



ER Model

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ITER,S'O'A(DEEMED TO BE UNIVERSITY)

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Review

■ The ER Model

Content

- The ER Model
- The ER Diagram

Reduction to Relational Schema

- An E-R design can be **Translated/mapped/reduced** into a relational design.
- Entity sets and relationship sets can be expressed uniformly as *relation schemas* that represent the contents of the database.
- A database which conforms to an E-R diagram can be represented by a collection of schemas.
- For each entity set and relationship set there is a unique schema that is assigned the name of the corresponding entity set or relationship set.
- Each schema has a number of columns (generally corresponding to attributes), which have unique names

(R₁) Mapping Strong Entity sets

- A strong entity set reduces to a schema with the same attributes as in entity set.

<i>A</i>
<i><u>a₁</u></i>
<i>a₂</i>
<i>a₃</i>

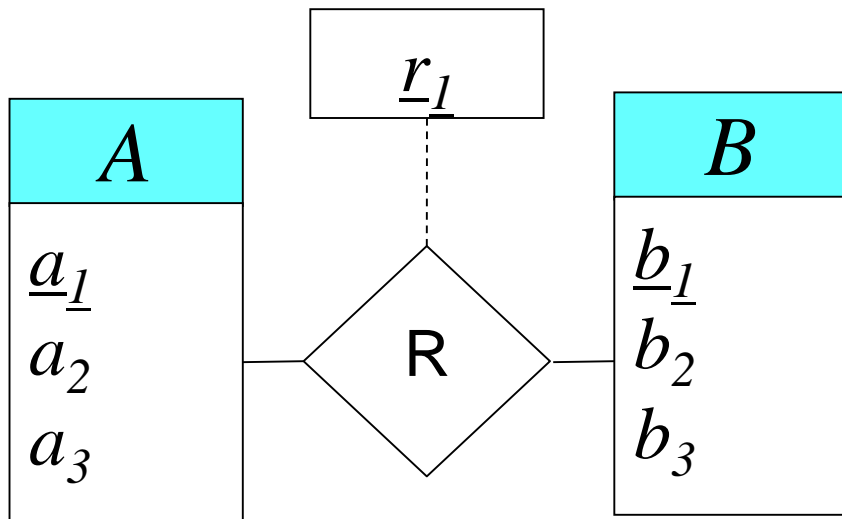
- Mapping: $A(\underline{a_1}, a_2, a_3)$

<i>student</i>
<i><u>ID</u></i>
<i>name</i>
<i>tot_cred</i>

- $student(\underline{ID}, name, tot_cred)$

(R₂) Mapping Relationship sets

- A relationship set reduces to a schema with the primary key attributes of participating entities and descriptive as in entity set.

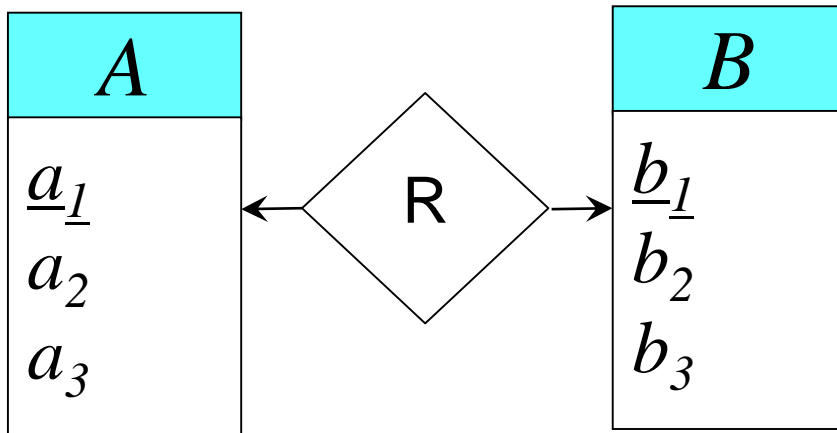


- $A(\underline{a_1}, a_2, a_3)$
- $B(\underline{b_1}, b_2, b_3)$
- $R(\underline{a_1}, \underline{b_1}, r_1)$

- (R_{2.1}) For a **binary many-to-many** relationship, the union of the **primary-key** attributes from the participating entity sets becomes the primary key.

