What is Data Model in DBMS and what are its types?

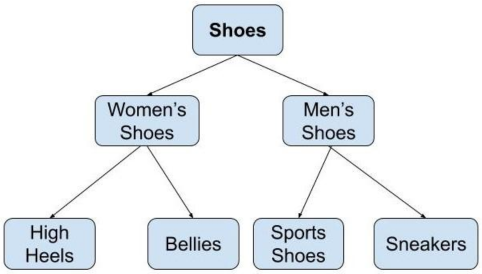
Data Model

Data Model gives us an idea that how the final system will look like after its complete implementation. It defines the data elements and the relationships between the data elements. Data Models are used to show how data is stored, connected, accessed and updated in the database management system. Here, we use a set of symbols and text to represent the information so that members of the organisation can communicate and understand it. Though there are many data models being used nowadays but the Relational model is the most widely used model. Apart from the Relational model, there are many other types of data models about which we will study in details in this blog. Some of the Data Models in DBMS are:

1. **Hierarchical Model**
2. **Network Model**
3. **Entity-Relationship Model**
4. **Relational Model**
5. **Object-Oriented Data Model**

Hierarchical Model

Hierarchical Model was the first DBMS model. This model organises the data in the hierarchical tree structure. The hierarchy starts from the root which has root data and then it expands in the form of a tree adding child node to the parent node. This model easily represents some of the real-world relationships like food recipes, sitemap of a website etc. *Example:* We can represent the relationship between the shoes present on a shopping website in the following way:



Hierarchical Model

Features of a Hierarchical Model

1. ***One-to-many relationship:* The data here is organised in a tree-like structure where the one-to-many relationship is between the datatypes. Also, there can be only one path from parent to any node. *Example:* In the above example, if we want to go to the node *sneakers* we only have one path to reach there i.e through men's shoes node.**
2. ***Parent-Child Relationship:* Each child node has a parent node but a parent node can have more than one child node. Multiple parents are not allowed.**

3. *Deletion Problem:* **If a parent node is deleted then the child node is automatically deleted.**
4. *Pointers:* **Pointers are used to link the parent node with the child node and are used to navigate between the stored data.** *Example:* **In the above example the '*shoes*' node points to the two other nodes '*women shoes*' node and '*men's shoes*' node.**

Advantages of Hierarchical Model

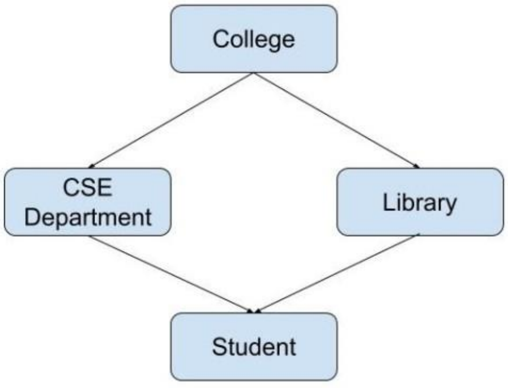
- **It is very simple and fast to traverse through a tree-like structure.**
- **Any change in the parent node is automatically reflected in the child node so, the integrity of data is maintained.**

Disadvantages of Hierarchical Model

- **Complex relationships are not supported.**
- **As it does not support more than one parent of the child node so if we have some complex relationship where a child node needs to have two parent node then that can't be represented using this model.**
- **If a parent node is deleted then the child node is automatically deleted.**

Network Model

This model is an extension of the hierarchical model. It was the most popular model before the relational model. This model is the same as the hierarchical model, the only difference is that a record can have more than one parent. It replaces the hierarchical tree with a graph. *Example:* **In the example below we can see that node student has two parents i.e. CSE Department and Library. This was earlier not possible in the hierarchical model.**



Network Model

Features of a Network Model

1. *Ability to Merge more Relationships:* **In this model, as there are more relationships so data is more related. This model has the ability to manage one-to-one relationships as well as many-to-many relationships.**
2. *Many paths:* **As there are more relationships so there can be more than one path to the same record. This makes data access fast and simple.**

3. ***Circular Linked List:*** **The operations on the network model are done with the help of the circular linked list. The current position is maintained with the help of a program and this position navigates through the records according to the relationship.**

Advantages of Network Model

- **The data can be accessed faster as compared to the hierarchical model. This is because the data is more related in the network model and there can be more than one path to reach a particular node. So the data can be accessed in many ways.**
- **As there is a parent-child relationship so data integrity is present. Any change in parent record is reflected in the child record.**

Disadvantages of Network Model

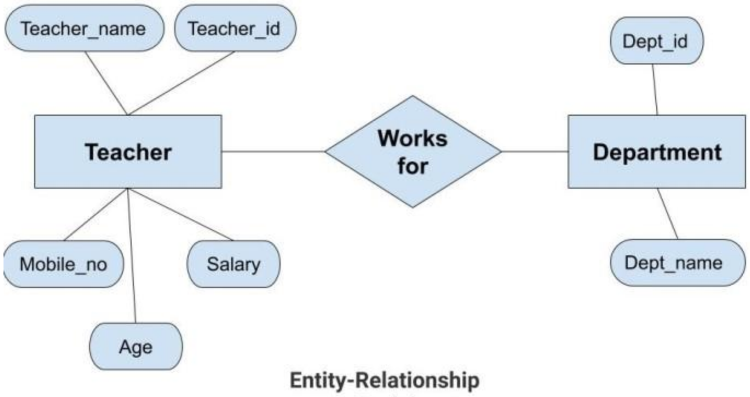
- **As more and more relationships need to be handled the system might get complex. So, a user must be having detailed knowledge of the model to work with the model.**
- **Any change like updation, deletion, insertion is very complex.**

Entity-Relationship Model

Entity-Relationship Model or simply ER Model is a high-level data model diagram. In this model, we represent the real-world problem in the pictorial form to make it easy for the stakeholders to understand. It is also very easy for the developers to understand the system by just looking at the ER diagram. We use the ER diagram as a visual tool to represent an ER Model. ER diagram has the following three components:

- ***Entities:*** **Entity is a real-world thing. It can be a person, place, or even a concept.** ***Example:*** **Teachers, Students, Course, Building, Department, etc are some of the entities of a School Management System.**
- ***Attributes:*** **An entity contains a real-world property called attribute. This is the characteristics of that attribute.** ***Example:*** **The entity teacher has the property like teacher id, salary, age, etc.**
- ***Relationship:*** **Relationship tells how two attributes are related.** ***Example:*** **Teacher works for a department.**

Example:



Entity-Relationship Model

In the above diagram, the entities are Teacher and Department. The attributes of *Teacher* entity are Teacher_Name, Teacher_id, Age, Salary, Mobile_Number. The attributes of entity *Department* entity are Dept_id, Dept_name. The two entities are connected using the relationship. Here, each teacher works for a department.

