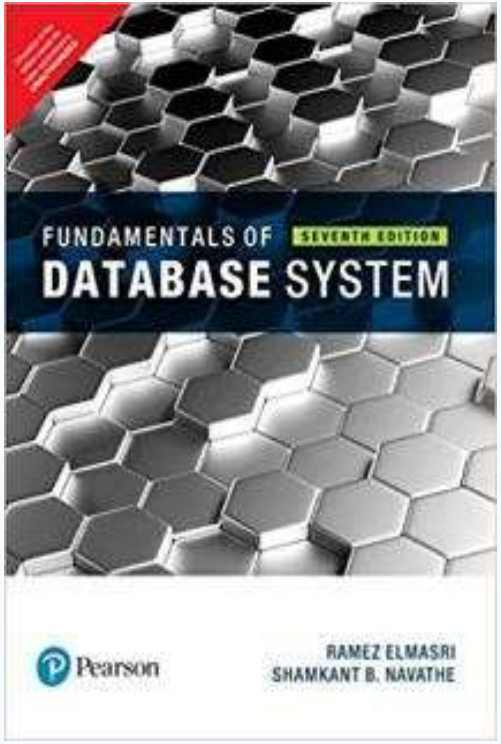
Database Management System

1

Learning Outcomes…

- Will Understand the role of a database management system in an organization.
- Will be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
- Will have a broad understanding of database concepts and database management system software.
- Will have a high-level understanding of major DBMS components and their function.

Text Book


FUNDAMENTALS OF
SEVENTH EDITION
DATABASE SYSTEM
Pearson
RAMEZ ELMASRI
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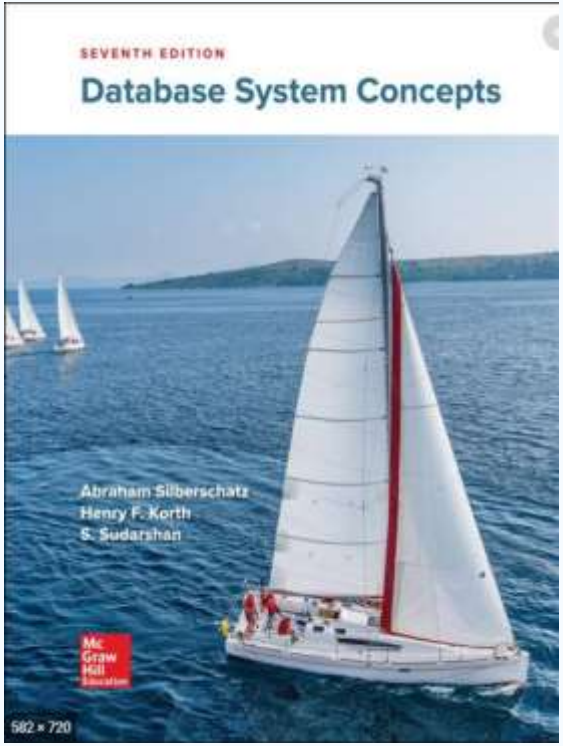
SEVENTH EDITION
Database System Concepts
Abraham Silberschatz
Henry F. Korth
S. Sudarshan
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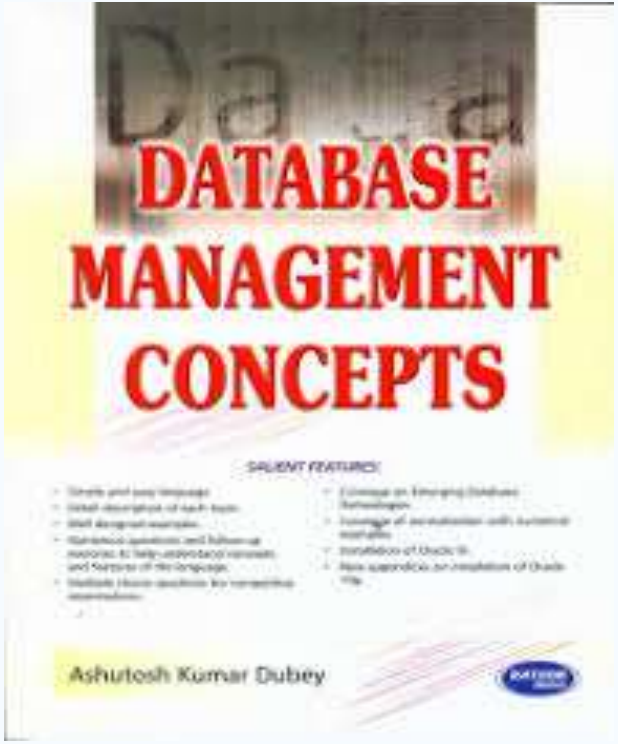

