

**DBMS**

**MODULE 2**  
**Entity Relationship Data Model**

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## 2. Entity-Relationship

### Data Model.

- Entity :-

Entity refers to an "object" or "thing" in real world. Object may be any person, place, event etc.

- Entity Type :-

Collection of entities having common attribute is termed as Entity type.

- Entity set :-

Set of entities of same entity type.  
(Collection of one or more entities).

- Attribute :-

Attributes are the particular properties or characteristics that describes the entities.

e.g.: Student can be described by his name, age, address, height, class etc.

A car can be described by its colour, model, company etc.

- Value :-

Value is the information or data which is stored in attributes of any entity.

- Domain (Value set) :-

Domain or value set is the set of all values or information about any attribute.

eg:- Consider student table shown in below:-

Sid	name	age	branch	sem	contact_no.
1	Priyanka	27	Comp	III	123
2	Snehal	25	I.T.	IV	456
3	Vipul	23	Comp	VII	789

table 1: Student Information.

- Enterprise :- It refers to the organization  
Here, enterprise is college where students are studied.

- Entity :- Here, entity refers to any single student with all his values.

eg:-

1	Priyanka	27	Comp	III	123
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- Entity set :- Coll. of entities.

1	Priyanka	27	Comp	III	123
3	Vipul	23	Comp	VII	789

Here, first and third entities are combined.

- Entity Type :- All students are described by same set of attributes. Therefore, entity type is "student information".

Value :-

The values are priyanka, 27, I.T.  
456 etc.

Domain :-

For attribute, "name" it is 'Priyanka',  
'Snehal', 'Vipul' and for age it is 27, 25, 23.

\*

### Types of attributes

#### 1) Simple and Composite Attributes :-

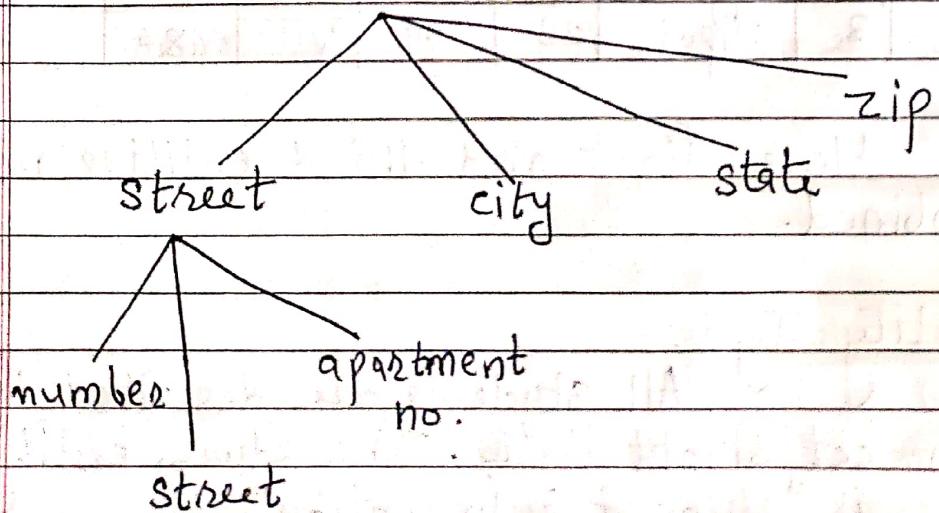
Simple attributes are those which cannot be divided into subparts.

eg: Colour of a car, branch of a student.

Composite attributes are those which can be divided into subparts.

eg:- Name of the student can be divided into firstname, middlename, lastname.

Composite attribute can form hierarchy.



## 2) Single Valued and multi-valued attribute :-

An attribute having only single value for a particular entity is known as single valued attribute.  
 eg:- age of a student.

An attribute having more than one possible value for a particular entity is known as multivalued.  
 eg:- Phone no. of a student: A student can have more than one phone no.

## 3) Stored vs derived attribute :-

In some cases, two or more attribute values are related.

eg:- The age and birth date attributes of a person.

for a particular entity 'person', the value of age can be determined from the current (today's) date and the value of the person's birth date. The age attribute hence called a derived attribute and is said to be derivable from the birth date attribute which is called as stored attribute.

## 4) NULL Value Attribute :-

NULL stands for nothing. In some cases a particular entity may not have an applicable value for an attribute.

eg:- The apartment number attribute of

an address applies only to addresses that are in apartment building and not to other types of residences, such as single family homes. Similarly, a college degree attribute applies only to persons with college degrees. For such situations, a special value called NULL is created.

NULL can also be used if we do not know the value of an attribute for a particular entity. e.g. We know do not know the home phone of the person "John". The meaning of the former type of NULL is not applicable whereas the meaning of the latter is unknown. The unknown category of NULL can further be classified into two cases.

The first case arises when it is known that the attribute value exists but it is missing. e.g. If height attribute of a person is listed as NULL.

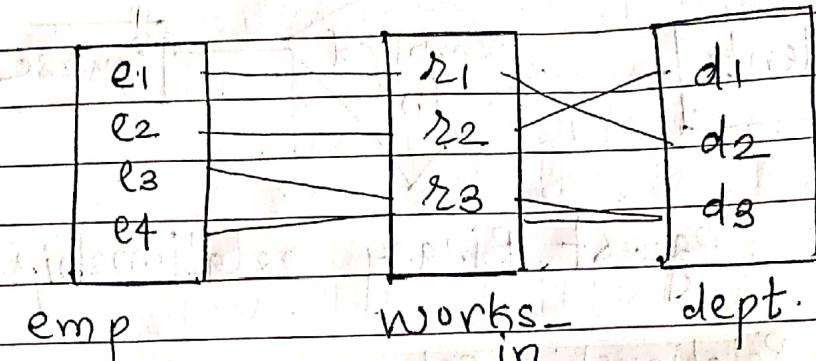
The second case arises when it is not known whether the attribute value exists. e.g.: home phone attribute of a person is NULL.



