

## **UNIT 2 (Entity-Relationship Model)**

1) What is Entity Relationship Model?

A) An Entity-relationship model (ER model) describes the structure of a database with the help of a diagram, which is known as Entity Relationship Diagram (ER Diagram). An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are: entity set and relationship set.

2) What is an Entity and what is Entity Set?

A) An Entity can be any person, place or thing of real world which can be either living or non-living that can be tangible or intangible, anything that can be represented in the database. An entity set is a group of similar entities and these entities can have attributes.

3) What is an E-R Diagram?

A) Entity relationship diagrams help us to represent the ER Model. An ER diagram shows the relationship among entity sets and also they useful to visualize the relationship among the entity set stored in the database, as a result we can better communicate the logical structure of the database.

4) What are building blocks or components of E-R Diagram?

A) The basic building blocks which are used by ER diagrams to represent the logical structure of a Database visually are

Entity / Entity Set

Attributes

Relationship

5) What is an Entity? Write various types of Entities.

A)

### **Entity**

An entity is an object or component of data. An entity is represented as rectangle in an ER diagram. Entities are of two types.

The different types of are Strong Entity and Weak Entity.

### **Strong Entity**

The Strong Entity is the one whose existence does not depend on the existence of any other entity in a schema. It is denoted by a single rectangle. A strong entity always has the primary key in the set of attributes that describes the strong entity.

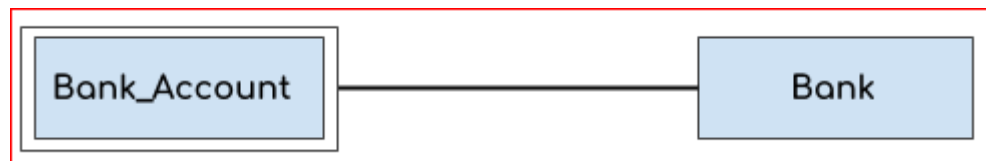
**Entity/Strong Entity**

### **Weak Entity**

An entity that cannot be uniquely identified by its own attributes and relies on the relationship with other entity is called weak entity. The weak entity is represented by a double rectangle.

**Weak Entity**

For example: A bank account cannot be uniquely identified without knowing the bank to which the account belongs, so **Bank\_Account** is a weak entity and **Bank** is strong entity



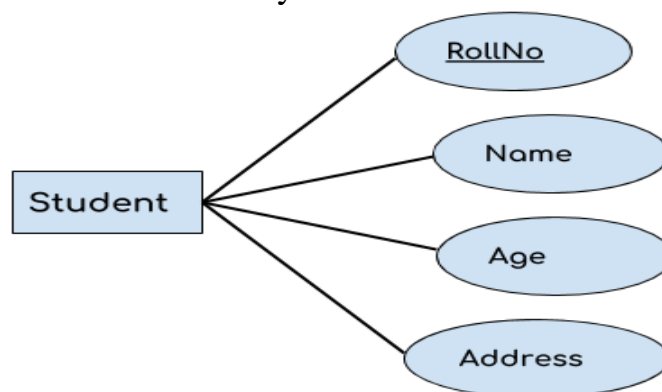
6) What is an Attribute? Write different types of Attributes.

A) An attribute describes the property or characteristics of an entity. An attribute is represented as Oval in an ER diagram. There are various types of attributes:

- i. Key attribute
- ii. Simple attribute
- iii. Composite attribute
- iv. Single valued attribute
- v. Multivalued attribute
- vi. Derived attribute

### i. Key Attribute

A key (**Primary Key**) attribute can uniquely identify an entity from an entity set. For example, In Student entity **RollNo** can uniquely identify a particular student from a group of students. Key attribute is represented by oval same as other attributes however the text of key attribute is **underlined**.

