



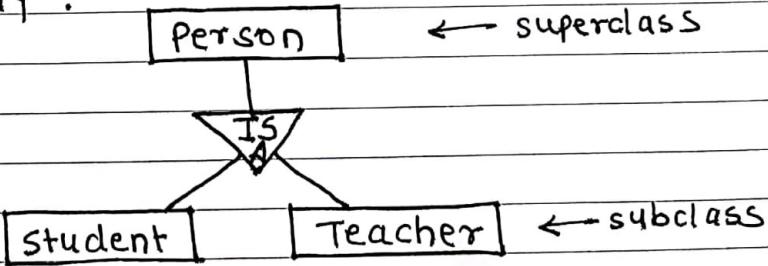
Subject:DBMS
Academic Year: 2018-19

* Extended Entity Relationship (EER) model :-

- The ER model that is supported with additional semantic concepts is called the Extended Entity Relationship (EER) model.
- The EER includes all the concepts of original E-R model together with the following additional concepts :-
 - 1) Specialization
 - 2) Generalization
 - 3) Aggregation

i) Specialization :-

- Specialization is the process of designating subgroupings within an entity set.
- Specialization is a top-down process.
- In this a group of entities is divided into sub-groups based on their characteristics.
- for e.g. In a school database, person can be specialized as teacher / student based on what role they play .



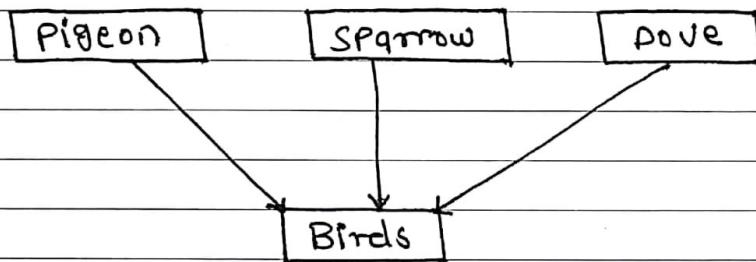


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Subject:DBMS
Academic Year: 2018-19

2) Generalization :-

- Generalization is opposite of specialization.
- Generalization is a bottom-up approach.
- In this, a number of entities are brought together into one generalized entity based on their similar characteristics.
- for e.g. pigeon, house sparrow, crow and dove can all be generalized as birds.



/constraints

* Some of the concepts, in generalization are :-

- Disjoint :- A disjointness constraint requires that an entity belong to only one lower-level entity set.

for e.g. An account entity may be either Saving-account or checking-account.

It satisfies just one condition at a time.



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Academic Year: 2018-19

- overlapping :-

In overlapping, the same entity may belong to more than one lower-level entity set within a single generalization.

for e.g. a person can be customer and employee as well .

- Completeness constraint :-

It specifies whether or not an entity in the higher-level entity set must belong to at least one of the lower-level entity sets with the generalization / specialization. This constraint may be one of the following :-

* Total generalization / specialization :-

Each higher-level entity must belong to a lower-level entity set .

* Partial generalization / specialization :-

Some higher-level entities may not belong to any lower-level entity set .



Subject:DBMS
Academic Year: 2018-19

* The Entity-Relationship Model :-

- The entity-relationship (E-R) data model represents the overall logical structure of a database.
- The E-R data model employs three basic concepts:- entity sets, relationship sets, & attributes.
- Entity sets :-

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

for e.g.- each person in a university is an entity.

- An entity has a set of properties, and the values may uniquely identify an entity.

for e.g.- a student may have a university roll no. which will uniquely identify one student from another.

- for e.g.- in a school database, students, teachers, classes & courses offered can be considered as entities.

- Attributes :-

Entities are represented by means of their properties, called as attributes. All attributes have values.

for e.g.- a student entity may have name, class & age as attributes.



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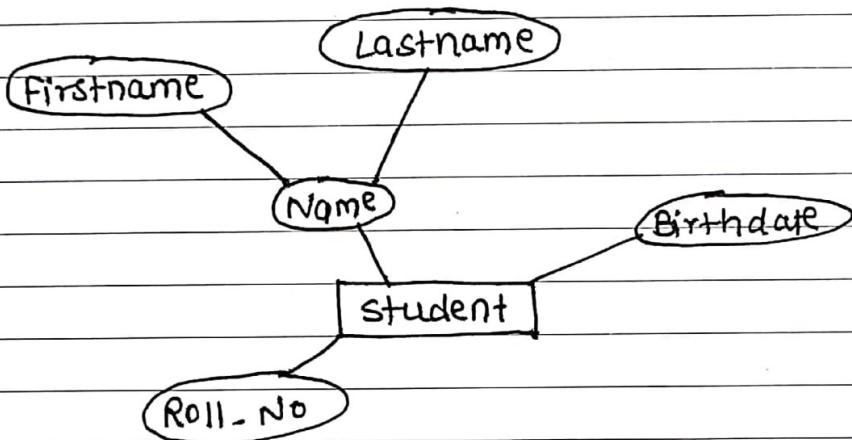
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Academic Year: 2018-19

