

## UNIT:2

# ENTITY RELATIONSHIP MODEL

### CONTENTS

- Basic Concepts
- ER Diagram Components
- Constraints
- Keys
- Weak Entity set

### BASIC CONCEPTS

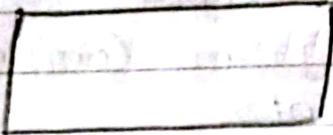
- Scientist Chas hen developed the ENTITY RELATIONSHIP MODEL which is conceptual data model
- ER diagram is the first step of database design to specify desired components of the database system and the relationships among those components
- ER model define data elements and relationships among various elements for a specified system

## ER Diagram Components

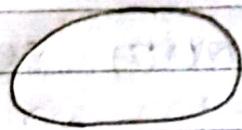
- Entity
- Attributes
- Relationships

### NOTATIONS USED

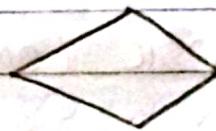
- Rectangle : Entity



- Ellipse : Attributes



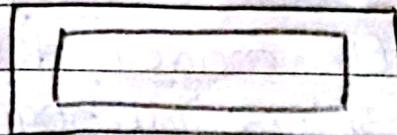
- Diamonds : Relationship Sets



- Lines : Links attributes to entity sets & viceversa

- Double Lines : Total Participation of an entity in a relationship set

- Double Rectangle : Weak Entity Sets



## ENTITY SETS

- An entity is a thing or object in the real world that is distinguishable from all other objects
- An entity may be concrete or it may be abstract
- An entity set is the set of entities of same type that share the same properties or attributes
- An entity represented by a set of attributes  
Attributes are descriptive properties possessed by each member of an entity set
- Each entity has a value for each of its attributes.

## ENTITY SET FOR INSTRUCTOR

201	KIM
251	SINGH
322	SHRINIVAS
451	EINSTIEN
101	CRICK
654	KATZ

## Relationship Sets

- A relationship is an association among several entities

201	KIM		9898	BROWN
251	SIMON		4646	SHARMA
322	SIM		5454	JAIN
654	KATZ		4444	DASHI
			1111	DAVE

- \* Degree: The degree of a relationship is number of participating entities



## ATTRIBUTES

For each attribute, there is a set of permitted values called the Domain or value set of that attribute

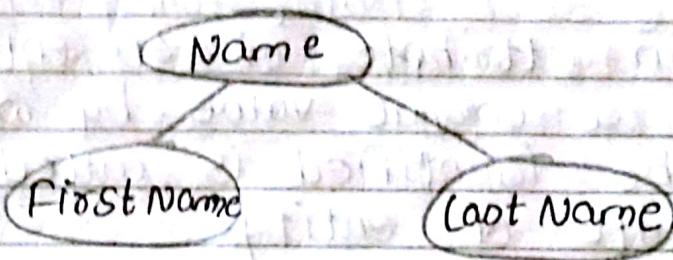
### Types of Attributes

- Simple Attributes - Which can not be divided into parts

Eg: **Age**

2] Composite Attributes - Which can be further divided into subparts

Eg:-



3] Single Valued - The attribute having only one value for particular entity

Eg:-

EMP\_ID

4] Multivalued - The attributes having many values for particular entity

Eg:-

phone number

5] Stored - The simple attribute stored in Database

Eg:-

date\_of\_birth

6] Derived - The value of this attribute can be derived from the value of related stored attribute

customer

age

## KEY ATTRIBUTES

This is an attribute of an entity which must have a unique value by which any row can be identified is called as key attribute of entity

Emp-id

Employee

### TYPES

Attribute (Simple /  
Single Valued / Stored)

### NOTATIONS

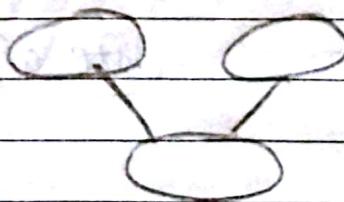
key Attribute



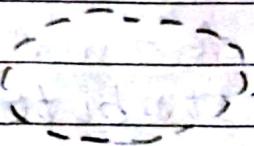
Multi-valued



Composite



Derived



## (CONSTRAINTS)

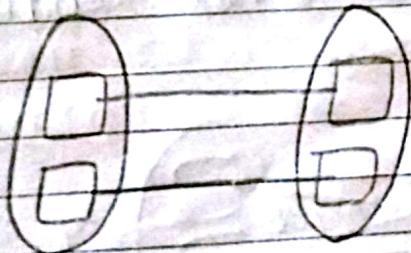
## A) MAPPING CARDINALITY / CARDINALITY RATIO

It express the number of entities to which another entity can be associated via a relationship set

Types of Mapping Cardinalities:-

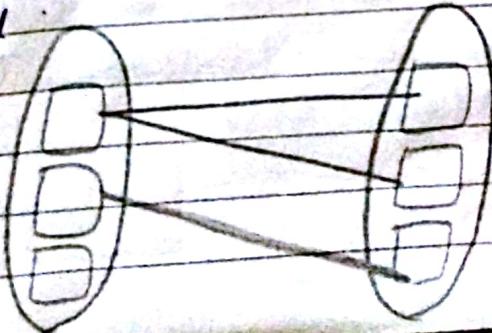
- 1. One is to One

In this type of constraint one tuple in entity is related with only one tuple in other entity i.e one row in table is related with only one row in other table



