

## Data Modeling using the ER Model.

### 2.1 ER Model Concepts.

(5/6) The Entity-relationship (E-R) model is a high-level data model. It is based on a perception of a real world that consists of a collection of basic objects, called entities, and of relationships among these objects. It was developed to facilitate database design by allowing specification of an enterprise schema, which represent the overall logical structure of a database.

An entity: is a "thing" or "object" in the real world that is distinguishable from all other objects.

OR

Anything about which we store information is called an Entity.

An entity set: is a set of entities of the same type that share the same properties, or attributes.

The set of all persons who are customers at a given bank, for eg:- can be defined as the entity set customer.

Attributes: An entity is represented by a set of attributes. Attributes are descriptive properties possessed by each member of an entity set. Attributes describe the entity to which they are associated.

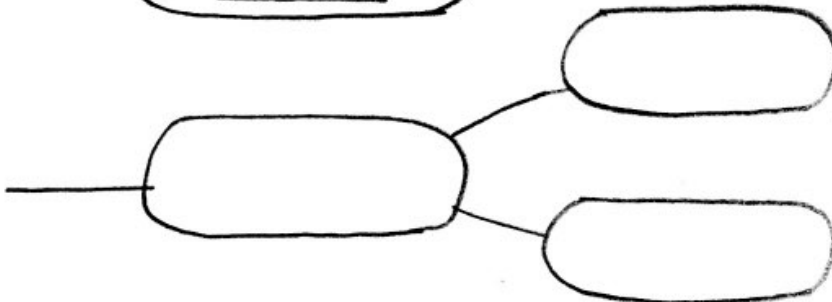
## 2.2 Notation for E-R Diagram.



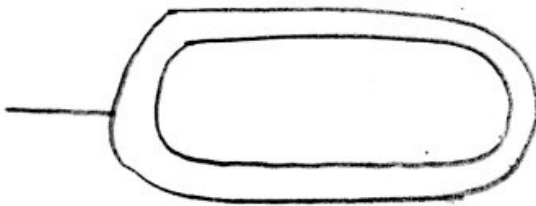
ATTRIBUTES



KEY ATTRIBUTES



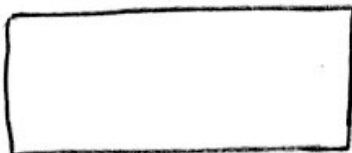
COMPOSITE  
ATTRIBUTES



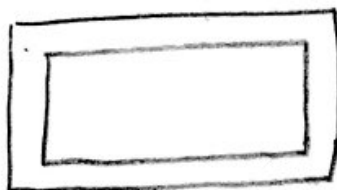
MULTIVALUED  
ATTRIBUTES



DERIVED ATTRIBUTES

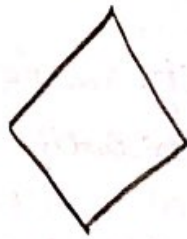


STRONG ENTITY SET



WEAK ENTITY SET





RELATIONSHIP



LINKS

Single-valued and multivalued attributes: The attributes in our examples all have a single value for a particular entity: for instance, the loan-number attributes for a specific loan entity refers to only one loan numbers. Such attributes are said to be "Single valued". An employee may have zero, one, or several phone numbers, and different employees may have different numbers of phones. This type of attribute is said to be "multivalued".

Simple and Composite attributes: Simple attributes are those, which are not divided into subparts. Whereas composite attributes, are those which can be divided into subparts. Composite attributes help us to group together related attributes.

✓ Derived Attributes: The value for this type of attribute can be derived from the values of other related attributes or entities.

An attribute takes a null value when an entity does not have a value for it. The null value may indicate "not applicable".

## 2.3 Mapping Constraints

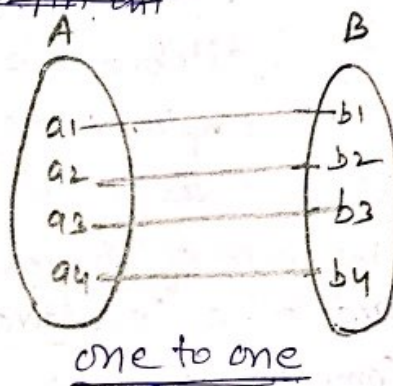
Mapping Cardinalities, or cardinality ratios, express the number of entities to which another entity can be associated via a relationship set.

Mapping cardinalities are most useful in describing binary relationship sets.

