# **LEC-3: Entity-Relationship Model**

 Data Model: Collection of conceptual tools for describing data, data relationships, data semantics, and consistency constraints.

## 2. ER Model

- 1. It is a high level data model based on a perception of a **real** world that consists of a collection of basic objects, called **entities** and of **relationships** among these objects.
- 2. Graphical representation of ER Model is **ER diagram**, which acts as a **blueprint** of DB.
- 3. Entity: An Entity is a "thing" or "object" in the real world that is distinguishable from all other objects.
  - 1. It has **physical existence**.
  - 2. Each student in a college is an entity.
  - 3. Entity can be **uniquely** identified. (By a primary attribute, aka Primary Key)
  - 4. **Strong Entity**: Can be uniquely identified.
  - 5. **Weak Entity**: Can't be uniquely identified., depends on some other strong entity.
    - 1. It doesn't have sufficient attributes, to select a uniquely identifiable attribute.
    - 2. Loan -> Strong Entity, Payment -> Weak, as instalments are sequential number counter can be generated separate for each loan.
    - 3. Weak entity depends on strong entity for existence.

# 4. Entity set

- 1. It is a set of entities of the **same** type that share the **same** properties, or attributes.
- 2. E.g., Student is an entity set.
- 3. E.g., Customer of a bank

### 5. Attributes

- 1. An entity is represented by a set of attributes.
- 2. Each entity has a value for each of its attributes.
- 3. For each attribute, there is a set of **permitted values**, called the **domain**, or **value** set, of that attribute.
- 4. E.g., Student Entity has following attributes
  - A. Student ID
  - B. Name
  - C. Standard
  - D. Course
  - E. Batch
  - F. Contact number
  - G. Address

# 5. Types of Attributes

# 1. Simple

- 1. Attributes which can't be divided further.
- 2. E.g., Customer's account number in a bank, Student's Roll number etc.

# 2. Composite

- 1. Can be divided into subparts (that is, other attributes).
- 2. E.g., Name of a person, can be divided into first-name, middle-name, last-name.
- 3. If user wants to refer to an entire attribute or to only a component of the attribute.
- 4. Address can also be divided, street, city, state, PIN code.

# 3. Single-valued

- Only one value attribute.
- 2. e.g., Student ID, loan-number for a loan.

# 4. Multi-valued

- 1. Attribute having more than one value.
- 2. e.g., phone-number, nominee-name on some insurance, dependent-name etc.
- 3. Limit constraint may be applied, upper or lower limits.

# 5. Derived

Value of this type of attribute can be derived from the value of other related attributes.

2. e.g., Age, loan-age, membership-period etc.

## 6. NULL Value

- 1. An attribute takes a null value when an entity does not have a value for it.
- 2. It may indicate "not applicable", value doesn't exist. e.g., person having no middle-name
- 3. It may indicate "unknown".
  - Unknown can indicate missing entry, e.g., name value of a customer is NULL, means it is missing as name
    must have some value.
  - 2. Not known, salary attribute value of an employee is null, means it is not known yet.

# 6. Relationships

- 1. **Association** among two or more entities.
- 2. e.g., Person has vehicle, Parent has Child, Customer borrow loan etc.
- 3. Strong Relationship, between two independent entities.
- 4. Weak Relationship, between weak entity and its owner/strong entity.
  - 1. e.g., Loan <instalment-payments> Payment.

# 5. Degree of Relationship

- 1. Number of entities participating in a relationship.
- 2. **Unary**, Only one entity participates. e.g., Employee manages employee.
- 3. **Binary**, two entities participates. e.g., Student takes Course.
- 4. **Ternary** relationship, three entities participates. E.g., Employee works-on branch, employee works-on job.
- 5. Binary are **common**.

# 7. Relationships Constraints

# 1. Mapping Cardinality / Cardinality Ratio

- 1. Number of entities to which another entity can be associated via a relationship.
- 2. **One to one,** Entity in A associates with at most one entity in B, where A & B are entity sets. And an entity of B is associated with at most one entity of A.
  - 1. E.g., Citizen has Aadhar Card.
- 3. **One to many,** Entity in A associated with N entity in B. While entity in B is associated with at most one entity in A.
  - 1. e.g., Citizen has Vehicle.
- 4. **Many to one,** Entity in A associated with at most one entity in B. While entity in B can be associated with N entity in A.
  - 1. e.g., Course taken by Professor.
- 5. **Many to many,** Entity in A associated with N entity in B. While entity in B also associated with N entity in
  - 1. Customer buys product.
  - Student attend course.

# 2. Participation Constraints

- 1. Aka, Minimum cardinality constraint.
- 2. **Types**, Partial & Total Participation.
- 3. **Partial Participation,** not all entities are involved in the relationship instance.
- 4. **Total Participation**, each entity must be involved in at least one relationship instance.
- 5. e.g., Customer borrow loan, loan has total participation as it can't exist without customer entity. And customer has partial participation.
- 6. Weak entity has total participation constraint, but strong may not have total.

# 8. ER Notations

# Entity Attribute Multi-valued Attribute Attribute Primary Key Attribute Weak Key Attribute Derived Attribute Derived Attribute