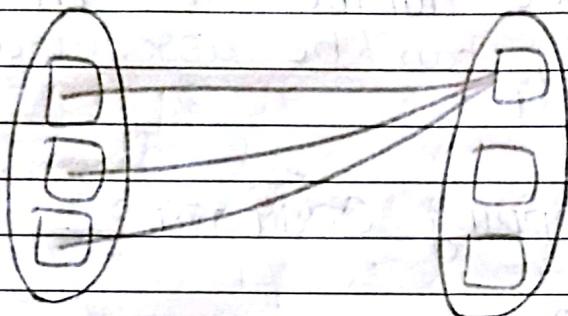
- 2. One to many

In this type of constraint one tuple in entity can be related with many tuples in other entity



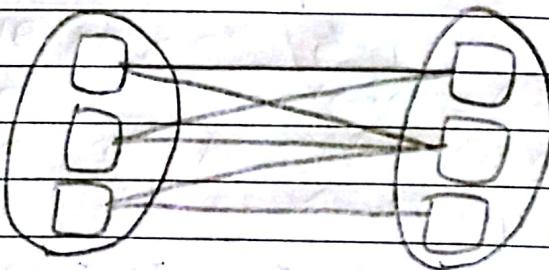
### 3. Many to One

In this type of constraint many tuples in one entity can be related with only one tuple in other entity.



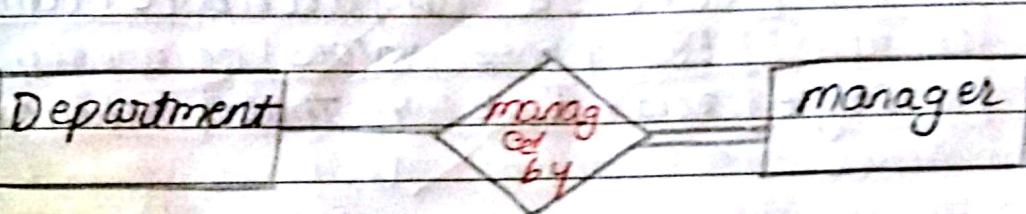
### 4. Many to Many

In this type of constraint many tuples in one constraint can be related with multiple tuples in other entity

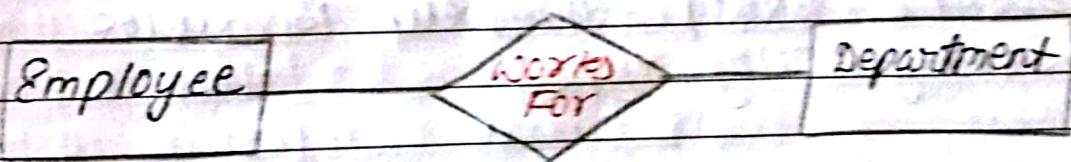


## E) PARTICIPATION CONSTRAINT

A participation of an Entity set E in a relationship set R is said to be "TOTAL" if every entity in E participated in atleast one relationship in R.



If only some entities in E participated in relationships in R, the participation of entity set E in relationship R is said to be in PARTIAL.



## K KEYS

An attribute that uniquely identifies a single tuple in a relational table is called as key of the table.

**Primary key:** Is an attribute / combination of attributes whose values uniquely identifies a single row / tuple in that relation.

## ENTITY TYPE

### 1. STRONG ENTITY

- Entity type which has its own distinct primary key by which we can identify specific entity uniquely is called Strong entity type.

#### Example

- In case of employee entity any specific employee can be identified by his employee id which is primary key of employee cit.
- In case of student in class each student identified by unique roll no which is primary key.

emp-id

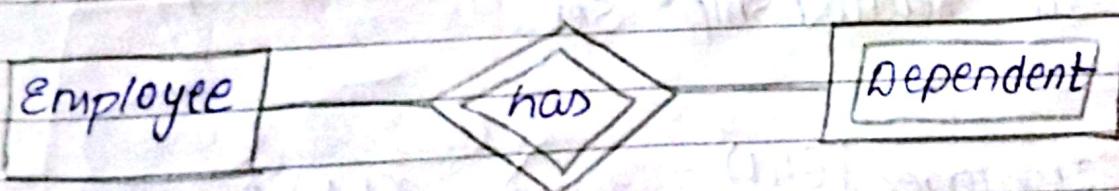
Ename

Employee

Age

### \* WEAK ENTITY

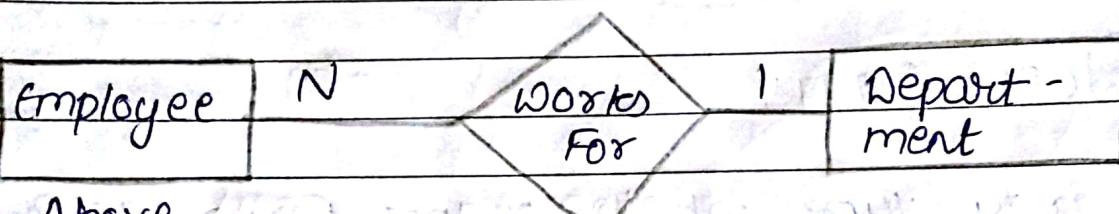
- Entity type which cannot form distinct primary key from their attributes is called as **weak entity type**
- These type of entities are dependent on strong entity for primary key
- For some weak entities we assign **"virtual primary key"**. Such virtual primary key is called as **"discriminator"**



## NOTATIONS USED IN ER DIAGRAMS

### 1. CARDINALITY RATIO NOTATIONS:

In this method we use cardinality of each entity involved into the relation.

