

Module 5 - DBMS - ER Model

What is DBMS?

A Database Management System (DBMS) is software that helps store, manage, and retrieve data in a structured way.

Examples of DBMS: MySQL, Oracle, Microsoft SQL Server.

Imagine DBMS as a digital cabinet where data is stored in an organized manner so we can find and use it easily.

What is the ER Model?

ER Model stands for Entity-Relationship Model. It is a way to design and visualize the structure of a database before creating it.

It helps show:

- What data needs to be stored
- How different pieces of data are related

This model is usually represented using diagrams called ER diagrams.

Why Use the ER Model?

- Helps design a clear plan for the database
- Makes the structure easy to understand
- Ensures that relationships between data are correctly represented
- Helps avoid errors when building the database

Components of the ER Model

1. Entity

An entity is any real-world object or thing that we want to store data about.

Example: Student, Teacher, Book, Car

In ER diagrams, entities are shown as rectangles.

2. Attributes

Attributes are the properties or characteristics of an entity.

Example: For a Student entity, attributes could be:

- Roll Number
- Name
- Age
- Email

In ER diagrams, attributes are shown as ellipses (ovals) connected to entities.

3. Entity Set

An entity set is a collection of similar types of entities.

Example: All students in a school form the "Student" entity set.



CBSE



ICSE



NTSE



Banking &
Insurance



Central Govt.
Service



State Govt.
Services



LAW
Entrance



MBA
Entrance



Railways & Metro
Services

...many more

abhyasonline.in



**Course
&
Test Series**

Data and Database Management System

 **CBSE**

 **ICSE**

 **NTSE**

 **Banking & Insurance**

 **Central Govt. Service**

 **State Govt. Services**

 **LAW Entrance**

 **MBA Entrance**

 **Railways & Metro Services**

...many more

abhyasonline.in

4. Relationship

A relationship is an association between two or more entities.

Example: A student ENROLLS in a course.

In ER diagrams, relationships are shown as **diamonds**.

5. Relationship Set







A relationship set is a collection of similar types of relationships.

Example: All students who enroll in courses form the ENROLLS relationship set.

6. Keys

A key is an attribute that uniquely identifies an entity.

Example: Student ID can be used to uniquely identify each student.

Figures	Symbols	Represents
Rectangle		Entities in ER Model
Ellipse		Attributes in ER Model
Diamond		Relationships among Entities
Line		Attributes to Entities and Entity Sets with Other Relationship Types
Double Ellipse		Multi-Valued Attributes
Double Rectangle		Weak Entity

7. Types of Attributes:

Type	Description	Example
Simple	Cannot be divided further	Name
Composite	Can be divided into sub-parts	Name → First Name, Last Name
Derived	Can be calculated from other attributes	Age (calculated from Date of Birth)
Multivalued	Can have more than one value	Phone Numbers

Course & Test Series

 **CBSE**

 **ICSE**

 **NTSE**

 **Banking & Insurance**

 **Central Govt. Service**

 **State Govt. Services**

 **LAW Entrance**

 **MBA Entrance**

 **Railways & Metro Services**

...many more

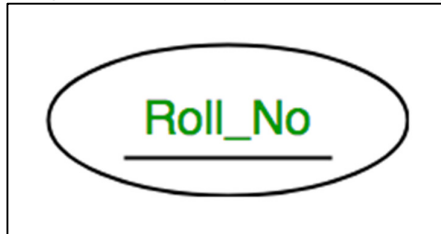
abhyasonline.in

Data and Database Management System

Types of Attributes

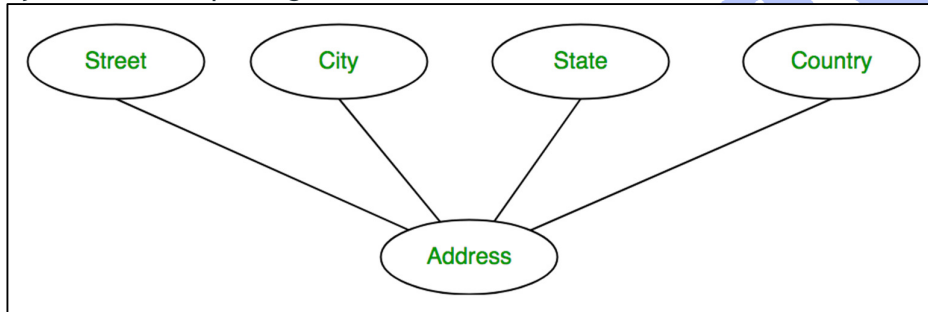
1. Key Attribute

The attribute which uniquely identifies each entity in the entity set is called the key attribute. For example, Roll_No will be unique for each student. In ER diagram, the key attribute is represented by an oval with an underline.



2. Composite Attribute

An attribute composed of many other attributes is called a composite attribute. For example, the Address attribute of the student Entity type consists of Street, City, State, and Country. In ER diagram, the composite attribute is represented by an oval comprising of ovals.