DATABASE
MANAGEMENT
CONCEPTS
Ashutosh Kumar Dubey

Today's Agenda

- Introduction of DBMS
- Data vs. Information
- DBMS Concepts
- Where is a DBMS being used?
- What is DBMS?
- Need of DBMS
- Applications
- Vendors

Why to Learn

- Traditionally, data was organized in file formats. DBMS was a new concept then, and all the research was done to make it overcome the deficiencies in traditional style of data management. A modern DBMS has the following characteristics −

✓ **Real-world entity**
✓ **Relation-based tables**
✓ **Isolation of data and application**
✓ **Less redundancy**
✓ **Consistency**
✓ **Query Language**

Why Study Databases??

- Shift from computation to information
  - at the “low end”: scramble to webspace (a mess!)
  - at the “high end”: scientific applications
- Datasets increasing in diversity and volume.
  Digital libraries, interactive video, Human Genome project
  - ... need for DBMS exploding
- DBMS encompasses most of CS
  - OS, languages, theory, AI, multimedia, logic

Introduction of DBMS

Have you ever analyzed how the various university prepare results and manage various records related to the student and faculty?

They also apply the concept of DBMS

What is DBMS

- DBMS stands for:

- Means:

Database Management System

Introduction of DBMS

- The software used for the management, maintenance and retrieval of the data stored in the database is called database management system (DBMS).

- It is the collection of interrelated data and a set of program to access those data.

Introduction of DBMS

- Database management system free the programmer from the need to worry about the organization and location of the data.

- The primary goal of DBMS is to provide an environment which is both convenient and efficient to use in retrieving and storing information.

Example: University Results, IRCTC

Data Vs. Information

- Data is the complete list of facts and details like text, observations, figures, symbols and description of things. It is the raw list of facts that are processed to gain information.

- Data themselves are fairly useless, but when these data are interpreted and processed to determine its true meaning, they becomes useful and can be named as Information.

- Information is data that has been processed in such a way as to be meaningful to the person who receives it. It is any thing that is communicated.

Data Vs. Information

- Data can be anything like name of a person or a place or a number etc. Data is the name given to basic facts and entities such as names and numbers. The main examples of data are weights, prices, costs, numbers of items sold, employee names, product names, addresses, tax codes, registration marks etc.

Data can be of two types:

- **Qualitative data:** It is the non-numerical data. For eg., texture of the skin, colour of eyes, etc.
- **Quantitative data:** Quantitative data is given in numbers. Data in the form of questions such as “how much”, “how many”, gives the quantitative data.

Data Vs. Information

Information:

Information is data that has been converted into a more useful or intelligible form. It is the set of data that has been organized for direct utilization of mankind, as information helps human beings in their decision making process. Examples are: Time Table, Merit List, Report card, Headed tables, printed documents, pay slips, receipts, reports etc. The information is obtained by assembling items of data into a meaningful form. For example, marks obtained by students and their roll numbers form data, the report card/sheet is the information.