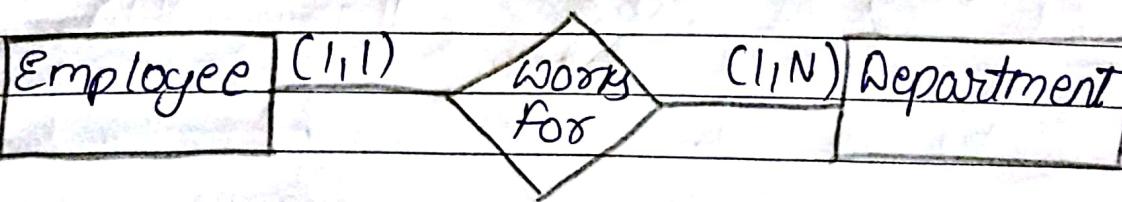


Above

Upper example says many employees  
works for 1 Dept

### 2. Max-Min notation:

A (min,max) notation for binary relationship specifies that entity is related to atleast min, at most max relationship instance in relationship set.



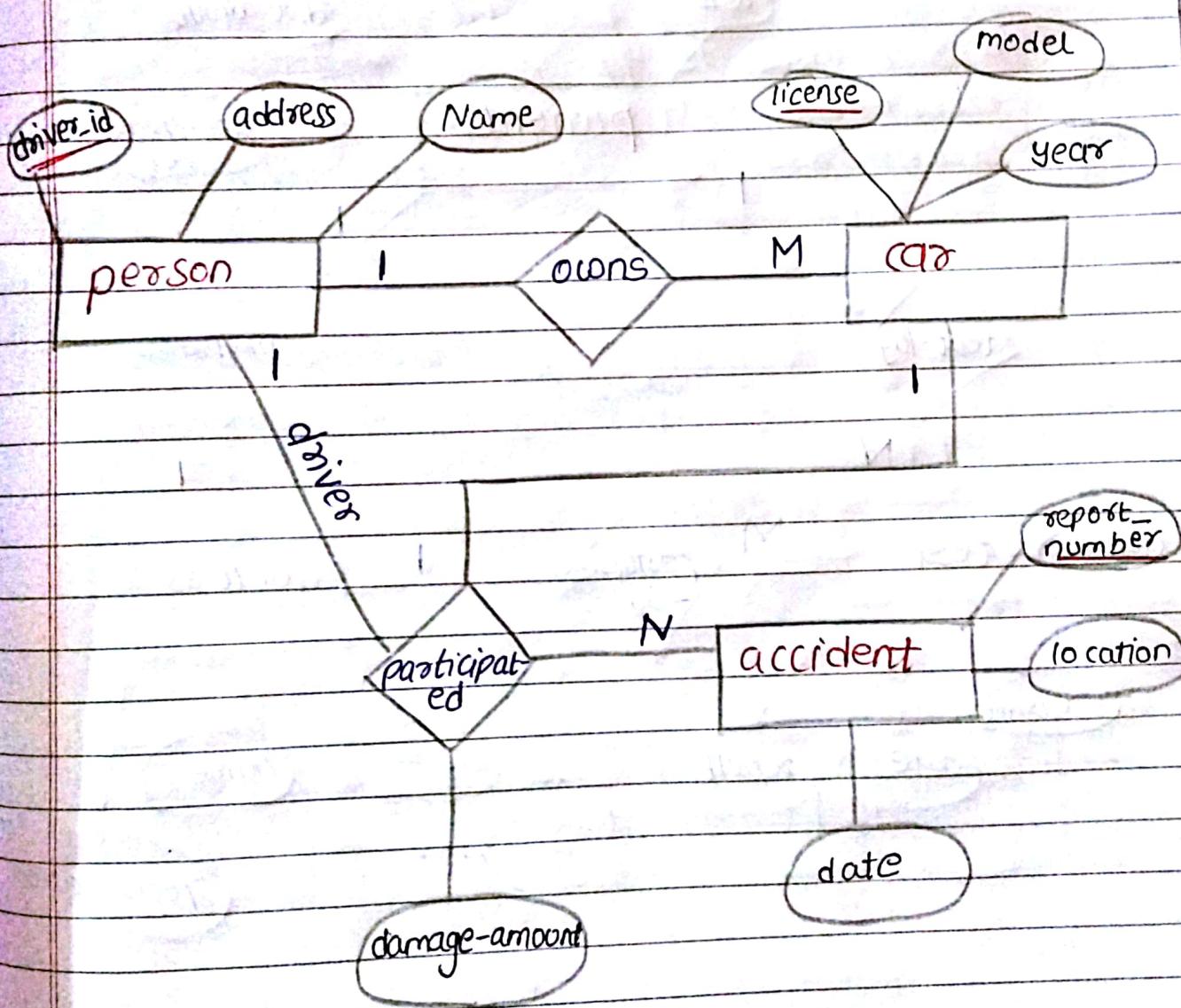
(1,1) | Employee works For  
| Department

