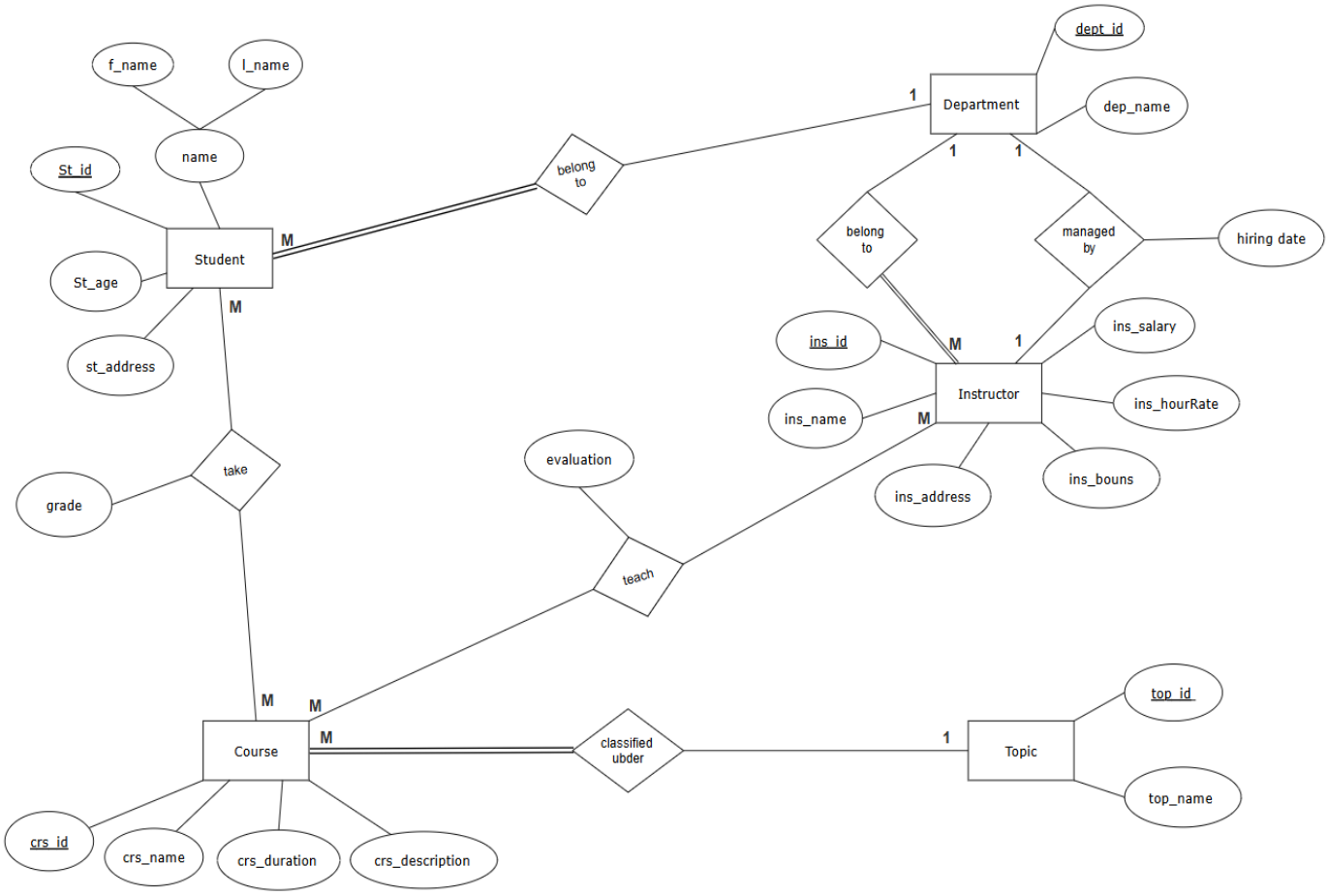
ERD

Proj_1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name
St_id
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St_age
st_address
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M
belong to
1
Department
dept_id
dep_name
1
1
belong to
managed by
hiring date
ins_id
M
1