Data Vs. Information

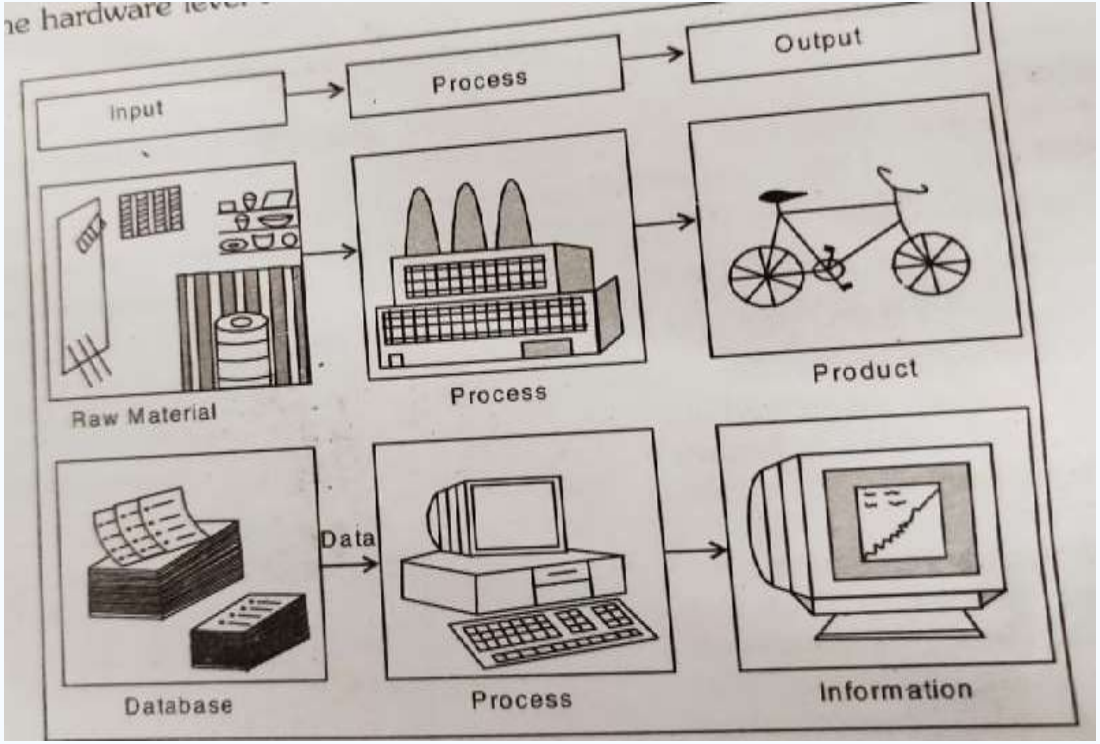
Data

- raw facts
- no context
- just numbers and text

Information

- data with context
- processed data
- value-added to data
  - summarized
  - organized
  - analyzed

Example


Input
Process
Output
Raw Material
Process
Product
Data
Database
Process
Information

DBMS Concepts

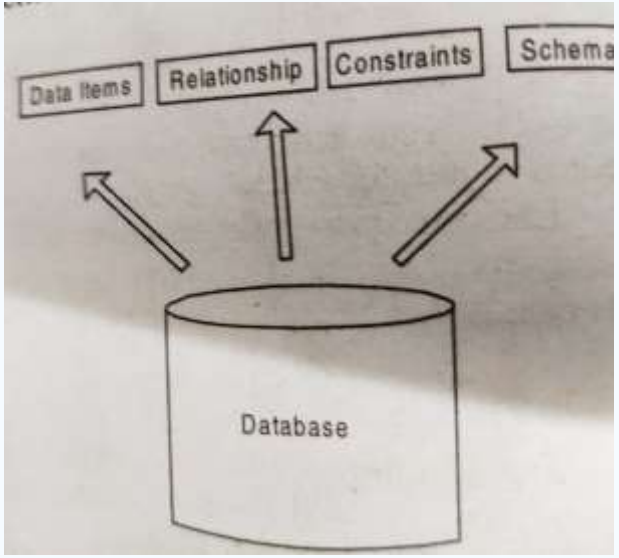
- **Database**
- **Access data from database**
- **Database system**
- **Function of DBMS**

Database

- A database is a logically coherent collection of data with some inherent meaning representing some aspects of real world. It is designed built and populated with data for a specific purpose.

It consist of four elements:

- ✓ **Data**
- ✓ **Relationship**
- ✓ **Constraints**
- ✓ **Schema**



Database

- **Data Items:**

Data are binary computer representation of stored logical entities. They are distinct pieces of information usually formatted in a special way. Data can exists in variety of forms like text, number or both.

- **Relationship:**

Relationship represents a correspondence between the various data elements.

Database

- **Constraints:** Constraints enforce limits to the data or type of data that can be inserted/updated/deleted from a table. The whole purpose of constraints is to maintain the data integrity during an update/delete/insert into a table. In this class we will learn several types of constraints that can be created in RDBMS.

Types of constraints

- NOT NULL
- UNIQUE
- DEFAULT
- CHECK
- Key Constraints – PRIMARY KEY, FOREIGN KEY
- Domain constraints
- Mapping constraints

Database

- ***Schema:***

The overall design of the database is called the database schema. It not only describes the organization of data but also represents the relationship between various tables in a database.