(1,N) | Department

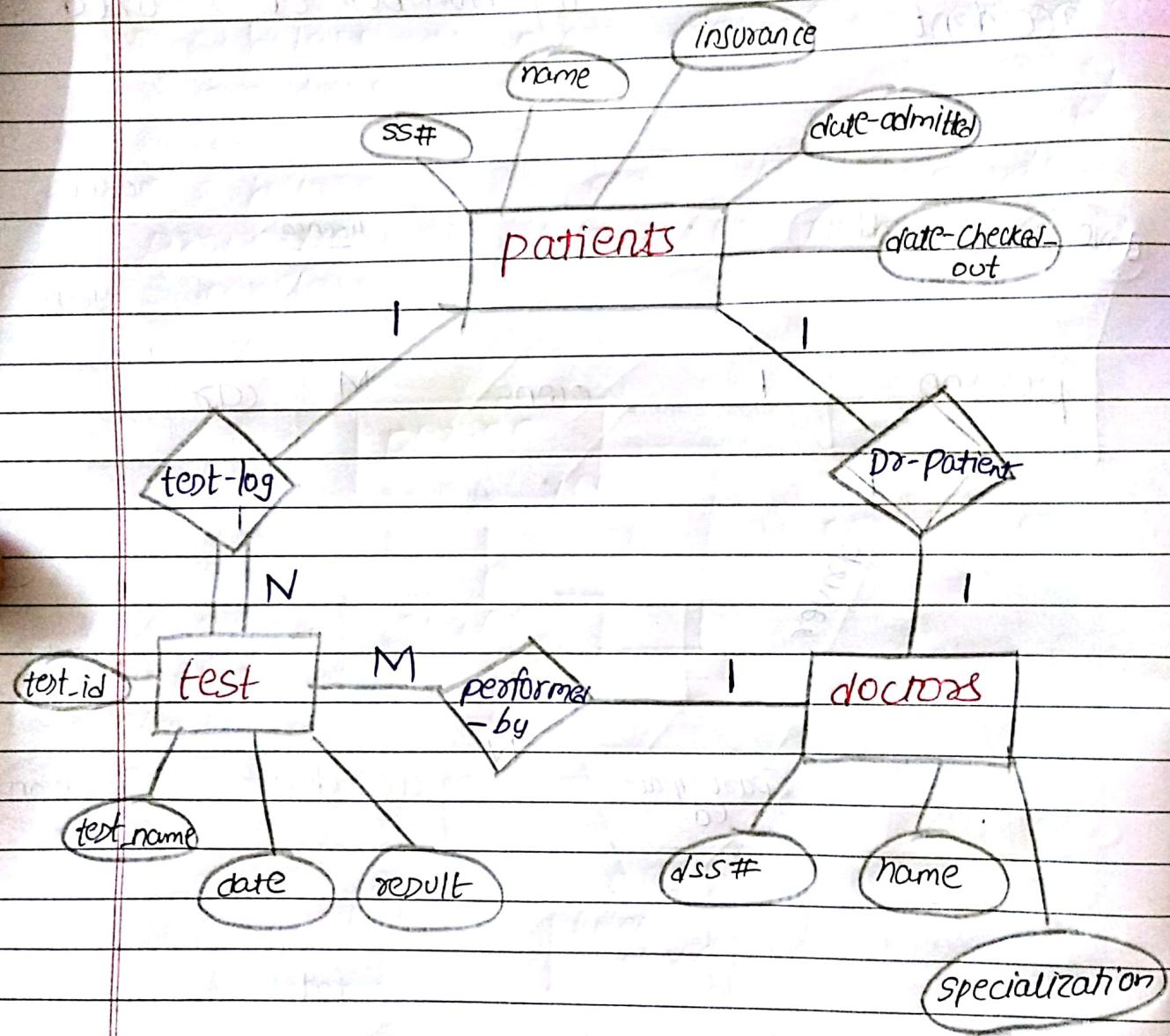
having N employees

## E-R Diagram Example

- 1] Construct an E-R diagram for a car-insurance company whose customer owns one/more cars each. Each a car associated with it zero to any number of recorded accidents



Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examination conducted



## EXTENDED ER MODEL

### EER features

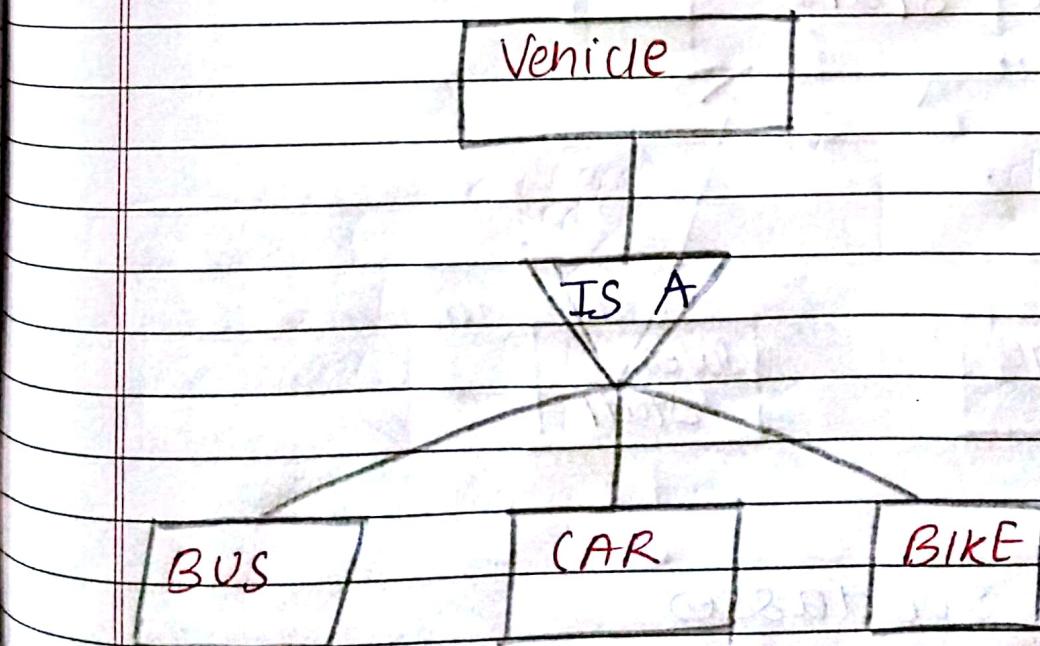
1. Subclass and Superclass
2. Specialization and Generalization
3. Aggregate

