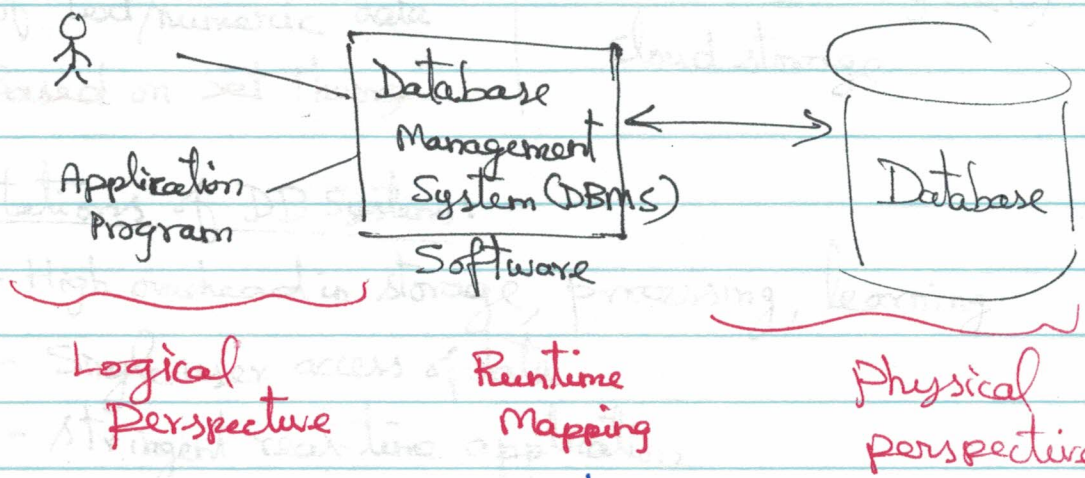
What is a database?

It is a collection of related data

## Database System




High Level of Data Abstraction

benefits

### Program-data independence

Allows to change the physical representation of data w/o making any changes to application programs.

### Program-operation independence

functions/methods

- interface/signature
  - name of the method
  - & parameters
- implementation of the method
  - Code segment

separation

Allows to modify implementation w/o making any changes to the interface.

# Database

**Part I & II**

Traditional (structured data)

(Relational Databases)

E.F. CODD – Bell Lab

A set of 2-D Flat Tables of text/numeric data

Based on Set Theory

**Part III**

Non-traditional (unstructured)

Social media: facebook, twitter

Big data

NOSQL (not only SQL) systems

cloud storage

## Limitations of DB Systems:

- High overhead in storage, processing, learning
- Single user access of data
- Stringent real-time application

## Data Model

A collection of concepts to store the structure of a database (meta-data)

- Conceptual (high-level)
- Physical (Low-level)

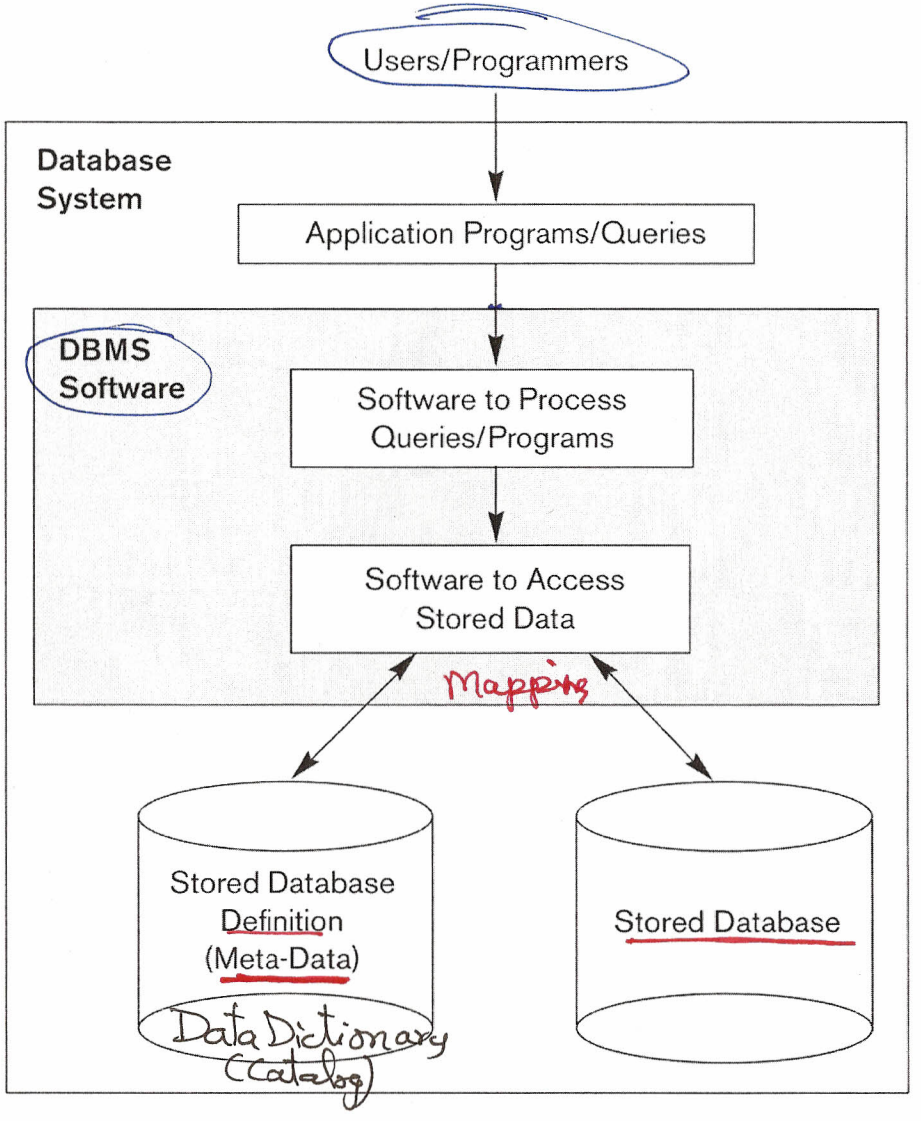
## Relational Model (Data Model): Set Theory.

