



ER MODEL

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July 2018

Review

■ The ER Model

Content

- The ER Model
- The ER Diagram

Keys - I

- The values of the attributes of an entity must be such that, they uniquely identify the entity.
- No two entities in an entity set are allowed to have exactly the same value for all its attributes.
- A **Key** makes one entity distinguishable from other entity in the same entity set.
- A **key** for an entity set is **a set of attributes**, whose value uniquely determines each and every entity in an entity set.
- Different keys used are
 - Candidate key
 - Super key
 - Primary Key
 - Alternate key

Keys - II

- Ex. Consider the entity set
 - Student(reg_no, name, branch, address, ph_no, DoB)
- **Candidate key**: is an attribute who's value uniquely determine each and every entity in an entity set.
 - Ex. Candidate keys {name, ph_no}, {name, address} or {reg_no}
 - For a given entity set, more than one candidate keys can be designed.
- **Super Key**: any superset of an candidate key is referred as super key
 - i.e. A candidate key is the **minimal super key**, of which no proper subset can again act as a key.
 - Ex. Super Keys: {reg_no, name}, {reg_no, name, ph_no}, {reg_no, name, branch}, {reg_no, name, address} or {reg_no, name, DoB}, . . .

Keys - III

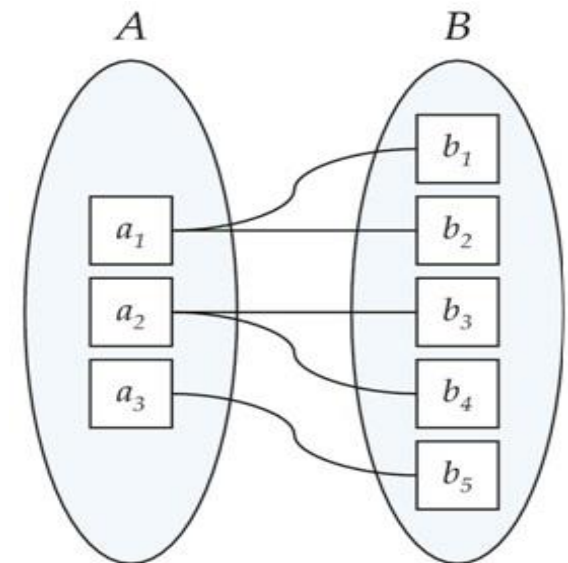
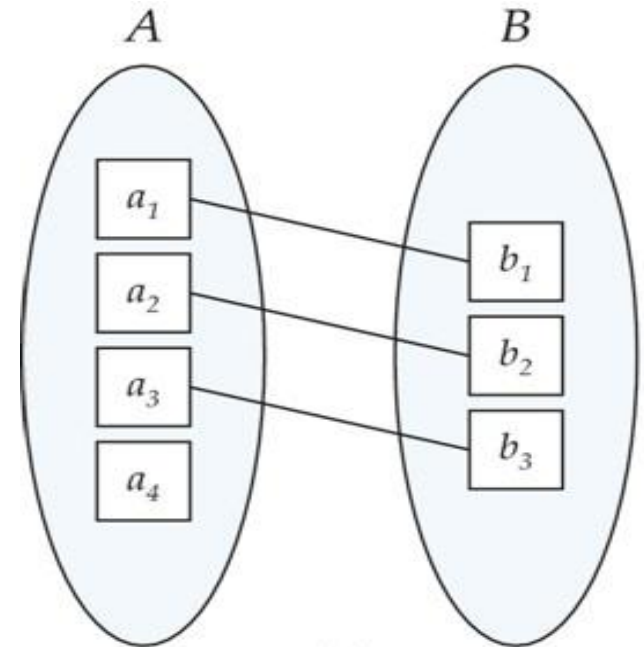
- **Primary key:** Out of multiple candidate keys, one of the key is chosen by the database engineer as the primary key.
- Primary key is used as **principal means** to uniquely identify each and every entity in the entity set.
 - **Ex.** Primary key {reg_no}
- **Alternate Key:** Rest of the candidate keys (excluding primary key) are called alternate keys
 - **Ex.** Alternate Keys {name, ph_no} and {name, address}
- Keys are represented in ER Diagram by underlining the key attribute(s)

ER Model: Constraints

- Constraints are the reflections of business rules/logic to which the database design must comply to.
- These are the characteristics of relationship set.
- ER Model supports two types of constraints:
 - Mapping Cardinalities or Cardinality constraints
 - ▶ How many entities in one entity set is associated with entities of another entity set?
 - Participation Constraints.
 - ▶ Tells about the **total** or **partial** participation of an entity set in a relationship set.
 - ▶ i.e. Whether all entities or few of them are participating in a relationship set.
 - ▶ Ex. Participation of **Student** entity set in the relationship **advisor** is **total**. But participation of **Instructor** may be **partial**