### 1. Super Class

The class having its sub-groupings called as **Super class**.

The vehicle entity is called super class

Example : Employee super class is having sub groupings as technician, secretary and developer

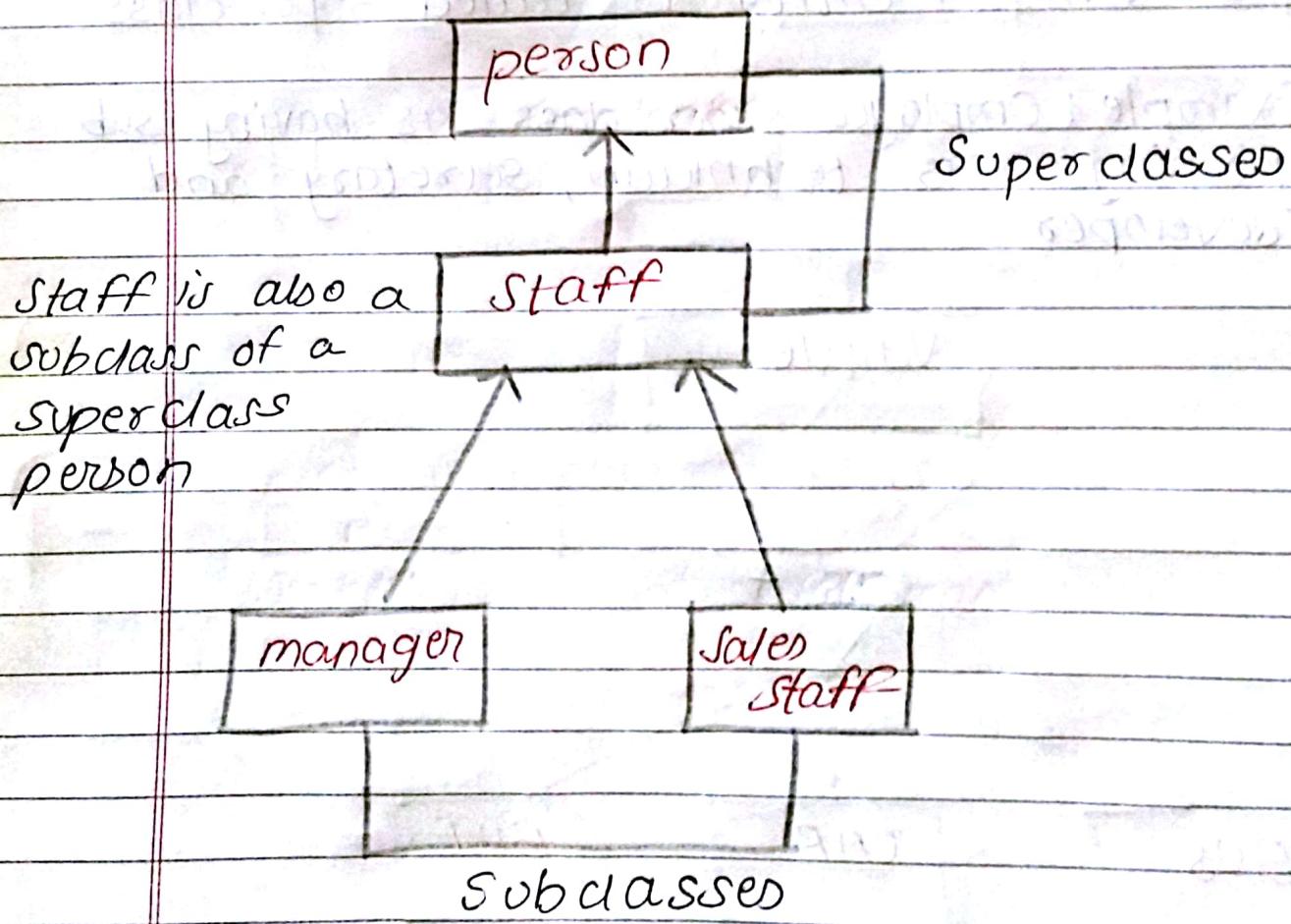


## 2° Sub Class

The class which is a subgrouping of some super class called Subclass

A subclass is more specific version of Superclass

A subclass is a class that inherits properties or attributes from it's Superclass

