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UNIT - II

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Database System Architecture :—

Introduction :—

Schemas :—

The overall design of a database is called schema.

as

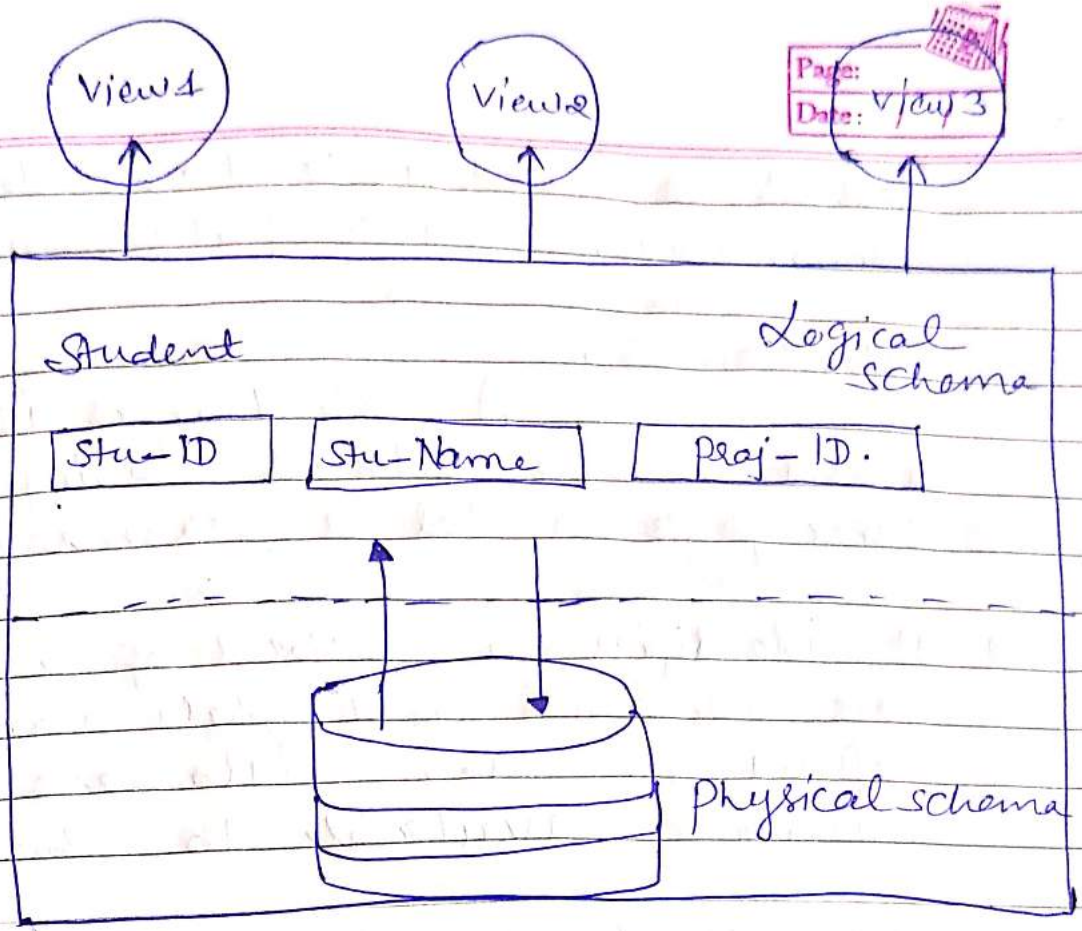
⇒ A schema is plan of the database that gives the names of the entities and attributes and the relationship among them.

⇒ A schema includes the defⁿ of the database name, the record type and the components that makeup the records.

⇒ Schema defines how the data is organized and how the relations among them are associated.

⇒ It contains a descriptive details of the database, which can be depicted by the means of schema diagrams.

⑥ A database schema can be divided broadly into ② categories—



① Physical Database schema.

② Logical Database schema.

① Physical Database Schema :—

This schema pertains to the actual storage of data and its form of storage like files, indices etc.

⇒ It defines how the data will be stored in a secondary storage.

② Logical Database Schema :—

This Schema defines all the Logical constraints that need to be

applied on the data stored. It defines tables, views, and integrity constraints.

Subschemas :-

A subschemas is a subset of the schema having the same properties that a schema has.

⇒ It identifies a subset of areas, sets, records and data names defined in the database schema available to user/session.

⇒ The sub-schema allows the user to view only that part of the database that is interest to him.

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Instances:-

The data in the database at a particular moment of time is called an instance or a database state.

⇒ Database schema defines the variable declaration in tables that belong to a particular database; the value of these variable at a moment of time is called the instance of that database.

For Ex:-

In a given instance each schema construct has its own current set of instances. Everytime we update the value of a data item in record, one state of the database change into another state.

This fig. shows an instance of the ITEM relation in a database schema.