Features of ER Model

- ***Graphical Representation for Better Understanding:*** **It is very easy and simple to understand so it can be used by the developers to communicate with the stakeholders.**
- ***ER Diagram:*** **ER diagram is used as a visual tool for representing the model.**
- ***Database Design:*** **This model helps the database designers to build the database and is widely used in database design.**

Advantages of ER Model

- ***Simple:*** **Conceptually ER Model is very easy to build. If we know the relationship between the attributes and the entities we can easily build the ER Diagram for the model.**
- ***Effective Communication Tool*****: This model is used widely by the database designers for communicating their ideas.**
- ***Easy Conversion to any Model*****: This model maps well to the relational model and can be easily converted relational model by converting the ER model to the table. This model can also be converted to any other model like network model, hierarchical model etc.**

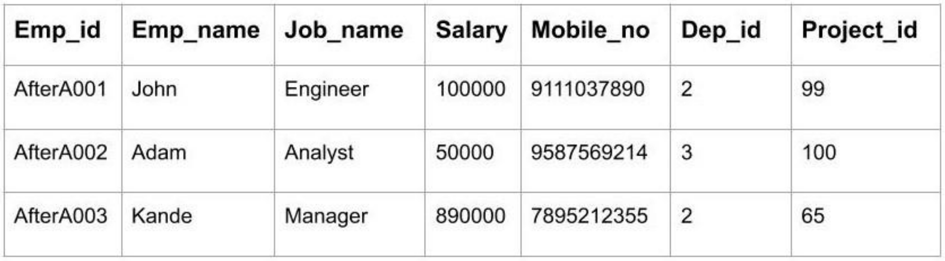
Disadvatages of ER Model

- ***No industry standard for notation:*** **There is no industry standard for developing an ER model. So one developer might use notations which are not understood by other developers.**
- ***Hidden information:*** **Some information might be lost or hidden in the ER model. As it is a high-level view so there are chances that some details of information might be hidden.**

Relational Model

Relational Model is the most widely used model. In this model, the data is maintained in the form of a two-dimensional table. All the information is stored in the form of row and columns. The basic structure of a

relational model is tables. So, the tables are also called *relations* in the relational model. *Example:* In this example, we have an Employee table.



Emp_id	Emp_name	Job_name	Salary	Mobile_no	Dep_id	Project_id
AfterA001	John	Engineer	100000	9111037890	2	99
AfterA002	Adam	Analyst	50000	9587569214	3	100
AfterA003	Kande	Manager	890000	7895212355	2	65

EMPLOYEE TABLE

Features of Relational Model

- ***Tuples*: Each row in the table is called tuple. A row contains all the information about any instance of the object. In the above example, each row has all the information about any specific individual like the first row has information about John.**
- ***Attribute or field:* Attributes are the property which defines the table or relation. The values of the attribute should be from the same domain. In the above example, we have different attributes of the *employee* like Salary, Mobile_no, etc.**

Advnatages of Relational Model

- ***Simple:* This model is more simple as compared to the network and hierarchical model.**
- ***Scalable:* This model can be easily scaled as we can add as many rows and columns we want.**
- ***Structural Independence:* We can make changes in database structure without changing the way to access the data. When we can make changes to the database structure without affecting the capability to DBMS to access the data we can say that structural independence has been achieved.**

Disadvantages of Relatinal Model

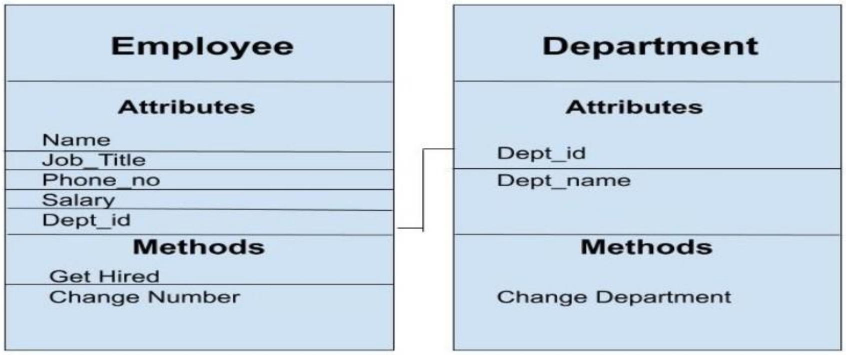
- ***Hardware Overheads:* For hiding the complexities and making things easier for the user this model requires more powerful hardware computers and data storage devices.**
- ***Bad Design:* As the relational model is very easy to design and use. So the users don't need to know how the data is stored in order to access it. This ease of design can lead to the development of a poor database which would slow down if the database grows.**

But all these disadvantages are minor as compared to the advantages of the relational model. These problems can be avoided with the help of proper implementation and organisation.

Object-Oriented Data Model

The real-world problems are more closely represented through the object-oriented data model. In this model, both the data and relationship are present in a single structure known as an object. We can store audio, video,

images, etc in the database which was not possible in the relational model(although you can store audio and video in relational database, it is adviced not to store in the relational database). In this model, two are more objects are connected through links. We use this link to relate one object to other objects. This can be understood by the example given below.



Object_Oriented_Model

In the above example, we have two objects Employee and Department. All the data and relationships of each object are contained as a single unit. The attributes like Name, Job_title of the employee and the methods which will be performed by that object are stored as a single object. The two objects are connected through a common attribute i.e the Department_id and the communication between these two will be done with the help of this common id.

What is ER Diagram?

ER Diagram stands for Entity Relationship Diagram, also known as ERD is a diagram that displays the relationship of entity sets stored in a database. In other words, ER diagrams help to explain the logical structure of databases. ER diagrams are created based on three basic concepts: entities, attributes and relationships.

ER Diagrams contain different symbols that use rectangles to represent entities, ovals to define attributes and diamond shapes to represent relationships.

At first look, an ER diagram looks very similar to the flowchart. However, ER Diagram includes many specialized symbols, and its meanings make this model unique. The purpose of ER Diagram is to represent the entity framework infrastructure.

What is ER Model?

ER Model stands for Entity Relationship Model is a high-level conceptual data model diagram. ER model helps to systematically analyze data requirements to produce a well-designed database. The ER Model represents real-world entities and the relationships between them. Creating an ER Model in DBMS is considered as a best practice before implementing your database.
ER Modeling helps you to analyze data requirements systematically to produce a well-designed database. So, it is considered a best practice to complete ER modeling before implementing your database.
In this Entity Relationship Diagram tutorial, you will learn-

History of ER models

ER diagrams are visual tools that are helpful to represent the ER model. Peter Chen proposed ER Diagram in 1971 to create a uniform convention that can be used for relational databases and networks. He aimed to use an ER model as a conceptual modeling approach.

Why use ER Diagrams?

Here, are prime reasons for using the ER Diagram

- Helps you to define terms related to entity relationship modeling
- Provide a preview of how all your tables should connect, what fields are going to be on each table
- Helps to describe entities, attributes, relationships
- ER diagrams are translatable into relational tables which allows you to build databases quickly

- ER diagrams can be used by database designers as a blueprint for implementing data in specific software applications
- The database designer gains a better understanding of the information to be contained in the database with the help of ERP diagram
- ERD Diagram allows you to communicate with the logical structure of the database to users

acts about ER Diagram Model

Now in this ERD Diagram Tutorial, let's check out some interesting facts about ER Diagram Model:

- ER model allows you to draw Database Design
- It is an easy to use graphical tool for modeling data
- Widely used in Database Design
- It is a GUI representation of the logical structure of a Database
- It helps you to identifies the entities which exist in a system and the relationships between those entities

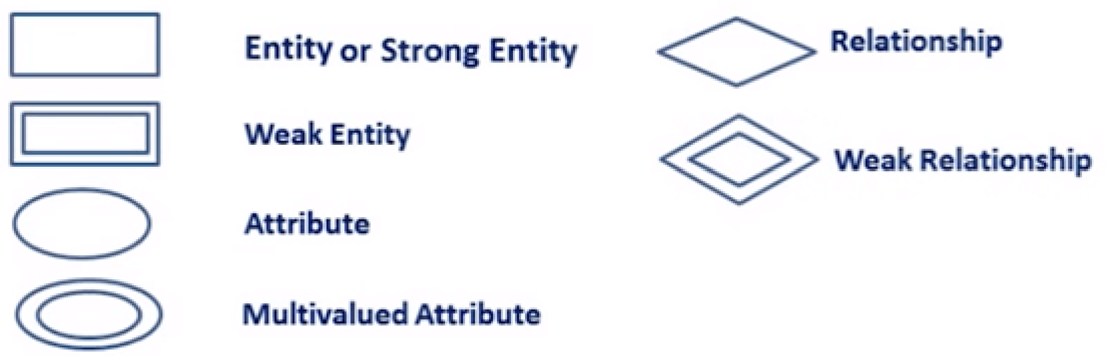
ER Diagrams Symbols & Notations

Entity Relationship Diagram Symbols & Notations mainly contains three basic symbols which are rectangle, oval and diamond to represent relationships between elements, entities and attributes. There are some sub-elements which are based on the main elements in ERD Diagram. ER Diagram is a visual representation of data that describes how data is related to each other using different ERD Symbols and Notations.

