To be discussed:-

- Entity
- Attribute
- Types of Attribute
- Relationship
- ER Diagram Representation
- Generalization
- Specialization
- Aggregation
- Relational Data Model
- ER Model to Relational Model

An Entity-Relationship (ER) diagram is a conceptual and graphical representation of entities (objects or concepts), attributes (properties or characteristics), and the relationships between entities.

Entity

An entity can be a real-world object having specific set of attributes, either animate or inanimate, that can be easily identifiable.

Entity set

An entity set is a collection of similar types of entities. An entity set may contain entities with attribute sharing similar values.

Example : School Database

- Teachers (E.No, T_Name, D.No, Salary)
- Students (R.No, S_Name, Class, Age)

$(A'+B')' = A \cdot B$

Attributes

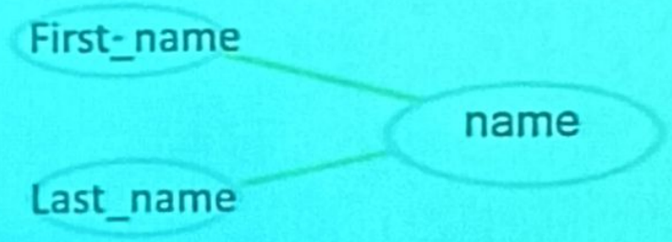
An **attribute** is a property or characteristic of an entity. An entity may contain any number of **attributes**.. All attributes have values.

Example : Student :- Name, Class, Age

Types of Attributes

- **Simple attribute** – Simple attributes are atomic values, which cannot be divided further. For example, a student's Roll_number is an atomic value.

- **Composite attribute** – Student's complete name may have first_name and last_name.

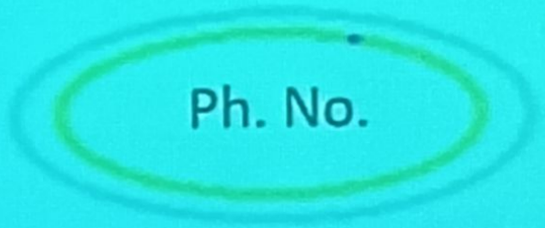


Types of Attributes Continue.....

- Derived attribute – It can be derived from other attribute. Value of derived attribute should not be saved directly in the database.

  Example: age can be derived from date_of_birth attribute.

- Multi-value attribute – Multi-value attributes may contain more than one values.
  Example: A person can have more than one phone number, email_address, etc



$(A'+B')' = A \cdot B$

Relationship

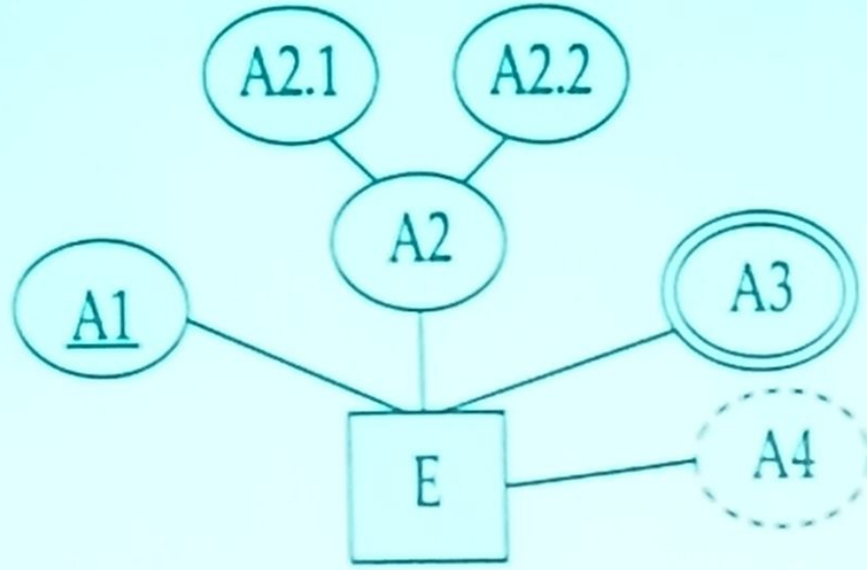
- The association among entities is called relationship.
- Ex: Employee **works at** department
- Ex: Student **enrolls** in a course

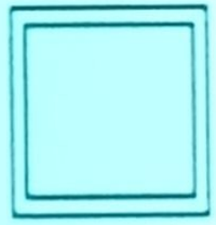
- **Relationship Set**

  A set of relationships of similar type is called a relationship set. Like entities, a relationship too can have attributes. These attributes are called **descriptive attributes**.

ER Diagrams Notations

entity set E with
simple attribute A1,
composite attribute A2,
multivalued attribute A3,
derived attribute A4,
and primary key A1



weak entity set 

generalization 

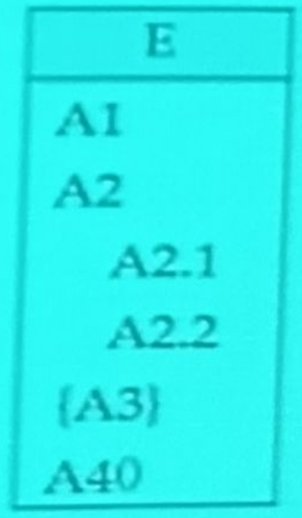
Summary of Symbols Used in E-R Notation

entity set

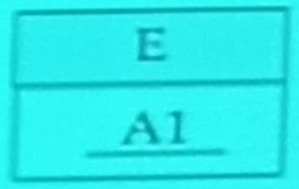
relationship set

identifying relationship set for weak entity set

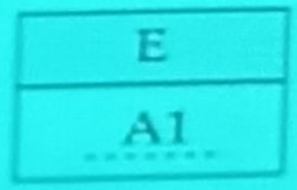
total participation of entity set in relationship



attributes:
simple (A1),
composite (A2) and
multivalued (A3)
derived (A4)



primary key



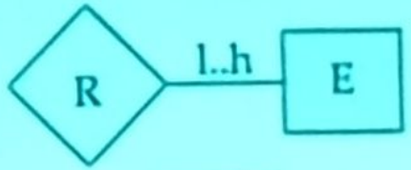
discriminating attribute of weak entity set

Symbols Used in E-R Notation (Cont.)

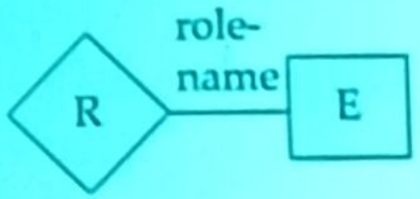
many-to-many relationship

many-to-one relationship

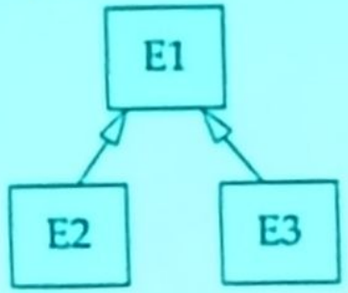
one-to-one relationship



cardinality limits



role indicator



ISA: generalization or specialization

$(A'+B')' = A'B''$

Keys

Super Key : A super key is set of one or more attribute which taken collectively, allows us to identify uniquely an entity in the entity set.

Example:

- Customer (Social_securityno , Cust_name, Street , City)
- Social_securityno is a Super Key
- Combination of {Social_securityno , Cust_name } is also a super key

- Super key may contain extraneous attributes.