ins_salary
Instructor
ins_name
M
ins_hourRate
ins_address
ins_bouns
take
grade
evaluation
teach
M
M
M
Course
classified ubder
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Topic
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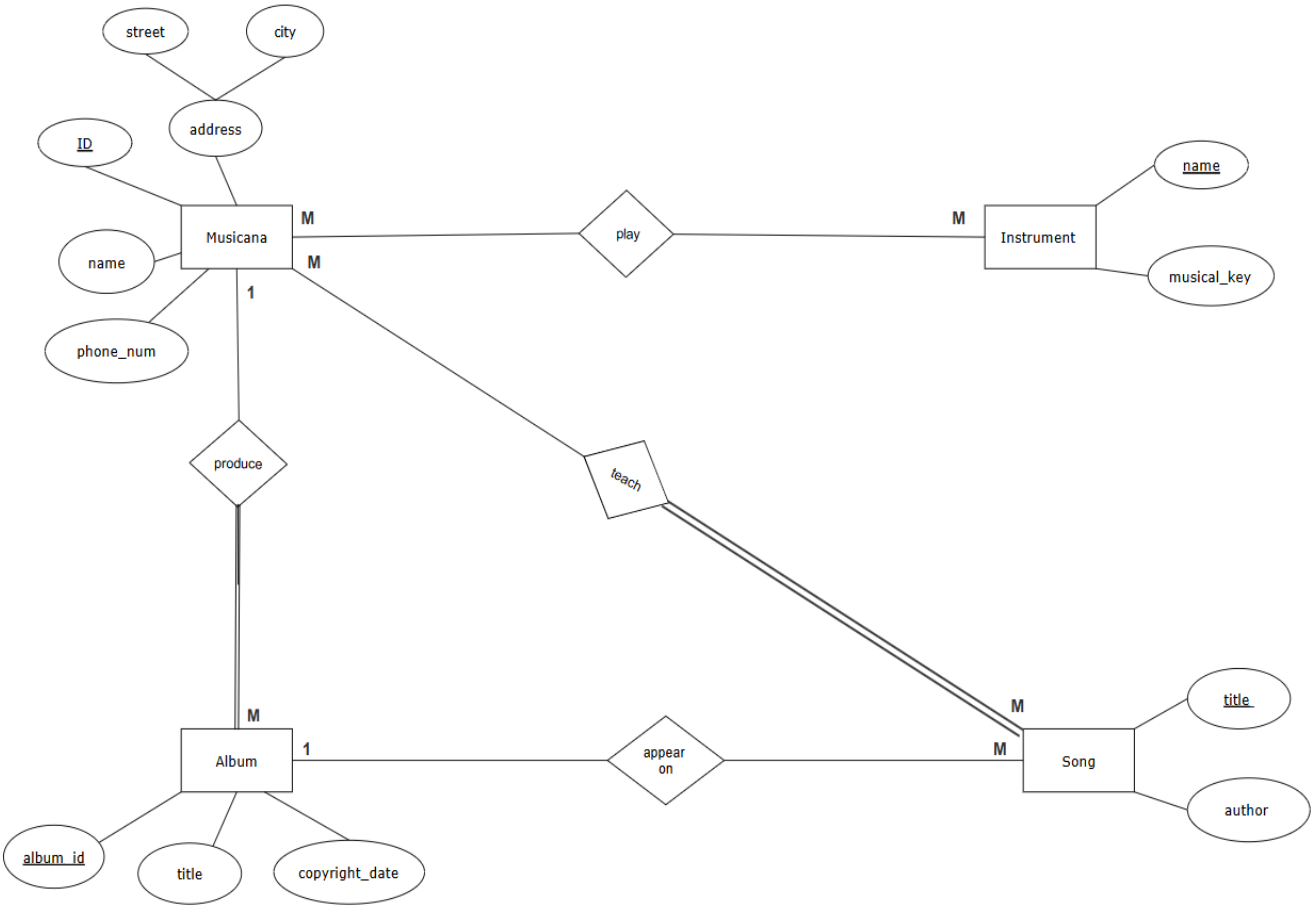
top_name
crs_id
crs_name
crs_duration
crs_description