ITEM_ID	ITEM_DESC	ITEM_COST
11AE	Screw	5
11BE	Cage	7
11CE	Fixture	8
11DE	Gear	50

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Database Architecture :-

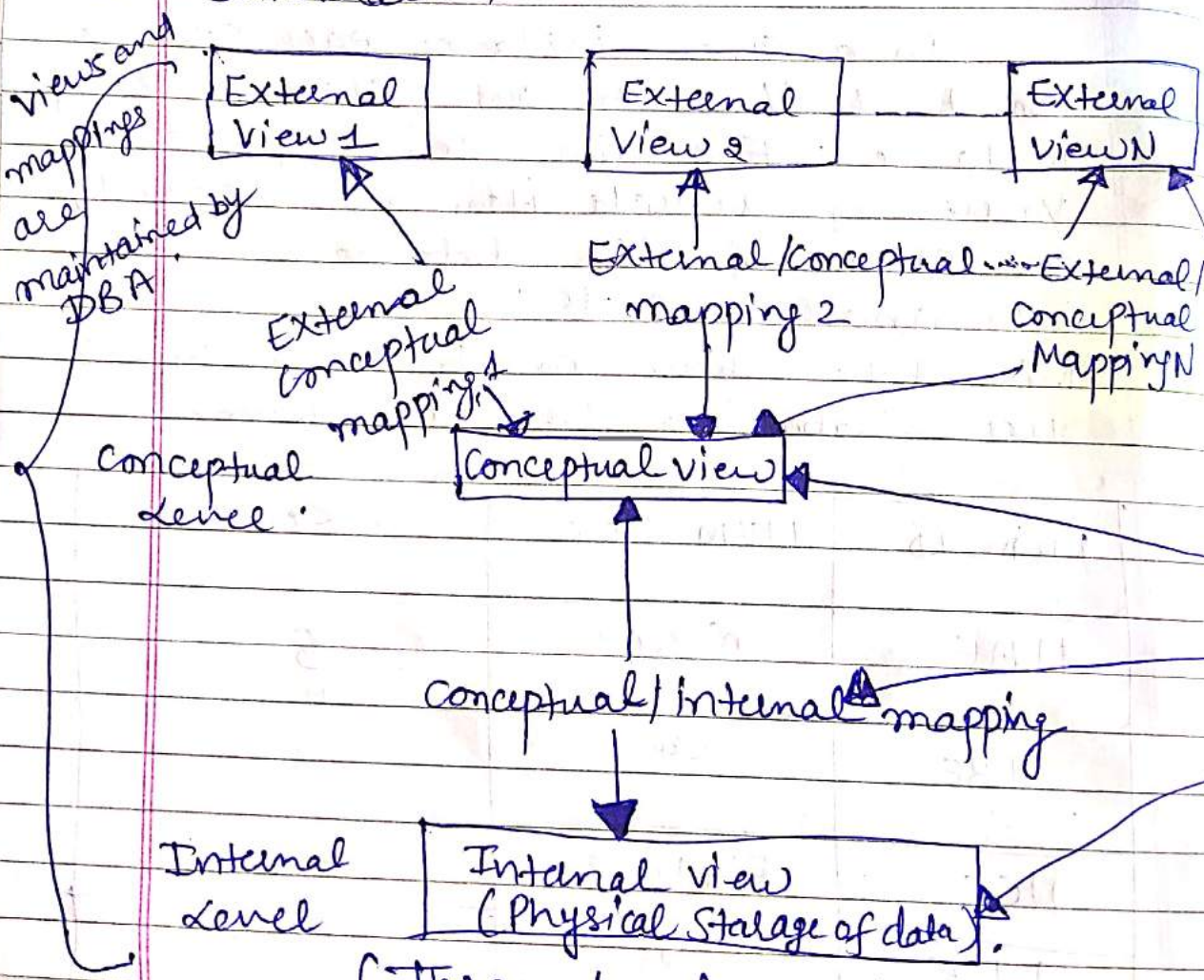
The architecture is a framework for describing database concepts and specifying the structure of the database system.

⇒ Here Database is divided into (3) three levels —

(1) External Level.

(2) Conceptual "

(3) Internal "



(Three Level architecture of DBMS).

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① Internal Level :—

desceibes the actual physical storage of data. as the way in which the data is actually stored in memory (It tells "How" the data are actually stored)

⇒ This Level is not relational because data is stored according to various coding schemes instead of tabular form. This is the low Level Representation of entire database.

⇒ It gives complete details of data storage access paths, various record types, physical sequence of record etc.

② conceptual Level :—

It is also known as Logical Level which describes the overall Logical Structure of whole database for a community of Users.

DBMS

⇒ This Level of data abstraction describes "What" data are to be stored in the database and what relationships exist

among these data.

(4) Database Administrator use the logical level of abstraction.

