

Entity Relationship Diagram | ER Model

In a database management system (DBMS), a group of information or data which is of interest to an organization that is called an Entity. A model that represents system data by entity and relationship sets that is called an Entity Relationship Diagram (E-R Diagram) or Entity-Relationship Model (E-R Model). The E-R model is based on a perception of real-world which consists of a set of basic objects. This E-R diagram was initially developed by P.P. Chen.

Components of Entity Relationship Diagram:

E-R Model consist of the following major components :

- Entity
- Attributes
- Key attributes
- Relationships

Entity :

An entity is a class of persons, place, objects, events or concepts about which we need to collect and store data. Here showing different entities include :

Persons : Employee, students, customer etc.

Places : Office, Building, Room etc.

Objects : Books, Vehicle, Machine etc.

Events : Sale, Registration, Order etc.

Concepts: Account, Qualification, Course etc.

Entity Set :

An entity set is the collection of entities of the same type entities which share common properties or attributes.

Such as : The set of all employees of an organization can be called as the **entity set Employee**.

Attributes :

Each entity can have a number of characteristics. The characteristics of an entity are called Attributes. An attribute is a descriptive property or characteristic of an entity. Some attributes can be logically grouped into super attributes called Compound Attribute.

Key attributes :

The Key attributes is an attribute that uniquely identifies an entity in the entity set.

Relationships :

An association of several entities in an Entity Relation model is called Relationship.

There are three types of relationships are exist :

(i) One to One Relationship (**1:1**)

(ii) One to Many Relationship (**1:M**)

(iii) Many to Many Relationship (**M:M**)

(i) **One to One Relationship (1:1)** : (i) One to One Relationship is an association only between two entities.

Such as : In a College, each department has only one head of the department.

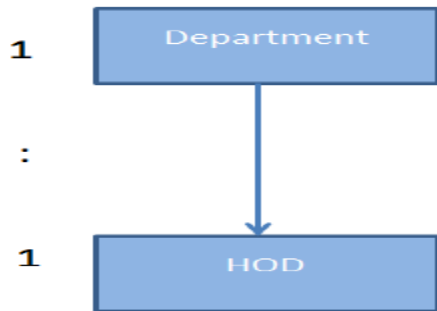


Fig : (1:1) Relationship

(ii) **One to Many Relationship (1:M)** : One to Many Relationship exists when one entity is related to more than one entity.

Such as : A father may have many children but a child has one father.

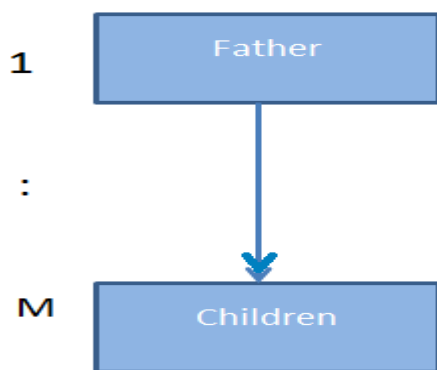


Fig : (1:M) Relationship

(iii) **Many to Many Relationship (M:M)** : A Many to Many Relationship (M:M) indicates that entities may have many relationships among each other.

Such as : One customer may buy many item of goods and one item of goods may be bought by many customers.

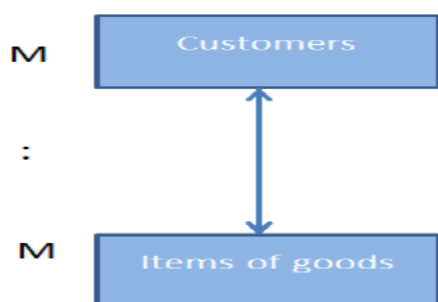


Fig: (M: M) Relationship

Entity Relationship Diagram – ER Diagram in DBMS

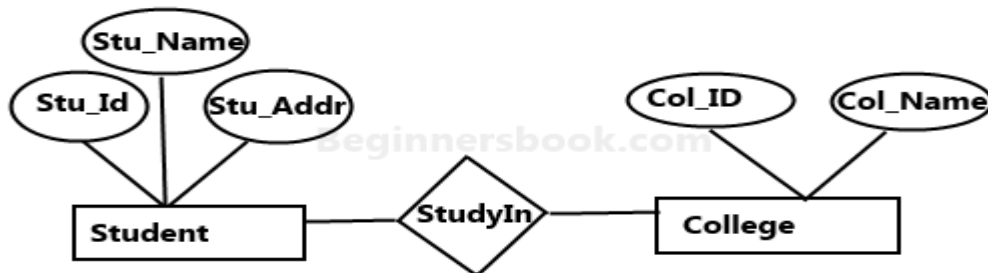
An **Entity-relationship model (ER model)** describes the structure of a database with the help of a diagram, which is known as **Entity Relationship Diagram (ER Diagram)**. An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are: entity set and relationship set.