Following are the main components and its symbols in ER Diagrams:

- **Rectangles:** This Entity Relationship Diagram symbol represents entity types
- **Ellipses :** Symbol represent attributes
- **Diamonds:** This symbol represents relationship types

- **Lines:** It links attributes to entity types and entity types with other relationship types
- **Primary key:** attributes are underlined
- **Double Ellipses:** Represent multi-valued attributes



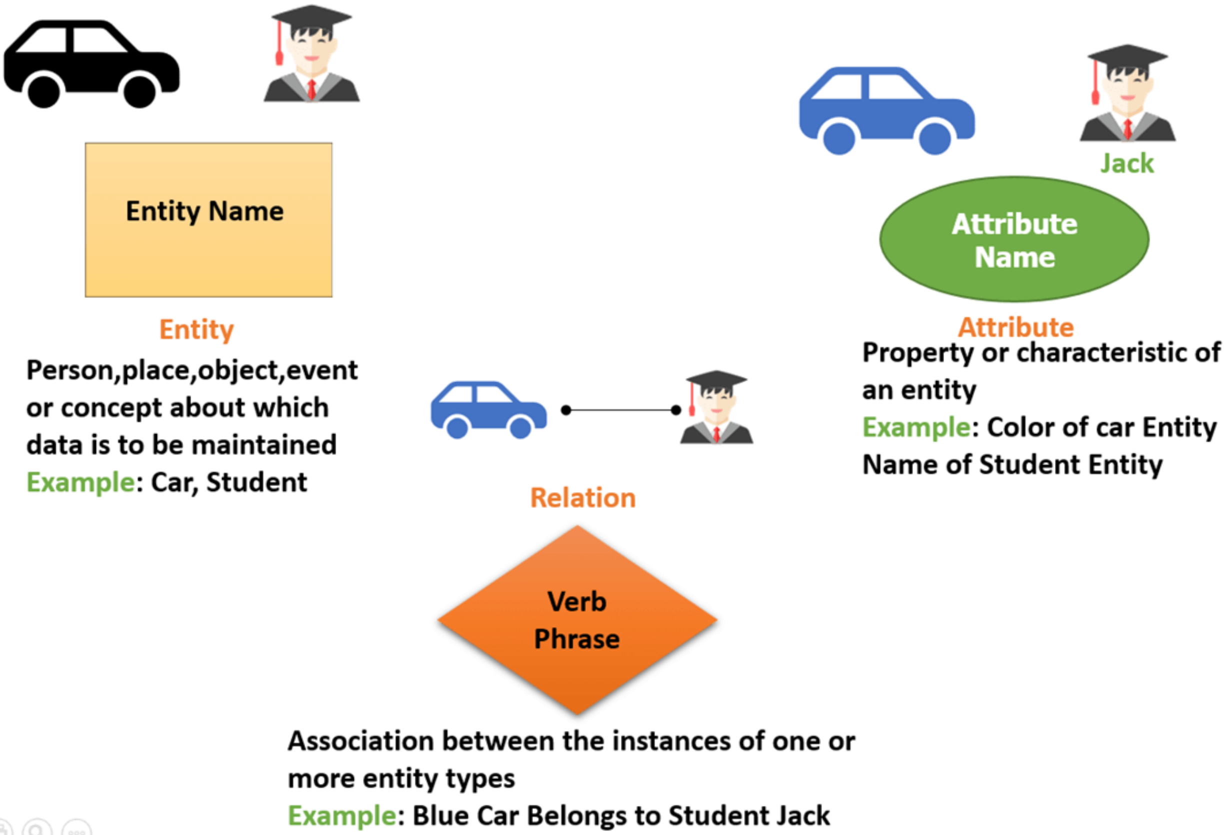
Components of the ER Diagram

This model is based on three basic concepts:

- Entities
- Attributes
- Relationships

ER Diagram Examples

For example, in a University database, we might have entities for Students, Courses, and Lecturers. Students entity can have attributes like Rollno, Name, and DeptID. They might have relationships with Courses and Lecturers.



Person,place,object,event or concept about which data is to be maintained
Example: Car, Student

Property or characteristic of an entity
Example: Color of car Entity Name of Student Entity

Association between the instances of one or more entity types
Example: Blue Car Belongs to Student Jack

Components of the ER Diagram

WHAT IS ENTITY?

A real-world thing either living or non-living that is easily recognizable and nonrecognizable. It is anything in the enterprise that is to be represented in our database. It may be a physical thing or simply a fact about the enterprise or an event that happens in the real world.
An entity can be place, person, object, event or a concept, which stores data in the database. The characteristics of entities are must have an attribute, and a unique key. Every entity is made up of some ‘attributes’ which represent that entity.

Examples of entities:

- **Person:** Employee, Student, Patient
- **Place:** Store, Building
- **Object:** Machine, product, and Car
- **Event:** Sale, Registration, Renewal

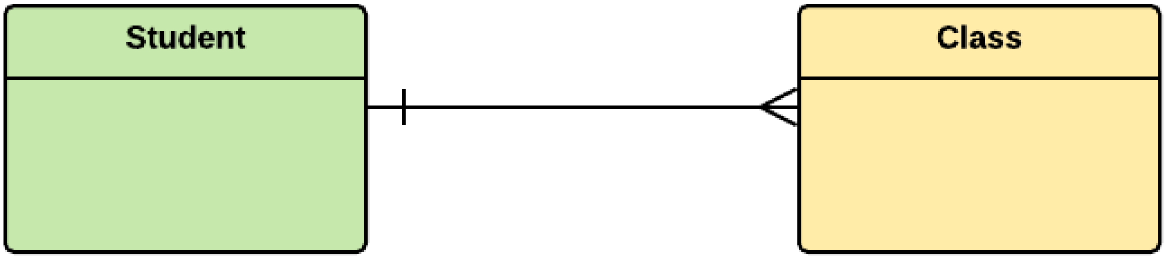
- **Concept:** Account, Course

Notation of an Entity

Entity set:

Student

An entity set is a group of similar kind of entities. It may contain entities with attribute sharing similar values. Entities are represented by their properties, which also called attributes. All attributes have their separate values. For example, a student entity may have a name, age, class, as attributes.



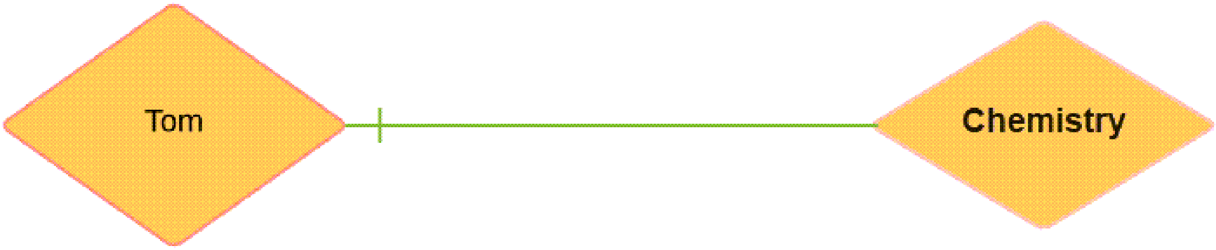
Example of Entities:

A university may have some departments. All these departments employ various lecturers and offer several programs.

Some courses make up each program. Students register in a particular program and enroll in various courses. A lecturer from the specific department takes each course, and each lecturer teaches a various group of students.

Relationship

Relationship is nothing but an association among two or more entities. E.g., Tom works in the Chemistry department.