## Relationship :-

A relationship is the association among several entities. It connects different entities through a meaningful relation.

eg:- employee works in different department,  
student issues books from library.



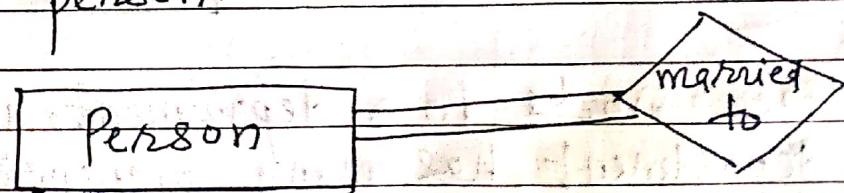
- Degree of relationship set:-

Total no. of entity sets participate in a relationship set is known as degree of that relationship set.

### 1) Unary Relationship :-

When there is only one entity set participating in the relationship, then it is Unary Relationship.

eg:- one person is married to only one person.

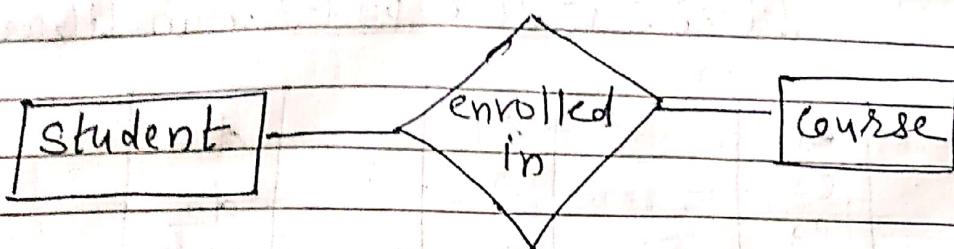


eg. Unary Relationship.

## 2) Binary Relationship set :-

When there are two entity sets participating in the relationship, the relationship called binary relationship.

eg:-

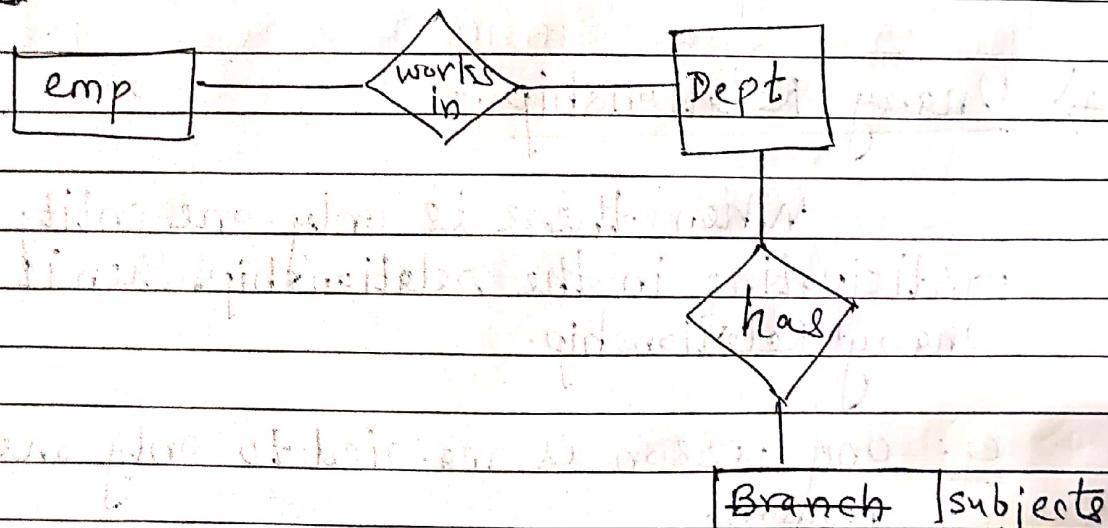


eg:- of Binary relationship.

## 3) Ternary Relationship set :-

A relationship set, in which three entity sets are involved is known as ternary relationship set.

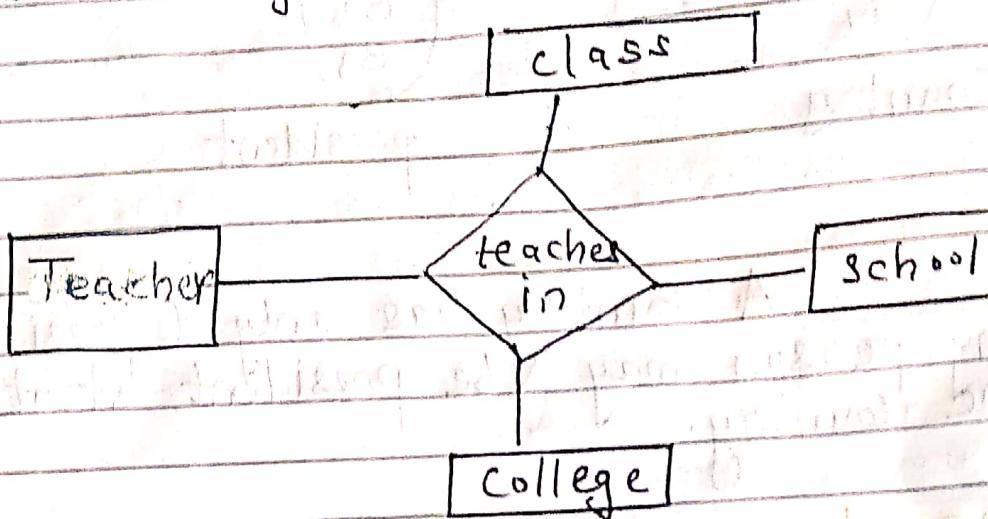
eg:-



Employee works in a department, and each department has many branches, subjects.