[3] External Level :-

It is also known as view level or User level.

⇒ It is the highest level of data abstraction that describes only parts of entire database.

⇒ This is the level closest to the users and is concerned with the way in which the data are viewed by individual users.

⇒ The External schema is defined by the DBA for every user. The remaining part of database is hidden from that user.

⇒ This means User can only access data of its own interest.

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Data Independence :-

It is defined as the characteristics of a database system to change the schema at one level without having to change the schema at the next higher level.

⇒ There are two(2) level of data independence —

① Physical Data Independence.

② Logical " "

① Physical Data Independence :-

It refers to the ability to modify the schema followed at the physical level without affecting the schema at the conceptual level.

② Logical Data Independence :-

It refers to the ability to modify the conceptual schema without causing any change in the schema followed at view level in the schema followed at view level.

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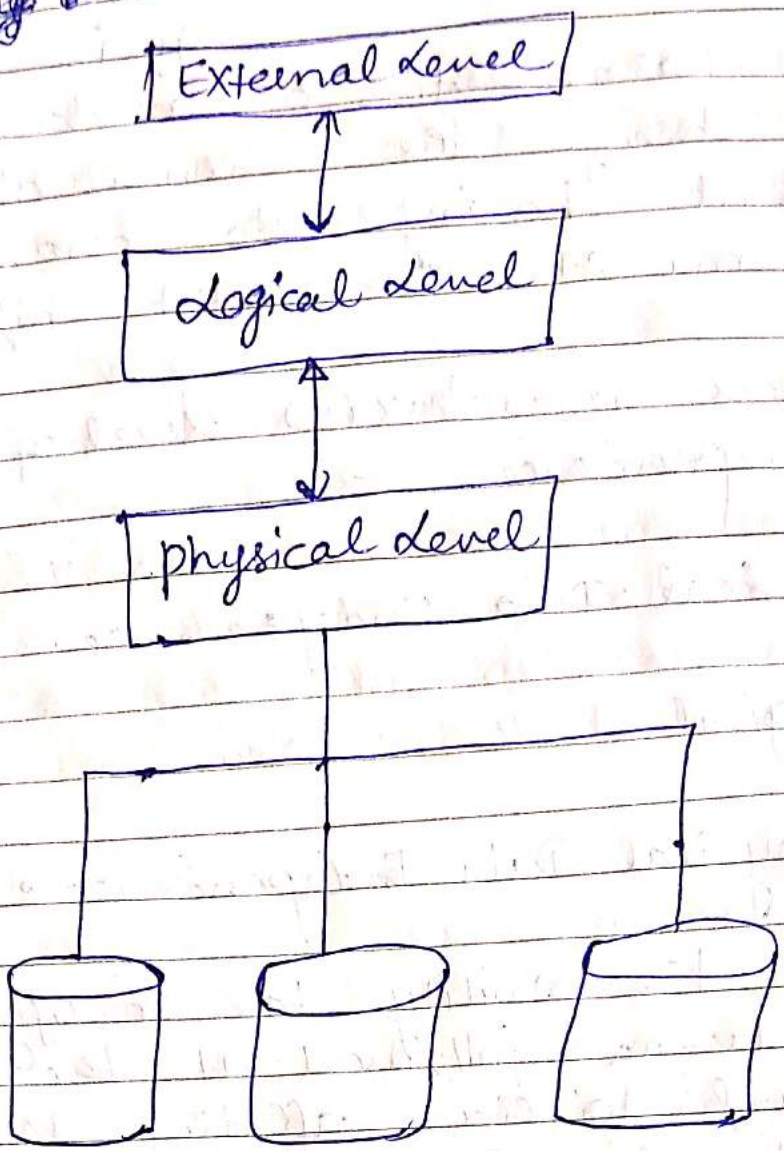
Mapping :-



(Data Independence)

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Mapping :-

Process of transforming request and results between three level is called Mapping.

There are (2) types of Mappings —

1. Conceptual / Internal Mapping :

- The conceptual / internal mapping defines the correspondence between the Conceptual view and the Store database.
- It specifies how conceptual record and fields are represented at the internal level.
- It relates conceptual schema with internal schema.
- If structure of the store database is changed.
- If changed is made to the storage structure defⁿ - then the conceptual / internal mapping must be changed accordingly, so that the conceptual schema can remain invariant.
- There could be one mapping between conceptual and internal levels.

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② External/Conceptual Mapping:-

⇒ It defines the correspondence between a particular external view and conceptual view.

⇒ It relates each external schema with conceptual schema.

⇒ The differences that can exist between these two levels are analogous to those that can exist between the conceptual view and the stored database.

→ EX:-

Fields can have different data types; fields and records name can be changed; several conceptual fields can be combined into a single external field.

⇒ Any no. of external views can exist at the same time, any no. of users can share a given external view; - different external views can overlap.

→ There could be several mapping between external and conceptual levels.

