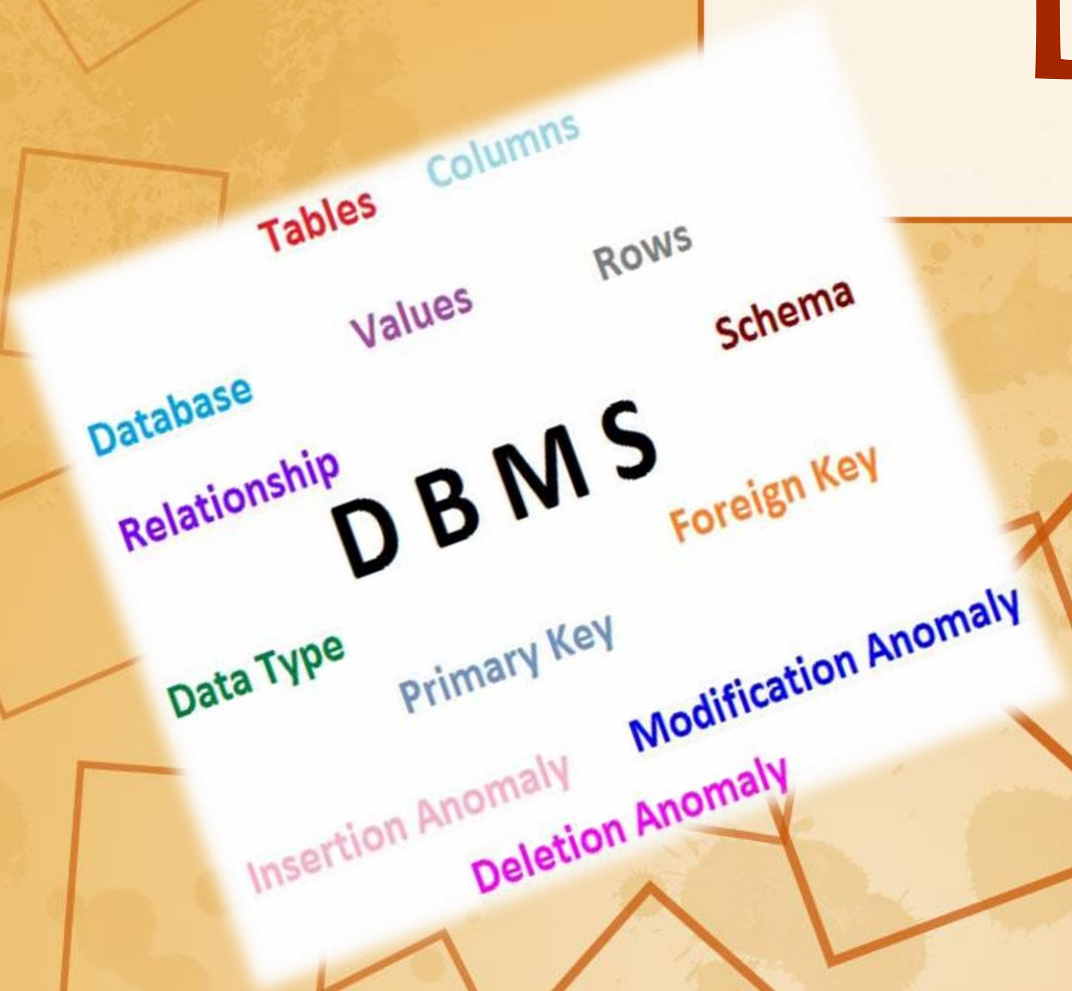
DBMS

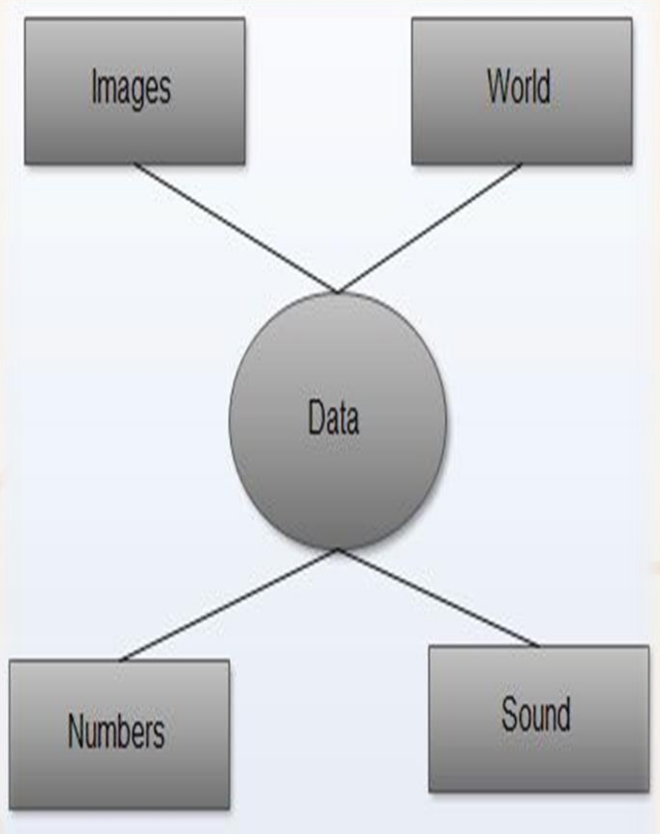

Columns
Tables
Rows
Values
Schema
Database
DBMS
Relationship
Foreign Key
Data Type
Primary Key
Modification Anomaly
Insertion Anomaly
Deletion Anomaly

Introduction to Databases and Transactions

Chapter 1

What is DATA ?

- Data can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation , or processing by human or electronic machine.
- Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9), or special characters (+,-,>,<,*,/,= etc.).
- Main examples of data are weights, prices, costs, numbers of items sold, employee names, product names, address, tax codes, registration marks etc.

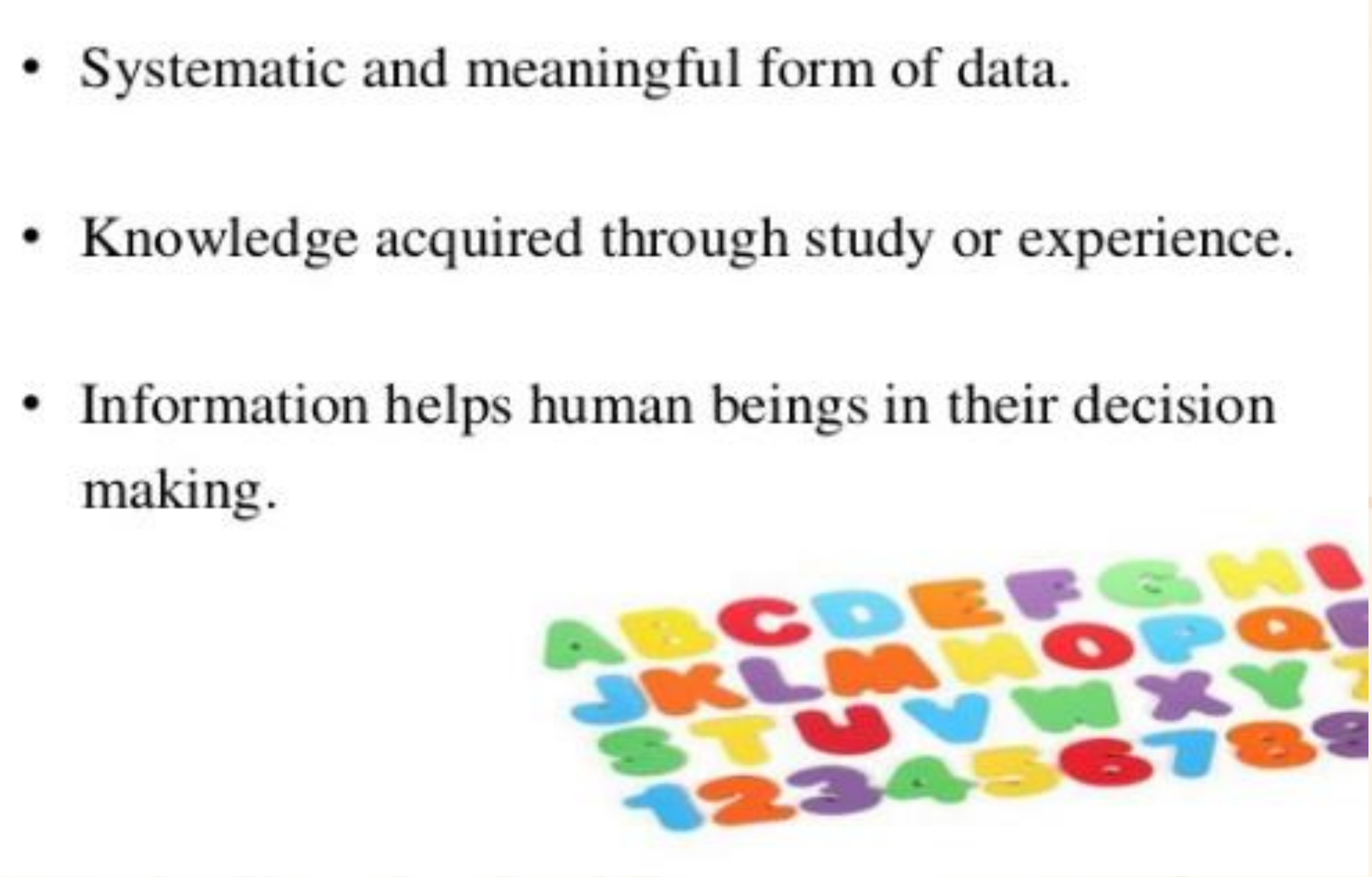


Different forms of data representation

- A collection of raw facts and figures.
- Raw material that can be processed by any computing machine.
- A collection of facts from which conclusions may be drawn.
- Data can be represented in the form of numbers and words which can be stored in computer's language.

  i.e. Paan Singh, Anshul 007

What is INFORMATION ?