#### 4) N-ary Relationship set :-

A relationship set in which more than 3 entity sets are involved is termed as 'N-ary' reln set.



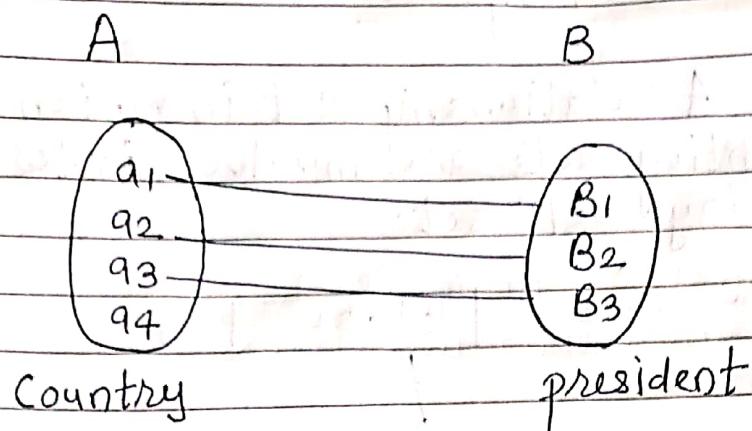
#### (\*) Mapping constraints / Cardinalities:-

It specifies the no. of entities of an entity set that are associated with entities of another entity set through a relationship set. Mapping cardinalities are helpful in describing binary relationship set.

##### a) One to one (1:1)

In this, an entity in A is associated with atmost one entity in B and an entity in B is associated with atmost one entity in A.

e.g:-



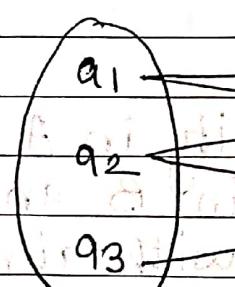
A country has only 1 president.  
Any person may be president of at most one country.

### ⑥ One to Many (1:N)

In one to many mapping, An entity in A is associated with any no. of entities (zero or more) in B, and entity in B is associated with atmost one entity in A.

A

B



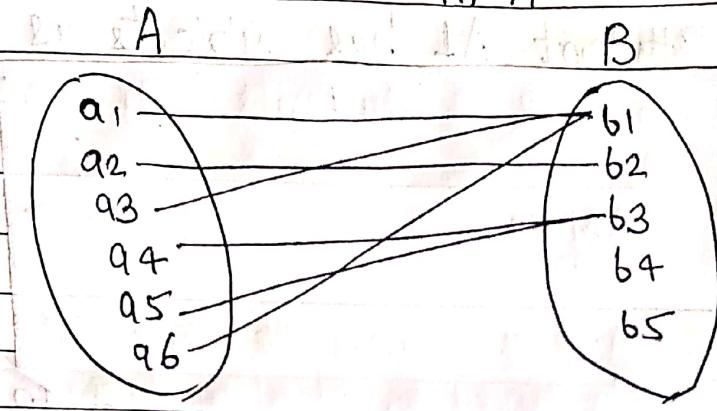
Manager

employee

A manager has many employees working under him; but an employee works under only one manager.

### (c) Many to one ( $m:1/N:1$ )

In many to one mapping an entity in A is associated with atmost one entity in B and entity in B is associated with any member of entities in A.



Employee                      Project

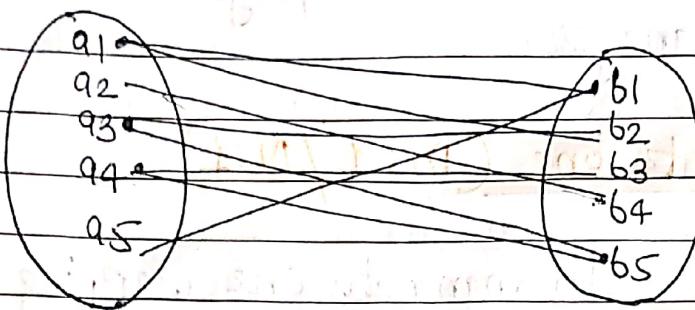
An employee can work on single project while any project can be assigned to more than one employee.

### (d) Many to Many ( $m:N$ )

An entity in A is associated with any number of entities in B and vice versa.

A

B



Student      Subject

Student A1 has subjects as (b1, b2)  
whereas b1 has 2 students (a1, a5).



### Keys in DBMS:-

A key is an attribute or set of attributes i.e. used to identify data in the entity sets. The attributes which are used as key are attributes. Keys ensure that each record within a table can be uniquely identified, by one or more combination of fields within the table.

- Type of Keys :-

- 1) Super key :-

A Super key is a set of one or more attributes (columns) that can uniquely identify each record (row) within a table.

An empty set has more than one

Superkey. Superkey has redundant attributes.  
Non minimal candidate key is nothing but  
Superkey.

e.g.

empid	fname	lname	Sal	Dob	DoJ	Passport No.	Dept. id
1	priyanka	Bhilare	50k	18/2/80	1/2/12	123	10
2	Akhila	Pawar	80k	20/2/89	1/2/12	245	20
3	Priyanka	Bhilare	85k	13/2/75	4/2/12	826	30
4	Tejaswi	Rane	80k	16/6/85	15/3/14	456	10

emp table

DeptId	Name
10	Sales
20	Marketing
30	accounts

Dept. table

In above table of emp. superkeys are as follows:-

- 1) empid
- 2) empid, fname
- 3) empid, lname
- 4) Passport no.
- 5) Dept, DoJ
- 6) Sal, Dob
- 7) Sal, lname
- 8) DoJ, Dob
- 9) DoJ, lname

2) Candidate key :-

When an entity has more than one attribute (or set of attributes) that can serve as primary key, each of such keys are

called as Candidate key. Only one of the candidate keys is chosen as primary key for the entity. Candidate key cannot be null or empty and its value should be unique.

