ER Model

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Review

- The ER Model

Content

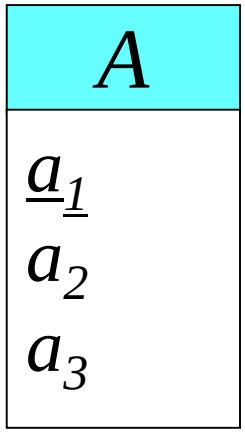
- The ER Model
- The ER Diagram

Reduction to Relational Schema

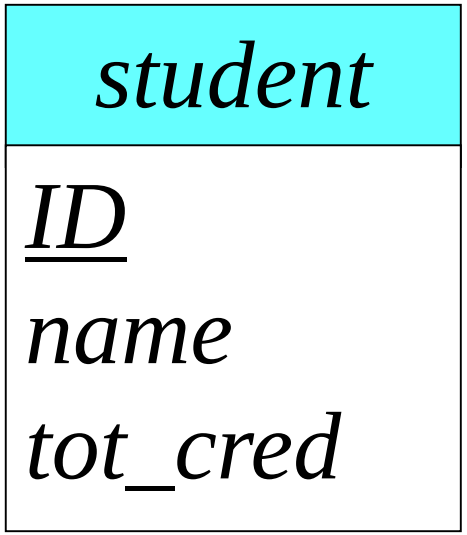
- An E-R design can be Translated/mapped/reduced into a relational design.
- Entity sets and relationship sets can be expressed uniformly as *relation schemas* that represent the contents of the database.
- A database which confirms to an E-R diagram can be represented by a collection of schemas.
- For 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

(R_1) Mapping Strong Entity sets

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



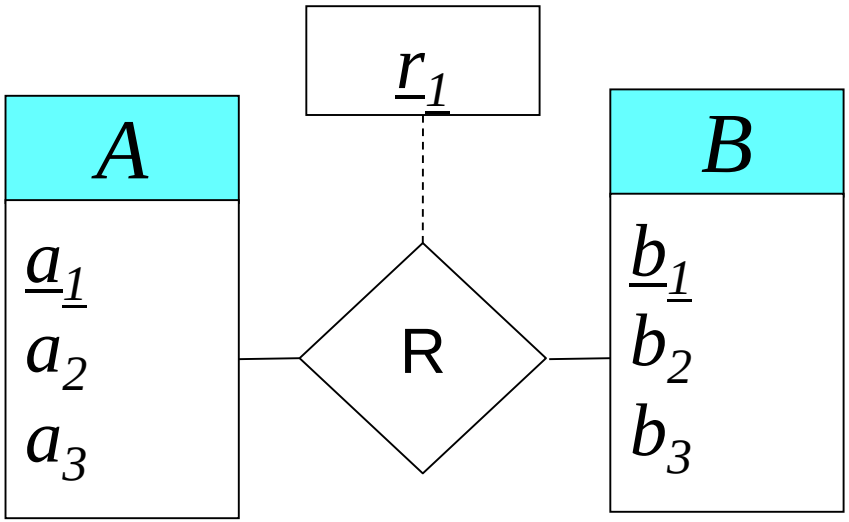
- Mapping: A(a1,a2,a3)



- student(ID, name, tot_cred)