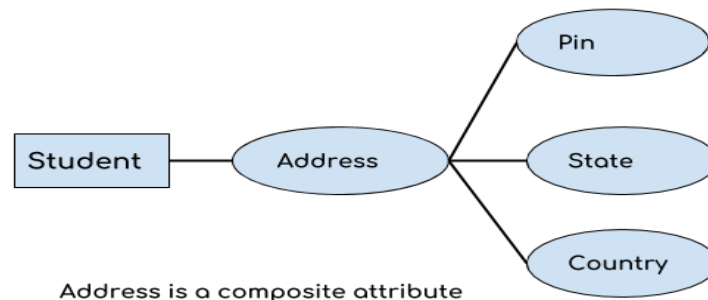


### ii. Simple attribute

An attribute is classified as a simple attribute if it cannot be partitioned into smaller components. For example, age and gender of a person. A simple attribute is represented by an oval, same as other attributes.

### iii. Composite Attribute

An attribute that is a combination of other attributes is known as composite attribute. For example, In Student entity, the student's **Address** is a composite attribute as an Address is composed of other attributes such as **Pin, State, Country**.

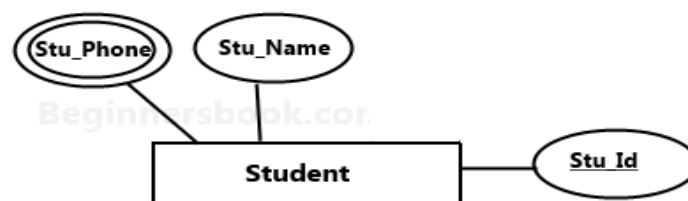


#### iv. Singlevalued Attribute

If an attribute of a particular entity represents single value for each instance, then it is called a single-valued attribute. For example, Guru, Nammu and Nidhi are the instances of entity 'Student' and each of them is issued a separate RollNumber. A single oval is used to represent this attribute, , same as other attributes.

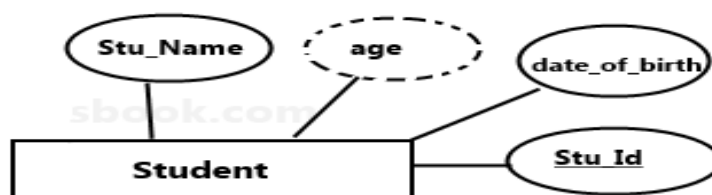
#### v. Multivalued Attribute

An attribute that can hold multiple values is known as multivalued attribute. It is represented with double ovals in an ER Diagram. For example – In Student entity a Studnet can have more than one phone numbers so the stu\_phone attribute is multivalued.



#### vi. Derived Attribute

A derived attribute is one whose value is dynamic and derived from another attribute. It is represented by dashed oval in an ER Diagram. For example – In Student entity **age** is a **derived attribute** as it changes over time and can be derived from another attribute **date\_of\_birth**.



### 7) What is a Relationship?

A) Association among entity sets(entities) is called relationship. A relationship describes how two or more entity sets are related. It shows the relationship among entities, a diamond is used to symbolically represent a relationship in the ER diagram. Generally a verb in a sentence signifies a relationship.

Ex:

- An employee **assigned** a project.
- Teacher **teaches** a student.
- Author **writes** a book.

8) Define Cardinality in Relationships.

A) Cardinality defines the numerical attributes of the relationship between two entities or entity sets.

9) Write about types of Relationships or Write about different types of cardinal relationships.

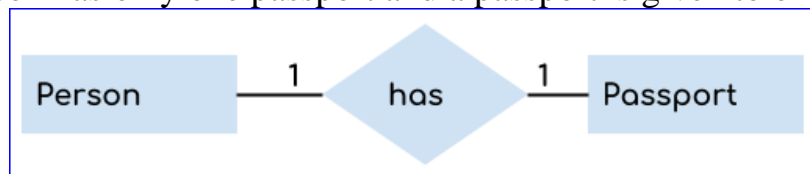
A) There are four types of relationships(**Connectivity of a relationship**):

- a. One to One
- b. One to Many
- c. Many to One
- d. Many to Many

#### a. One to One Relationship

When a single instance of an entity is associated with a single instance of another entity then it is called one to one relationship.