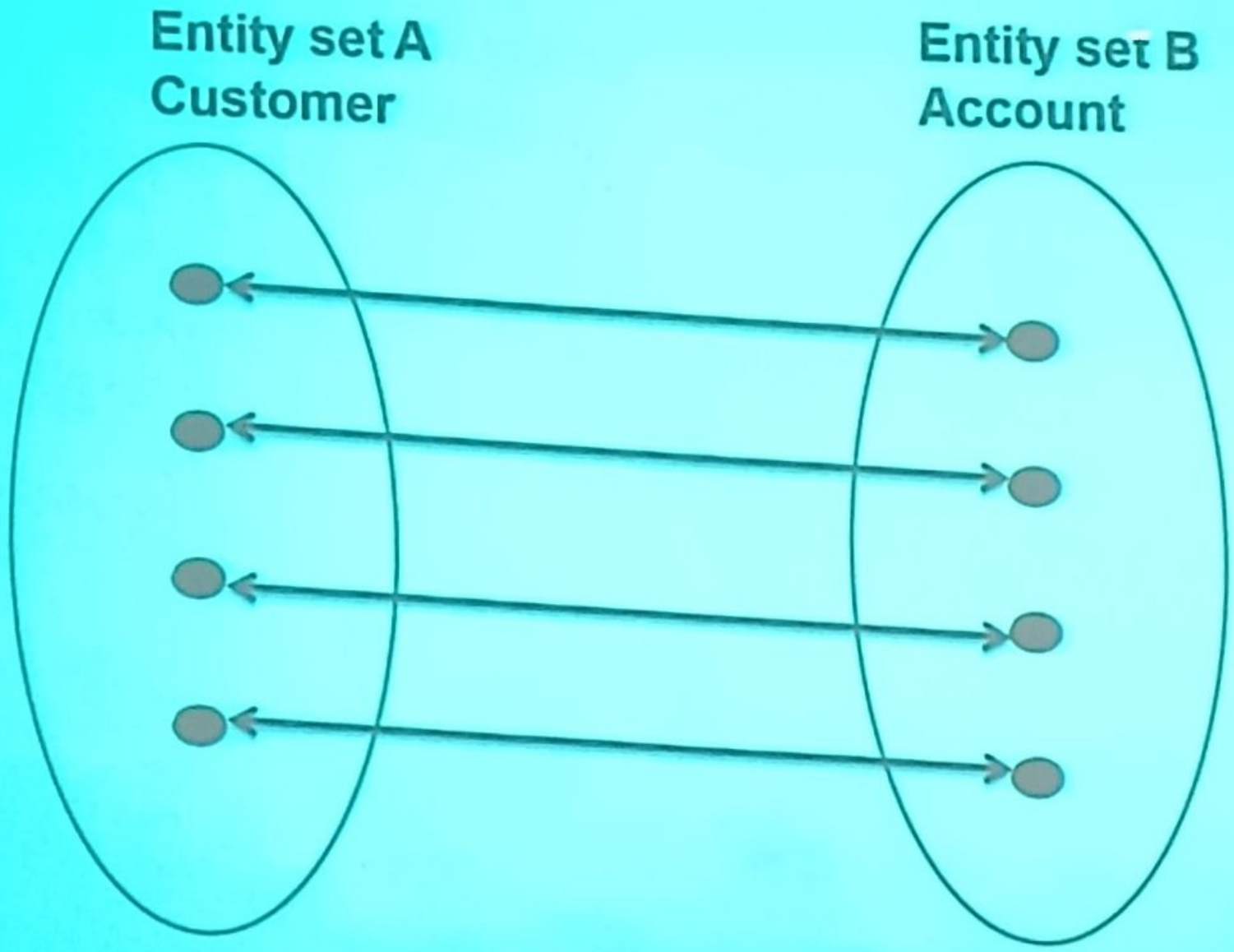
$(A'+B')' = A \cdot B$

Mapping cardinalities

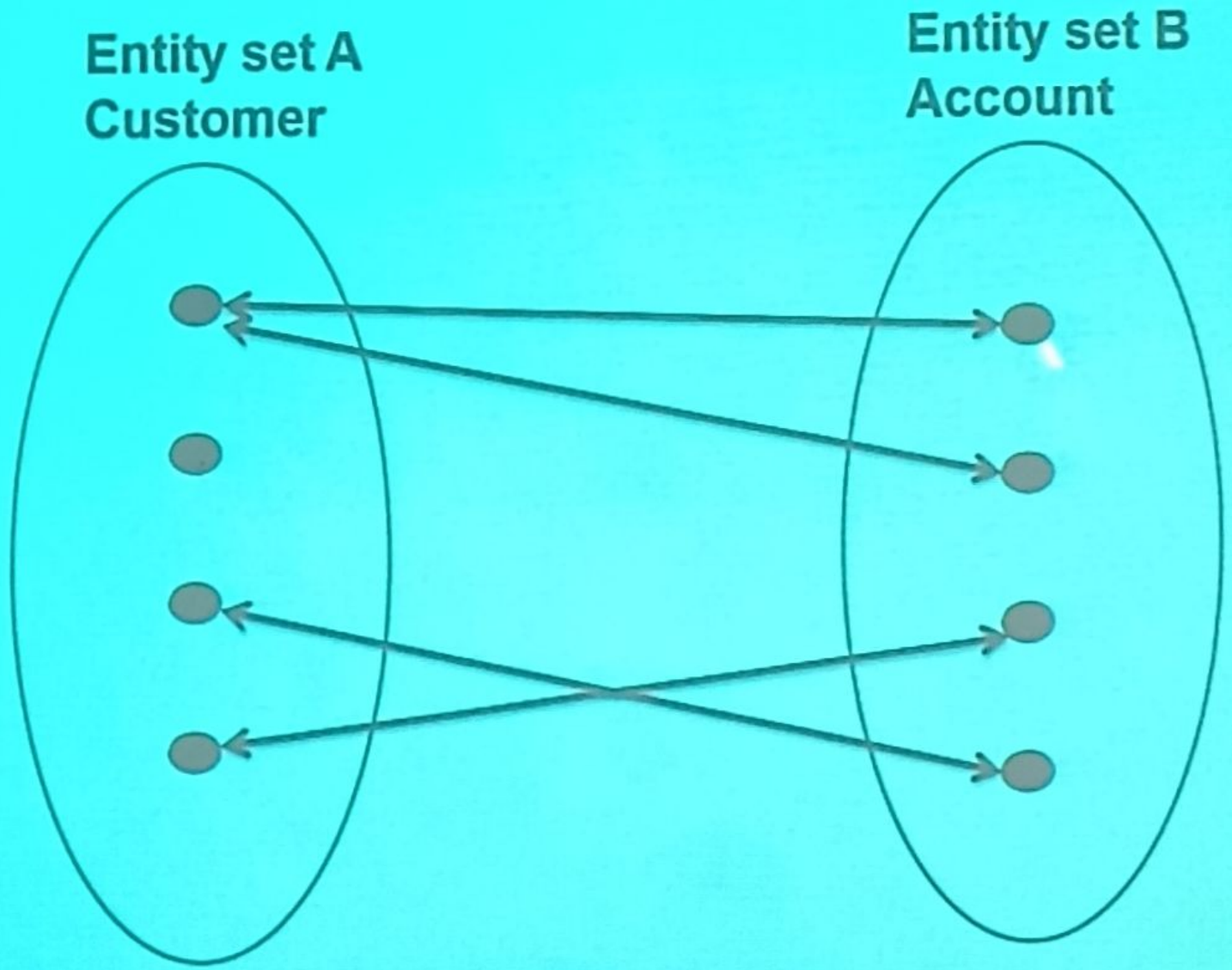
- **Cardinality** defines the number of entities in one entity set, which can be associated with the number of entities of other entity set via relationship set.