(R₂) Mapping Relationship sets - II

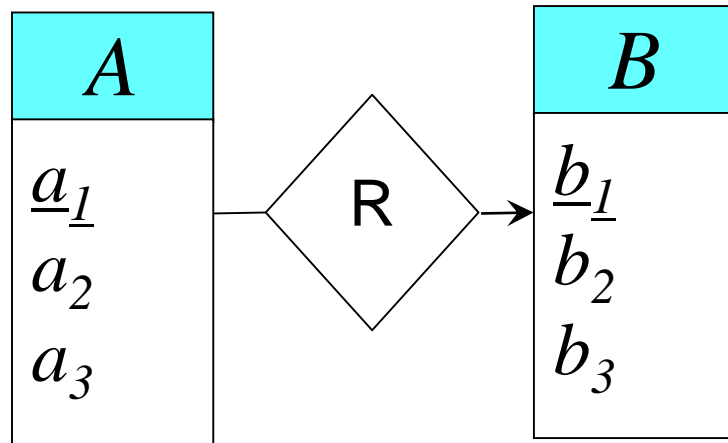
- (R_{2.2}) For a **binary one-to-one** relationship set, the primary key of either entity set can be chosen as the primary key. The choice can be made arbitrarily



- $A(\underline{a_1}, a_2, a_3)$
- $B(\underline{b_1}, b_2, b_3)$
- $R(\underline{a_1}, b_1)$ or
- $R(a_1, \underline{b_1})$

(R₂) Mapping Relationship sets - III

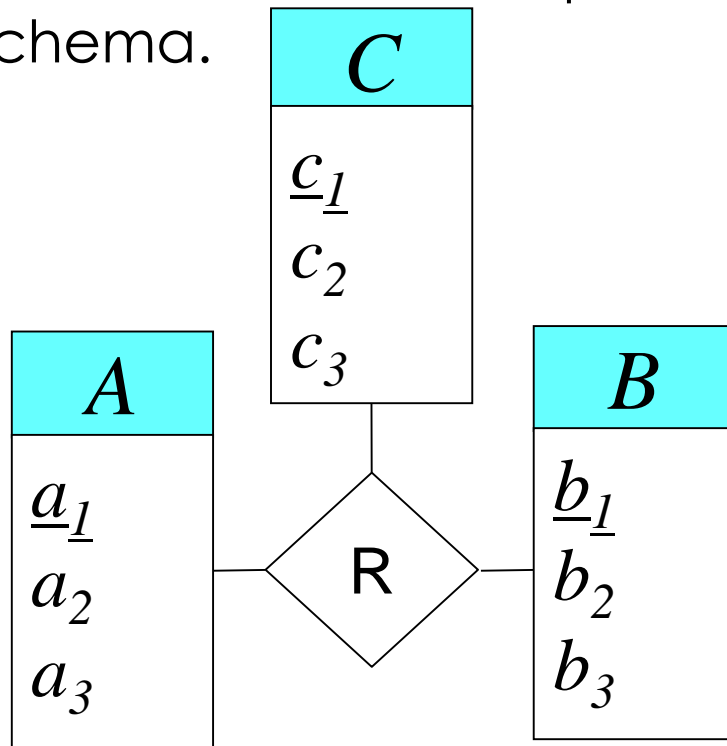
- (R_{2.3}) For a **binary many-to-one** or **one-to-many** relationship, the primary key of the entity set on the “**many**” side of the relationship set serves as the primary key.



- $A(\underline{a_1}, a_2, a_3)$
- $B(\underline{b_1}, b_2, b_3)$
- $R(\underline{a_1}, b_1)$

(R₂) Mapping Relationship sets - IV

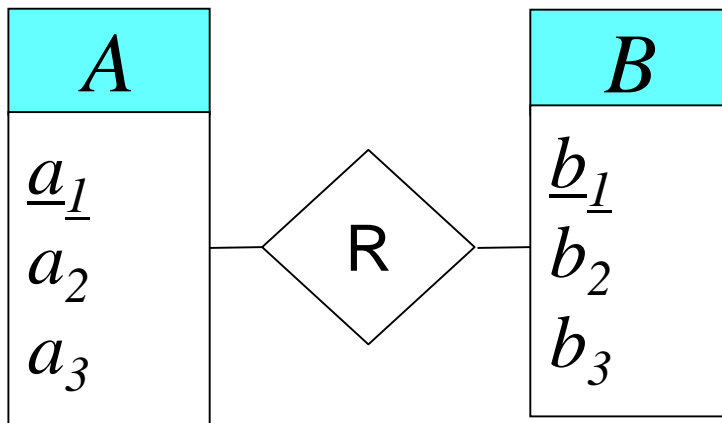
- (R_{2.4}) For an **n-ary** relationship set **without any arrows** on its edges, the union of the primary key-attributes from the participating entity sets becomes the primary key.
- (R_{2.4}) For an **n-ary** relationship set **with an arrow on one of its edges**, the primary keys of the entity sets **not on the “arrow”** side of the relationship set serve as the primary key for the schema.