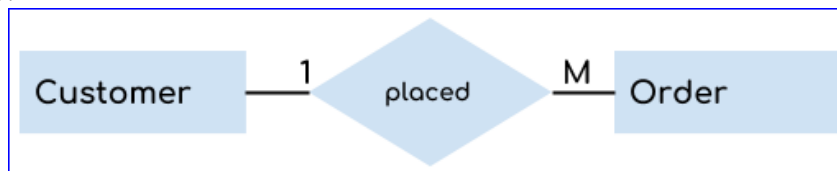
Ex: A person has only one passport and a passport is given to one person.



#### b. One to Many Relationship

When a single instance of an entity is associated with more than one instances of another entity then it is called one to many relationship.

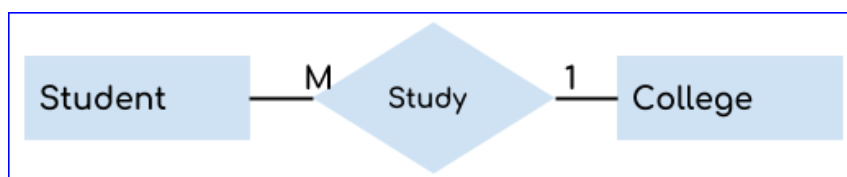
Ex: A customer can place many orders but a order cannot be placed by many customers.



#### c. Many to One Relationship

When more than one instances of an entity is associated with a single instance of another entity then it is called many to one relationship.

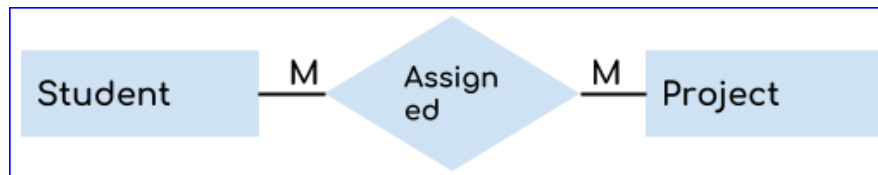
Ex: Many students can study in a single college but a student cannot study in many colleges at the same time.



#### d. Many to Many Relationship

When more than one instances of an entity is associated with more than one instances of another entity then it is called many to many relationship.

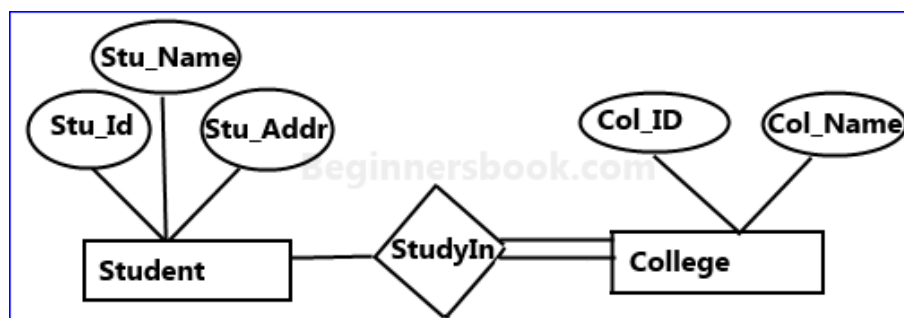
Ex: A student can be assigned to many projects and a project can be assigned to many students.



10) Write about total participation of an Entity Set. Give example.

A) A Total participation of an entity set represents that each entity in entity set must have at least one relationship in a relationship set.

Ex: In diagram given below each college must have at-least one associated Student.



It is a E-R Diagram with total participation of **College** entity set in **StudyIn** relationship set. This indicates that each college must have at least one associated **Student**.

11) Write about Degree of Relationship and their classification.

A) Degree of relationship specifies that how many entities involved in a relationship.

Degree of a relationship can be classified into following types:

### **Unary relationship**

If only single entity is involved in a relationship then it is a unary relationship.

For example, An employee(manager) supervises another employee.

### **Binary relationship**

When two entities are associated to form a relation, then it is known as a binary relationship. For example, A person works in a company. Most of the times we use only binary relationship in an e-r diagram. The teacher-student example shown above signifies a binary relationship.