- Systematic and meaningful form of data.
- Knowledge acquired through study or experience.
- Information helps human beings in their decision making.

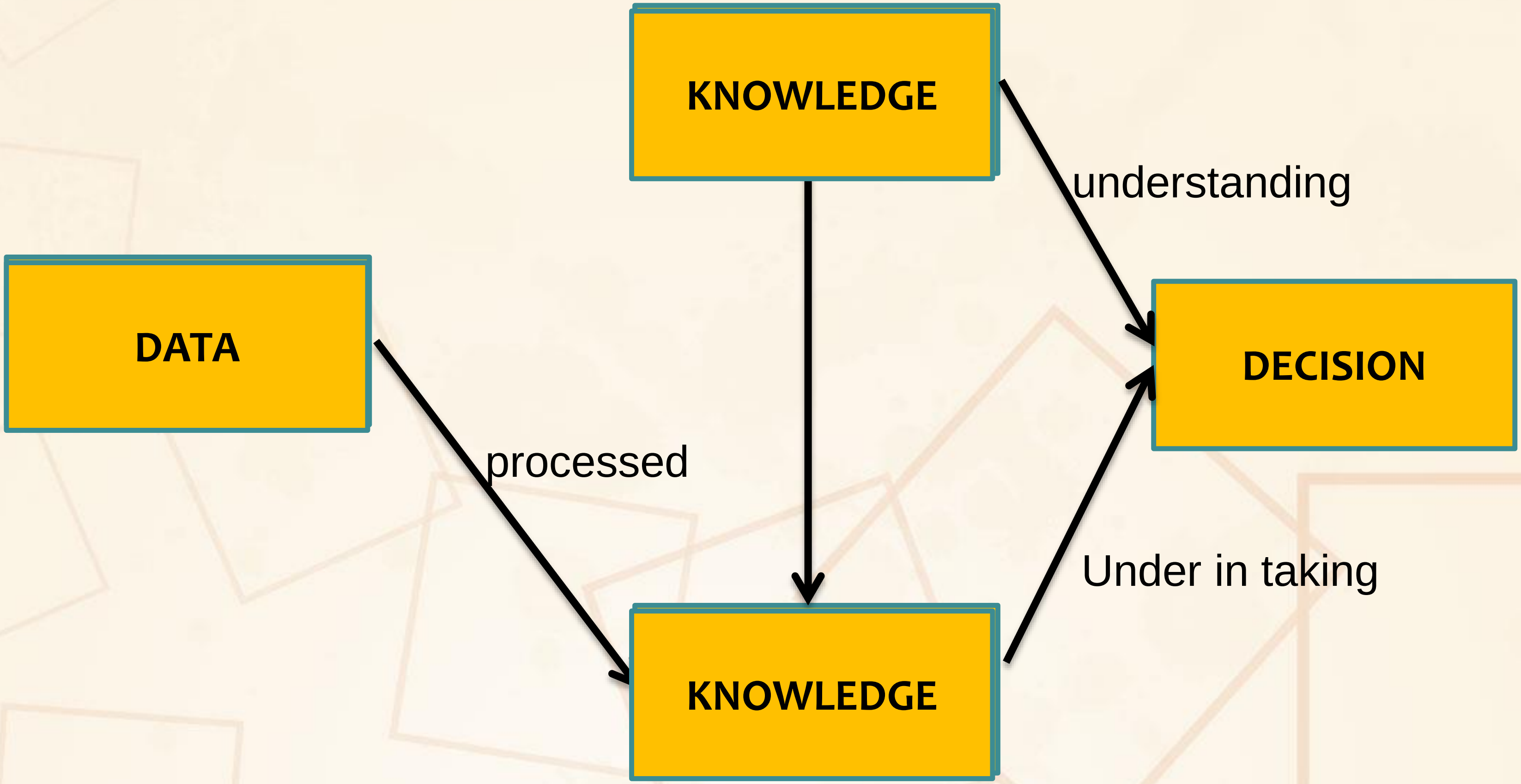
ABCDEFGHI
JKLMNOPQ
STUVWXY
123456789

Characteristics of Information

1. Timely: Information should be available when required.
2. Accuracy : Information should be accurate.
3. Completeness : Information should be appropriate.

Examples : Time Table, Merit List, Report Card, Printed Documents, Pay Slips, Receipts, Reports etc.

What is KNOWLEDGE ?



KNOWLEDGE

DATA

processed

understanding

DECISION

KNOWLEDGE

Under in taking

Difference between **Data** and **Information**

DATA	INFORMATION
Data is a raw fact	It is processed form of data
It is not significant to business	It is significant to business
Data is atomic level of piece of information	It is a collection of data
Data does not help in decision making	It helps in decision making
E.g. Product name, Price, Number	E.g. Report card sheet

File System

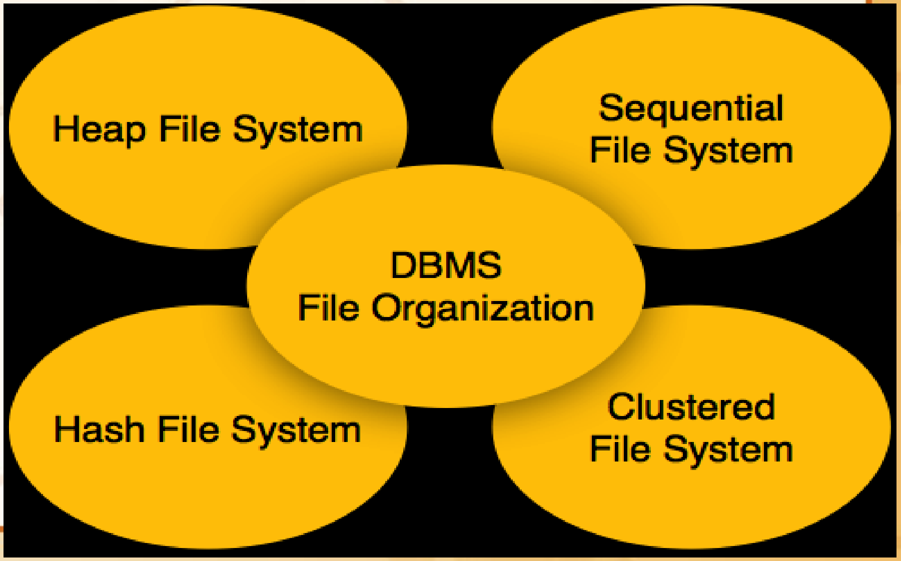
- A file is a sequence of records stored in binary format.
- Relative data and information is stored collectively in file formats.
- A disk drive is formatted into several blocks that can store records.
- File records are mapped onto those disk blocks.

File Organization

Defines “ How file records are mapped onto disk blocks ? ”

❑ **Four types of File Organization**

1. Heap file
2. Sequential file
3. Hash file
4. Clustered file



1. Heap File Organization :

- OS allocates memory area to that file without any further accounting details.
- File records placed any where in that memory area.
- Responsibility of the software to manage records.
- File does not support any ordering, sequencing, or indexing on its own.

2. Sequential File Organization

-Every file record contains data field (attribute) to uniquely identify that record.

- Sequential file organization, records are placed in the file in some sequential order based on the unique key field or search key.
- Not possible to store all records sequentially in physical form.

3. Hash File Organization :

- Uses Hash function computation on some fields of the records.
- o/p of the hash function determines the location of disk block where the records are to be placed.

4. Cluster File Organization:

- Is not good for large databases.
- Related records from one or more relations are kept in the same disk block, that is , the ordering of records is not based on primary key or search key.

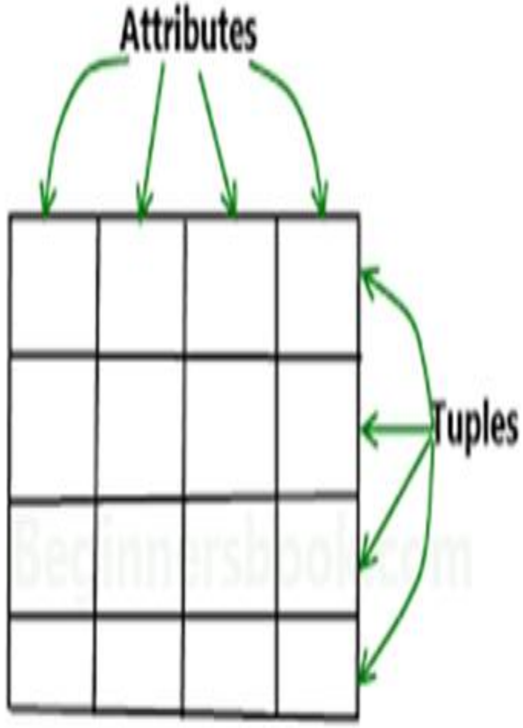
Drawbacks of **File System**

1. Data Redundancy :
2. Data Inconsistency :
3. Difficulty in Accessing Data :
4. Data Isolation :
5. Integrity Problems :
6. Atomicity Problem :
7. Concurrent Access Anomalies :
8. Security Problems :

What is DATABASE ?

…a database is an organized collection of data.

A collection of data of similar information compiled in a table of records consisting of individual fields.



