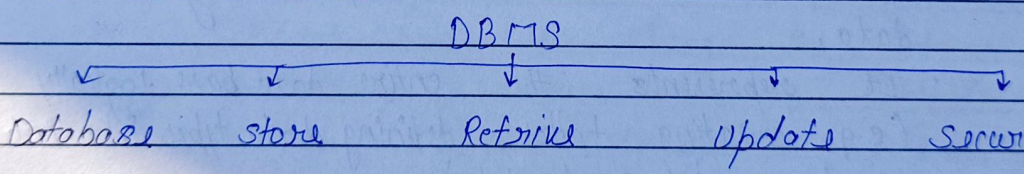
Unit 1 Date..23-01-26.

Data → Raw facts (No meaning)
eg→ 85, Aman, CSE

Information → Processed data (Proper meaning of Data)
eg→ Aman got 85 marks.

Database → Data's organized collection
eg→ School's students records
A digital store room, where data store in a proper way.

DBMS → Database Management system (software)
It works → Data store, retrive, update/delete to secure.
eg→ MySQL, Oracle



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Three-level Architecture (Data Abstraction)

The Three-level Architecture was proposed to separate the User Application from the physical database. It consists of the following three-levels:

1. Physical level (Internal level)
   - This is the lowest level of data abstraction.
   - It describe how the data is actually stored on the storage medium.
   - It deals with complex low-level data structure, file organization methods and compression technique.

2. Conceptual level (logic level):
   - This is the middle level of Abstraction
   - It describes what data is stored in the database and the relationships among those data.
   - It represents the entire data base logically (e.g. creating tables, defining data types like int, varchar and constraints).
   - Database Administrators works at this level

3. External level (View level)
   - This is the hieghest level of Abstraction.
   - It describes only part of the database that a particular user group is interested in and hides the rest.
   - There can be multiple external views for the same database (e.g. student View vs. Teacher view).

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Data Independence

Data independence is the ability to modify a schema defination in one level without affecting the schema defination in the next higher level. It is of two types :

1. Physical Data independence
   - The capacity to change the internal schema (Physical storage) without having to change the conceptual schema.

   eg→ changing the storage device or the file organization method should not requires changes in the logical structure of the tables.

2. Logical Data independence
   - The capacity to change the conceptual schema without having to change the ~~internal~~ external schema or application program.

   eg:- Adding a new column to a table or splitting a table should not break the existing application code that does not use the new column.

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ER Models (Entity-Relation)

The Entity-Relation model is a high level Conceptual data models. It help in analyzing data requirements systimatically to produce a well-designed database. It views the real world as a set of basic objects called entities and relationship among these objects.

- Key components

1. Entity
   - An entity is a real word objects that exits and is distinguishable from other objects.

   Eg→ A specific person, company or event.
   In a College database, student and Teacher are entities.

   - Represented by a Rectangle. ▭

2. Attribute
   - Attribute are the properties that describe an entity.

   Eg→ A student entity may have Attribute like Name, Roll no, Age.

   - Represented by an Ellipse (Oval) connected to the rectangular entity.

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3. Relationship

- A relationship is an association among several entities.

Eg→ A students enrolls in a courses. Here enrolls is the Relationship.

- Represented by a Diamond shape connecting the entities.

Types of Attributes or keys

Attributes define the properties of an entity. They are classified into the following types:

1. Key Attributes (Primary Attributes)
   - An Attributes that uniquely identifiers an entity from an entity set.

   Ex→ Roll no for a students, ISBN for a Book.
   - Represented by an ellipse with the text underlined

2. Composite Attributes:
   - An Attributes that can be divided into ~~sup~~ sub parts (smaller independent attributes)

   Eg→ Name can be divided into First name, Middle name, last name.

3. Multivalued Attributes
   - An Attributes that can hold multiple values for a single entity.

   Eg→ Phone numbers, Degree (A person have multiple mobile numbers or Degree like B.Tech, M
   - Represented by a Double ellipse.