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Mapping Constraints :-

is a data constrai-nt that express the no. of entities to which another entity can be related via a relationship set.

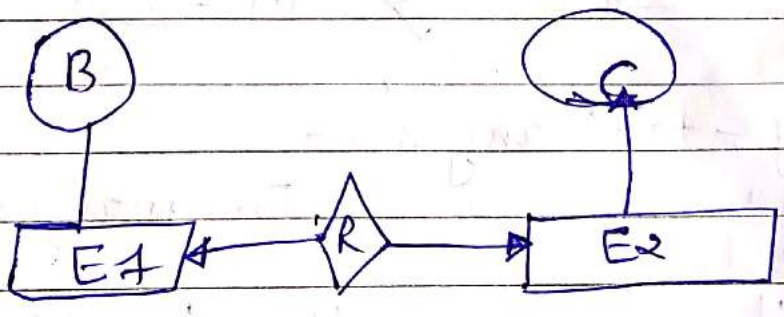
⊙ It is most useful in describing the relationship sets that involve more than two entity sets.

⇒ For binary relationship set (R) on an entity set A and B, there are (4) possible mapping cardinalities ——

These are as follows :——

(1) one to one :—

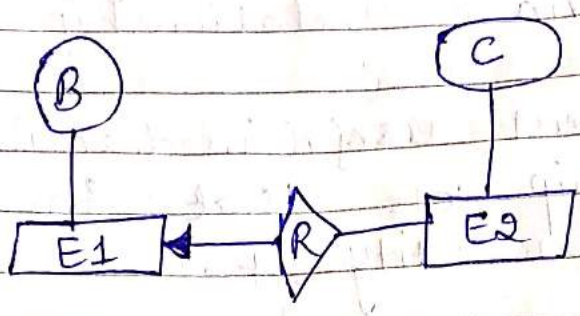
In one-to-one mapping, an entity in E1 is associated with atmost one entity in E2, and an entity in E2 is associated with atmost one entity in E1.



(2) one-to-many —

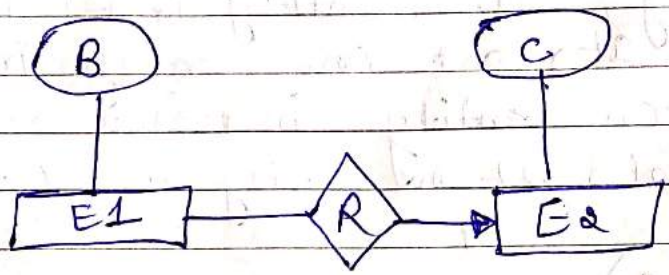
In one-to-many mapping, an entity in E1 is

associated with any no. of entities in E2, and an entity in E2 is associated with atmost one entity in E1.



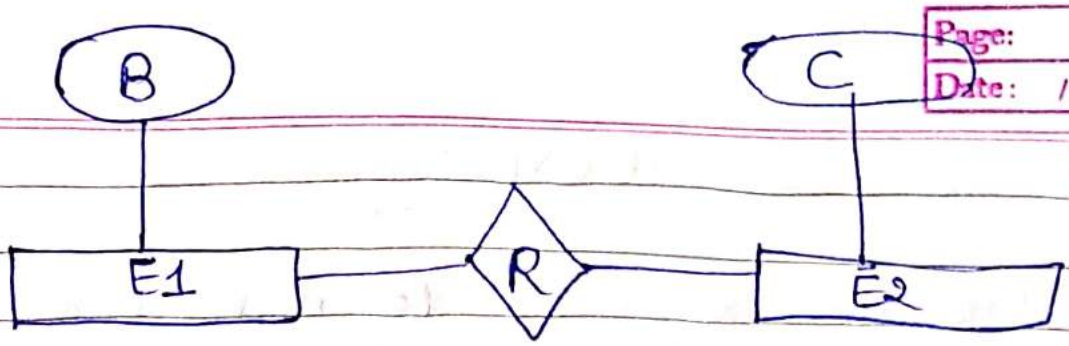
(3) Many-to-one :-

In one-to many mapping, an entity in E1 is associated with atmast entity in E2, and an entity in E2 is associated with any no. of entities in E1.



(4) Many-to-Many :-

In many to many mapping, an entity in E1 is associated with any no. of entities in E2, and an entity in E2 is associated with any no. of entities in E1.



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Data Models.

Database Model defines the logical design and structure of a database and defines how data will be stored, accessed and updated in a database Management System.

(a) There are various types of database Model —

(1) Hierarchical Model.

(2) Network "

(3) Relational "

(4) Entity – Relationship Model

(1) Hierarchical Model :-

The database Model organises data into a tree-like structure, with a single root, to which all the other data is linked. The hierarchy starts from the Root data, and expands like a tree, adding child nodes to the parent node.