- $A(\underline{a_1}, a_2, a_3)$
- $B(\underline{b_1}, b_2, b_3)$
- $C(\underline{c_1}, c_2, c_3)$
- $R(\underline{a_1}, \underline{b_1}, \underline{c_1})$

(R₂) Referential Integrity

- For each entity set E_i related to relationship set R , we create a **foreign-key** constraint from relation schema R , with the attributes of R that were derived from primary-key attributes of E_i referencing the primary key of the relation schema representing E_i .

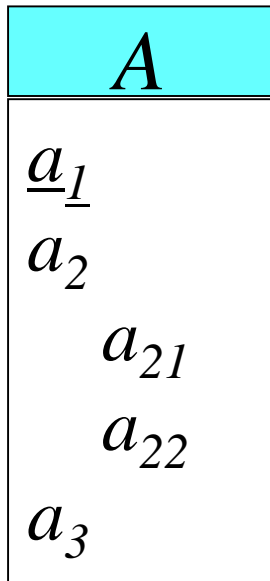


- $A(\underline{a_1}, a_2, a_3)$
- $B(\underline{b_1}, b_2, b_3)$
- $R(\underline{r_{a_1}}, r_{b_1})$

- Two **foreign key** constraints are created on relation R
- i.e. attribute r_{a_1} **referencing** primary key of A and attribute r_{b_1} **referencing** primary key of B.

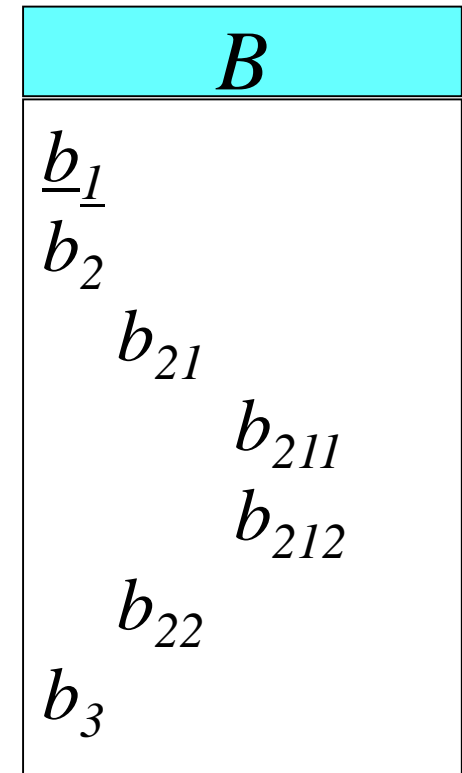
(R₃) Mapping Composite attributes

- While mapping a composite attribute to a relation, we form **one attribute** in the relation schema for **each sub-attribute** in the composite attribute of ER diagram.
- Attribute is **not created** for the composite attribute itself.



■ $A(a_1, a_{21}, a_{22}, a_3)$

■ $B(b_1, b_{211}, b_{212}, b_{22}, b_3)$



(R₄) Mapping Multivalued attributes

- For a multivalued attribute *m*, we create a separate relation schema *R* with an attribute *a* that corresponds to *m* and the primary key of the entity set.
- All of the attributes of *R* becomes the primary key of the relation *R*.