- Types of attributes :-

attribute

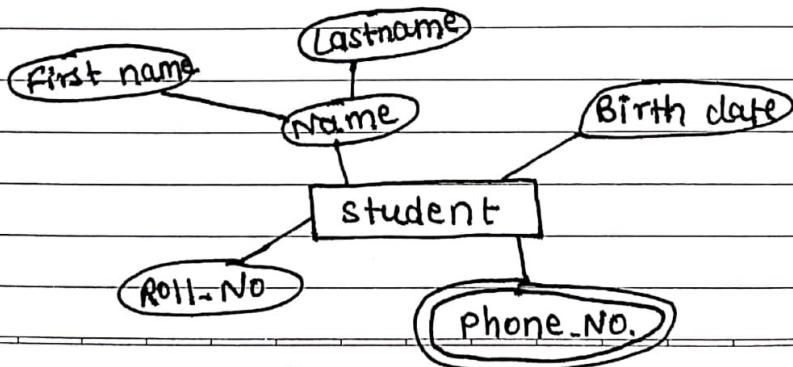


Composite attribute :- They are further divided in a tree like structure.



Multi-valued attributes :- Multivalued attributes may contain more than one values.

for e.g.- a person can have more than one phone number, email address etc.



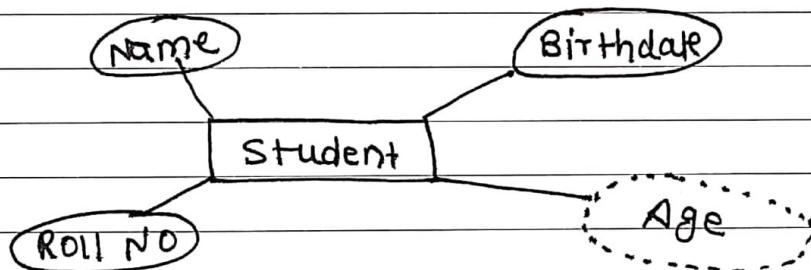


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Academic Year: 2018-19

Derived attributes :- Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database.

It can be represented by dashed ellipse.



single-value attribute :- single-value attributes contain single value.

e.g. - social security number (ssn)



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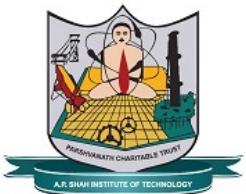
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Academic Year: 2018-19

- TYPE of Key :-

Super key :- A set of attributes (one or more) that collectively identifies an entity in an entity set.

Candidate key :- A minimal super key is called a candidate key. An entity set may have more than one candidate key.

Primary key :- A primary key is one of the candidate keys chosen by the database designer to uniquely identify the entity set.



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Academic Year: 2018-19

ER Diagram

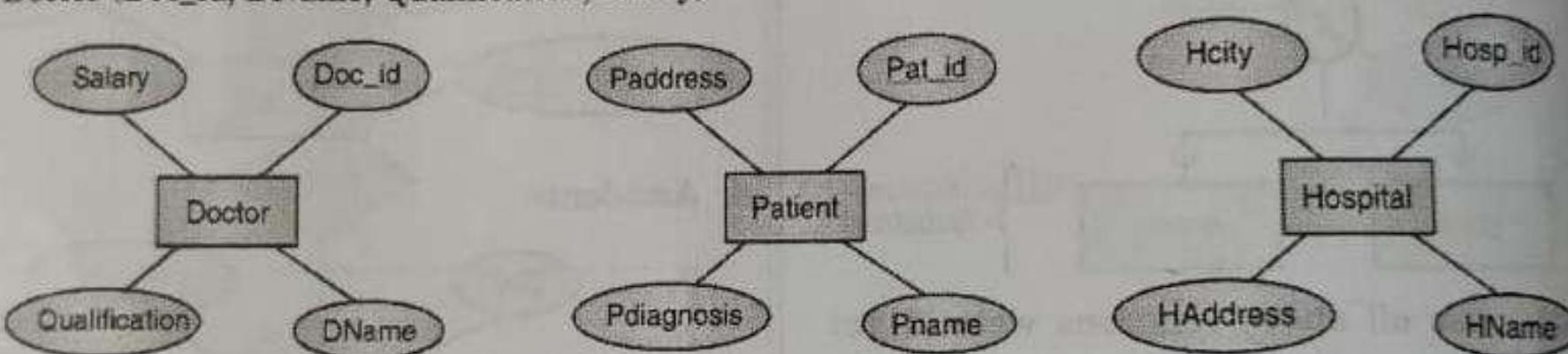
Construct an E-R diagram for a Hospital with a set of patients and the set of medical doctors associated with each patient a record of various test and examination conducted.