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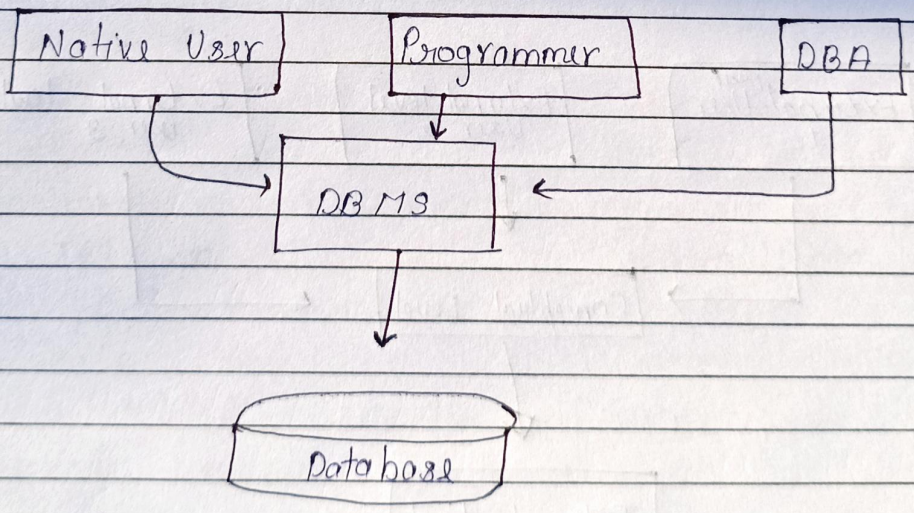
* Database :- A database is an organized collection of logically related data that is stored and accessed electronically.

* DBMS :- DBMS is a software system that enables user to efficiently create, store, retrieve and manage data in a database.

* Database System :- A Database system consists of the database, DBMS software, application programs and users.

* Types of Database Users
  - Native user
  - Application Programmers
  - Sophisticated Users
  - Database Administrator (DBA)



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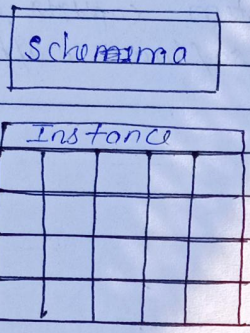
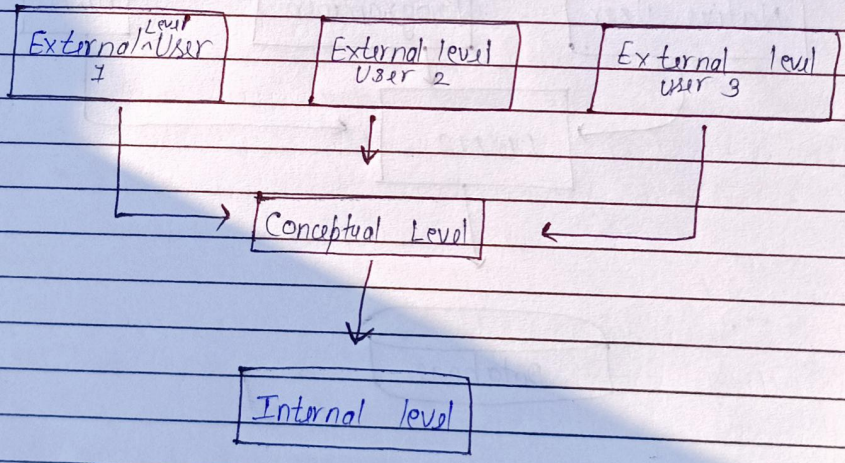
* Schema :- Schema is the logical structure of the database that defines how data is organized. (Rarely change, Defined by DBA)

* Instance :- Instance is the actual content of the Database at a particular points of time. (Frequently changes, Generated by user)



* Three level Architecture



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Keys in DBMS

A key is an attribute or set of attributes used to uniquely identify a tuple in a relation (row or record). Key ensure data integrity and establish relationships b/w tables.

1. Super key
   - A set of one or more attributes that uniquely identifies a record in a table.
   Ex→ (Roll no), (Roll no + name), (Email ID).