⇒ In this model, a child node will

only have a single parent node.

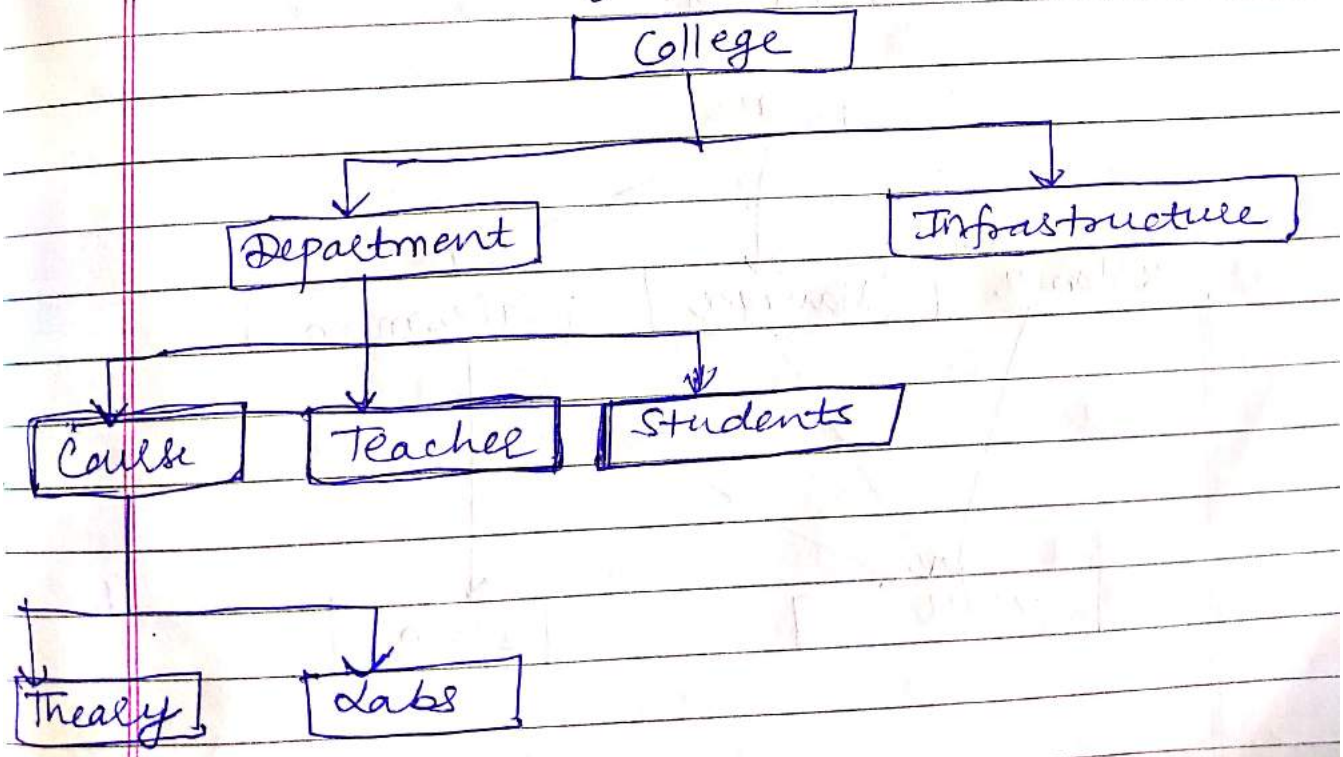
⇒ This model efficiently describes many real-world relationships like index of book, recipes etc.

⇒ This model efficiently describes many real-world relationships like index of a book, ~~recipes~~

⇒ In hierarchical model, data is organised into tree-like structure with one-to-many relationship between two different types of data.

for Ex:-

one department can have many courses, many professor and of-course many students.



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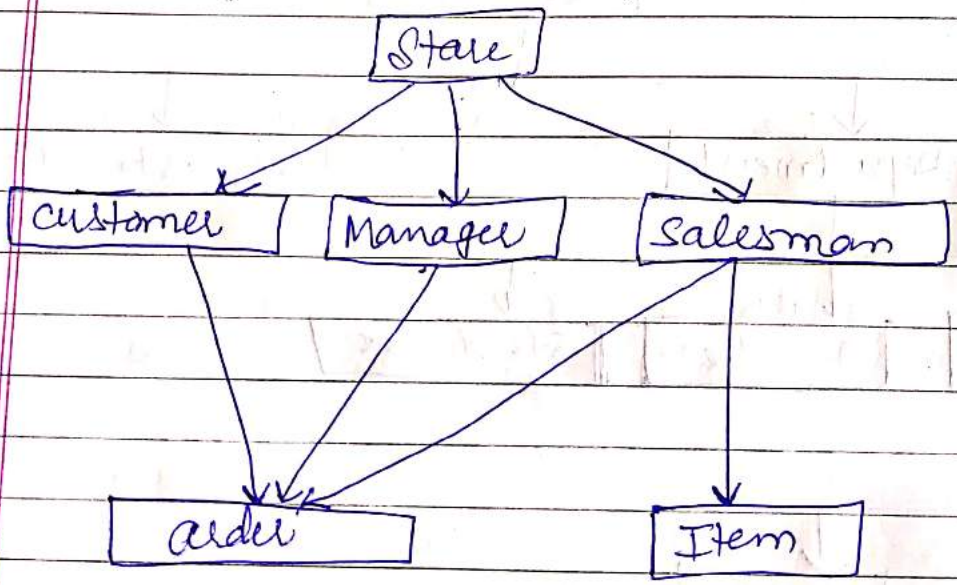
(2) Network Model :-

