

Lecture 2.1. ER Diagram. Entity, Attributes, Relationships

ER (Entity–Relationship) Model

What is ER Model?

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- Entity–Relationship (ER) model is a **high-level conceptual data model**.
- Used to **analyze data requirements systematically** and design a **well-structured database**.
- It represents:
 - **Real-world entities** (things we store data about),
 - **Relationships** between those entities.

ER model = *conceptual picture* of the database before we create tables.

ER Diagrams (ERD)

What is an ER Diagram?

ERD (Entity–Relationship Diagram) shows the **relationships of entity sets stored in a database**. It helps explain the **logical structure** of the database

ER model = concept, ERD = picture.

Why do we use ER Diagrams?

1. **Help define terms** related to ER modeling
 - Entity, attribute, relationship, etc.

2. Give a preview of table connections
 - a. Show **how tables should connect** (foreign keys later),
 - b. What **fields/attributes** are needed
 3. Describe entities, attributes, and relationships
 - a. ERD is like a map of all main objects and how they relate.
 4. Are translatable into relational tables
 - a. ERD → tables → real database.
 - b. This makes **implementation faster**.
 5. Help communicate the logical structure to users
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Entity

Definition:

An **entity** is a **real-world thing** (living or non-living, recognizable or conceptual) that stores data in the database

If you want to *store multiple records* about something, that thing is usually an **entity**.

Examples of Entities:

- **Person:** Employee, Student, Patient
 - **Place:** Store, Building
 - **Object:** Machine, Product, Car
 - **Event:** Sale, Registration, Renewal
 - **Concept:** Account, Course
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Attributes

Definition:

| Entities are represented by their **properties**, which are called attributes

Example:

- Entity: **Student**
- Attributes: **name, age, class, ...**

Relationships

What is a Relationships?

| A **relationship** describes how entities are **logically connected** in the data model.

| In ERD usually drawn as a **diamond** between entities.

Types of Relationships:

1. **One-to-many (1:M)**

- a. One record in entity A can be associated with **many** records in entity B, but a record in B is associated with **only one** record in A

2. **Many-to-many (M:N)**

- a. One record in A can be associated with **many** records in B, and one record in B can be associated with **many** records in A

- b. Examples:

- i. One students takes many courses
 - ii. One course has many students
- c. In relational implementation, M:N becomes **two 1:M** with a **junction table**

3. **One-to-one(1:1)**

- a. A record in A is associated with **at most one** record in B, and **vice versa**

b. Examples:

i. Person - Passport

ii. User - UserProfile

Typical exam question:

- *MCQ*: "ER diagram is mainly used to:
A) Optimize queries
B) Describe logical structure of database
C) Store data
D) Manage users"
- *Open*: "Explain two reasons why ER diagrams are useful when designing a database."
- *MCQ*: "Which of the following is an attribute of entity STUDENT?"
- *Open*: "Define attribute and give an example for entity CAR."
- *MCQ*: "Which relationship type best describes Students–Courses?" → **M:N**
- *MCQ*: "Which relationship is commonly modeled as a junction/bridge table?" → **M:N**
- *Open*: "Explain the difference between 1:M and M:N relationship with an example."