



Learning Objectives:

- Understanding and Implementing ERD

1. Entity-Relation Diagram:

Database Design Process

Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a Data Definition Language, which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity.

The term database design can be used to describe many different parts of the design of an overall database system. Principally, and most correctly, it can be thought of as the logical design of the base data structures used to store the data.

Steps for creating ERD:

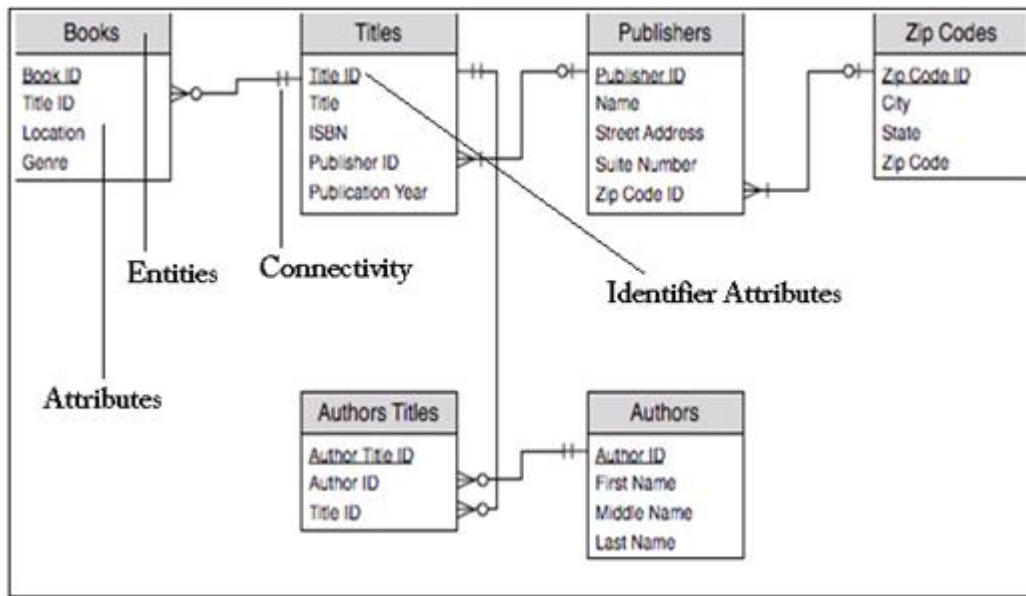
Creating an Entity Relationship Diagram (ERD) involves the following steps:

- 1- Identify the entities:** Begin by identifying the main entities or objects involved in the system you are modeling. These entities can be physical objects, such as customers, orders, products, or conceptual entities such as payments, transactions, or bookings.
- 2- Define the relationships:** Next, define the relationships between the entities. Relationships describe how the entities interact with each other, and they can be one-to-one, one-to-many, or many-to-many. For example, a customer can place many orders, but an order can only belong to one customer.
- 3- Assign attributes to the entities:** Each entity has its own set of attributes, which describe the characteristics or properties of the entity. For example, a customer entity may have attributes such as name, address, phone number, and email address.
- 4- Identify primary keys:** Primary keys are unique identifiers for each entity. They are used to distinguish one entity from another and must be unique for each record in the entity.
- 5- Draw the ERD:** Once you have identified the entities, relationships, attributes, and primary keys, you can start drawing the ERD. An ERD is a visual representation of the entities, relationships, and attributes in the system.

Finally, you can generate the schema from the ERD, which provides the blueprint for creating the database that will store the data for the system.

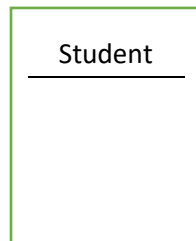
Notation that represents the ER-Diagrams

1- Crow's Foot Notation



2- Entities

An entity is a thing or object of importance about which data must be captured. Entities in an ERD are typically represented by rectangular boxes.



3- Attributes

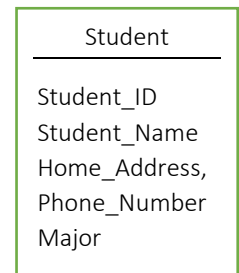
Inside each entity box, you would include the attributes of that entity. These are the specific properties or characteristics of the entity that you need to track in the system.