2. Candidate Key
   - A minimal Super key. It is a super key from which we cannot remove any attribute without losing the uniqueness property.
   - A table can have multiple candidate keys.
   Ex→ Roll no and Email ID.

3. ~~Primary key Prim~~ Foreign key
   - An attribute in one table that refers to the primary key of another table. It is used to maintain Referential Integrity.
   Ex→ If student ID is a primary key in the student table and we use student ID in the Marks table to link marks to a student then student ID in the Marks table is a foreign key.

4. Primary key
   - One specific Candidate key selected by the database designer to uniquely identify tuples

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within the table.
- It cannot be null and must be unique.

Ex → Roll no. is slected as the Primary key.

Relationship / Cardinality Ratio in ER Model

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

1. One to One (1:1)
   - An entity in Set A is associated with at most one entity in Set B and vice-versa.

   Ex → Department manages Head of Department. (1 D has 1 HOD)

2. One to many (1:N)
   - An entity in Set A is associated with any number of entities in Set B, but an entity in Set B is associated with at most one entity in Set A.

   Ex → Department employs Employees

3. Many to One (N:1)
   - Reverse of (1:N) multiple entities in Set A are associated with a single entity in Set B.

   Example → Student belongs to class.

4. Many to Many (N:N)
   An entity in Set A is associated with any number of entities in set B and an entity in Set B is associated with any number of entities in Set A.

   Ex → Student enrolls in Courses. (A student takes many courses, A courses has many Student.

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Difference b/w Model Type.

Hierarchical model	Network model	Relational model
• Tree-like structure	Graph like structure	Table based structure
• One to many (Relation)	Many to many	Many to Many using Table.
• A child has only one parent	A child have multiple parent	Not applicable (use keys)
• Less flixible	More flixible than Hierarchical	Most flixible and easy to use.
ex→ IBM, IMS	IDS	My SQL, Oracle.

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Integrity Constraints

Integrity Constraints are a set of rules used to maintain the quality and consistency of data in a database. They ensure that data insertion, updating and other processes do not ruin the data integrity.

1. Domain Constraints :
   - It restricts the type of data that can be stored in a Column.

Ex→ If an attribute Age is defined as integer, it cannot stores values like "Twenty" or negative number.

2. Entity Integrity Constraints (key constraints)
   - It states that the Primary key can never be null and must be unique.
   - We need to uniquely identify each row, and if a key is Null, we cannot identify that record.

3. Referential Integrity Constraints :
   - This constraints works on the concept of foreign keys.
   - It states that if a foreign key in a Table 2 refers to a primary key in Table 1, then that Primary key value exist in Table 1.

Ex→ You cannot enter marks for a student ID (in Table) 105, if Student ID 105 does not exist in Student Table.

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Entity

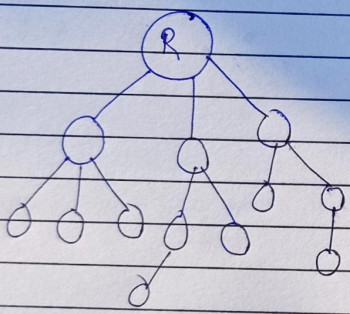
Diamond → Relationship

Attribute

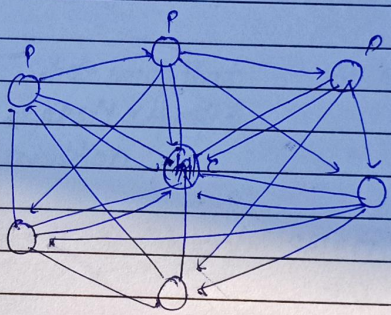
Weak Entity

Primary Key

Diagrams :-



Hierarchical Model



Network Model

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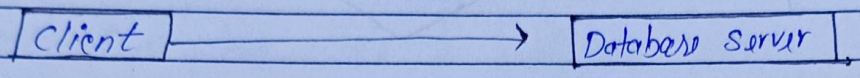
• 2 Tier Architecture



3 Tier Architecture