DBMS

What is Data?

Data is generally a raw format of any information
It may be text information or any rich formatted information.

What is Database?

The database is a collection of related data, organized in a structured and meaningful way. For computers, having the data stored in a way that is allowed faster –

- Storage(entry)
- Access
- Update
- Manipulation

What is Database Management System?

The
database management system is software that controls all the different manipulation of stored or to be stored data in a database. It allows the creation, update, manipulation, definition of a database.

A database management system perform the following –

- Database Definition
- Data Updation
- Data Retrieval
- Administration
- Security

TUPLE

Each tuple represents a complete record of the specific data item, each tuple stores different data with the same structure.

RECORD

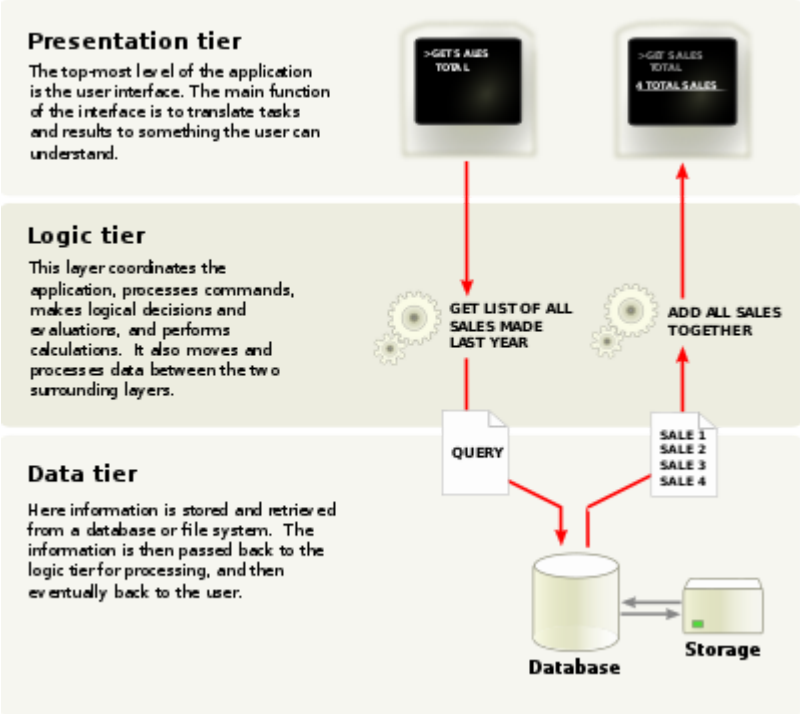
Each record represents complete information of the specific data item, each record stores different data with the same structure

The term `record` is often also called `tuple` and `row` in a database table.

ENAME	JOB	SAL	HIREDATE	HIREDATE+2
KING	PRESIDENT	5000	17-NOV-81	19-NOV-81
BLAKE	MANAGER	2850	01-MAY-81	03-MAY-81
CLARK	MANAGER	2450	09-JUN-81	11-JUN-81
JONES	MANAGER	2975	02-APR-81	04-APR-81
SCOTT	ANALYST	3000	19-APR-87	21-APR-87
FORD	ANALYST	3000	03-DEC-81	05-DEC-81
SMITH	CLERK	800	17-DEC-80	19-DEC-80

3 tier architecture

- `3 tier architecture` is the most popularly used DBMS architecture
- As the name suggests three tiers consists of three components in addition to the client-side and server-side application of two-tier architecture, it consists application server layer as an intermediate tier between these two.



Components of 3 tier architecture

1. Client-side :

- It is nothing but the ***presentation layer*** (your PC, Tablet, Mobile, etc.) It ***sends a request to the server-side*** via the application server layer

2. Application server :

- It is present as an ***intermediate tier between the client and server tires*** Unlike two-tier architecture, in this requests are not directly sent from the client to the server-side, ***when a client sends a request first it is transferred to the application***
  server then this application server transfers the request to the server-side, followed by query processing and transaction managementThis intermediate layer ***also acts as a senses medium*** for the exchange of partially processed data between server and client

3. Server-side:

- Nothing but the ***database of the server-side application*** It ***sends responses to the requests received from the client-side to the application server*** and the application server, in turn, transfer them to the client-side.

Examples of three-tier architecture

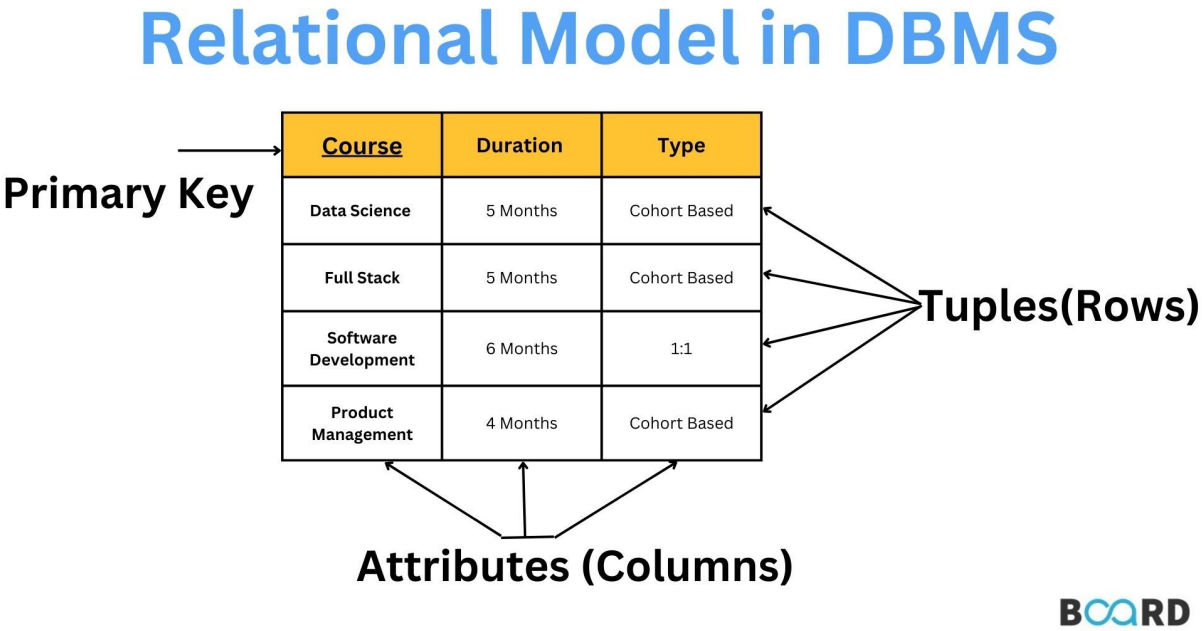
- All ***large dynamic web applications present over the internet*** or examples of this 3 tier architecture