ER Model: Mapping Cardinalities - I

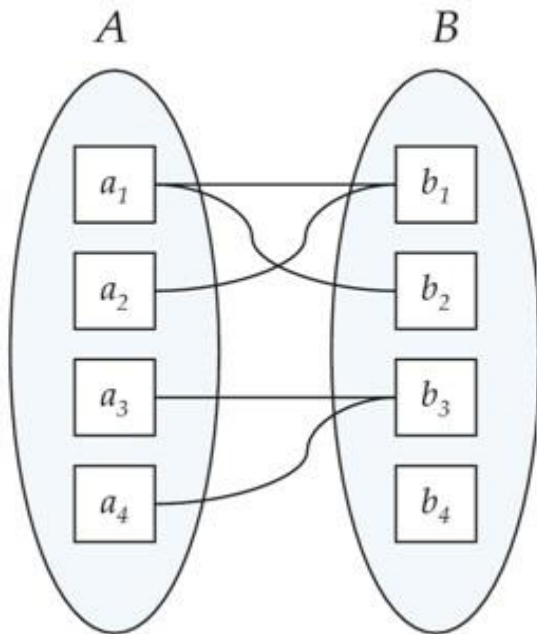
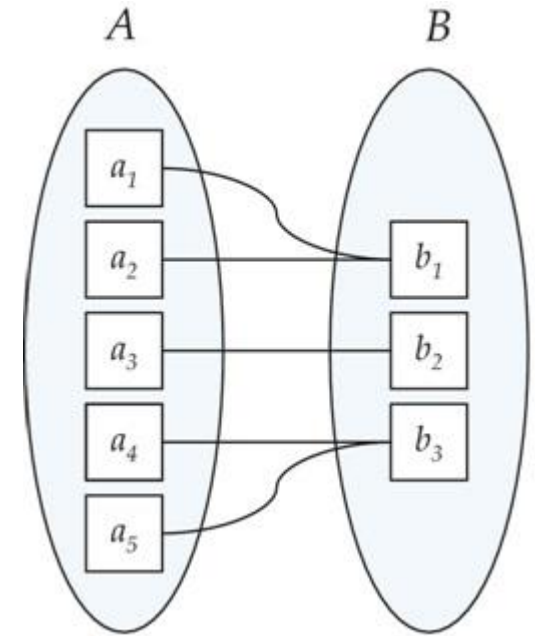
- Mapping cardinalities or cardinality ratios tells the number of entities to which another entity can be associated via a relationship set.
 - One-to-One: An entity in entity set A is associated with at most one entity in another entity set B.
 - Ex. One Student enrolls in One course
- One-to-Many: An entity in entity set A is associated with any number of entities in entity set B.
 - Ex. One Teacher advises Multiple students



ER Model: Mapping Cardinalities - II

- Many-to-One: An entity in A is associated with **at most one entity** in B. An entity in B, however, can be associated with **any** number of entities in A.

- Ex. **Many Students** are **enrolled** in **One Course**

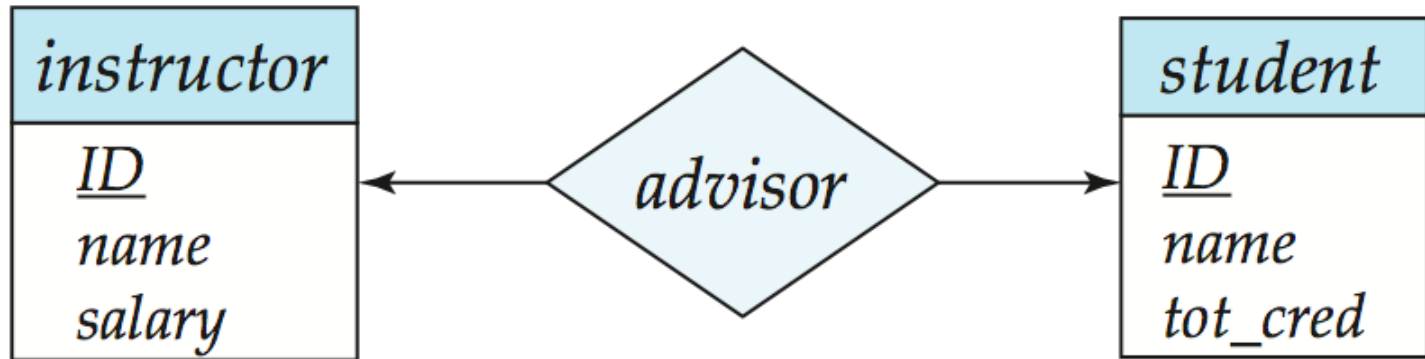


- Many-to-Many: An entity in A is associated with **any** number of entities in B and an entity in B is associated with **any** number of entities in A.