<i>A</i>
<u><i>a</i>₁</u>
<i>a</i> ₂
{ <i>m</i> }

■ $R(\underline{a_1}, m)$

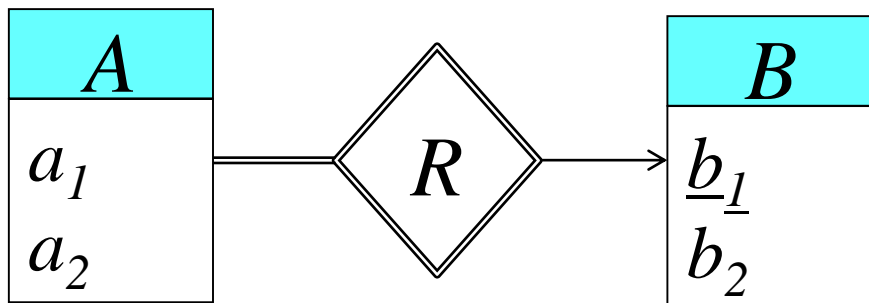
■ instructorPhone(id₁, phone_no)

<i>instructor</i>
<u><i>id</i></u>
<i>name</i>
<i>address</i>
{ <i>phone_no</i> }

- We create a foreign-key constraint on the relation schema created from the multivalued attribute.

(R₅) Mapping Weak Entity Set

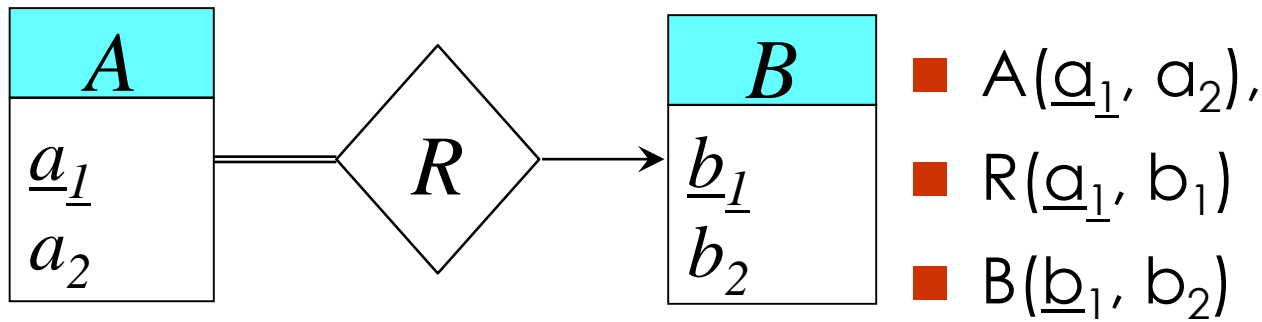
- For schemas derived from a weak entity set, the combination of the **primary key** of the strong entity set and the **discriminator** of the weak entity set serves as the **primary key** of the schema.



- Primary key of B: b_1
- Discriminator of A: a_1, a_2
- $A(\underline{a_1}, \underline{b_1}, a_2)$ and $B(\underline{b_1}, b_2)$
- No separate relation for R is required, however, if R contains a descriptive attribute, then it is added in A
- A foreign-key constraint is created on the relation A, specifying that the attributes b_1 reference the primary key of the relation B.

(R₆) Combination of Schemas

- If entity sets participate in a **total** participation with cardinality constraint as **many-to-one**, then the schema for entity set in total participation and the relationship set may be reduced to a **single schema**.
- The relation schema for other entity set remain as it is.

