

# Database Design Using ER Model

---

CHAPTER 2

# ER Model

---

The entity-relationship model (or ER model) is a way of graphically representing the logical relationships of entities in order to create a database

Peter Pin-Shan Chen of Massachusetts Institute of Technology (MIT) first proposed the ER model in the 1970s.

In ER modelling, the structure for a database is portrayed as a diagram, called an entity-relationship diagram (or ER diagram)

# Components of ER Model:

---

The ER Model consists of the following major components.

1. Entity
2. Attributes
3. Relationships/Cardinality
4. Key attributes

# Entity

---

An entity is class of person, places, objects, events or concepts about which we need to collect and store data.

Categories of different entities include:

1. Persons
2. Places
3. Objects
4. Events
5. Concepts

**Entity Symbol:**

# Example of Entities

---

Persons: Employee, customer, students, supplier etc.

Places: Branch Office, Building, Room etc.

Objects: Book, Machine, Vehicle etc.

Events: Sale, Reservation, Registration, order, etc.

Concepts: Qualification, Account, Course, Stocks etc.

**Example:**

Customer
----------

# Types of Entities

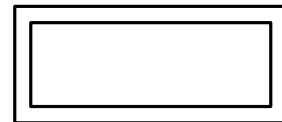
---

1. Strong entities
2. Weak entities

**Strong Entity:**



**Weak Entity:**



# Entity Set:

---

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

For example, the set of all employees of an organisation can be called as the entity set Employee.

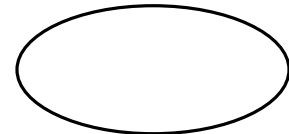
# Attribute:

---

Each entity can have a number of characteristics. The characteristics of an entity are called Attributes.

Some attributes can be logically grouped into super attributes called compound attribute. For example, an Employee's name is a compound attribute consisting of first\_name, middle\_name, and last\_name.

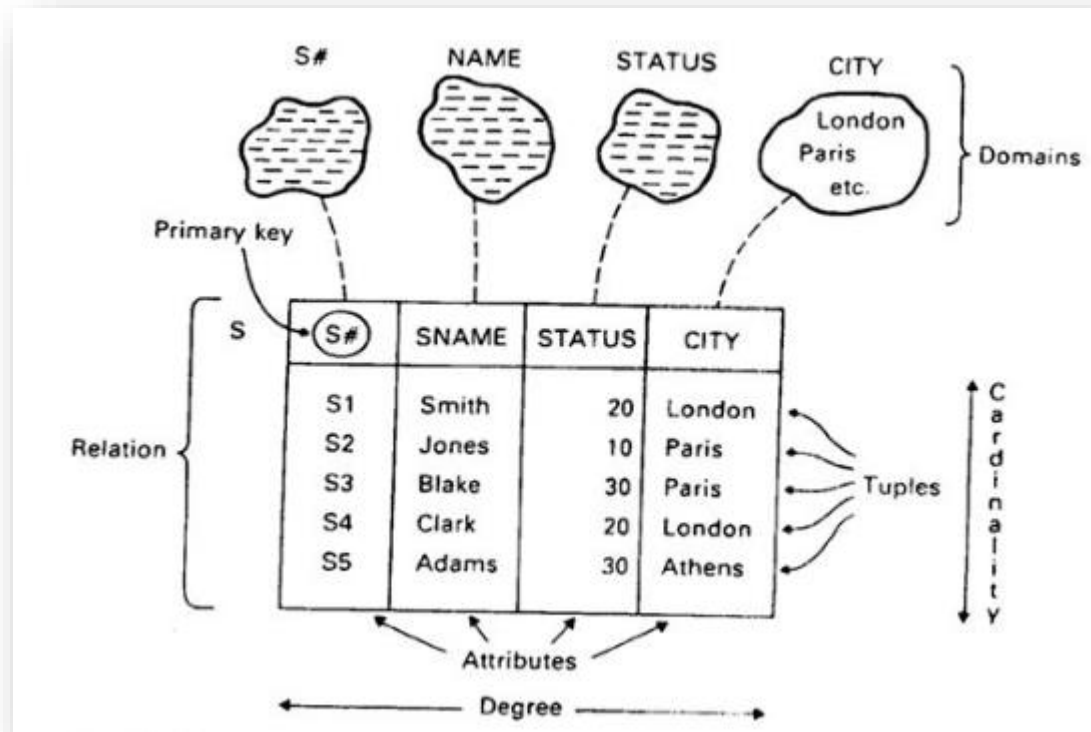
**Attribute Symbol:**





# Domain

For each attribute, there is a set of permitted values are called domain or value set



# Types of attributes

---

- Simple and composite
- Single-valued and multivalued
- Complex Attribute
- Stored and Derived
- Null value attribute
- Key attribute

# Simple and Composite Attributes

---

- Attributes those used in our examples are of simple attributes, they have not been divided into a subpart.



