Define the following terms.

Entity

- An entity is a thing or object or person in the real world that is unique from all other object.
- E.g. book, student, employee, college, etc.

Entity sets

- An entity set is a set of entities of same type that share the same properties or attributes.
- E.g. the set of all students in a college can be defined as entity set student.

Relationship

- Relationship is an association (connection) between several entities.
- Relationship between two entities is called binary relationship.
- E.g. book is issued by student where book and student are entities and issue is relation.

Relationship set

- Relationship set is a set of relationships of the same type.

Attributes

- Attributes are properties hold by each member of an entity set.
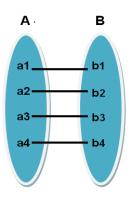- E.g. entity is student and attributes of students are enrollmentno, name, address, cpi, etc.

Explain Different Types of Attributes. [Refer PPT For Symbolic Notation]

- **Simple attribute:** It cannot be divided into subparts. E.g. cpi, rollno
- **Composite attribute**: It can be divided into subparts. E.g. address, name
- **Single valued attribute:** It has single data value. E.g. enrollmentno, birthdate
- **Multi valued attribute**: It has multiple data value. E.g. contactno (may have multiple phones)
- **Stored attribute:** its value is stored manually in database. E.g. birthdate
- **Derived attribute**: its value is derived or calculated from other attributes. E.g. age (can be calculated using current date and birthdate).
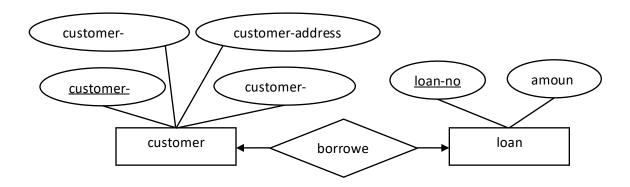
Explain Various Mapping Cardinality (Cardinality Constraint).

Mapping cardinality (cardinality constraints)

- It represents the number of entities of another entity set which are connected to an entity using a relationship set.
- It is most useful in describing binary relationship sets.
- For a binary relationship set the mapping cardinality must be one of the following types:
1. **One-to-one relationship**
- An entity in A is associated with at most one entity in B and an entity in B is associated with at most one entity in A.
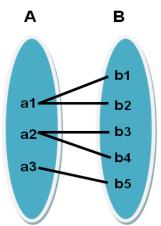
A · **B**

- A customer is connected with only one loan using the relationship borrower and a loan is connected with only one customer using borrower.
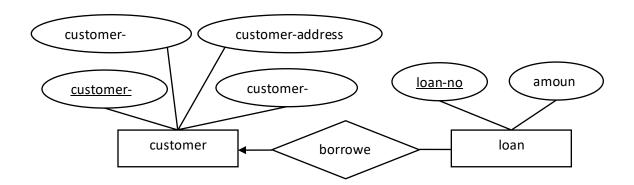

2. One-to-many relationship

- An entity in A is associated with any number (zero or more) of entities in B and an entity in B is associated with at most one entity in A.
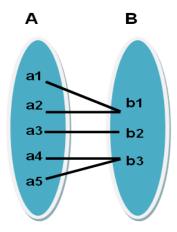
A   **B**

- In the one-to-many relationship a loan is connected with only one customer using borrower and a customer is connected with more than one loans using borrower.
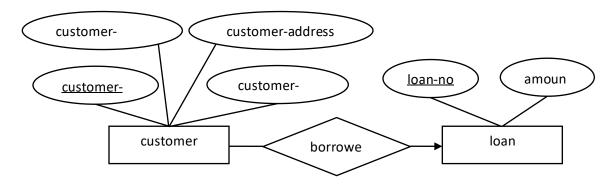
3. Many-to-one relationship

- An entity in A is associated with at most one entity in B and an entity in B is associated with any number (zero or more) of entities in A.
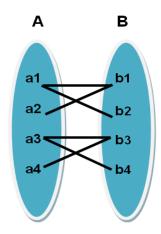

- In a many-to-one relationship a loan is connected with more than one customer using borrower and a customer is connected with only one loan using borrower.
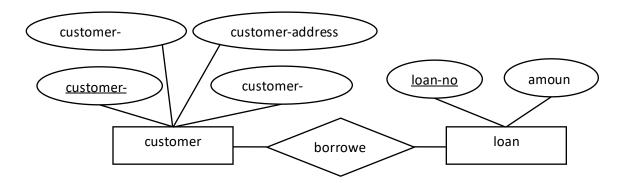

4. Many-to-many relationship

- An entity in A is associated with any number (zero or more) of entities in B and an entity in B is associated with any number (zero or more) of entities in A.