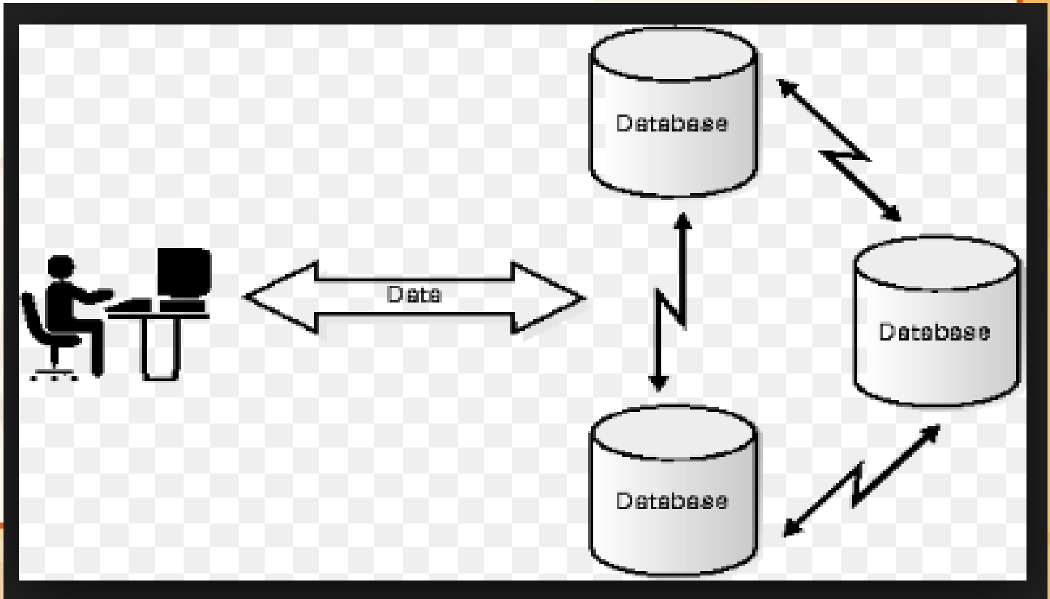
Table

A Database is…

- an organized set of stored information usually on one topic
- a collection of records
- a way to organize information in a file so that you can examine information on a variety of ways and access the information in new ways
- a type of "filing cabinet" that can help you manage, manipulate, organize, sort and modify information

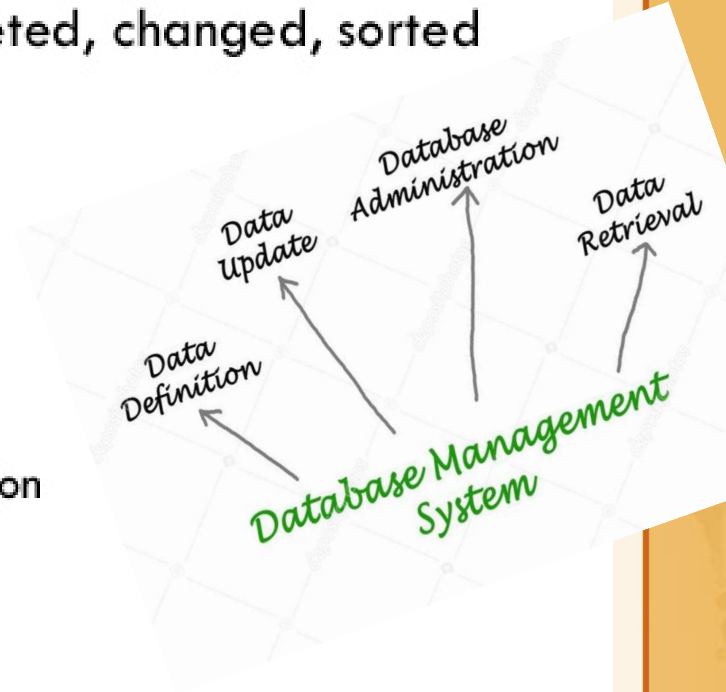
E.g. :

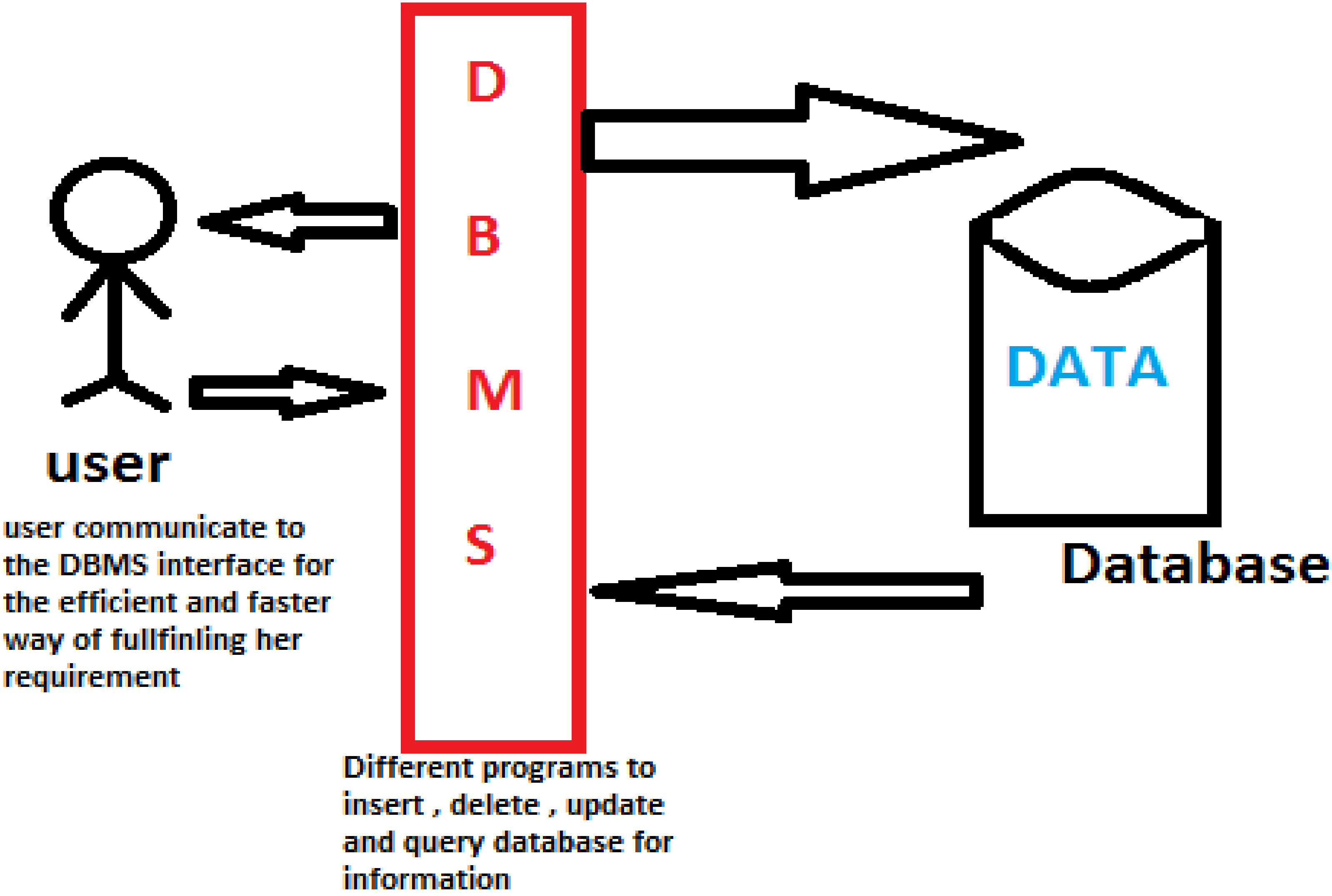
- Dictionary
- Airline Database
- Student Database
- Library
- Railway Timetable



What is DBMS ?

- A set of software programs that allows users to create, edit and update data in database files, and store and retrieve data from those database files.
- Data in a database can be added, deleted, changed, sorted or searched all using a DBMS.
- Example usage of Database System:
  - Membership and subscription mailing lists
  - Accounting and bookkeeping information
  - The data obtained from scientific research
  - Customer information and Inventory information
  - Personal records
  - Library information





user

D
B
M
S

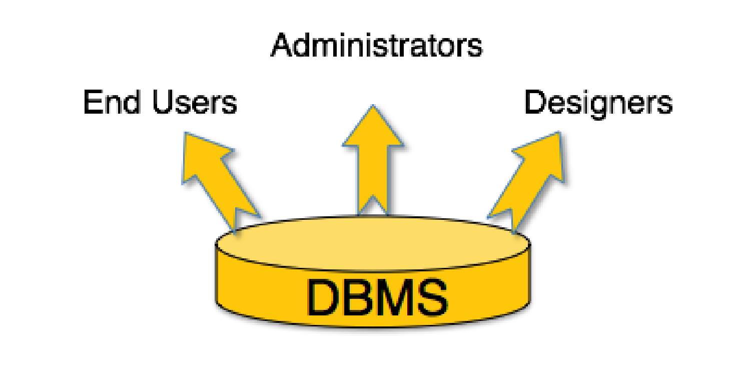
DATA

Database

user communicate to the DBMS interface for the efficient and faster way of fullfinling her requirement

Different programs to insert , delete , update and query database for information

USERS with different rights



Administrators – Administrators maintain the DBMS and are responsible for administrating the database.

- Responsible to look after its usage and by whom it should be used.
- They create access profiles for users and apply limitations to maintain isolation and force security.
- Administrators also look after DBMS resources like system license, required tools, and other software and hardware related maintenance.