1. Identify Entities

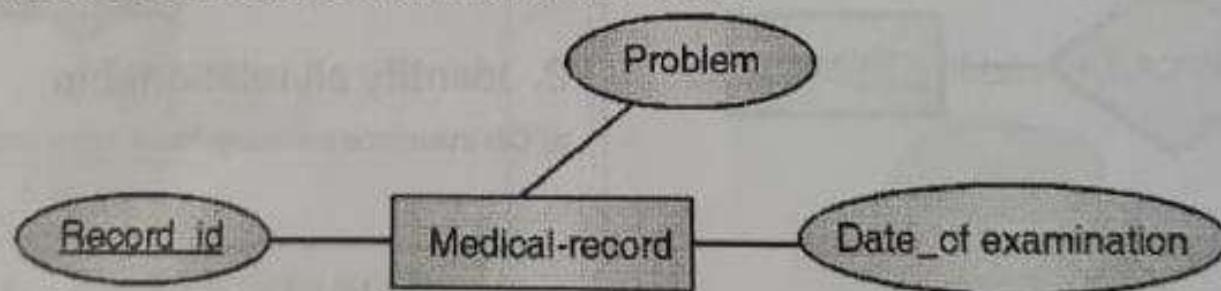
1. Hospital
2. Patient
3. Doctors
4. Medical-record (Record of various test and examination conducted)

2. Identify Attributes

1. Hospital (Hosp_id, HName, HAddress, Hcity)
2. Patient (Pat_id, Pname, Pdiagnosis, Padress)
3. Doctor (Doc_id, DName, Qualification, salary)