The minimal superkey is known as candidate key (must have minimum number of keys to ensure uniqueness).

For emp. table candidate keys are :-

- 1) empid;
- 2) Passportno;
- 3) Dept, DOJ
- 4) Sal, DOB
- 5) Sal, Lname
- 6) DOB, Lname
- 7) DOJ, Lname

3) Primary key :-

It is the first and foremost key which is used to identify a record uniquely.

It can be a single attribute or combination of attributes. Primary key must contain unique values and must never be null.

Selection of primary key for each entity is based on the requirements of the developer.  
eg:- Primary key for emp table will be empid.

4) Secondary / Alternate key :-

An attribute or set of attributes which are not selected as primary keys are called as secondary keys or alternate keys.

## 5) Foreign key :-

A foreign key is an attribute in any entity set which is also a primary key in any other entity set.

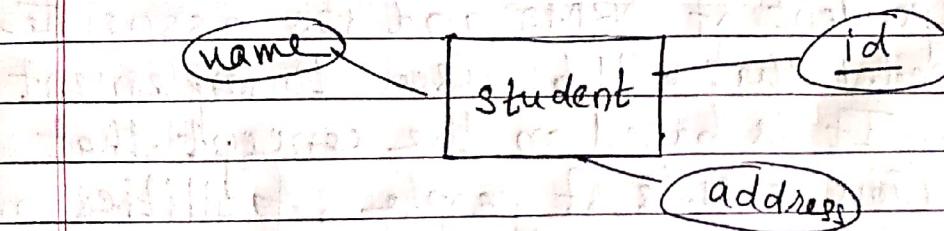
e.g.: Deptid is an attribute in entity set employee and also a primary key in entity set dept. This is Foreign key in employee.

## (\*) Types of Entity sets :-

There are two types of entity sets

### 1) Strong entity set :-

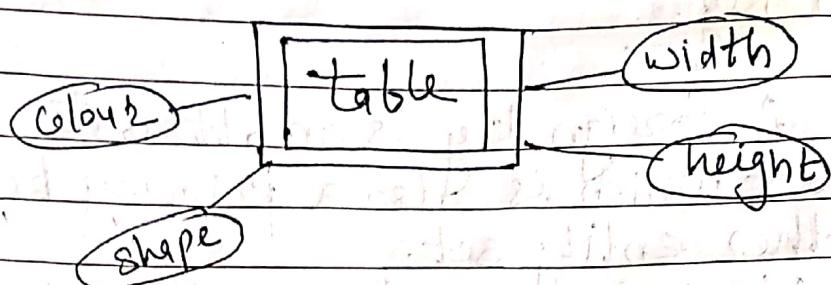
An entity set having primary key attribute is known as strong entity set.



In the above e.g. student will have primary key as id, therefore student acts as strong entity.

### 2) Weak entity set :-

Entity sets having no key attributes are known as weak entity sets.



In above eg. table entity does not contain any primary key, therefore treated as weak entity set.



### E-R Model :-

The E-R model is mainly used for communication between DB designers and end users during the analysis phase of DB. This E-R model is representation of the structure & constraints of DB that is independent of DBMS and its associated data model that will be used to implement the DB. It is based on the concept that organization consists of people, facilities and objects. These components of an enterprise interact with each other to achieve certain goals of the enterprise.

E-R diagram describes logical structure of a DB.

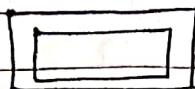
Symbols used in ER diagrams are shown in the table.