Example

Student

Student _name	ID	Semester	Stream

Course

Course_name	Course_ID	Department

Grade

ID	Semester	Course_name	Grade

Student Schema

Types of Schema

Logical Database Schema:

This represents **how the data is organized** in terms of tables, and how the different attributes in the different tables link them. Different database management systems use different syntax to define the logical architecture and constraints of a database which is called logical database schema.

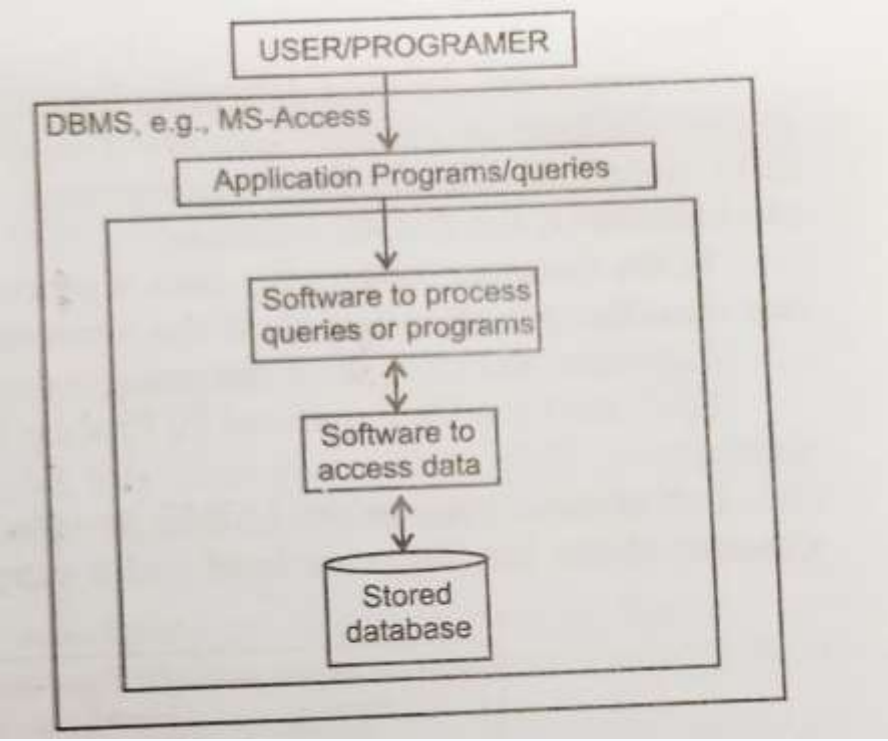
Physical Database Schema:

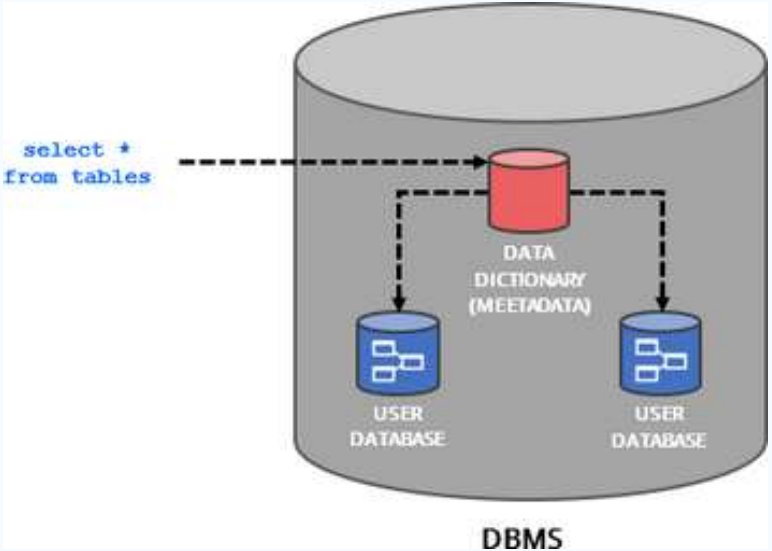
This represents how data is stored physically on disk storage.

Database schema is Just a representation and it does not contain any data.