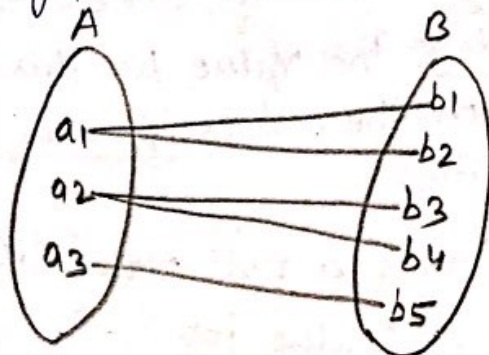
There are 4 types.

2.3.1 One to one: 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.

2. One to many: ~~An ent~~



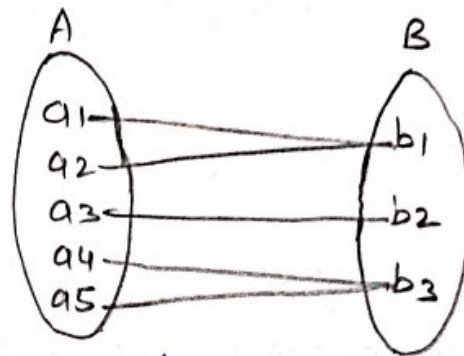
② 2.3.2 One to many: An entity in A is associated with any number (zero or more) of entities in B. An entity in B, however, can be associated with at most one entity in A.



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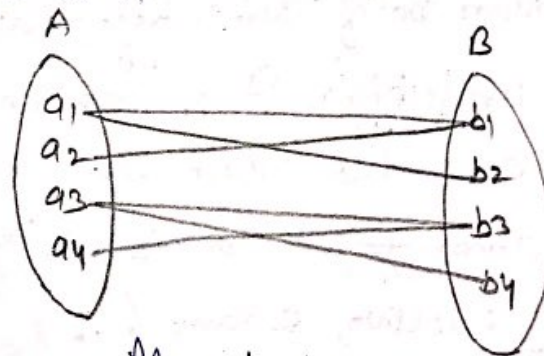


2.3.3 Many to one: An entity in A is associated with at most one entity in B. An entity in B, however, can be associated with any number (zero or more) of entities in A.



Many to one

2.3.4 Many to Many: 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.



Many to Many

2.4 KEYS: A key is a value which can always be used to uniquely identify an object instance. It allows us to identify a set of attributes that suffice to distinguish entities from each other.

It is basically of 3 types:

① Super key ② Candidate key ③ Primary key.



Table of student.

S-RollNo.	S-Name	S-Branch	S-College	S-Year
0302913026	Ram	I.T	K.D.E.T	3 <sup>rd</sup>
0402910026	Shyam	C.S.	K.D.E.T	2 <sup>nd</sup>
0402940026	Ravi	M.E.	K.D.E.T	2 <sup>nd</sup>
⋮				

2.4.1 Superkey: A superkey is a set of one or more attributes that, taken collectively, allow us to identify uniquely an entity in the entity set.

for eg: in the above table, set of superkey:

$$S = \{ \text{S-rollNo}, \text{S-Name}, \text{S-Branch}, \dots \}$$

2.4.2 Candidate key: Candidate key can be define as the minimum no. of superkey that identifies the record uniquely. It is possible that several distinct set of attributes could serve as a candidate key. for eg: in the above table candidate key.

$$C = \{ \text{S-rollNo}, \text{S-Name} \}$$

2.4.3 Primary key: Primary key can be define as the minimum no. of candidate key that is chosen by the database designer as the principal means of identifying entities within an entity set. There should not be any duplicacy in the record of primary key. for eg: in the above table

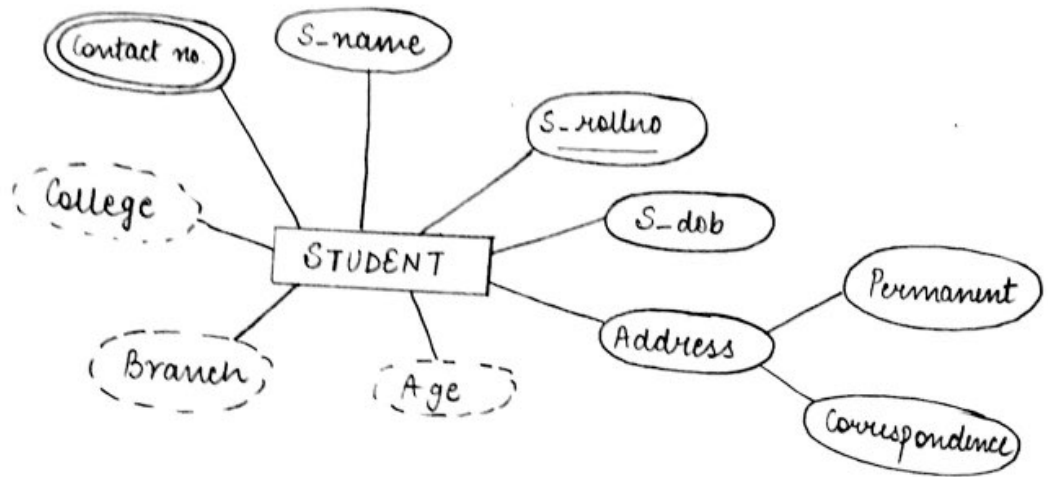
$$P = \{ \text{S-rollNo} \}$$

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~~Ques.~~ Draw an ER diagram for student.