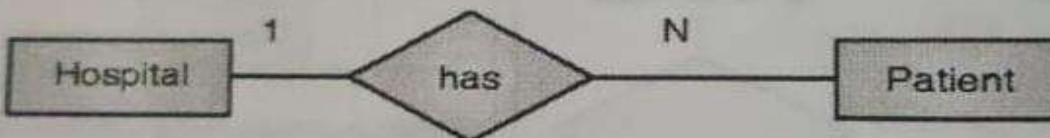


4. Medical_Record (Record_id, Date_of_examination, Problem)

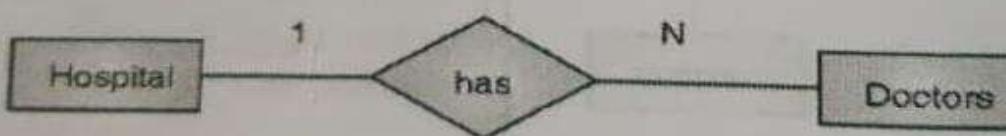


3. Identify relationships

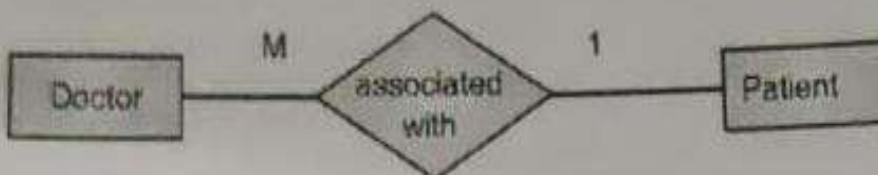
a. Hospital has a set of patients



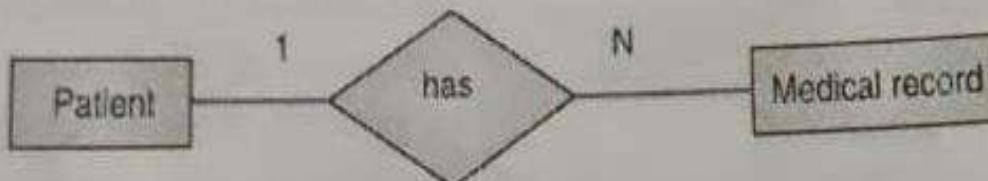
b. Hospital has a set of doctors



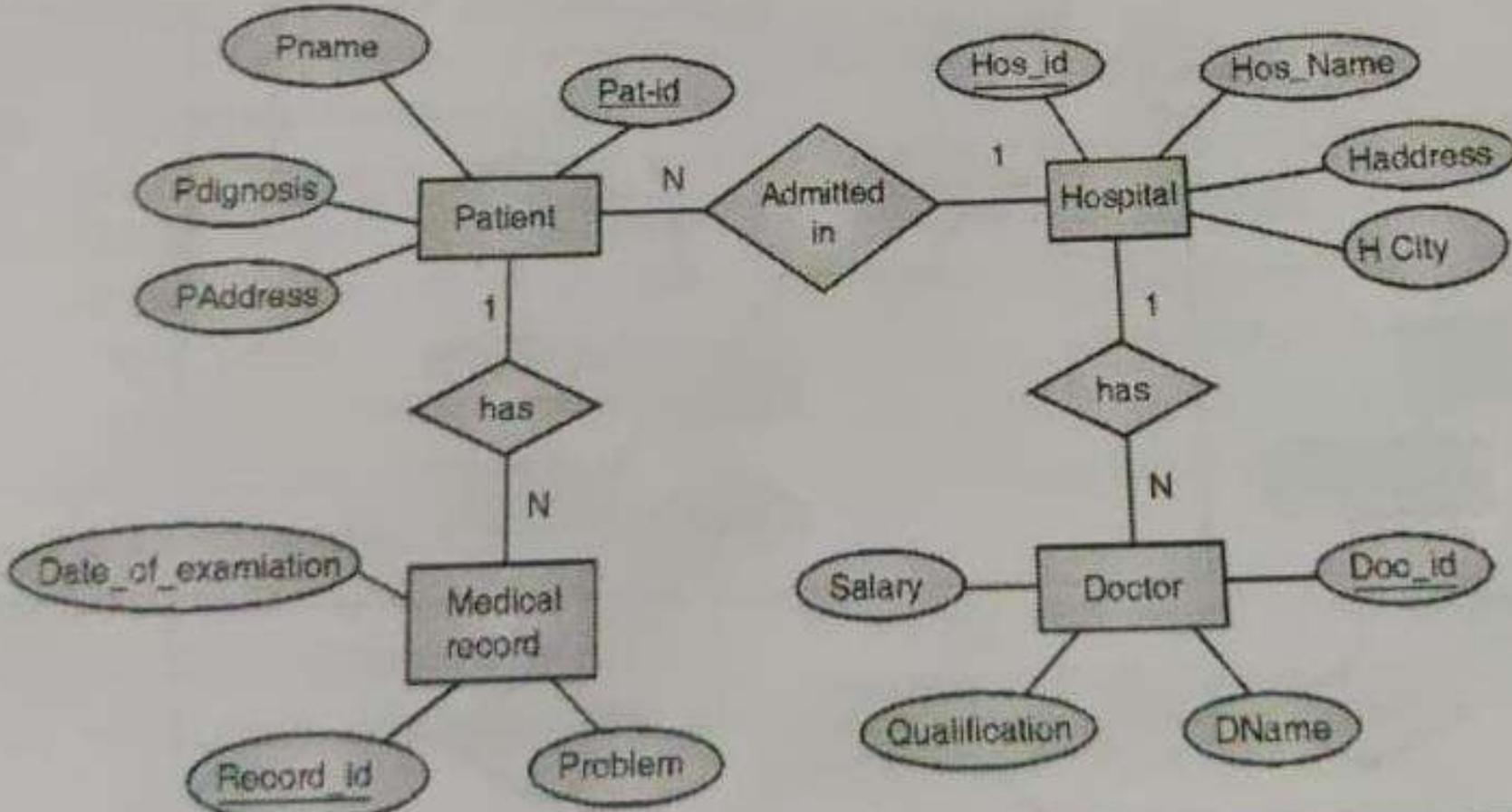
c. Doctors are associated with each patient



d. Each patient has record of various test and examination conducted



4. Construct ER Model from merging all above relationship



- Construct an E-R diagram for a car-insurance company that has a set of customers each of whom owns one or more cars. Each car has associated with it zero to any number of accidents.

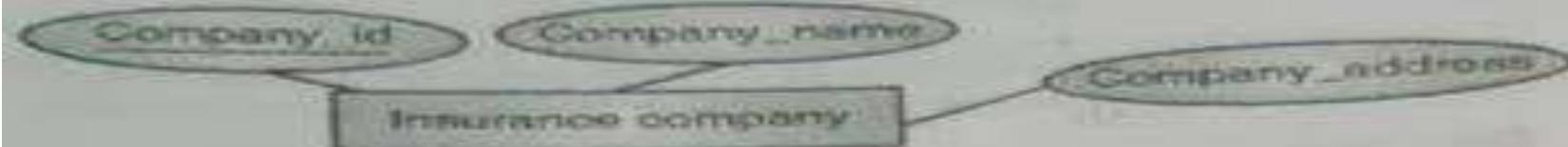
Solution :

1. Identify all entities

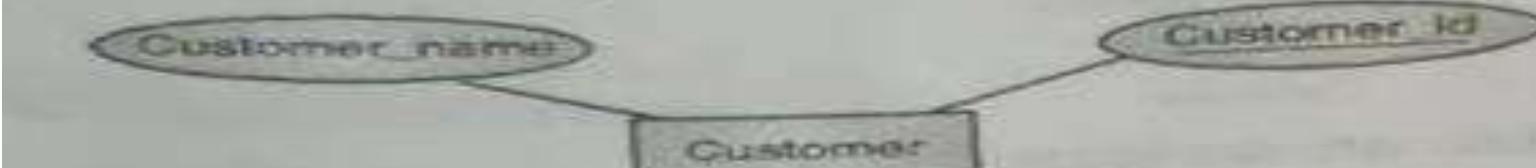
- a. Insurance company
- b. Customer
- c. Car
- d. Accidents