It is an extension of the Hierarchical Model. In this model, data is organised more like a graph, and are allowed to have more than one parent node.

⇒ In this database model, data is more related, hence accessing the data is also easier and fast.

⇒ The database model was used to map many-to-many data relationships.

⇒ This was the most widely used database model, before Relational Model was introduced.



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Relational Model :-

In this model, data is organized in two dimensional tables and the relationship is maintained by storing a common field.

⇒ This model was introduced by E.P. Codd in 1970, and since then it has been the most widely used database Model, infact that, we can say the only database model used around the world.

⇒ The Basic structure of data in the relational model is tables. All the information related to a particular type is stored in rows of that table.

⇒ Hence, tables are also known as relations in relational model.

Student-id	name	age
1	AKon	17
2	BKon	18
3	CKon	17
4	DKon	18

Stud-id	name	teacher
1	Java	Mr. J
2	C++	Miss C
3	C#	Mr. C#
4	php	Mr. PHP

Student-id	Subject-id	marks
1	1	98
1	2	78
2	1	76
	2	88

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ER-MODEL:-

① ER stands for Entity-Relationship Model.

② This model is used for design and representation of relationships between data.

③ It is best used for the conceptual design of a database.

④ ER Model is based on —

- Entities and their attributes.
- Relationships among entities.

Ex:- In a school management software, we have to store Student information, Teacher information, classes & subjects.

considering this example:—

Entity Ex:- Student :—

is an entity Teacher, class, subject all are entities.

Entity :-

An Entity is generally a real-world object which has characteristics & hold

relationships.

Entity Set :—

If a Student is an entity, then the complete dataset of all the Students will be the entity set.

Attributes :—

Entity having property called Attribute.

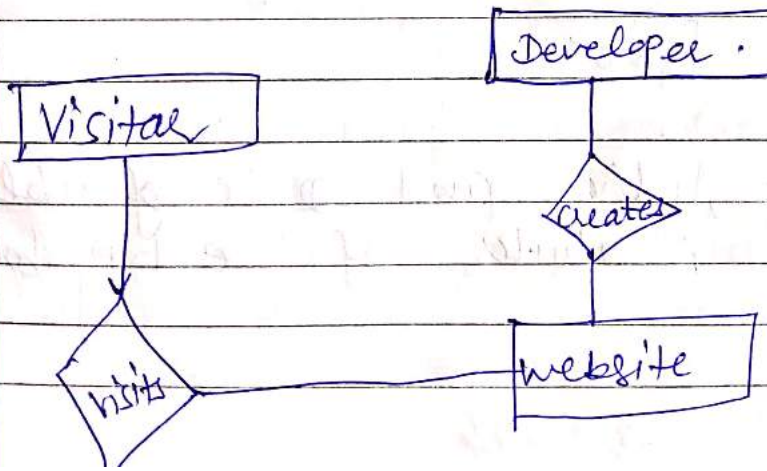
Ex:- If a Student is an entity, then Student's roll-no, Student name, Student age, Student's gender etc. will be its attributes.

Domain :—

Every attribute is defined by its set of value called domain.

Working with ER Diagrams :—

It is a visual representation of data that describes how data is related to each other.



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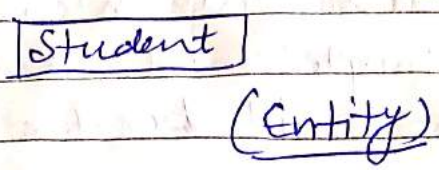
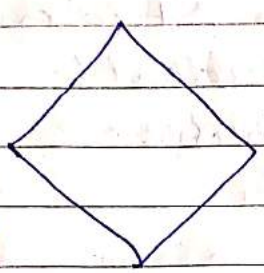
Entity :-
Simple rectangular box represents an Entity.