①



strong entity set

②



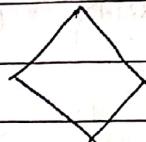
weak entity set

③



attribute

④



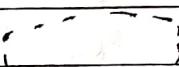
Relationship set

⑤



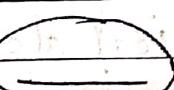
Multivalued Attribute

⑥



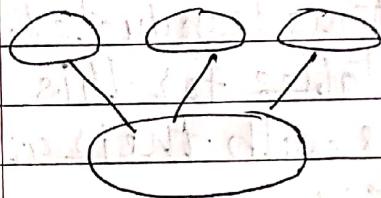
Derived attribute

⑦



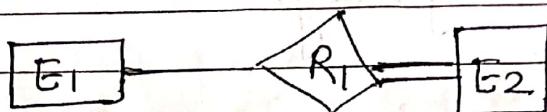
Key attribute

⑧



Composite Attribute

⑨



Total Participation

⑩



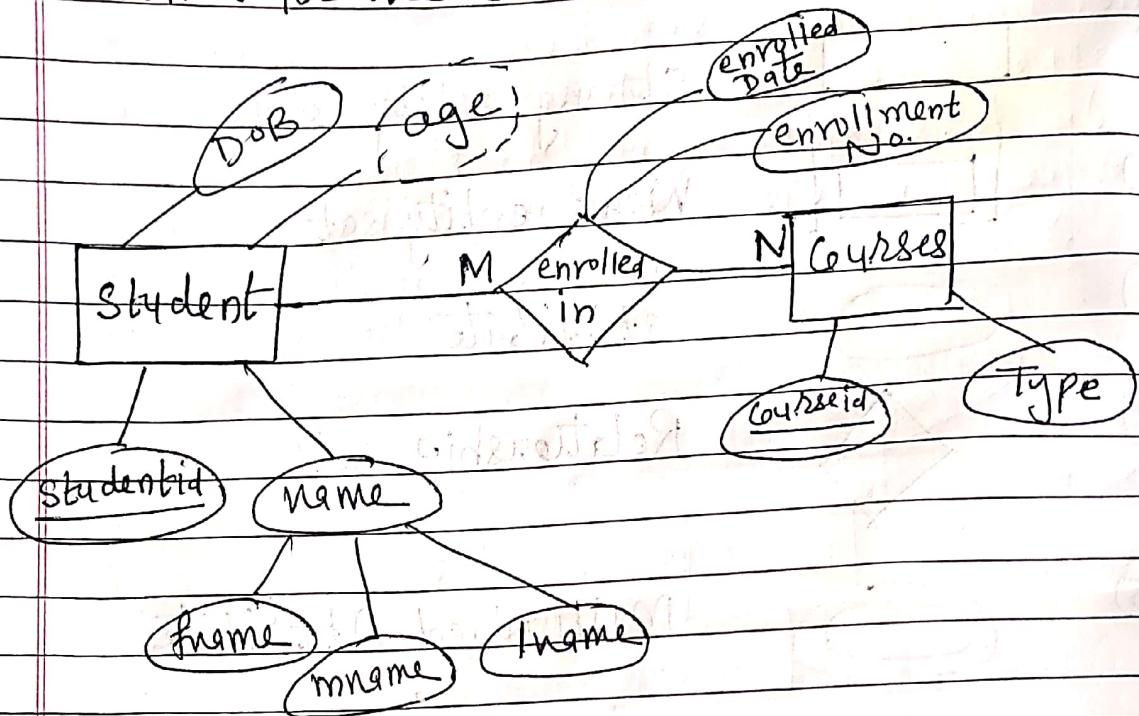
Partial Participation

⑪

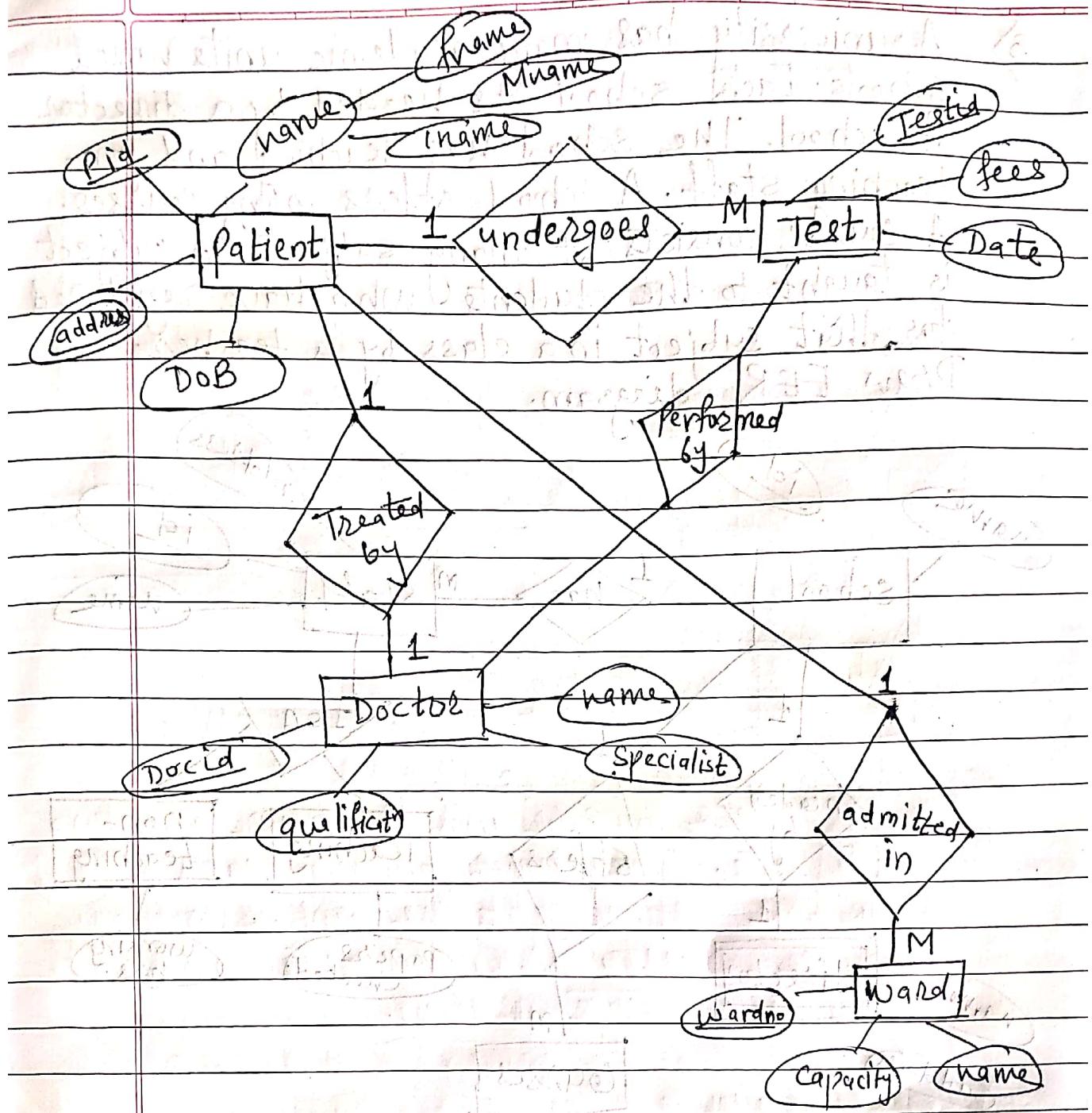


specialization or  
generalization

- 1) Draw ER diagram showing students enrolled for the courses.