- Ex. **One Customer** have **Many** bank **Accounts** and **One Account** can have **Multiple** number of **Customers**.

ER Diagram: Cardinality Constraints-I

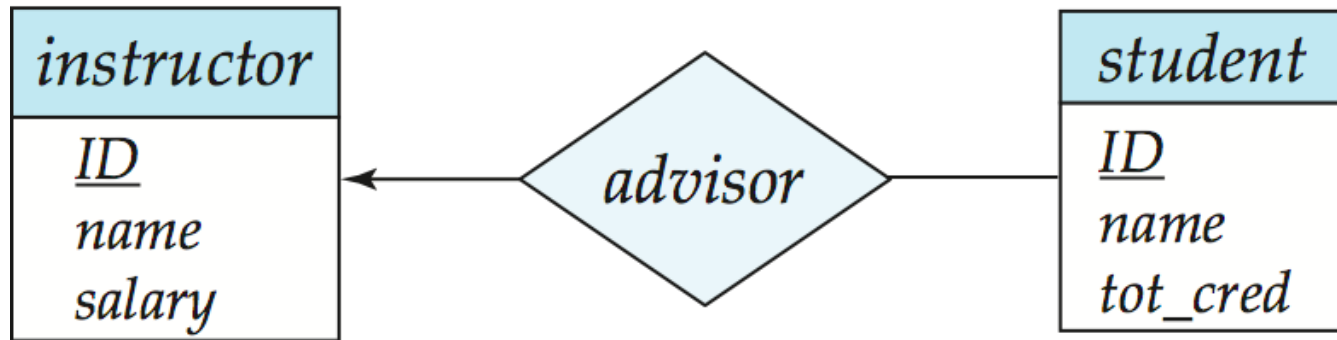
- One: A directed line (\rightarrow) from relationship set to entity set
- Many: an undirected line (---)



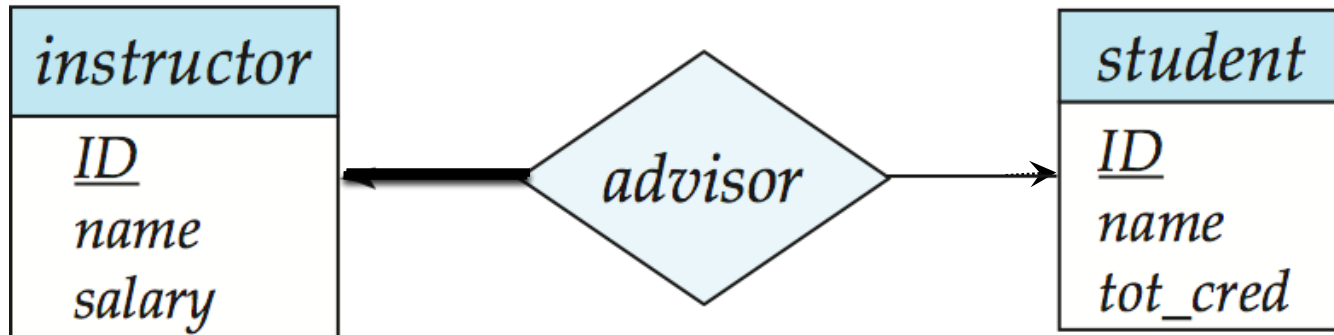
- One-to-One relationship between an *instructor* and a *student* :
 - A student is associated with at most one *instructor* via the relationship *advisor*
 - **Task:** Draw ER diagram where, A *student* is associated with at most one *department* via *stud_dept*

ER Diagram: Cardinality Constraints-II

- One-to-Many: an instructor is associated with several (including 0) students via *advisor*