1. One to One
2. One to Many
3. Many to One
4. Many to Many

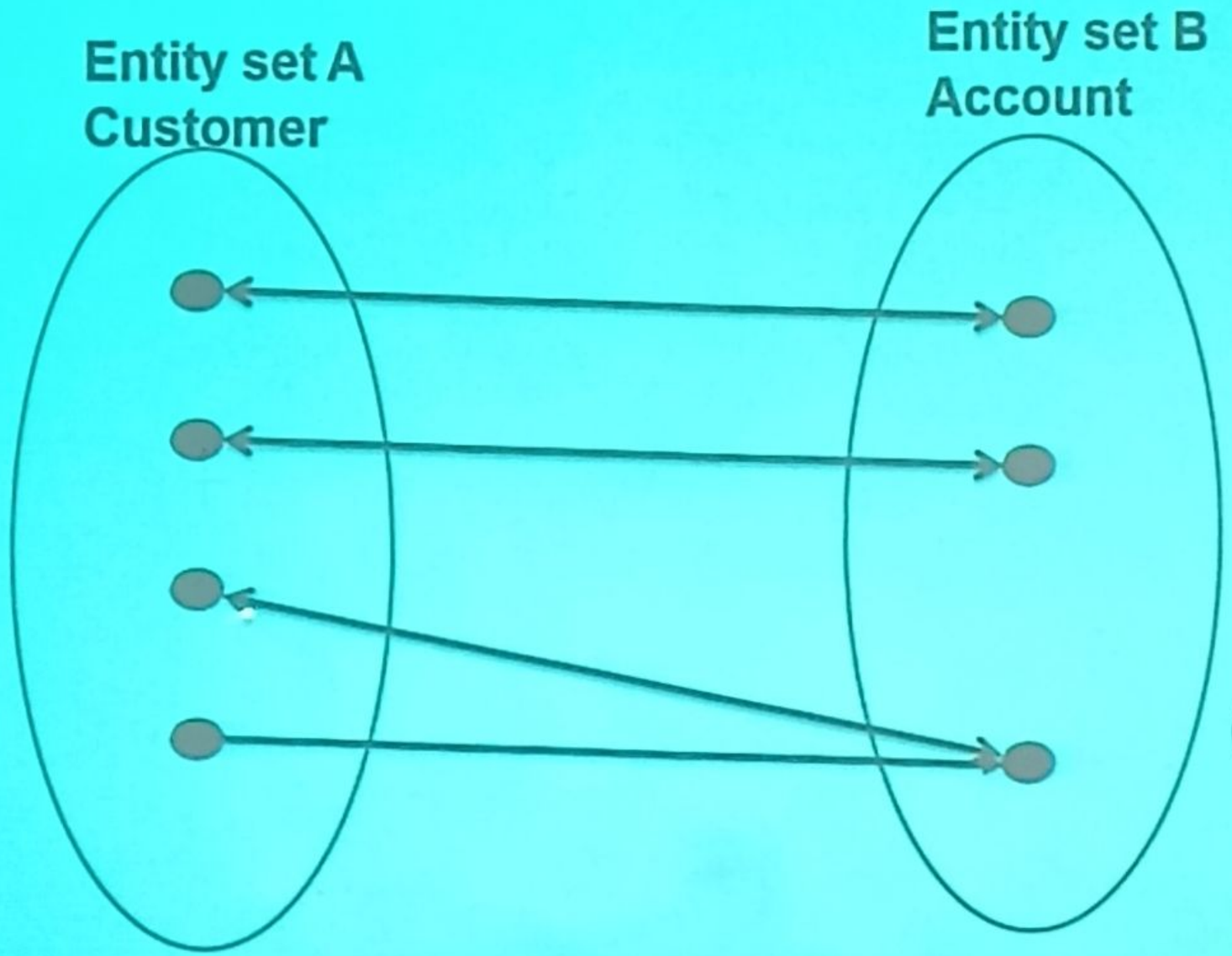
One to One



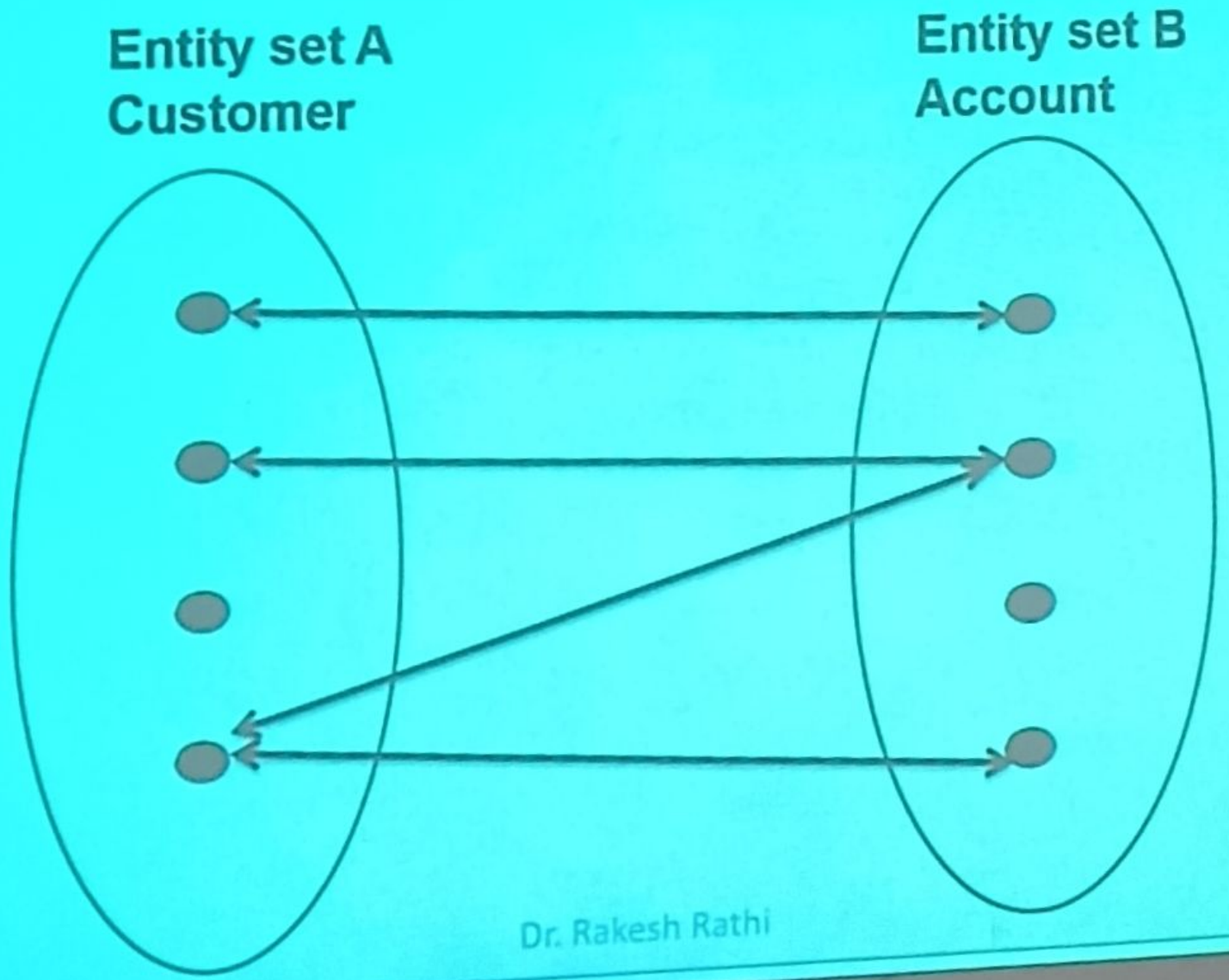
One to Many



Many to One

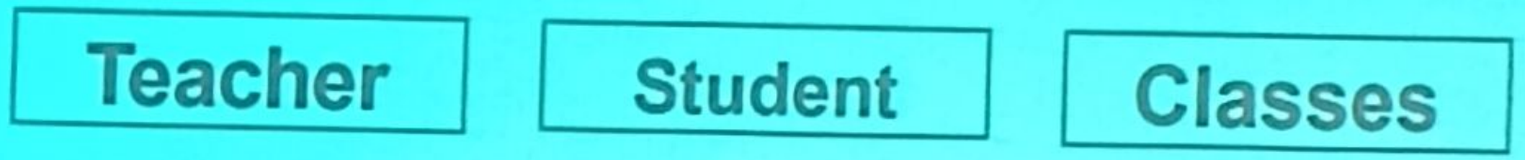


Many to Many

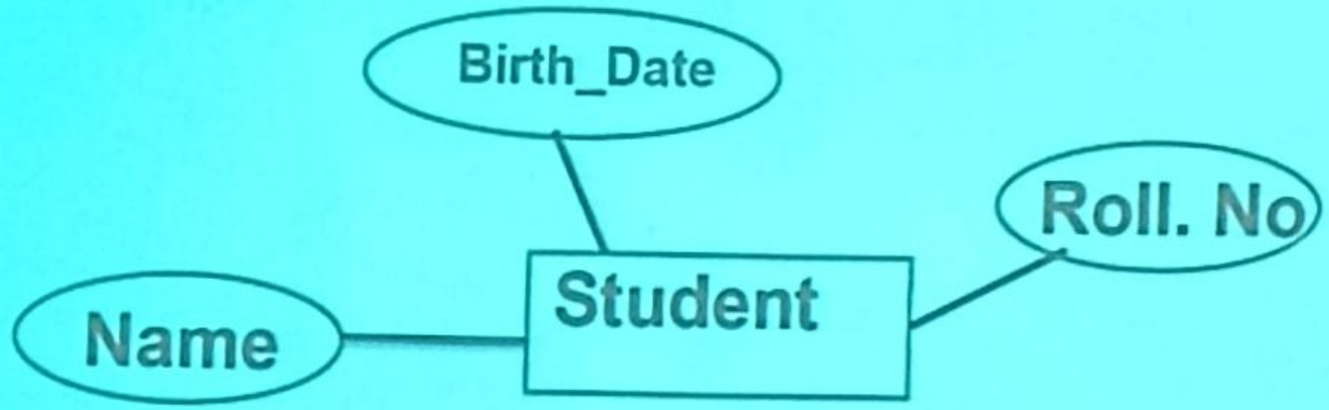