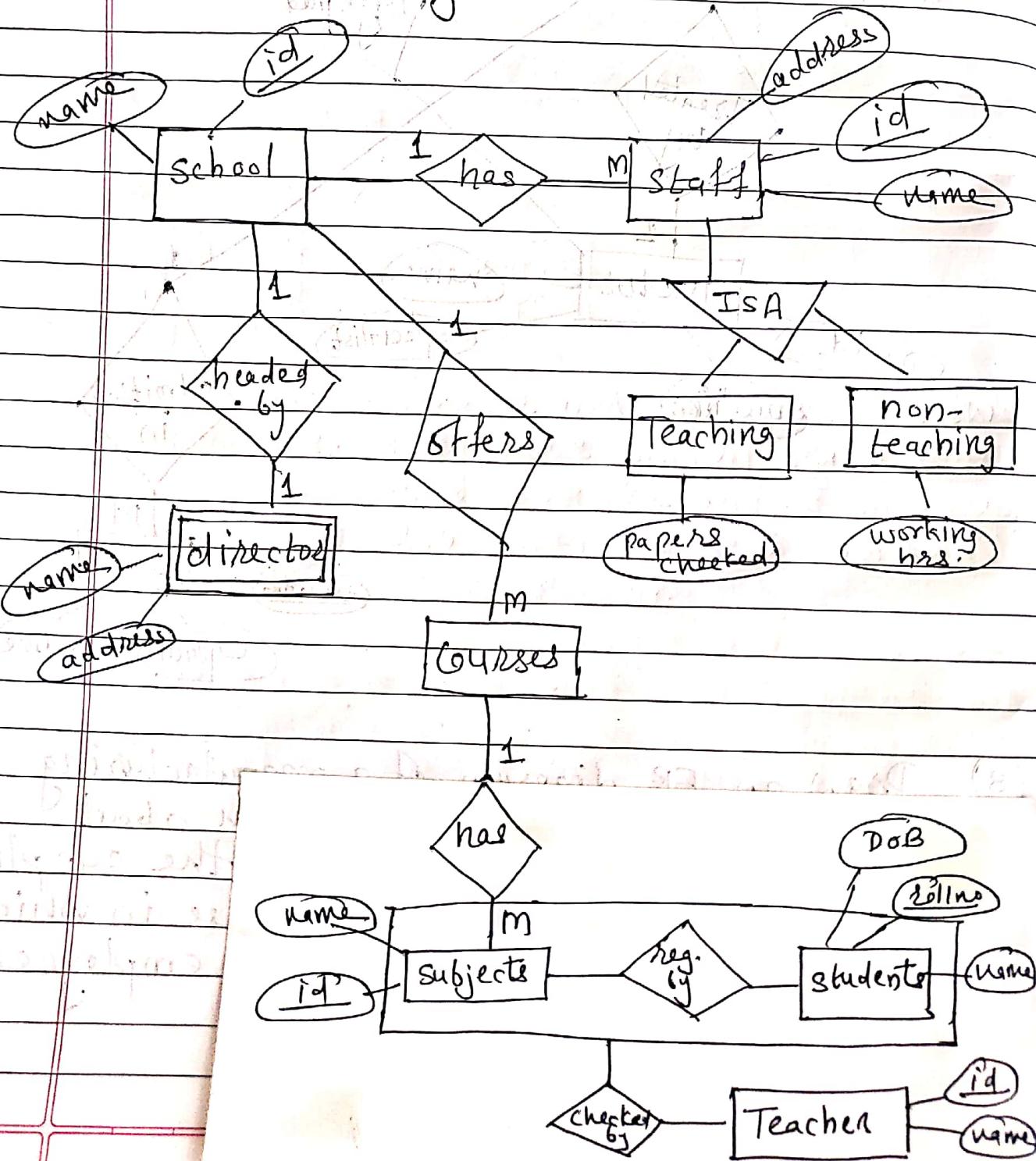


- 2) Construct an E-R diagram for hospital with set of patients and set of medical doctors. Associate with each record of patient, a log of various tests examinations conducted. Construct the appropriate tables for this ER diagram and list the tables with their attributes, primary key and foreign key.



- (3) Draw an ER diagram of a manufacturing company which records information about projects, parts used in projects, the supplier who supplies the parts, warehouse in which those parts are stored and the employees who work on these projects.

3) A university has many academic units named schools. Each school is headed by a director of school. The school has teaching and non-teaching staff. A school offers many courses. A course consists of many subjects. A subject is taught to the students who have registered for that subject in a class by a teacher. Draw EER diagram.





## EER (Extended ER / Enhanced ER model) :-

EER model is basically the enhanced version of E-R model which includes all the basic concepts of E-R model with capability to support additional concepts of complex application.