Relational model in DBMS

- `Relational model` was first outlined by EF Codd in 1970 and since then it was the most
  widely used data model and in fact, the only used database management system today in the world
- The basic idea between this relational data model is simple two-dimensional tables, also called relations which consist of rows and columns.

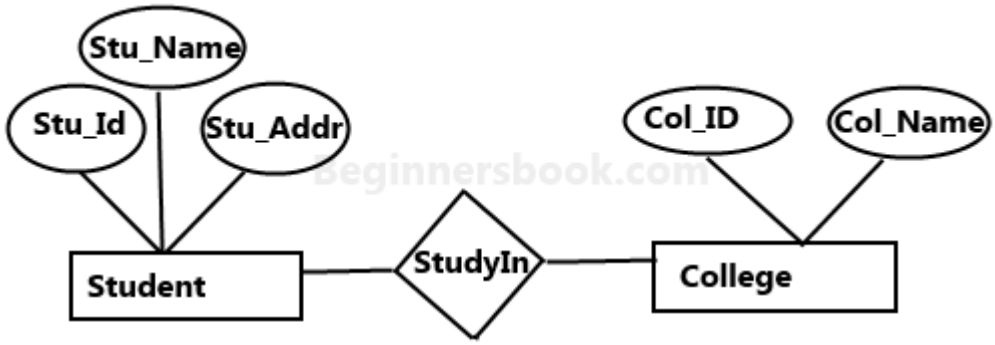
Main components of the relational model

- ***Rows and columns*** of tables
- ***Operations*** on these rows and columns ***manipulating required data***



Entity-Relationship model (ER model)

- An effective system where data is organized into discrete categories called entities(different database tables)
- `ERmodel` is an illustration of various entities in business and the relationship between them
- It is built during the ***analysis phase of the system development life cycle***
- The ER model separates the information required in the business i.e it establishes a clear distinction between data that is useful and not useful for business operations



Sample E-R Diagram

Key components of the ER model

Entity :

It is a set of related information i.e ***nothing but a database table.***

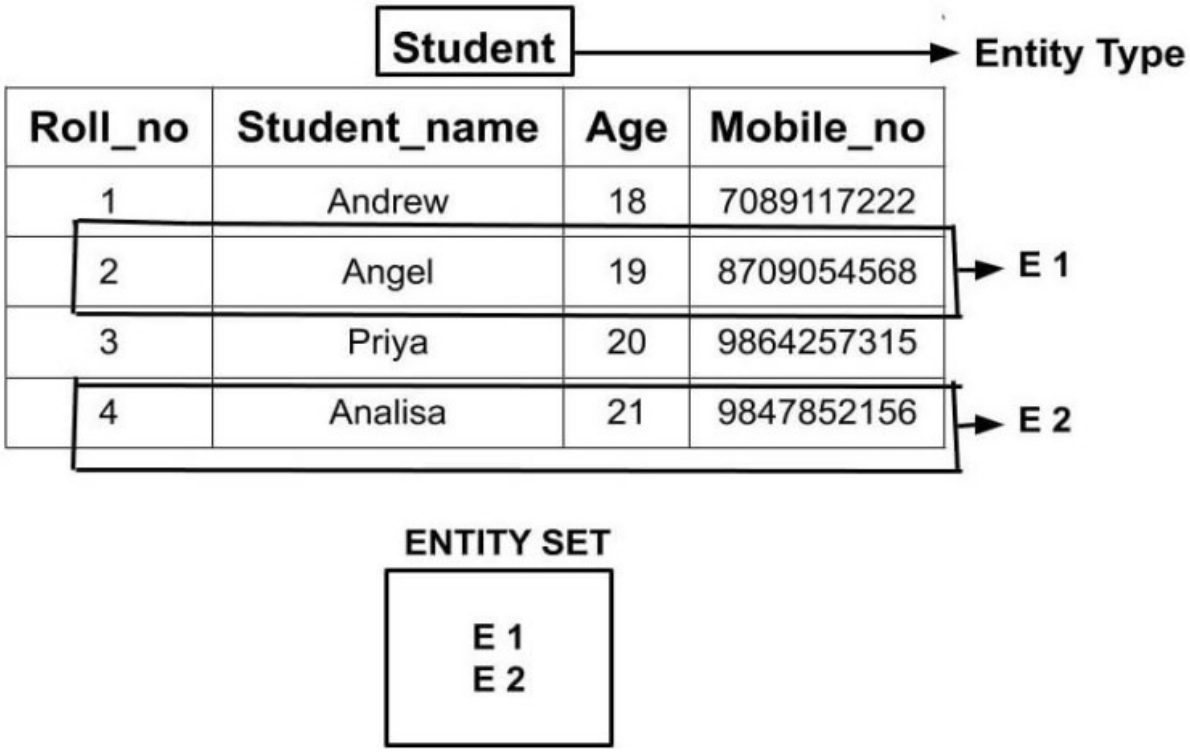
Entity is a real object representation in an Entity Relationship diagram. For example if we want to create a database for a college in that case `students` studying in the college will be considered as an `entity`

It can be anything like –

- Teachers
- Courses

- Buildings
- Classrooms

A set of all entities together is called an entity set.