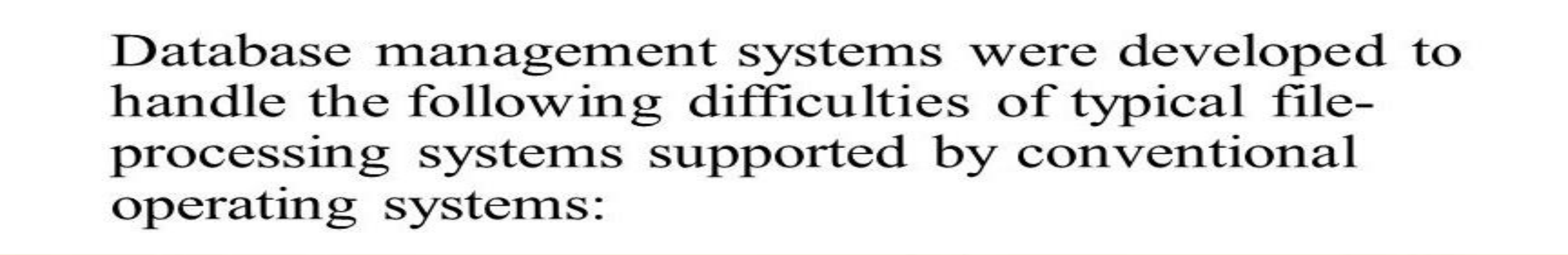
Designers – Designers are the group of people who actually work on the designing part of the database.

- They keep a close watch on what data should be kept and in what format. They identify and design the whole set of entities, relations, constraints, and views.

End Users – End users are those who actually reap the benefits of having a DBMS.

- End users can range from simple viewers who pay attention to the logs or market rates to sophisticated users such as business analysts.

Advantages of **DBMS**



Database management systems were developed to handle the following difficulties of typical file-processing systems supported by conventional operating systems:

1. **Data Redundancy**– multiple file formats and duplication of information in different files.

2. **Elimination of inconsistency –**

3. **Difficulty in accessing data** – need to write new program to carry out new task.

4. **Data isolation** – multiple files and formats.

5. Integrity problems – integrity constraint (e.g. account balance > 0) is a part of a program.

- Hard to add new constraint and change existing ones.

6. Atomicity of updates – failures may leave database in an inconsistent state with partial updates carried out.

- e.g. transfer of funds from one account to another should either complete or not happen at all.

7. Concurrent access by multiple users - concurrence access needed for performance.

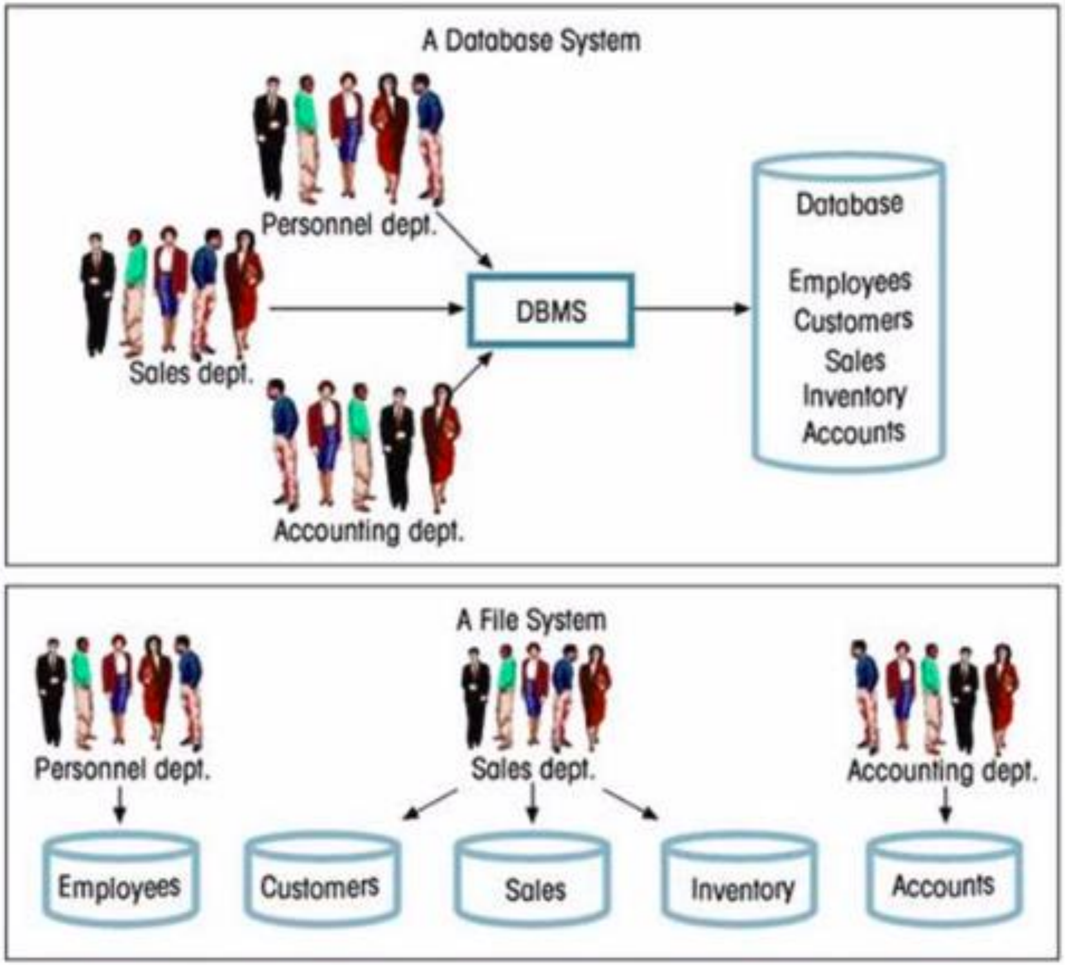
- uncontrolled concurrent access leads to inconsistencies

  e.g. two people reading the balance and updating it at the same time.

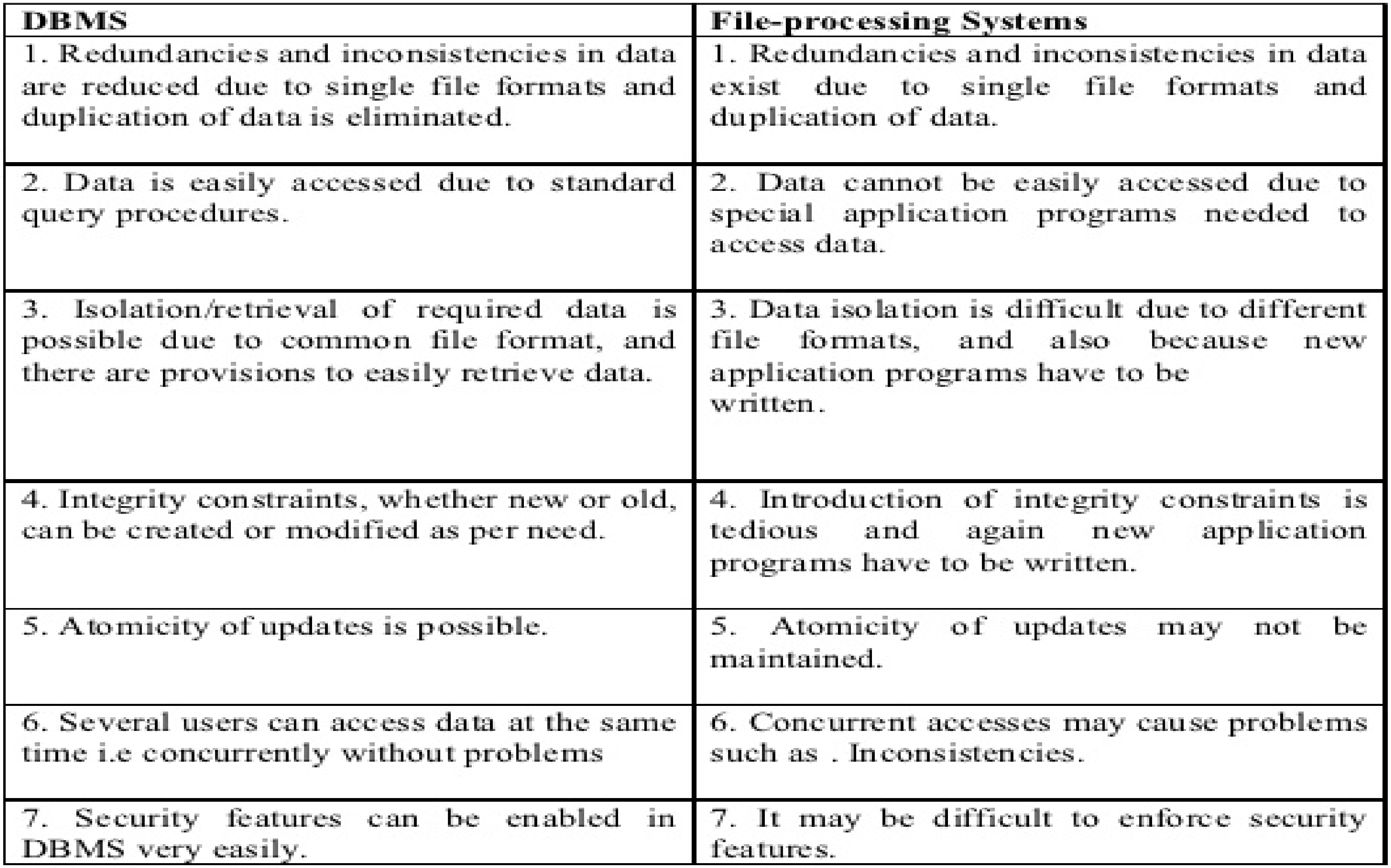
8. Security

DBMS vs. File Systems?