~~Ans.~~

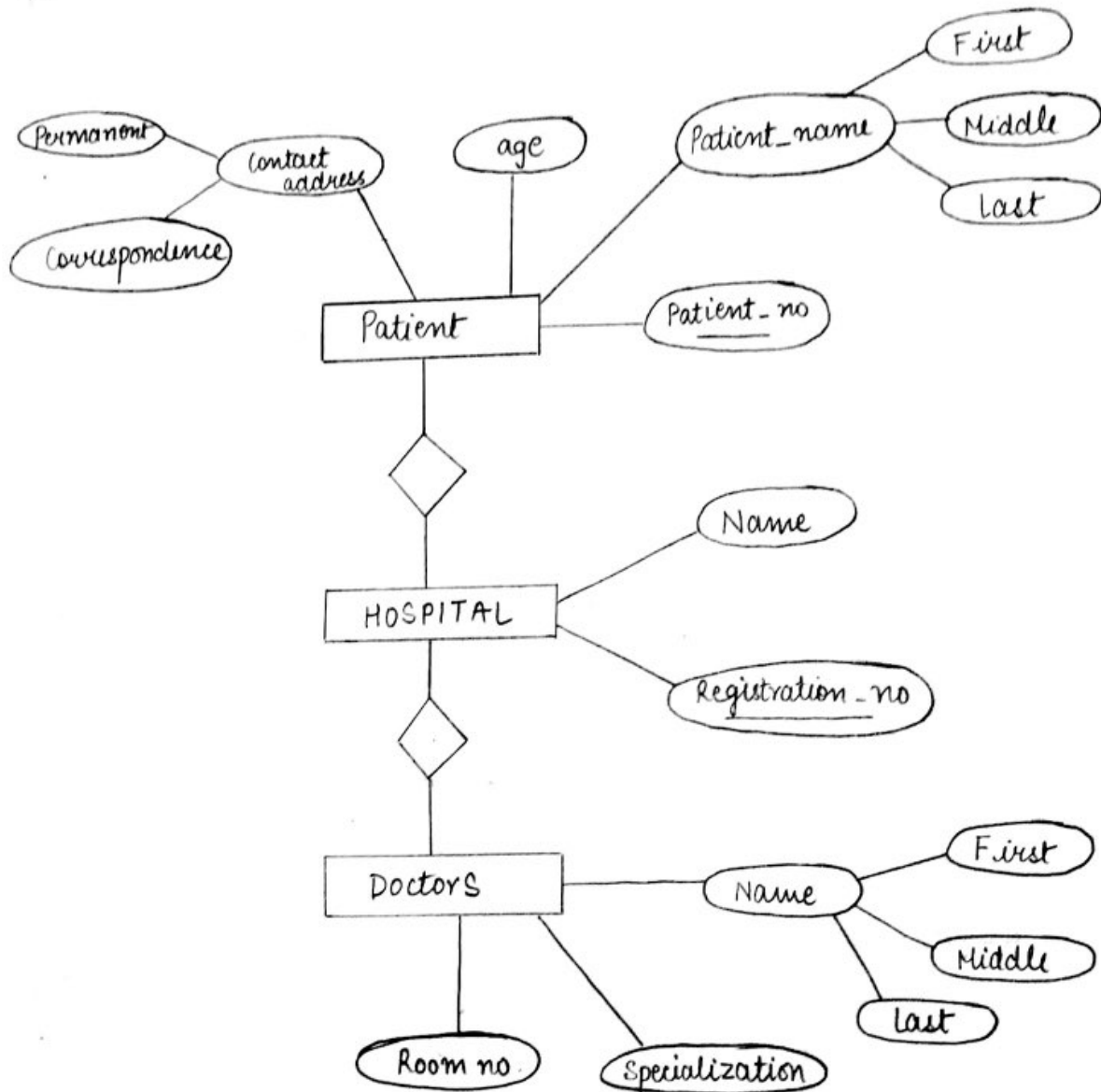
## 2.5 Examples of E-R Diagram



ER diagram for student.