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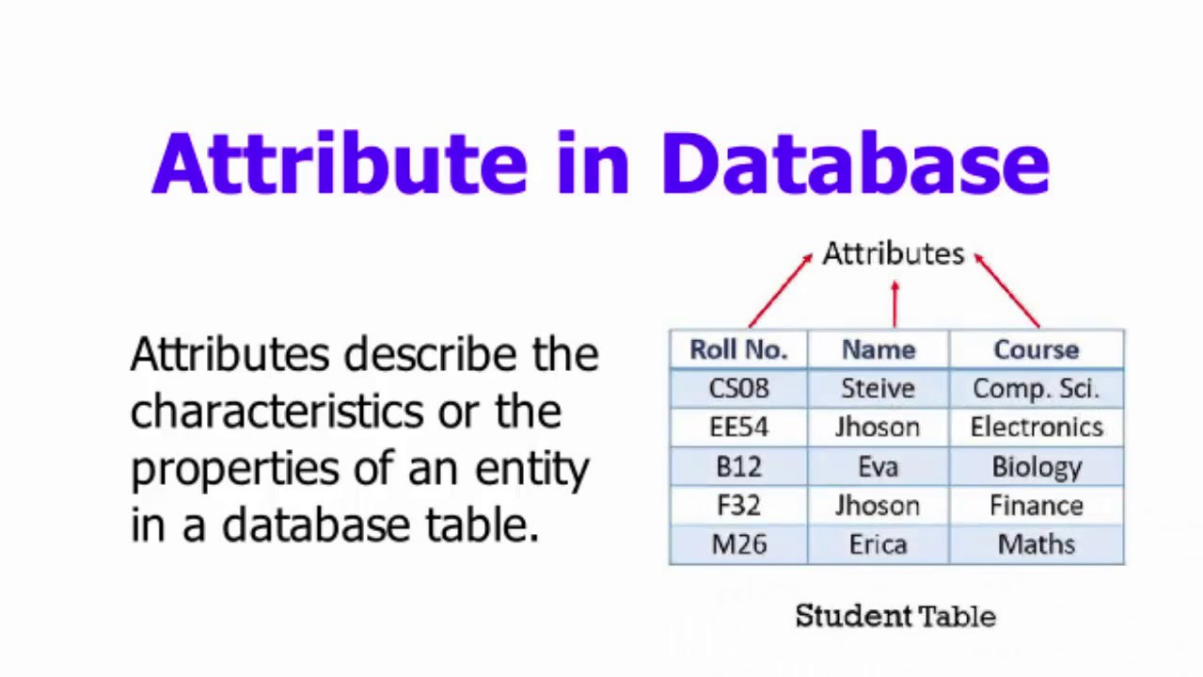
Attributes :

- It defines ***what type of data an entity is storing*** i.e different columns in a table For example, ***a student entity consists of student name, ID, marks as attributes*** An entity may contain any numbers of attribute but ***it must contain at least one attribute .***
- ID
- email ID
- Age
- Address
- Phone Number

There are the following types of attributes

- Key attribute
- Composite attribute
- Multivalued attribute
- Derived attribute

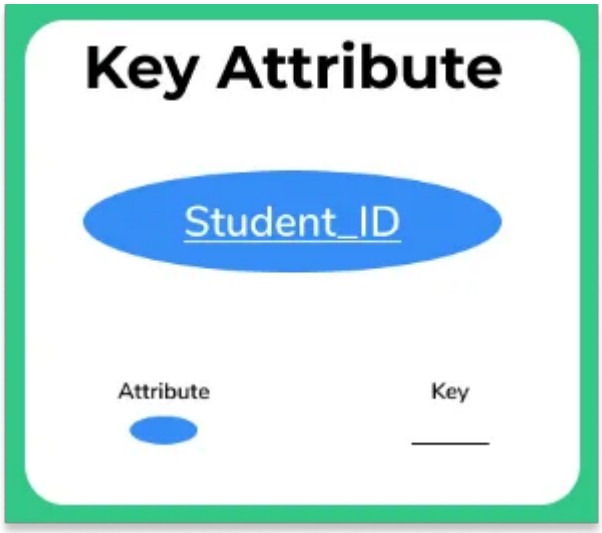


Key Attribute

A key attribute is the one which will uniquely identify and associate identity for an entity.

For example –

For a student, his roll number or his student ID maybe its key attribute. For course offered by university, the course code like IT101 will be its key attribute.