2. Identify all attributes

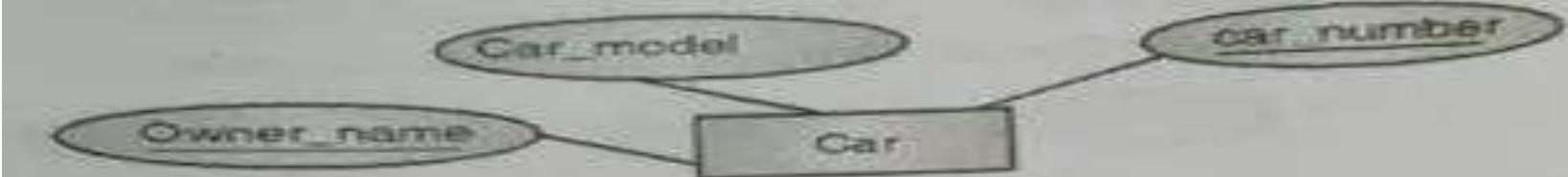
a. Company entity



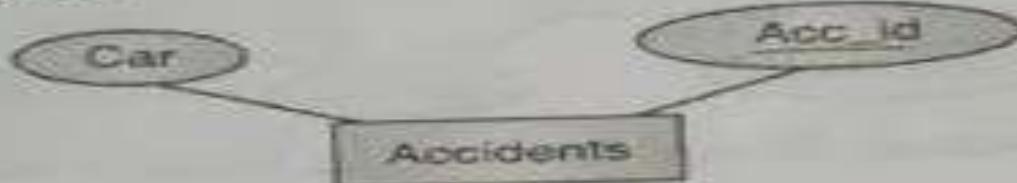
b. Customer entity



c. Car entity



d. Accidents



3. Identify all relationship

a) Car insurance company has a set of customers



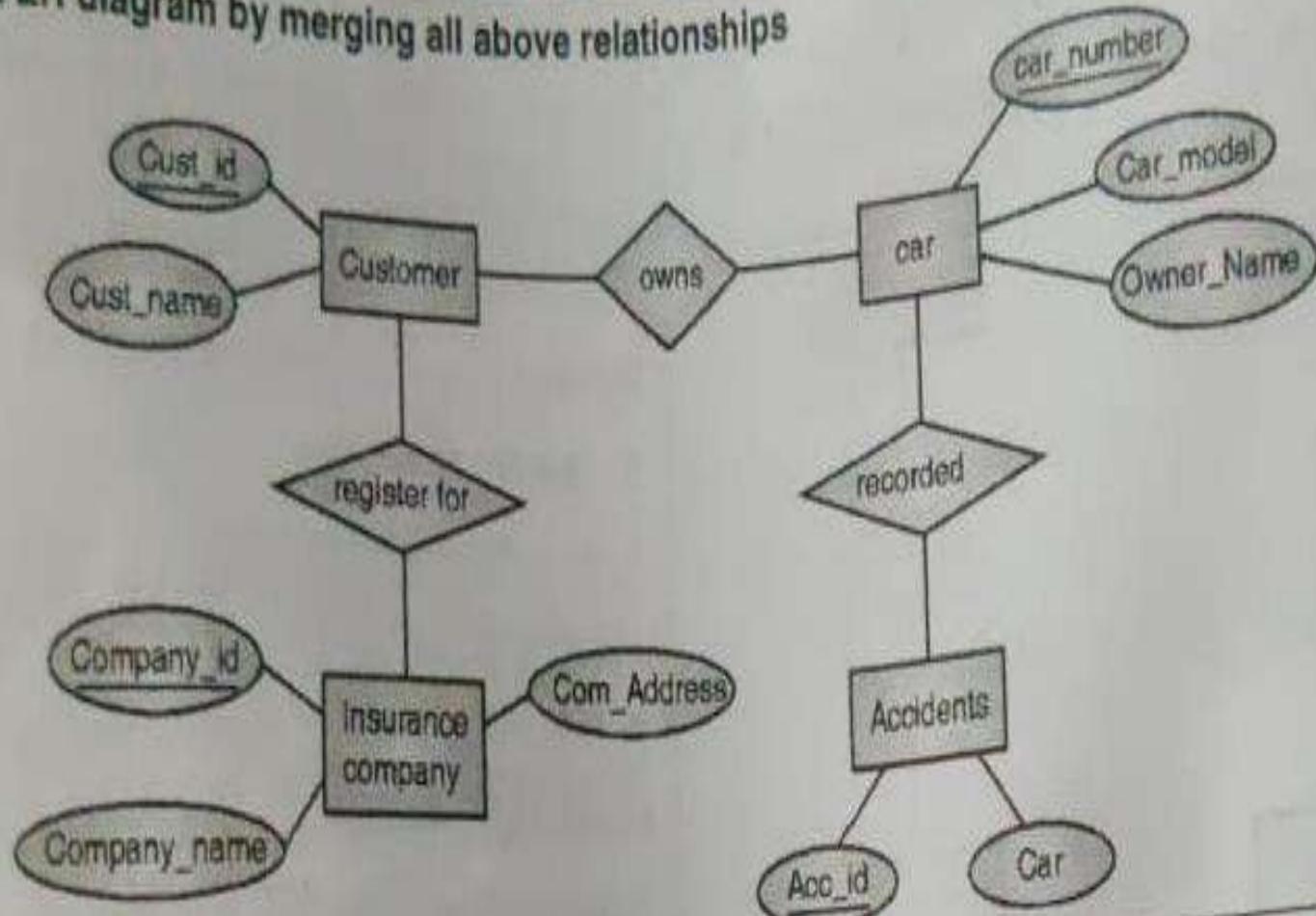
b) Customer owns one or more car



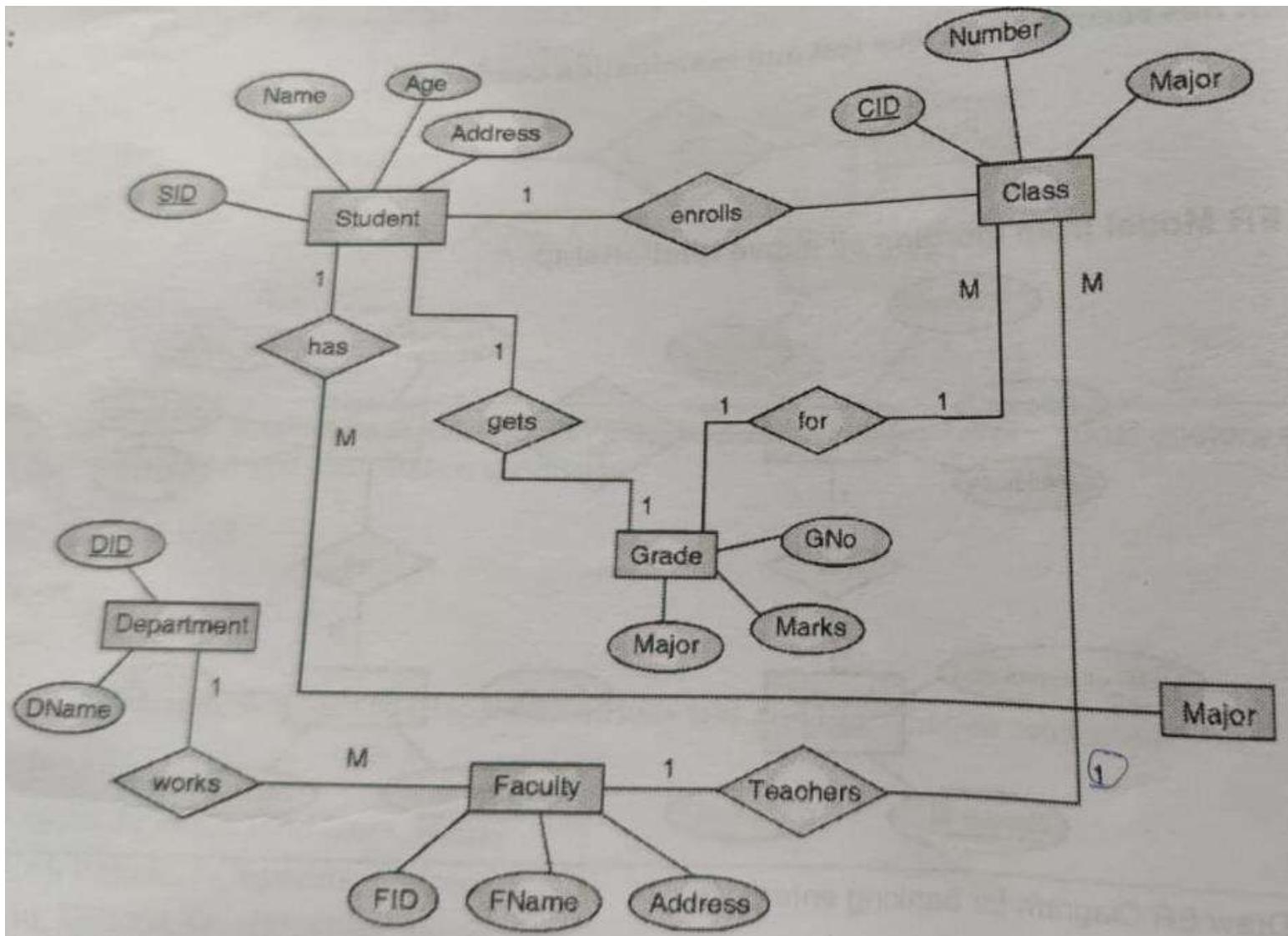
c) Each car associated with zero or any number of accidents



4. Construct ER diagram by merging all above relationships



- Draw ER Diagram for University Database consisting four Entities Student,Department,Class and Faculty.Student has q unique id, the student can enroll for multiple classes and has most one major.Faculty must belong to department and faculty can teach multiple classes.Each class is taught by only faculty.Every student will get grade for the class he/she has enrolled.