- 1 → University Examinations
- 2 → Registration process
- 3 → Exam process.
- 4 → Hospital.
- 5 → Bank
- 5 → Airline Res
6. KIET WUPO
- 7- WWC.
- 8- Car Insurance
9. Customer & loan
10. 30

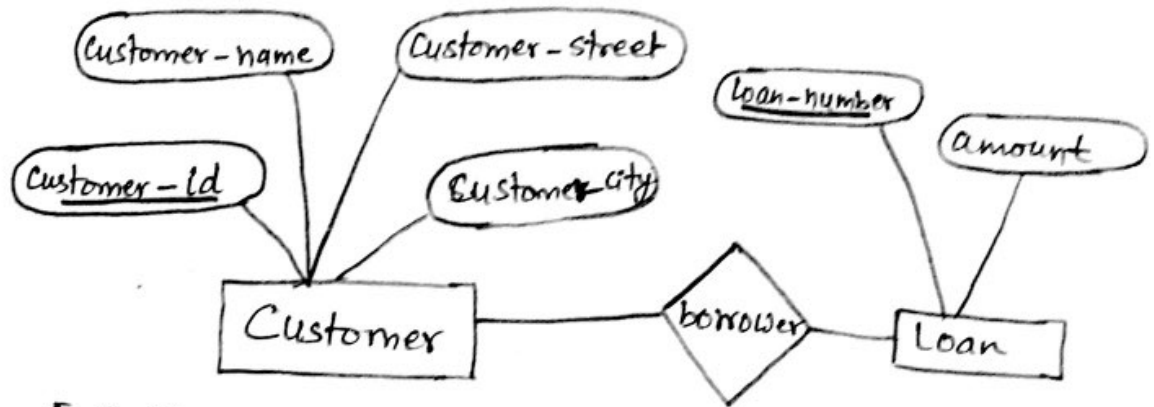
Ques. Construct an ER-diagram for hospital with a set of patients and medical doctors?  
 Ans.