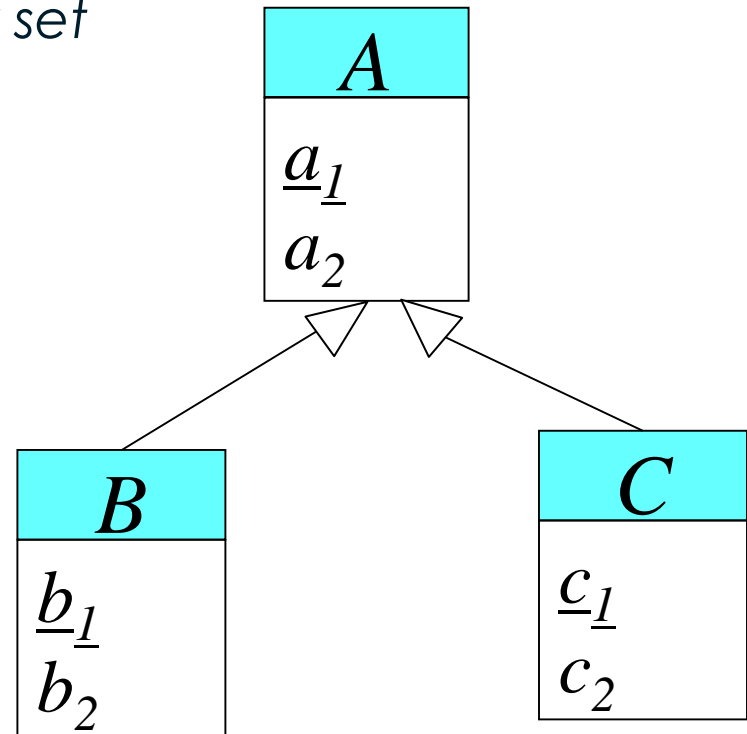


- Now the first two schemas may further be reduced to one schema as
- $A(\underline{a_1}, a_2, b_1),$ where b_1 is the foreign key for b_1 in B

(R_{7.1}) Mapping Generalization - I

- **Case I:** Create a schema for higher level entity set.
- Again create a schema for each lower level entity sets with attributes as follows
 - *Primary key of higher level entity set*
 - *All attributes of lower level entity set*

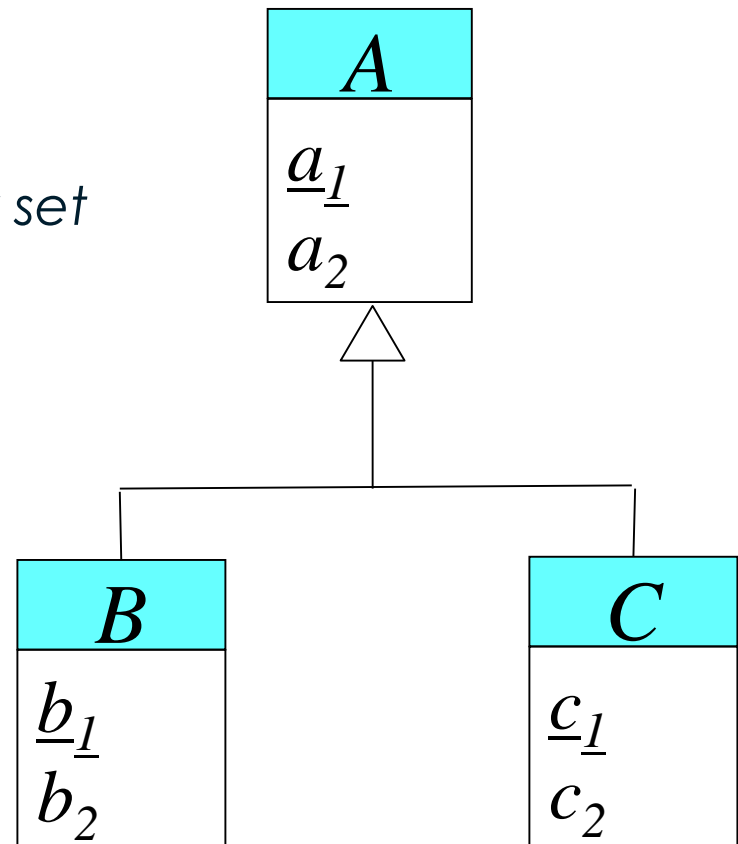
- $A(\underline{a_1}, a_2)$
- $B(\underline{a_1}, b_1, b_2)$
- $C(\underline{a_1}, c_1, c_2);$



(R_{7.2}) Mapping Generalization - II

- **Case II: (Disjoint Generalization)** Schema for higher level entity set is not created.
- The schema for lower level entities will have following attributes.
 - All higher level attributes.
 - All attributes of lower level entity set