What is an Entity Relationship Diagram (ER Diagram)?

An ER diagram shows the relationship among entity sets. An entity set is a group of similar entities and these entities can have attributes. In terms of DBMS, an entity is a table or attribute of a table in database, so by showing relationship among tables and their attributes, ER diagram shows the complete logical structure of a database. Lets have a look at a simple ER diagram to understand this concept.

A simple ER Diagram:

In the following diagram we have two entities Student and College and their relationship. The relationship between Student and College is many to one as a college can have many students however a student cannot study in multiple colleges at the same time. Student entity has attributes such as Stu_Id, Stu_Name & Stu_Addr and College entity has attributes such as Col_ID & Col_Name.



Sample E-R Diagram

Here are the geometric shapes and their meaning in an E-R Diagram. We will discuss these terms in detail in the next section(Components of a ER Diagram) of this guide so don't worry too much about these terms now, just go through them once.

Rectangle: Represents Entity sets.

Ellipses: Attributes

Diamonds: Relationship Set

Lines: They link attributes to Entity Sets and Entity sets to Relationship Set

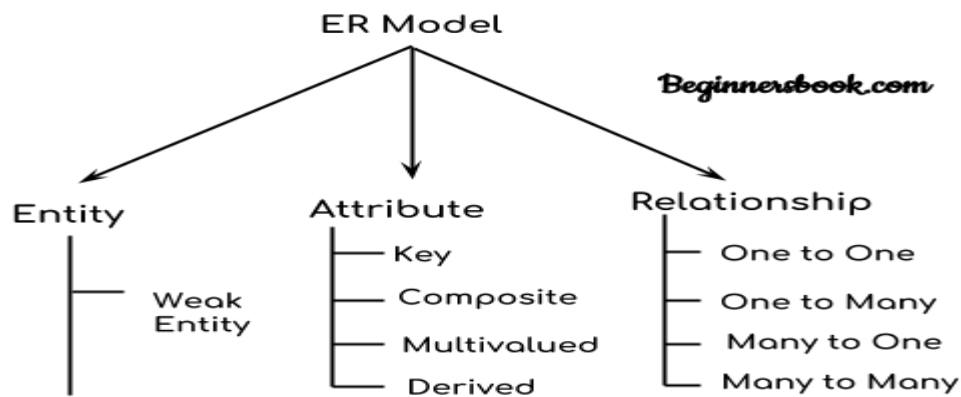
Double Ellipses: Multivalued Attributes

Dashed Ellipses: Derived Attributes

Double Rectangles: Weak Entity Sets

Double Lines: Total participation of an entity in a relationship set

Components of a ER Diagram



Components of ER Diagram

As shown in the above diagram, an ER diagram has three main components:

1. Entity
2. Attribute
3. Relationship

1. Entity

An entity is an object or component of data. An entity is represented as rectangle in an ER diagram.

For example: In the following ER diagram we have two entities Student and College and these two entities have many to one relationship as many students study in a single college. We will read more about relationships later, for now focus on entities.



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Weak Entity:

An entity that cannot be uniquely identified by its own attributes and relies on the relationship with other entity is called weak entity. The weak entity is represented by a double rectangle. For example – a bank account cannot be uniquely identified without knowing the bank to which the account belongs, so bank account is a weak entity.



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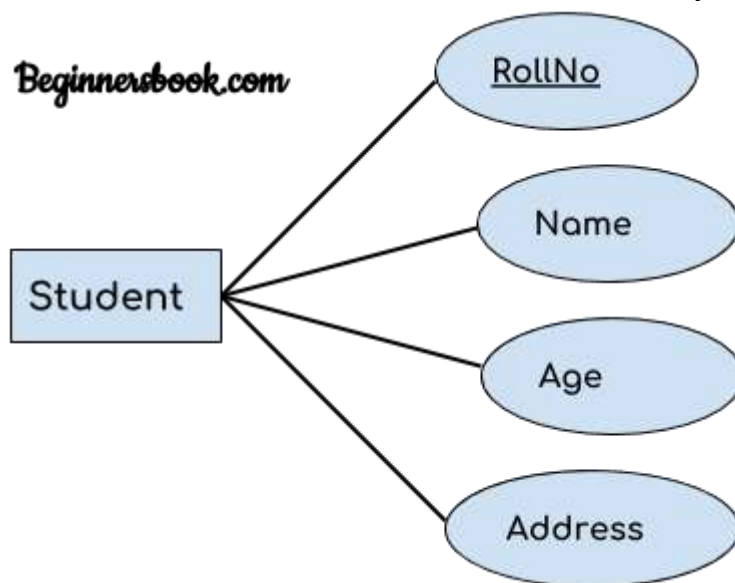
2. Attribute