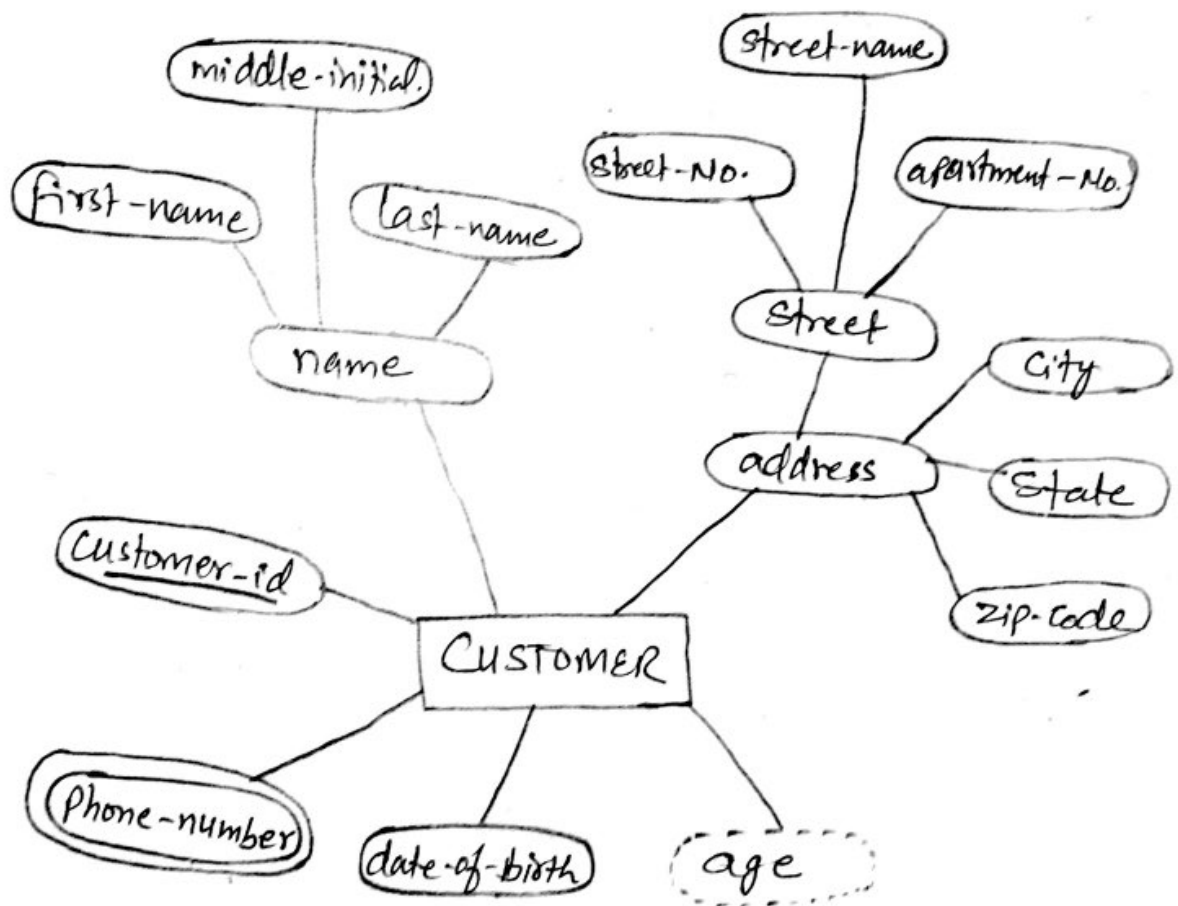
ER diagram for hospital



## 2.5 Examples of E-R diagram:



1. E-R diagram corresponding to customers and loans.

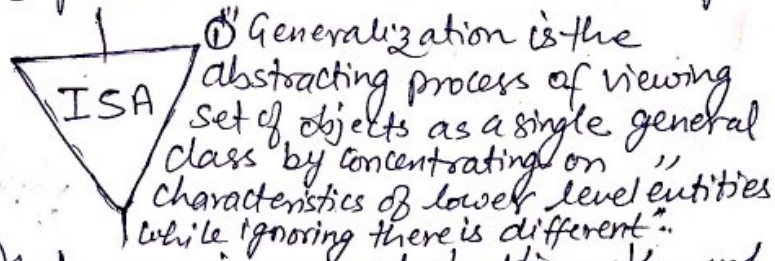


E-R diagram with composite, multivalued and derived attributes.

2.6 Generalization: ① Generalization is a relationship that exists between a high-level entity set and one or more lower-level entity set.

for eg:- person is a high-level entity set and customer and employee are lower-level entity sets. Higher- and lower-level entity sets also may be designated by the terms superclass and subclass respectively. The person entity set is the super class of the customer and employee subclass.

Generalization is represented by a triangle Component labeled ISA. The Label ISA stands for "is a" and represents, for eg: that a customer "is a" person. The ISA relationship may also be referred to as a Superclass-Subclass relationship.



2.7 Aggregation: ① Aggregation is an abstraction through

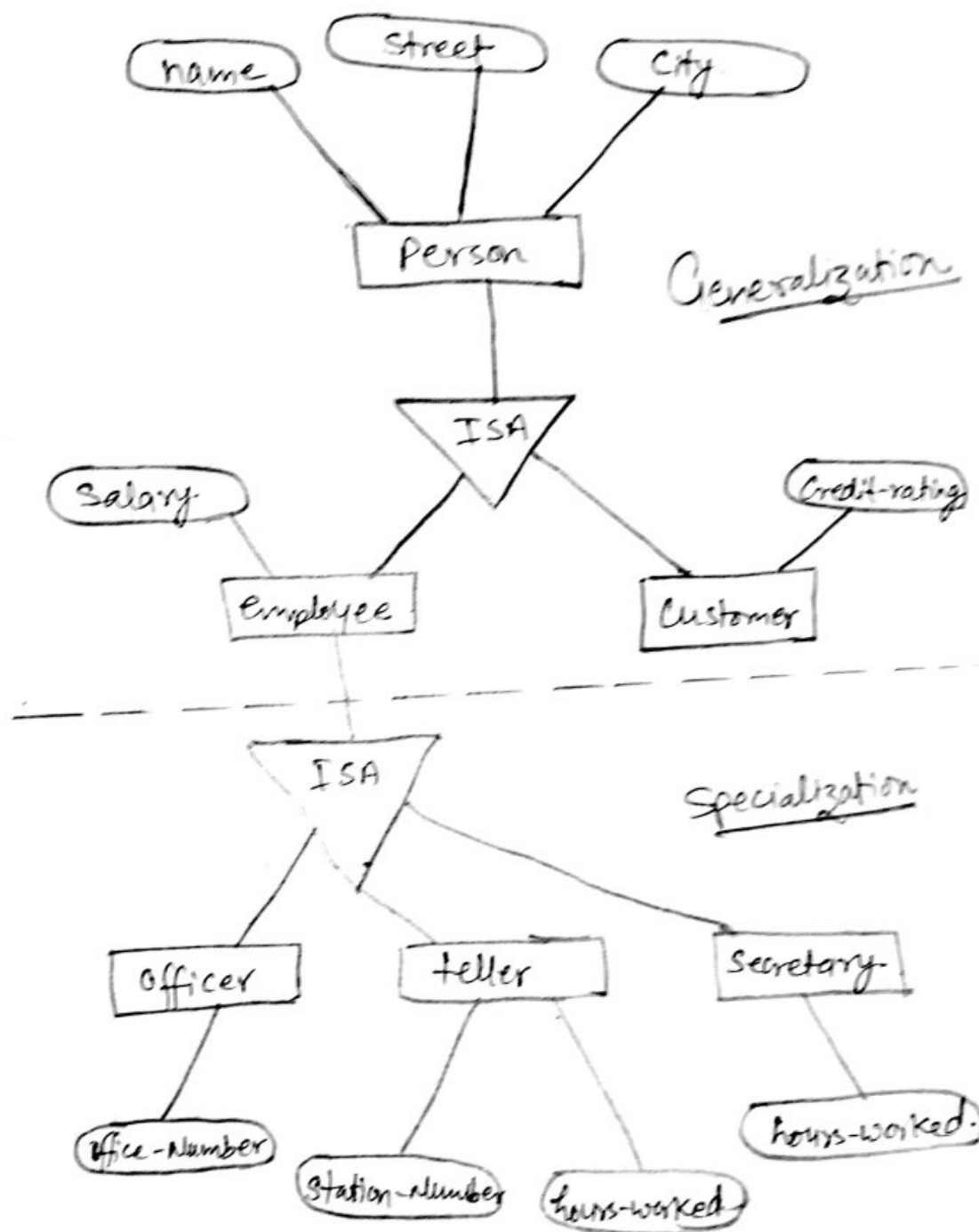
which relationships are treated as higher-level entities.