- Composite attribute on the other hand can be divided into a subpart.  
For example : An attribute ADDRESS could be structured as a composite attribute consisting of STATE, CITY, ZIP



# Single-valued and Multivalued

---

- Most attributes have a single value for any particular entity; such attributes are called Single-Valued Attributes.

**Example: Roll\_No is a single-valued attribute of a person.**



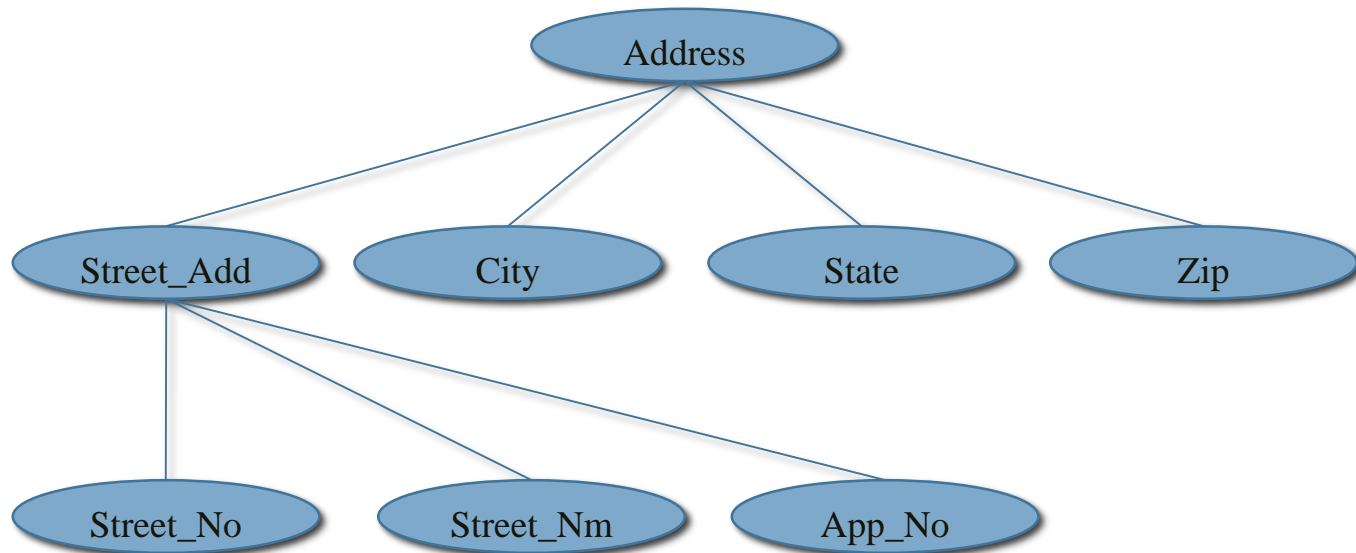
- A multivalued attribute in DBMS(Data Base Management System) is an attribute that can have multiple values for a single instance of an entity.



# Complex Attribute

---

- Those attributes, which can be formed by the nesting of composite and multi-valued attributes, are called “*Complex Attributes*”.



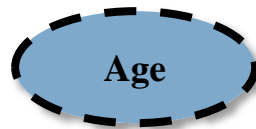
# Stored and Derived Attributes

---

- Stored attributes are those attributes that are stored in the physical database for e.g date of birth.



- Derived attributes are those attributes that are not present in the physical database, but can be derived from the attributes present in the database. For e.g. age can be derived from date of birth



# Null Value Attributes

---

- An attribute, which has not any value for an entity is known as null valued attribute.
- For example, assume Student is an entity and its attributes are Name, Age, Address and Email. There may be chance when a student has no Email. In that case, Email is called null valued attributes.



**Email**

- In two cases the value of an attribute would have the NULL.
  - Known
  - Unknown
- Attribute value is exist but missing that is Known. E.g. :- Height of a Person
- Attribute value when it not sure whether it is exist or not that is Unknown. E.g. :- Home Phone.