3. Multivalued Attribute

An attribute consisting of more than one value for a given entity. For example, Phone_No (can be more than one for a given student). In ER diagram, a multivalued attribute is represented by a double oval.



Course & Test Series

CBSE

ICSE

NTSE

Banking & Insurance

Central Govt. Service

State Govt. Services

LAW Entrance

MBA Entrance

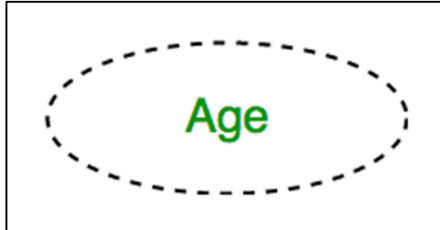
Railways & Metro Services

...many more
abhyasonline.in

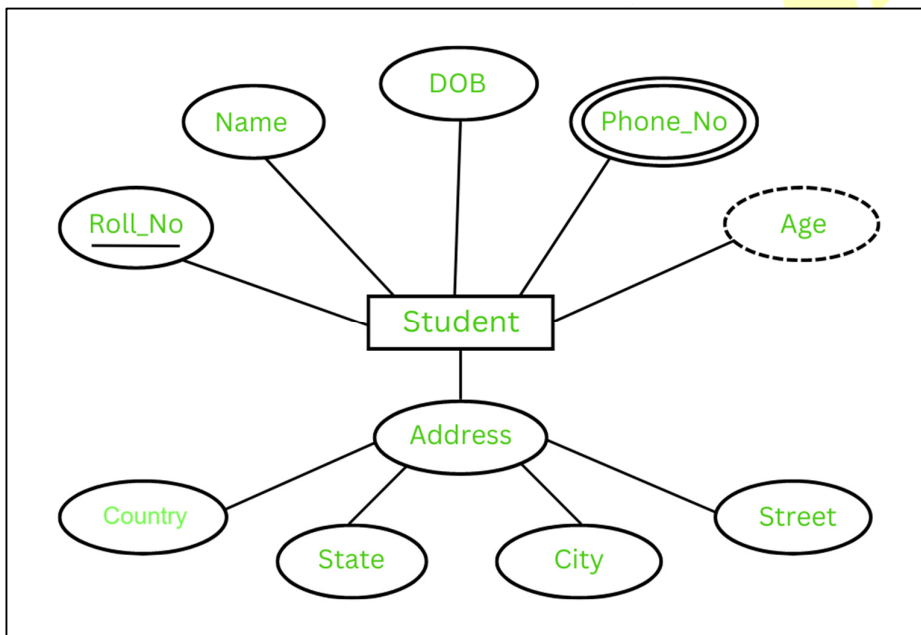
Data and Database Management System

4. Derived Attribute

An attribute that can be derived from other attributes of the entity type is known as a derived attribute. e.g.; Age (can be derived from DOB). In ER diagram, the derived attribute is represented by a dashed oval.



The Complete Entity Type Student with its Attributes can be represented as:



Types of Relationships

Type	Description	Example
One to One	One entity is related to one entity	A person has one passport
One to Many	One entity related to many others	One teacher teaches many students
Many to One	Many entities related to one	Many employees work in one department
Many to Many	Many entities related to many	Students enroll in many courses



**Course
&
Test Series**

Data and Database Management System

 **CBSE**

 **ICSE**

 **NTSE**

 **Banking & Insurance**

 **Central Govt. Service**

 **State Govt. Services**

 **LAW Entrance**

 **MBA Entrance**

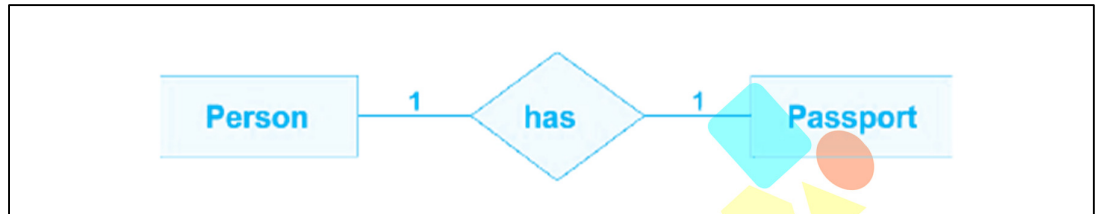
 **Railways & Metro Services**

...many more

abhyasonline.in

Type 1: One-to-One Relationship

A one-to-one relationship occurs when each record in one entity is related to only one record in another entity, and vice versa. This type of relationship is relatively rare in databases, but it is essential in specific scenarios.



For example: If there are two entities, one is a 'Person' (Id, Name, Age, Address) and the other is a 'Passport' (Passport_id, Passport_no). As a result, each individual can only have one passport, and each passport can only belong to one person. **For example:** If there are two entities, one is a 'Person' (Id, Name, Age, Address) and the other is a 'Passport' (Passport_id, Passport_no). As a result, each individual can only have one passport, and each passport can only belong to one person.