A DB is a set of tables.

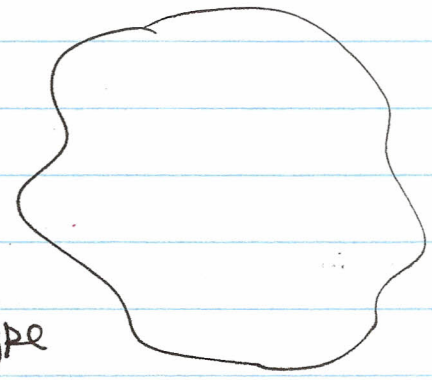
Each table has a set of rows.

Each row has a set of columns.

**Figure 1.1** A simplified database system environment.



## Properties of a set



- Any number of elements
  - no element
  - one element
  - three elements
  - infinite elements
- All elements must be of the same type
- Each element must be unique
  (The set cannot have duplicate elements)
- No order among elements

## Data Model: Conceptual

Represent
- Entities
  and attributes of entities
- Relationships
  among entity types
- Constraints (Rules that must be obeyed by the DB)

Only One → Conceptual Schema: (Logical Schema) — Diagram — Conceptual data model of the DB.

## Data model: Physical

Tables, Columns, data type, size

only one → Internal schema (Physical Schema) — Data Definition Lang (DDL)
Storage and Access paths...

Several → External View: Subset of the conceptual schema for a specific user group

For each usergroup, a separate view is created.

**Figure 2.2** The three-schema architecture.

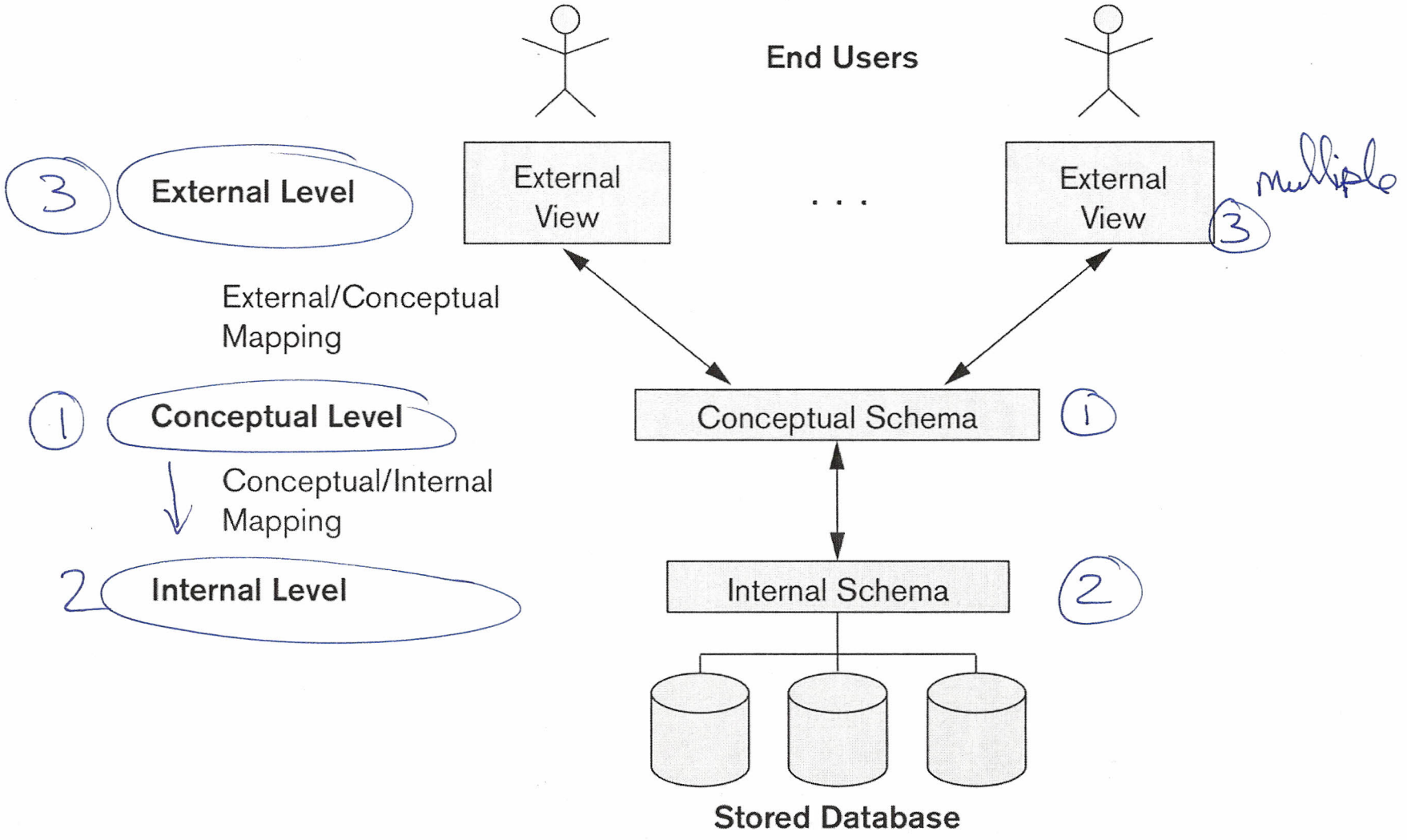


**Figure 2.3** Component modules of a DBMS and their interactions.