(R_2) Mapping Relationship sets

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

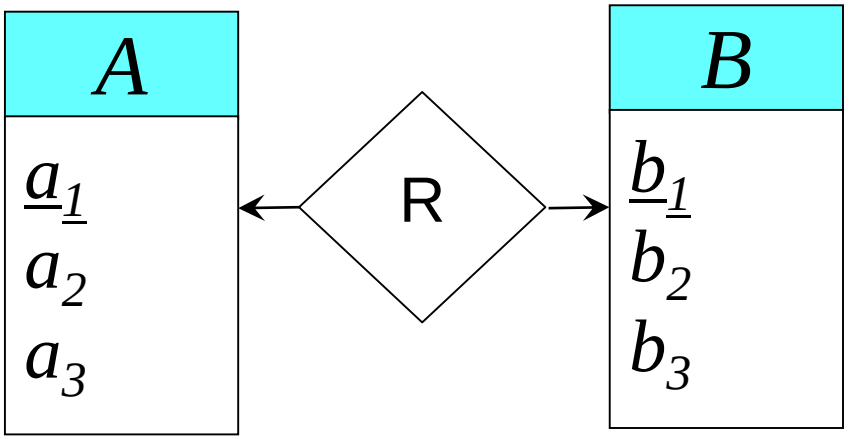


- A($\underline{a_1}$, a_2, a_3)
- B($\underline{b_1}$, b_2, b_3)
- R($\underline{a_1, b_1}$, r_1)

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

(R_2) Mapping Relationship sets - II

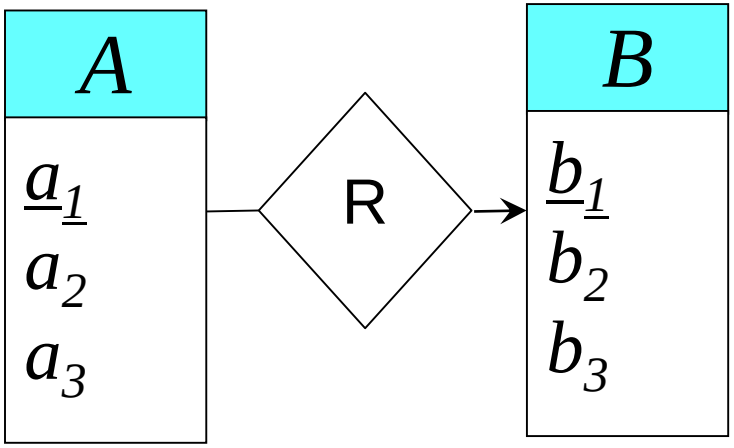
- ($R_{2.2}$)For a binary one-to-one relationship set, the primary key of either entity set can be chosen as the primary key. The choice can be made arbitrarily



- 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, $\underline{b_1}$)

(R_2) Mapping Relationship sets - III

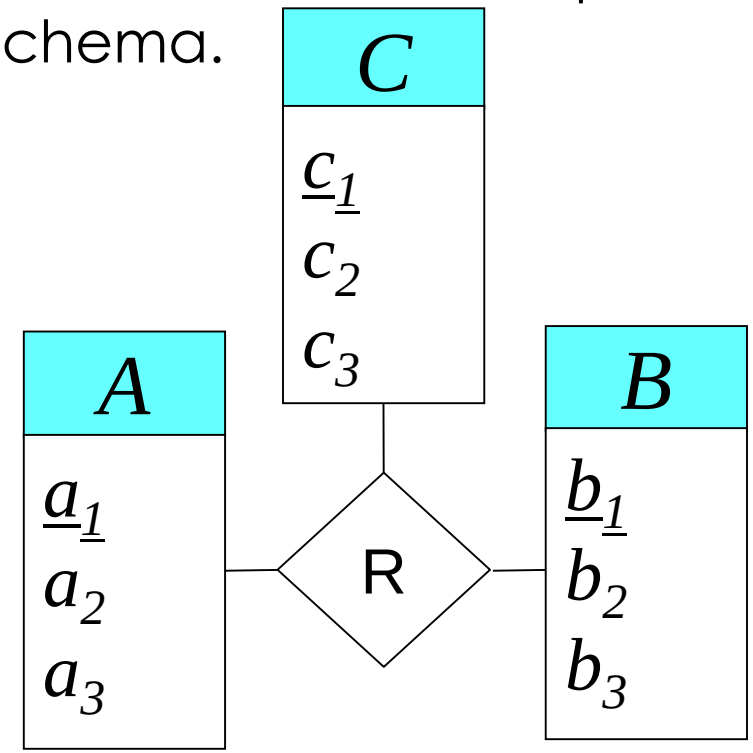
- ($R_{2.3}$) For a binary many-to-one or one-to-many relationship, the primary key of the entity set on the "many" side of the relationship set serves as the primary key.