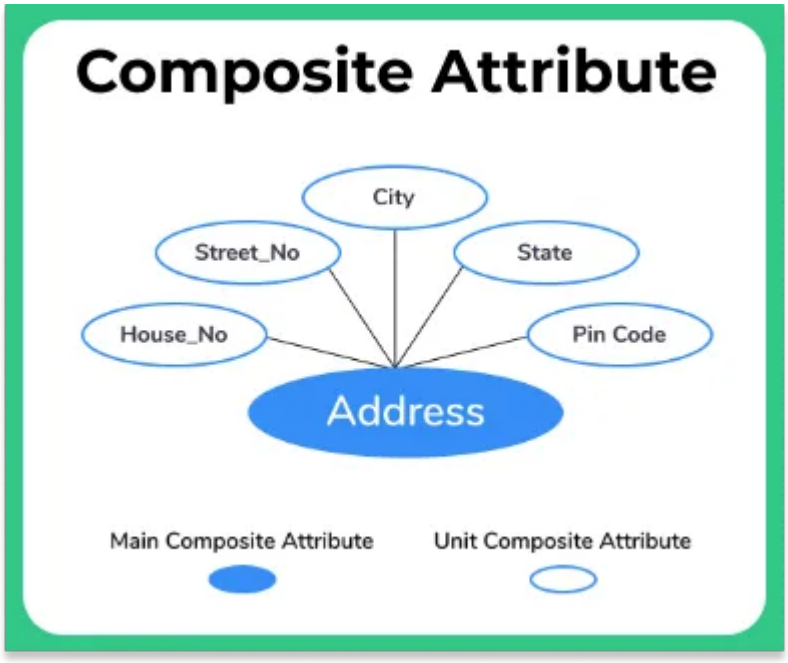


Composite Attribute

As clear from its name a composite attribute composes of multiple units of attributes forming a larger one.

For example – Address may have following composite attributes –

- House Number
- Street
- City
- State
- Country
- Pin Code



Multivalued Attribute

A multivalued attribute is one, which may have more than one value.

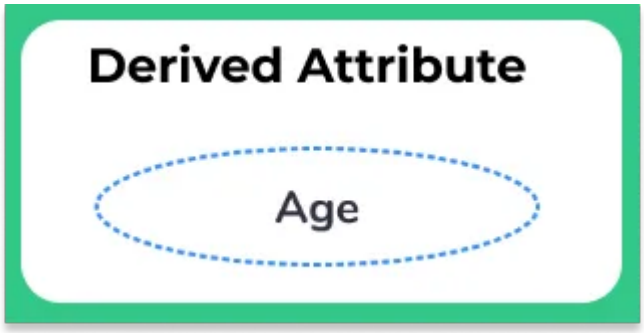
For example –

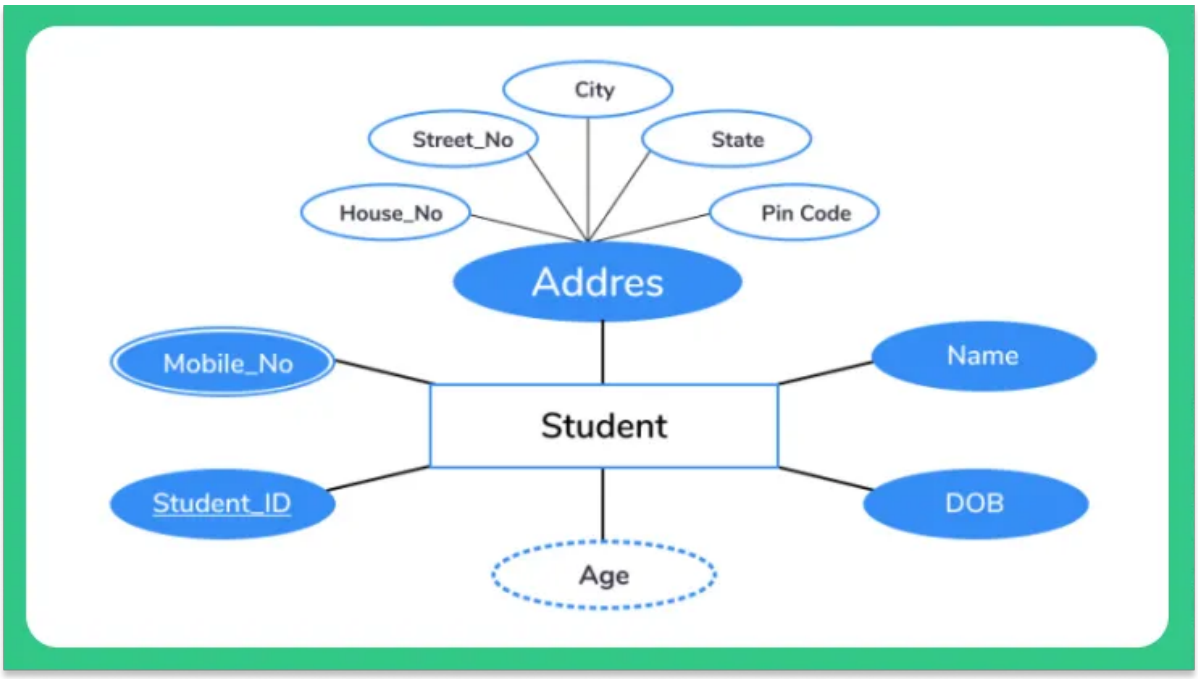
The phone number for student maybe multivalued as student may have one or more than 1 phone numbers.

Derived Attribute

A derived attribute as the name suggests is the one that can be derived or calculated with the help of other attribute present itself.

For example – The age of the student can be calculated from date of birth present as an attribute.





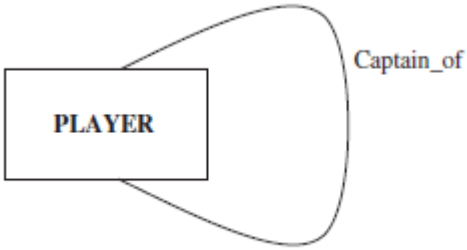
Relationships :

The association between different entities that are existing in a database is depicted by relationship.

There are various types of relationships than can exist in a database which are –

Unary Relationship

Unary relationship is where there is only entity which is related to itself.