# Relationship sets

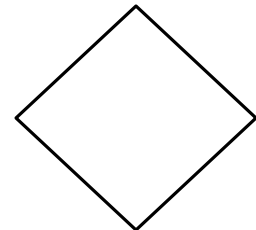
---

A relationship is an association among several entities

A relationship set is set of relationships of the same type

Relationship set – collection of all relationships of relationship type

**Relationship Symbol:**



# Cardinality Mapping

---

Mapping cardinalities, or cardinality ratios, express the number of entities to which another entity can be associated via a relationship set.

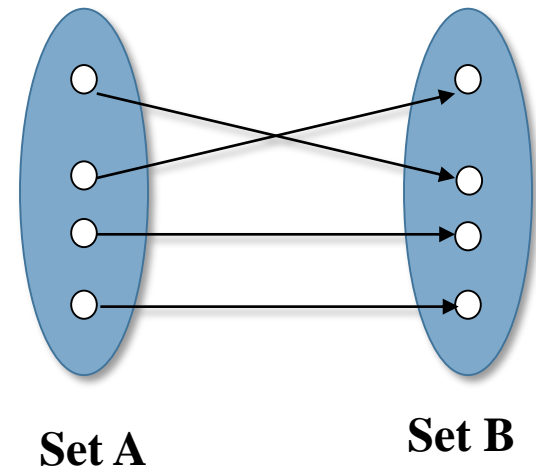
There are three types of Cardinality or relationships exist among entities, these are:

- One-to-one (1:1)
- One-to-many (1:M)
- Many-to-many (M:N)

# One-to-one (1:1)

---

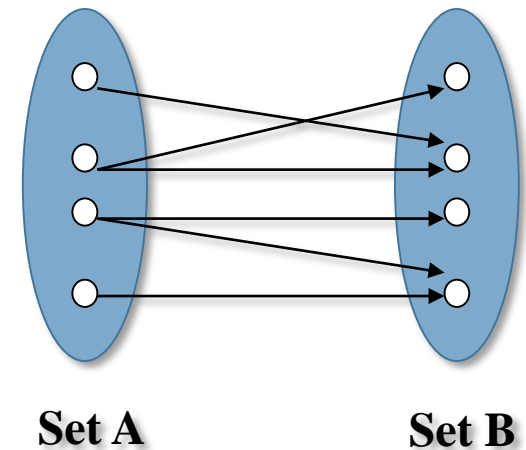
- In a one-to-one relationship, one [record](#) in a [table](#) is associated with one and only one record in another table. For example, in a college database, each department have one HOD



# One-to-many (1:M)

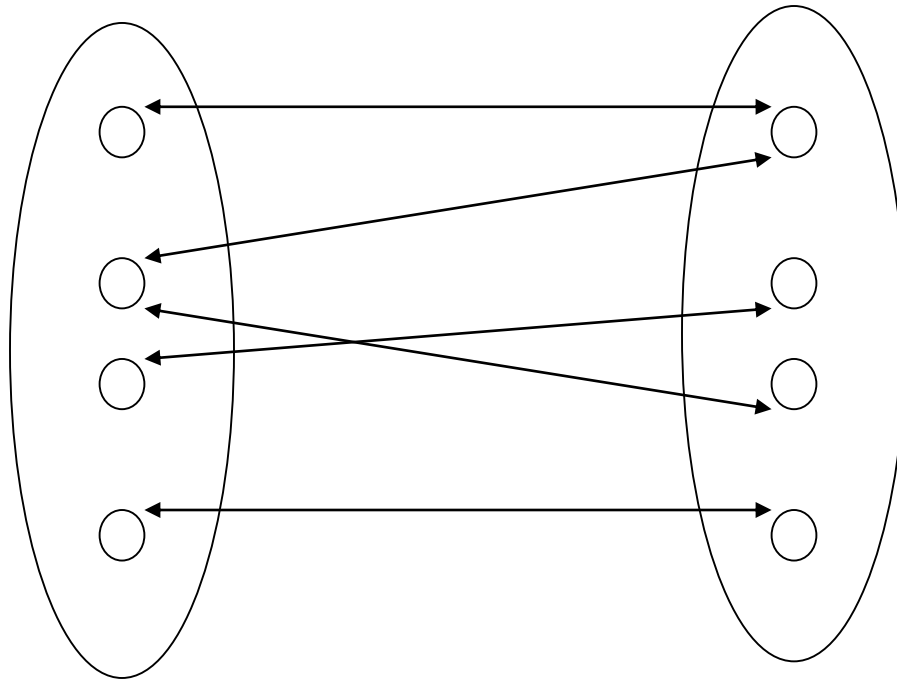
---

- In a one-to-many relationship, one record in a table can be associated with one or more records in another table. For example, each customer can have many sales orders.



# Many-to-many (M:N)

---



# Example

---