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

(R_2) Mapping Relationship sets - IV

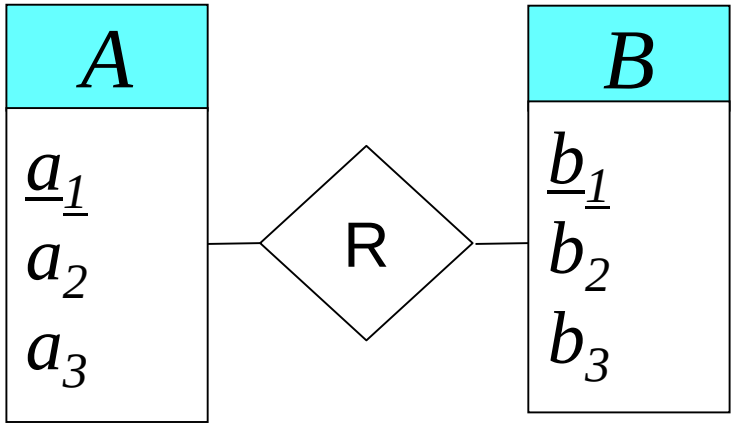
- ($R_{2.4}$) For an n-ary relationship set without any arrows on its edges, the union of the primary key-attributes from the participating entity sets becomes the primary key.
- ($R_{2.4}$) For an n-ary relationship set with an arrow on one of its edges, the primary keys of the entity sets not on the "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($\underline{a_1, b_1, c_1}$)

(R_2) 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 *Ei* .

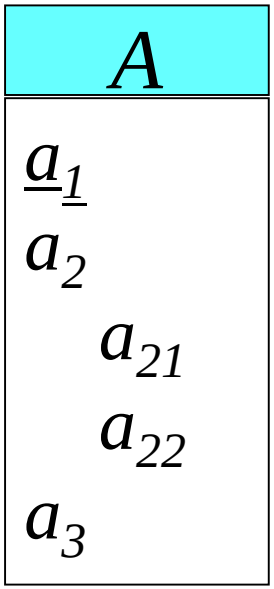


- A($\underline{a_1}$, a_2, a_3)
- B($\underline{b_1}$, b_2, b_3)
- R($\underline{r\_a_1}$, $\underline{r\_b_1}$)

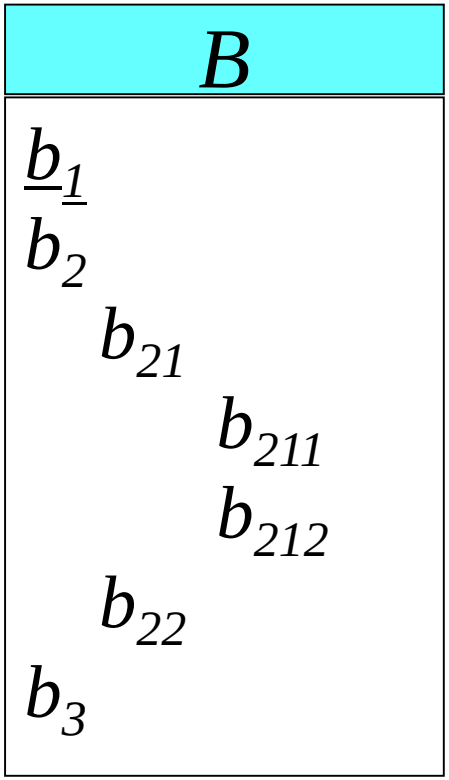
- Two foreign key constraints are created on relation R
- i.e. attribute r_a_1 referencing primary key of A and attribute r_b_1 referencing primary key of B.