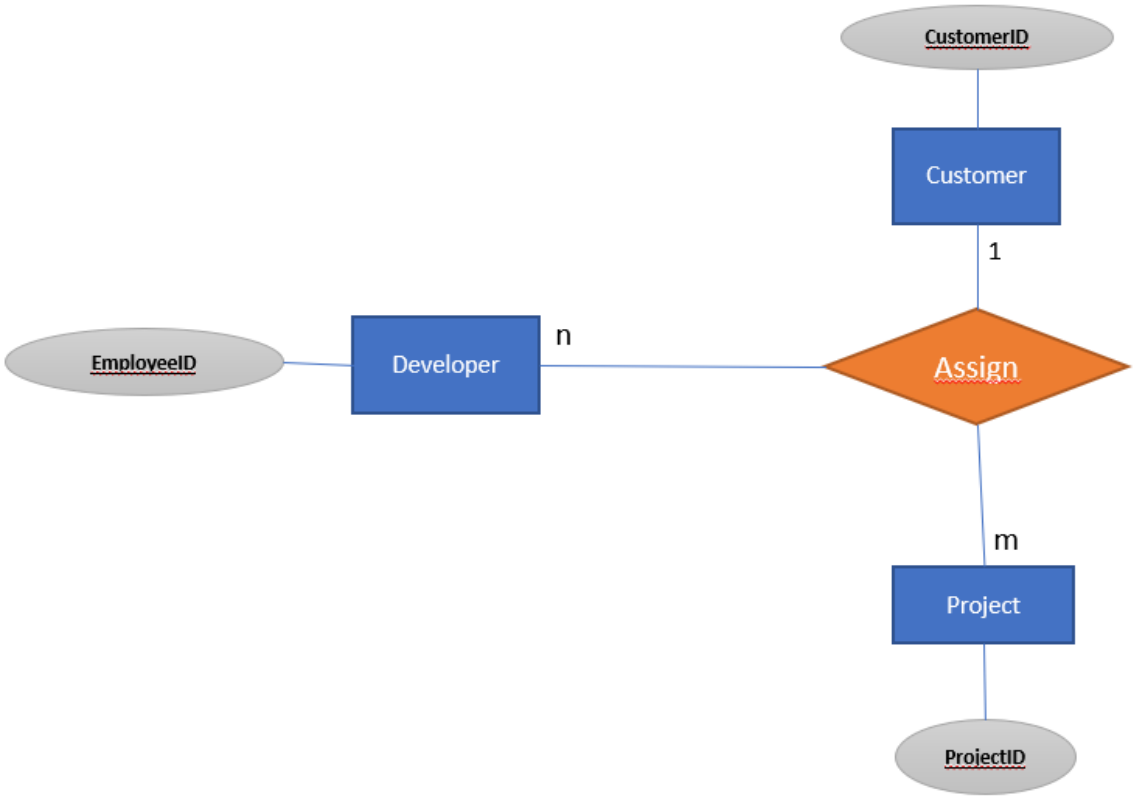
Binary Relationship

Binary relationship is when there are 2 different entities associated with some relationship with one another.

Binary Relationship Set

n-ary Relationship

n-ary relationship is when there is complex relationship amongst various entities.



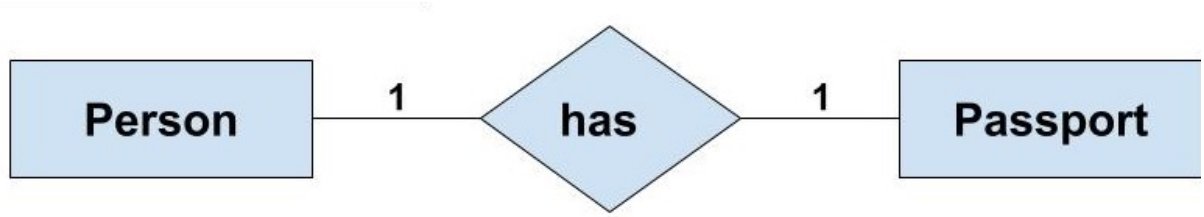
Relationship set is mapping of different entity set to the others with the help of connected lines

Cardinality

For a given entity sites, the number of entities that can participate in a relationship with another entity set is called cardinality.

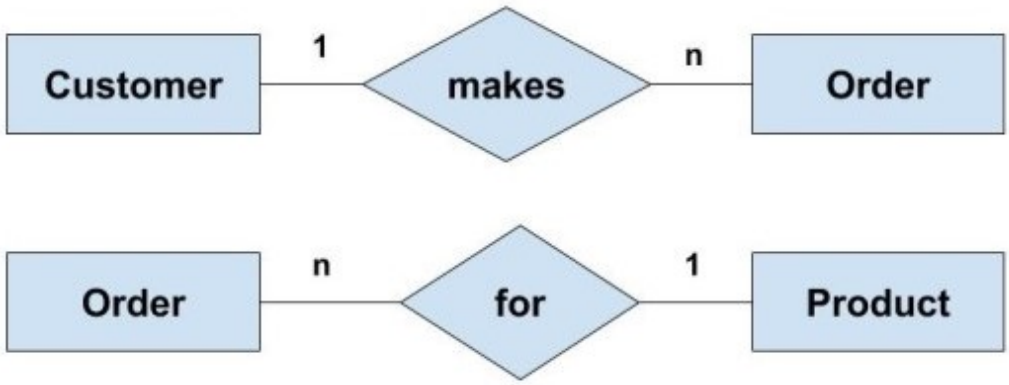
One to One

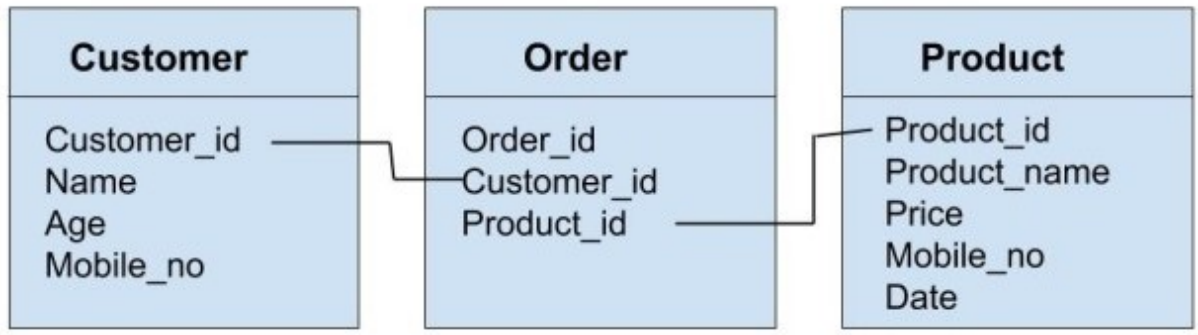
When there is only one entity at a given instance participating in a relationship or association with only one different entity.