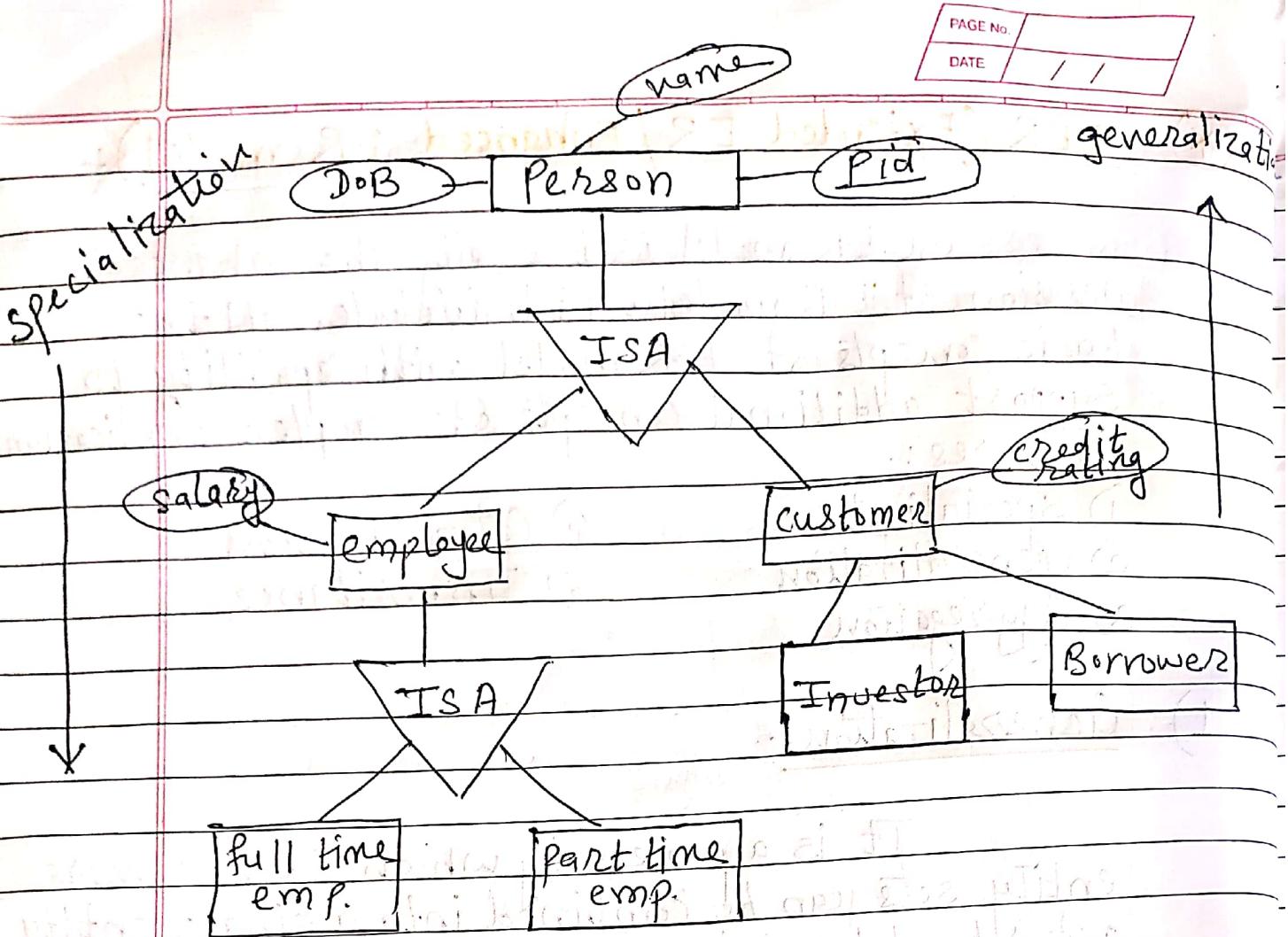
Features :-

- 1) Specialization
- 2) Generalization
- 3) Aggregation
- 4) Categorization
- 5) Inheritance

### 1) Generalization:-

It is a process by which two or more entity sets can be combined into a single entity set by determining similarities between the entities. Generalization proceeds from the recognition that no. of entity sets share some common features.

It is the process of extracting common properties from a set of entities and create a generalized entity from it. It is bottom-up approach in which two or more entities can be generalized to a higher level entity if they have some attributes in common.



Here, investor and Borrower are two entity sets. They have common feature that they are customers of the bank. Similarly, employee & customer entity sets can be combined as type person.

2) Specialization: In specialization, entity is divided into subentities based on their characteristics. It is top-down approach where higher level entity is specialized into two or more lower level entities.

Eg:- Consider the example of bank, in this person is an entity set of all people

Who belongs to bank. Further person is classified into employees and customers of bank. So person entity set is divided into employee entity set and customer entity set. Employee are further classified into two categories full time employee and part time employees. Customers are classified into investors and borrowers and so on...

### 3) Inheritance:-

Specialization and generalization leads to attribute inheritance between higher level entity set and lower level entity set. Inheritance is a process by which lower level entity set inherits some properties of its higher level entity set.

Here, the entity set employee & customer inherit the attributes person-id, name, address, age from person entity set.

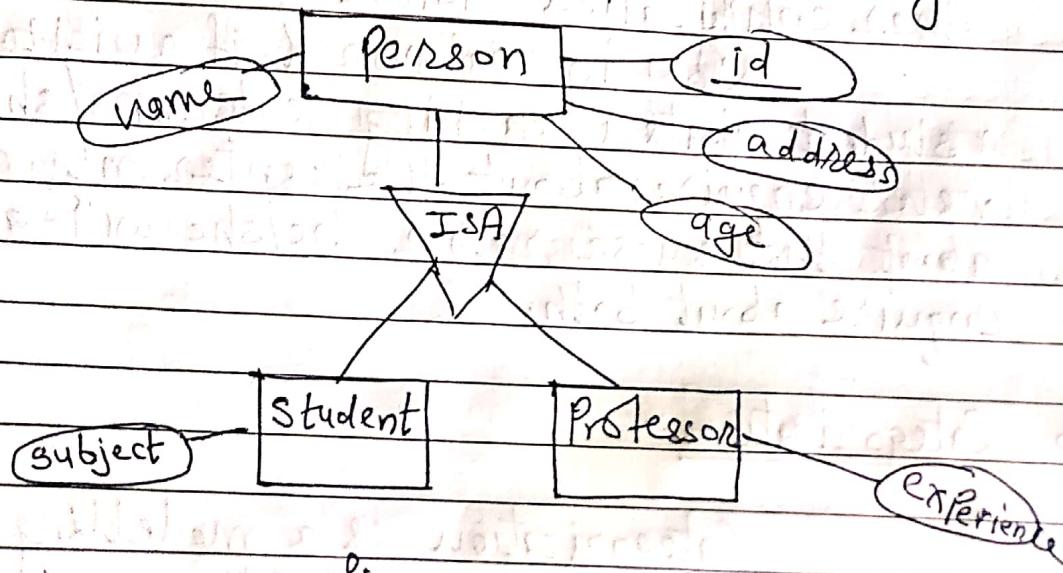
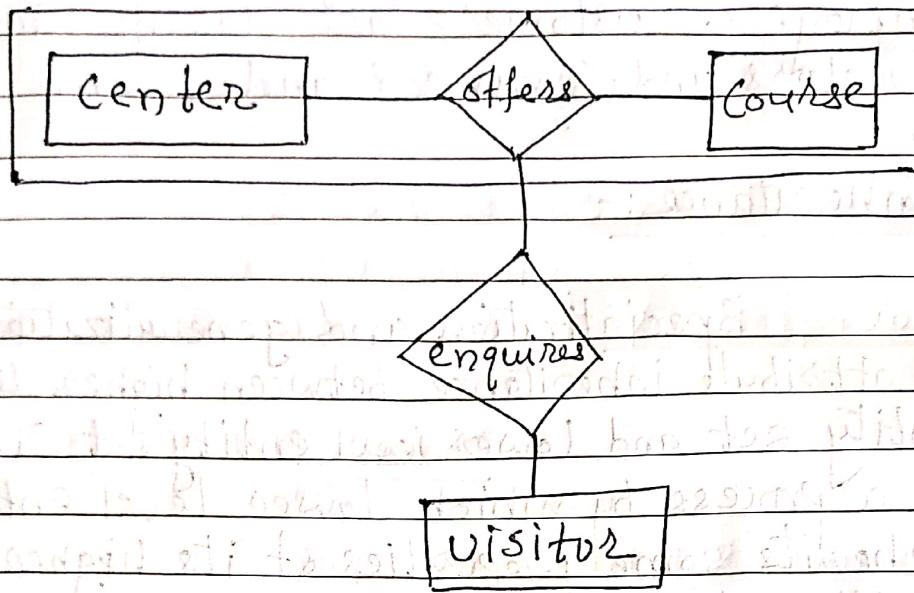