(R_3) 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)



(R_4) 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.*

A
$\underline{a_1}$
a_2
$\{m\}$

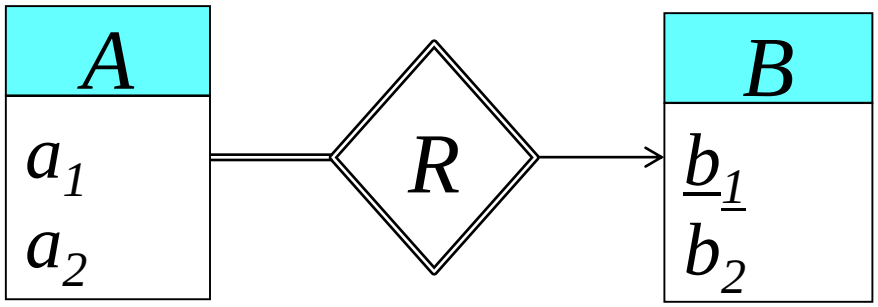
- R($\underline{a_1}$, m)
- instructorPhone($\underline{id_1}$, $\underline{phone\_no}$)

instructor
id
name
address
{phone_no}

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

(R_5) 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.

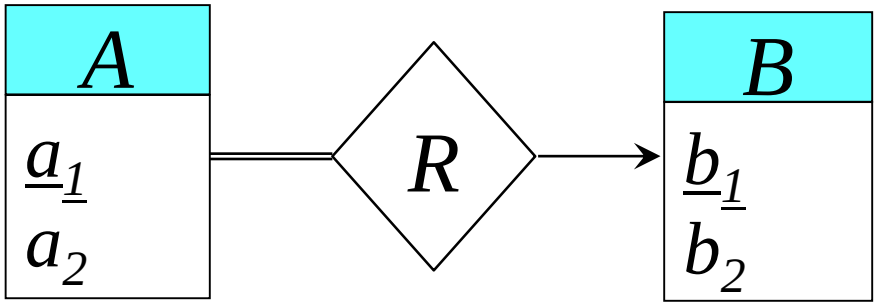


- Primary key of B: b_1
- Discriminator of A: a_1,a_2
- A($\underline{a_1}$, $\underline{b_1}$, a_2) and B($\underline{b_1}$,b_2)

- 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 b1 reference the primary key of the relation B.

(R_6) 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.

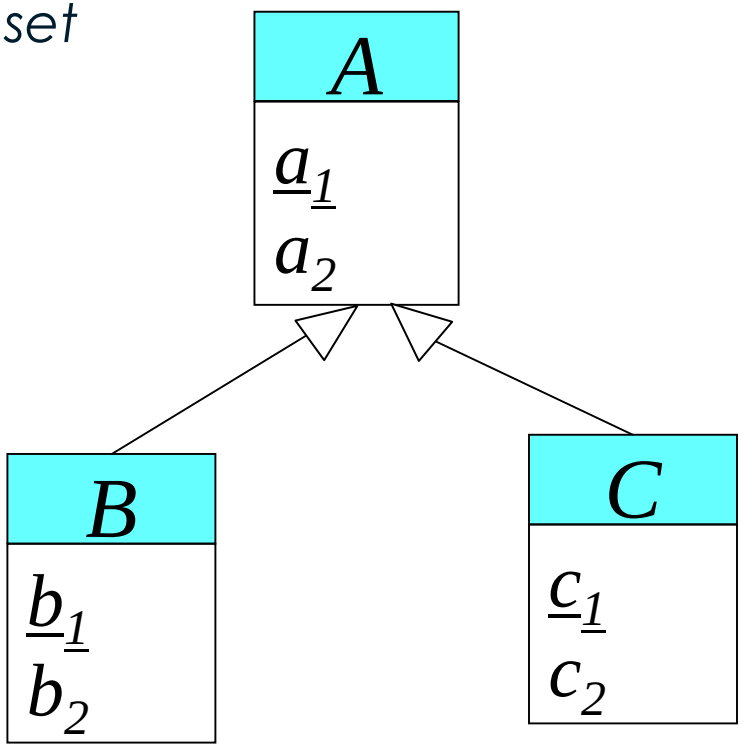


- A($\underline{a_1}$, a_2),
- R($\underline{a_1}$, b_1)
- B($\underline{b_1}$, b_2)