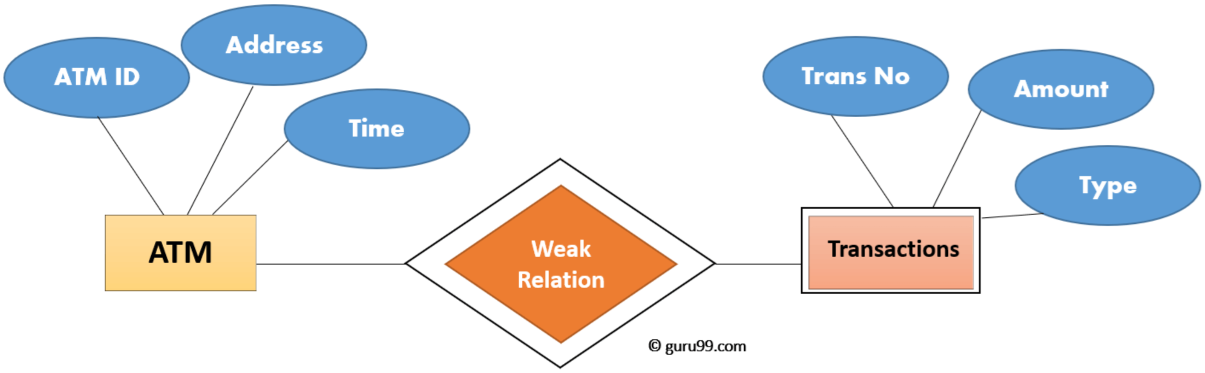
Entities take part in relationships. We can often identify relationships with verbs or verb phrases.

For example:

- You are attending this lecture
- I am giving the lecture
- Just loke entities, we can classify relationships according to relationship-types:
- A student attends a lecture
- A lecturer is giving a lecture.

Weak Entities

A weak entity is a type of entity which doesn't have its key attribute. It can be identified uniquely by considering the primary key of another entity. For that, weak entity sets need to have participation.



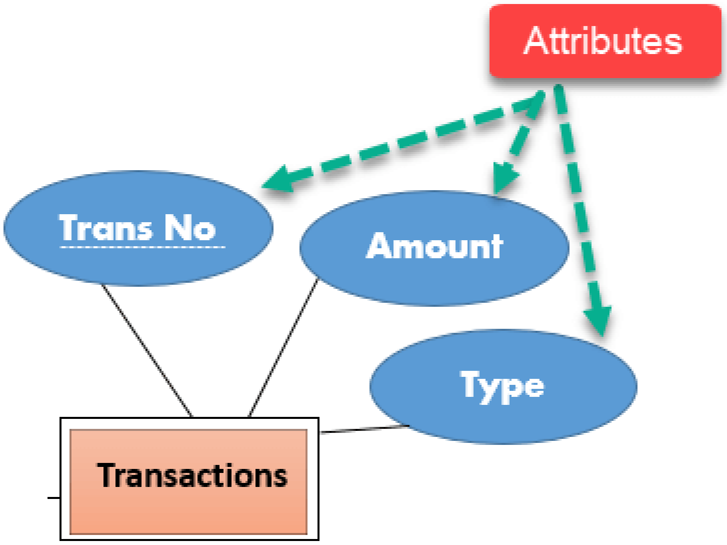
In above ER Diagram examples, “Trans No” is a discriminator within a group of transactions in an ATM.
Let's learn more about a weak entity by comparing it with a Strong Entity

Strong Entity Set	Weak Entity Set
Strong entity set always has a primary key.	It does not have enough attributes to build a primary key.
It is represented by a rectangle symbol.	It is represented by a double rectangle symbol.
It contains a Primary key represented by the underline symbol.	It contains a Partial Key which is represented by a dashed underline symbol.

The member of a strong entity set is called as dominant entity set.	The member of a weak entity set called as a subordinate entity set.
Primary Key is one of its attributes which helps to identify its member.	In a weak entity set, it is a combination of primary key and partial key of the strong entity set.
In the ER diagram the relationship between two strong entity set shown by using a diamond symbol.	The relationship between one strong and a weak entity set shown by using the double diamond symbol.
The connecting line of the strong entity set with the relationship is single.	The line connecting the weak entity set for identifying relationship is double.

Attributes

It is a single-valued property of either an entity-type or a relationship-type. For example, a lecture might have attributes: time, date, duration, place, etc. An attribute in ER Diagram examples, is represented by an Ellipse



Types of Attributes	Description

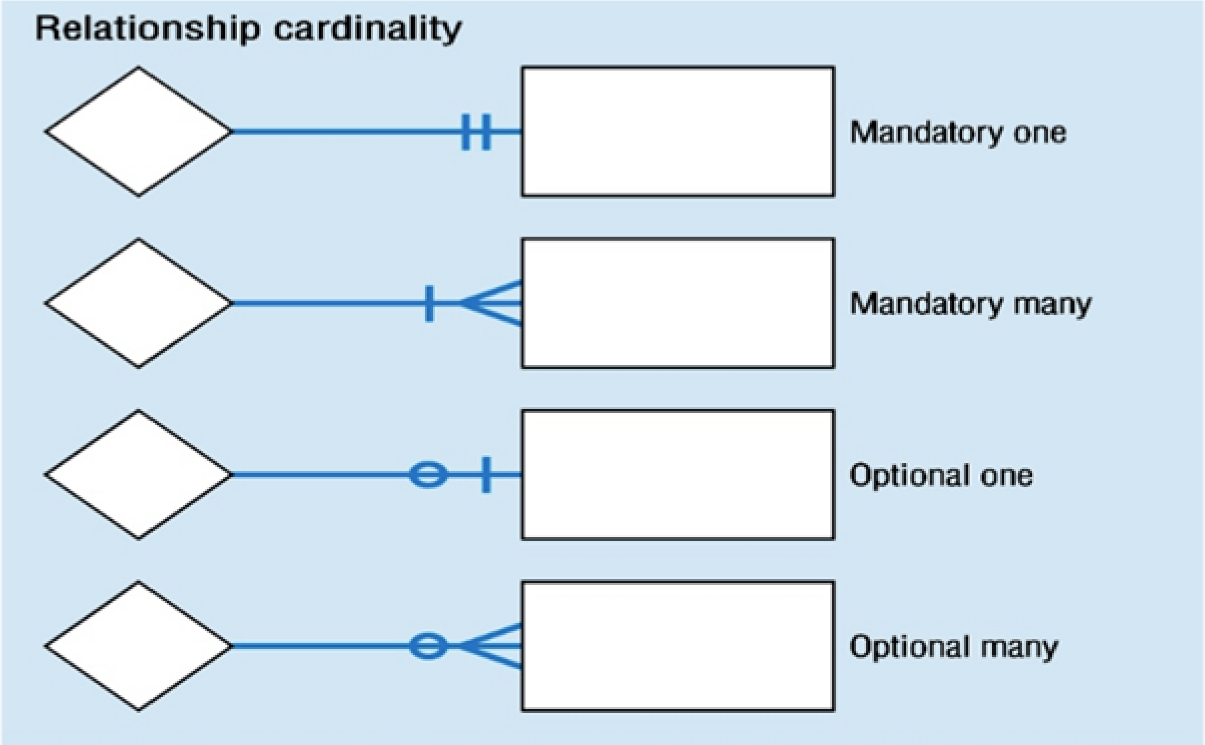
Simple attribute	Simple attributes can’t be divided any further. For example, a student’s contact number. It is also called an atomic value.
Composite attribute	It is possible to break down composite attribute. For example, a student’s full name may be further divided into first name, second name, and last name.
Derived attribute	This type of attribute does not include in the physical database. However, their values are derived from other attributes present in the database. For example, age should not be stored directly. Instead, it should be derived from the DOB of that employee.
Multivalued attribute	Multivalued attributes can have more than one values. For example, a student can have more than one mobile number, email address, etc.