Type 2: One-to-Many Relationship

The one-to-many relationship is the most common type of relationship in DBMS. In this relationship, a record in one entity can be associated with multiple records in another entity, while each record in the second entity is related to only one record in the first entity. For instance, in a customer and order database, each customer can place multiple orders, but each order is associated with only one customer.



For example: If there are two entity types 'Customer' and 'Account' then each 'Customer' can have more than one 'Account' but each 'Account' is owned by only one 'Customer'. In this case, one Customer is connected with several Accounts. As a result, it is a one-to-many relationship. However, if we look at it another way, that multiple Accounts are connected with one Customer, we may claim that it is a many-to-one connection.

Type 3: Many-to-Many Relationship

A many-to-many relationship arises when multiple records in one entity can be linked to multiple records in another entity. To represent such relationships, a

Course & Test Series

CBSE

ICSE

NTSE

Banking & Insurance

Central Govt. Service

State Govt. Services

LAW Entrance

MBA Entrance

Railways & Metro Services

...many more

abhyasonline.in

Data and Database Management System

separate associative entity, often called a junction table or bridge table, is introduced. For example, in a database for students and courses, a many-to-many relationship exists, as each student can enroll in multiple courses, and each course can have multiple students.



Example: If there are two entity type 'Customer' and 'Product' then each customer can buy more than one product and a product can be bought by many different customers.

Example: ER Model for Student-Course Database

Scenario

We want to store data about:

- Students
- Courses
- Which student enrolled in which course

Entities and Attributes

Student

- Student_ID (Primary Key)
- Name
- Email
- Age

Course

- Course_ID (Primary Key)
- Course_Name
- Duration

Relationship: ENROLLS

- Student enrolls in Course
- Relationship has attribute: Date_Of_Enrollment

Tables Based on ER Model

Table: Student

Student_ID	Name	Email	Age
101	John	john@gmail.com	20

Course & Test Series

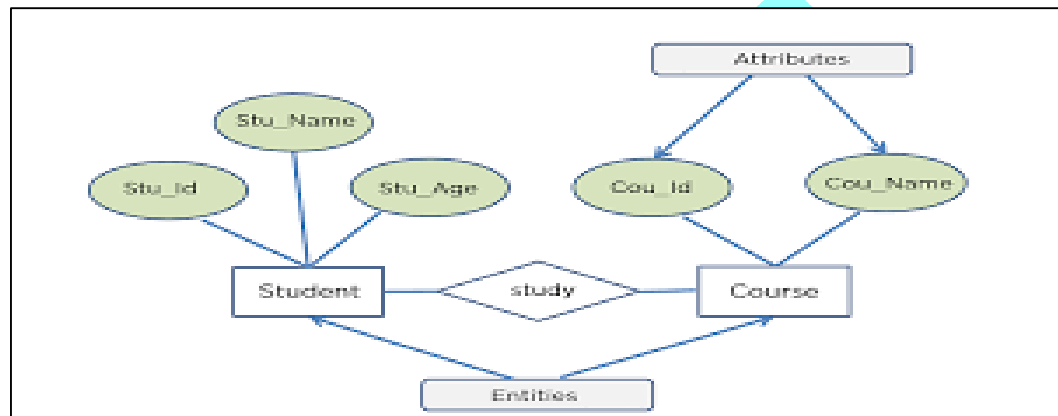
Data and Database Management System

Table: Course

Course_ID	Course_Name	Duration
CSE101	DBMS	4 Months

Table: Enrolls

Student_ID	Course_ID	Date_Of_Enrollment
101	CSE101	2025-06-20



Assignment: Design an ER Diagram for a Library Management System

Objective:

Design an Entity-Relationship (ER) Diagram for a Library Management System that stores and manages information about books, members, and borrowing activities.

Scenario:

You have been hired to design a database system for a library. The library wants to manage:

- Books and their details
- Library members
- Which member borrows which books
- The date when a book is borrowed and returned

Requirements:

Based on the scenario, identify entities, their attributes, and relationships. Then, draw an ER Diagram representing the following:

- ◆ Entities and Sample Attributes:

1. Book

- Book_ID (Primary Key)

...many more
abhyasonline.in

Course
&
Test Series

Data and Database Management System

- Title
- Author
- ISBN (International Standard Book Number)
- Publisher

2. Member

- Member_ID (Primary Key)
- Name
- Email
- Phone_Number
- Address

3. Borrow

- Relationship between Member and Book
- Attributes: Borrow_Date, Return_Date

Relationships:

- A Member can borrow many books
- A Book can be borrowed by many members over time (many-to-many)
- The Borrow relationship includes Borrow_Date and Return_Date

 CBSE

 ICSE

 NTSE

 Banking & Insurance

 Central Govt. Service

 State Govt. Services

 LAW Entrance

 MBA Entrance

 Railways & Metro Services

...many more

abhyasonline.in