### **Ternary Relationships**

As the name signifies, a ternary relationship is associated with three entities.

Other types of relationships include quaternary and N-ary, a quaternary relationship is associated with four entities and N-ary, contains N number of entities involved in the relationship.

12) Write the steps involving in reducing an E-R Diagram into a relational table.

A) ER diagram is converted into the tables in relational model.

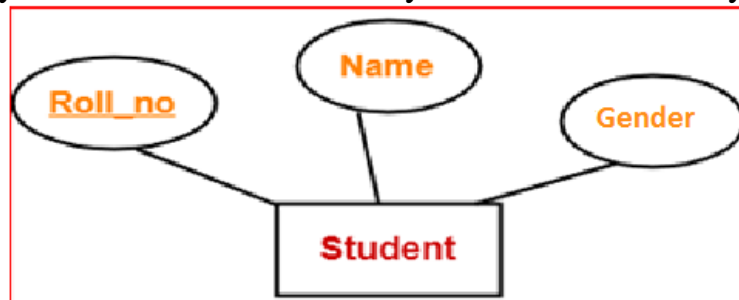
This is because relational models can be easily implemented by RDBMS like Oracle,MySQL etc.

The various rules we follow in reducing ER –Diagram into a table are:

**Rule-01: For Strong Entity Set With Only Simple Attributes**

Attributes of the table will be the attributes of the entity set.

The primary key of the table will be the key attribute of the entity set.



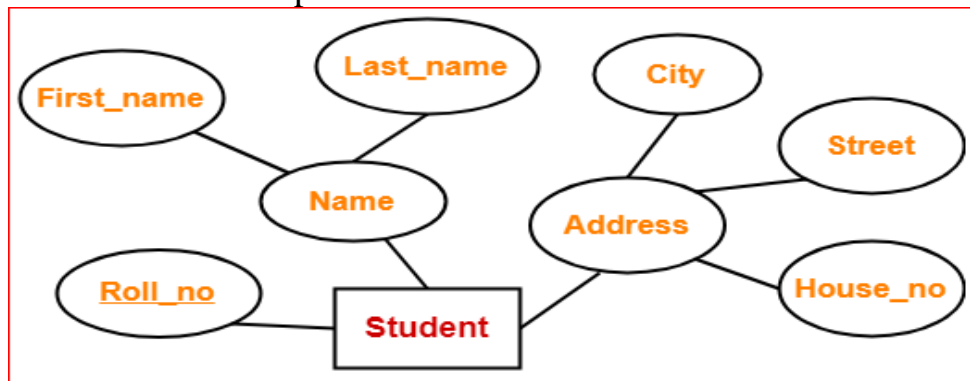
Schema/Table : Student(**Roll\_no**,Name,Gendre)

Roll_no	Name	Gender

**Rule-02: For Strong Entity Set With Composite Attributes**

A strong entity set with any number of composite attributes will require only one table in relational model.

While conversion, simple attributes of the composite attributes are taken into account and not the composite attribute itself.



Schema : Student ( **Roll\_no**, First\_name, Last\_name, House\_no, Street , City)

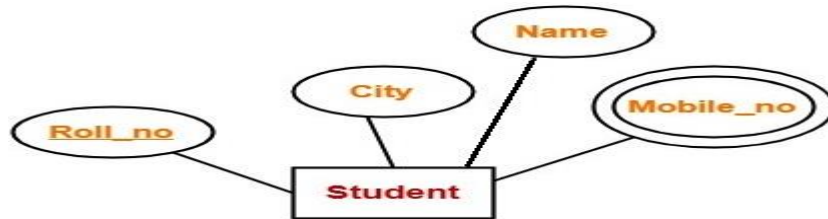
<b>Roll_no</b>	First_name	Last_name	House_no	Street	City

**Rule-03: For Strong Entity Set With Multi Valued Attributes**

A strong entity set with any number of multi valued attributes will require two tables in relational model.

One table will contain all the simple attributes with the primary key.

Other table will contain the primary key and all the multi valued attributes.