Example attributes:

STUDENT: Student_ID, Student_Name, Home_Address, Phone_Number, Major

Guidelines for naming attributes:

- An attribute name is a *noun*.
- An attribute name should be *unique*
- To make an attribute name unique and clear, each attribute name should follow a *standard format*
- Similar attributes of different entity types should use similar but *distinguishing names*.



4- Identifier Attributes

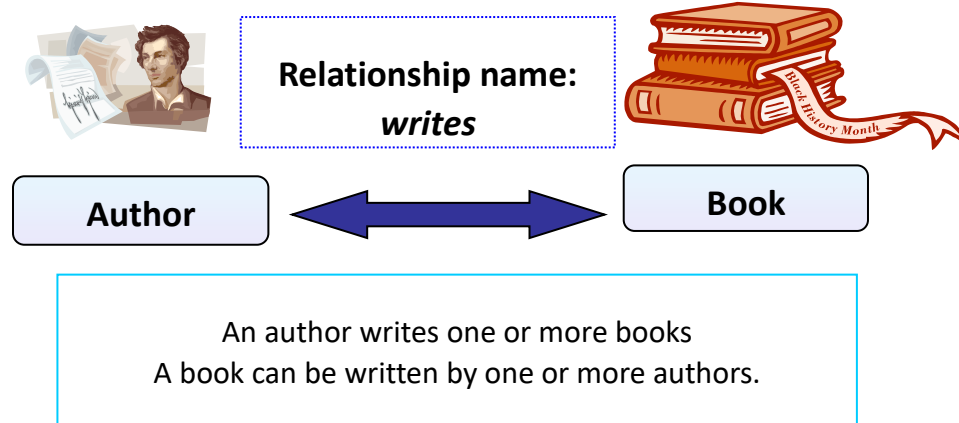
Attribute (or combination of attributes) that uniquely identifies each instance of an entity type

Example: An Identifier Attributes for Student is Student_ID, and it is underlined.

Student
<u>Student_ID</u>
Student_Name
Home_Address,
Phone_Number
Major

5- Relationships

Associations between instances of one or more entity types

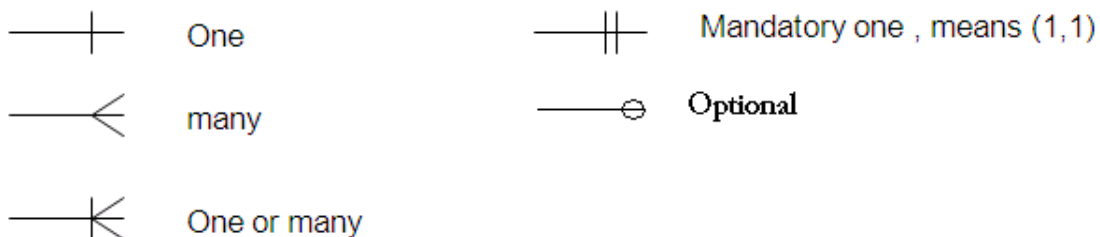


6- Cardinality

Minimum and maximum number of instances of an entity that can (or must be) associated with each instance of another entity.

