# ER Models

Entity Relationship Model is the graphical representation of database design. It is a high level data model that describes data in terms of entities, attributes and relationships. It shows the relationship between entity sets.

ER Diagram is the blueprint of our database.

For Example:
If we have to design a Bank's Loan Database storing the customer's data as well the data related to loans that have been given to each customer.
It's ER-diagram with few of its attributes will look like:
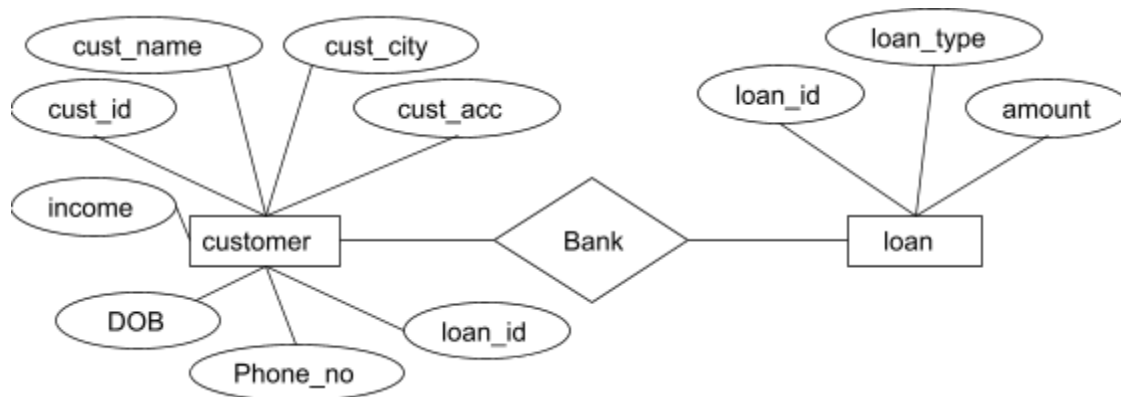
Figure: ER – Diagram 1

Keywords

1. **Entity**
   Entity is a real world object,class, person or place. Entities can be uniquely identified. It has a physical existence.
   It is represented by a rectangle, like in the above diagram customer and loan are the entities.

Example –
In ER Diagram -1 any customer who has taken a Loan from the bank could be an entity.

2. **Entity Set**
Set of entities of the same type at a particular point of time is known as the entity set.
Example –
In ER Diagram -1 customer and loan are the entity sets..

3. **Attributes**
Properties of the entity are known as attributes. Each attribute has some value. An entity can contain multiple attributes.
They are represented by eclipse.
In ER – Diagram 1 cust_id, cust_name, cust_city, cust_acc, dob, phone_no, loan_id and income are attributes of customer entity set.

Example
In the above ER Diagram - 1 customer and loan are entities.
- cust_id, cust_name, cust_city, cust_acc, dob, phone_no, loan_id and income are attributes of customer entity.
- loan_id, loan_type, amount are attributes of the loan entity.
- Bank is a relationship set between customer and loan, as a customer of the bank will take loan from his/her bank only.

Types of attributes

Based on Composition

1. **Simple Attributes -** If an attribute cannot be divided further then it is known as a simple attribute.
   Example – In ER – Diagram 1 cust_acc is a simple attribute.

2. **Composite Attributes -** If any attribute can be divided into further parts then it is known as a composite attribute.

Example – In ER – Diagram 1 cust_name is a composite attribute because it is further divided into Fist_name, Middle_name and Last_name.
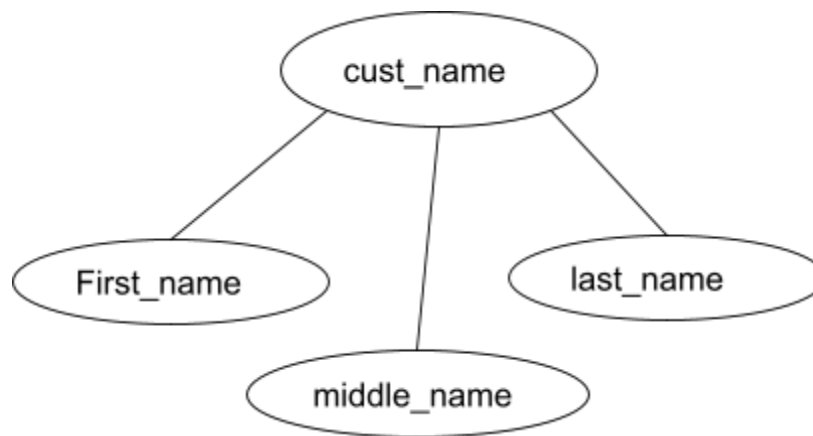
Based on count of values that can be stored

1. **Single Valued Attribute -** If a particular attribute has only one value then it is known as a single valued attribute.
   Example – cust_id is a single valued attribute because a customer could have only one name.
2. **Multi Valued Attribute -** If an attribute has more than one value then it is known as a multivalued attribute.
   It is represented by a double oval.
   Example – Phone_no can be a multivalued attribute because a customer can have multiple contact numbers.