Many to One

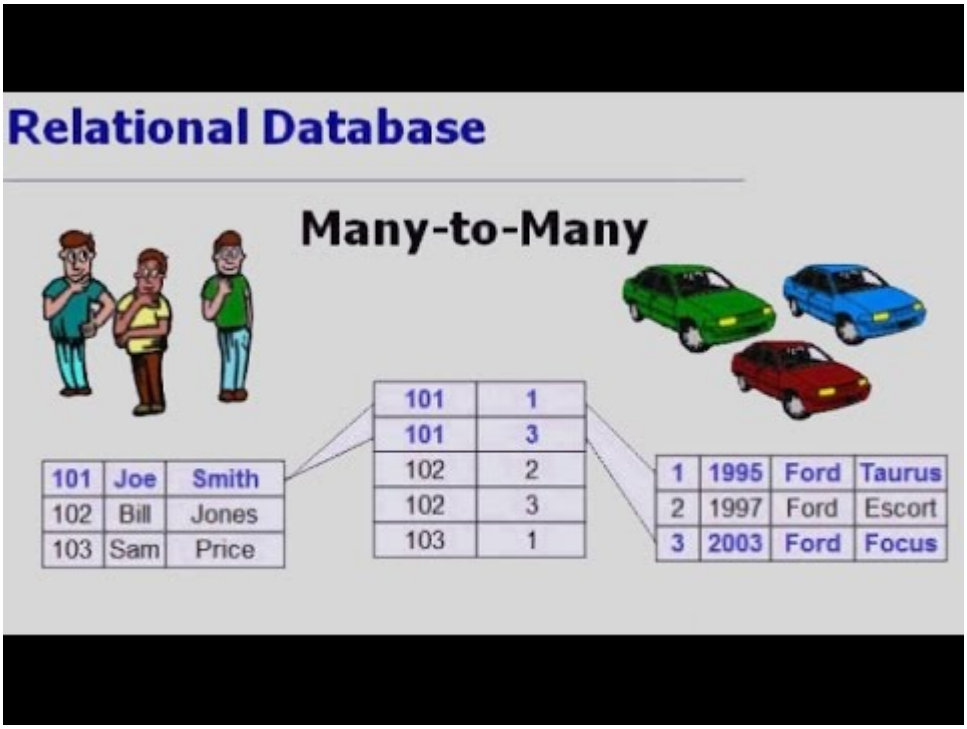
When there are multiple entities in a given entity set in relationship with only one entity of another or same entity set.





Many to Many

A *many-to-many relationship*
occurs when multiple records in a table are associated with multiple records in another table.



Participation Constraint

Total Participation

All the entities in the entity set must participate in the relationship.

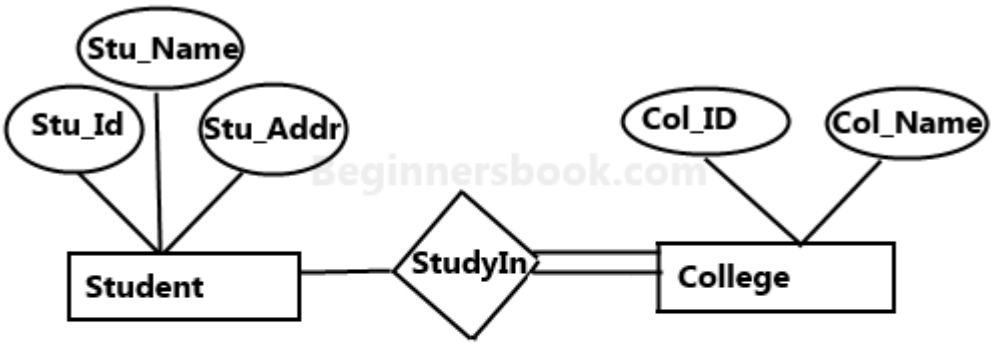
For example the university forces, you to necessarily enroll in at least 1 course, in that case it will be called total participation that student end.

It is represented by a double line joining entity and relationship.

Partial Participation

It is when there maybe cases when some entities may and some entities may not participate in a relationship.

