

# Lecture 2.1. ER Diagram. Entity, Attributes, Relationships

## ER (Entity–Relationship) Model

### What is ER Model?

- 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.

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## 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, ...**
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## 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 student 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
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## 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."