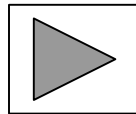
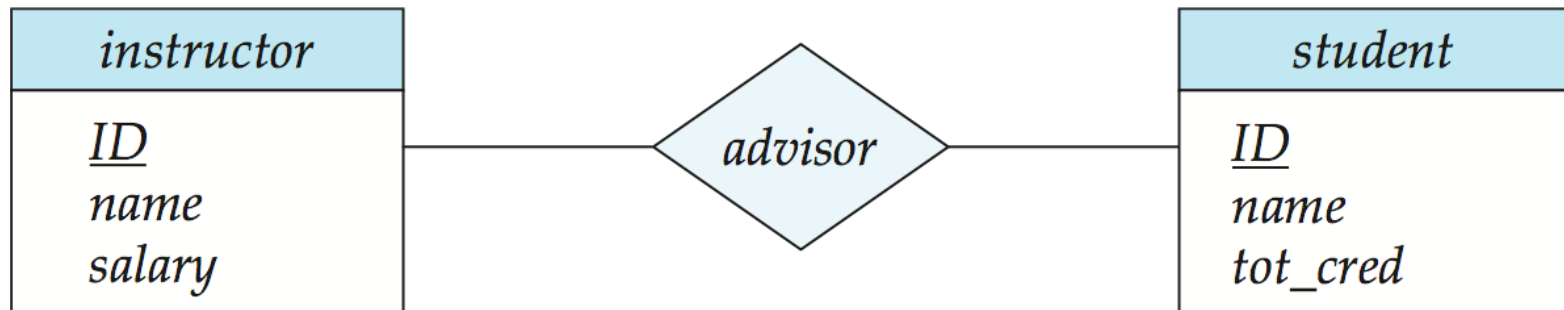
- Many-to-One: a student is associated with several (including 0) instructors via *advisor*



ER Diagram: Cardinality Constraints-III

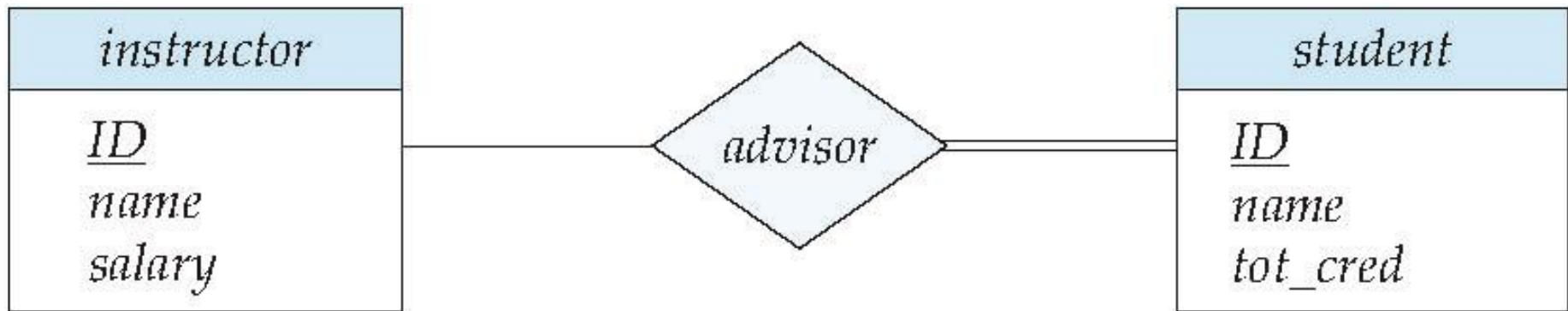
■ Many-to-Many:

- An instructor is associated with several (possibly 0) students via *advisor*
- A student is associated with several (possibly 0) instructors via *advisor*



ER Diagram: Total and Partial Participation

- **Total participation** is indicated by double line:
 - i.e. every entity in the entity set participates in at least one relationship in the relationship set



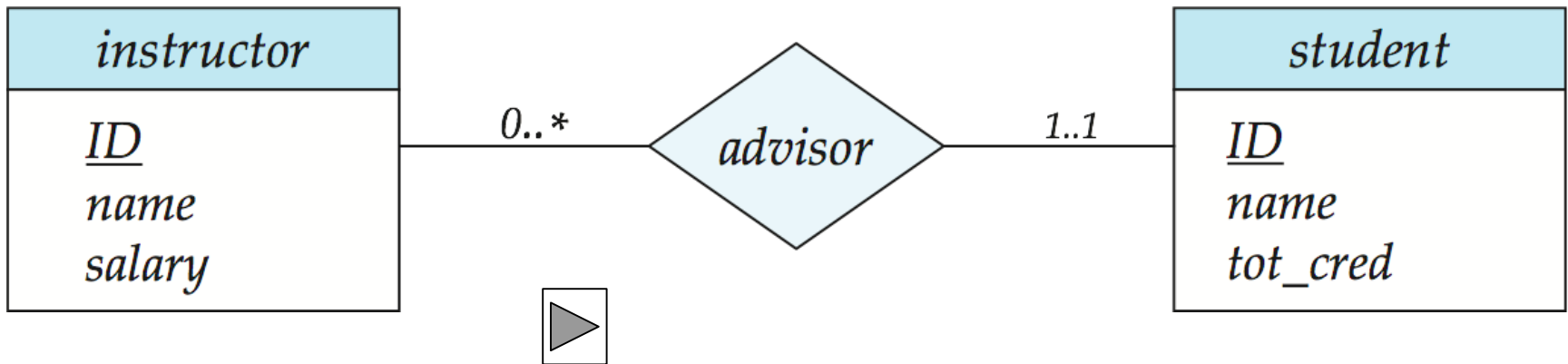
Ex. participation of *student* in *advisor* relation is *total*