① Aggregation is a technique to express relationship among relationships.

Through E-R modeling we cannot express relationship among relationships. Thus, we use the concept of Aggregation for this purpose.

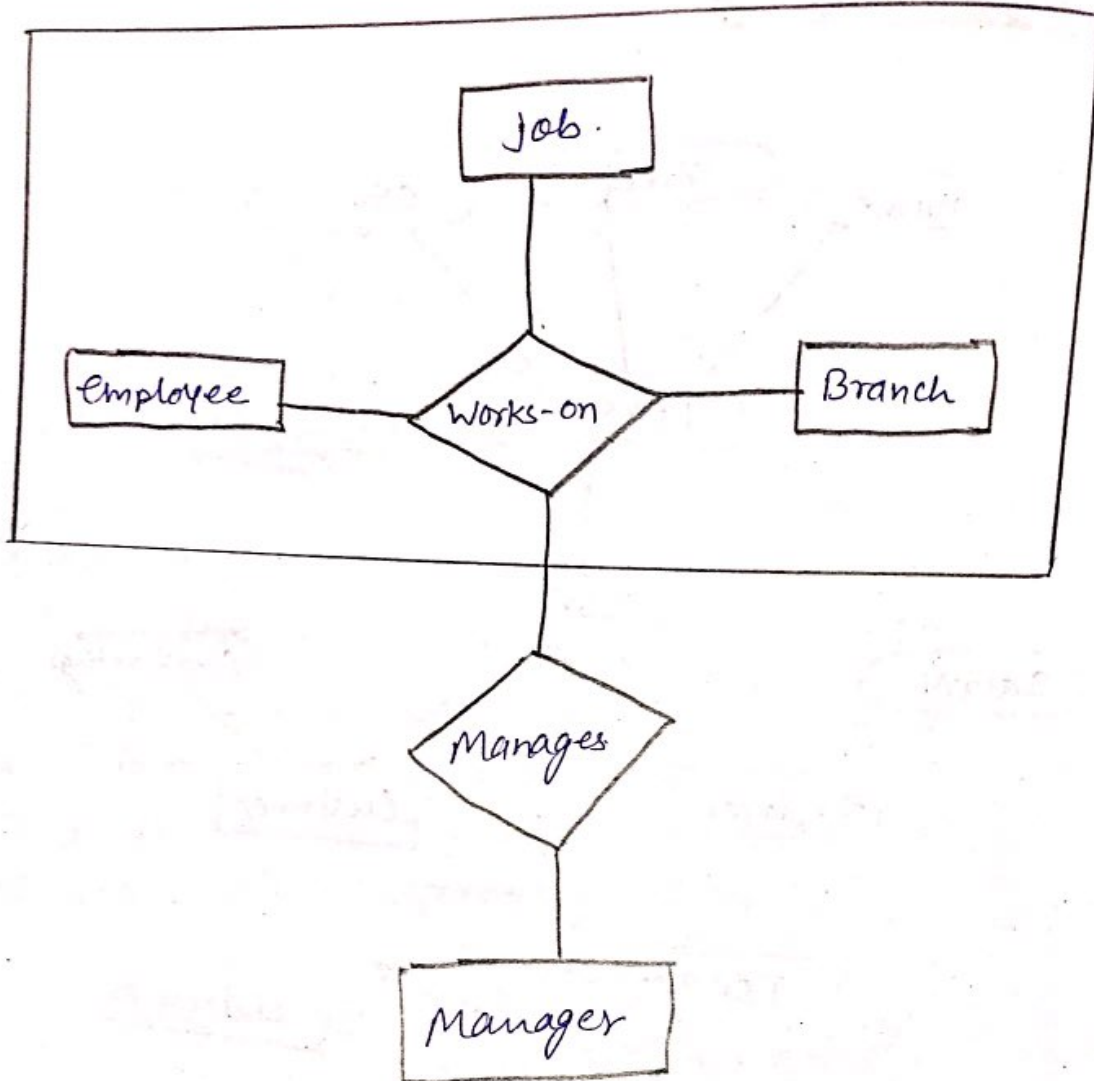


eg. of Generalization:



E-R diagram with Generalization & Specialization

specializa  
with an en  
of person a  
to whether th



E-R diagram with aggregation.

## 2.8 Extended E-R Model:

The Extended Entity Relationship Model (EER) Model include all the modeling concepts of the E-R model and the concepts of specialization, generalization, higher-level & lower-level entity set, attribute inheritance & aggregation.