Subject:DBMS
Academic Year: 2018-19

* Benefits of data modeling :-

- A data model is a collection of concepts that can be used to describe the structure of a database.
- By structure of a database we mean the data types, relationships and constraints that apply to the data.
- A data model provides a way to describe the design of a database at the physical, logical and view levels.
- A data model can facilitate interaction among the designer, the application programmer and the end user.
- Data models are a communication tool.
- End users have different views and needs for data. Data model organizes data for various users.
- Data model prevents system from future risk and failure by defining structure of data in advance.
- As we got an idea of final system at the beginning of development itself, so we can reduce cost of project by proper planning and cost estimations as actual system is not yet developed.



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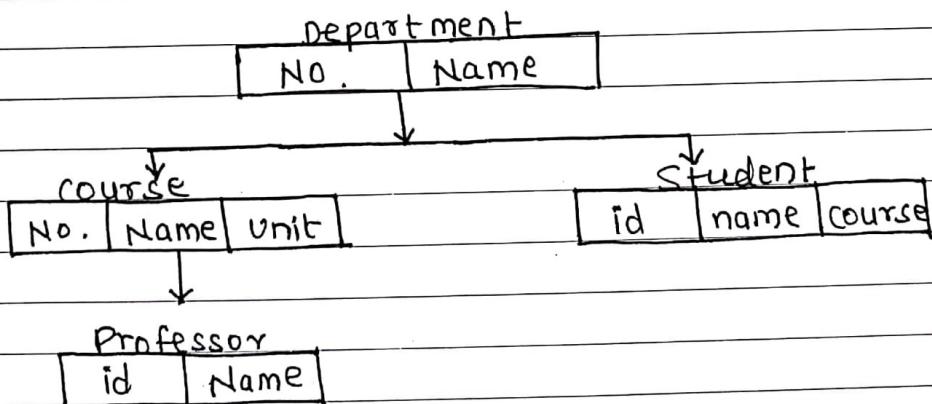
Subject:DBMS
Academic Year: 2018-19

* Types of models :-

The data models can be classified into following categories :-

1) Hierarchical model :-

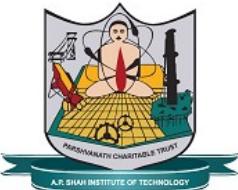
- A hierarchical model is a model in which data is organized into a tree-like structure.
- The data is stored as records which are connected to one another through links.
- In this model each entity has only one parent but can have several children. At the top of hierarchy there is only one entity which is called as Root.





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Subject:DBMS
Academic Year: 2018-19

→ Advantages :-

- Parent / child relationship promotes conceptual simplicity.
- It promotes data sharing.
- Database security is provided and enforce by DBMS.
- As parent and child are always attached to each other. This relationship promotes data integrity.
- It is efficient with one-to-many (1:m) relationship.

(for e.g. - a class contains many students studying in it).

→ Disadvantages :-

- For building a database system, designer & programmer should have knowledge of physical storage which may be complex.
- changes in any structure needs changes in all applications.
- Generally one-to-many (1:m) relationship can be implemented in hierarchical model. But it is very difficult to implement many-to-many (m:n) relationship in hierarchical model.
- Lack of structural independence.
(change in database structure doesn't affects data access is called as structural independence.)

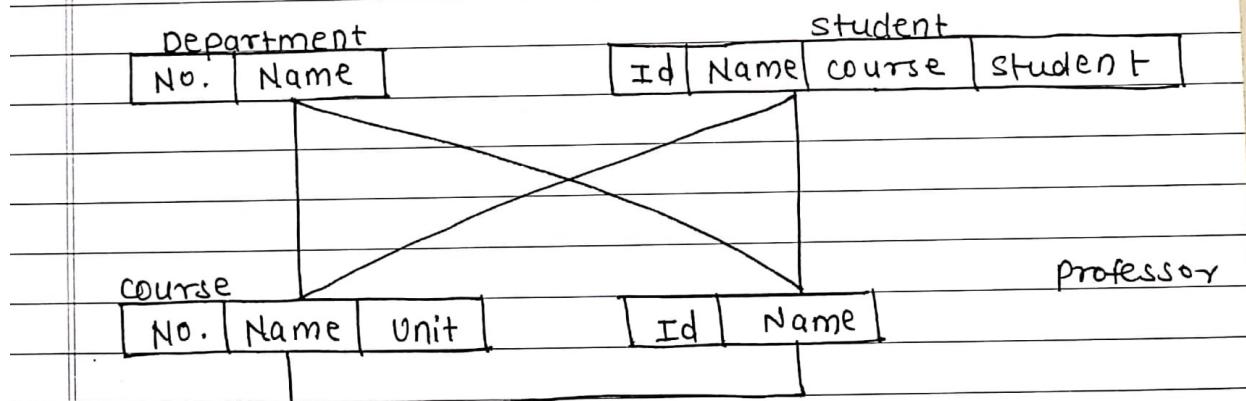


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Subject:DBMS
Academic Year: 2018-19

2) Network model :-

- In the network model, entities are organised in a graph, in which some entities can access through several paths.
- This model is created to represent complex data relationships more effectively.
- It improves database performance.