- Now the first two schemas may further be reduced to one schema as
- A($\underline{a_1}$, a_2, b_1), where b1 is the foreign key for b1 in B

($R_{7.1}$) Mapping Generalization - I

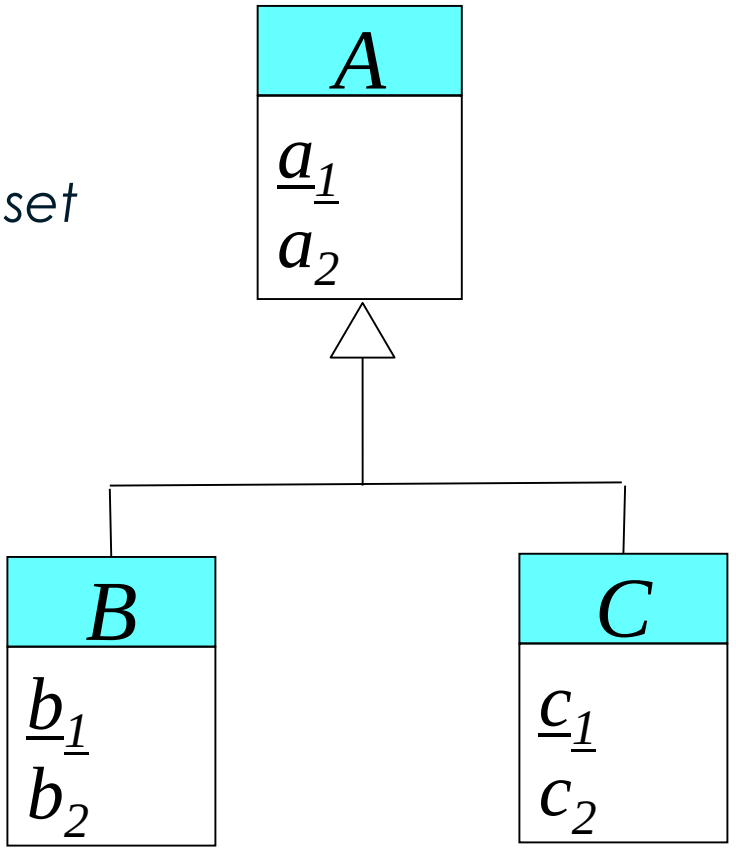
- Case I: Create a schema for higher level entity set.
- Again create a schema for each lower level entity sets with attributes as follows
  - *Primary key of higher level entity set*
  - *All attributes of lower level entity set*