- A customer is connected with more than one loan using borrower and a loan is connected with more than one customer using borrower.
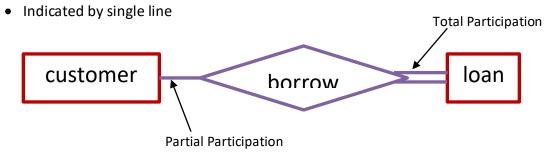

Participation Constraints

- It specifies the participation of an entity set in a relationship set.
- There are two types participation constraints
  ➡ Total participation
  ➡ Partial participation

Total participation

- Every entity in the entity set participates in at least one relationship in the relationship set.
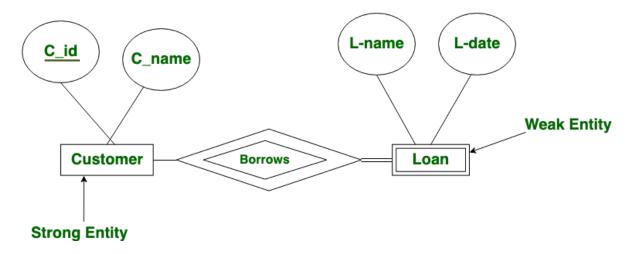- Indicated by double line

Partial participation

- Some entities in the entity set may not participate in any relationship in the relationship set.
- Indicated by single line

Weak Entity Set

- An entity set that does not have a primary key is called weak entity set and the entity set which have primary key is known as strong entity set.
- However, it contains a partial key called as a discriminator. Discriminator can identify a group of entities from the entity set.
- Weak entity is represented by double rectangle. The relation between strong and weak entity is represented by double diamond.
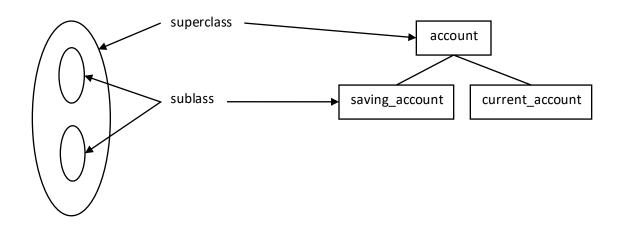

Explain the Superclass and Subclass in E-R diagram with the help of Example.

Superclass

- A superclass is an entity from which another entity can be derived.
- A superclass is a generic entity set which has a relationship with one or more subclasses.
- For example, an entity set account has two subsets saving_account and current_account. So an account is superclass.
- Each member of subclass is also a member of superclass. So any saving account or a current account is a member of entity set account.
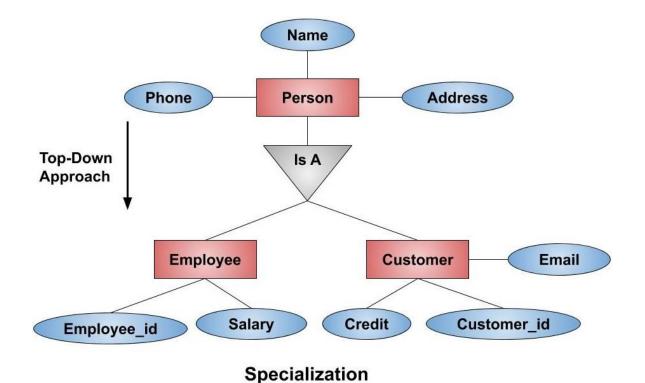
Subclass

- A subclass is an entity that is derived from another entity.
- A class is a subset of entities in an entity set which has attributes distinct from those in another subset.
- For example, entities of the entity set account are grouped in to two classes saving_account and current_account. So, saving_account and current_account are subclasses.