- ▶ every *student* must have an associated instructor

- **Partial participation**: some entities may not participate in any relationship in the relationship set
 - Ex. participation of *instructor* in *advisor* is *partial*

ER Diagram: Complex Constraints

- A line may have an associated **minimum** and **maximum cardinality**, shown in the form *l..h*, where
 - A minimum value of 1 indicates total participation
 - A maximum value of 1 indicates that the entity participates in at most one relationship
 - A maximum value of * indicates no limit.



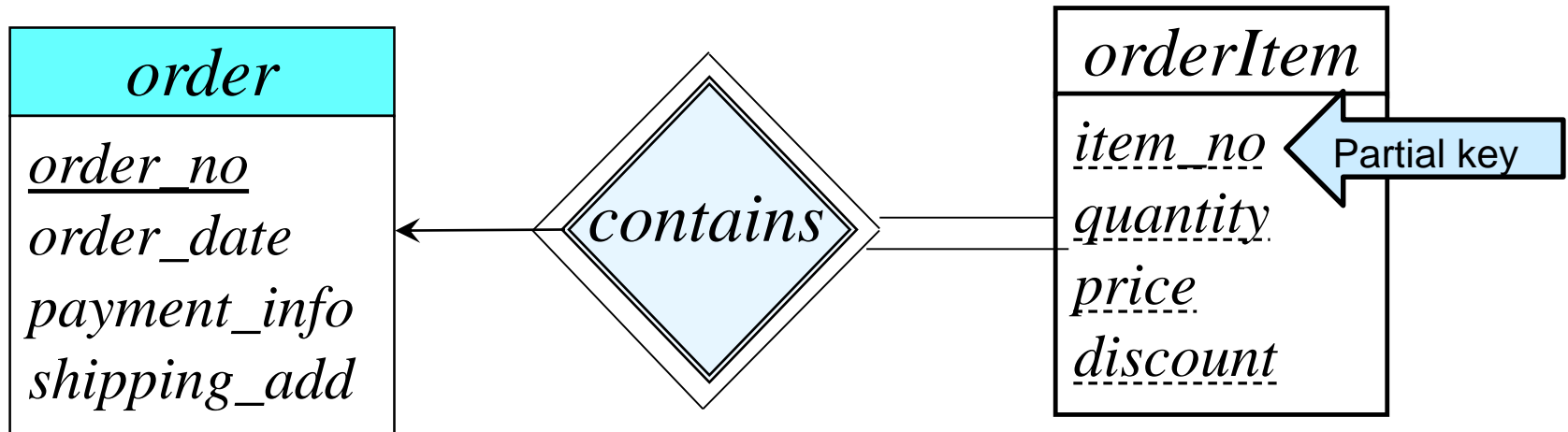
Instructor can advise **0 or more** students. A student must have **1 advisor**; cannot have **multiple advisors**

ER Model: Weak Entity Set - I

- An entity set that cannot be uniquely identified by its attributes alone are called weak entity sets.
 - i.e. the entity set does not have sufficient attributes to form a primary key and are dependent on other entity sets for their existence.
- An entity having own primary key is called a strong entity.
- The strong entity upon which the weak entity depends is referred as identity entity
- The relationship set through which the weak entity is connected to its identity (strong) entity set is called identifying relationship set.