- 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

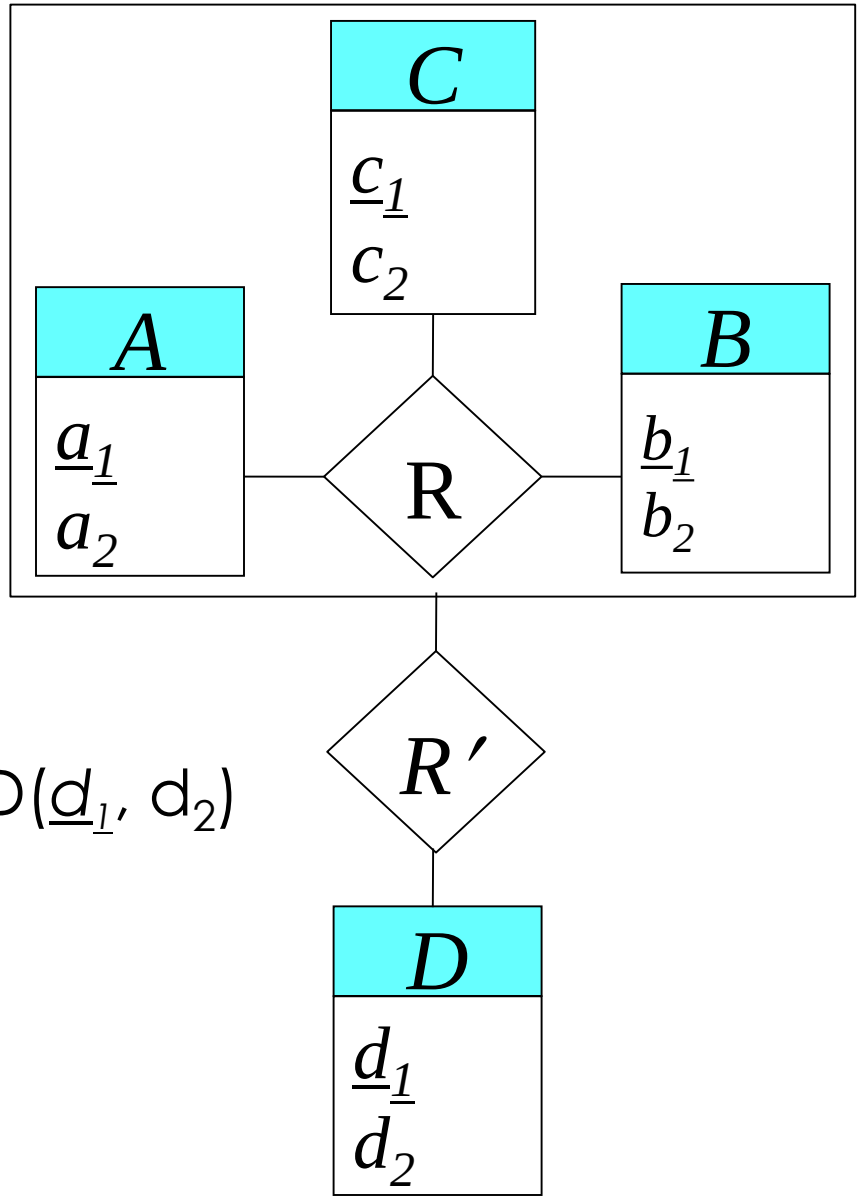
- Case II: (Disjoint Generalization) Schema for higher level entity set is not created.
- The schema for lower level entities will have following attributes.
  - *All higher level attributes.*
  - *All attributes of lower level entity set*



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

(R_8) 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*.