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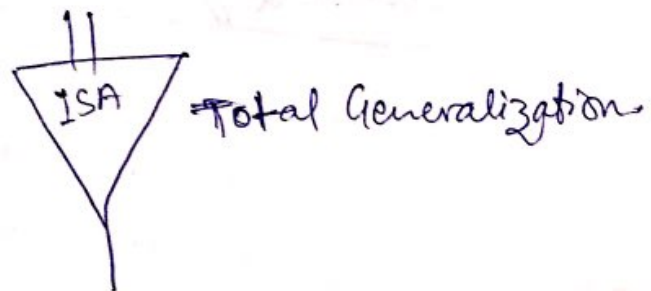


Specialization: The process of designating subgroupings with an entity set is called "specialization". The specialization of person allows us to distinguish among persons according to whether they are employee or customers.

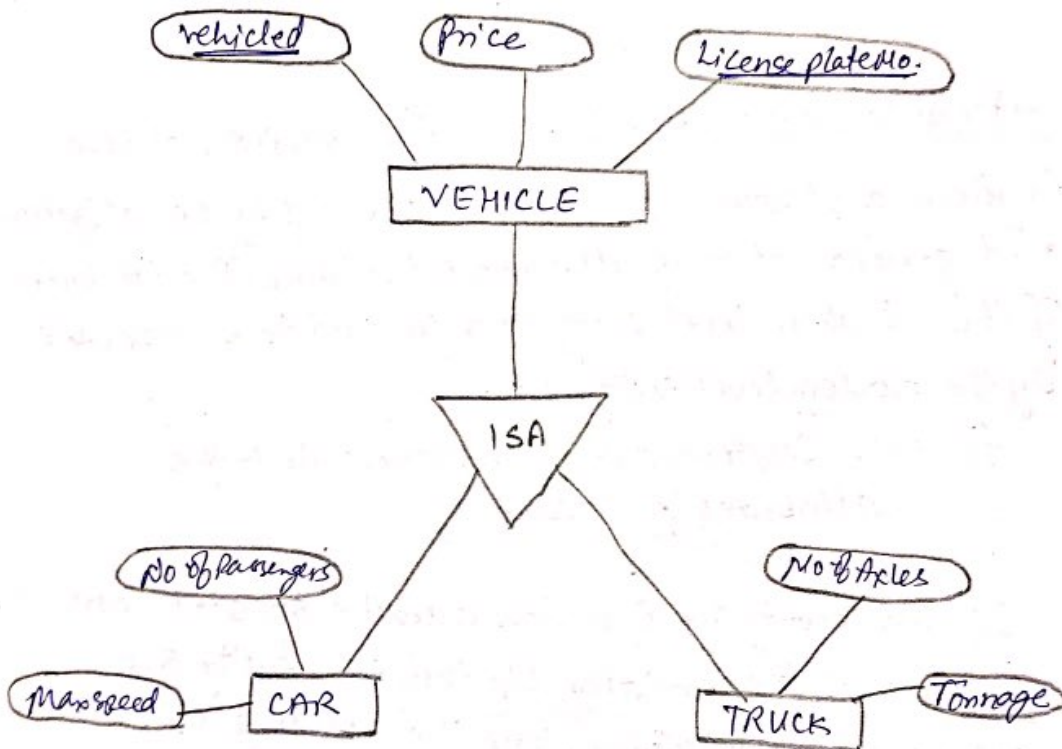
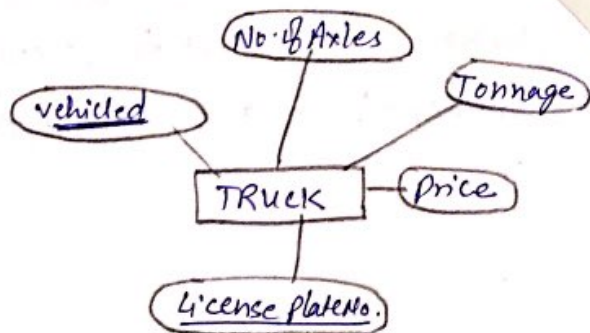
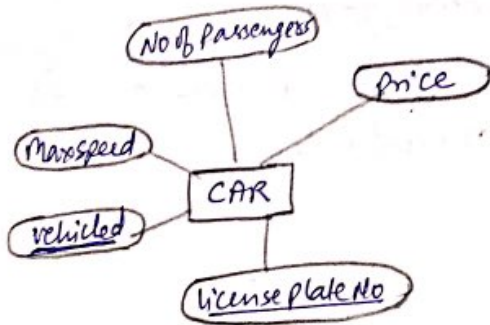
Attribute Inheritance: A crucial property of the higher- and lower-level entities created by specialization and generalization is attribute inheritance. The attributes of the higher-level entity sets are said to be inherited by the lower-level entity sets.