Schema : Student ( Roll\_no, Name, City)

Roll_no	Name	City

Schema : Mobile( **Roll\_no**, Mobile\_no)

Roll_no	Mobile_no

#### Rule-04: Translating Relationship Set into a Table

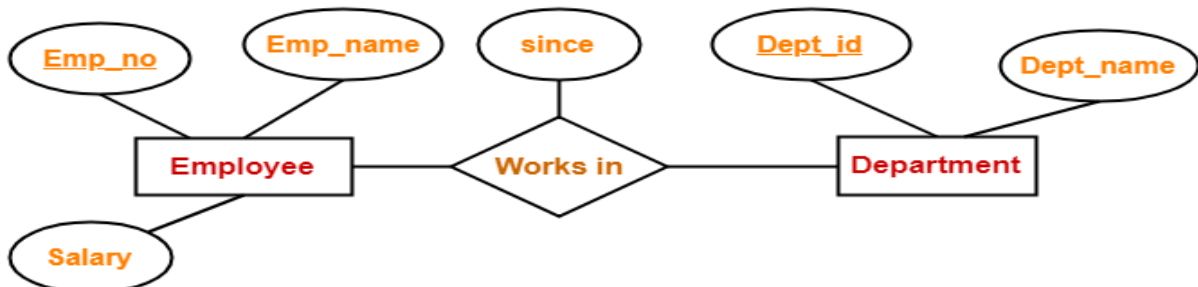
A relationship set will require one table in the relational model.

Attributes of the table are:

Primary key attributes of the participating entity sets

Its own descriptive attributes if any.

Set of non-descriptive attributes will be the primary key.



A relationship set will require one table in the relational model.

Attributes of the table are-

Primary key attributes of the participating entity sets

Its own descriptive attributes if any.

Set of non-descriptive attributes will be the primary key.

Schema : Works\_in ( **Emp\_no**, **Dept\_id**, since )

Emp_no	Dept_id	since

Note : If we consider the overall ER diagram, three tables will be required in relational model-

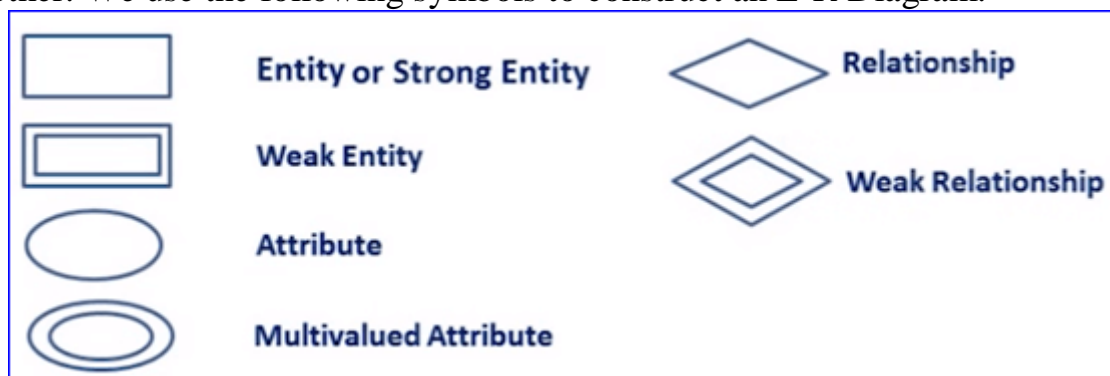
One table for the entity set “Employee”

One table for the entity set “Department”

One table for the relationship set “Works in”

**13)** Write about various symbols used in constructing an E-R Diagram.

A) ER- Diagram is a visual representation of data that describe how data is related to each other. We use the following symbols to construct an E-R Diagram.



**Rectangles:** This symbol represent 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

14) Write about EER model.

A) Enhanced Entity Relationship (EER) Model is a high level data model which is an extension to original Entity Relationship (ER) model. EER Models supports more details design. EER Modeling emerged as a solution for modeling highly complex databases.