ER Diagram Representation

- Entity Set



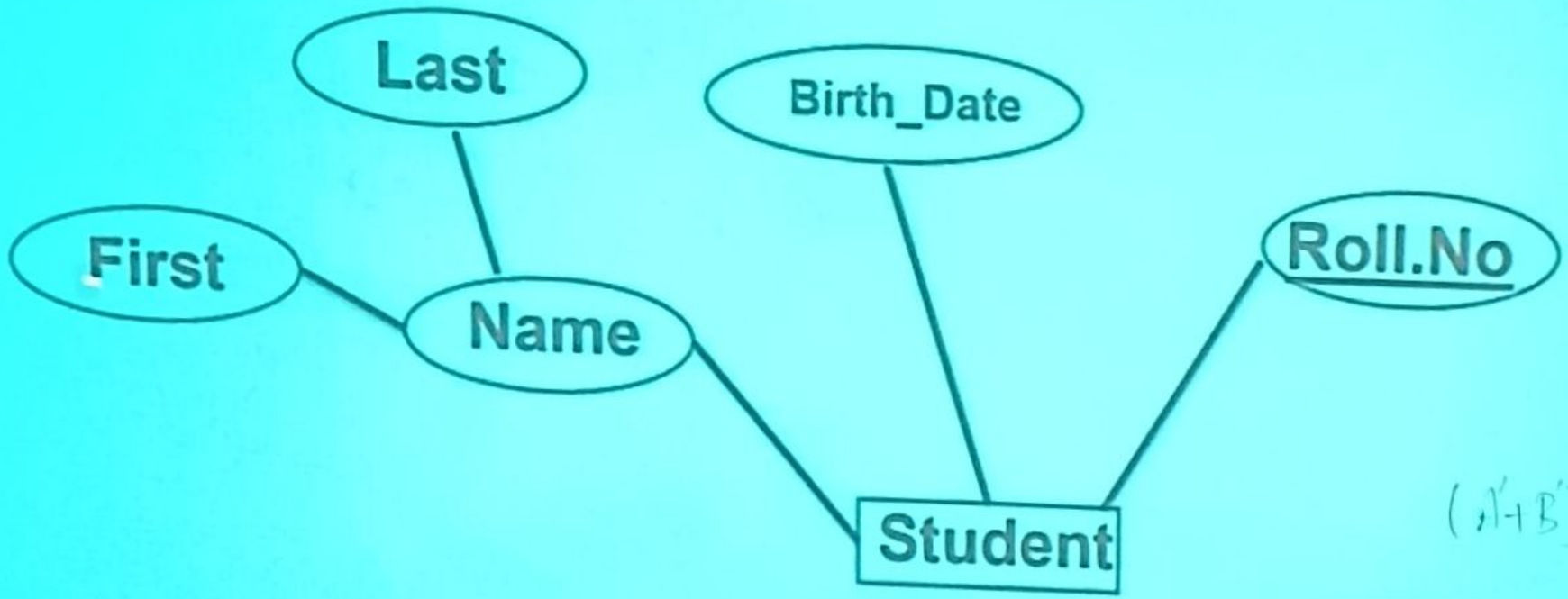
- Attributes



$(A'+B')' = A'.B''$

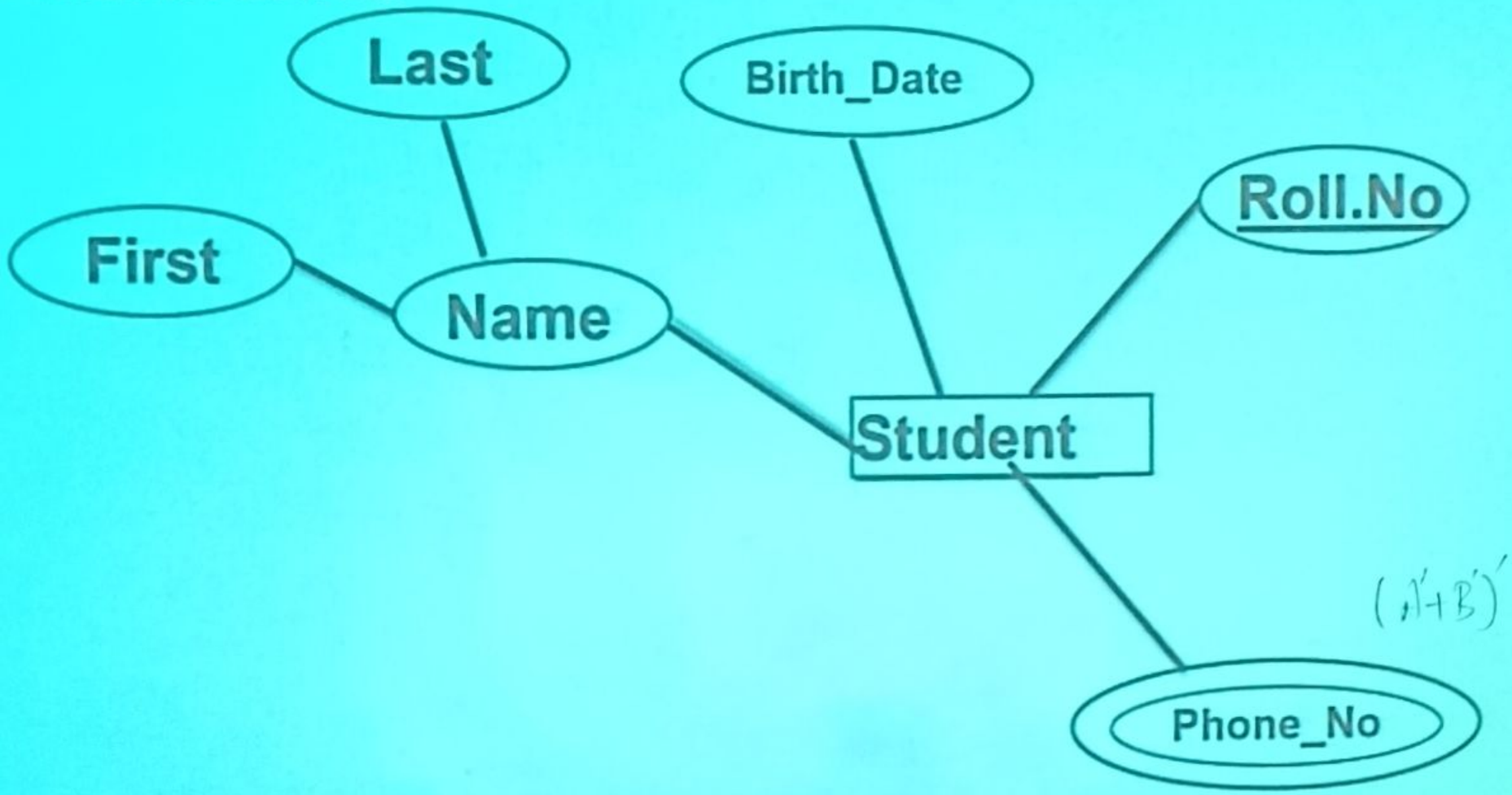
ER Diagram Representation Continue...

- Composite Attributes



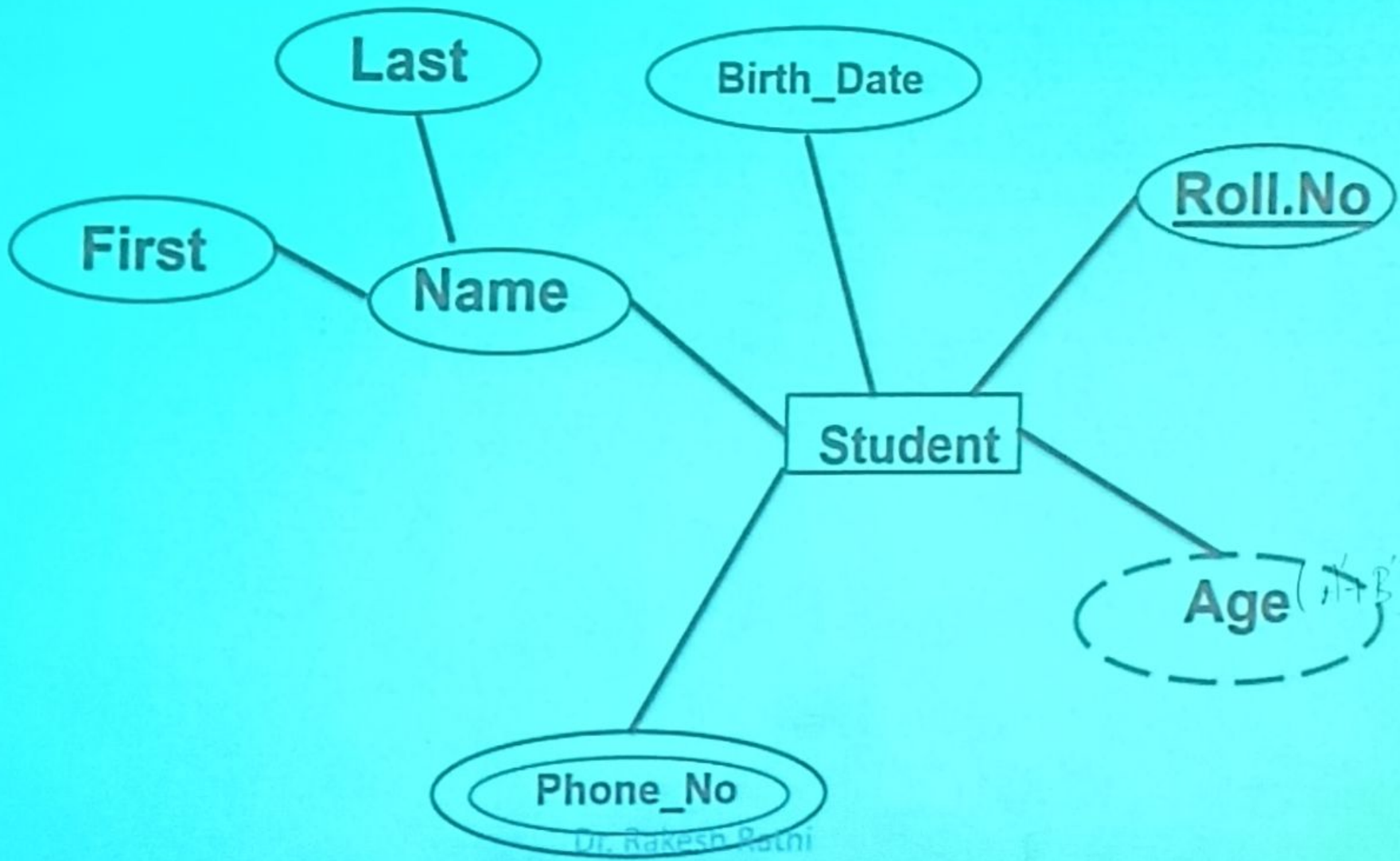
ER Diagram Representation Continue...