Cardinality

Defines the numerical attributes of the relationship between two entities or entity sets.

Different types of cardinal relationships are:

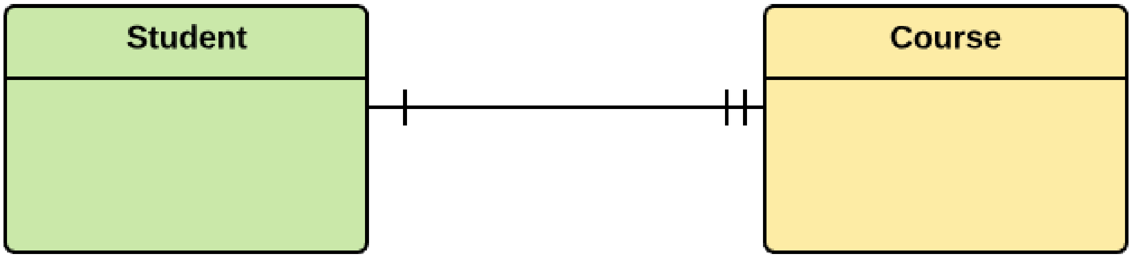
- One-to-One Relationships
- One-to-Many Relationships
- May to One Relationships
- Many-to-Many Relationships



1.One-to-one:

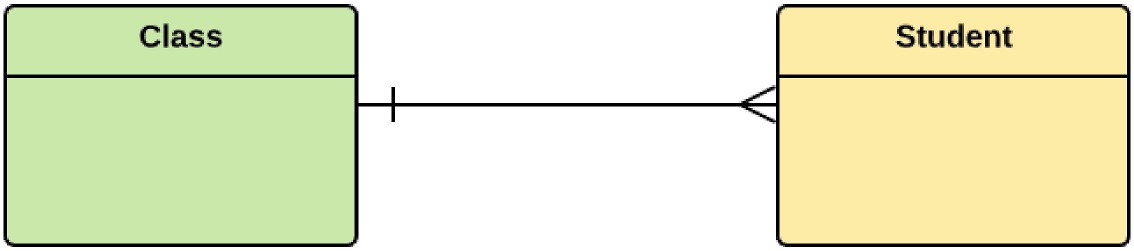
One entity from entity set X can be associated with at most one entity of entity set Y and vice versa.

Example: One student can register for numerous courses. However, all those courses have a single line back to that one student.



2.One-to-many:

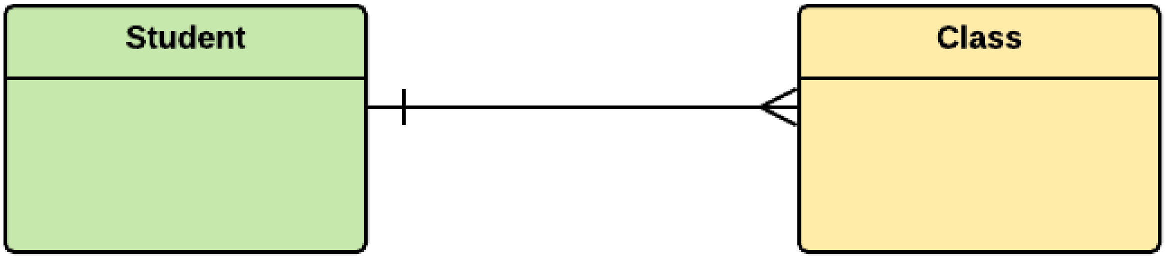
One entity from entity set X can be associated with multiple entities of entity set Y, but an entity from entity set Y can be associated with at least one entity. For example, one class is consisting of multiple students.



3. Many to One

More than one entity from entity set X can be associated with at most one entity of entity set Y. However, an entity from entity set Y may or may not be associated with more than one entity from entity set X.

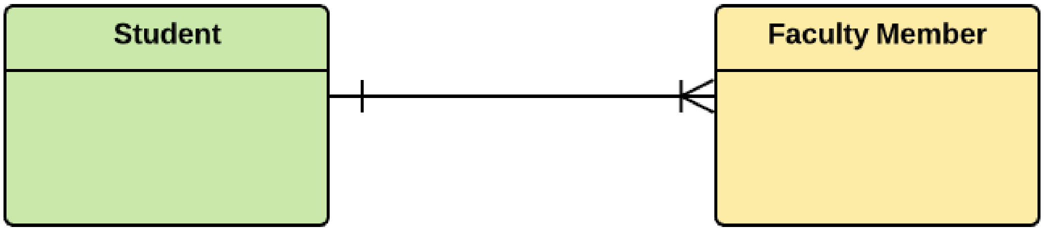
For example, many students belong to the same class.



4. Many to Many:

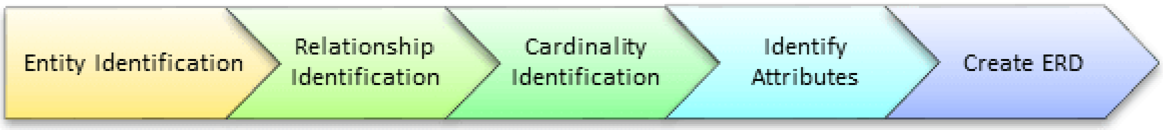
One entity from X can be associated with more than one entity from Y and vice versa.

For example, Students as a group are associated with multiple faculty members, and faculty members can be associated with multiple students.



How to Create an Entity Relationship Diagram (ERD)

Now in this ERD Diagram Tutorial, we will learn how to create an ER Diagram. Following are the steps to create an ER Diagram:



Steps to Create an ER Diagram

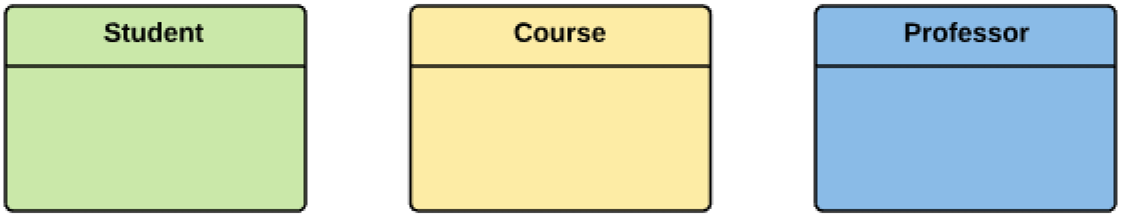
Let's study them with an Entity Relationship Diagram Example:

```
In a university, a Student enrolls in Courses. A student
must be assigned to at least one or more Courses. Each
course is taught by a single Professor. To maintain
instruction quality, a Professor can deliver only one
course
```

Step 1) Entity Identification

We have three entities

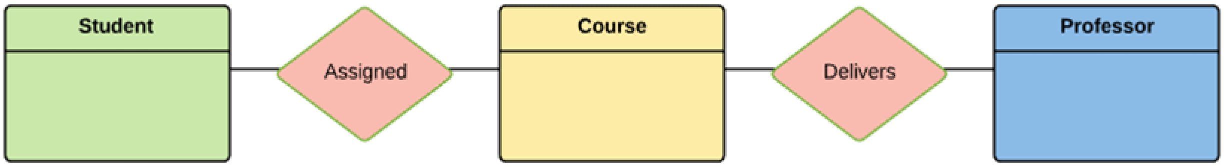
- Student
- Course
- Professor



Step 2) Relationship Identification

We have the following two relationships

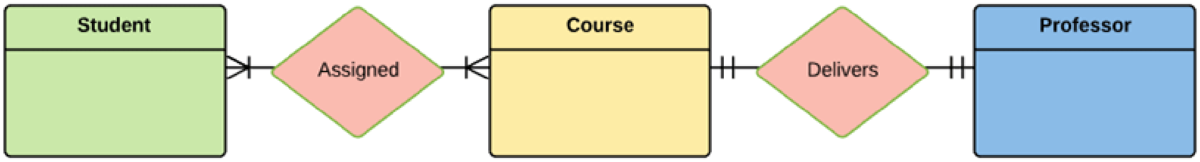
- The student is **assigned** a course
- Professor **delivers** a course