Based on how the attribute value can be stored

1. **Stored Attribute -** The initial information which we save in our database is known as a stored attribute.
   Example – In ER diagram 1 DOB is a stored attribute.

2. **Derived Attribute -** The value which we can derive from stored attributes is known as derived attribute.
   Example - Age is a derived attribute because <u>it can be derived from DOB.</u>
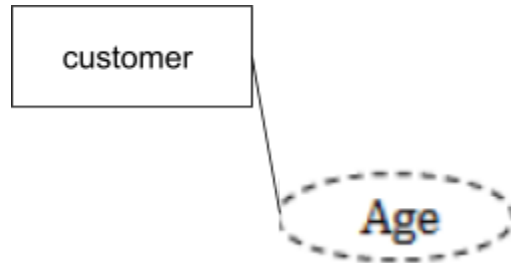
3. **Complex Attribute -** If an attribute has multivalued and composite components in it then it is called complex attribute.
   Example - In a person table a person can have many residents i.e. multivalued and each resident is a composite attribute which can be further divided into house number and city i.e. composite. So address is a complex attribute.

Null Values - It represents something which is unknown.
Example - If we have to insert the income of a customer but it is unknown then we may insert NULL there.

Keys in ER diagram

An attribute or set of attributes which can uniquely identify a record is known as keys.
Example - In the customer table, cust_id is a key attribute because it can identify each customer record uniquely and it can be represented as
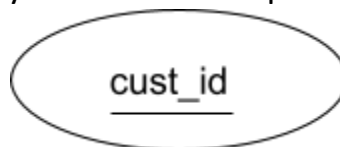
Types of Keys in ER Model –

1. **Primary Key –** This is an attribute or set of attributes that can uniquely identify each entity in the entity set. In ER – diagram 1 cust_id can be the primary key in the customer table.

2. **Foreign Key –** Whenever there is some relationship between two entities there must be some common attribute between them. This common attribute must be the primary key of an entity set and will become foreign key of another entity set.
   In ER diagram 1 loan_id is foreign key in the customer entity set and the discriminator or Partial key(won't call it a Primary key) in the loan entity set because it is maintaining the relationship between student and course entity set.

**Note:** Primary key for Loan entity here will be: (cust_id, Loan_id.)
   (Primary key of a weak entity set = It's Partial Key/Discriminator + Primary key of strong entity set)
These discriminators or partial key is represented in ER-Diagram with a dashed underlining.
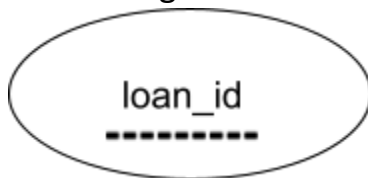
Strong and Weak Entity Set

- An entity set which is not dependent on any other entity set in the schema is known as a strong entity set i.e. a strong entity set will always have a primary key. It is represented with a rectangle.

- A weak entity set is usually dependent on a strong entity set to ensure its existence and it does not have any primary key rather contains a discriminator or a partial key to differentiate between the records present in the weak entity set table. It is represented with a double rectangle.
   It needs to have participation.
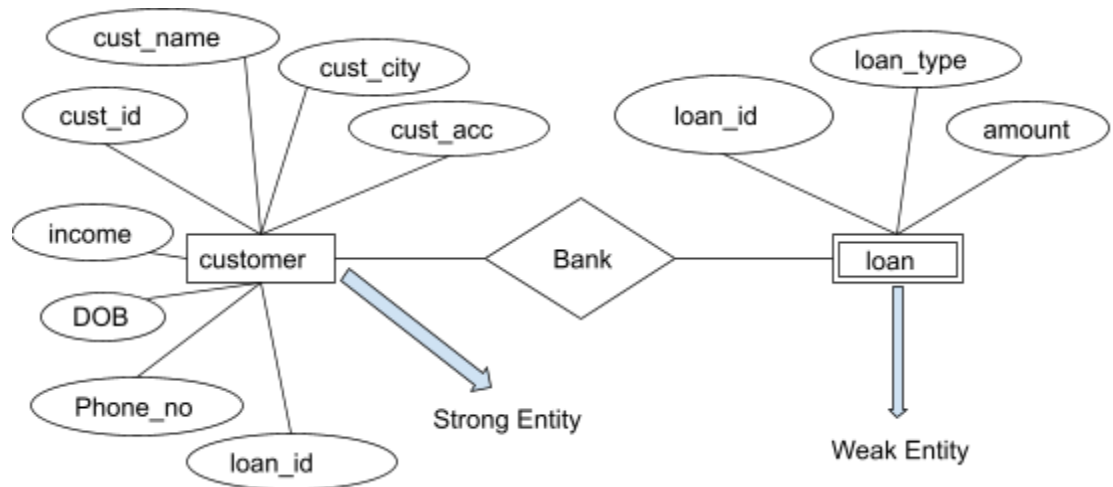
Figure: ER – Diagram 2

In above ER Diagram customer is strong entity set and Loan is weak entity set because without a customer there is no existence of loan and loan entity set has total participation i.e. every loan must have at least one customer.

The Final ER-Diagram we get by defining all the things we learnt till now,