- Database consists of logically related data stored in a single repository
- Provides advantages over file system management approach
  - Eliminates inconsistency, data anomalies, data dependency, and structural dependency problems
  - Stores data structures, relationships, and access paths

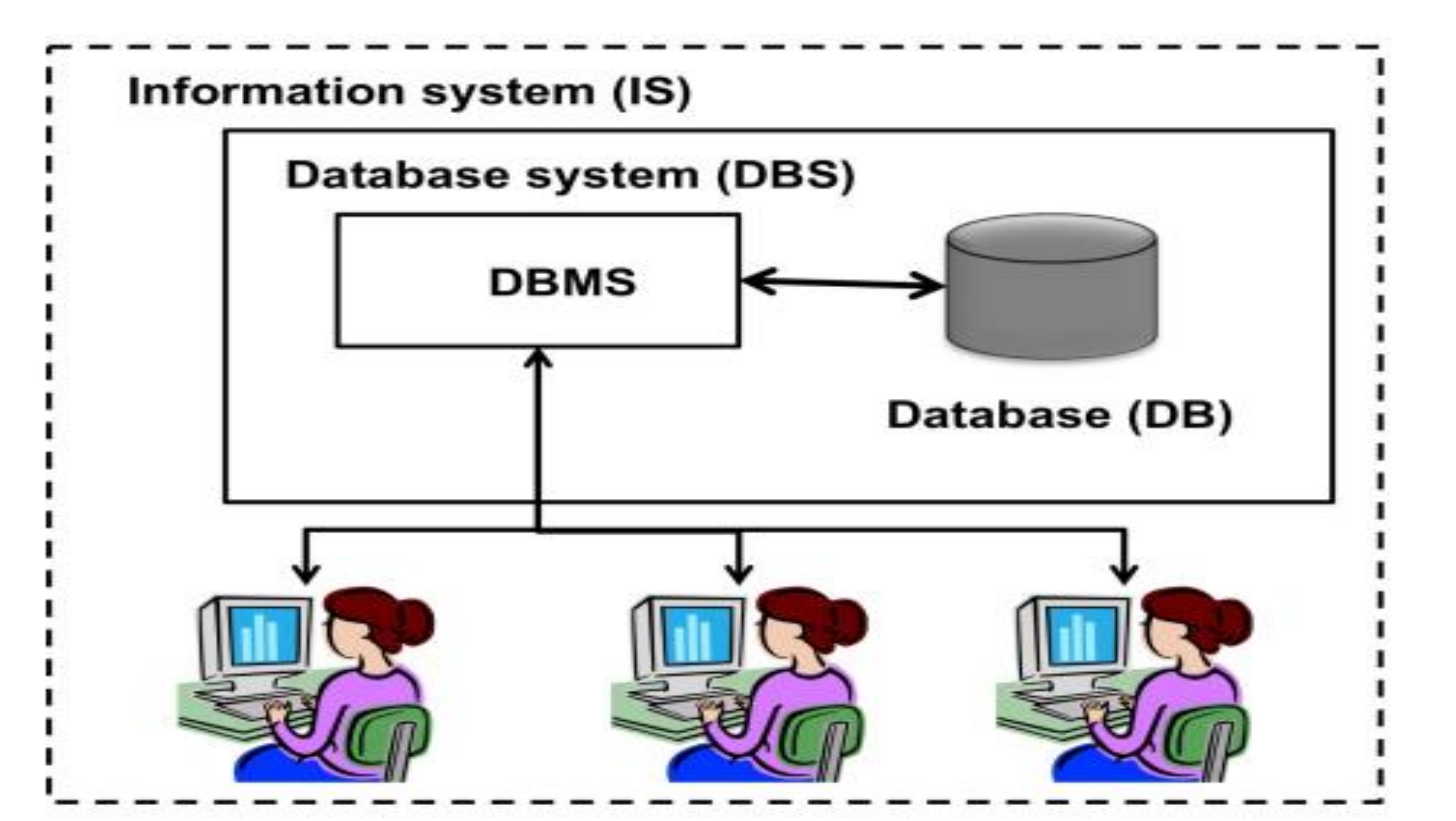


Difference between File system and DBMS

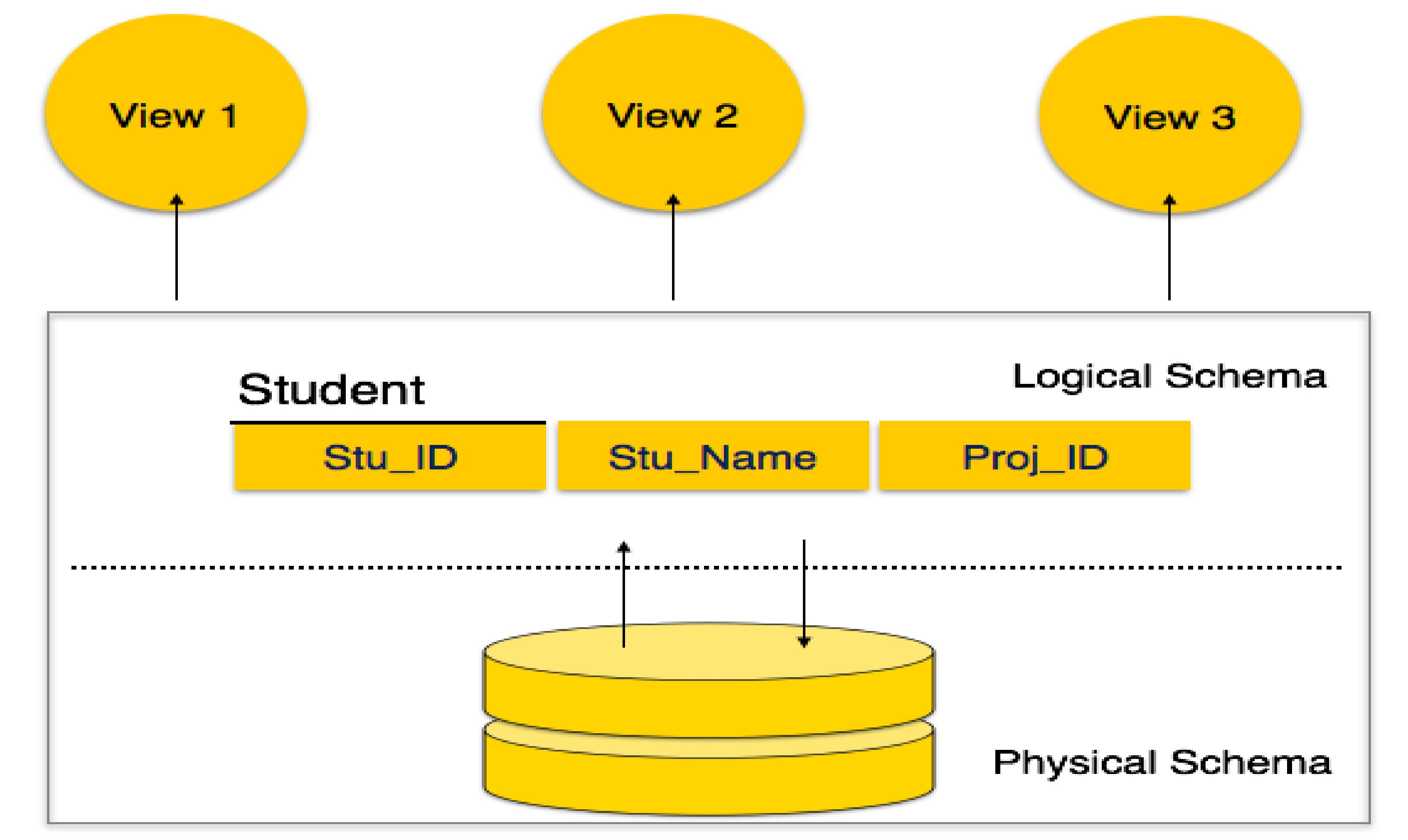


DBMS	File-processing Systems
1. Redundancies and inconsistencies in data are reduced due to single file formats and duplication of data is eliminated.	1. Redundancies and inconsistencies in data exist due to single file formats and duplication of data.
2. Data is easily accessed due to standard query procedures.	2. Data cannot be easily accessed due to special application programs needed to access data.
3. Isolation/retrieval of required data is possible due to common file format, and there are provisions to easily retrieve data.	3. Data isolation is difficult due to different file formats, and also because new application programs have to be written.
4. Integrity constraints, whether new or old, can be created or modified as per need.	4. Introduction of integrity constraints is tedious and again new application programs have to be written.
5. Atomicity of updates is possible.	5. Atomicity of updates may not be maintained.
6. Several users can access data at the same time i.e concurrently without problems	6. Concurrent accesses may cause problems such as . Inconsistencies.
7. Security features can be enabled in DBMS very easily.	7. It may be difficult to enforce security features.