for eg! - Customer and employee inherit the attributes of person.

If an entity set is a lower-level entity set in more than one ISA relationship, then the entity set has multiple inheritance, and the resulting structure is said to be a "lattice".



eg. of Generalization:



Generalizing Car & Truck into vehicle.

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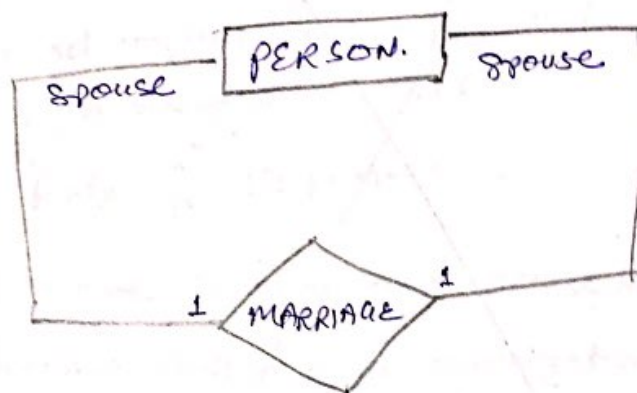
2.9 Relationships

If there are  
relation then  
two (binary),



## 2.9 Relationships of Higher Degree:

If there are two entity types participating in a relation then it is called a relationship type of degree two (binary), and a relationship type is called degree three (ternary) if there are three entity types participating. If there is a relationship that involves  $N$  entities is called  $N$ -ary relationship.



DA (Data Administrator): It refers to Data Administrator, is that particular person who has the central responsibility for the data. The basic job of the Data Administrator is to decide what data should be stored in database and which place.

Data Base Administrator (DBA): Database Administrator is a technical person responsible for implementation of data. The job of DBA is to create actual data base and implement the technical control needed by the management level.

The Role of DBA are:

1. Storage structure and access-method definition.
2. Schema and physical-organization modification.
3. Granting of authorization for data access.
4. Routine maintenance.
5. Schema definition.



Selected Exercises:-

1. Discuss briefly the conventions for displaying an ER diagram?
2. What is the difference between specialization and Generalization with respect to Database?
3. Explain difference between a weak and a strong entity set?
4. Explain the distinction among the terms, Primary key, Candidate key and Super key?
5. What is the role of Database Administrator?
6. Construct an ER Diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient, a log of various test and examination conducted.
7. Explain the Mapping Constraints in detail?

→ Fieldname, datatype, (width), ...

→ SQL > Create Table TN (Name Varchar(12),  
Age number(20), ...);

→ Insert into stud (Name, Age, Address, Class)  
values ('vijay', 25, 'Kamper', 1);

→ Char is ' ' single quotes

Substitute:

→ Insert into table values ('empno', 'empname',  
'address', 'desig');

→ Select \* from Dual;

→ Select 2\*2 from Dual;

→ Select sysdate from Dual;

→ Desc TN;

→ Select \* from TN;

→ Commit;

→ Rollback;

Char  
Varchar  
Varchar2  
Number