- **Multivalued**



ER Diagram Representation Continue...

- Derived



ER Diagram Representation Continue…

Relationship

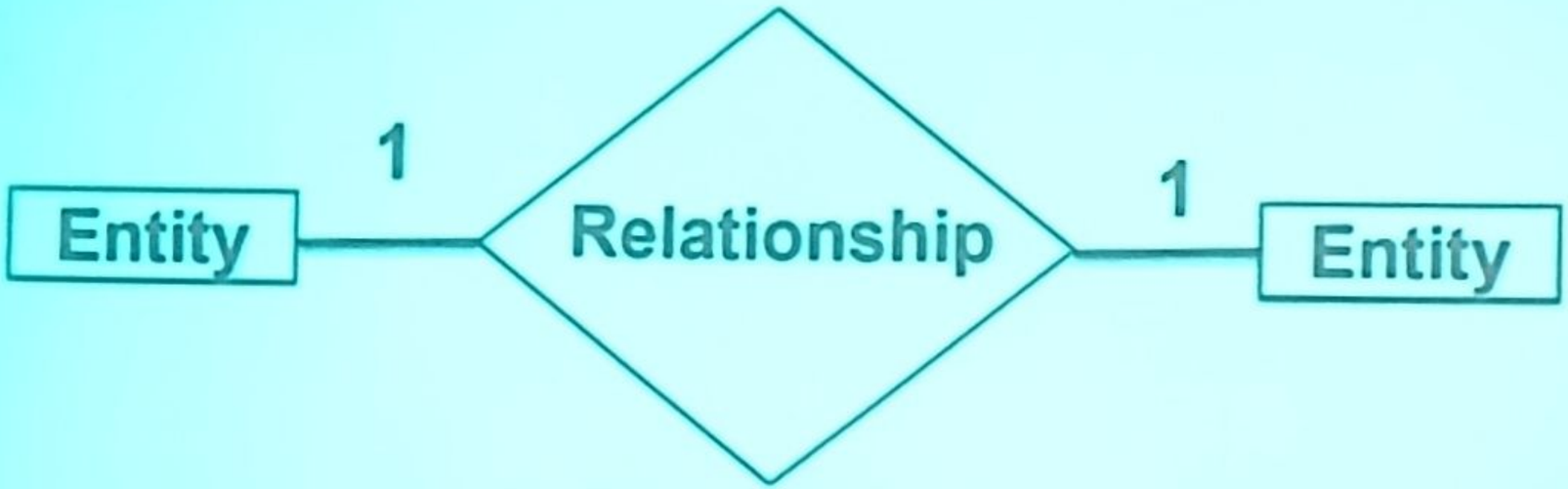
- **Binary Relationship :-** When two Entity Set participating in a relationship then it is called Binary Relationship.