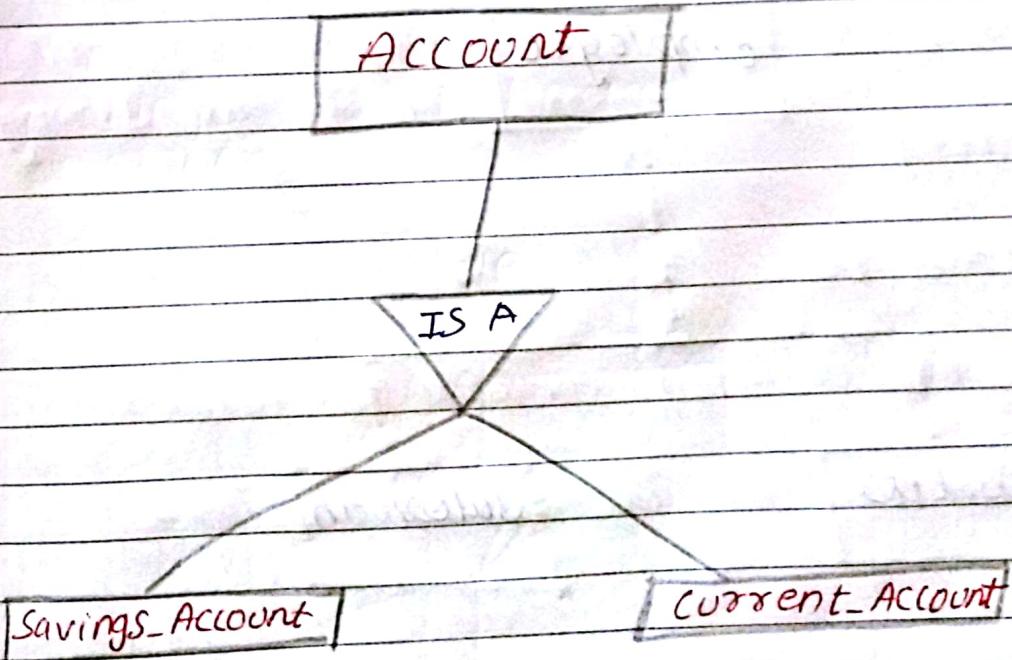


## SPECIALIZATION

Top down approach of superclass/subclass relationship

Specialization is a process of defining a set of subclass of entity type, this entity type is called class of specialization

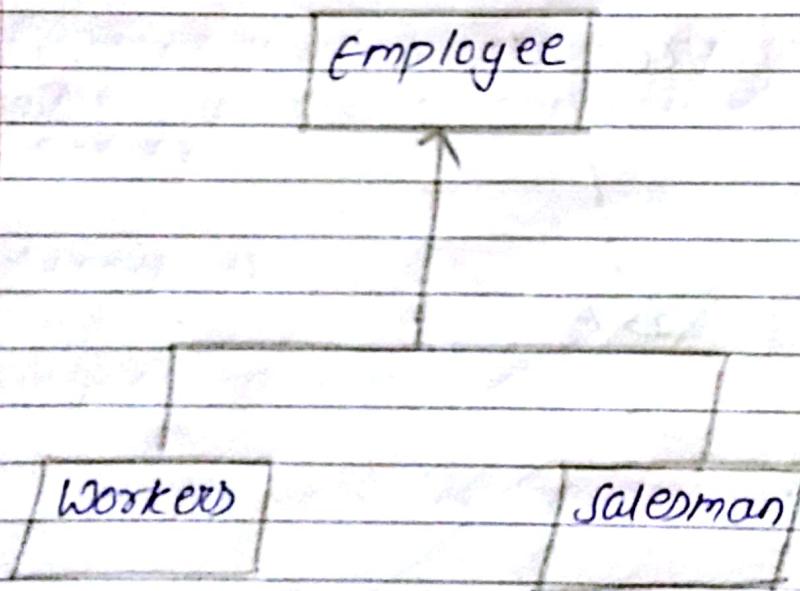
The set of subclasses that form a specialization is defined on the basis of some distinguishing characteristic of entity in super class



## GENERALIZATION

This is reverse process of specialization or this is bottom up approach of super/sub class relationship

Generalization is a process in which we differentiate among several entity types identifying their common features and generalizing them to a single Super class of which original entity types are special subclasses