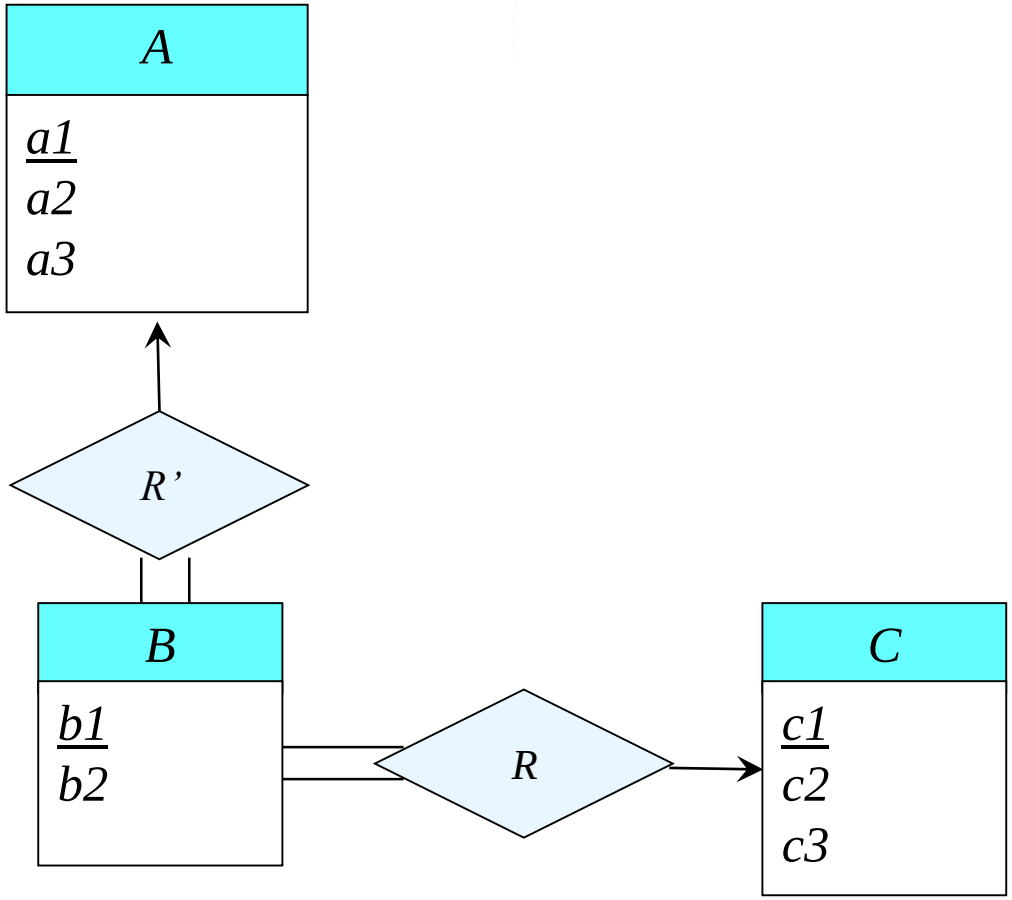


- A($\underline{a_1}$,a_2), B($\underline{b_1}$, b_2), C($\underline{c_1}$, c_2), D($\underline{d_1}$, d_2)
- R($\underline{a_1,b_1,c_1}$), R′($\underline{a_1,b_1,c_1,d_1}$)

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.