- **Ternary Relationship :-** When three Entity Set participating in a relationship then it is called Ternary Relationship.

$(A'+B')' = A''B''$

ER Diagram Representation Continue…

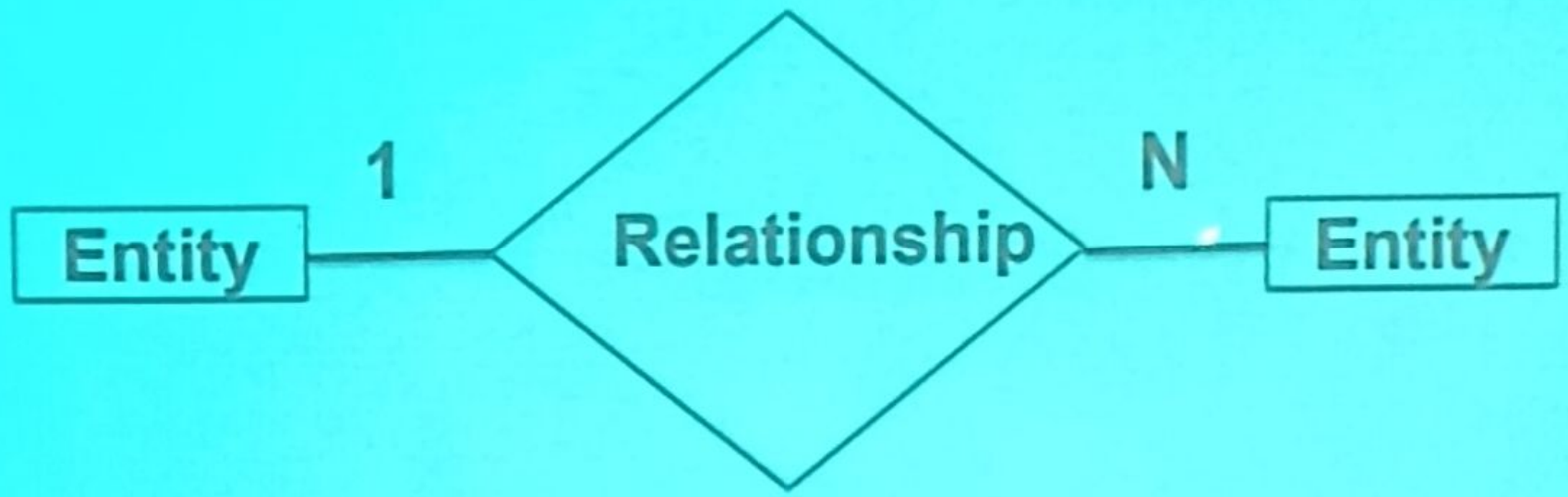
- One to One (1:1)



Example : Person – Passport

ER Diagram Representation Continue…

- One to Many (1:N)