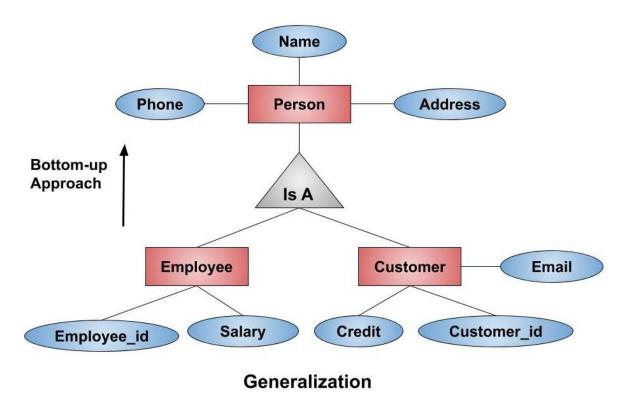## Explain Specialization and Generalization in E-R diagram with Example.

Specialization

- Specialization is the process of defining subclasses of a super class based on some different characteristics.
- Specialization identifies the sub sets of an entity set. Each of these sub sets has some attributes. These attributes are unique to that sub set.
- Specialization is a top-down process to define super class / sub class relationships.
- It maximizes the different between entities of the entity set and identifies unique characteristics for sub set of entities.
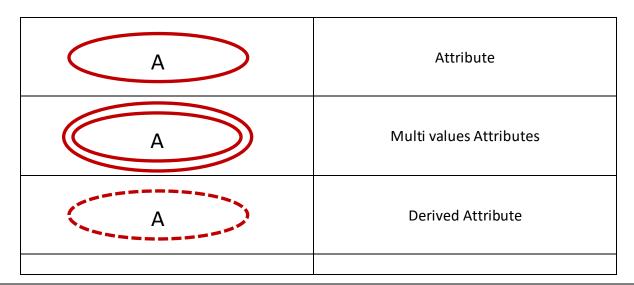

Specialization

Generalization

- Generalization is the process of defining super class from sub classes based on some common characteristics.
- Generalization identifies the super class from different entity set (sub class). This super class possess some attributes. These attributes are common to given entity sets.
- Generalization is a bottom-up process to define super class / sub class relationships.
- It minimizes the different between entities of different entity sets by identifying common characteristics.

Generalization
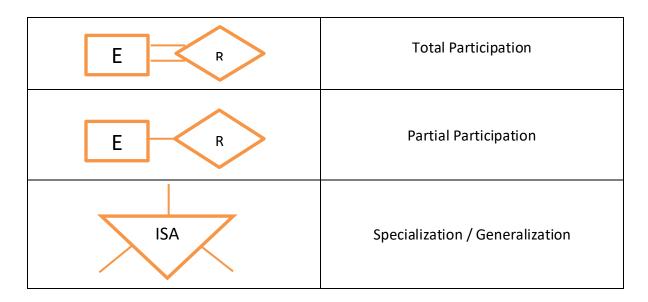
Symbols used in E-R diagram.

A	Attribute
A	Multi values Attributes
A	Derived Attribute

E	Weak Entity / Weak Entity Set
A	Primary key Attribute
A	Discriminating Attribute
R	Relationship / Relationship Set
R	Weak Relationship Set
E → R → E	One to One Relationship
E ← R — E	One to Many Relationship
E — R → E	Many to One Relationship
E — R — E	Many to Many Relationship

E — R (double line, diamond)	Total Participation
E — R (single line, diamond)	Partial Participation
ISA (triangle)	Specialization / Generalization

Constraints on Specialization and Generalization

- There are two may types of constraints apply on specialization and generalization.
    1. Disjoint
    2. Participation

Disjoint

- It describes relationship between members of the superclass and subclass and indicates whether member of a superclass can be a member of one, or more than one subclass.
- Types of disjoint constraints
    ➡ Disjoint Constraint
    ➡ Non-disjoint (Overlapping) Constraint

Disjoint Constraint

- It specifies that the entity of a super class can belong to only one lower-level entity set (sub class).
- Specified by '**d**' or by writing **disjoint** near to the ISA triangle.

Non-Disjoint (Overlapping) Constraint

- It specifies that an entity of a super class can belong to more than one lower-level entity set (sub class).
- Specified by 'o' or by writing overlapping near to the ISA triangle.

Participation

- It determines **whether every member of super class must participate as a member of subclass or not**.
- Types of participation (Completeness) Constraint
    ➡ Total (Mandatory) participation
    ➡ Partial (Optional) participation

Total Participation

- Total participation specifies that every entity in the superclass must be a member of some subclass in the specialization.
- Specified by a double line in E-R diagram.

Partial Participation

- Partial participation specifies that every entity in the super class does not belong to any of the subclass of specialization.
- Specified by a single line in E-R diagram.