- The network model schema is not small enough to be a hierarchy, the hierarchical tree is replaced by a graph, which allows more basic connections with the nodes.



Subject:DBMS
Academic Year: 2018-19

* Advantages :-

→ simple concept :- Like hierarchical model, this model is simple and the implementation is effortless.

→ Ability to manage more relationship types :-

The network model has the ability to manage one-to-one (1:1) as well as many-to-many (m:n) relationships.

→ Easy access to data :-

Access of data is simpler when compared to hierarchical model.

→ Data Integrity :- There is always a connection between parent and child.

* Disadvantages :-

→ System complexity limits efficiency.

→ Structural changes require changes in all application programs.



Subject: DBMS
Academic Year: 2018-19

3) Relational model :-

- Relational model was first described in 1969 by Edgar F. Codd.
- A relational database is a collection of rows and columns.

Relational model

Customer table

cust_id	cust-name	phone
101	Neha	11111
102	Sneha	22222
103	Swati	33333
104	Mudra	44444

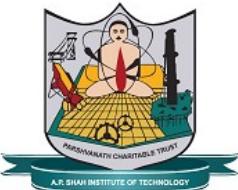
* Advantages :-

- changes in tables do not affect data access or application programs. (structural independence)
- Tabular view substantially improves conceptual simplicity, which makes the database easier to access. (structural independence).
- RDBMS isolates the end user from physical level details & improves implementation and management simplicity.



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Academic Year: 2018-19

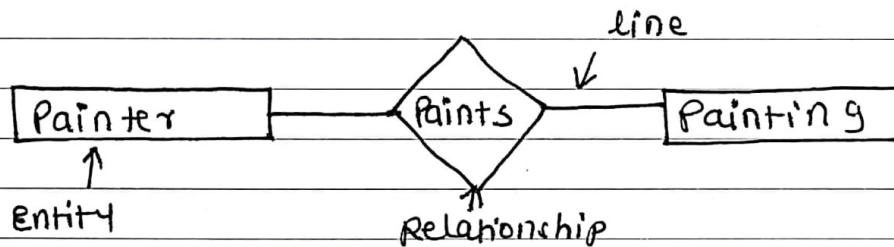


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Subject:DBMS
Academic Year: 2018-19

4) Entity - relationship data mode (E-R) :-

- The E-R model is a way of graphically representing the logical relationships of entities (or objects) to create a database.
- It works around real-world entities and the associations among them.
- Graphical representation of entities and their relationships in a database structure.
- Entity instance is present in rows in table.
- Diamond represents relationship among the entities which can be connected through a relationship line.



- Relationships can be of three types :-
① one-to-one (1:1)



one employee manages only one store.



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Subject:DBMS
Academic Year: 2018-19

* Disadvantages :-

- There is a limited constraints representation.
- There is limited relationship representation.
- There is no DML
- Loss of information content occurs when attributes are removed from entities to avoid crowded displays.

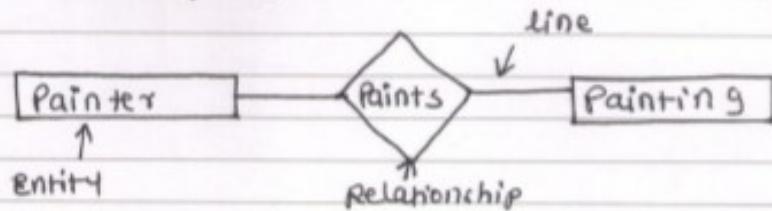


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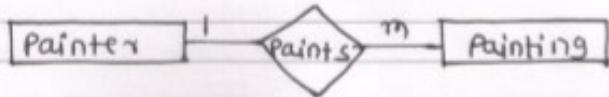
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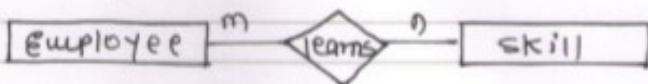
Subject: DBMS Academic
Year: 2018-19

⑥ one - to - many (1:m) :-



one painter can paint many paintings.

⑦ Many - to - many (m:n) :-



many employees can learn many skills.

* Advantages :-

- E-R model has an exceptional conceptual simplicity.
- Visual representation makes it an effective communication tool.
- It is integrated with the relational model