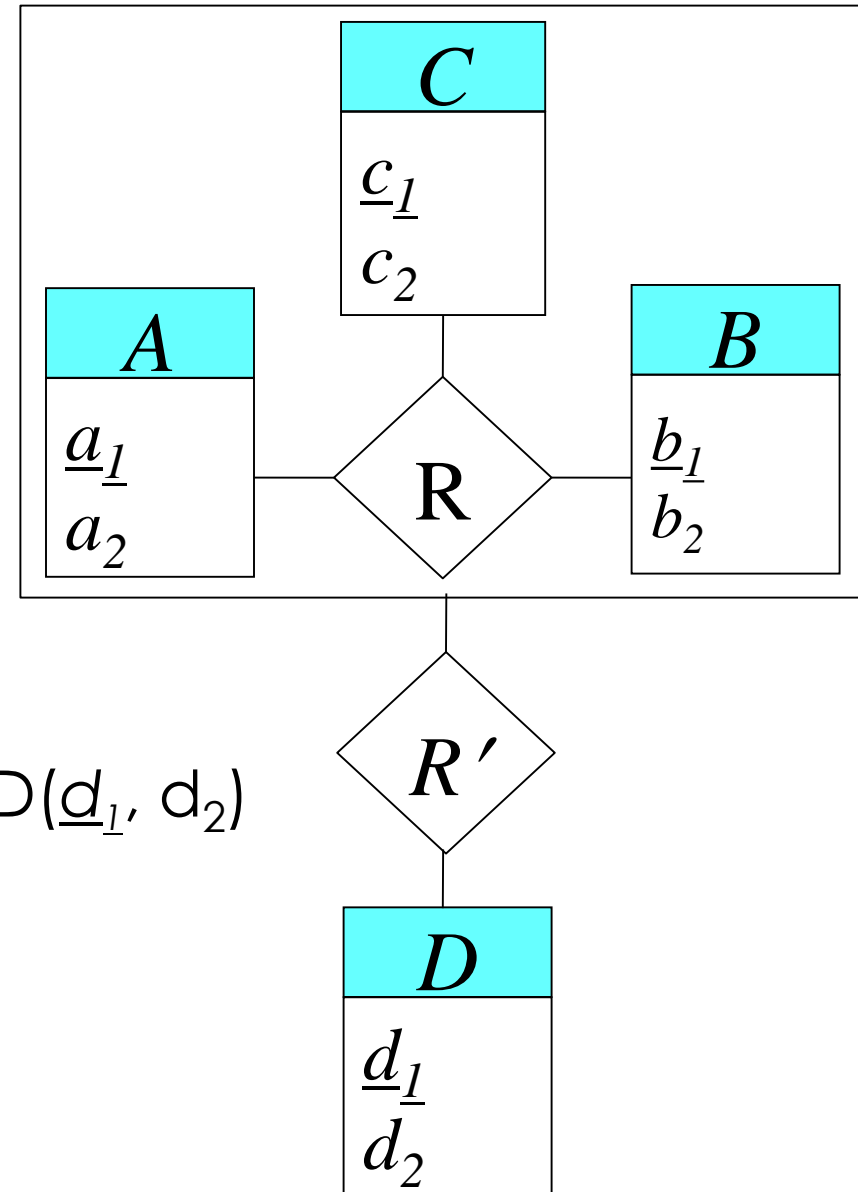
- $B(\underline{a_1}, a_2, b_1, b_2)$
- $C(\underline{a_1}, a_2, c_1, c_2);$



(R₈) Mapping Aggregation

- The schema for the relationship set R' between the aggregation of R and the entity set D includes an attribute for each attribute in the primary keys of the entity set D , and the relationship set R .