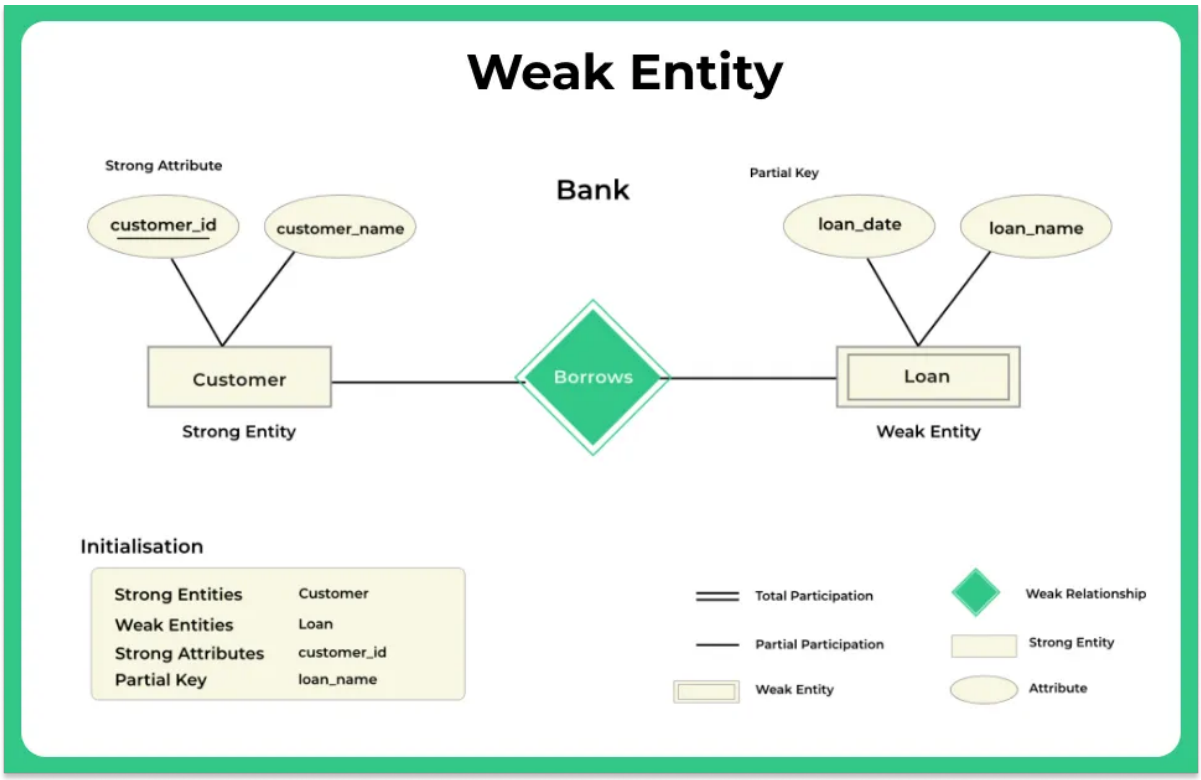
This is represented by single line joining entity and relationship.



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

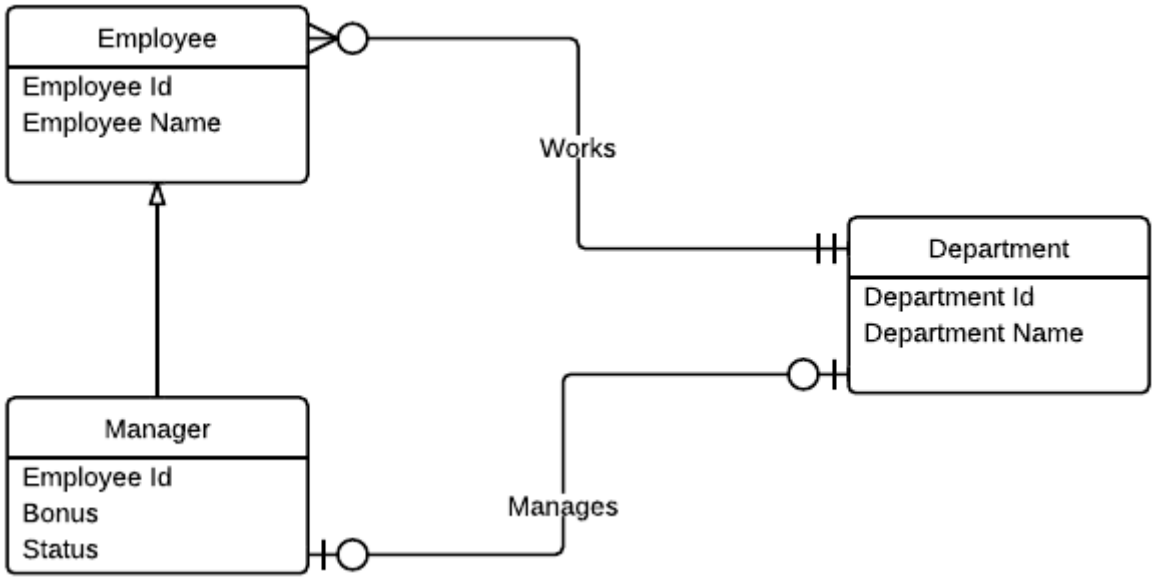
Weak Entity and Weak Relationship

Weak entities are the one which may not have their own attributes and depend on other entity for their existence. For example the monthly instalment is dependent upon the loan entity and its attributes. The participation for weak entity type is always total.



Recursive Relationship in DBMS

- A relationship represents the association between two are more entities
- The relationship also ***shows the different entity sets that are participating in a relationship,*** these relationships very much useful analyzing the design process of the system



Generalization, Specialization and Aggregation

Generalization

`Generalization` is the term that is frequently used for the design process of any relational schema.