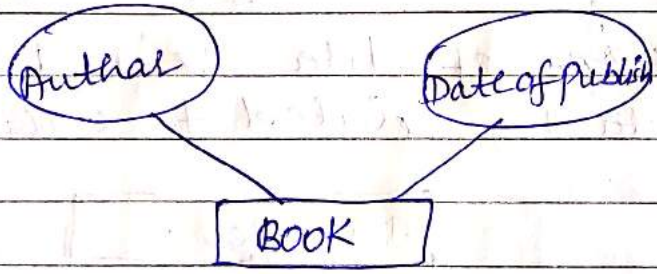


(Entity)

Relationship :-
Rhombus is used to setup relationship between two or more entities.



Attribute: Ellipse is used to represent attributes of any entity. It is connected to the entity.



Here :- Authar and Date of publish are Attributes of entity book.

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Types of Database Mgt system :-

There is a Variety of Databases in DBMS ——

Types of DBMS :-

1. Hierarchical Databases
2. Network "
3. Relational "
4. Object-oriented "
5. Graph databases
6. ER Model Databases.
7. Document "

(1) Hierarchical Databases :-

@ system structure was developed by IBM in the early 1960s.

(b) In this type of database, data gets stored in parent-children relationship nodes. Also, the records not only contain the data of it but of their parent & children as well.

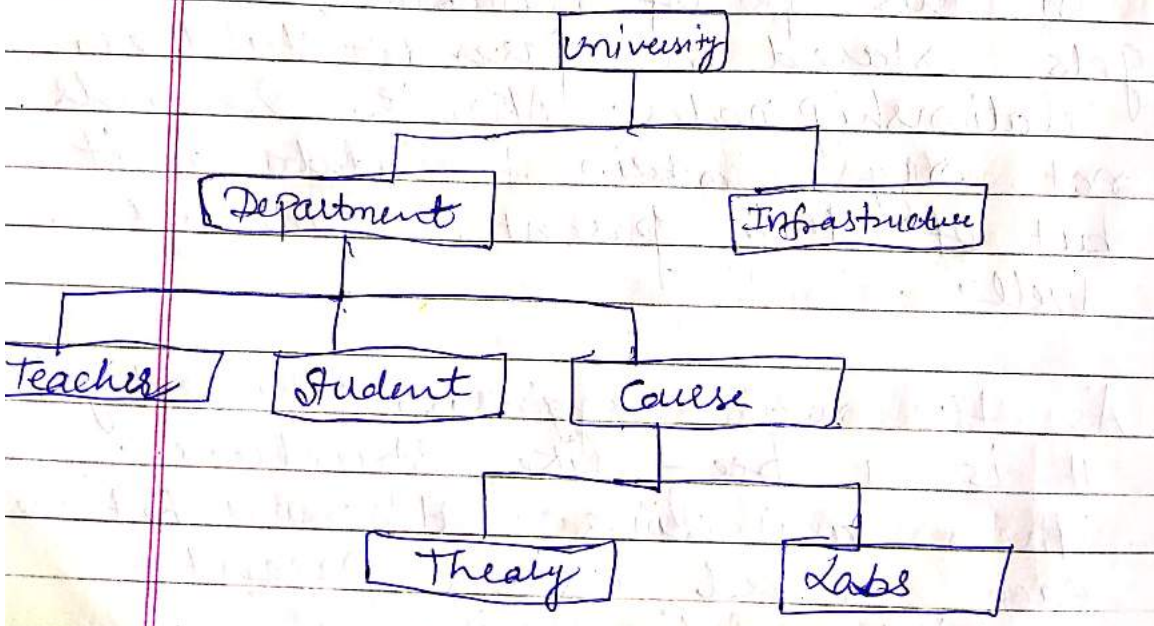
(c) As the name suggests, 'Hierarchy', it is a tree-like structure. There are links attached between each record as a parent-child relationship.

(d) Data gets stored in the form of collection of fields in which each fields contain only one value, i.e every individual record has only one parent & a parent can have one or more than one children.

(e) To retrieve the data, we need to traverse each tree until we get the desired data.

⇒ It is simple but inflexible due to the parent-child one to many relationship.

⇒ They are mostly used in Banking and telecommunications industries to build high performance & manage appⁿ.



(Hierarchical Database Model)