**15)** Write about EER model and its features in detail.

A) As the complexity of data increased day to day, it became more and more difficult to use the traditional ER Model for database modeling. Hence some enhancements were made to the existing ER Model to make it able to handle the complex applications better.

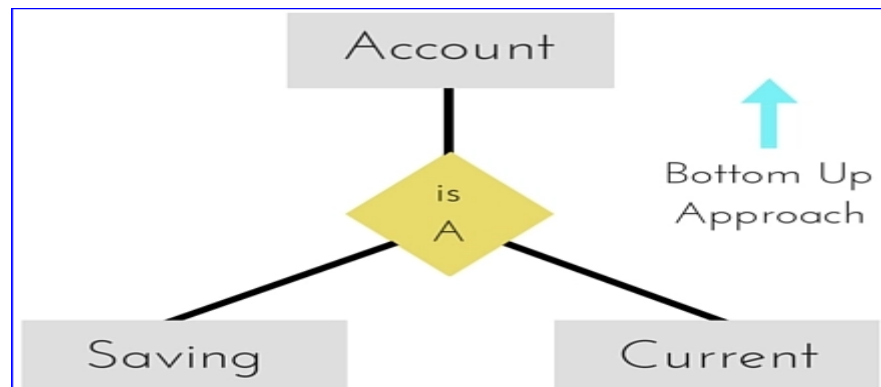
Hence, as part of the Enhanced ER Model, along with other improvements, three new concepts were added to the existing ER Model, they were:

### **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. Here sub-classes are combined to form a super-class.

**Ex:** Saving and Current account types entities can be generalized and an entity with name Account can be created, which covers both.

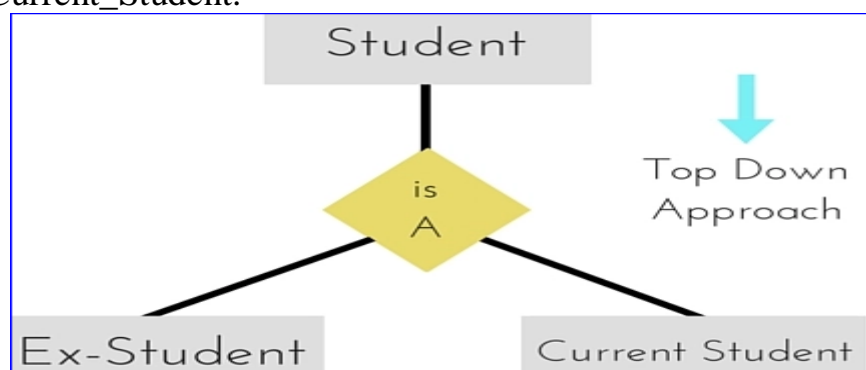




## Specialization

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.

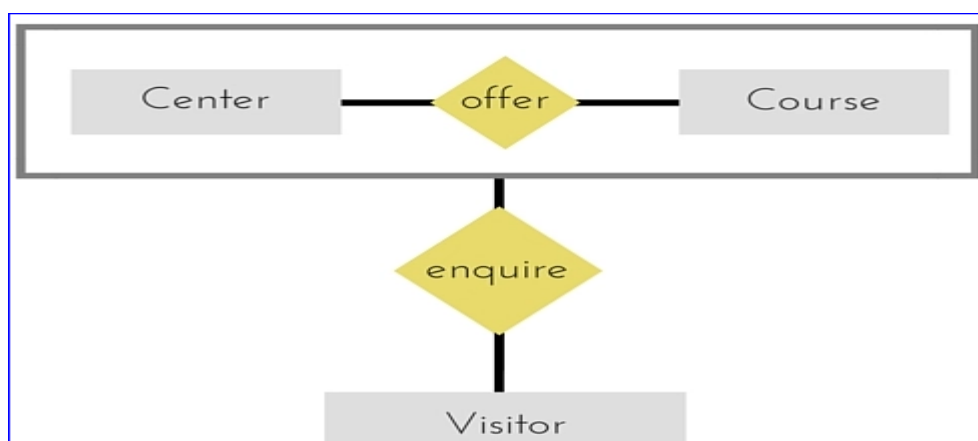
**Ex:** Student entity can be specialized and can be divided into two entities with name Ex-Student and Current\_Student.



