Experiment No 1

Aim: To identify the case study and detail statement of the problem and to design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model for the problem statement.

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Entity:

- An entity can be a real-world object, either animate or inanimate, that can be easily identifiable.
- For example, in a school database, students, teachers, classes, and courses offered can be considered as entities.
- All these entities have some attributes or properties that give them their identity.
- An entity set is a collection of similar types of entities.
- An entity set may contain entities with attributes sharing similar values.
- For example, a Students set may contain all the students of a school; likewise a Teachers set may contain all the teachers of a school from all faculties.
- Entity sets need not be disjoint.
- Entities are represented by means of rectangles.
- Rectangles are named with the entity set they represent.

Relationship:

- The association among entities is called a relationship.
- For example, an employee works_at a department, a student enrolls in a course.
    - Here, works_at and enrolls are called relationships.
- 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.
- The number of participating entities in a relationship defines the degree of the
- relationship.
- Cardinality defines the number of entities in one entity set, which can be associated with the number of entities of another set via relationship set.
    - One-to-one: One entity from entity set A can be associated with at most one entity of entity set B and vice versa.
    - One-to-many: One entity from entity set A can be associated with more than one entity of entity set B, however an entity from entity set B can be associated with at most one entity.
    - Many-to-one: More than one entity from entity set A can be associated with at most one entity of entity set B, however an entity from entity set B can be associated with more than one entity from entity set A.

        - Many-to-many: One entity from A can be associated with more than one entity from B and vice versa.
- Relationships are represented by diamond-shaped boxes.
- Name of the relationship is written inside the diamond-box.
- All the entities (rectangles) participating in a relationship are connected to it by a line.

Attributes:

Attributes of an entity set are descriptive properties possessed by all instance entities belonging to that entity set.

- Each attribute is given a set of permitted values termed as domain.
- In the relational model, attributes form the columns for the table representing an entity set.
- Types of attributes:
    - Simple attribute:
        - Simple attributes are atomic values, which cannot be divided further.
        - For example, a student's phone number is an atomic value of 10 digits.
        - In the ER Diagram, ellipses represent attributes.
    - Composite attribute:
        - Composite attributes are made of more than one simple attribute.
        - For example, a student's complete name may have first_name and last_name.
        - In the ER Diagram, ellipses represent attributes.
    - Derived attribute:
        - Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database.
        - For example, average_salary in a department should not be saved directly in the database, instead it can be derived.
        - For another example, age can be derived from data_of_birth.
        - Dashed ellipses represent derived attributes.
    - Single-value attribute:
        - Single-value attributes contain single value. For example: Social_Security_Number.
        - In the ER Diagram, ellipses represent attributes.
    - Multi-value attribute:
        - Multi-value attributes may contain more than one value. For example, a person can have more than one phone number, email_address, etc.
        - Double ellipses represent multi-valued attributes.

Participation Constraints:

- Total Participation:
    - Each entity from it's entity set is involved in the relationship.
    - Total participation is represented by double lines.
- Partial participation:
    - Not all entities from it's entity set are involved in the relationship.
    - Partial participation is represented by single lines.

Weak Entity Set:

- An entity set not having sufficient attributes to form a primary key is termed as a Weak Entity Set.
- For a weak entity set to be meaningful, it must be associated with another entity set, called the Identifying Entity Set, and is said to be "existence dependent" on the Identifying Entity Set.
- The relationship associating the weak entity set with the identifying entity set is called the identifying relationship.
- In the ER Diagram, a weak entity set is represented by a double-lined rectangle and the corresponding identifying relationship is represented by a double-lined diamond.
- The primary key of the weak entity set is the union of the primary key of the identifying entity set and the discriminator (partial key) of the weak entity set.
- In the ER Diagram, the discriminator is represented by a dashed-underline to the chosen attribute's name.

Generalization:

- Generalization is a process of generalizing an entity which contains generalized attributes or properties of generalized entities.
- The entity that is created will contain the common features.
- Generalization is a Bottom up process.

Specialization:

- Specialization is a process of identifying subsets of an entity that shares different characteristics.
- It breaks an entity into multiple entities from higher level (super class) to lower level (sub class).
- The breaking of higher level entities is based on some distinguishing characteristics of the entities in super class.
- It is a top down approach in which we first define the super class and then sub class and then their attributes and relationships.

Aggregation:

- Aggregation represents the relationship between a whole object and its component.
- Using aggregation we can express relationships among relationships.
- Aggregation shows ‘has-a’ or ‘is-part-of’ relationship between entities where one represents the ‘whole’ and other ‘part’.

Case Study:

E-Commerce Receipt Management System:

- Manages consumer information, the orders placed by them, products available, product-shipping details and payment details.
- This system helps in forming transaction receipts for any commercial organization and thereby making it easier for organization management to keep track of fundamental processes.

Entity-Relationship Diagram: