ER MODEL introduction

The entity-relationship model (or ER model) is a way of graphically representing the logical relationships of entities (or objects) in order to create a database. The ER model was first proposed by Peter Pin-Shan Chen of Massachusetts Institute of Technology (MIT) in the 1970s.

The ER model defines the conceptual view of a database. It works around real-world entities and the associations among them. At view level, the ER model is considered a good option for designing databases.

Entity

An entity can be a real-world object, either animate or inanimate, that can be easily identifiable. For example, in a school database, students, teachers, classes, and courses offered can be considered as entities. All these entities have some attributes or properties that give them their identity.

An entity set is a collection of similar types of entities. An entity set may contain entities with attribute sharing similar values. For example, a Students set may contain all the students of a school; likewise a Teachers set may contain all the teachers of a school from all faculties. Entity sets need not be disjoint.

Entities are represented by means of rectangles. Rectangles are named with the entity set they represent.

Attributes

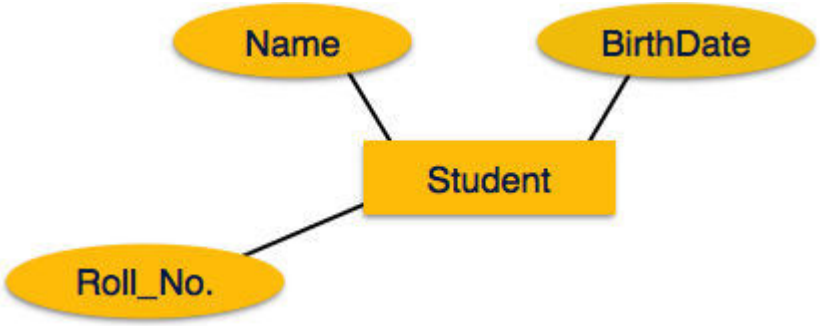
Entities are represented by means of their properties, called **attributes**. All attributes have values. For example, a student entity may have name, class, and age as attributes.

There exists a domain or range of values that can be assigned to attributes. For example, a student's name cannot be a numeric value. It has to be alphabetic. A student's age cannot be negative, etc.

Types of Attributes

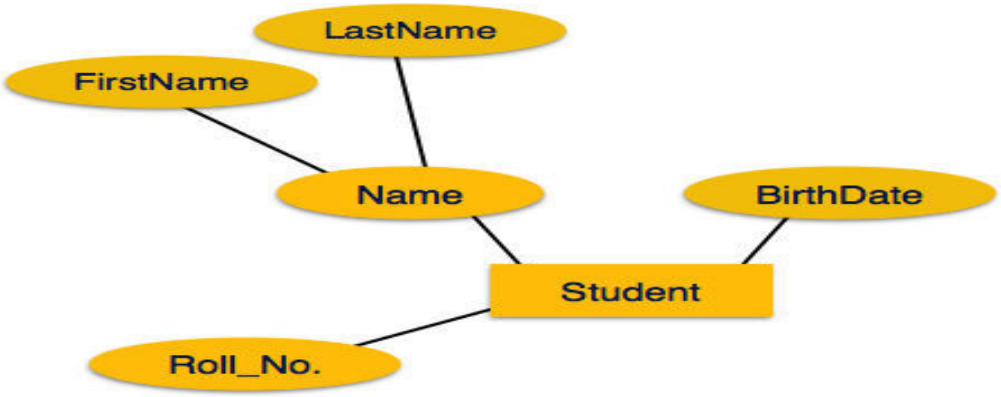
- **Simple attribute** − Simple attributes are atomic values, which cannot be divided further. For example, a student's Roll number is an atomic value of 10 digits.

Attributes are the properties of entities. Attributes are represented by means of ellipses. Every ellipse represents one attribute and is directly connected to its entity (rectangle).



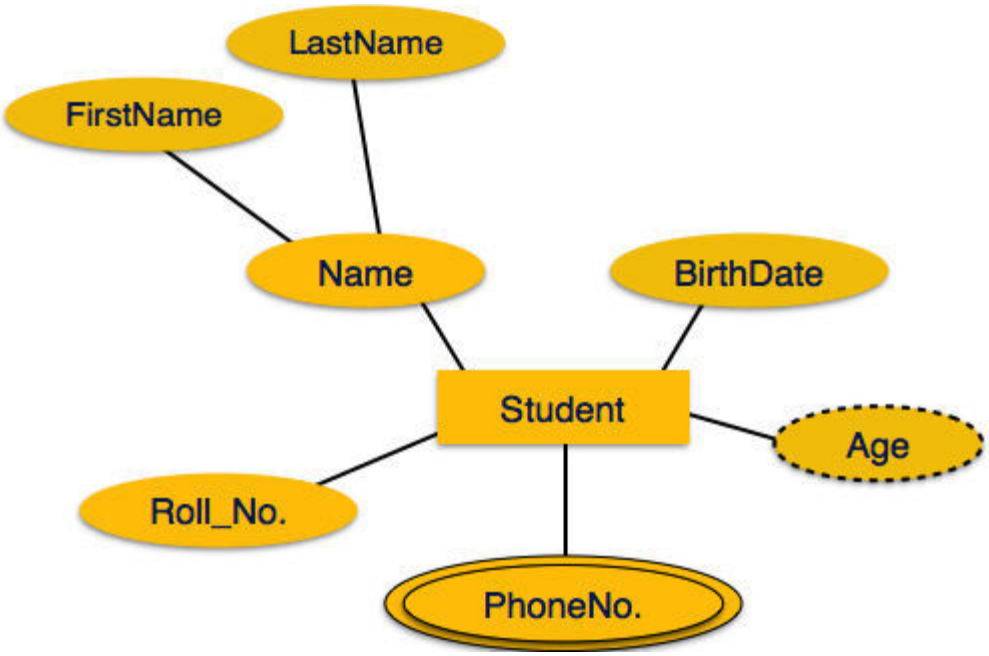
- **Composite attribute** − Composite attributes are made of more than one simple attribute. For example, a student's complete name may have first_name and last_name.

If the attributes are **composite**, they are further divided in a tree like structure. Every node is then connected to its attribute. That is, composite attributes are represented by ellipses that are connected with an ellipse.



- **Derived attribute** − Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database. For example, average_salary in a department should not be saved directly in the database, instead it can be derived. For another example, age can be derived from data_of_birth.

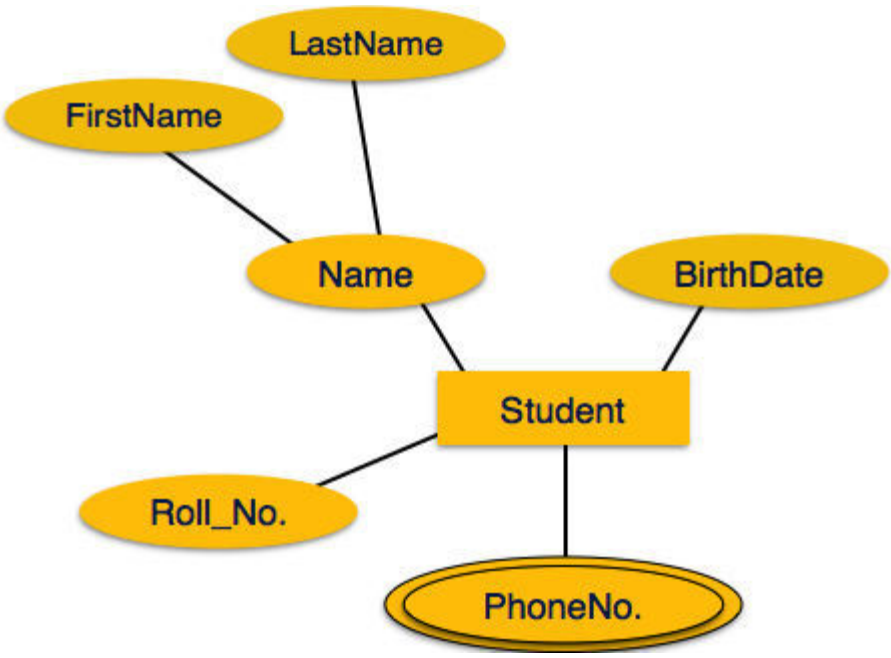
  Derived attributes are depicted by dashed ellipse.



- **Single-value attribute** − Single-value attributes contain single value. For example − Social_Security_Number.

- **Multi-value attribute** − Multi-value attributes may contain more than one values. For example, a person can have more than one phone number, email_address, etc.

- **Multivalued** attributes are depicted by double ellipse



These attribute types can come together in a way like −

- simple single-valued attributes
- simple multi-valued attributes
- composite single-valued attributes
- composite multi-valued attributes

Entity-Sets(keys)

Key is an attribute or collection of attributes that uniquely identifies an entity among entity set.

For example, the roll_number of a student makes him/her identifiable among students.

- **Super Key** − A set of attributes (one or more) that collectively identifies an entity in an entity set.
- **Candidate Key** − A minimal super key is called a candidate key. An entity set may have more than one candidate key.
- **Primary Key** − A primary key is one of the candidate keys chosen by the database designer to uniquely identify the entity set.

Relationship

The association among entities is called a relationship. For example, an employee **works_at** a department, a student **enrolls** in a course. Here, Works_at and Enrolls are called relationships.

Relationship Sets

A set of relationships of similar type is called a relationship set. Like entities, a relationship too can have attributes. These attributes are called **descriptive attributes**.

Degree of Relationship

The number of participating entities in a relationship defines the degree of the relationship.

- Binary = degree 2
- Ternary = degree 3
- n-ary = degree

There are three types of relationships that exist between Entities.

- Binary Relationship
- Recursive Relationship
- Ternary Relationship

Binary Relationship

Binary Relationship means relation between two Entities. This is further divided into three types.

1. **One to One :** This type of relationship is rarely seen in real world.

The above example describes that one student can enroll only for one course and a course will also have only one Student. This is not what you will usually see in relationship.

2. **One to Many :** It reflects business rule that one entity is associated with many number of same entity. The example for this relation might sound a little weird, but this menas that one student can enroll to many courses, but one course will have one Student.

The arrows in the diagram describes that one student can enroll for only one course.

3. **Many to One :** It reflects business rule that many entities can be associated with just one entity. For example, Student enrolls for only one Course but a Course can have many Students.

4. **Many to Many :**

The above diagram represents that many students can enroll for more than one courses.

Recursive Relationship

When an Entity is related with itself it is known as **Recursive** Relationship.

Ternary Relationship

Relationship of degree three is called Ternary relationship.

Let us now learn how the ER Model is represented by means of an ER diagram. Any object, for example, entities, attributes of an entity, relationship sets, and attributes of relationship sets, can be represented with the help of an ER diagram

Constraints:

An E-R enterprise schema may define certain constraints to which the contents of a database must confirm.Two of the most important types of constraints are

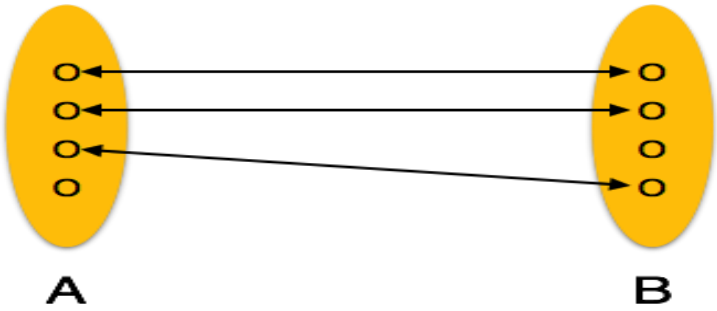
1.Mapping cardinalities

2.participation constraints

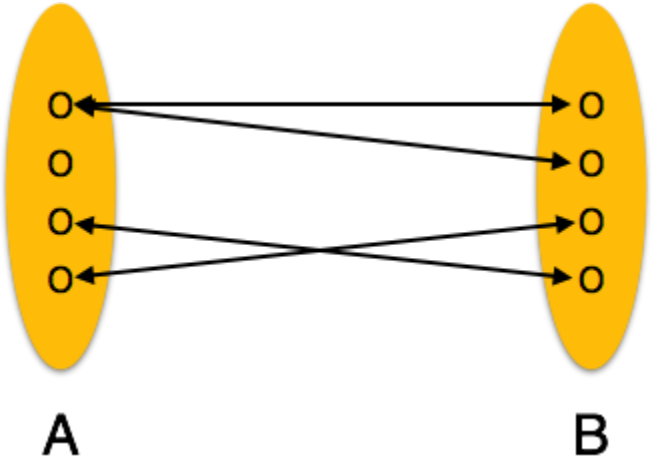
Mapping Cardinalities

Cardinality defines the number of entities in one entity set, which can be associated with the number of entities of other set via relationship set.

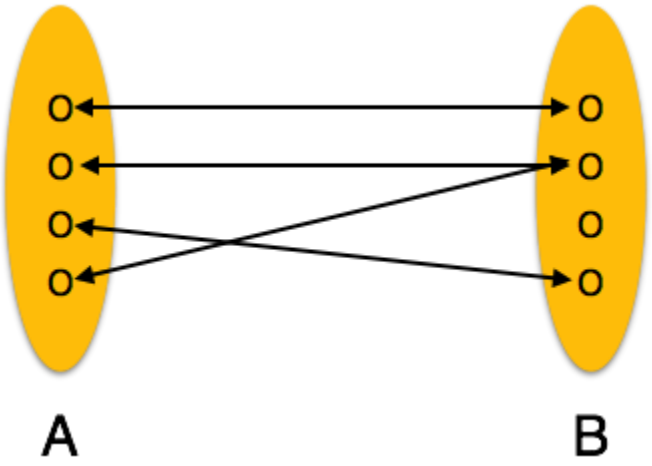
- **One-to-one** − One entity from entity set A can be associated with at most one entity of entity set B and vice versa.



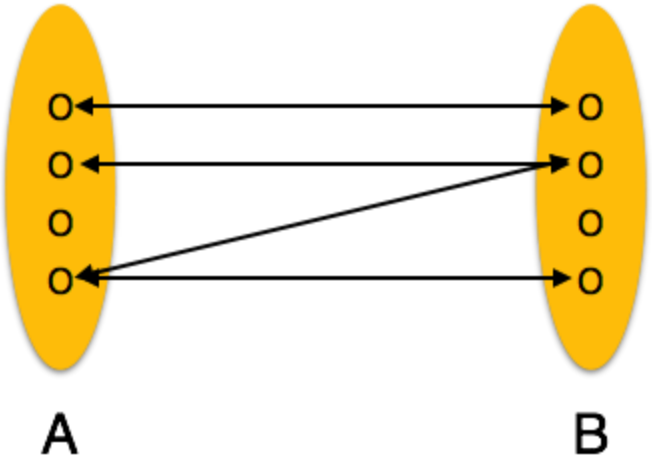
- **One-to-many** − One entity from entity set A can be associated with more than one entities of entity set B however an entity from entity set B, can be associated with at most one entity.



- **Many-to-one** − More than one entities from entity set A can be associated with at most one entity of entity set B, however an entity from entity set B can be associated with more than one entity from entity set A.

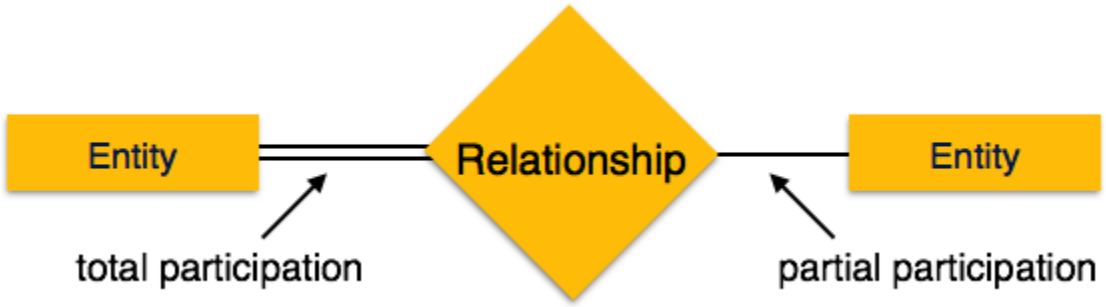


- **Many-to-many** − One entity from A can be associated with more than one entity from B and vice versa.



Participation Constraints

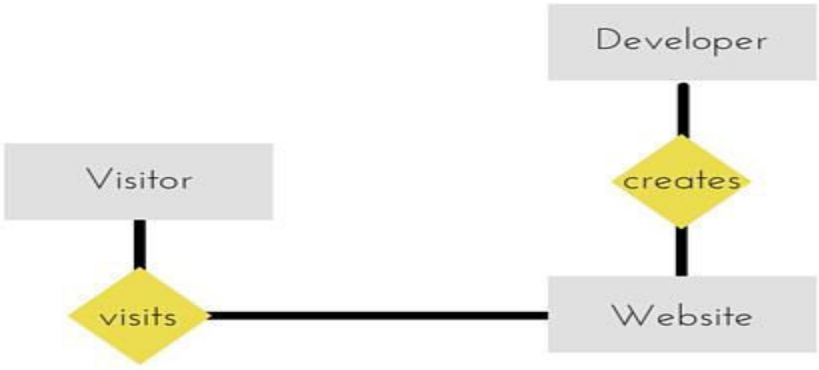
- **Total Participation** − Each entity is involved in the relationship. Total participation is represented by double lines.
- **Partial participation** − Not all entities are involved in the relationship. Partial participation is represented by single lines.



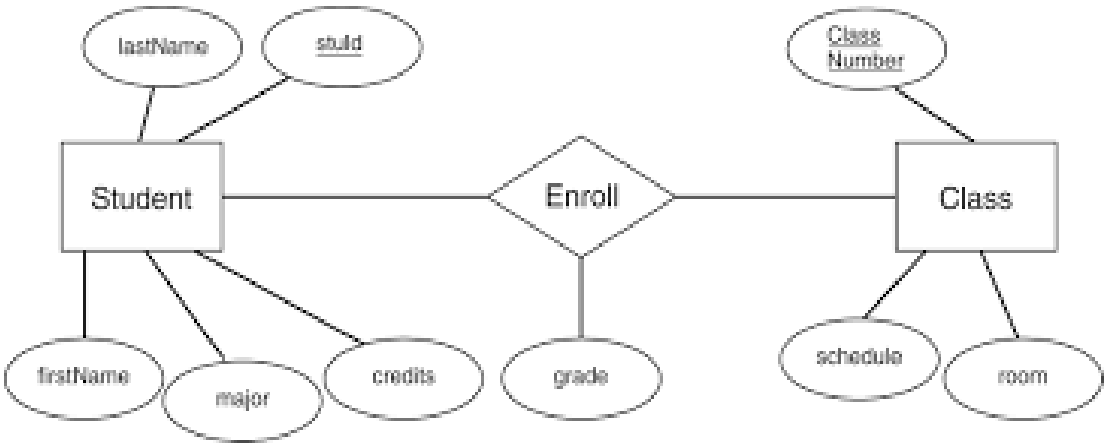
The ER Model has the power of expressing database entities in a conceptual hierarchical manner. As the hierarchy goes up, it generalizes the view of entities, and as we go deep in the hierarchy, it gives us the detail of every entity included.

E-R Diagram

ER-Diagram is a visual representation of data that describes how data is related to each other. Some examples are

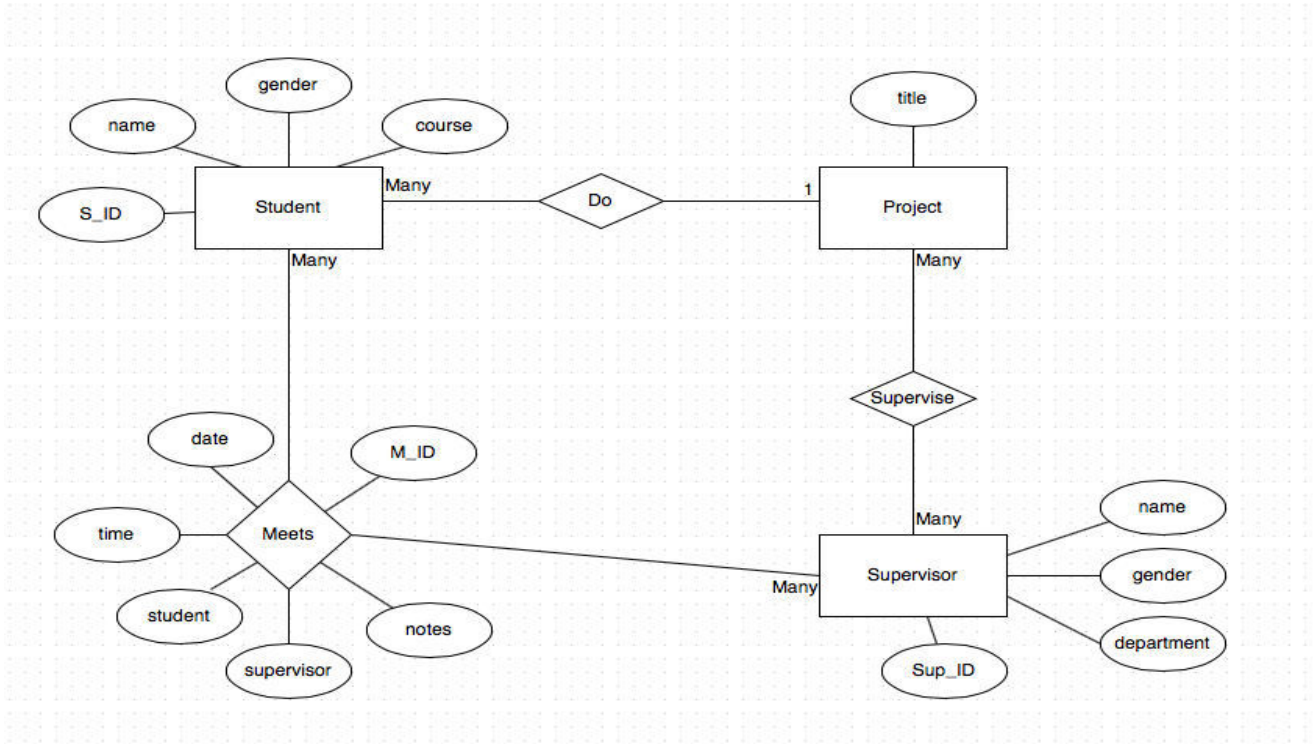


Another example for E-R diagram

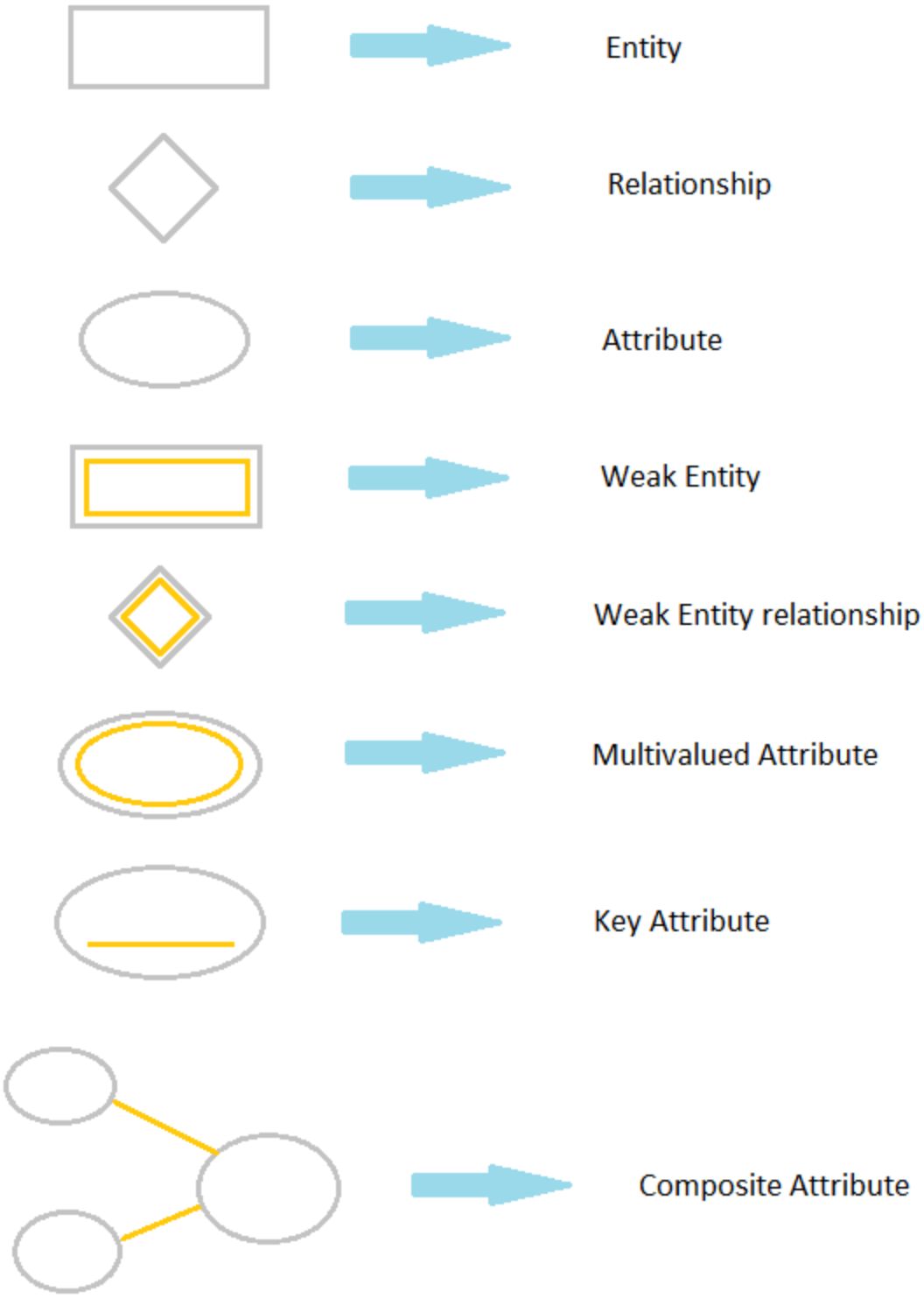


Here is a sample database (E-R diagram)

Students (name, gender, course) do projects(title). Each project has two supervisors (name, gender, department). All students do a project but not all projects get taken. More than one student can do the same project. Students meet one of their supervisors regular and these meetings are recorded (date, time, student, supervisor, notes).



Symbols and Notations



Components of E-R Diagram

The E-R diagram has three main components.

1) Entity.

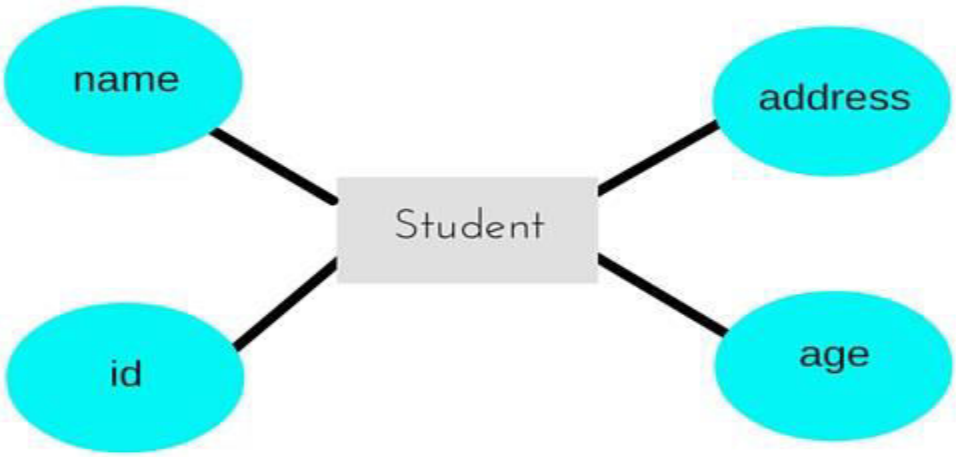
An **Entity** can be any object, place, person or class. In E-R Diagram, an **entity** is represented using rectangles. Consider an example of an Organisation. Employee, Manager, Department, Product and many more can be taken as entities from an Organisation.

Weak Entity

Weak entity is an entity that depends on another entity. Weak entity doen't have key attribute of their own. Double rectangle represents weak entity.

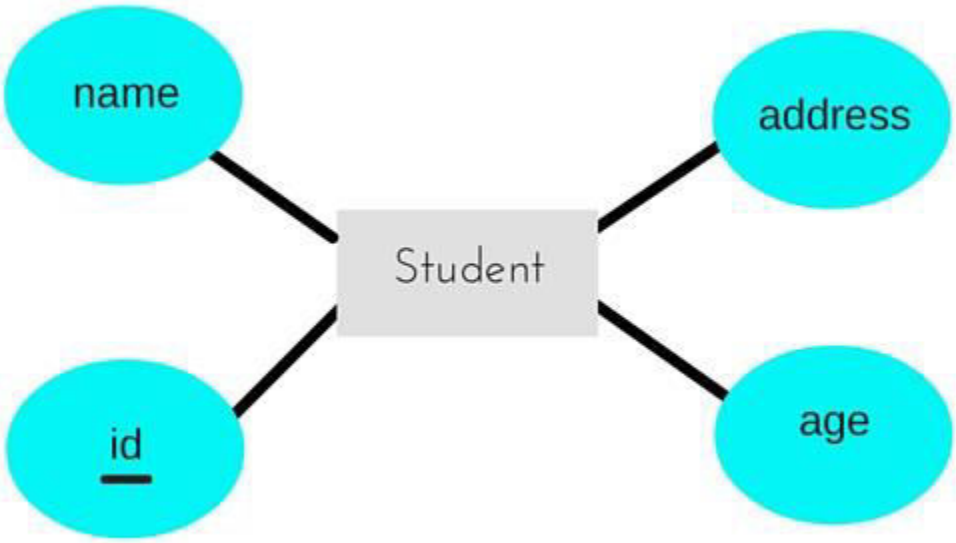
2) Attribute

An **Attribute** describes a property or characterstic of an entity. For example, Name, Age, Address etc can be attributes of a Student. An attribute is represented using eclipse.



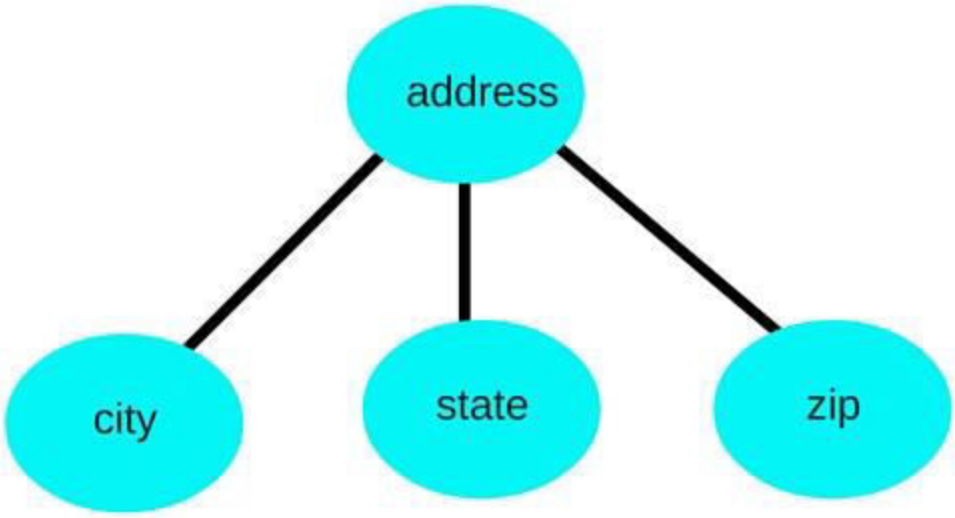
Key Attribute

Key attribute represents the main characterstic of an Entity. It is used to represent Primary key. Ellipse with underlying lines represent Key Attribute.



Composite Attribute

An attribute can also have their own attributes. These attributes are known as **Composite** attribute.



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3) Relationship

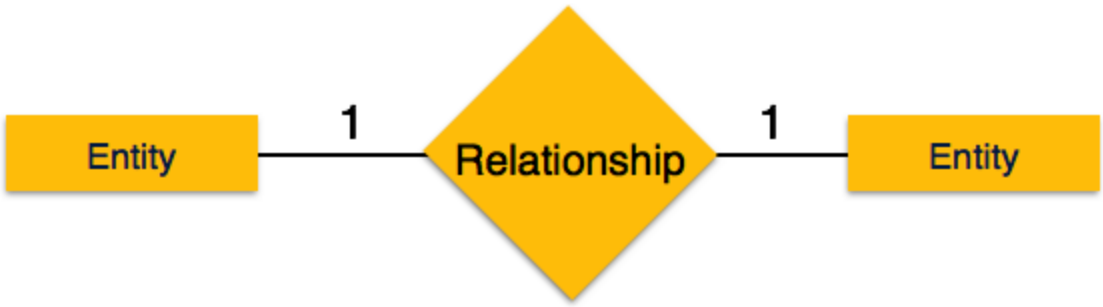
A Relationship describes relations between **entities**. Relationship is represented using diamonds.

All the entities (rectangles) participating in a relationship, are connected to it by a line.

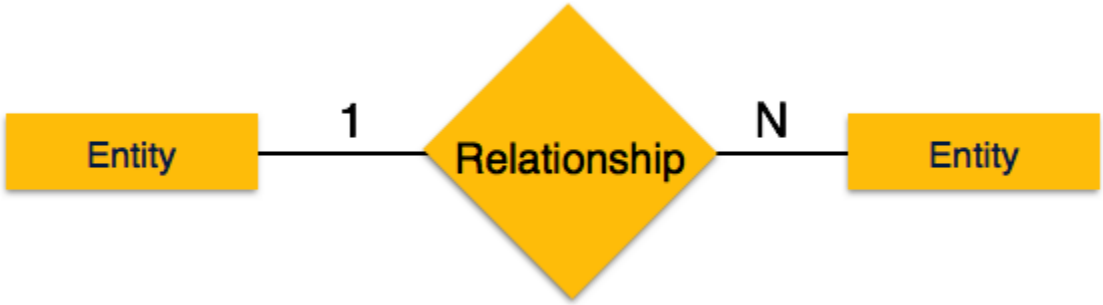
Binary Relationship and Cardinality

A relationship where two entities are participating is called a **binary relationship**. Cardinality is the number of instance of an entity from a relation that can be associated with the relation.

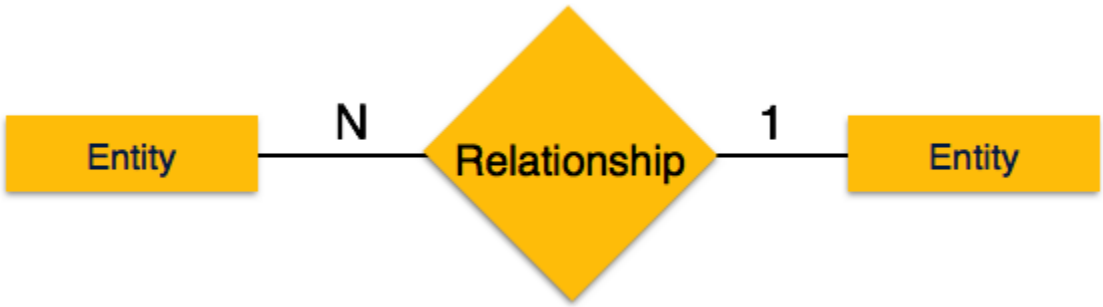
- **One-to-one** − When only one instance of an entity is associated with the relationship, it is marked as '1:1'. The following image reflects that only one instance of each entity should be associated with the relationship. It depicts one-to-one relationship.



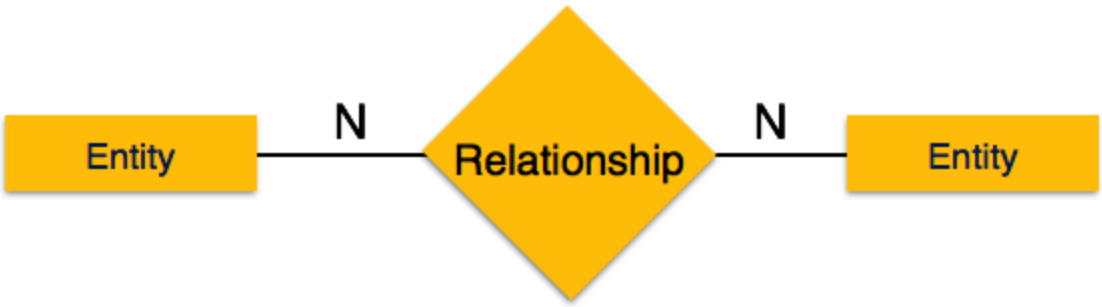
- **One-to-many** − When more than one instance of an entity is associated with a relationship, it is marked as '1:N'. The following image reflects that only one instance of entity on the left and more than one instance of an entity on the right can be associated with the relationship. It depicts one-to-many relationship.



- **Many-to-one** − When more than one instance of entity is associated with the relationship, it is marked as 'N:1'. The following image reflects that more than one instance of an entity on the left and only one instance of an entity on the right can be associated with the relationship. It depicts many-to-one relationship.



- **Many-to-many** − The following image reflects that more than one instance of an entity on the left and more than one instance of an entity on the right can be associated with the relationship. It depicts many-to-many relationship.



Going up in this structure is called **generalization**, where entities are clubbed together to represent a more generalized view. For example, a particular student named Mira can be generalized along with all the students. The entity shall be a student, and further, the student is a person. The reverse is called **specialization** where a person is a student, and that student is Mira.

Entity Type Hierarchies(subclass and super class)

One entity type might be a subtype of another(very similar to subclasses in OO programming)

Entity type Y is a subtype (subclass) of an entity type X if and only if every Y is necessarily an X. A subclass entity inherits all attributes and relationships of its superclass entity. This property is called the attribute and relationship inheritance. A subclass entity may have its own specific attributes and relationships (together with all the attributes and relationships it inherits from the superclass).

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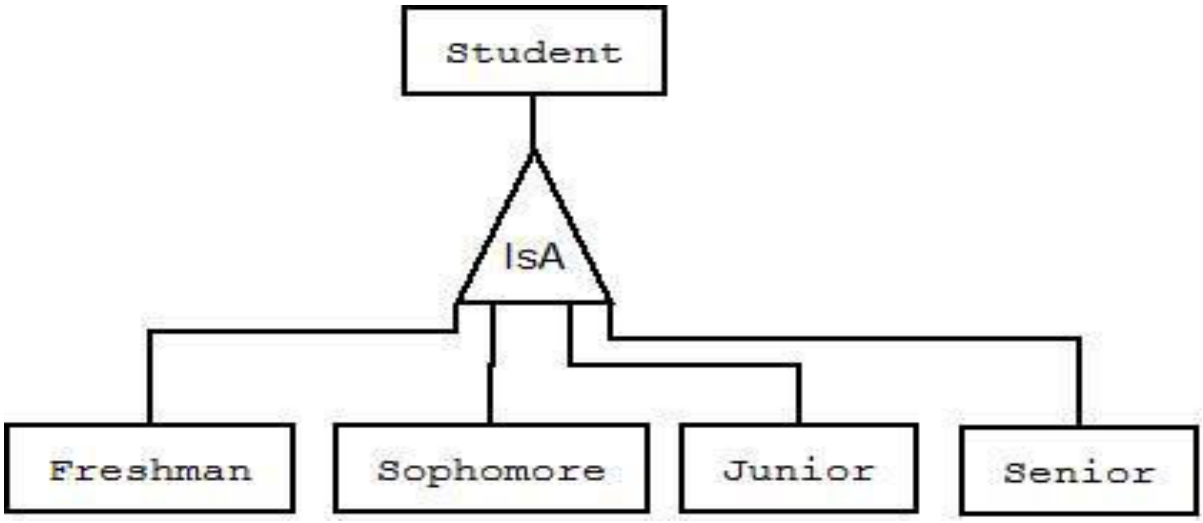


- **Freshman** is a subtype of **Student**

A relationship exists between a **Freshman** entity and the corresponding **Student** entity

- e.g., **Freshman** John is related to **Student** John

This relationship is called ***IsA***

- Freshman IsA Student, an eagle IsA bird
- The two entities related by IsA are always descriptions of the same real-world object
- Typically used in databases to be implemented as Object Oriented Models.
- The upper entity type is the more abstract entity type (supertype) from which the lower entities inherit its attributes

Properties of IsA

Inheritance - All attributes of the supertype apply to the subtype.

- E.g., *GPA* attribute of **Student** applies to **Freshman**
- The subtype *inherits* all attributes of its supertype.
- The key of the supertype is also the key of the subtype

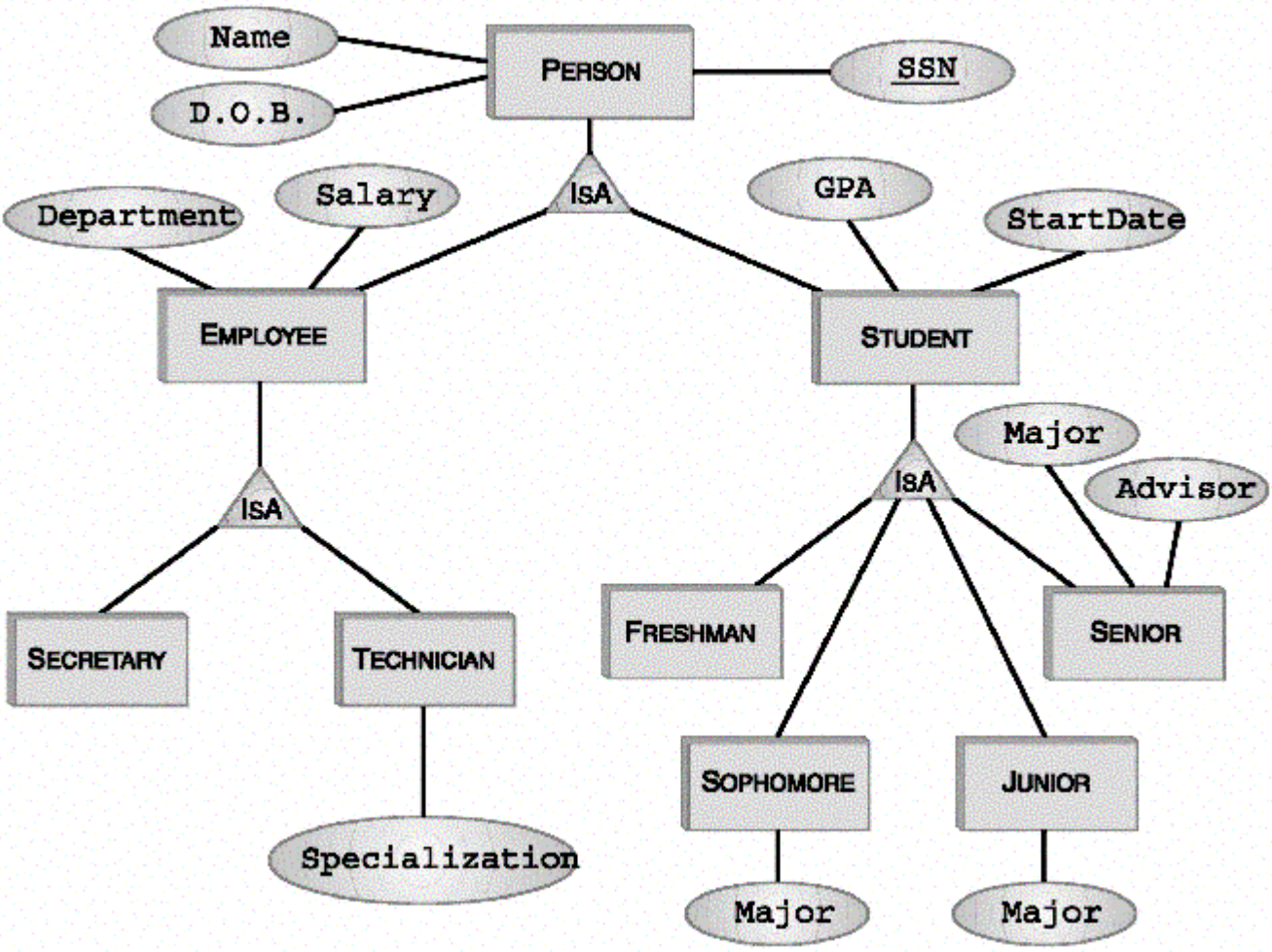
Transitivity - This property creates a hierarchy of IsA relationships

- **Student** is subtype of **Person**,
  Freshman is subtype of **Student**,
  therefore **Freshman** is also a subtype of **Person**

Advantage: Used to create a more concise and readable E-R diagram. It best maps to object oriented approaches either to databases or related applications.

- Attributes common to different entity sets need not be repeated
- They can be grouped in one place as attributes of the supertype
- Attributes of (sibling) subtypes are likely to be different (and should be for this to be very useful)

Example of IsA



Type Hierarchy associated constraints may apply:

Covering constraint: Union of subtype entities is equal to set of supertype entities. An entity is an element of at least one subtype

- Employee is either a secretary or a technician (or even both) -- does not cover
- Class standing of Fr, So, Jn, Sn covers

Disjointness constraint: Sets of subtype entities are disjoint from one another (i.e., the sets are mutually exclusive). An entity can be an element of at most one entity

- Freshman, Sophomore, Junior, Senior are disjoint sets, and in this case covers, too.
- The above Employee is not disjoint

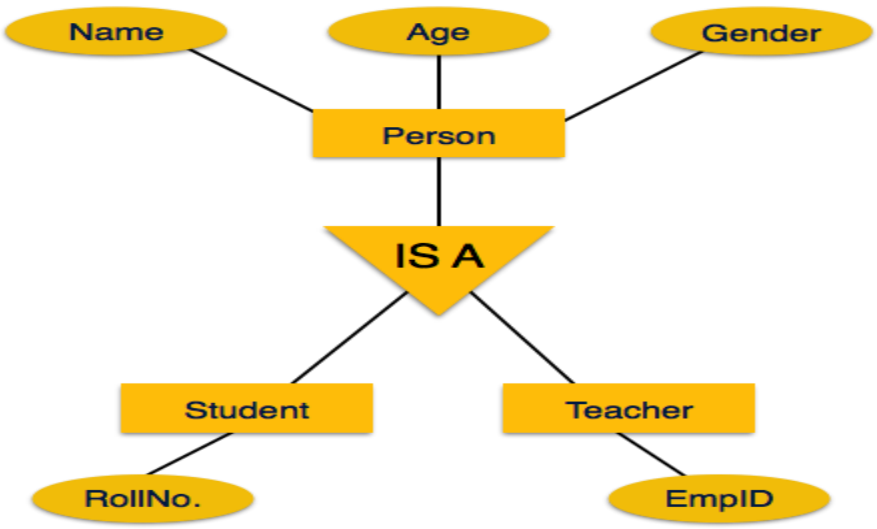
NOTE:

- Participation constraints dictate whether each instance (member) of a superclass must participate as an instance (member) of a subclass.
- Disjoint constraints define whether it is possible for an instance of a superclass to simultaneously be a member of one or more subclasses.
- A superclass/subclass hierarchy is a hierarchical structure of a superclass and its various subclasses in which each subclass has exactly one superclass.

Inheritance

We use all the above features of ER-Model in order to create classes of objects in object-oriented programming. The details of entities are generally hidden from the user; this process known as **abstraction**.

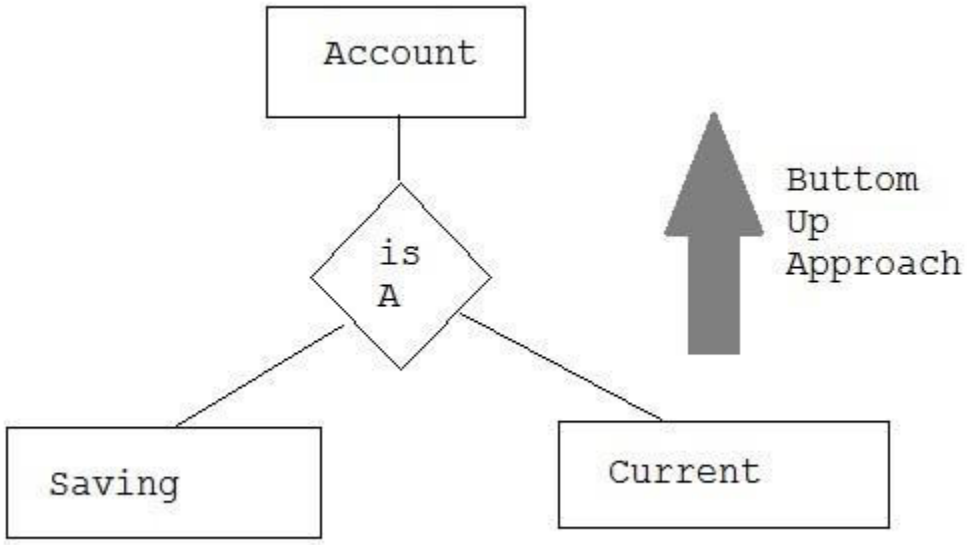
Inheritance is an important feature of Generalization and Specialization. It allows lower-level entities to inherit the attributes of higher-level entities.



For example, the attributes of a Person class such as name, age, and gender can be inherited by lower-level entities such as Student or Teacher.

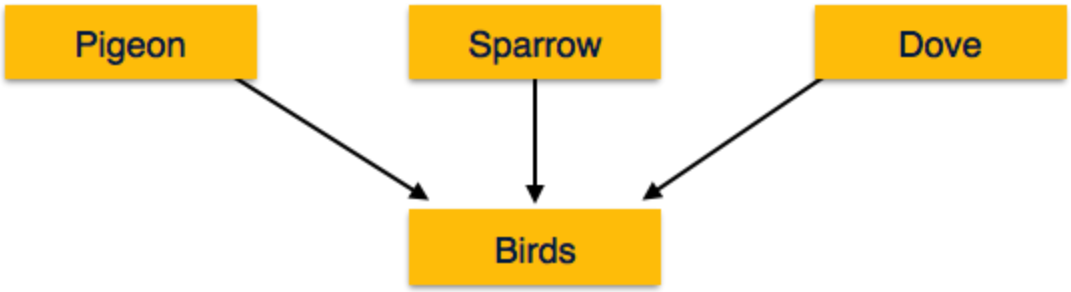
Generalization

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 entity to make further higher level entity.



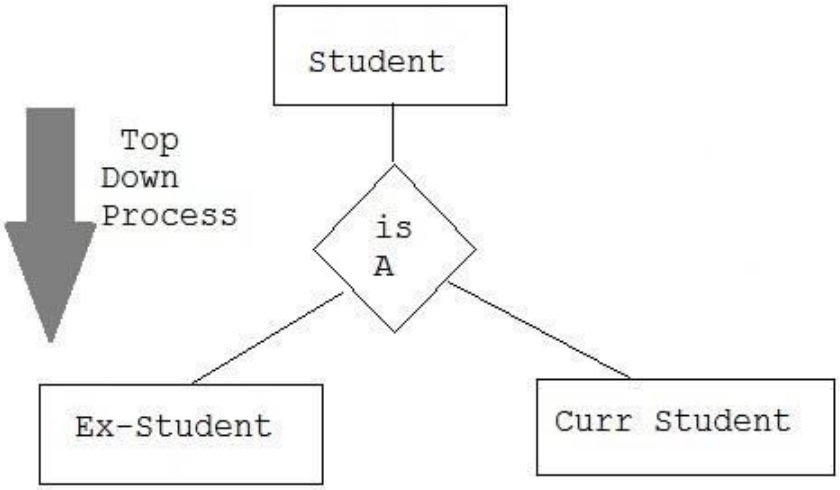
(OR)

As mentioned above, the process of generalizing entities, where the generalized entities contain the properties of all the generalized entities, is called generalization. In generalization, a number of entities are brought together into one generalized entity based on their similar characteristics. For example, pigeon, house sparrow, crow and dove can all be generalized as Birds.



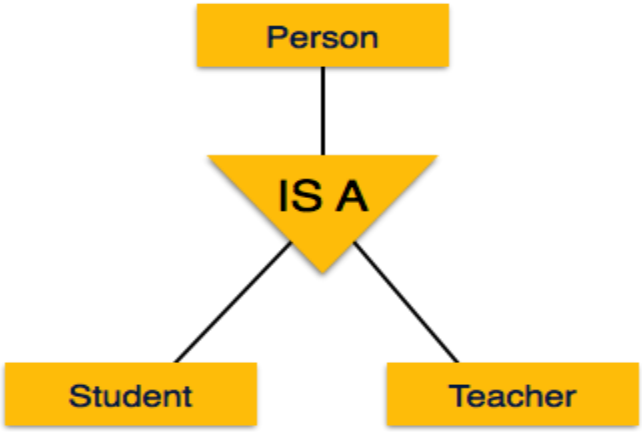
Specialization

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, some higher level entities may not have lower-level entity sets at all.



(OR)

Specialization is the opposite of generalization. In specialization, a group of entities is divided into sub-groups based on their characteristics. Take a group 'Person' for example. A person has name, date of birth, gender, etc. These properties are common in all persons, human beings. But in a company, persons can be identified as employee, employer, customer, or vendor, based on what role they play in the company.



Similarly, in a school database, persons can be specialized as teacher, student, or a staff, based on what role they play in school as entities.

Creating tables with relationships: (tables with primary key and foreign key relationship)

The relationship between 2 tables matches the Primary Key in one of the tables with a Foreign Key in the second table.

If a table has a primary key defined on any field(s), then you can not have two records having the same value of that field(s).

Example:

Consider the structure of the two tables as follows:

CUSTOMERS table:

```
CREATE TABLE CUSTOMERS(
       ID   INT              NOT NULL,
       NAME VARCHAR (20)     NOT NULL,
       AGE  INT              NOT NULL,
       ADDRESS  CHAR (25) ,
       SALARY   DECIMAL (18, 2),
       PRIMARY KEY (ID)
);
```

ORDERS table:

```
CREATE TABLE ORDERS (
       ID          INT        NOT NULL,
       DATE        DATETIME,
       CUSTOMER_ID INT references CUSTOMERS(ID),
       AMOUNT     double,
       PRIMARY KEY (ID)
);
```

If ORDERS table has already been created, and the foreign key has not yet been set, use the syntax for specifying a foreign key by altering a table.

```
ALTER TABLE ORDERS
   ADD FOREIGN KEY (Customer_ID) REFERENCES CUSTOMERS (ID);
```

DROP a FOREIGN KEY Constraint:

To drop a FOREIGN KEY constraint, use the following SQL:

```
ALTER TABLE ORDERS
   DROP FOREIGN KEY;
```

Implementation of key and Integrity Constraints:

Integrity constraints are used to ensure accuracy and consistency of data in a relational database. Data integrity is handled in a relational database through the concept of referential integrity.

There are many types of integrity constraints that play a role in referential integrity (RI). These constraints include Primary Key, Foreign Key, Unique Constraints and other constraints mentioned above.

Constraints can be specified when the table is created (inside the CREATE TABLE statement) or after the table is created (inside the ALTER TABLE statement).

SQL CREATE TABLE + CONSTRAINT Syntax

```
CREATE TABLE table_name
(
column_name1 data_type(size) constraint_name,
```

```
column_name2 data_type(size) constraint_name,
column_name3 data_type(size) constraint_name,
....
);
```

In SQL, we have the following constraints:

1. Specifying Attribute constraints and attribute Defaults(notnull,unique,default)

2. Specifying Key and Referential Integrity Constraints(primary,foreign key)

3. Giving names to Constraints: using Keyword CONSTRAINT we can give names to constraint

4. Specifying Constraints on Tuples Using CHECK

- **NOT NULL** - Indicates that a column cannot store NULL value
- **UNIQUE** - Ensures that each row for a column must have a unique value
- **PRIMARY KEY** - A combination of a NOT NULL and UNIQUE. Ensures that a column (or combination of two or more columns) have an unique identity which helps to find a particular record in a table more easily and quickly
- **FOREIGN KEY** - Ensure the referential integrity of the data in one table to match values in another table
- **CHECK** - Ensures that the value in a column meets a specific condition
- **DEFAULT** - Specifies a default value when specified none for this column

SQL NOT NULL Constraint

The NOT NULL constraint enforces a column to NOT accept NULL values.

The NOT NULL constraint enforces a field to always contain a value. This means that you cannot insert a new record, or update a record without adding a value to this field.

The following SQL enforces the "P_Id" column and the "LastName" column to not accept NULL values:

Example

```
CREATE TABLE PersonsNotNull
(
P_Id int NOT NULL,
LastName varchar(255) NOT NULL,
```

```
FirstName varchar(255),
Address varchar(255),
City varchar(255)
)
```

SQL UNIQUE Constraint on CREATE TABLE

The following SQL creates a UNIQUE constraint on the "P_Id" column when the "Persons" table is created:

SQL Server / Oracle / MS Access:

```
CREATE TABLE Persons
(
P_Id int NOT NULL UNIQUE,
LastName varchar(255) NOT NULL,
FirstName varchar(255),
Address varchar(255),
City varchar(255)
)
```

SQL UNIQUE Constraint on ALTER TABLE

To create a UNIQUE constraint on the "P_Id" column when the table is already created, use the following SQL:

MySQL / SQL Server / Oracle / MS Access:

```
ALTER TABLE Persons
ADD UNIQUE (P_Id)
```

To DROP a UNIQUE Constraint

To drop a UNIQUE constraint, use the following SQL:

SQL Server / Oracle / MS Access:

```
ALTER TABLE Persons
DROP CONSTRAINT uc_PersonID
```

SQL PRIMARY KEY Constraint

The PRIMARY KEY constraint uniquely identifies each record in a database table.

Primary keys must contain UNIQUE values.

A primary key column cannot contain NULL values.

Most tables should have a primary key, and each table can have only ONE primary key.

SQL PRIMARY KEY Constraint on CREATE TABLE

The following SQL creates a PRIMARY KEY on the "P_Id" column when the "Persons" table is created:

MySQL:

```
CREATE TABLE Persons
(
P_Id int NOT NULL,
LastName varchar(255) NOT NULL,
FirstName varchar(255),
Address varchar(255),
City varchar(255),
PRIMARY KEY (P_Id)
)
```

SQL Server / Oracle / MS Access:

```
CREATE TABLE Persons
(
P_Id int NOT NULL PRIMARY KEY,
LastName varchar(255) NOT NULL,
FirstName varchar(255),
Address varchar(255),
City varchar(255)
)
```

To allow naming of a PRIMARY KEY constraint, and for defining a PRIMARY KEY constraint on multiple columns, use the following SQL syntax:

MySQL / SQL Server / Oracle / MS Access:

```
CREATE TABLE Persons
(
```

```
P_Id int NOT NULL,
LastName varchar(255) NOT NULL,
FirstName varchar(255),
Address varchar(255),
City varchar(255),
CONSTRAINT pk_PersonID PRIMARY KEY (P_Id,LastName)
)
```

Note: In the example above there is only ONE PRIMARY KEY (pk_PersonID). However, the VALUE of the primary key is made up of TWO COLUMNS (P_Id + LastName).

SQL PRIMARY KEY Constraint on ALTER TABLE

To create a PRIMARY KEY constraint on the "P_Id" column when the table is already created, use the following SQL:

MySQL / SQL Server / Oracle / MS Access:

```
ALTER TABLE Persons
ADD PRIMARY KEY (P_Id)
```

To allow naming of a PRIMARY KEY constraint, and for defining a PRIMARY KEY constraint on multiple columns, use the following SQL syntax:

MySQL / SQL Server / Oracle / MS Access:

```
ALTER TABLE Persons
ADD CONSTRAINT pk_PersonID PRIMARY KEY (P_Id,LastName)
```

Note: If you use the ALTER TABLE statement to add a primary key, the primary key column(s) must already have been declared to not contain NULL values (when the table was first created).

To DROP a PRIMARY KEY Constraint

To drop a PRIMARY KEY constraint, use the following SQL:

MySQL:

```
ALTER TABLE Persons
DROP PRIMARY KEY
```

SQL Server / Oracle / MS Access:

```
ALTER TABLE Persons
DROP CONSTRAINT pk_PersonID
```

SQL FOREIGN KEY Constraint

A FOREIGN KEY in one table points to a PRIMARY KEY in another table.

Let's illustrate the foreign key with an example. Look at the following two tables:

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

The "Orders" table:

O_Id	OrderNo	P_Id
1	77895	3
2	44678	3
3	22456	2
4	24562	1

Note that the "P_Id" column in the "Orders" table points to the "P_Id" column in the "Persons" table.

The "P_Id" column in the "Persons" table is the PRIMARY KEY in the "Persons" table.

The "P_Id" column in the "Orders" table is a FOREIGN KEY in the "Orders" table.

The FOREIGN KEY constraint is used to prevent actions that would destroy links between tables.

The FOREIGN KEY constraint also prevents invalid data from being inserted into the foreign key column, because it has to be one of the values contained in the table it points to.

SQL FOREIGN KEY Constraint on CREATE TABLE

The following SQL creates a FOREIGN KEY on the "P_Id" column when the "Orders" table is created:

MySQL:

```
CREATE TABLE Orders
(
O_Id int NOT NULL,
OrderNo int NOT NULL,
P_Id int,
PRIMARY KEY (O_Id),
FOREIGN KEY (P_Id) REFERENCES Persons(P_Id)
)
```

SQL Server / Oracle / MS Access:

```
CREATE TABLE Orders
(
O_Id int NOT NULL PRIMARY KEY,
OrderNo int NOT NULL,
P_Id int FOREIGN KEY REFERENCES Persons(P_Id)
)
```

To allow naming of a FOREIGN KEY constraint, and for defining a FOREIGN KEY constraint on multiple columns, use the following SQL syntax:

MySQL / SQL Server / Oracle / MS Access:

```
CREATE TABLE Orders
(
```

```
O_Id int NOT NULL,
OrderNo int NOT NULL,
P_Id int,
PRIMARY KEY (O_Id),
CONSTRAINT fk_PerOrders FOREIGN KEY (P_Id)
REFERENCES Persons(P_Id)
)
```

SQL FOREIGN KEY Constraint on ALTER TABLE

To create a FOREIGN KEY constraint on the "P_Id" column when the "Orders" table is already created, use the following SQL:

MySQL / SQL Server / Oracle / MS Access:

```
ALTER TABLE Orders
ADD FOREIGN KEY (P_Id)
REFERENCES Persons(P_Id)
```

To allow naming of a FOREIGN KEY constraint, and for defining a FOREIGN KEY constraint on multiple columns, use the following SQL syntax:

MySQL / SQL Server / Oracle / MS Access:

```
ALTER TABLE Orders
ADD CONSTRAINT fk_PerOrders
FOREIGN KEY (P_Id)
REFERENCES Persons(P_Id)
```

To DROP a FOREIGN KEY Constraint

To drop a FOREIGN KEY constraint, use the following SQL:

MySQL:

```
ALTER TABLE Orders
DROP FOREIGN KEY fk_PerOrders
```

SQL Server / Oracle / MS Access:

```
ALTER TABLE Orders
DROP CONSTRAINT fk_PerOrders
```

Nested queries and sub queries:

A Subquery or Inner query or Nested query is a query within another SQL query and embedded within the WHERE clause.

A subquery is used to return data that will be used in the main query as a condition to further restrict the data to be retrieved.

Subqueries can be used with the SELECT, INSERT, UPDATE, and DELETE statements along with the operators like =, <, >, >=, <=, IN, BETWEEN etc.

There are a few rules that subqueries must follow:

- Subqueries must be enclosed within parentheses.
- A subquery can have only one column in the SELECT clause, unless multiple columns are in the main query for the subquery to compare its selected columns.
- An ORDER BY cannot be used in a subquery, although the main query can use an ORDER BY. The GROUP BY can be used to perform the same function as the ORDER BY in a subquery.
- Subqueries that return more than one row can only be used with multiple value operators, such as the IN operator.
- The SELECT list cannot include any references to values that evaluate to a BLOB, ARRAY, CLOB, or NCLOB.
- A subquery cannot be immediately enclosed in a set function.
- The BETWEEN operator cannot be used with a subquery; however, the BETWEEN operator can be used within the subquery.

Subqueries with the SELECT Statement:

Subqueries are most frequently used with the SELECT statement. The basic syntax is as follows:

```
SELECT column_name [, column_name ]
FROM   table1 [, table2 ]
WHERE  column_name OPERATOR
```

```
      (SELECT column_name [, column_name ]
      FROM table1 [, table2 ]
      [WHERE])
```

Example:

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Now, let us check following subquery with SELECT statement:

```
SQL> SELECT *
     FROM CUSTOMERS
     WHERE ID IN (SELECT ID
                  FROM CUSTOMERS
                  WHERE SALARY > 4500) ;
```

This would produce the following result

```
+----+----------+-----+---------+----------+
| ID | NAME     | AGE | ADDRESS | SALARY   |
+----+----------+-----+---------+----------+
|  4 | Chaitali |  25 | Mumbai  |  6500.00 |
|  5 | Hardik   |  27 | Bhopal  |  8500.00 |
|  7 | Muffy    |  24 | Indore  | 10000.00 |
+----+----------+-----+---------+----------+
```

Subqueries with the INSERT Statement:

Subqueries also can be used with INSERT statements. The INSERT statement uses the data returned from the subquery to insert into another table. The selected data in the subquery can be modified with any of the character, date or number functions.

The basic syntax is as follows:

```
INSERT INTO table_name [ (column1 [, column2 ]) ]
           SELECT [ *|column1 [, column2 ]
           FROM table1 [, table2 ]
           [ WHERE VALUE OPERATOR ]
```

Example:

Consider a table CUSTOMERS_BKP with similar structure as CUSTOMERS table. Now to copy complete CUSTOMERS table into CUSTOMERS_BKP, following is the syntax:

```
SQL> INSERT INTO CUSTOMERS_BKP
     SELECT * FROM CUSTOMERS
     WHERE ID IN (SELECT ID
                  FROM CUSTOMERS) ;
```

Subqueries with the UPDATE Statement:

The subquery can be used in conjunction with the UPDATE statement. Either single or multiple columns in a table can be updated when using a subquery with the UPDATE statement.

The basic syntax is as follows:

```
UPDATE table
SET column_name = new_value
[ WHERE OPERATOR [ VALUE ]
   (SELECT COLUMN_NAME
   FROM TABLE_NAME)
   [ WHERE) ]
```

Example:

Assuming, we have CUSTOMERS_BKP table available which is backup of CUSTOMERS table.

Following example updates SALARY by 0.25 times in CUSTOMERS table for all the customers whose AGE is greater than or equal to 27:

```
SQL> UPDATE CUSTOMERS
     SET SALARY = SALARY * 0.25
     WHERE AGE IN (SELECT AGE FROM CUSTOMERS_BKP
                   WHERE AGE >= 27 );
```

This would impact two rows and finally CUSTOMERS table would have the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  35 | Ahmedabad |   125.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  2125.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Subqueries with the DELETE Statement:

The subquery can be used in conjunction with the DELETE statement like with any other statements mentioned above.

The basic syntax is as follows:

```
DELETE FROM TABLE_NAME
[ WHERE OPERATOR [ VALUE ]
   (SELECT COLUMN_NAME
   FROM TABLE_NAME)
   [ WHERE) ]
```

Example:

Assuming, we have CUSTOMERS_BKP table available which is backup of CUSTOMERS table.

Following example deletes records from CUSTOMERS table for all the customers whose AGE is greater than or equal to 27:

```
SQL> DELETE FROM CUSTOMERS
     WHERE AGE IN (SELECT AGE FROM CUSTOMERS_BKP
                   WHERE AGE > 27 );
```

This would impact two rows and finally CUSTOMERS table would have the following records:

```
+----+----------+-----+---------+----------+
| ID | NAME     | AGE | ADDRESS | SALARY   |
+----+----------+-----+---------+----------+
|  2 | Khilan   |  25 | Delhi   |  1500.00 |
|  3 | kaushik  |  23 | Kota    |  2000.00 |
|  4 | Chaitali |  25 | Mumbai  |  6500.00 |
|  6 | Komal    |  22 | MP      |  4500.00 |
|  7 | Muffy    |  24 | Indore  | 10000.00 |
+----+----------+-----+---------+----------+
```

Nested Subquery:-If a Subquery contains another subquery, then the subquery inside another subquery is called nested subquery.

Let us suppose we have table called "StudentCourse" which contains the information, which student is connected to which Course. The structure of the table is:-

```
create table StudentCourse( StudentCourseid int identity(1,1), Studentid int,Courseid int)
```

nested subquery example:

```
select Firstname, lastname from student
where studentid in (select studentidfrom studentcourse
where courseid in (select courseid from course wherecoursename='Oracle'))
```

Result:-

	Firstname	lastname
1	Vivek	Johari

Correlated Subquery:-If the outcome of a subquery depends on the value of a column of its parent query table then the Sub query is called Correlated Subquery.

Suppose we want to get the details of the Courses (including the name of their course admin) from the Course table, we can use the following query:-

```
select Coursename ,Courseadminid,(select Firstname+''+Lastname
from studentwhere studentid=Course.courseadminid)as CourseAdminName
from course
```

Result:-

	Coursename	Courseadminid	CourseAdminName
1	Oracle	2	Vivek Johari
2	Automation	4	Tarveen Kaur
3	Java	2	Vivek Johari
4	QTP	4	Tarveen Kaur

NOTE:

- Correlated subquery runs once for each row selected by the outer query. It contains a reference to a value from the row selected by the outer query.

  Nested subquery runs only once for the entire nesting (outer) query. It does not contain any reference to the outer query row.

Grouping (The GROUP BY Statement)

The GROUP BY statement is used in conjunction with the aggregate functions to group the result-set by one or more columns.

SQL GROUP BY Syntax

```
SELECT column_name, aggregate_function(column_name)
FROM table_name
WHERE column_name operator value
GROUP BY column_name;
```

Example:

Consider the CUSTOMERS table is having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
```

```
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

If you want to know the total amount of salary on each customer, then GROUP BY query would be as follows:

```
SQL> SELECT NAME, SUM(SALARY) FROM CUSTOMERS
     GROUP BY NAME;
```

This would produce the following result:

```
+----------+-------------+
| NAME     | SUM(SALARY) |
+----------+-------------+
| Chaitali |     6500.00 |
| Hardik   |     8500.00 |
| kaushik  |     2000.00 |
| Khilan   |     1500.00 |
| Komal    |     4500.00 |
| Muffy    |    10000.00 |
| Ramesh   |     2000.00 |
+----------+-------------+
```

Now, let us have following table where CUSTOMERS table has the following records with duplicate names:

```
+----+----------+-----+-----------+----------+
```

```
| ID | NAME     | AGE | ADDRESS    | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Ramesh   |  25 | Delhi     |  1500.00 |
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | kaushik  |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Now again, if you want to know the total amount of salary on each customer, then GROUP BY query would be as follows:

```
SQL> SELECT NAME, SUM(SALARY) FROM CUSTOMERS
     GROUP BY NAME;
```

This would produce the following result:

```
+---------+-------------+
| NAME    | SUM(SALARY) |
+---------+-------------+
| Hardik  |     8500.00 |
| kaushik |     8500.00 |
| Komal   |     4500.00 |
| Muffy   |    10000.00 |
| Ramesh  |     3500.00 |
+---------+-------------+
```

The HAVING Clause

The HAVING clause enables you to specify conditions that filter which group results appear in the final results.

The HAVING clause was added to SQL because the WHERE keyword could not be used with aggregate functions.

The WHERE clause places conditions on the selected columns, whereas the HAVING clause places conditions on groups created by the GROUP BY clause.

Syntax:

The following is the position of the HAVING clause in a query:

```
SELECT
FROM
WHERE
GROUP BY
HAVING
ORDER BY
```

The HAVING clause must follow the GROUP BY clause in a query and must also precede the ORDER BY clause if used. The following is the syntax of the SELECT statement, including the HAVING clause:

```
SELECT column1, column2
FROM table1, table2
WHERE [ conditions ]
GROUP BY column1, column2
HAVING [ conditions ]
ORDER BY column1, column2
```

Example:

Consider the CUSTOMERS table having the following records:

```
+----+----------+-----+-----------+----------+
| ID | NAME     | AGE | ADDRESS   | SALARY   |
+----+----------+-----+-----------+----------+
|  1 | Ramesh   |  32 | Ahmedabad |  2000.00 |
|  2 | Khilan   |  25 | Delhi     |  1500.00 |
```

```
|  3 | kaushik  |  23 | Kota      |  2000.00 |
|  4 | Chaitali |  25 | Mumbai    |  6500.00 |
|  5 | Hardik   |  27 | Bhopal    |  8500.00 |
|  6 | Komal    |  22 | MP        |  4500.00 |
|  7 | Muffy    |  24 | Indore    | 10000.00 |
+----+----------+-----+-----------+----------+
```

Following is the example, which would display record for which similar age count would be more than or equal to 2:

```
SQL > SELECT ID, NAME, AGE, ADDRESS, SALARY
FROM CUSTOMERS
GROUP BY age
HAVING COUNT(age) >= 2;
```

This would produce the following result:

```
+----+--------+-----+---------+---------+
| ID | NAME   | AGE | ADDRESS | SALARY  |
+----+--------+-----+---------+---------+
|  2 | Khilan |  25 | Delhi   | 1500.00 |
+----+--------+-----+---------+---------+
```

Another example :Below is a selection from the "Orders" table:

OrderID	CustomerID	EmployeeID	OrderDate
10248	90	5	1996-07-04
10249	81	6	1996-07-05
10250	34	4	1996-07-08

And a selection from the "Employees" table:

EmployeeID	LastName	FirstName	BirthDate	Photo	Notes
1	Davolio	Nancy	1968-12-08	EmpID1.pic	Education includes a BA....
2	Fuller	Andrew	1952-02-19	EmpID2.pic	Andrew received his BTS....
3	Leverling	Janet	1963-08-30	EmpID3.pic	Janet has a BS degree....

Now we want to find if any of the employees has registered more than 10 orders.

We use the following SQL statement:

Example:

```
SELECT Employees.LastName, COUNT(Orders.OrderID) AS NumberOfOrders
FROM (Orders
INNER JOIN Employees
ON Orders.EmployeeID=Employees.EmployeeID)
GROUP BY LastName
HAVING COUNT(Orders.OrderID) > 10;
```

Now we want to find if the employees "Davolio" or "Fuller" have registered more than 25 orders.

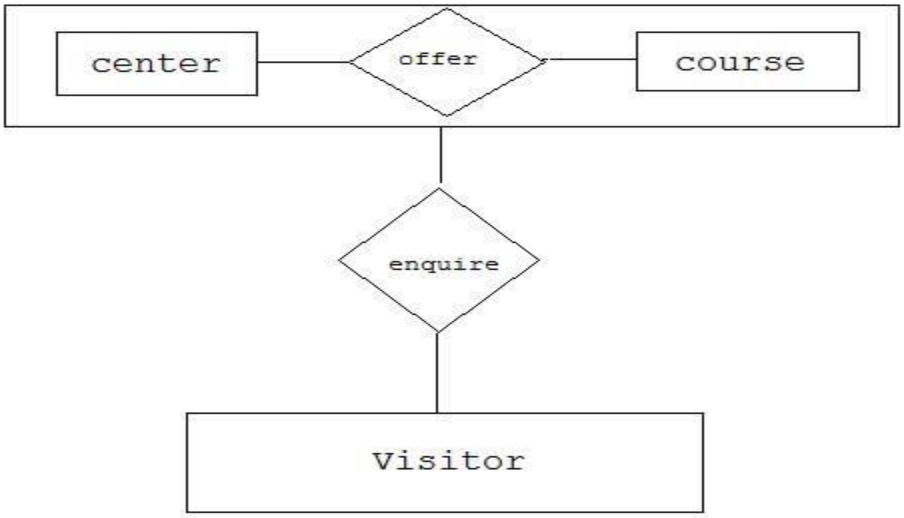
We add an ordinary WHERE clause to the SQL statement:

Example :

```
SELECT Employees.LastName, COUNT(Orders.OrderID) AS NumberOfOrders FROM
Orders
INNER JOIN Employees
ON Orders.EmployeeID=Employees.EmployeeID
WHERE LastName='Davolio' OR LastName='Fuller'
GROUP BY LastName
HAVING COUNT(Orders.OrderID) > 25;
```

Aggregration

Aggregration is a process when relation between two entity is treated as a single entity. Here the relation between Center and Course, is acting as an Entity in relation with Visitor.



Aggregrate Functions

These functions return a single value after calculating from a group of values.

In database management an **aggregate function** is a function where the values of multiple rows are grouped together as input on certain criteria to form a single value of more significant meaning or measurement such as a set, a bag or a list.

SQL aggregate functions return a single value, calculated from values in a column.

Common aggregate functions include:

- AVG() - Returns the average value
- COUNT- Returns the total number of values in a given column
- COUNT(*) - Returns the number of rows
- FIRST() - Returns the first value
- LAST() - Returns the last value
- MAX() - Returns the largest value
- MIN() - Returns the smallest value
- SUM() - Returns the sum

1) AVG()

Average returns average value after calculating from values in a numeric column.

Its general Syntax is,

```
SELECT AVG(column_name) from table_name
```

Example using AVG()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query to find average of salary will be,

```
SELECT avg(salary) from Emp;
```

Result of the above query will be,

avg(salary)
8200

---

2) COUNT()

Count returns the number of rows present in the table either based on some condition or without condition.

Its general Syntax is,

```
SELECT COUNT(column_name) from table-name
```

Example using COUNT()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query to count employees, satisfying specified condition is,

```
SELECT COUNT(name) from Emp where salary = 8000;
```

Result of the above query will be,

count(name)
2

Example of COUNT(distinct)

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query is,

```
SELECT COUNT(distinct salary) from emp;
```

Result of the above query will be,

count(distinct salary)
4

3) FIRST()

First function returns first value of a selected column

Syntax for FIRST function is,

```
SELECT FIRST(column_name) from table-name
```

Example of FIRST()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query

```
SELECT FIRST(salary) from Emp;
```

Result will be,

first(salary)
9000

---

4) LAST()

LAST return the return last value from selected column

Syntax of LAST function is,

```
SELECT LAST(column_name) from table-name
```

Example of LAST()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query will be,

```
SELECT LAST(salary) from emp;
```

Result of the above query will be,

last(salary)
8000

---

5) MAX()

MAX function returns maximum value from selected column of the table.

Syntax of MAX function is,

```
SELECT MAX(column_name) from table-name
```

Example of MAX()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query to find Maximum salary is,

```
SELECT MAX(salary) from emp;
```

Result of the above query will be,

MAX(salary)
10000

---

6) MIN()

MIN function returns minimum value from a selected column of the table.

Syntax for MIN function is,

```
SELECT MIN(column_name) from table-name
```

Example of MIN()

Consider following **Emp** table,

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query to find minimum salary is,

```
SELECT MIN(salary) from emp;
```

Result will be,

MIN(salary)
8000

---

7) SUM()

SUM function returns total sum of a selected columns numeric values.

Syntax for SUM is,

```
SELECT SUM(column_name) from table-name
```

Example of SUM()

Consider following **Emp** table

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

SQL query to find sum of salaries will be,

```
SELECT SUM(salary) from emp;
```

Result of above query is,

SUM(salary)
41000

We will use the Cars table to show how to use SQL aggregate functions:

CarMake	Model	Year	Color
Toyota	Camry XLE	2005	Gray
Honda	Accord EX	2002	Black
Lexus	ES 350	2008	Gray
BMW	3 Series Coupe	2008	Red

The most commonly used SQL aggregate function is the COUNT function. Here is an example:

```
SELECT COUNT(*) FROM Cars WHERE Color = 'Gray';
```

The result of this will be the number 2.

You can select minimum and maximum Year from Cars as follows:

```
SELECT MIN(Year) FROM Cars;
```

```
SELECT MAX(Year) FROM Cars;
```

The results will be 2002 and 2008 respectively.

You can also select the average Year from the Cars table like this:

```
SELECT AVG(Year) FROM Cars;
```

The result will be 2005.75, which works out to be 2005 year and 9 months.

Finally you can use the SUM SQL aggregate function to get the sum of values in a certain column:

```
SELECT SUM(Year) FROM Cars;
```

The result will be 8023, which is not a very useful number as we are summing years, but if we had another column called DollarValue it would have made perfect sense to use SUM to get the total value of our cars for example.

SQL Scalar functions

SQL scalar functions return a single value, based on the input value.

Useful scalar functions:

- UCASE() - Converts a field to upper case
- LCASE() - Converts a field to lower case
- MID() - Extract characters from a text field
- LEN() - Returns the length of a text field
- ROUND() - Rounds a numeric field to the number of decimals specified
- NOW() - Returns the current system date and time
- FORMAT() - Formats how a field is to be displayed

1) UCASE()

UCASE function is used to convert value of string column to Uppercase character.

Syntax of UCASE,

```
SELECT UCASE(column_name) from table-name
```

Example of UCASE()

Consider following **Emp** table

eid	name	age	salary
401	anu	22	9000
402	shane	29	8000
403	rohan	34	6000
404	scott	44	10000

405	Tiger	35	8000

SQL query for using UCASE is,

```
SELECT UCASE(name) from emp;
```

Result is,

UCASE(name)
ANU
SHANE
ROHAN
SCOTT
TIGER

---

2) LCASE()

LCASE function is used to convert value of string column to Lowecase character.

Syntax for LCASE is,

```
SELECT LCASE(column_name) from table-name
```

Example of LCASE()

Consider following **Emp** table

eid	**name**	**age**	**salary**

401	anu	22	9000
402	shane	29	8000
403	rohan	34	6000
404	scott	44	10000
405	Tiger	35	8000

SQL query for converting string value to Lower case is,

```
SELECT LCASE(name) from emp;
```

Result will be,

LCASE(name)
anu
shane
rohan
scott
tiger

3) MID()

MID function is used to extract substrings from column values of string type in a table.

Syntax for MID function is,

```
SELECT MID(column_name, start, length) from table-name
```

Example of MID()

Consider following **Emp** table

eid	name	age	salary
401	anu	22	9000
402	shane	29	8000
403	rohan	34	6000
404	scott	44	10000
405	Tiger	35	8000

SQL query will be,

```
select MID(name,2,2) from emp;
```

Result will come out to be,

MID(name,2,2)
nu
ha

oh
co
ig

---

4) ROUND()

ROUND function is used to round a numeric field to number of nearest integer. It is used on Decimal point values. Syntax of Round function is,

```
SELECT ROUND(column_name, decimals) from table-name
```

Example of ROUND()

Consider following **Emp** table

eid	name	age	salary
401	anu	22	9000.67
402	shane	29	8000.98
403	rohan	34	6000.45
404	scott	44	10000
405	Tiger	35	8000.01

SQL query is,

```
SELECT ROUND(salary) from emp;
```

Result will be,

ROUND(salary)
9001
8001
6000
10000
8000

SQL Alias

Alias is used to give an alias name to a table or a column. This is quite useful in case of large or complex queries. Alias is mainly used for giving a short alias name for a column or a table with complex names.

Syntax of Alias for table names,

```
SELECT column-name

from table-name

as alias-name
```

Following is an Example using Alias,

```
SELECT * from Employee_detail as ed;
```

Alias syntax for columns will be like,

```
SELECT

column-name as alias-name
```

```
from

table-name
```

Ordering(Order By Clause)

Order by clause is used with **Select** statement for arranging retrieved data in sorted order. The **Order by**clause by default sort data in ascending order. To sort data in descending order **DESC** keyword is used with**Order by** clause.

Syntax of Order By

```
SELECT column-list|* from table-name order by asc|desc;
```

Example using Order by

Consider the following **Emp** table,

eid	name	age	salary
401	Anu	22	9000
402	Shane	29	8000
403	Rohan	34	6000
404	Scott	44	10000
405	Tiger	35	8000

```
SELECT * from Emp order by salary;
```

The above query will return result in ascending order of the **salary**.

eid	name	age	salary

403	Rohan	34	6000
402	Shane	29	8000
405	Tiger	35	8000
401	Anu	22	9000
404	Scott	44	10000

Example of Order by DESC

Consider the **Emp** table described above,

```
SELECT * from Emp order by salary DESC;
```

The above query will return result in descending order of the **salary**.

eid	**name**	**age**	**salary**
404	Scott	44	10000
401	Anu	22	9000
405	Tiger	35	8000
402	Shane	29	8000
403	Rohan	34	6000

Join in SQL

SQL Join is used to fetch data from two or more tables, which is joined to appear as single set of data. SQL Join is used for combining column from two or more tables by using values common to both tables. **Join** Keyword is used in SQL queries for joining two or more tables. Minimum required condition for joining table, is**(n-1)** where **n**, is number of tables. A table can also join to itself known as, **Self Join**.

Different Types of Join

The following are the types of JOIN that we can use in SQL.

- Natural join
- Cross join
- Inner join
- Outer join

Cross JOIN or Cartesian Product

This type of JOIN returns the cartesian product of rows of from the tables in Join. It will return a table which consists of records which combines each row from the first table with each row of the second table.

Cross JOIN Syntax is,

```
SELECT column-name-list

from table-name1

CROSS JOIN

table-name2;
```

Example of Cross JOIN

The **class** table,

ID	NAME
1	abhi
2	adam
4	alex

The **class_info** table,

ID	Address
1	DELHI
2	MUMBAI
3	CHENNAI

Cross JOIN query will be,

```
SELECT *
 from class,
 cross JOIN class_info;
```

The result table will look like,

ID	NAME	ID	Address
1	abhi	1	DELHI
2	adam	1	DELHI

4	alex	1	DELHI
1	abhi	2	MUMBAI
2	adam	2	MUMBAI
4	alex	2	MUMBAI
1	abhi	3	CHENNAI
2	adam	3	CHENNAI
4	alex	3	CHENNAI

INNER Join or EQUI Join

This is a simple JOIN in which the result is based on matched data as per the equality condition specified in the query.

Inner Join Syntax is,

```
SELECT column-name-list

from table-name1

INNER JOIN

table-name2

WHERE table-name1.column-name = table-name2.column-name;
```

Example of Inner JOIN

The **class** table,

ID	NAME
1	abhi
2	adam
3	alex
4	anu

The **class_info** table,

ID	Address
1	DELHI
2	MUMBAI
3	CHENNAI

Inner JOIN query will be,

```
SELECT * from class, class_info where class.id = class_info.id;
```

The result table will look like,

ID	NAME	ID	Address
1	abhi	1	DELHI
2	adam	2	MUMBAI

3	alex	3	CHENNAI

Natural JOIN

Natural Join is a type of Inner join which is based on column having same name and same datatype present in both the tables to be joined.

Natural Join Syntax is,

```
SELECT *
from table-name1
NATURAL JOIN
table-name2;
```

Example of Natural JOIN

The **class** table,

ID	NAME
1	abhi
2	adam
3	alex
4	anu

The **class_info** table,

ID	Address

1	DELHI
2	MUMBAI
3	CHENNAI

Natural join query will be,

```
SELECT * from class NATURAL JOIN class_info;
```

The result table will look like,

ID	NAME	Address
1	abhi	DELHI
2	adam	MUMBAI
3	alex	CHENNAI

In the above example, both the tables being joined have ID column(same name and same datatype), hence the records for which value of ID matches in both the tables will be the result of Natural Join of these two tables.

Outer JOIN

Outer Join is based on both matched and unmatched data. Outer Joins subdivide further into,

- Left Outer Join
- Right Outer Join
- Full Outer Join

Left Outer Join

The left outer join returns a result table with the **matched data** of two tables then remaining rows of the **left**table and null for the **right** table's column.

Left Outer Join syntax is,

```
SELECT column-name-list
from table-name1
LEFT OUTER JOIN
table-name2
on table-name1.column-name = table-name2.column-name;
```

Left outer Join Syntax for **Oracle** is,

```
select column-name-list
from table-name1,
table-name2
on table-name1.column-name = table-name2.column-name(+);
```

Example of Left Outer Join

The **class** table,

ID	NAME
1	abhi
2	adam
3	alex
4	anu
5	ashish

The **class_info** table,

ID	Address
1	DELHI
2	MUMBAI
3	CHENNAI
7	NOIDA
8	PANIPAT

Left Outer Join query will be,

```
SELECT * FROM class LEFT OUTER JOIN class_info ON (class.id=class_info.id);
```

The result table will look like,

ID	NAME	ID	Address
1	abhi	1	DELHI
2	adam	2	MUMBAI
3	alex	3	CHENNAI
4	anu	null	null
5	ashish	null	null

Right Outer Join

The right outer join returns a result table with the **matched data** of two tables then remaining rows of the **right table** and null for the **left** table's columns.

Right Outer Join Syntax is,

```
select column-name-list

from table-name1

RIGHT OUTER JOIN

table-name2

on table-name1.column-name = table-name2.column-name;
```

Right outer Join Syntax for **Oracle** is,

```
select column-name-list

from table-name1,

table-name2

on table-name1.column-name(+) = table-name2.column-name;
```

Example of Right Outer Join

The **class** table,

ID	NAME
1	abhi
2	adam
3	alex
4	anu
5	ashish

The **class_info** table,

ID	Address
1	DELHI
2	MUMBAI
3	CHENNAI
7	NOIDA
8	PANIPAT

Right Outer Join query will be,

```
SELECT * FROM class RIGHT OUTER JOIN class_info on (class.id=class_info.id);
```

The result table will look like,

ID	NAME	ID	Address
1	abhi	1	DELHI
2	adam	2	MUMBAI
3	alex	3	CHENNAI
null	null	7	NOIDA
null	null	8	PANIPAT

Full Outer Join

The full outer join returns a result table with the **matched data** of two table then remaining rows of both **left**table and then the **right** table.

Full Outer Join Syntax is,

```
select column-name-list

from table-name1

FULL OUTER JOIN

table-name2

on table-name1.column-name = table-name2.column-name;
```

Example of Full outer join is,

The **class** table,

ID	NAME
1	abhi
2	adam
3	alex
4	anu
5	ashish

The **class_info** table,

ID	Address
1	DELHI

2	MUMBAI
3	CHENNAI
7	NOIDA
8	PANIPAT

Full Outer Join query will be like,

```
SELECT * FROM class FULL OUTER JOIN class_info on (class.id=class_info.id);
```

The result table will look like,

ID	**NAME**	**ID**	**Address**
1	abhi	1	DELHI
2	adam	2	MUMBAI
3	alex	3	CHENNAI
4	anu	null	null
5	ashish	null	null
null	null	7	NOIDA
null	null	8	PANIPAT

SQL View

A view in SQL is a logical subset of data from one or more tables. View is used to restrict data access.

Types of View

There are two types of view,

- Simple View
- Complex View

Simple View	Complex View
Created from one table	Created from one or more table
Does not contain functions	Contain functions
Does not contain groups of data	Contains groups of data

Syntax for creating a View,

```
CREATE or REPLACE view view_name AS
SELECT column_name(s)
FROM table_name
WHERE condition
```

Example of Creating a View

Consider following **Sale** table,

oid	order_name	previous_balance	customer
11	ord1	2000	Alex
12	ord2	1000	Adam
13	ord3	2000	Abhi
14	ord4	1000	Adam
15	ord5	2000	Alex

SQL Query to Create View

```
CREATE or REPLACE view sale_view as select * from Sale where customer = 'Alex';
```

The data fetched from select statement will be stored in another object called **sale_view**. We can use create seperately and replace too but using both together works better.

Example of Displaying a View

Syntax of displaying a view is similar to fetching data from table using Select statement.

```
SELECT * from sale_view;
```

Force View Creation

force keyword is used while creating a view. This keyword force to create View even if the table does not exist. After creating a force View if we create the base table and enter values in it, the view will be automatically updated.

Syntax for forced View is,

```
CREATE or REPLACE force view view_name AS

SELECT column_name(s)

FROM table_name

WHERE condition
```

Update a View

Update command for view is same as for tables.

Syntax to Update a View is,

```
UPDATE view-name
set value
WHERE condition;
```

If we update a view it also updates base table data automatically.

Read-Only View(non-updatable view)

We can create a view with read-only option to restrict access to the view.

Syntax to create a view with Read-Only Access

```
CREATE or REPLACE force view view_name AS
SELECT column_name(s)
FROM table_name
WHERE condition with read-only
```

The above syntax will create view for read-only purpose, we cannot Update or Insert data into read-only view. It will throw an error.

DROP SQL VIEW

Once a SQL VIEW has been created, you can drop it with the SQL DROP VIEW Statement.

Syntax :The syntax for the SQL DROP VIEW Statement is:

```
DROP VIEW view_name;
```

view_name - The name of the view that you wish to drop.

Example:Here is an example of how to use the SQL DROP VIEW Statement:

```
DROP VIEW sup_orders;
```