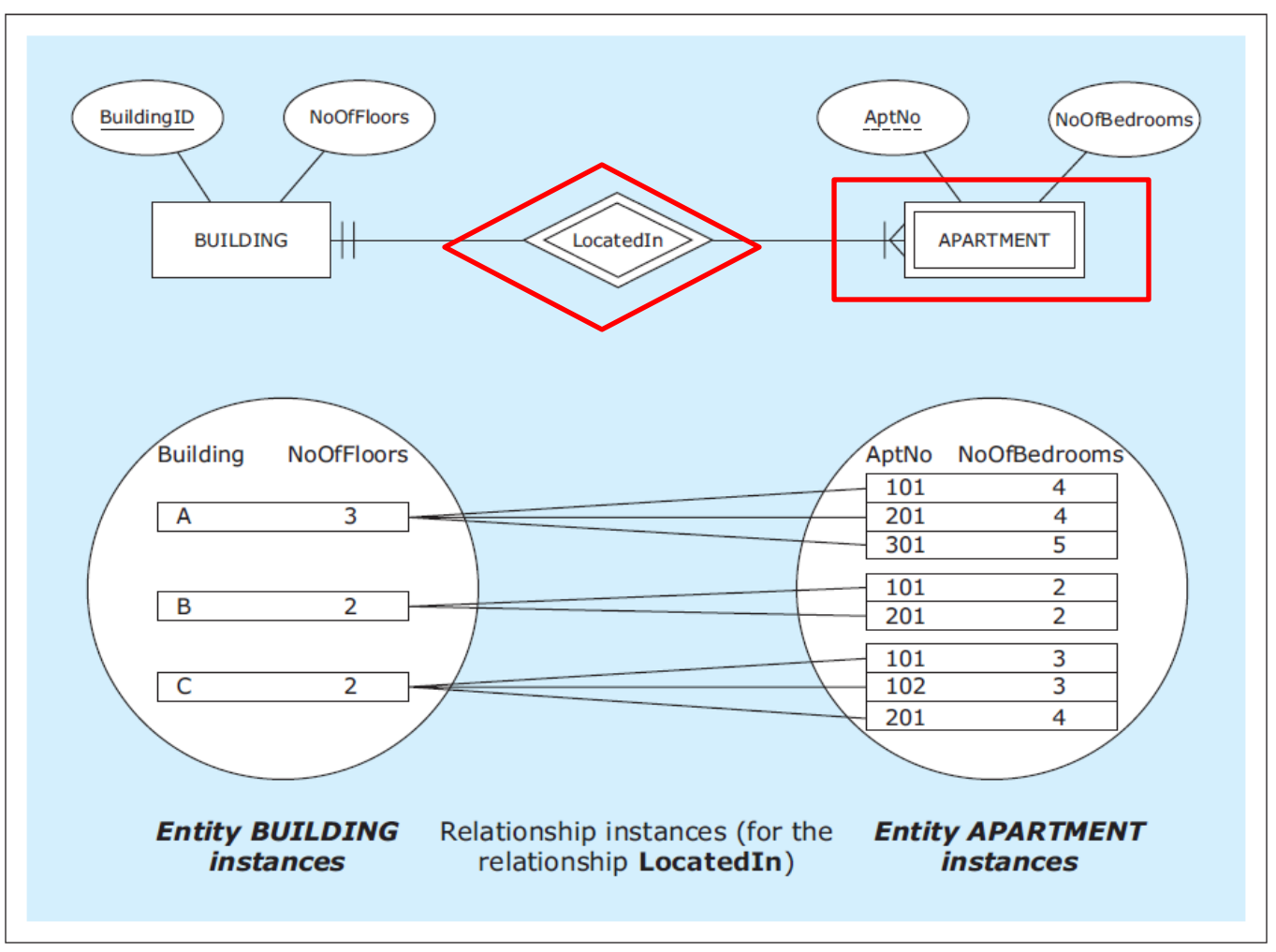
- **Weak entity**
  - Entity that does not have a unique attribute of its own
- **Owner entity**
  - Entity whose unique attribute provides a mechanism for identifying instances of a weak entity
- **Identifying relationship**
  - Relationship between a weak entity and its owner entity
    - Each instance of a weak entity is associated with exactly one instance of an owner entity
    - Each weak entity must be associated with its owner entity via an identifying relationship
    - Unique attribute from the owner entity uniquely identifies every instance of the weak entity via an identifying relationship

WEAK ENTITY

- Partial key
  - Attribute of a weak entity
  - Combination of the partial key and the unique attribute from the owner entity uniquely identifies every instance of the weak entity