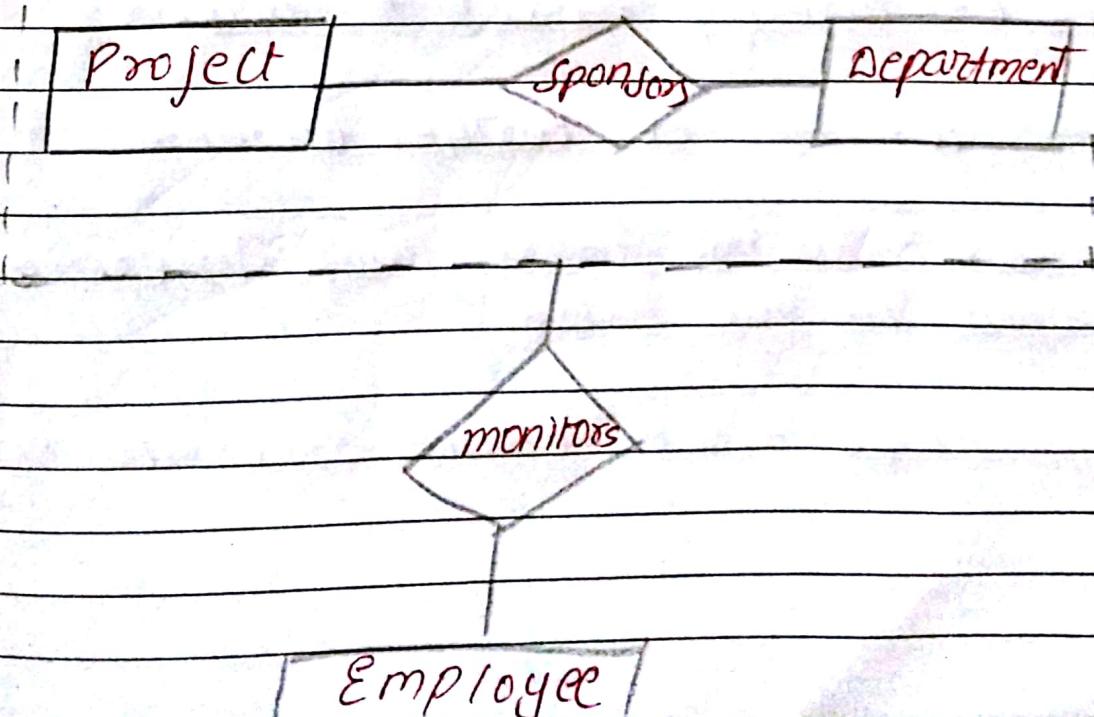
**A**

## AGGREGATION

- It is meant to represent a relationship between a whole object and its component parts
- It is used when we have to model a relationship involving entity sets and a relationship set
- It allows us to treat a relationship set as an entity set for the purpose

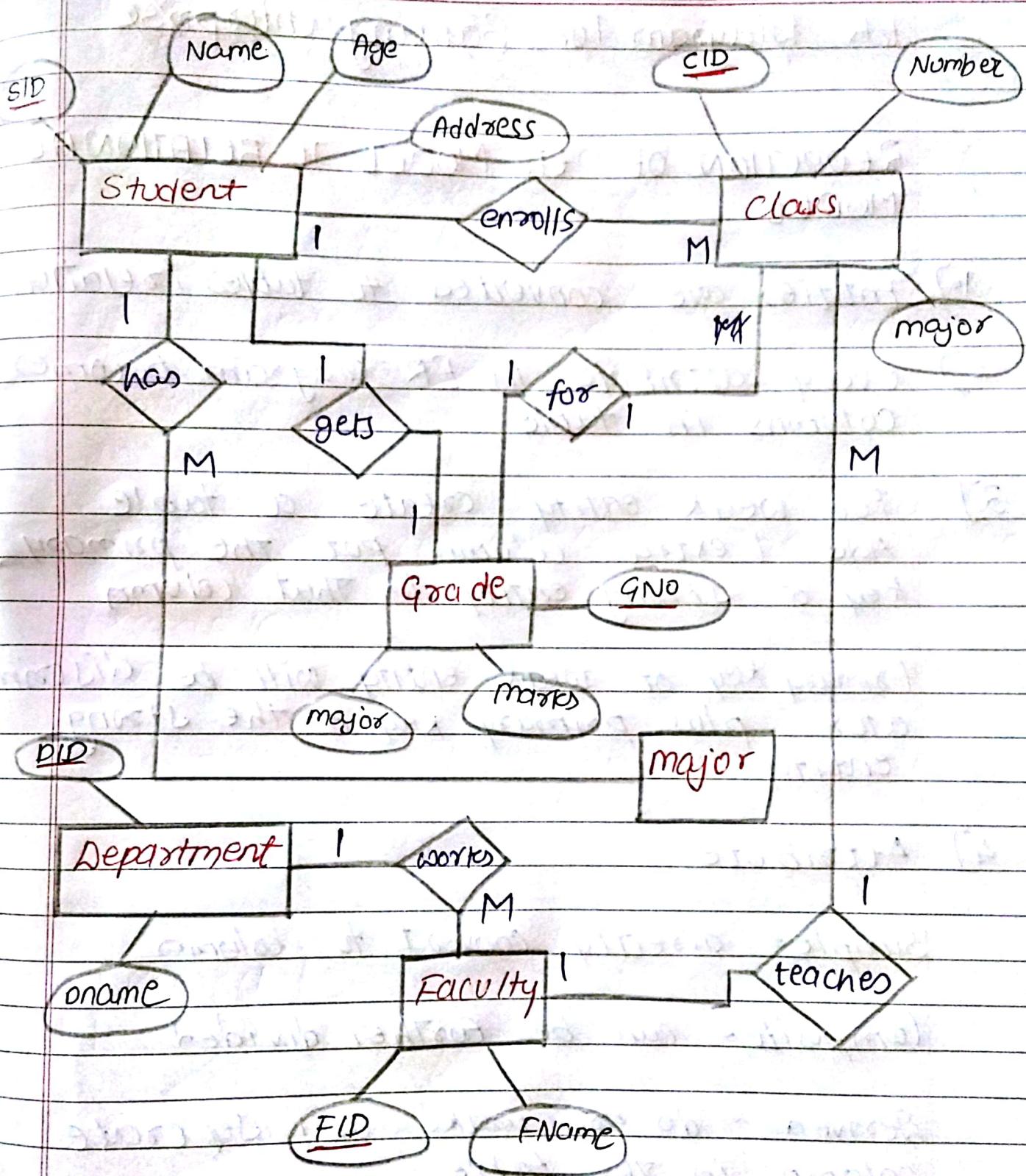
### Example

- A project is sponsored by a department. This is simple relation.
- An employee monitors the sponsorship (and not Project / dept). This is called as aggregation.