## Aggregation

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

**Ex:** In the diagram below, 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.



16) Write about constraints on specialization and generalization, aggregation.A)

There are three constraints that may apply to a specialization/generalization:

membership constraints,

disjoint constraints and

completeness constraints.

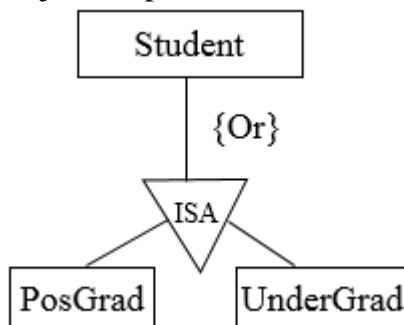
### Membership constraints

**Condition defined:** Membership of a specialization/generalization relationship can be defined as a condition in the requirements

e.g. tanker is a ship where cargo = oil

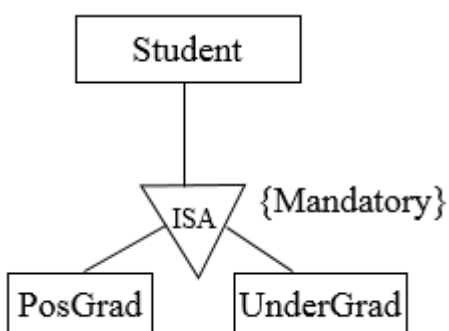
**User defined:** Sometimes the designer can define the superclass-subclass relationship. This can be done to simplify the design model or represent a complex relationship that exists between entities.

**Disjoint constraint:** The disjoint constraint only applies when a superclass has more than one subclass. If the subclasses are disjoint, then an entity occurrence can be a member of only one of the subclasses, e.g. postgrads or undergrads “you cannot be both”. To represent a disjoint superclass/subclass relationship, “Or” is used.



### completeness constraints:

Each superclass (higher-level entity) must belong to subclasses (lower-level entity sets), e.g. a student must be postgrad or undergrad. To represent completeness in the specialization/generalization relationship, the keyword “Mandatory” is used.



### Aggregation

Aggregation represents a “has-a” relationship between entity types, where one represents the “whole” and the other the “part”.

An example of aggregation is the Car and Engine entities. A car is made up of an engine. The car is the whole and the engine is the part. Aggregation does not represent strong ownership. This means, a part can exist on its own without the whole. There is no stronger ownership between a car and the engine. An engine of a car can be moved to another car.

## Representation of aggregation in ER diagrams

A line with a diamond at the end is used to represent aggregation.



The example of the Tree-Branch relationship can be represented as shown below



17) Write about Entity Clusters.

A) An entity cluster is a “virtual” entity type used to represent multiple entities and relationships in the ERD. An entity cluster is formed by combining multiple interrelated entities into a single abstract entity object. An entity cluster is considered “virtual” or “abstract” in the sense that it is not actually an entity in the final ERD. Instead, it is a temporary entity used to represent multiple entities and relationships, with the purpose of simplifying the ERD and thus enhancing its readability.

18) Write about advantages of E-R modeling.

A) Various advantages of E-R Modeling are

**Conceptually it is very simple:** ER model is very simple because if we know relationship between entities and attributes, then we can easily draw an ER diagram.

**Better visual representation:** ER model is a diagrammatic representation of any logical structure of database. By seeing ER diagram, we can easily understand relationship among entities and relationship.