Proj_2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1
play
M
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name
musical_key
produce
teach
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Album
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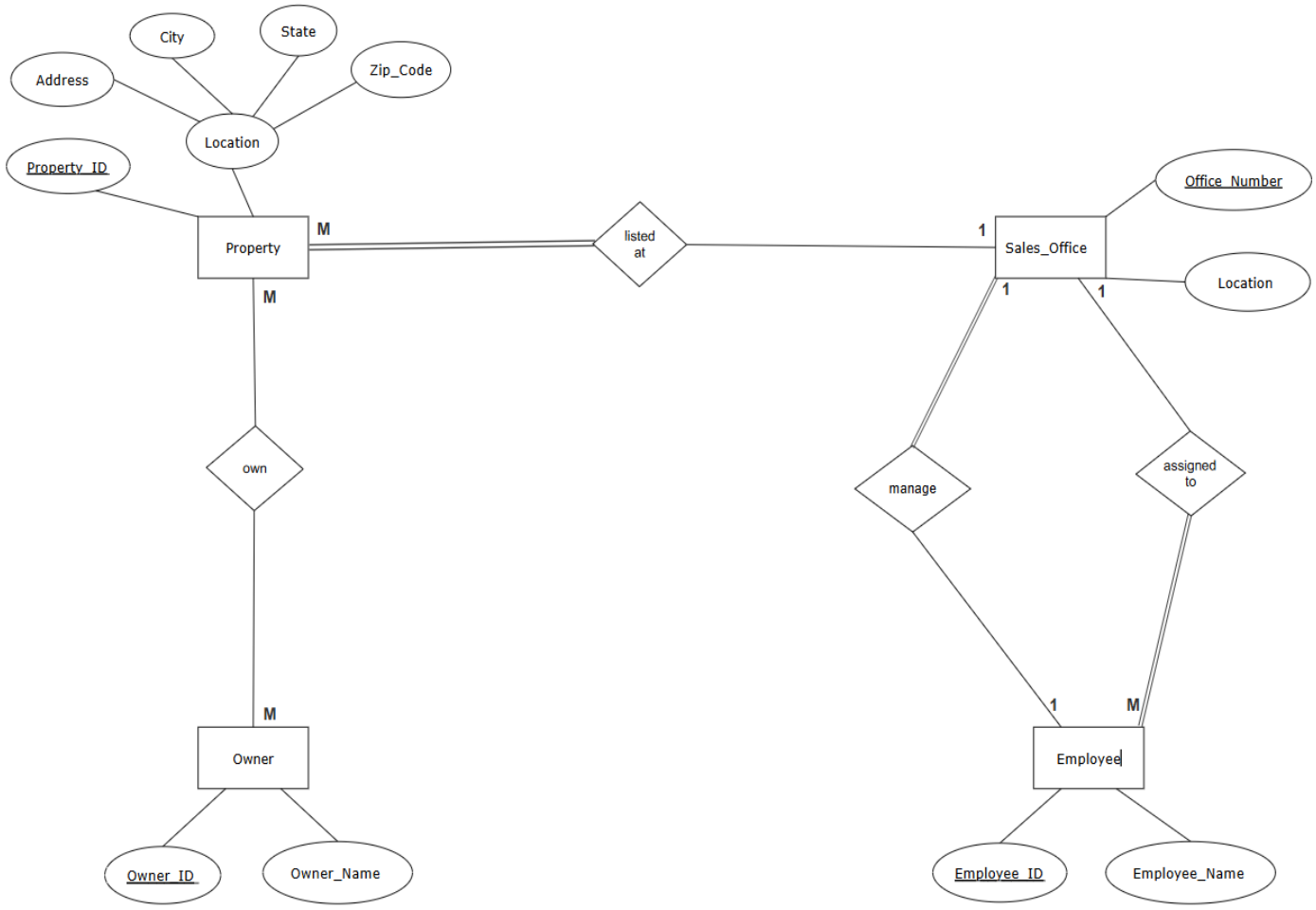
appear
on
M
Song
title
author
album_id
title
copyright_date