An attribute describes the property of an entity. An attribute is represented as Oval in an ER diagram. There are four types of attributes:

1. Key attribute
2. Composite attribute
3. Multivalued attribute
4. Derived attribute

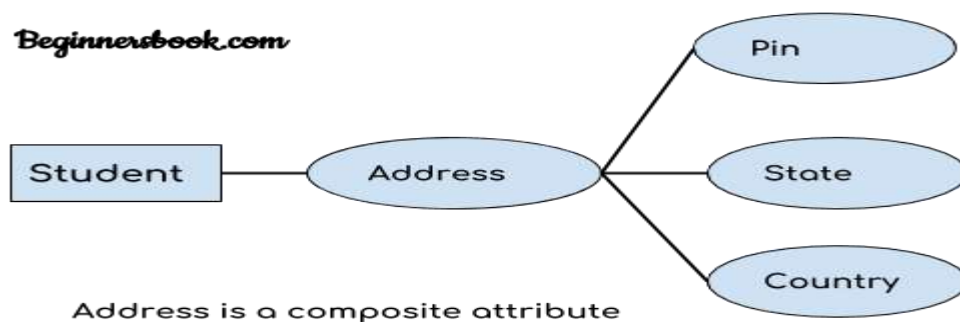
1. Key attribute:

A key attribute can uniquely identify an entity from an entity set. For example, student roll number can uniquely identify a student from a set of students. Key attribute is represented by oval same as other attributes however the **text of key attribute is underlined**.



2. Composite attribute:

An attribute that is a combination of other attributes is known as composite attribute. For example, In student entity, the student address is a composite attribute as an address is composed of other attributes such as pin code, state, country.



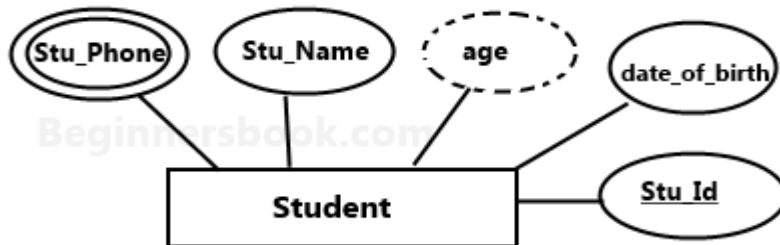
3. Multivalued attribute:

An attribute that can hold multiple values is known as multivalued attribute. It is represented with **double ovals** in an ER Diagram. For example – A person can have more than one phone numbers so the phone number attribute is multivalued.

4. Derived attribute:

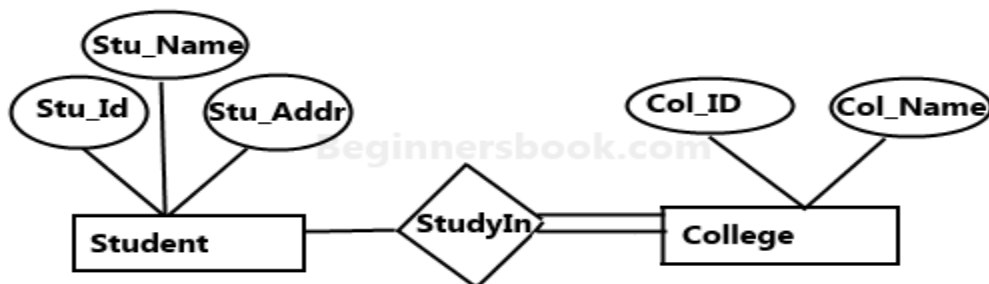
A derived attribute is one whose value is dynamic and derived from another attribute. It is represented by **dashed oval** in an ER Diagram. For example – Person age is a derived attribute as it changes over time and can be derived from another attribute (Date of birth).

E-R diagram with multivalued and derived attributes



Total Participation of an Entity set

A Total participation of an entity set represents that each entity in entity set must have at least one relationship in a relationship set. For example: In the below diagram each college must have at-least one associated Student.



E-R Diagram with total participation of College entity set in StudyIn relationship Set - This indicates that each college must have atleast one associated Student.