Database System **DBS**



View of DATA / db SCHEMA



- **Physical level:** describes *how* a record (e.g., customer) is stored.
- **Logical level:** describes *what* data stored in database, and the relationships among the data.
  - *Example (in PASCAL):*

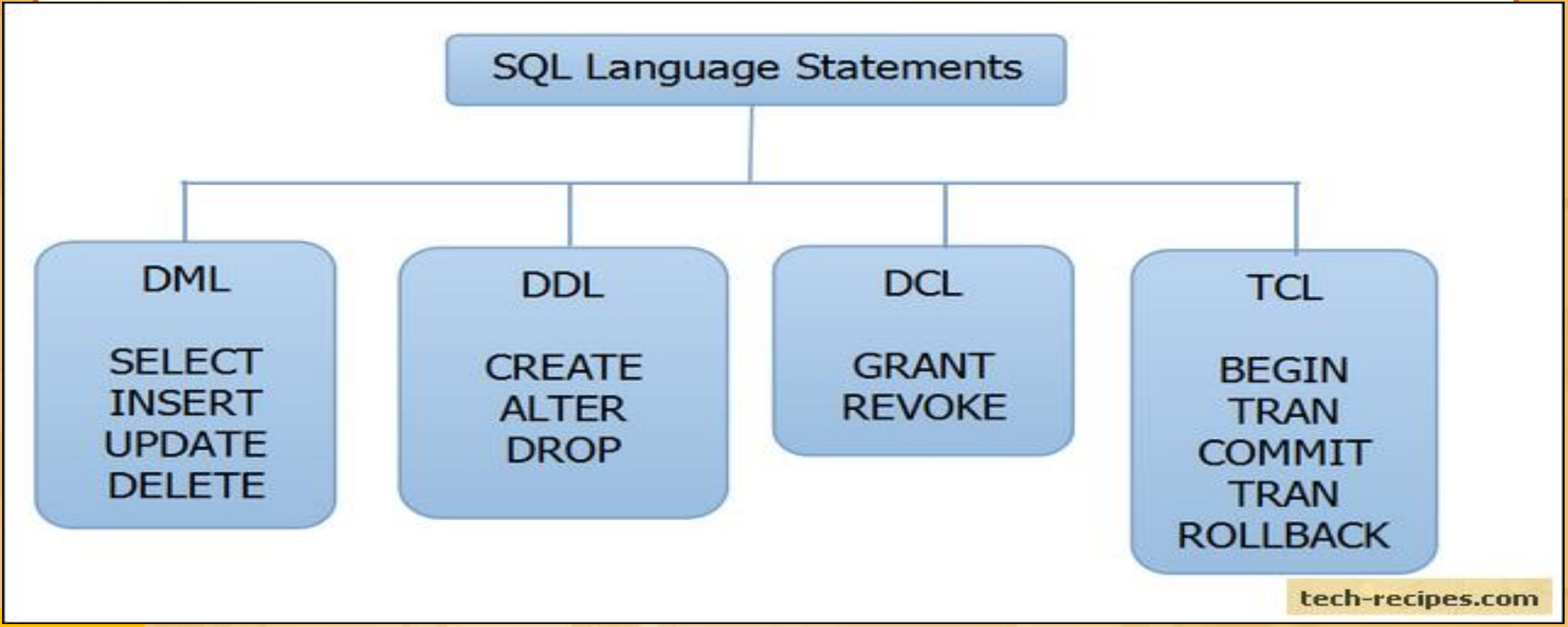
```
type  instructor = record

              ID : string;
              name : string;
              dept_name : string;
              salary : integer;

          end ;
```

- **View level:** application programs hide details of data types. Views can also hide information (such as an employee's salary) for security purposes.

Database Languages

- The various database languages are :

1. **DDL**(Data Definition Language)
2. **DML**(Data Manipulation Language)
3. **DCL**(Data Control Language)
4. **DQL**(Data Query Language)



SQL Language Statements

DML

SELECT
INSERT
UPDATE
DELETE

DDL

CREATE
ALTER
DROP

DCL

GRANT
REVOKE

TCL

BEGIN
TRAN
COMMIT
TRAN
ROLLBACK

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DML

- DML statements affect records in a table.
- These are basic operations we perform on data such as selecting a few records from a table, inserting new records, deleting unnecessary records, and updating/modifying existing records.

DML statements include the following:

- **SELECT** – select records from a table
  INSERT – insert new records
  UPDATE – update/Modify existing records
  DELETE – delete existing records

DDL

- DDL statements are used to alter/modify a database or table structure and schema.
- These statements handle the design and storage of database objects.

- **CREATE** – create a new Table, database, schema
  ALTER – alter existing table, column description
  DROP – delete existing objects from database

DCL

- DCL statements control the level of access that users have on database objects.

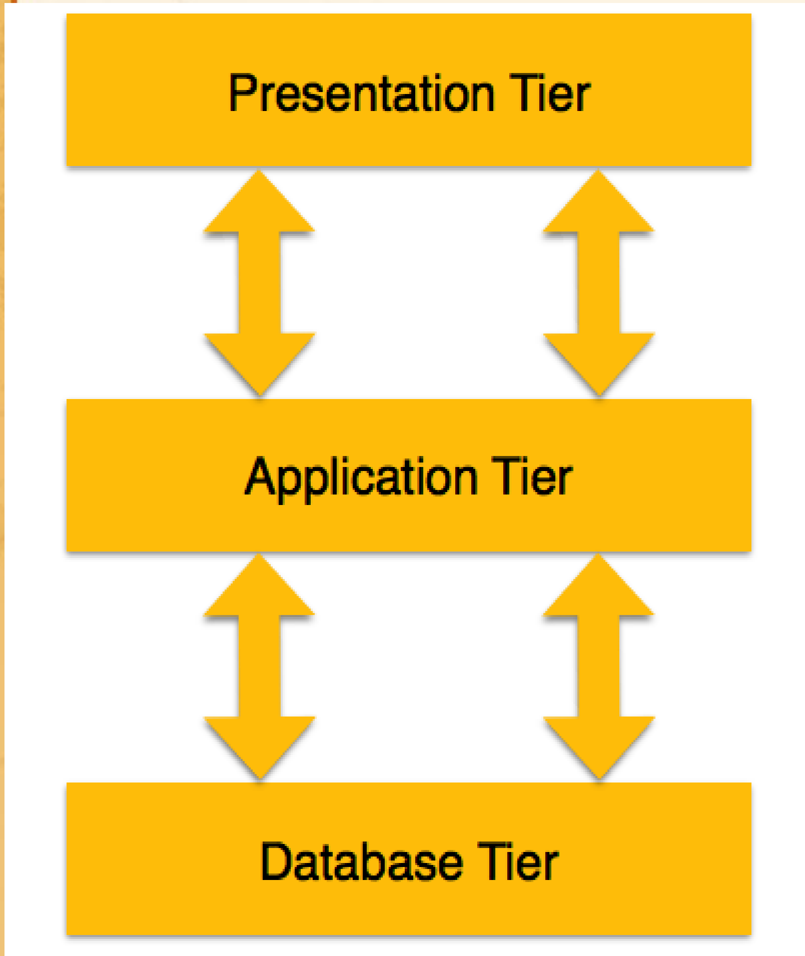
- **GRANT** – allows users to read/write on certain database objects
  REVOKE – keeps users from read/write permission on database objects

TCL

- TCL statements allow you to control and manage transactions to maintain the integrity of data within SQL statements.

- **BEGIN Transaction** – opens a transaction
  COMMIT Transaction – commits a transaction
  ROLLBACK Transaction – ROLLBACK a transaction in case of any error

Database Architecture



A 3-tier architecture separates its tiers from each other based on the complexity of the users and how they use the data present in the database.

1. Database (Data) Tier

- The database resides along with its query processing languages.
- Also have the relations that define the data and their constraints at this level.

2. Application (Middle) Tier

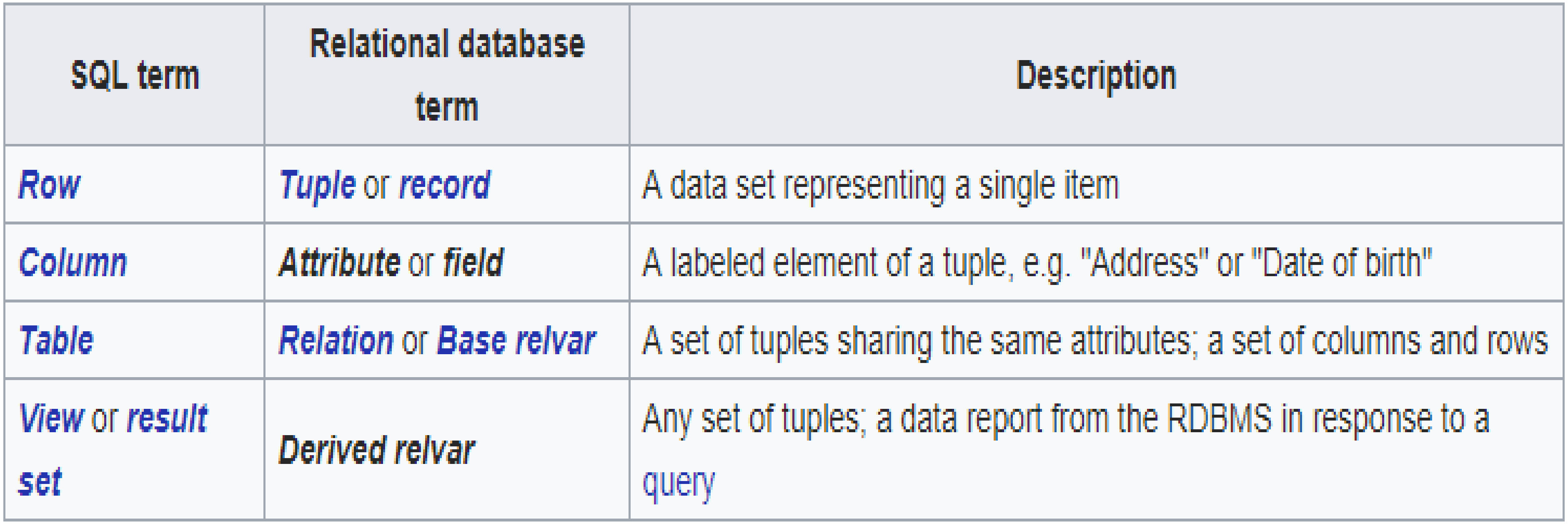
- At this tier reside the application server and the programs that access the database.
- Hence, the application layer sits in the middle and acts as a mediator between the end-user and the database.