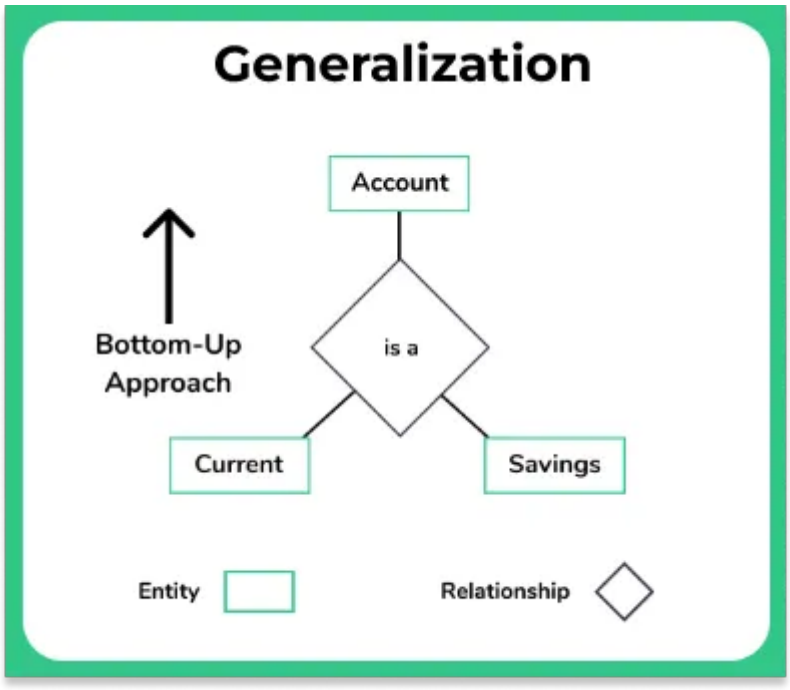
- Generalization is a bottom-up design process in which two or more entities of lower level or combined to form a higher level entity if they have some common attributes or properties.
- In these two or more entities integrated to form a generalized entity that sub-classes are combined to make a super-class.
- Generalization is viewed as a Reverse process of specialization.

Example:

In a bank there are two different types of accounts – Current and Savings, combine to form a super entity Account.

It thus follows system like classes, like super-classes and sub-classes right ?

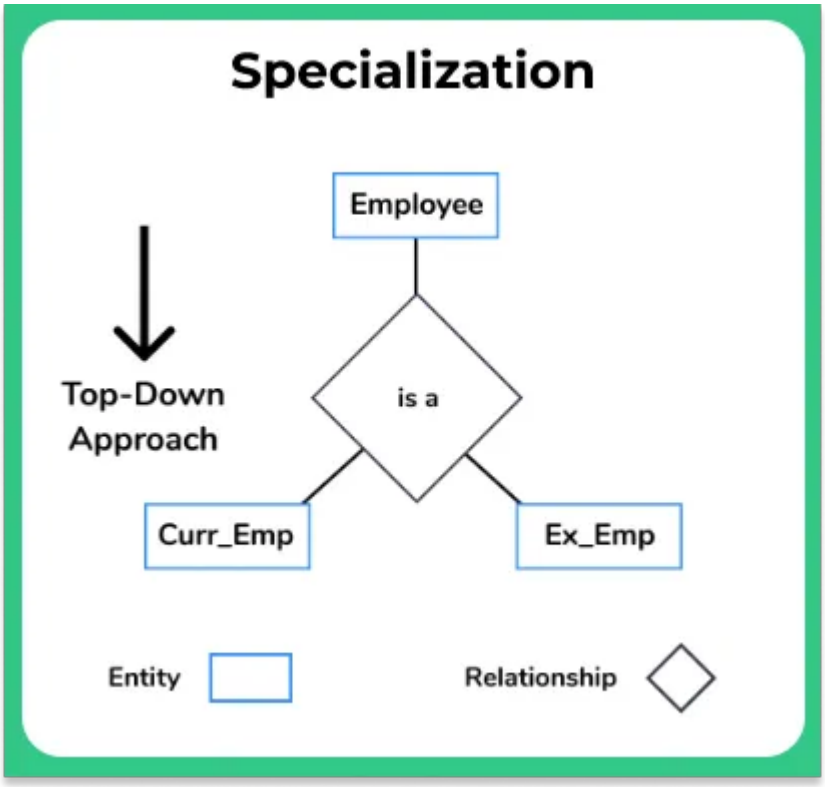
It may also be possible that the higher level entity may also combine with further entity to form a one more higher level entity.



Specialization

- Specialization is a top-down design approach where one higher level entity can be broken
  into two or more lower level entities so that subsets of entities that *share some distinguishing characteristics can be identified*
- The specialization can be viewed as a ***reverse design process for generalization***

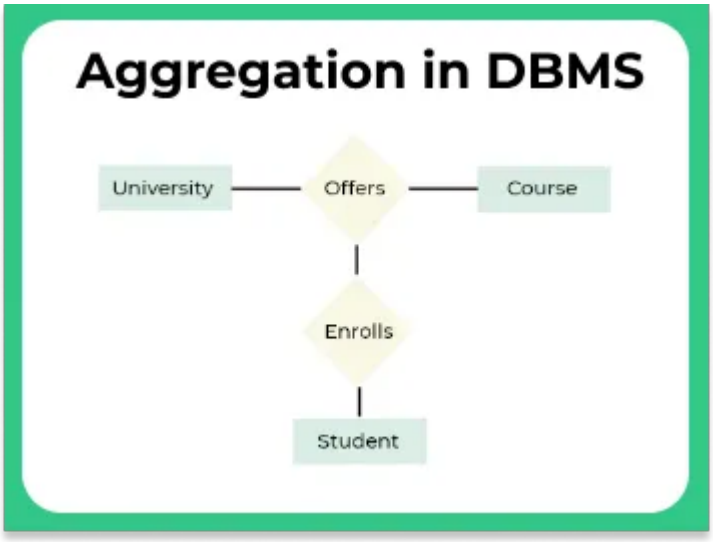
Employee may be decomposed to further as current employee entity and ex employee entity.



Aggregation

- Aggregation is a design
  strategy in which the relationship is modelled between a collection of entities and another relationship.
- Simply it is used when **we need Express a relationship among other relationships.**

In Real-world situation for example if students visit a coaching institute then he shows interest not only to inquire about the course alone or not only just coaching Centre, he will definitely enquire the details about both the coaching institute and the details of the concerned course



EF Codd’s rules in DBMS

RDBMS

Normalization in DBMS

SQL

SQL JOIN