Step 3) Cardinality Identification

For them problem statement we know that,

- A student can be assigned **multiple** courses
- A Professor can deliver only **one** course

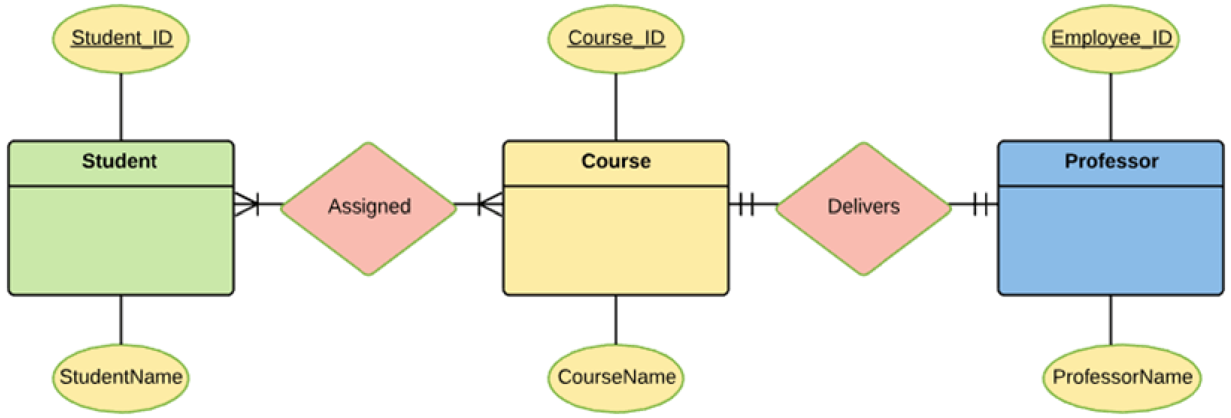


Step 4) Identify Attributes

You need to study the files, forms, reports, data currently maintained by the organization to identify attributes. You can also conduct interviews with various stakeholders to identify entities. Initially, it's important to identify the attributes without mapping them to a particular entity.
Once, you have a list of Attributes, you need to map them to the identified entities. Ensure an attribute is to be paired with exactly one entity. If you think an attribute should belong to more than one entity, use a modifier to make it unique.
Once the mapping is done, identify the primary Keys. If a unique key is not readily available, create one.

Entity	Primary Key	Attribute
Student	Student_ID	StudentName
Professor	Employee_ID	ProfessorName

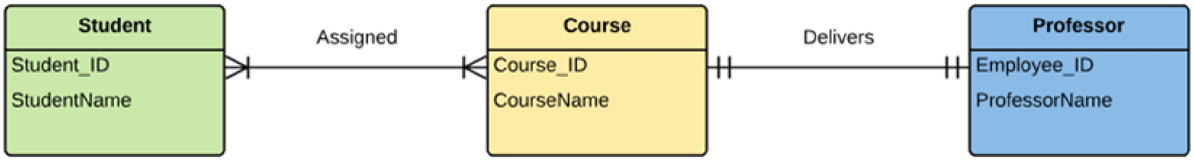
Course	Course_ID	CourseName



For Course Entity, attributes could be Duration, Credits, Assignments, etc. For the sake of ease we have considered just one attribute.

Step 5) Create the ERD Diagram

A more modern representation of Entity Relationship Diagram Example



Best Practices for Developing Effective ER Diagrams

Here are some best practice or example for Developing Effective ER Diagrams.

- Eliminate any redundant entities or relationships
- You need to make sure that all your entities and relationships are properly labeled
- There may be various valid approaches to an ER diagram. You need to make sure that the ER diagram supports all the data you need to store
- You should assure that each entity only appears a single time in the ER diagram

- Name every relationship, entity, and attribute are represented on your diagram
- Never connect relationships to each other
- You should use colors to highlight important portions of the ER diagram

Summary

- ER Model in DBMS stands for an Entity-Relationship model
- The ER model is a high-level data model diagram
- ER diagrams are a visual tool which is helpful to represent the ER model
- ER diagrams in DBMS are blueprint of a database
- Entity relationship diagram DBMS displays the relationships of entity set stored in a database
- ER diagrams help you to define terms related to entity relationship modeling
- ER Model in DBMS is based on three basic concepts: Entities, Attributes & Relationships
- An entity can be place, person, object, event or a concept, which stores data in the database (DBMS)
- Relationship is nothing but an association among two or more entities
- A weak entity is a type of entity which doesn't have its key attribute
- It is a single-valued property of either an entity-type or a relationship-type
- It helps you to defines the numerical attributes of the relationship between two entities or entity sets
- ER- Diagram DBMS is a visual representation of data that describe how data is related to each other
- While Drawing ER diagrams in DBMS, you need to make sure all your entities and relationships are properly labeled.

What are Keys in DBMS?

KEYS in DBMS is an attribute or set of attributes which helps you to identify a row(tuple) in a relation(table). They allow you to find the relation between two tables. Keys help you uniquely identify a row in a table by a combination of one or more columns in that table. Key is also helpful for finding unique record or row from the table. Database key is also helpful for finding unique record or row from the table.

Example:

Employee ID	FirstName	LastName
11	Andrew	Johnson
22	Tom	Wood
33	Alex	Hale

In the above-given example, employee ID is a primary key because it uniquely identifies an employee record. In this table, no other employee can have the same employee ID.

Why do we need a Key?

Here are some reasons for using sql key in the DBMS system.

- Keys help you to identify any row of data in a table. In a real-world application, a table could contain thousands of records. Moreover, the records could be duplicated. Keys in RDBMS ensure that you can uniquely identify a table record despite these challenges.
- Allows you to establish a relationship between and identify the relation between tables
- Help you to enforce identity and integrity in the relationship.

Types of Keys in DBMS (Database Management System)

There are mainly Eight different types of Keys in DBMS and each key has it’s different functionality:

1. Super Key
2. Primary Key
3. Candidate Key
4. Alternate Key
5. Foreign Key
6. Compound Key
7. Composite Key

- **Super Key –** A super key is a group of single or multiple keys which identifies rows in a table.
- **Primary Key –** is a column or group of columns in a table that uniquely identify every row in that table.
- **Candidate Key –** is a set of attributes that uniquely identify tuples in a table. Candidate Key is a super key with no repeated attributes.
- **Alternate Key –** is a column or group of columns in a table that uniquely identify every row in that table.
- **Foreign Key –** is a column that creates a relationship between two tables. The purpose of Foreign keys is to maintain data integrity and allow navigation between two different instances of an entity.
- **Compound Key –** has two or more attributes that allow you to uniquely recognize a specific record. It is possible that each column may not be unique by itself within the database.
- **Composite Key –** is a combination of two or more columns that uniquely identify rows in a table. The combination of columns guarantees uniqueness, though individual uniqueness is not guaranteed.

What is the Super key?

A superkey is a group of single or multiple keys which identifies rows in a table. A Super key may have additional attributes that are not needed for unique identification.

Example:

EmpSSN	EmpNum	Empname
9812345098	AB05	Shown
9876512345	AB06	Roslyn
199937890	AB07	James

In the above-given example, EmpSSN and EmpNum name are superkeys

What is a Primary Key?

PRIMARY KEY in DBMS is a column or group of columns in a table that uniquely identify every row in that table. The Primary Key can't be a duplicate meaning the same value can't appear more than once in the table. A table cannot have more than one primary key.

Rules for defining Primary key:

- Two rows can't have the same primary key value
- It must for every row to have a primary key value.
- The primary key field cannot be null.
- The value in a primary key column can never be modified or updated if any foreign key refers to that primary key.

Example:

In the following example, <code>StudID</code> is a Primary Key.

StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com

3	13	Dana	Natan	mno@yahoo.com

What is the Alternate key?

ALTERNATE KEYS is a column or group of columns in a table that uniquely identify every row in that table. A table can have multiple choices for a primary key but only one can be set as the primary key. All the keys which are not primary key are called an Alternate Key.
Example:
In this table, StudID, Roll No, Email are qualified to become a primary key. But since StudID is the primary key, Roll No, Email becomes the alternative key.

StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

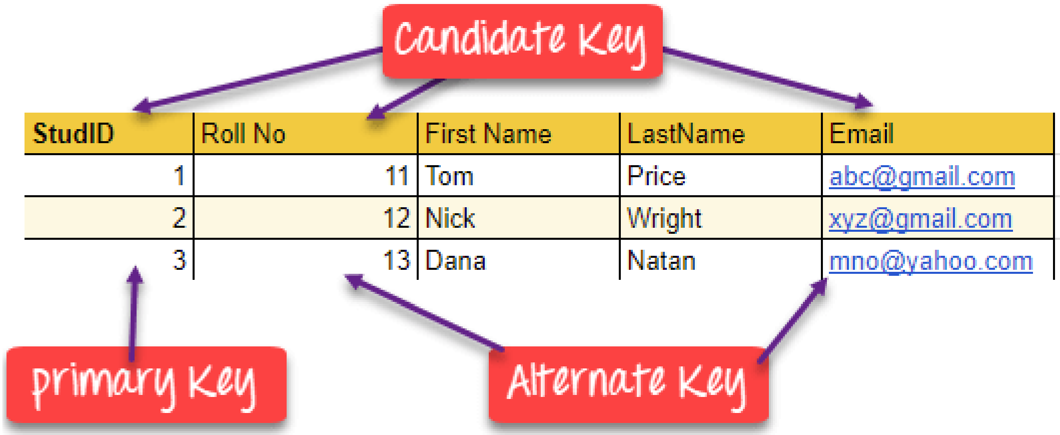
What is a Candidate Key?

CANDIDATE KEY in SQL is a set of attributes that uniquely identify tuples in a table. Candidate Key is a super key with no repeated attributes. The Primary key should be selected from the candidate keys. Every table must have at least a single candidate key. A table can have multiple candidate keys but only a single primary key.
Properties of Candidate key:

- It must contain unique values
- Candidate key in SQL may have multiple attributes
- Must not contain null values
- It should contain minimum fields to ensure uniqueness
- Uniquely identify each record in a table

Candidate key Example: In the given table Stud ID, Roll No, and email are candidate keys which help us to uniquely identify the student record in the table.

StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com



StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Candidate Key
primary Key
Alternate Key

Candidate Key in DBMS

What is the Foreign key?

FOREIGN KEY is a column that creates a relationship between two tables. The purpose of Foreign keys is to maintain data integrity and allow navigation between two different instances of an entity. It acts as a cross-reference between two tables as it references the primary key of another table.

Example:

DeptCode	DeptName
001	Science

002	English
005	Computer

Teacher ID	Fname	Lname
B002	David	Warner
B017	Sara	Joseph
B009	Mike	Brunton

In this key in dbms example, we have two table, teach and department in a school. However, there is no way to see which search work in which department.
In this table, adding the foreign key in Deptcode to the Teacher name, we can create a relationship between the two tables.

Teacher ID	DeptCode	Fname	Lname
B002	002	David	Warner
B017	002	Sara	Joseph
B009	001	Mike	Brunton

This concept is also known as Referential Integrity.

What is the Compound key?

COMPOUND KEY has two or more attributes that allow you to uniquely recognize a specific record. It is possible that each column may not be unique by itself within the database. However, when combined with the other column or columns the combination of composite keys become unique. The purpose of the compound key in database is to uniquely identify each record in the table.

Example:

OrderNo	PorductID	Product Name	Quantity
B005	JAP102459	Mouse	5
B005	DKT321573	USB	10
B005	OMG446789	LCD Monitor	20
B004	DKT321573	USB	15
B002	OMG446789	Laser Printer	3

In this example, OrderNo and ProductID can’t be a primary key as it does not uniquely identify a record. However, a compound key of Order ID and Product ID could be used as it uniquely identified each record.

What is the Composite key?

COMPOSITE KEY is a combination of two or more columns that uniquely identify rows in a table. The combination of columns guarantees uniqueness, though individually uniqueness is not guaranteed. Hence, they are combined to uniquely identify records in a table.
The difference between compound and the composite key is that any part of the compound key can be a foreign key, but the composite key may or maybe not a part of the foreign key.

Difference Between Primary key & Foreign key

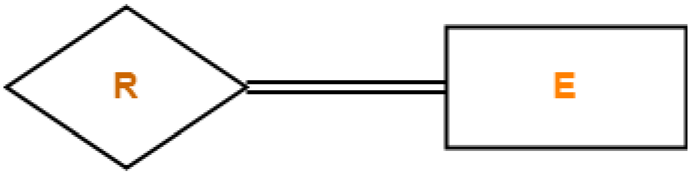
Following is the main difference between primary key and foreign key:

Primary Key	Foreign Key
Helps you to uniquely identify a record in the table.	It is a field in the table that is the primary key of another table.
Primary Key never accept null values.	A foreign key may accept multiple null values.
Primary key is a clustered index and data in the DBMS table are physically organized in the sequence of the clustered index.	A foreign key cannot automatically create an index, clustered or non-clustered. However, you can manually create an index on the foreign key.
You can have the single Primary key in a table.	You can have multiple foreign keys in a table.

Total Participation and Partial Participation with example.

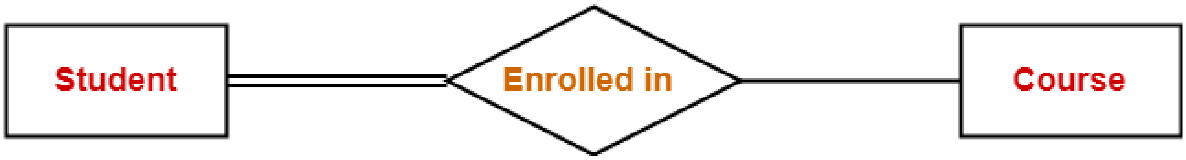
Total Participation-

1. **It specifies that each entity in the entity set must compulsorily participate in at least one relationship instance in that relationship set.That is why, it is also called as mandatory participation.**
2. **Total participation is represented using a double line between the entity set and relationship set.**



Total Participation

Example-

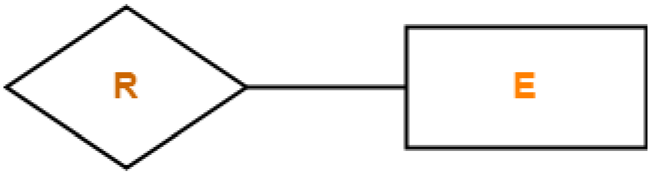


Here,

Double line between the entity set “Student” and relationship set “Enrolled in” signifies total participation. It specifies that each student must be enrolled in at least one course.

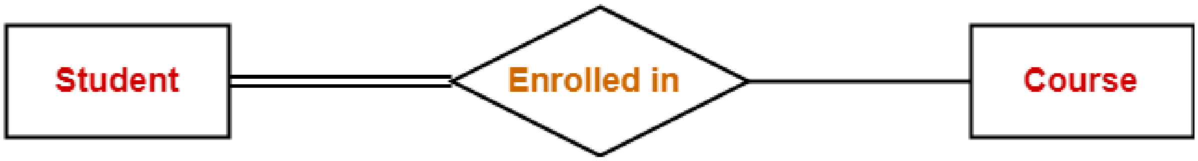
2. Partial Participation-

1. It specifies that each entity in the entity set may or may not participate in the relationship instance in that relationship set. That is why, it is also called as optional participation.
2. Partial participation is represented using a single line between the entity set and relationship set.



Partial Participation

Example-



Here,

Single line between the entity set “Course” and relationship set “Enrolled in” signifies partial participation. It specifies that there might exist some courses for which no enrollments are made.

The Enhanced ER Model (EER)

As the complexity of data increased in the late 1980s, it became more and more difficult to use the traditional ER Model for database modelling. Hence some improvements or enhancements were made to the existing ER Model to make it able to handle the complex applications better.

Hence, as part of the Enhanced ER Model, along with other improvements, three new concepts were added to the existing ER Model, they were:

1. Generalization
2. Specialization
3. Aggregration

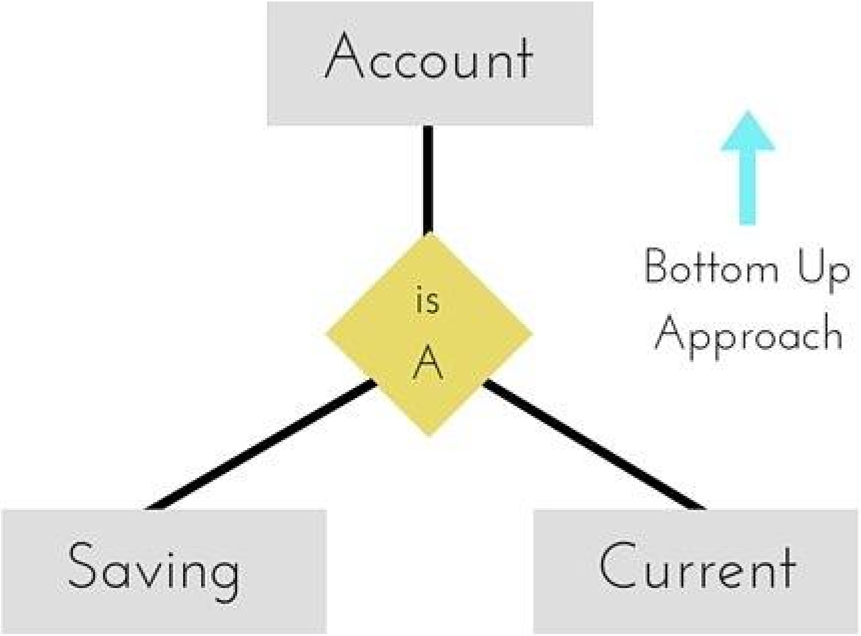
> Generalization, Specialization and Aggregation in ER model are used for data abstraction in which abstraction mechanism is used to hide details of a set of objects.

Let's understand what they are, and why were they added to the existing ER Model

Generalization

Generalization is a bottom-up approach in which two lower level entities combine to form a higher level entity. In generalization, the higher level entity can also combine with other lower level entities to make further higher level entity.

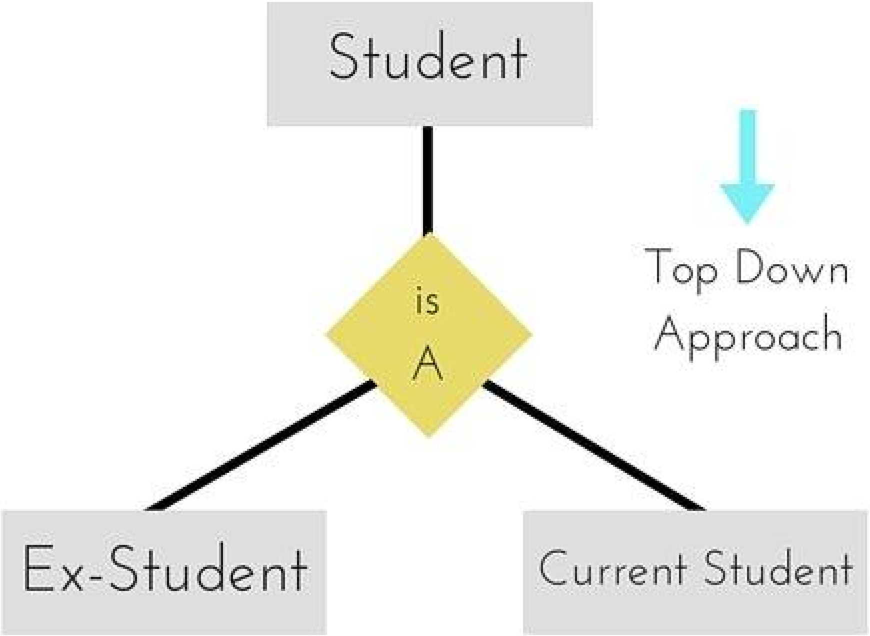
It's more like Superclass and Subclass system, but the only difference is the approach, which is bottom-up. Hence, entities are combined to form a more generalised entity, in other words, sub-classes are combined to form a super-class.



For example, Saving and Current account types entities can be generalised and an entity with name Account can be created, which covers both.

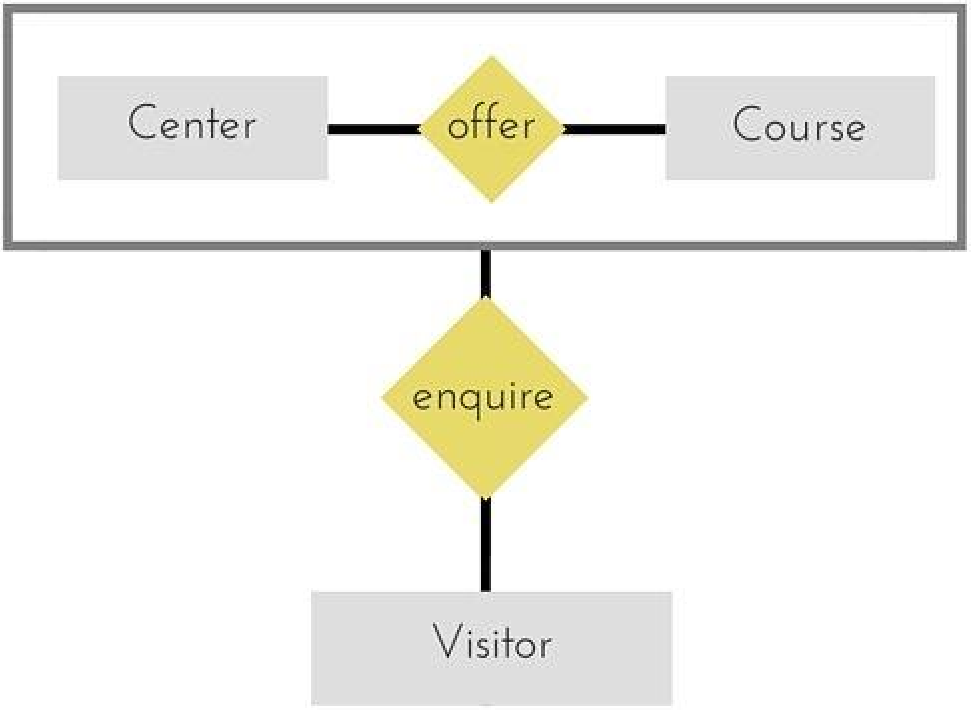
Specialization

Specialization is opposite to Generalization. It is a top-down approach in which one higher level entity can be broken down into two lower level entity. In specialization, a higher level entity may not have any lower-level entity sets, it's possible.



Aggregration

Aggregration is a process when relation between two entities is treated as a single entity.



In the diagram above, the relationship between Center and Course together, is acting as an Entity, which is in relationship with another entity Visitor. Now in real world, if a Visitor or a Student visits a Coaching Center, he/she will never enquire about the center only or just about the course, rather he/she will ask enquire about both.