3. User (Presentation) Tier

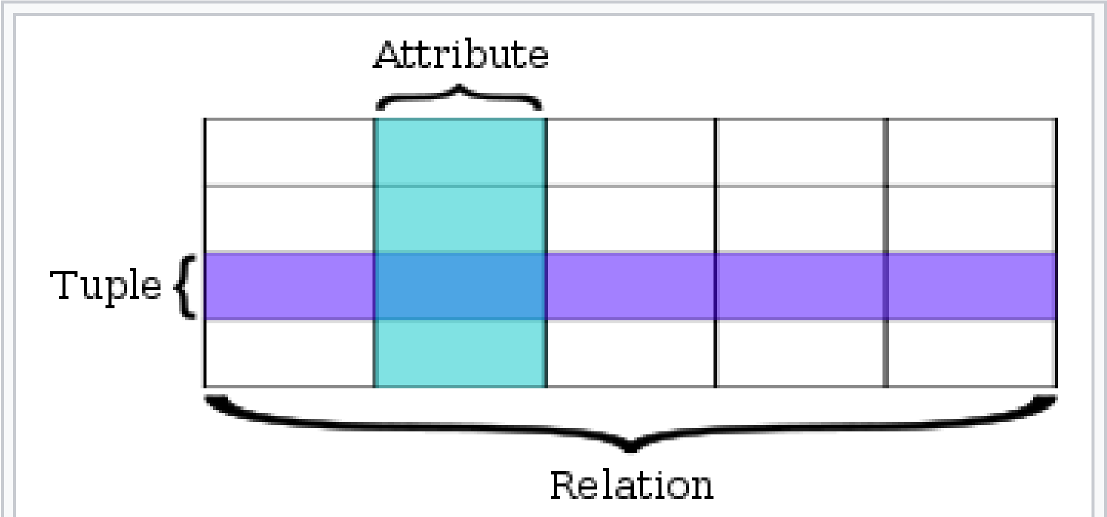
- End-users operate on this tier and they know nothing about any existence of the database beyond this layer.
- Multiple views of the database can be provided by the application.
- All views are generated by applications that reside in the application tier.

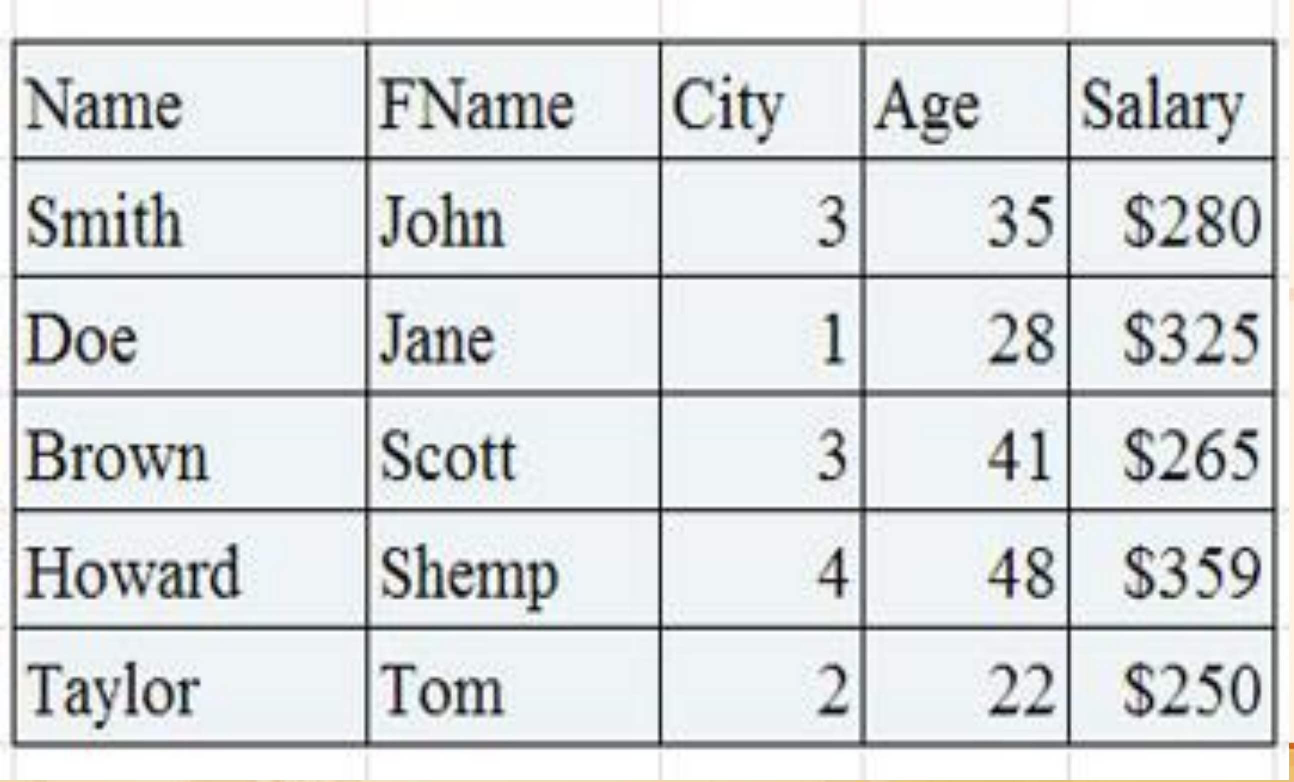
Relational Database

- Database structured to recognize relations between stored items of information.
- A relational database has become the predominant type of database.
- Other models besides the relational model include the hierarchical database model and the network model.



SQL term	Relational database term	Description
Row	*Tuple* or *record*	A data set representing a single item
Column	*Attribute* or *field*	A labeled element of a tuple, e.g. "Address" or "Date of birth"
Table	*Relation* or *Base relvar*	A set of tuples sharing the same attributes; a set of columns and rows
View or *result set*	*Derived relvar*	Any set of tuples; a data report from the RDBMS in response to a query



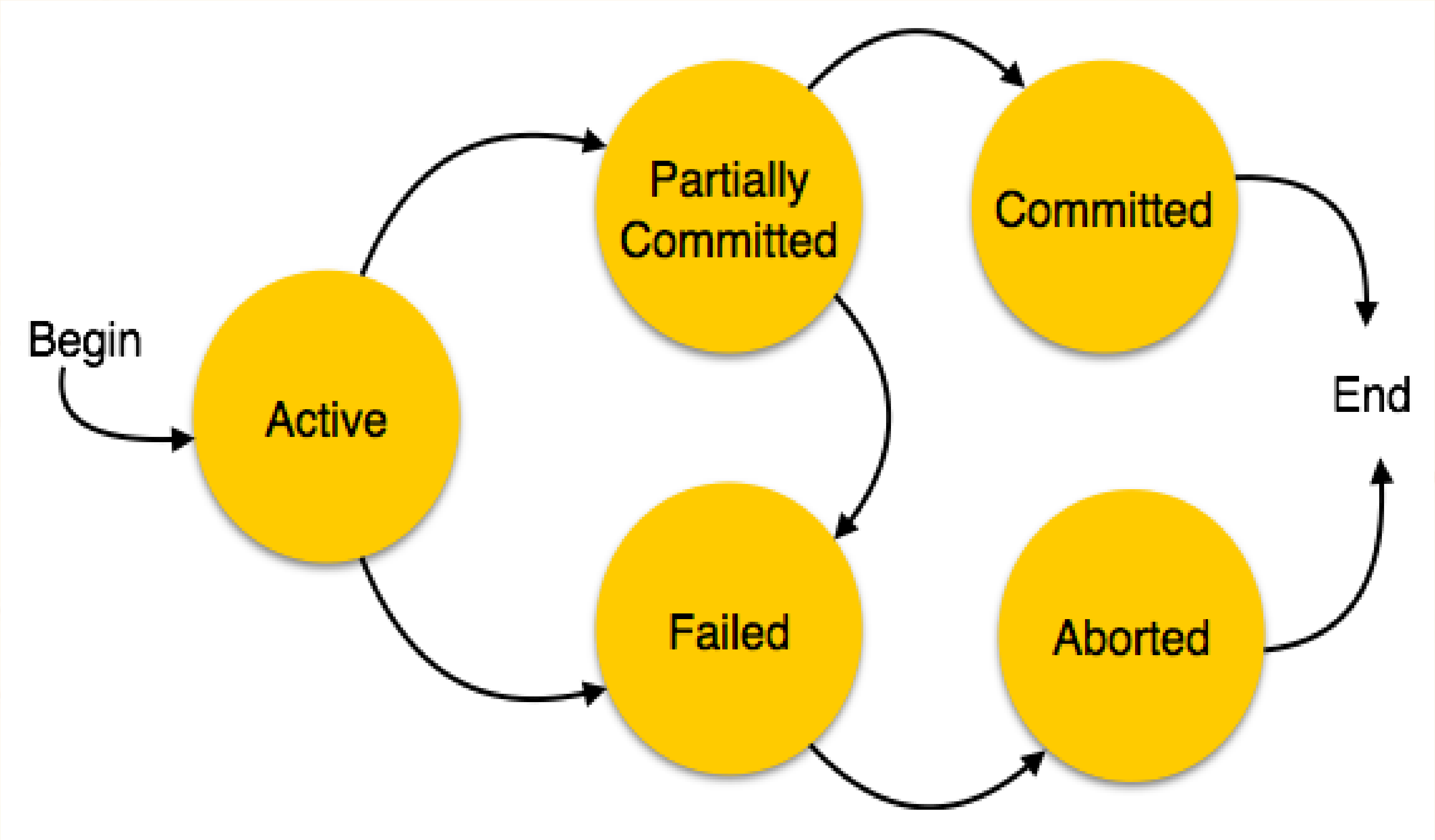


Name	FName	City	Age	Salary
Smith	John	3	35	$280
Doe	Jane	1	28	$325
Brown	Scott	3	41	$265
Howard	Shemp	4	48	$359
Taylor	Tom	2	22	$250

What is Transaction Management ?