**Effective communication tool:** It is an effective communication tool for database designer.

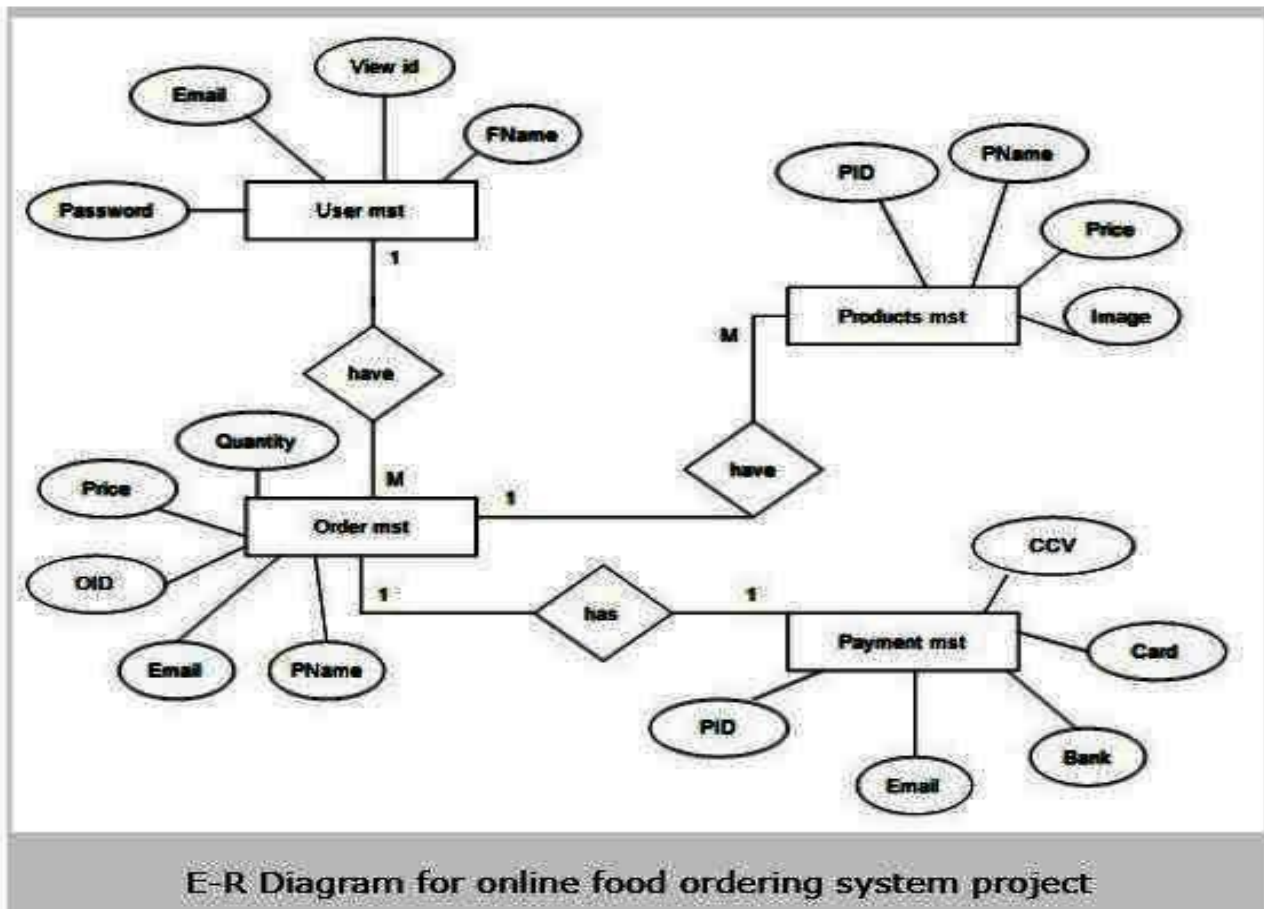
**Highly integrated with relational model:** ER model can be easily converted into relational model by simply converting ER model into tables.

**Easy conversion to any data model:** ER model can be easily converted into another data model like hierarchical data model, network data model and so on.

**19) What is ER-Model? Frame ER Diagram with suitable example.**

A) An Entity–relationship model (ER model) describes the structure of a database with the help of a diagram, which is known as Entity Relationship Diagram (ER Diagram). An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are: entity set and relationship set.

## E-R Diagram for Online Food System



**\*\*Describe about each entity and their relationships with respective participating entities.(if it is given for 10M)**