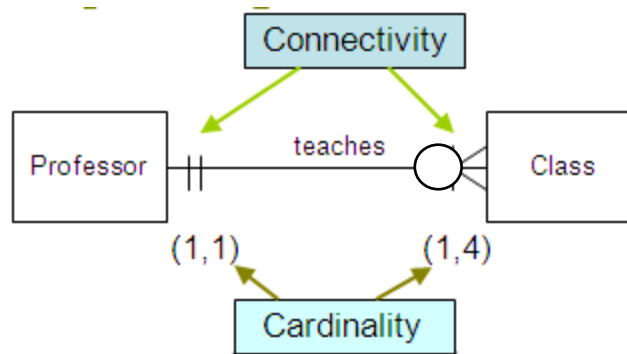
7- Connectivity

Crow's Foot



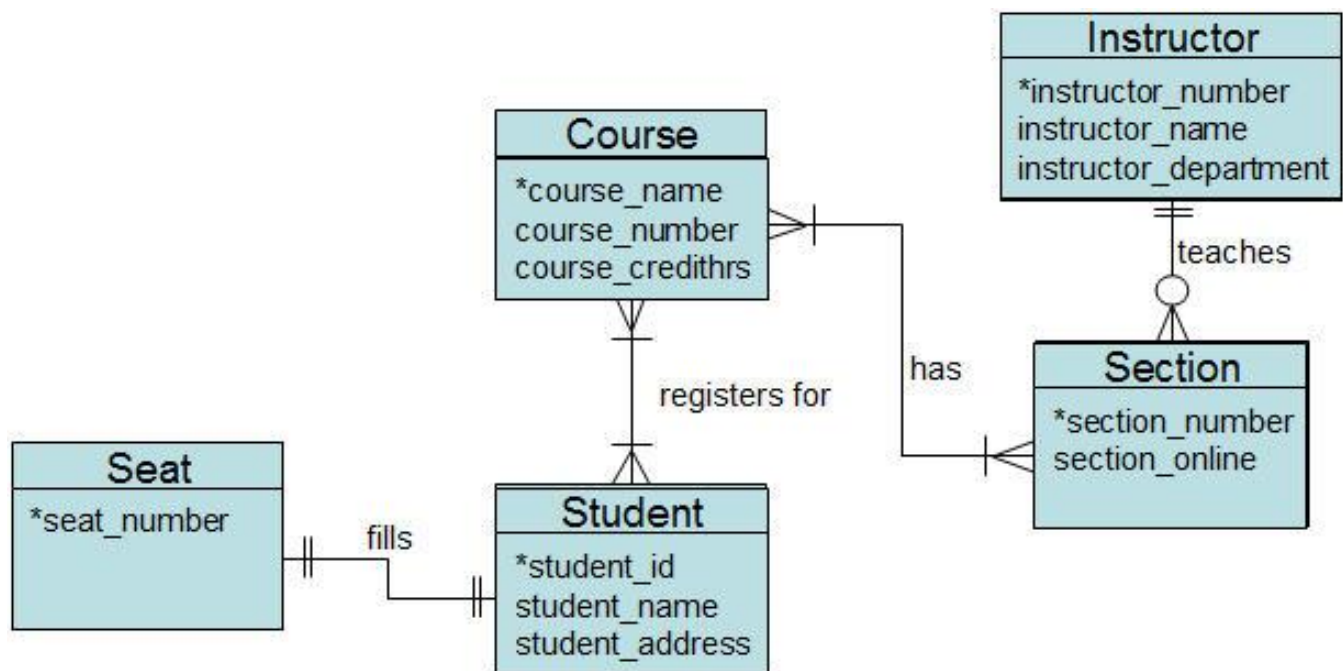
8- Cardinality and Connectivity

A Professor may handle zero or many classes.



Example:

A system for managing student course registration would need data about *courses*, *instructors*, *course sections*, *course seats*, and *students*; these are **entities**. The course registration management process might require course name, number, and credit hours; these are **attributes**. The course registration management process might also require instructor name, number, and department; these are also **attributes**. In ERD notation, the entity name appears in the top of the box. The attributes are listed in the box below the name. The lines connecting the boxes convey information about the relationships between the data.



2. Lab Tasks

1. *Suppose you are tasked with designing a database for a library system. The library system allows users to borrow books and other materials from the library. The library has multiple branches, and each branch has its own collection of books and other materials.*

Entities:

User: A library user who borrows books and other materials.

Book: A book that is available for borrowing.

Branch: A library branch that has its own collection of books and other materials.

Borrowing: A record of a user borrowing a book from the library.

Identify relationships, attributes, and Primary keys. Create ERD of the given scenario.

2. *A chemistry department wants to have a database of all chemicals in the stockroom. The information includes the name, molecular formula, amount on hand, date purchased, supplier, and supplier contact information.*