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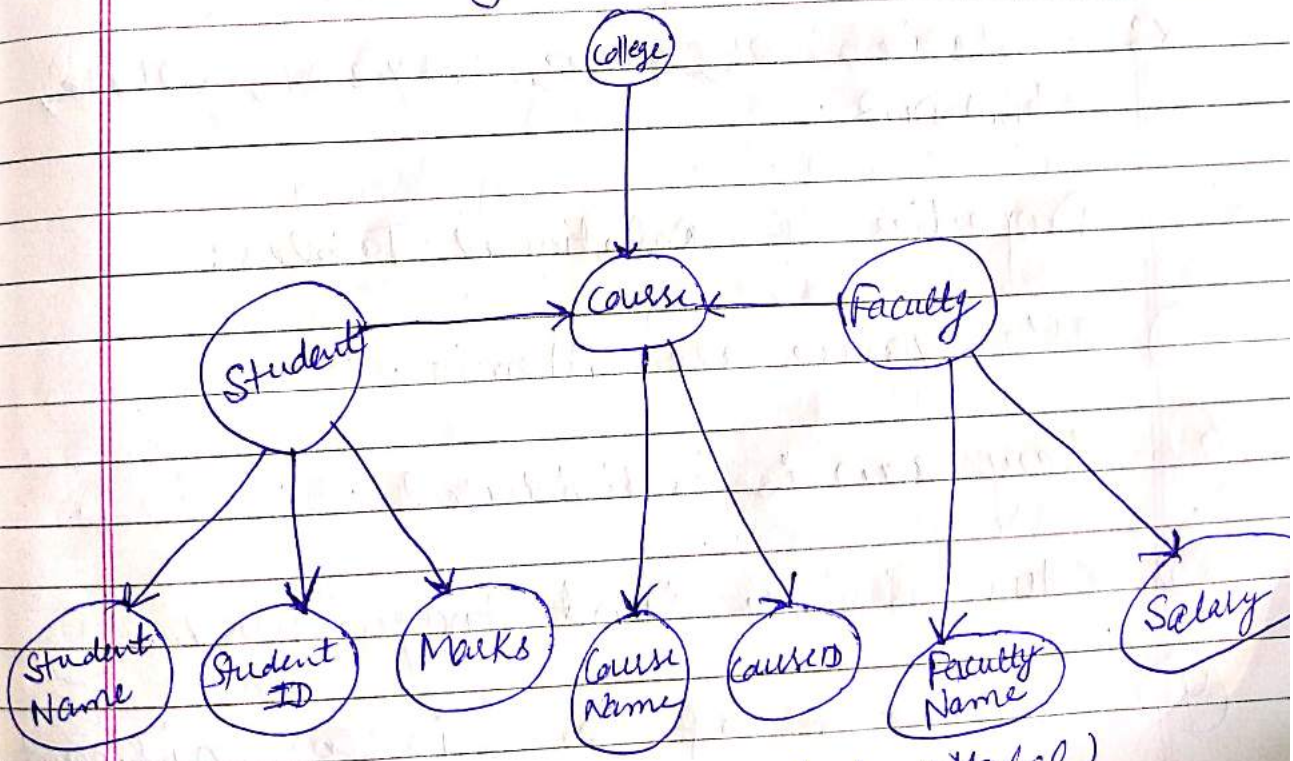
② Network Databases :-

ⓐ Network DBMS uses network structure to create a relationship entities.

ⓑ Network databases are mainly used on a large network of computers.

ⓒ Network databases are similar to hierarchical databases differ with one key point that in network databases one node can have a relationship with multiple entities.

ⓓ In network database, parents are termed as 'occupier and children are termed as members. Data in the n/w database is organized as many-to-many relationships.



(Network Database Model)

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③ Relational Database :—

@ Relational databases are the most popular among all databases.

ⓑ In this type of database, there is a relationship between data and that is stored in the form of table of rows and columns so that row represents records and column represent the attribute.

ⓒ Every individual field represents the data value. In order to query the Relational databases, SQL is used which includes insertion, deletion, manipulation and search the records.

Ex:- oracle, SQL Server, MySQL, SQLite, IBM DB2.

Properties of Relational Tables:—

① It's value are Atomic.

② Every row is individual.

③ columns are undistinguished.

④ Sequence of Rows is Insignificant

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Ex:

Course ID	Student Name	Enrollment No.
IDMW230C	Akhil singh	1
IMLC340C	Neha Pandey	2
INSE430C	Shashwat Rana	3

Course ID	Course Name
IDMW230C	Data Mining
IMLC340C	Machine Learning
INSE430C	Network Security

Course ID	Faculty Name
IDMW230C	Ajit Singh
IMLC430C	Shiv Kumar
INSE430C	Prajit Bose

(Relational Database Model)

(4) Object - oriented Databases — @ were created in the early 1980's.

(b) Object-oriented Databases deals with the functionality of the Project-oriented programming and it increases the semantics of the C++ and Java.

(c) Advance programming Language objects are required in object-oriented databases.

(d) It provides full-featured database programming capability while containing native Language compatibility such that it alters the database functionality to object-~~oriented~~ progeramming Languages.

(e) Applications in object-oriented database require Less code, use more natural data modelling, and code bases are easier to maintain.

(f) object-oriented databases use small software called objects. The object themselves are stored in the object-oriented database.

(g) Every object in object-oriented databases contain two elements

(i) pieces of data (Ex — sound, video,

text or graphics).

(ii) Instructions or software programs called methods.

Ex: .Some OODs were designed to work with OOP languages such as Delphi, Ruby, C++, Java and Python.

O-ODs are TORNADO, Gemstone, Intersystem Caches, etc.