Proj_3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Property_ID
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1
Sales_Office
Office_Number
Location
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manage
assigned to
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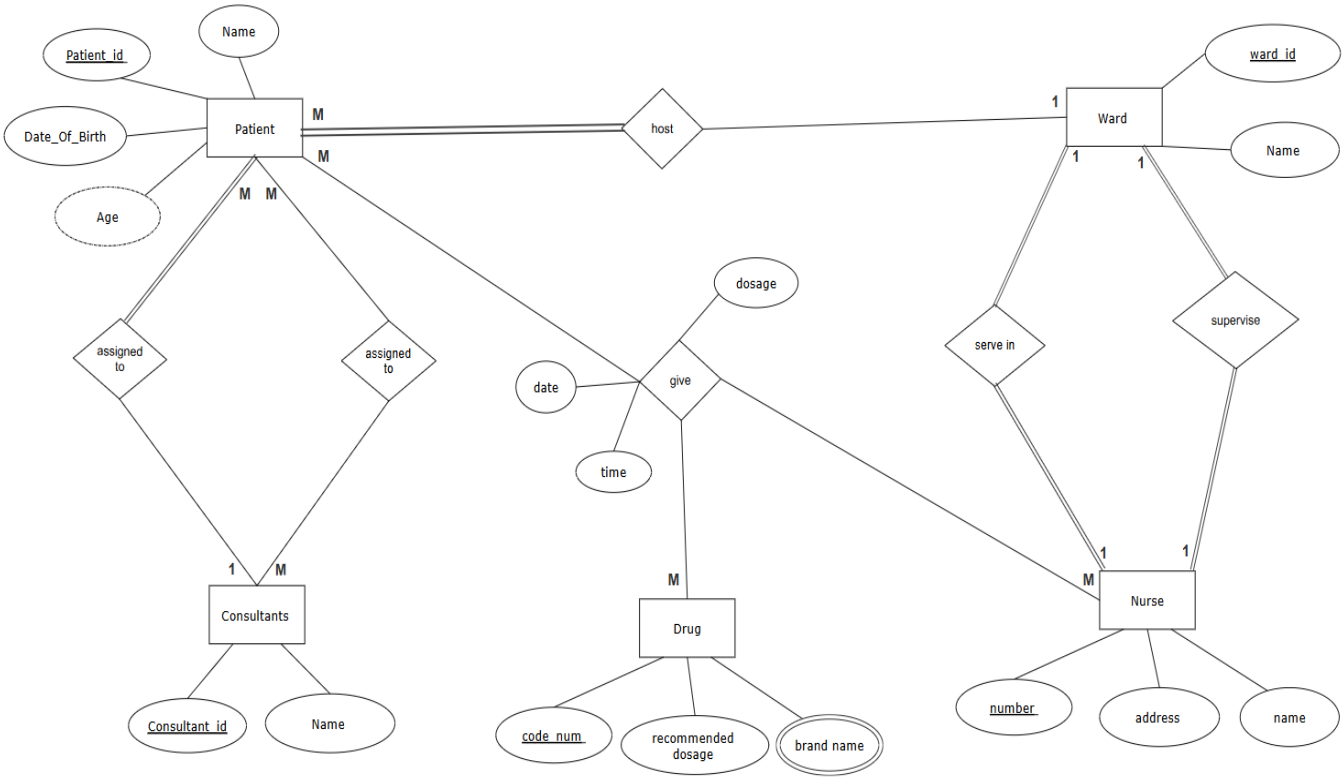
1
M
Owner
Employee
Owner_ID
Owner_Name
Employee_ID
Employee_Name