ER Diagram: Weak Entity Set

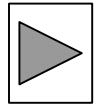
- Ex. orderItem(item_no, quantity, price, discount)



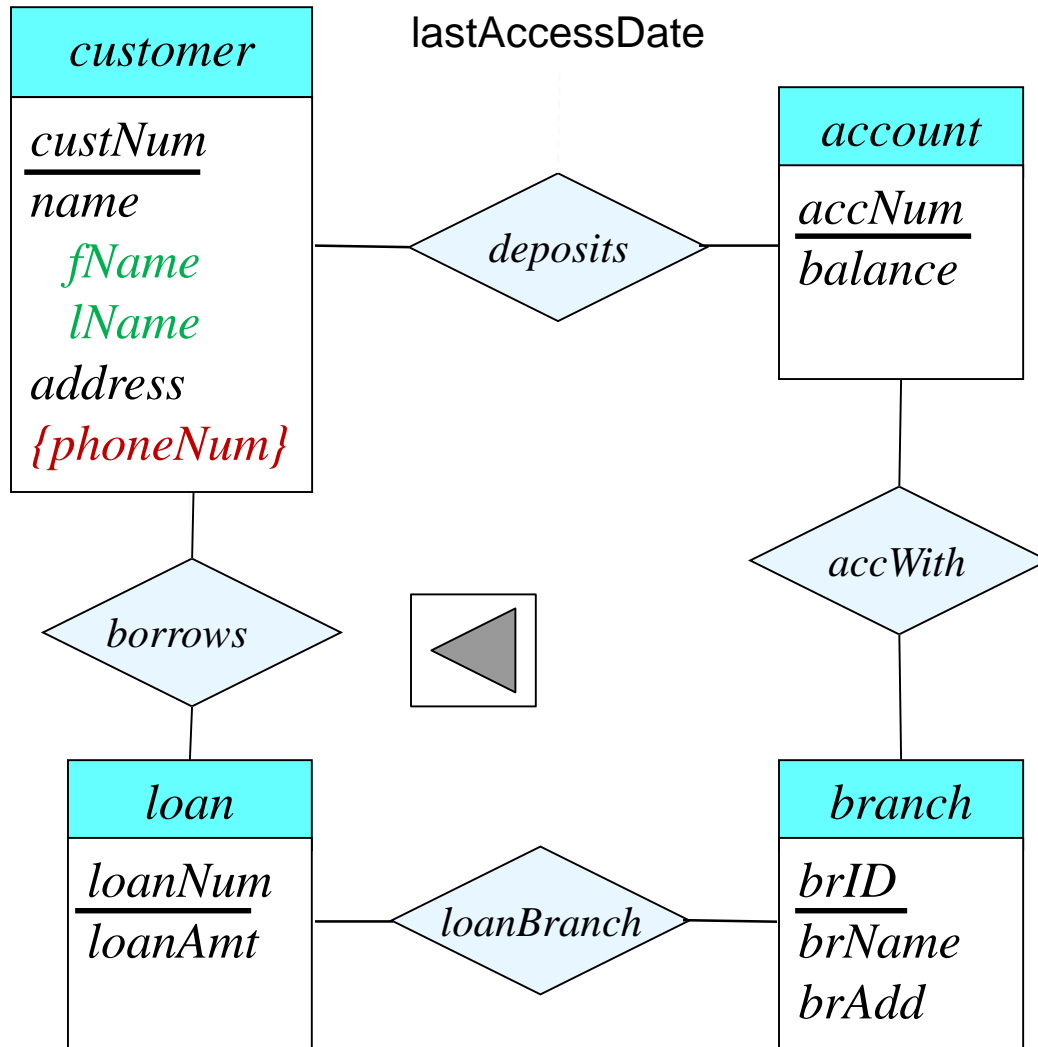
- The relationship set with its identity entity (strong) set is represented using double line diamond
- The line from **weak** entity to **identifying** relationship set is **double lined**
- A set of attributes of a weak entity set is referred as the **discriminator** (or **partial key**) that is used as a means of distinguishing among all those entities in the weak entity set that depend on one particular strong entity

Weak Entity Set - III

- The primary key of a weak entity set is formed by
 - the primary key of the identifying entity set, plus
 - the weak entity set's discriminator.
 - Example: {order_no, item_no} is the primary key in the table **orderItem**
- In the case of the entity set *section*, its primary key is {course_id, sec_id, year, semester}
- The participation of the weak entity set with its identifying relationship set is always total.
- The cardinality of the identifying relationship set is always many-to-one from the weak entity set to its identifying entity set
- The identifying relationship set is not allowed to have any descriptive attribute
- Weak entity can participate in any other relationship set after forming the primary key.