Feature	Logical	Physical
Attributes	Yes	No
Primary and secondary keys	yes	Yes
Table Names	No	yes
Column Names and Datatypes	No	yes

Accessing data from Database

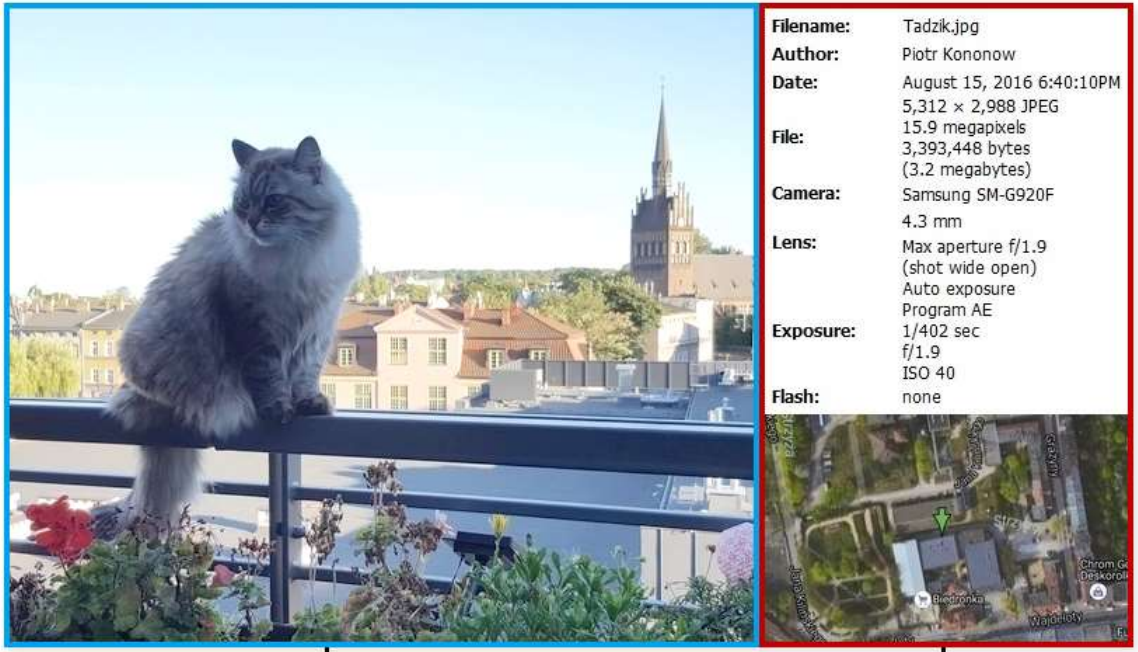




Metadata

- Metadata is simply data about data. It means it is a description and context of the data. It helps to organize, find and understand data. Here are a few real world examples of metadata:
- Title and description,
- Tags and categories,
- Who created and when,
- Who last modified and when,
- Who can access or update.