Proj_4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Name
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1
assigned to
assigned to
1
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Consultants
Consultant_id
Name
dosage
date
give
time
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Drug
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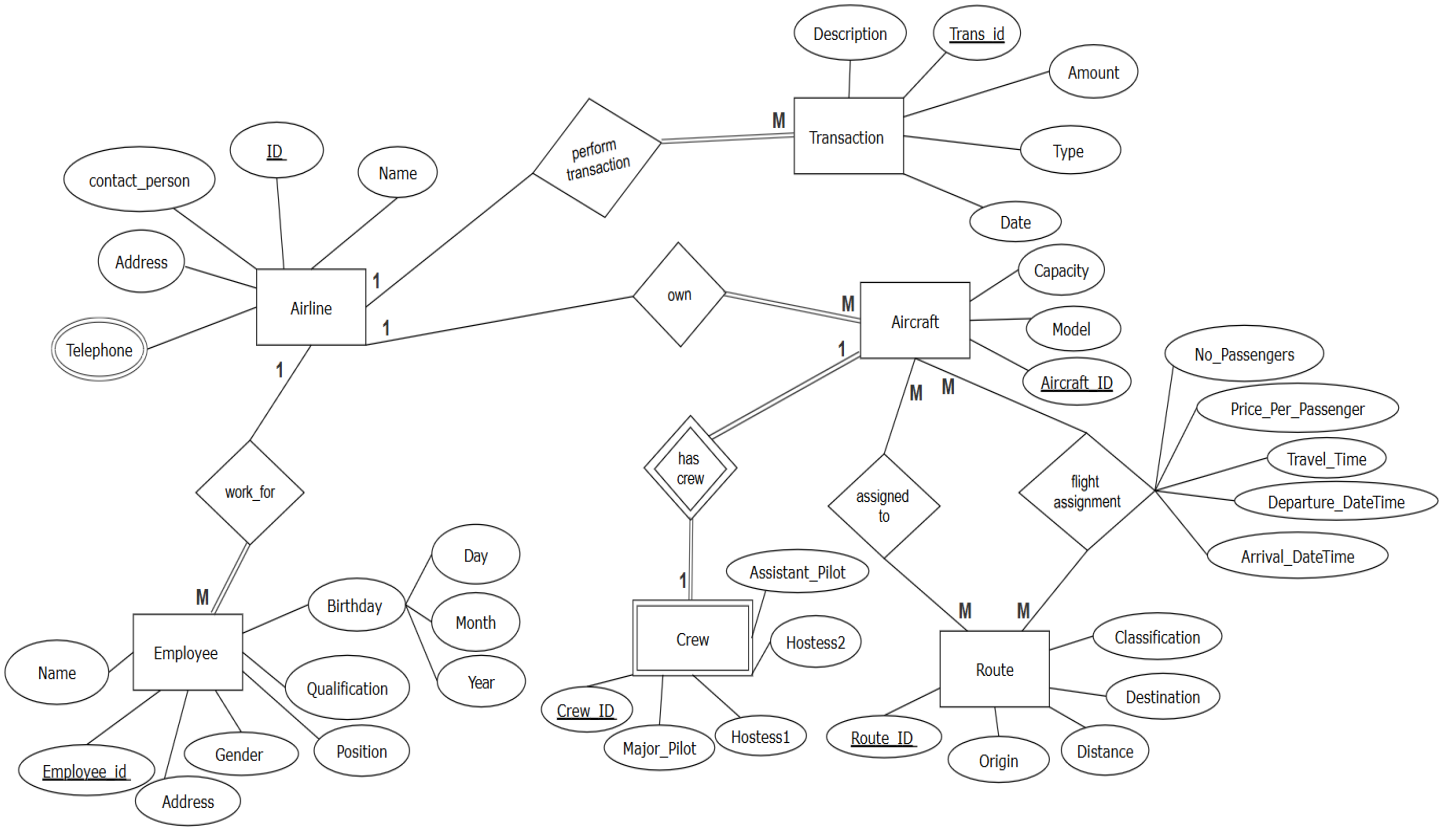
brand name
serve in
supervise
1
1
M
Nurse
number
address
name

Proj_5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Transaction
Type
Date
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Address
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Airline
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1
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own
M
1
Aircraft
Capacity
Model
Aircraft_ID
No_Passengers
Price_Per_Passenger
Travel_Time
Departure_DateTime
Arrival_DateTime
flight assignment
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M
work_for
has crew
assigned to
M
1
M
M
Day
Birthday
Month
Year
Assistant_Pilot
Crew
Hostess2
Hostess1
Major_Pilot
Crew_ID
Classification
Route
Destination
Route_ID
Origin
Distance
Name
Employee
Qualification
Position
Gender
Employee_id
Address