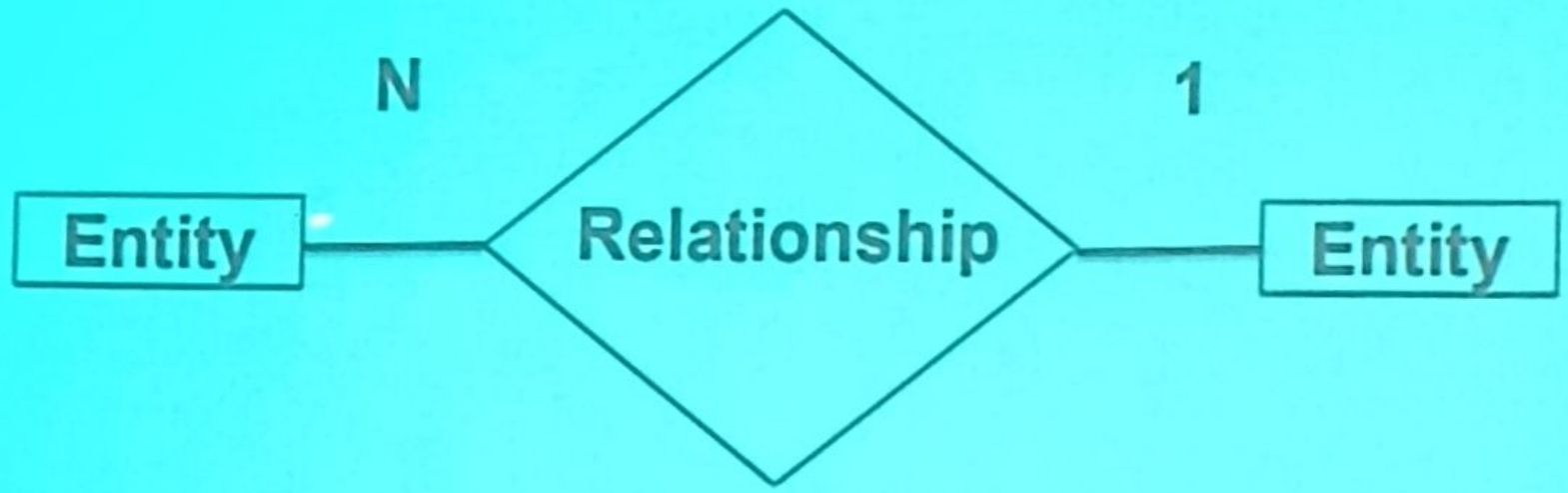


$(A'+B')' = A \cdot B$

Example : Mother- Children

ER Diagram Representation Continue…

- **Many to One (N:1)**

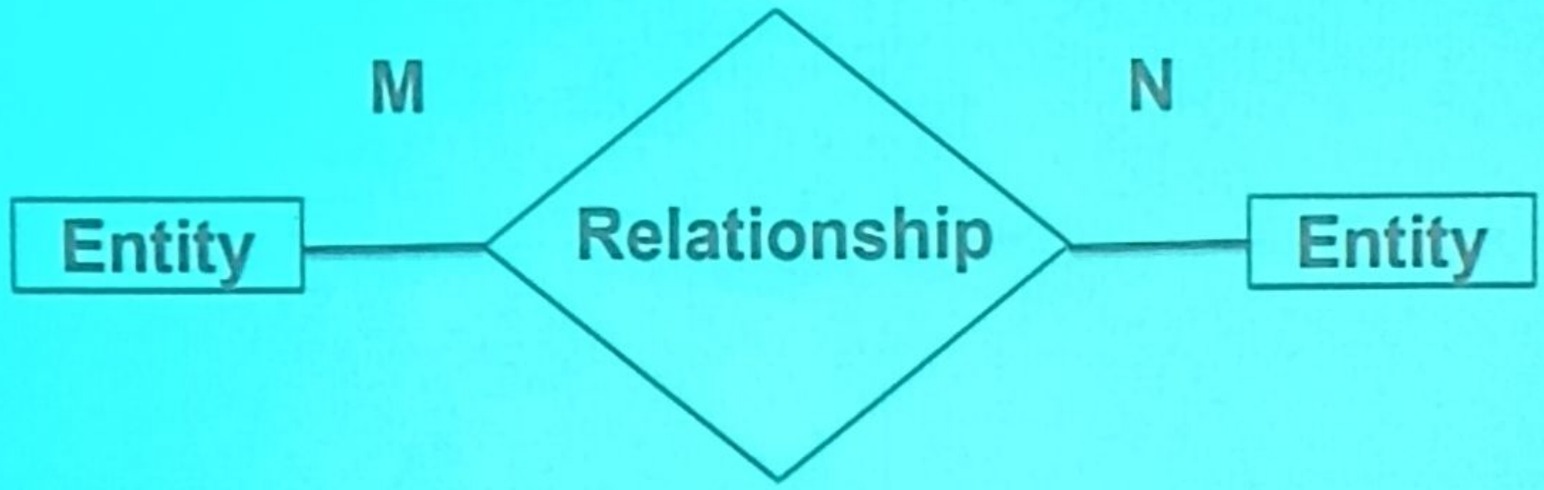


Example : Students – Teacher(Mentor)
Customer- Account (Joint Account)

$(A'+B')' = A'.B''$

ER Diagram Representation Continue…

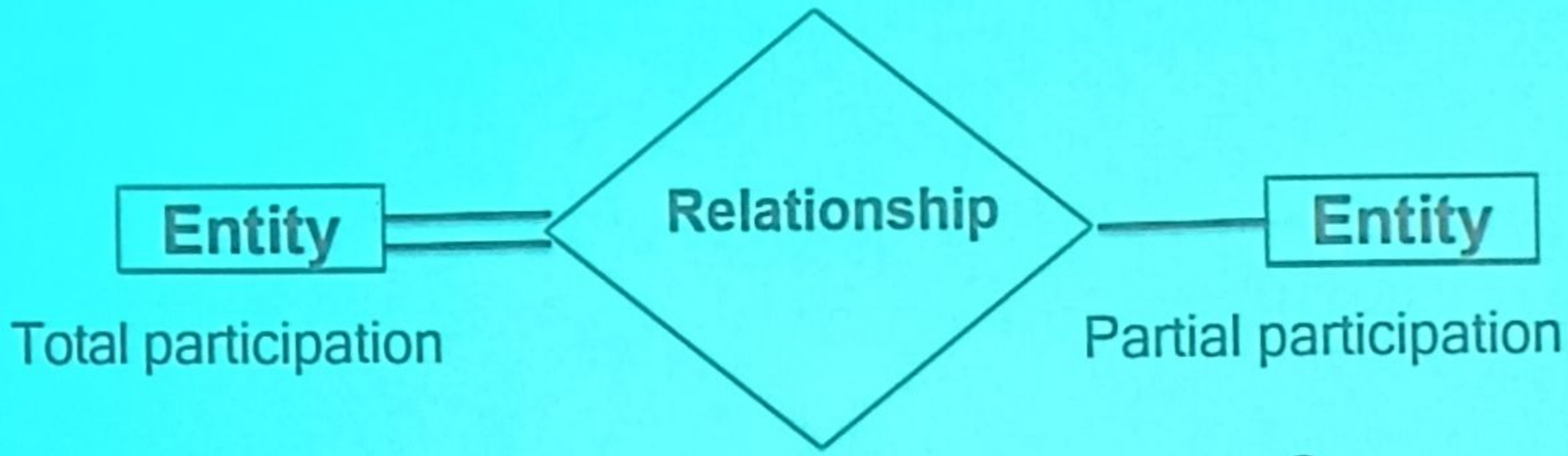
- **Many to Many (M:N)**



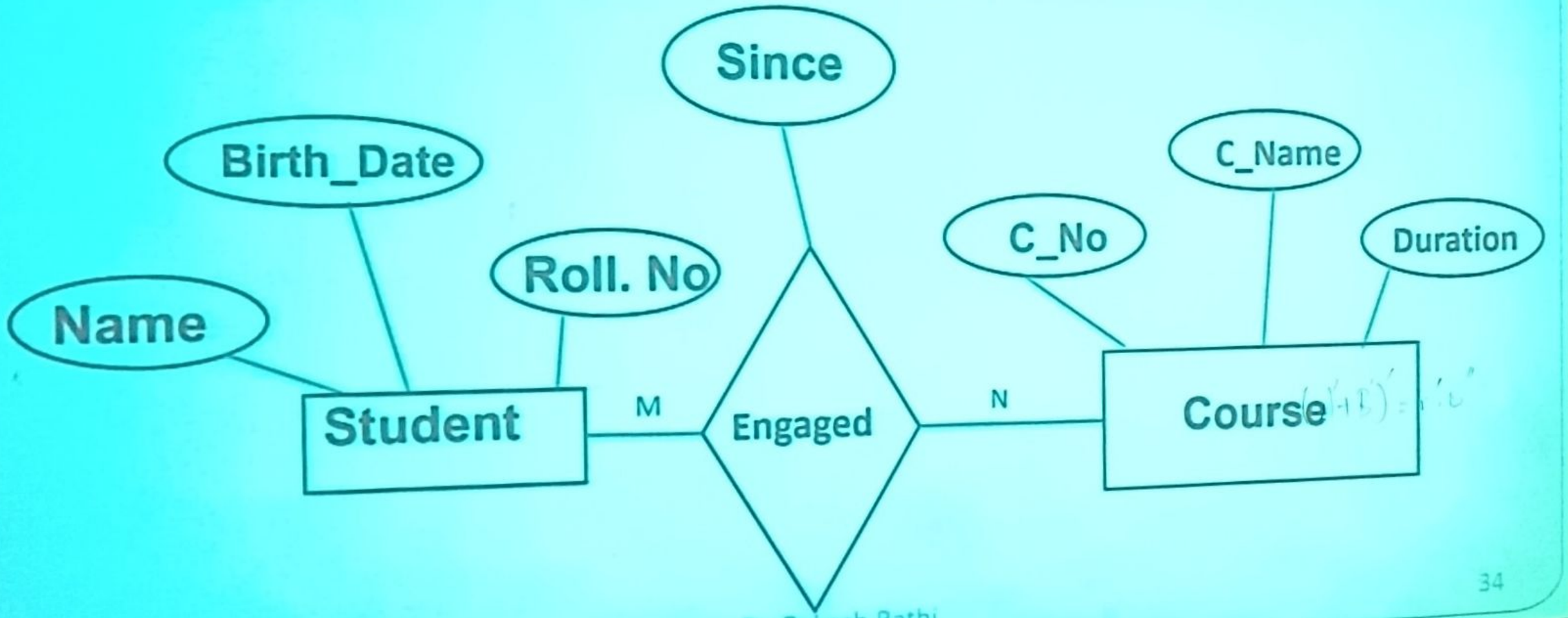
Example : - 1)Books – Authors 2) Customer- Account (Multiple Account of a Customer & Joint Account)

ER Diagram Representation Continue…

- **Participation Constraint**



ER Diagram Representation Continue...