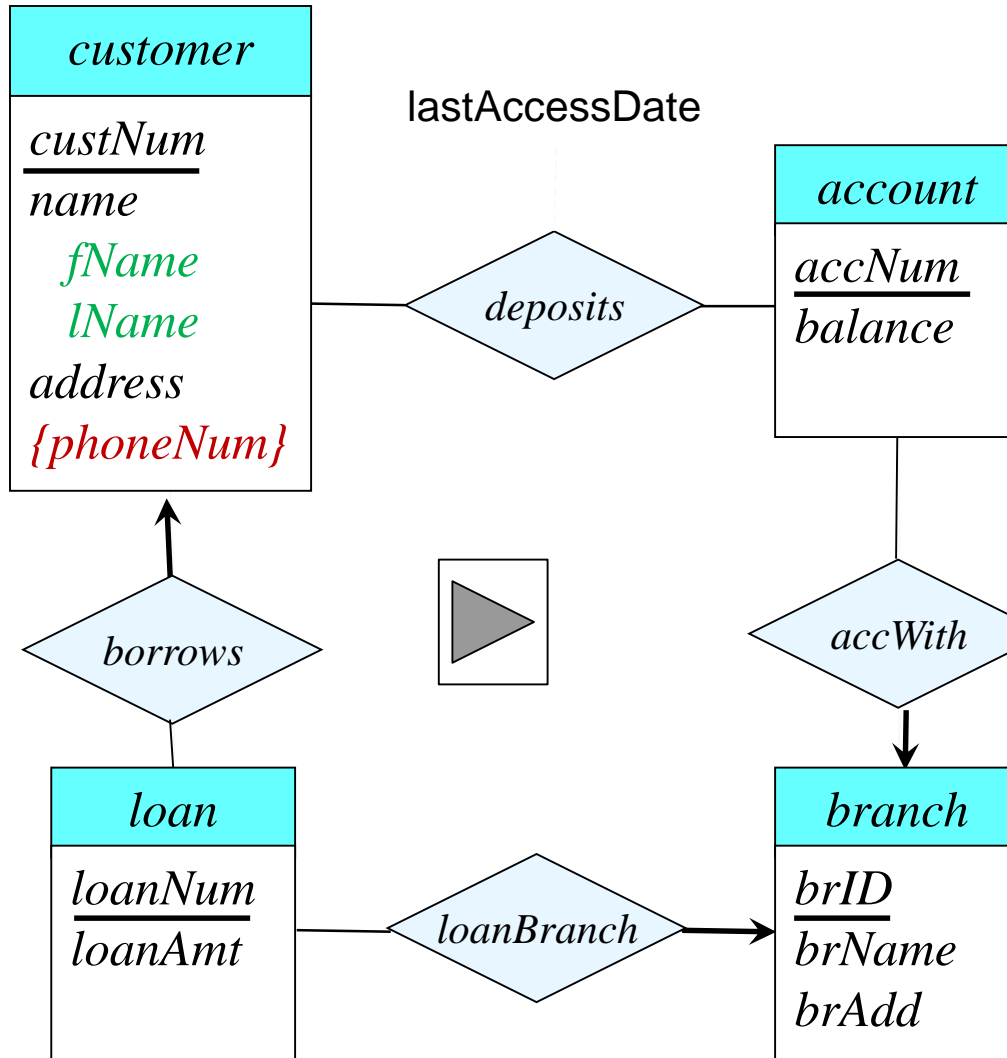


Complex Attributes



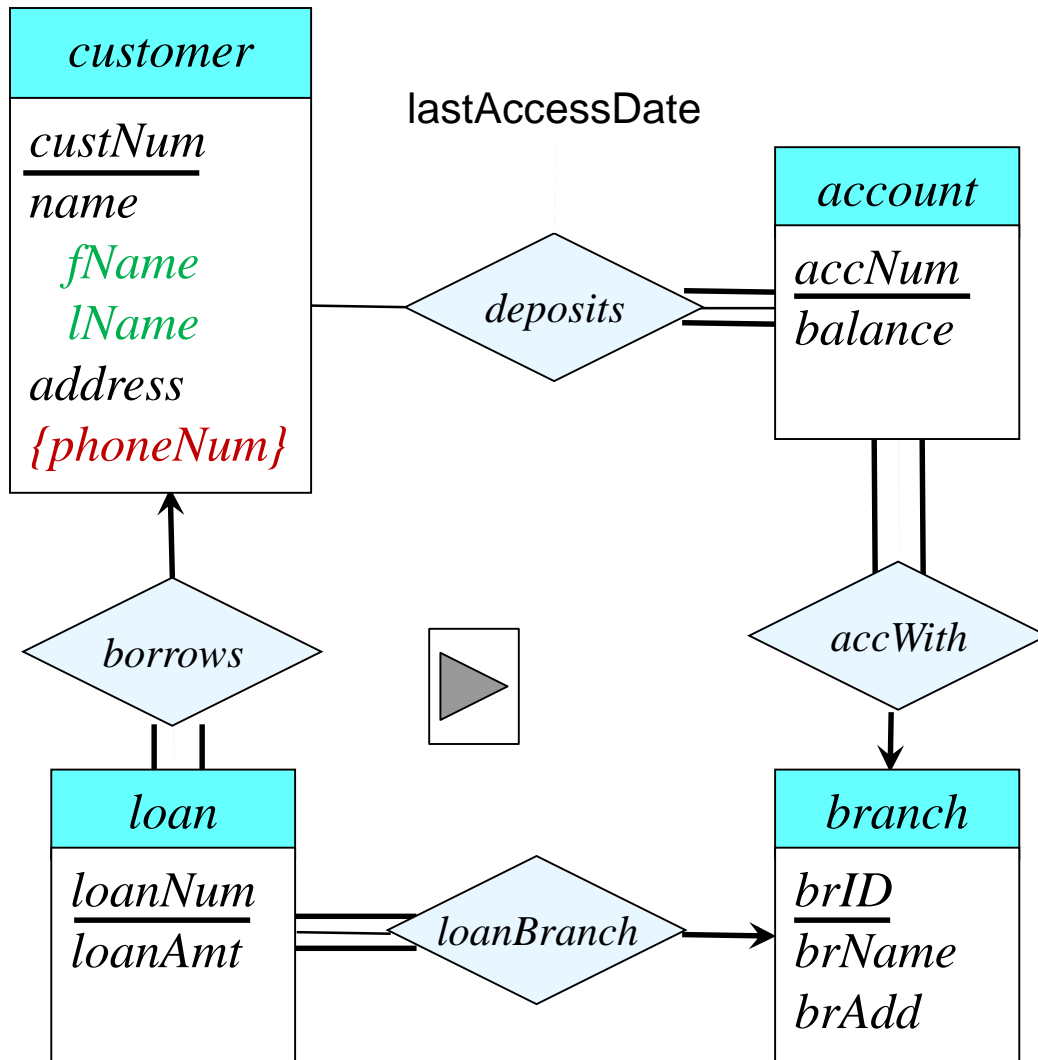
- Make **name** attribute of **customer** entity set as **composite** attribute with component attributes as
 - fName & lName
- Make **phoneNum** attribute of **customer** entity set as **multivalued** attribute as one customer can have **multiple** phone numbers

Cardinality Constraints



- There is a **many-to-many** relationship between **customer** and **account** via deposit
- **many-to-one** relationship between **account** and **branch**
- **many-to-one** relationship between **loan** and **branch**