Q) Draw an ER diagram for university database consisting of entities Student, Department, Class and Faculty

1. Student has a unique id
2. The student can enroll for multiple classes
3. Student has at most one major
4. Faculty belongs to department and can teach multiple classes
5. Every student will get grade for the class he / she has enrolled



# ER Diagram For Banking/Enterprise

## REDUCTION OF ER MODEL TO RELATIONAL MODEL

- 1.) Entities are converted to tables / relation
- 2.) Every attribute in ER diagram becomes columns in table
- 3.) For weak entity create a table  
Add 1 extra column put the primary key of strong entity in that column  
Primary key of weak entity will be discriminator plus primary key of the strong entity
- 4.) Attribute

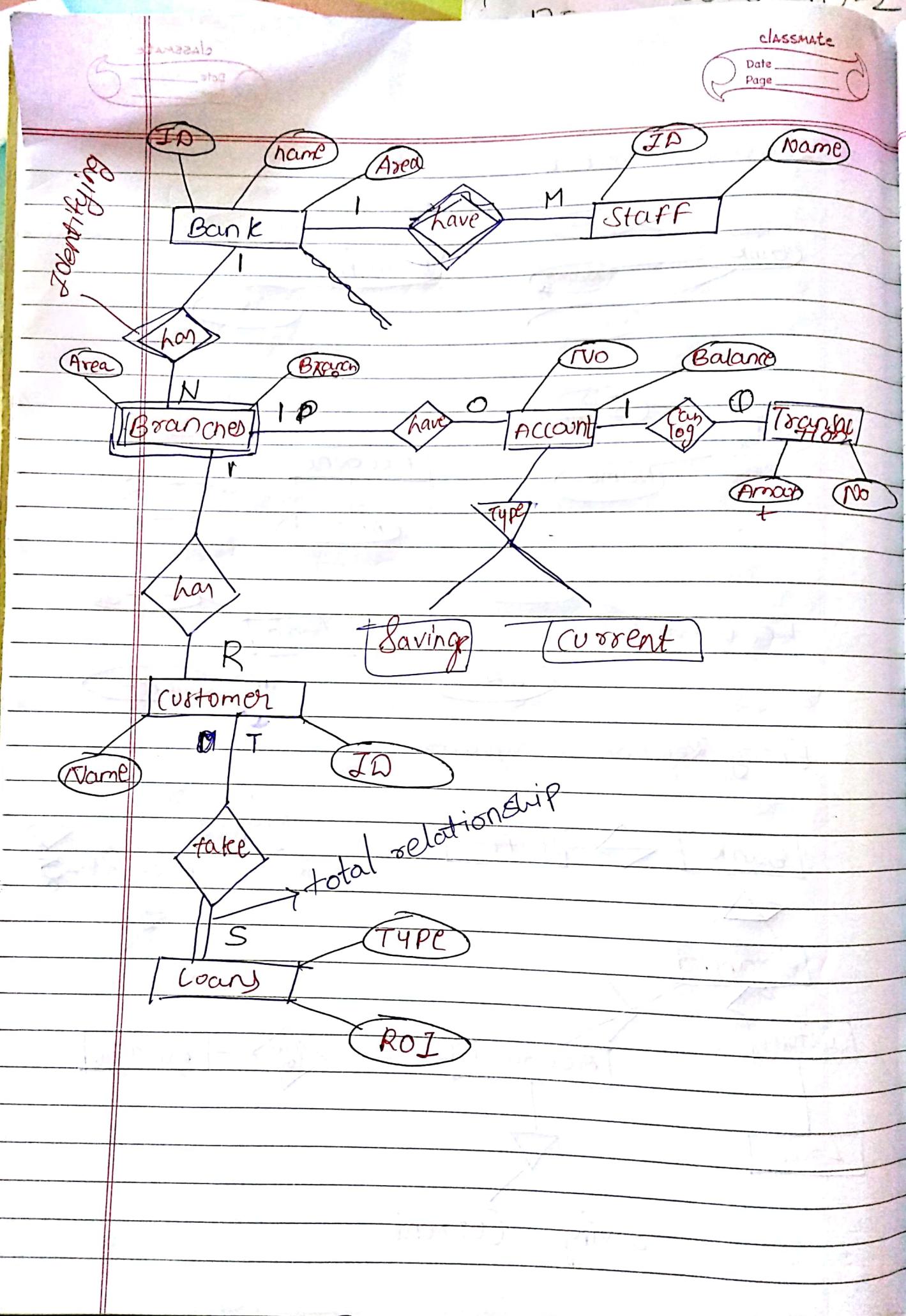
Simple - directly convert to column

Composite - can be further divided

Derived - do not make any separate column in the table

Multivalued - we create separate table

- 5] For many to many relationships we create a separate table for other cardinalities we do not
- 6) The table will have primary key of both the entities
- 6] For generalization and specialization we make tables for the subclasses and also add attributes of super class.



## 1.] Bank

ID	Primary
Name	
Area	

## 2.] Staff

ID
Name

## 3.] Branches

Area
Number
ID Virtual Primary /
Bank-ID Primary key of bank

## 4.] Account

No	Prim
Balance	
Type	

## 5.] Transaction

Amount
Number Prim

## 6.] Customer

Name
ID Prim

## 7.] Loan

Type
Rate Of Interest

## 8.] Savings

Acc-No	Pri
Bala	

## 9.] Current

Acc-no	Prim
Interest	