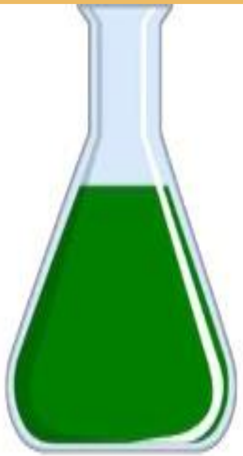
- A **transaction** is one or more SQL statements that make up a unit of work performed against the **database**, and either all the statements in a **transaction** are committed as a unit or all the statements are rolled back as a unit.

States of Transaction



ACID PROPERTIES

To preserve the integrity of data the database system must ensure ACID properties



A Atomicity → All operation done successfully

C Consistency → Reliable data

I Isolation → Separation

D Durability → long life

Advantage of Transaction Management

- It makes the performance fast because database is hit at the time of commit.

Types of Transaction

- Local Transaction
- Distributed or global transaction

1. Local Transaction

- A local transaction means, all operation in a transaction are executed against one database.
  For example; If transfer money from first account to second account belongs to same bank then transaction is local transaction.

2. Global Transaction

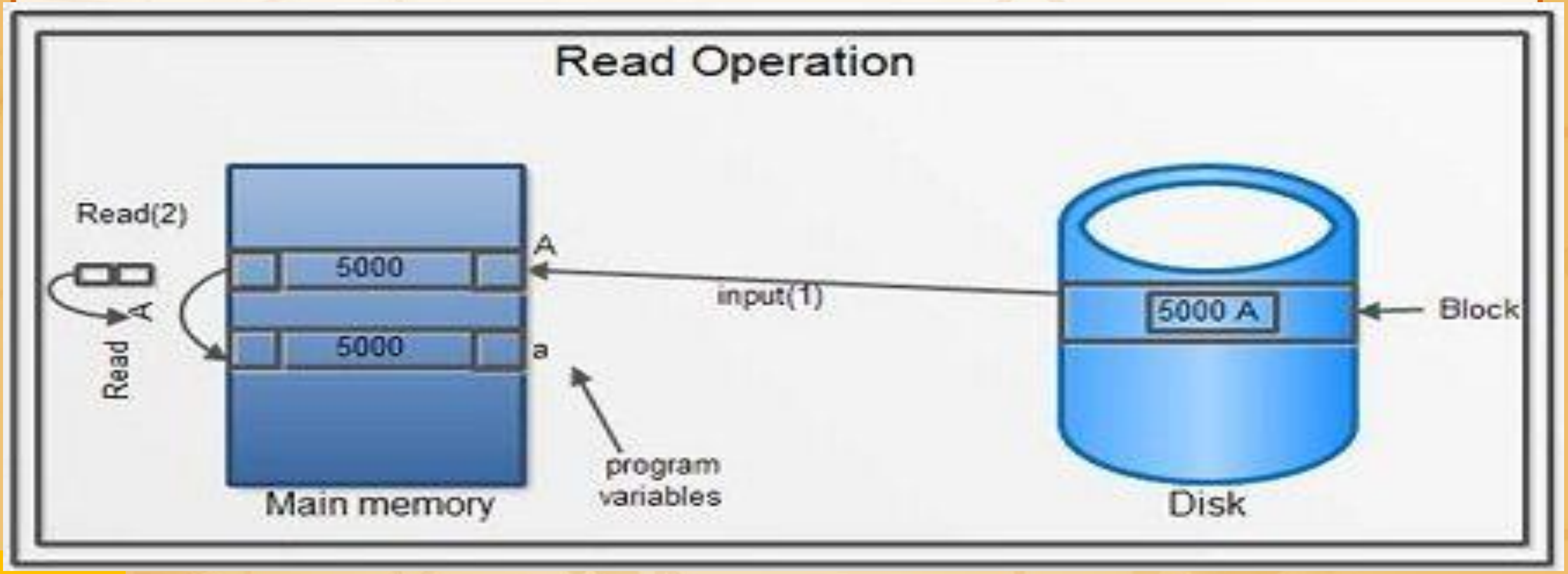
- A global transaction means, all operations in a transaction are executed against multiple database.
  For Example; If transfer money from first account to second account belongs to different banks then the transaction is a global transaction.

❑ Process of Transaction

- Transaction is executed as a series of reads and writes of DB objects, which are explained below :

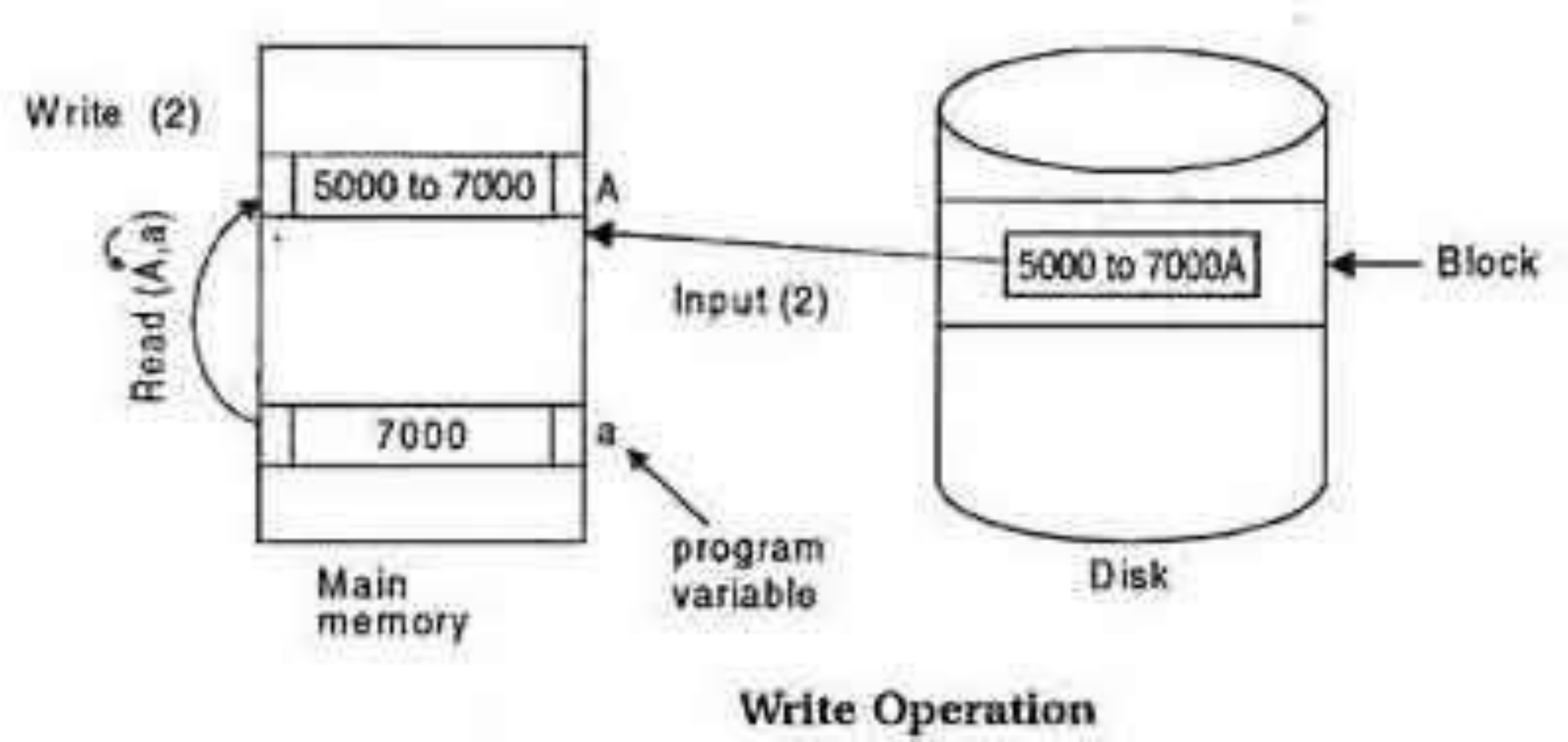
Read Operation :

To read a DB objects, it is first brought into main memory from disk, and then its value is copied into a program variable.



Write Operation :

To write a database object , an in memory copy of the first modified and then written to disk.



Write Operation

Application area of DBS

1. Banking :
2. Airline and reservation system :
3. Telecommunication :
4. Finance :
5. E- commerce :
6. Human resources :
7. Telecom :
8. Industry :
9. Education sector :
10. Online shopping :