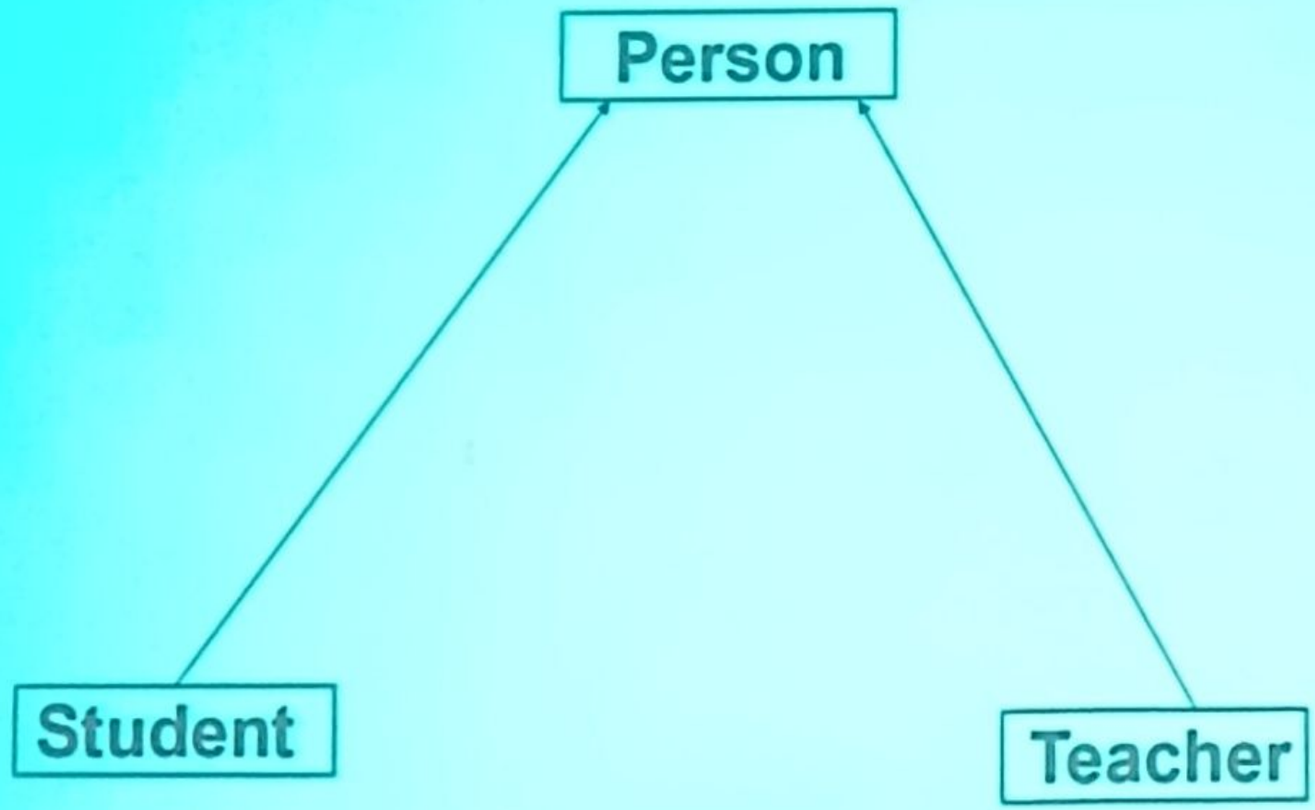


Generalization and Specialization

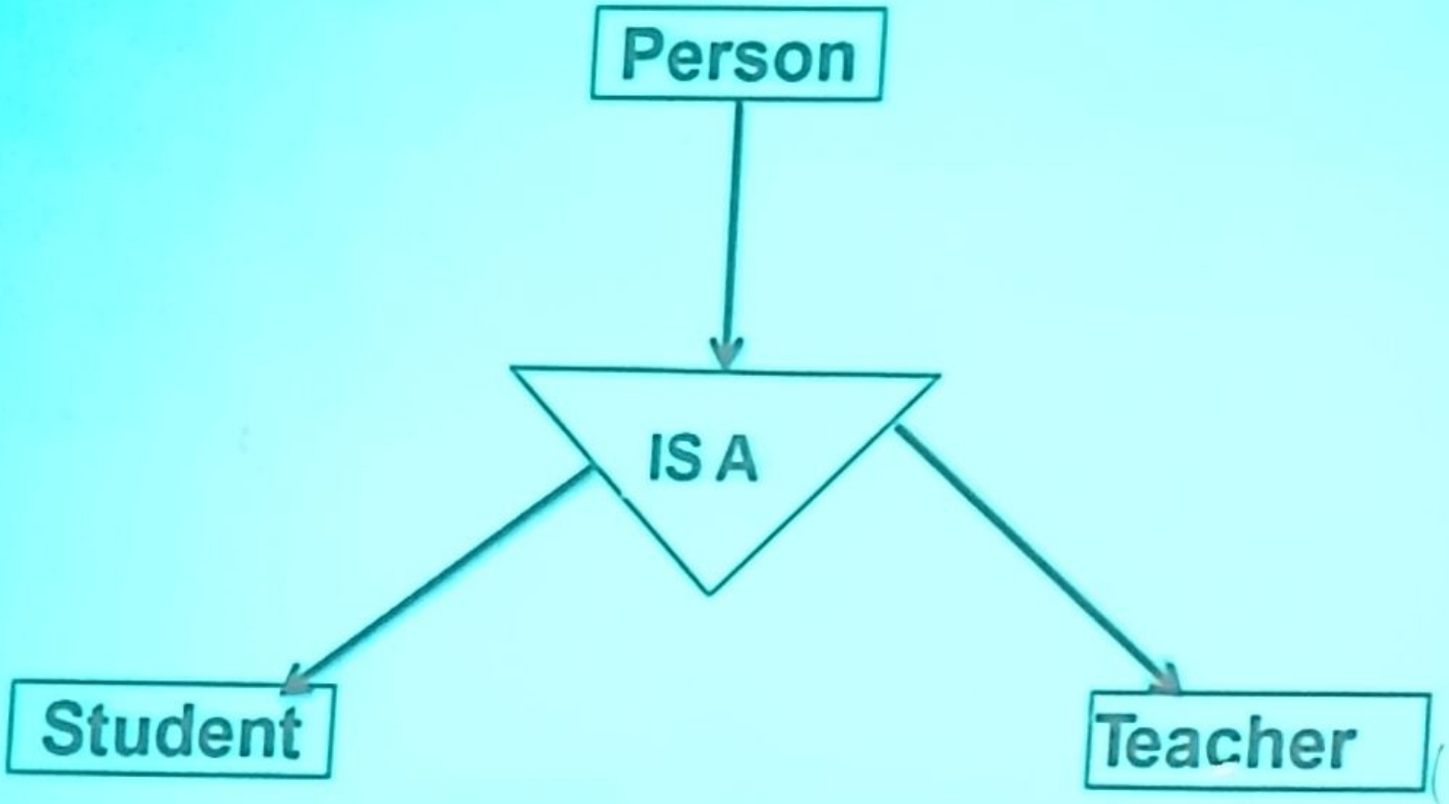
- **Generalization** is a bottom-up approach in which multiple lower-level entity set are combined to form a single higher-level entity set. **Generalization** is usually used to find common attributes among entity set to form a generalized entity set. It can also be thought of as the opposite of **specialization**.
- **Specialization** is a process of taking a subset of a higher level entity set to form a lower-level entity set. Going up in this structure is called Generalization Reverse is called Specialization.

$(A'+B')' = A'B''$

Generalization



Specialization



Generalization and Specialization