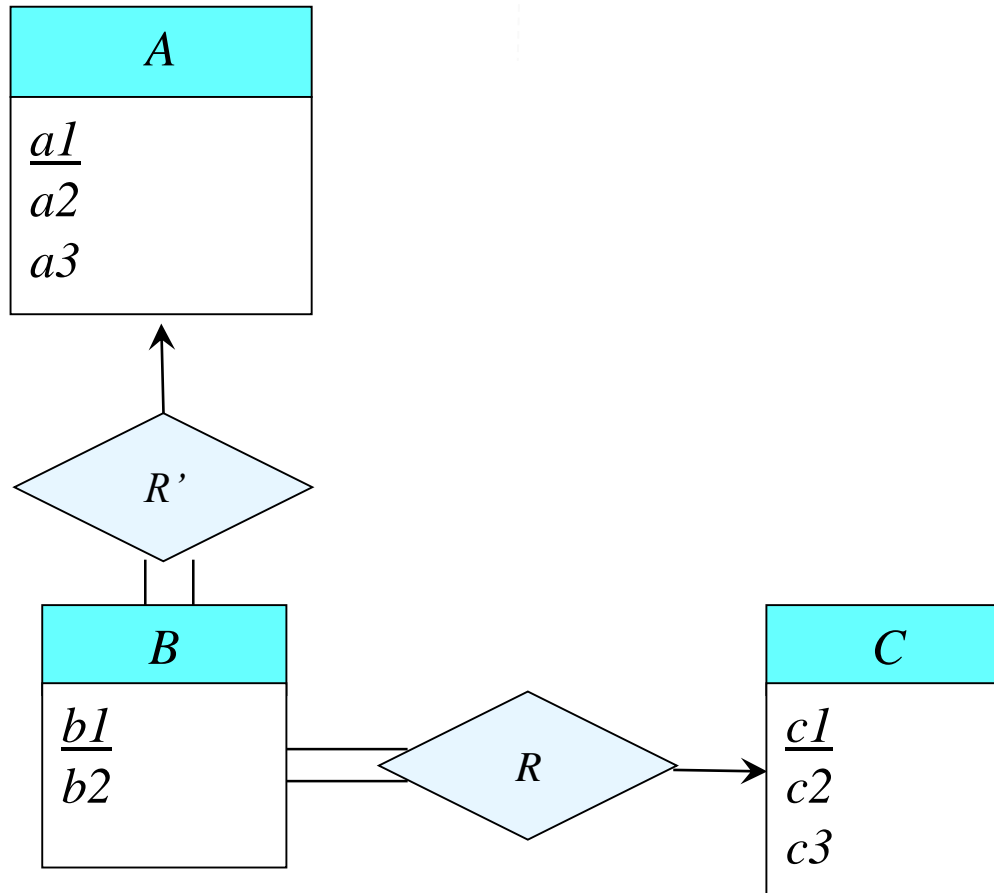
- $A(\underline{a_1}, a_2)$, $B(\underline{b_1}, b_2)$, $C(\underline{c_1}, c_2)$, $D(\underline{d_1}, d_2)$
- $R(\underline{a_1}, b_1, c_1)$, $R'(\underline{a_1}, b_1, c_1, d_1)$



Schema Diagram

- A database schema, along with primary key and foreign key dependencies, can be depicted by **schema diagrams**.
- Each relation appears as a box, with the relation name at the top, and the attributes listed inside the box.
- Primary key attributes are shown underlined.
- Foreign key dependencies appear as arrows from the **foreign key** attributes of the referencing relation to the **primary key** of the referenced relation.