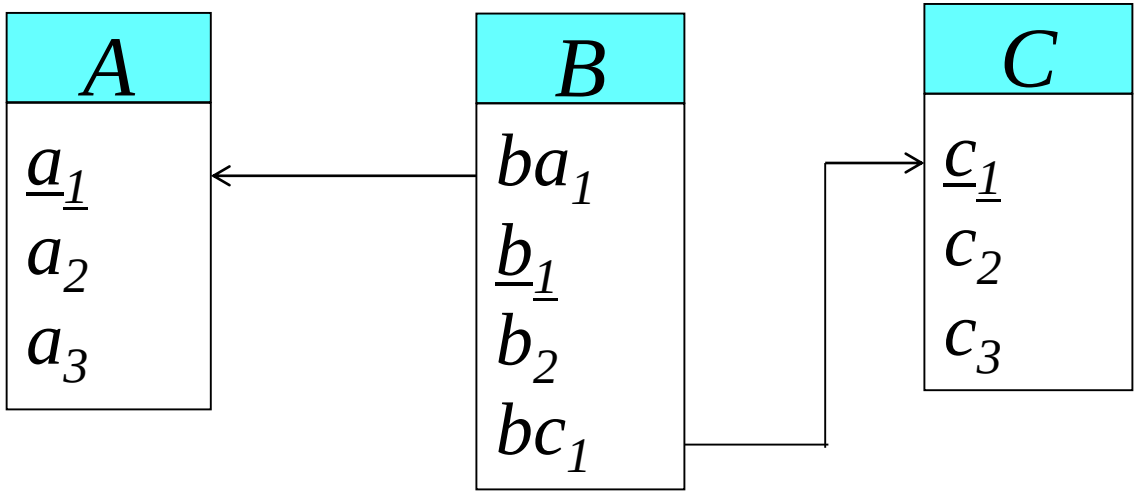
Given ER Model



Example: Conversion into Relation Schema

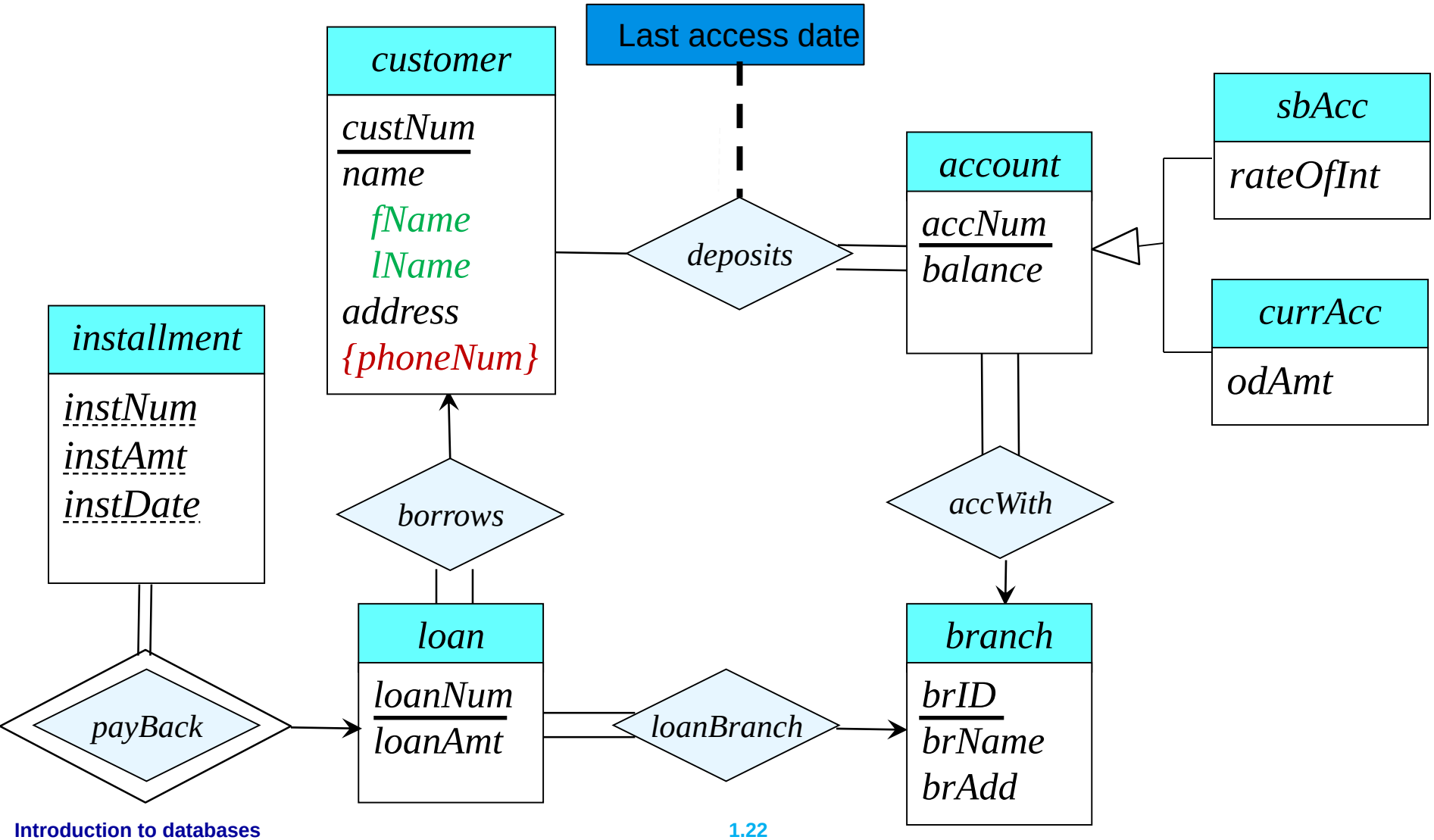
- A(a1,a2,a3)
- C(c1,c2,c3)
- B(ba1,b1,b2,bc1)

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