fig. Example of Inheritance

#### 4) Aggregation :-

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



In the diagram above, the relation between center and course together is acting as an entity, which is in relationship with other entity called visitor.

Now in realworld, 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.

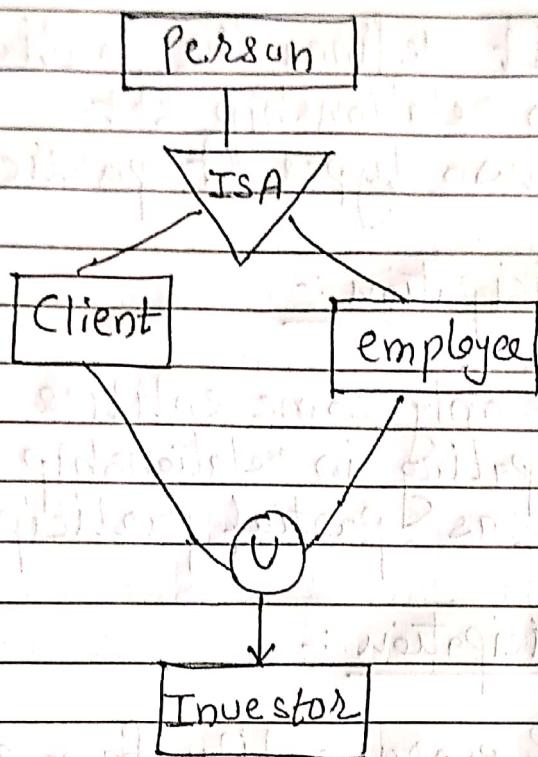
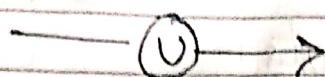
#### 5) Categorization :-

Categorization is a modelling process of a single subclass having relationship with

more than distinct superclasses.

The subclass having more than one superclass is known as category and the process of defining a category is known as categorization.

Symbol for categorization is



In a bank, person can be either a employee or a client and both of them may be investors. So, here subclasses employee & Client act as disjoint superclass & subclass investor acts as a category.

### ① Disjoint Constraint:-

It describes the relationship between

members of different subclasses. According to the Disjoint constraint if the subclass of specialization/generalization are disjoint then an entity can be a member of only one subclass of that specialization/generalization.

### (\*) Participation Constraints :-

It defines the participation of entity set in relationship set.

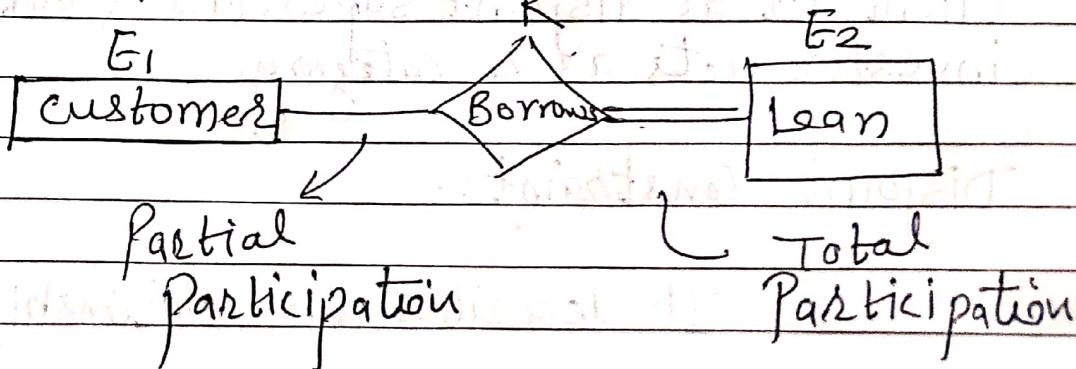
There are two types of participations :-

#### ① Partial Participation :-

If only some entities from entity set E is participating in relationship set R then it is known as partial participation.

#### ② Total Participation :-

If every entity from entity set E is participated with at least 1 relation in relationship set R then it is known as total participation.



Here, customer and Loan are two entity sets and relationship set is borrower. Every customer may or may not take loan so customer entity set is partially participated. But for every loan, at least one customer is concerned, so entity set loan is totally participated.