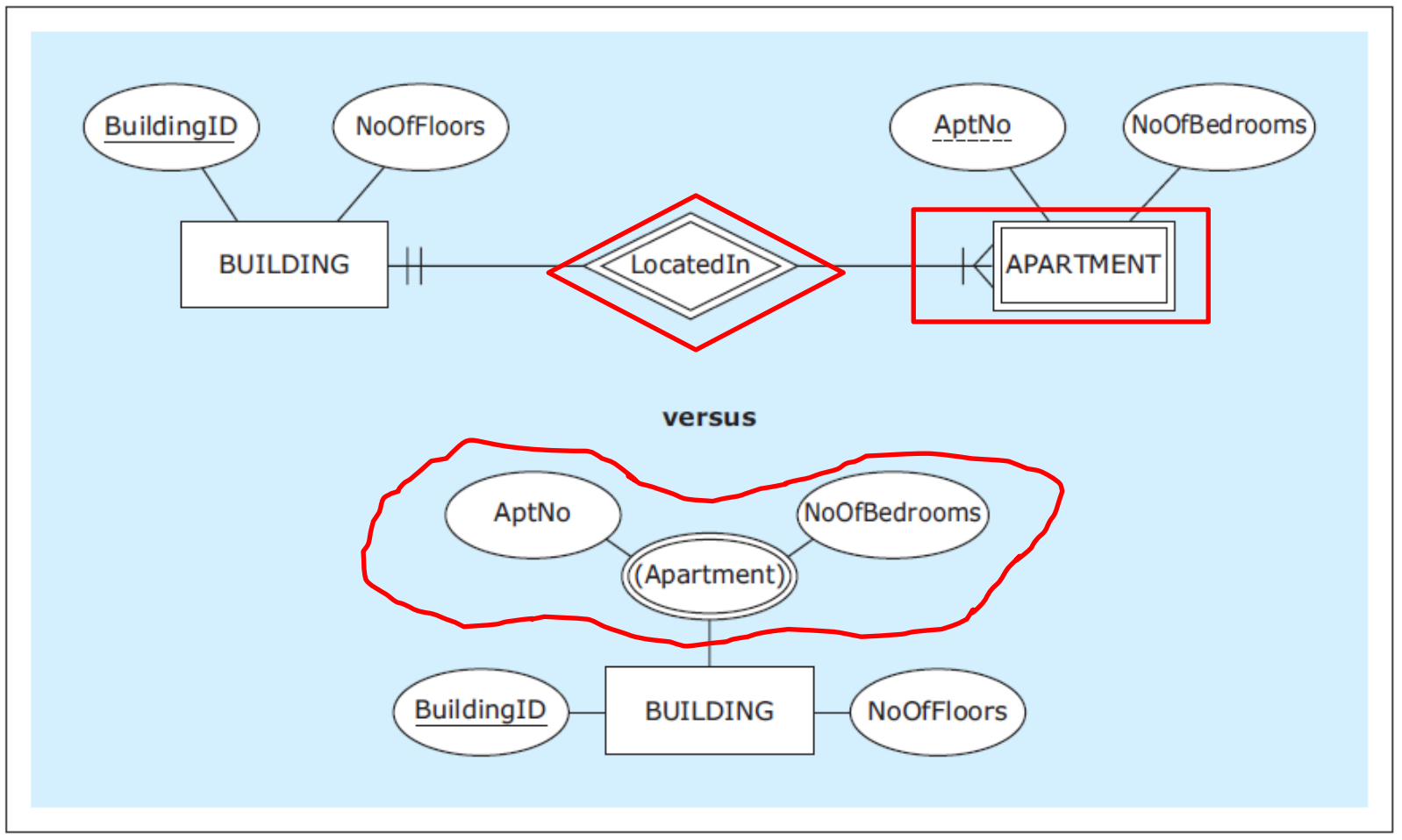
WEAK ENTITY

A weak entity example with entity instances



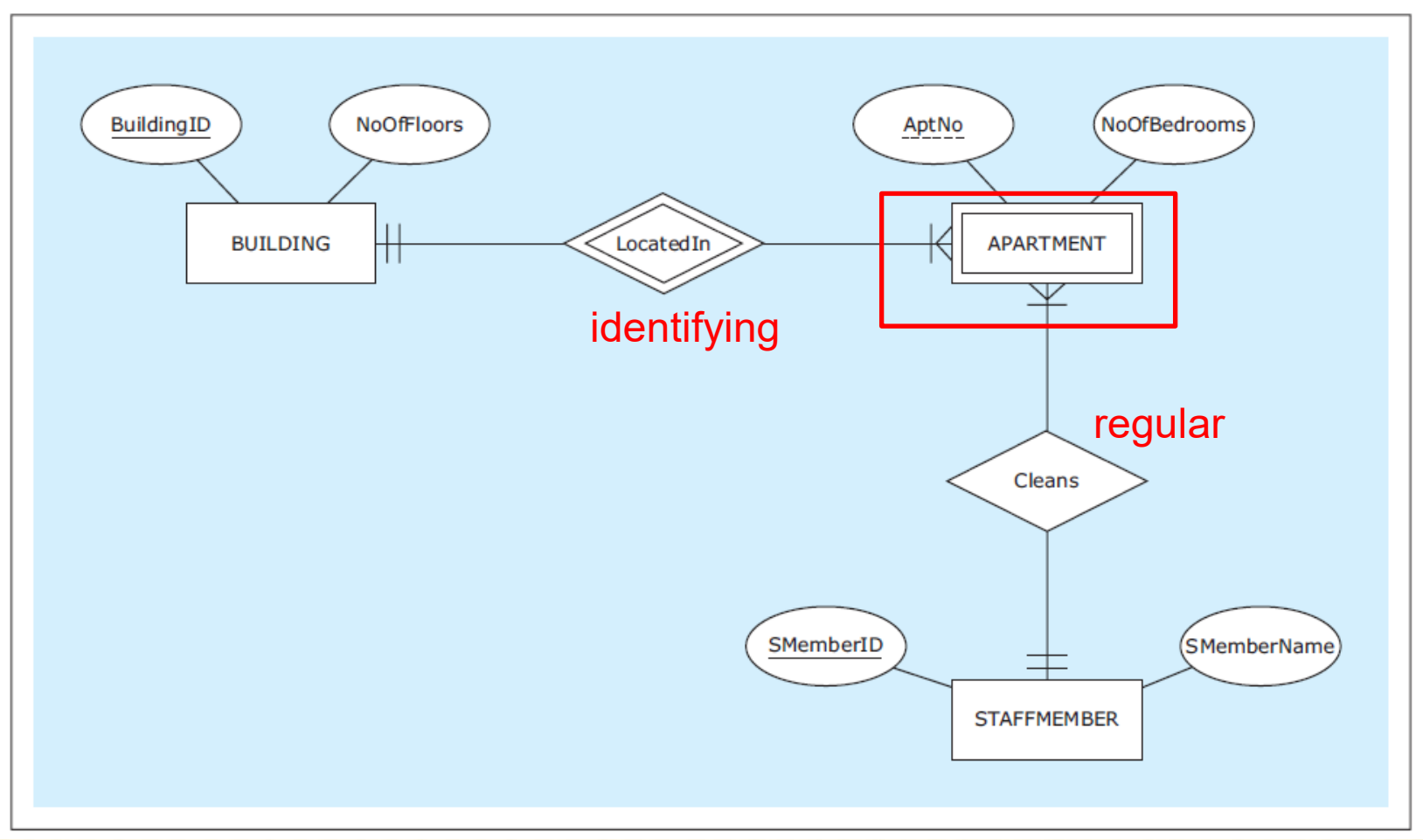
WEAK ENTITY

A weak entity versus a multivalued composite attribute



WEAK ENTITY

A weak entity with an identifying and regular relationship

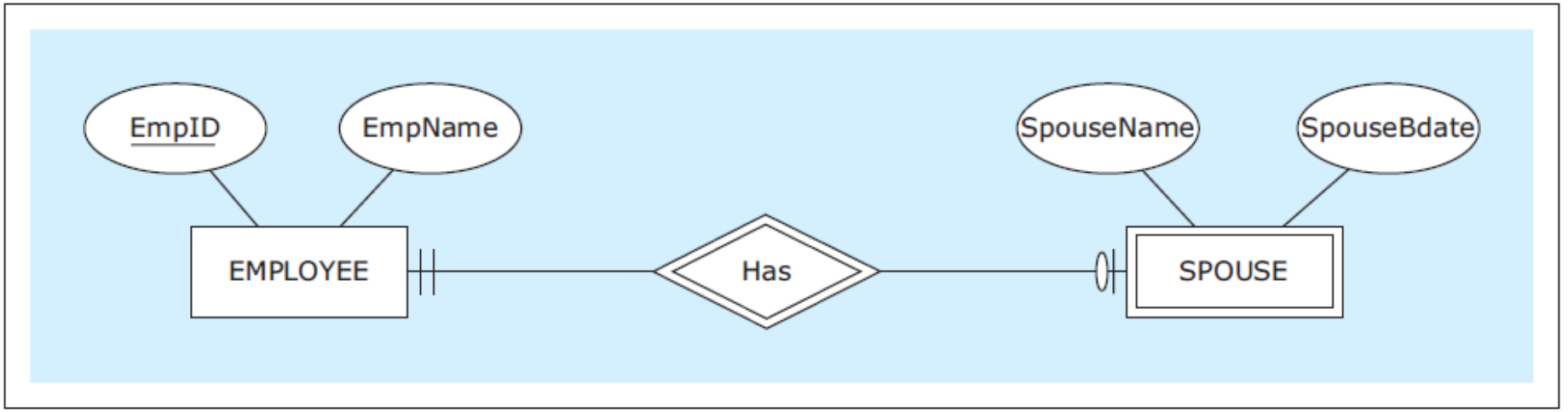


WEAK ENTITY

- Identifying relationship is either 1:M or 1:1 relationship
  - In case of 1:M identifying relationship, a weak entity must have a partial key attribute
  - In case of 1:1 identifying relationship, a weak entity doesn't need to have a partial key attribute

WEAK ENTITY

A weak entity with a 1:1 identifying relationship



NAMING CONVENTIONS FOR ER DIAGRAMS

- Entities and attributes
  - Use singular (rather than plural) nouns
- Relationships
  - Use verbs or verb phrases, rather than nouns

NAMING CONVENTIONS FOR ER DIAGRAMS

- Names should be as brief as possible, without being too condensed as to obscure the meaning of the construct
- If possible, give all attributes in the entire ER diagram different names