- **many-to-one** relationship between **loan** and **customer**

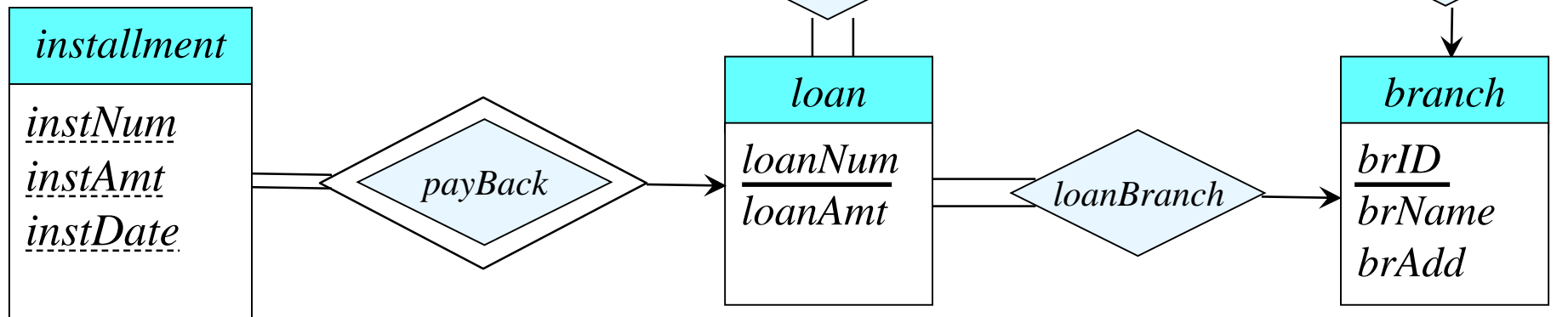
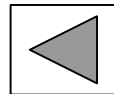
Participation Constraints



- Participation of entity set **account** in **deposit** relationship & **accWith** relationship is **total**
- Participation of **loan** entity set in **loanBranch** relationship & **borrows** relationship is **total**

Weak Entity Set

- Design an **Weak entity** set **installment** with attributes **instNum**, **instAmt**, **instDate**
- Join it with **loan** entity set with the relationship set **payBack**



Thank You