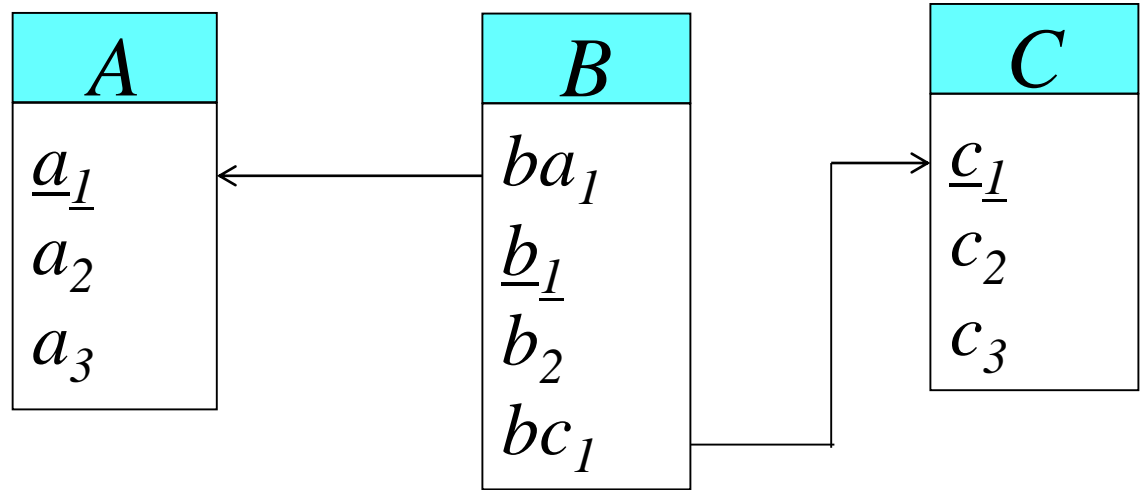
Given ER Model



Example: Conversion into Relation Schema

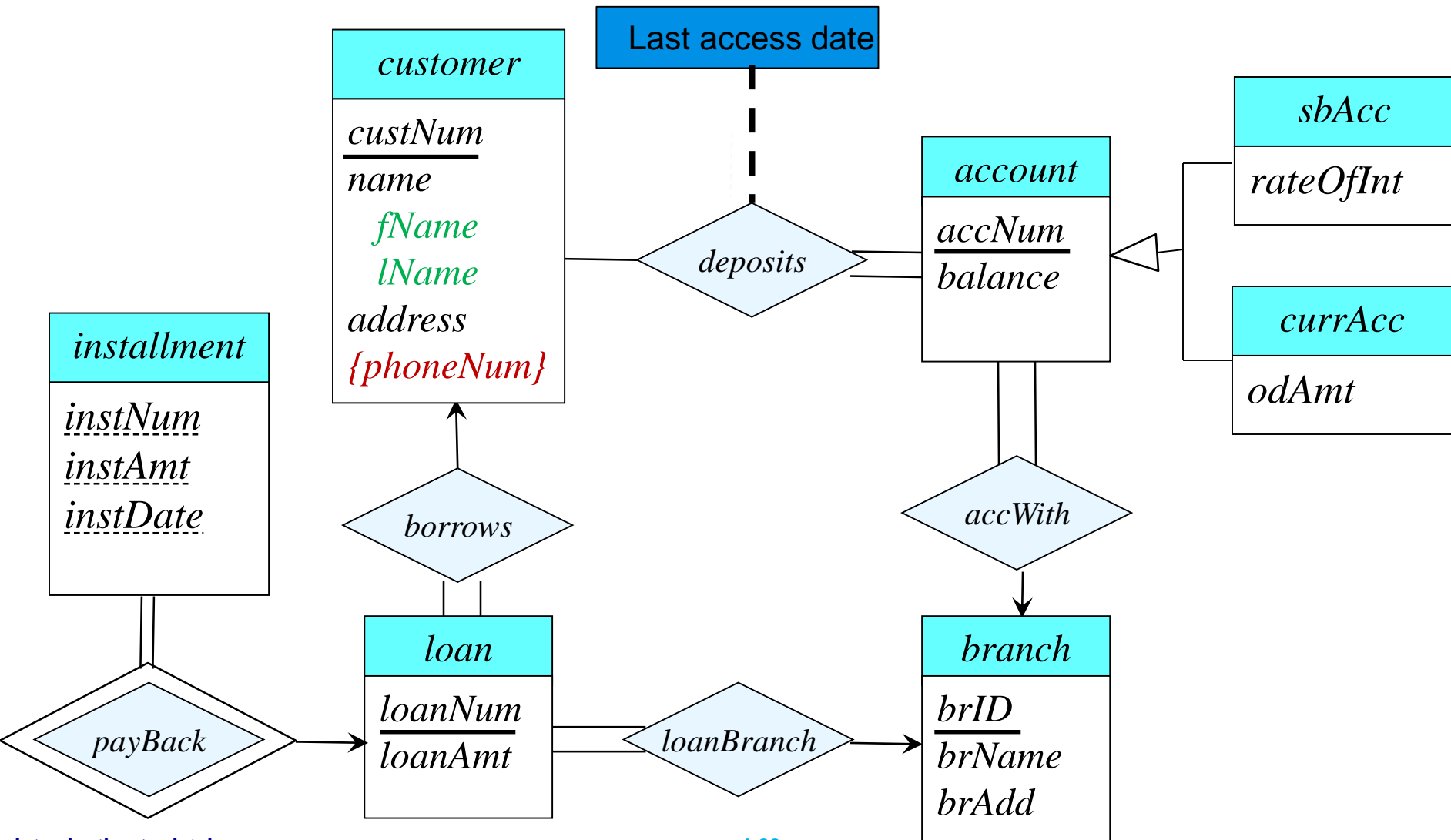
- $A(\underline{a1}, a2, a3)$
- $C(\underline{c1}, c2, c3)$
- $B(ba1, b1, b2, bc1)$

Example: Schema Diagram



- ba_1 is the **foreign key** attribute of the referencing relation **B** to the **primary key** attribute a_1 of the referenced relation **A**
- Similarly bc_1 is the **foreign key** attribute of the referencing relation **B** to the **primary key** attribute c_1 of the referenced relation **C**

Part-I:Final ER Model for Project



Part II

Convert the Given ER Model
into Relation Schema

Part III

Convert the resultant
Relational Schema into
Diagram

End of Chapter