Self

- ## Relationship between ERD & UML:

1. ERD and UML are both modeling tools

- Both are used during the **system design phase**.
- They help visualize and plan the system **before implementation**.
- But each focus on a different aspect:
    - **ERD** focuses on **data structure**
    - **UML** focuses on **system structure and behavior**

2. ERD can be represented inside UML

- **Class Diagrams** in UML can **represent the same information as ERDs**.
    - Entities → Classes
    - Attributes → Class attributes
    - Relationships → Associations between classes

So, **an ERD can be considered a simplified form of a UML Class Diagram**, focused only on data.

- ## Where is the equation written?

The derived entity equation is usually documented in the **design documents** such as the **ERD (Entity-Relationship Diagram)**, **Data Dictionary**, or **Business Logic Specifications**. It may also be written directly in the **backend code** (e.g., SQL queries or business logic functions).

How does the developer receive it?
The developer receives the derived equation either from:

- The **System Analyst** or **Database Designer** through proper documentation.
- A shared **business logic document** that outlines how each derived attribute is calculated.
- Or by direct communication with the analyst or client if documentation is missing.

How is it implemented?
The equation is usually implemented as:

- A computed column in a SQL query or view.
- A function or formula in backend code (Python, Java, etc.).

- ## Relationship Between Strong Entity and Weak Entity (as Classes):

  A **Strong Entity** is like an **independent class (Parent/Base Class)**. It has its own primary key and can exist on its own.

  A **Weak Entity** is like a **dependent class (Child or Composed Class)**. It **cannot exist without the strong entity** and depends on it for identification.

  The relationship between them is similar to **Composition** in Object-Oriented Programming:

  - The weak entity is **owned** by the strong entity.
  - If the strong entity is deleted, the weak one usually cannot exist.

- ## Enhanced ERD, Inheritance, and SOLID:

  Enhanced ERD (EERD) extends the basic ERD by introducing advanced concepts like:

  - **Generalization**
  - **Specialization**
  - **Inheritance**
  - **Aggregation**

  These features directly support **object-oriented programming (OOP)** by allowing entities to be modeled using **class inheritance**, where:

  - Superclasses (general entities) define shared attributes.
  - Subclasses (specialized entities) inherit and extend those attributes.

  It helps in building structured class hierarchies and supports **SOLID principles** by:

  - Promoting responsibility separation (SRP)
  - Enabling extension without modification (OCP)
  - Supporting substitutability (LSP)
  - Encouraging cleaner, focused models (ISP)
  - Allowing abstraction and dependency inversion (DIP

- **The selection of a primary key depends:**

1. Nature of the Data

- Is there a naturally unique attribute already in the table?
  → If **yes**, it may be used as a **natural key** (e.g., National ID, ISBN).
  → If **no**, then use a **surrogate key** (e.g., auto-incremented ID).

2. Stability of the Attribute

- Will the value **remain constant** over time?
  → Choose attributes that **don't change** (e.g., employee ID, not name/email).

3. Data Integrity

- Is the attribute **always available and non-null**?
  → Must choose an attribute that always exists for every row.

4. Performance

- Is the attribute suitable for **fast indexing and searching**?
  → Numeric keys (like integers) are better for performance than long strings.

5. Simplicity and Clarity

- Is the key **simple and easy to use** in queries and joins?
  → A single-column key is better than a multi-column (composite) key unless necessary.

6. Uniqueness Across the System

- Will the key remain **unique even in the future**?
  → Make sure it won't cause duplication later when data grows or integrates with other systems.

- **Why Do We Define a Primary Key When Modeling the System as Classes**

Reason	Explanation
Unique Object Identity	Helps distinguish each object (like a row in a table)
ORM and Database Mapping	Required for mapping classes to database tables
Object Updates and Tracking	Makes it easy to update/delete specific instances
Relationships Between Classes	Enables linking classes just like foreign keys
System Consistency	Keeps object models aligned with database structure