Metadata

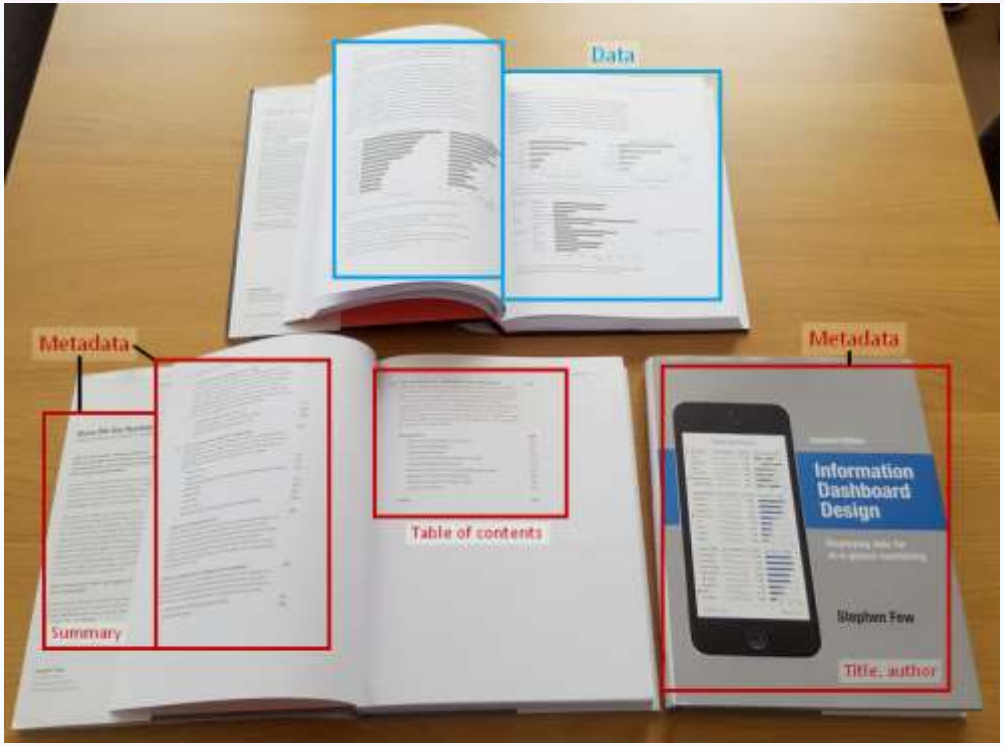


Every time you take a photo with today's cameras a bunch of metadata is gathered and saved with it:

- date and time,
- filename,
- camera settings,
- geolocation.

Source: https://dataedo.com/kb/data-glossary/what-is-metadata

Metadata



Each book has a number of standard metadata on the covers and inside. This includes:

- a title,
- author name,
- publisher and copyright details,
- description on a back,
- table of contents,
- index,
- page numbers.

Source: https://dataedo.com/kb/data-glossary/what-is-metadata

Metadata

- *Most popular databases provide access to their metadata with a set of tables or views often called system catalog or data dictionary. Many of them implement or standard information schema. We can access those views using SQL.*

Database System

It is a collection of database and DBMS software.

It consist of four major components:

- **Data**
- **Hardware**
- **Software**
- **Database Users**

Database System

Hardware

- The secondary storage volumes-typically magnetic disks that are used to hold the stored data together with the associated I/O devices like disk drives, device controller, I/O Channel etc.
- The hardware processor and associated main memory that are used to support the execution of the database system software.

Software and Database Users

- All request for access to the database are handled by the DBMS software.
- The primary goal of the system is to retrieve data and store new data in the database. People who work with a database can be categorized as the database users and administrator.
- We will discuss it in detail in the next class.

Function of DBMS

- Accept data definition in the source form and convert.
- Creation of records.
- Query
- DDL Compiler
- DDL Compiler
- Transaction Processing
- Data dictionary function
- Metadata task

Application of database

- Universities
- Hospital
- Bank
- Railway reservation
- Airlines
- Human resources
- IT Industry
- Telecommunication
- Credit and transactions

Popular database system vendors

- Oracle
- IBM
- MSSQL-Server
- Sybase
- Informix
- MS Access
- Fire Bird
- Mark Logic
- My SQL

Big name in databases

Company	Product
Oracle	8i, 9i, 10 g, 11g, 12c
IBM	DB2, Universal Server
Microsoft	Access, SQL Server
Sybase	Adaptive server
Informix	Dynamic server

Introduction to Database Management System

As the name suggests, the database management system consists of two parts. They are:

1. Database and
2. Management System

What is a Database?

- **To find out what database is, we have to start from data, which is the basic building block of any DBMS.**
- Data: Facts, figures, statistics etc. having no particular meaning (e.g. 1, ABC, 19 etc).
- Record: Collection of related data items, e.g. in the above example the three data items had no meaning. But if we organize them in the following way, then they collectively represent meaningful information.

Cont…

Roll	Name	Age
1	ABC	19

Table or Relation: Collection of related records.

Roll	Name	Age
1	ABC	19
2	DEF	22
3	XYZ	28

The columns of this relation are called **Fields, Attributes or Domains**. The rows are called **Tuples or Records**

Cont…

Database: Collection of related relations. Consider the following collection of tables:

We now have a collection of 4 tables. They can be called a “related collection” because we can clearly find out that there are some common attributes existing in a selected pair of tables. Because of these common attributes we may combine the data of two or more tables together to find out the complete details of a student. Questions like “Which hostel does the youngest student live in?” can be answered now, although Age and Hostel attributes are in different tables.

T1

Roll	Name	Age
1	ABC	19
2	DEF	22
3	XYZ	28

T2

Roll	Address
1	KOL
2	DEL
3	MUM

T3

Roll	Year
1	I
2	II
3	I

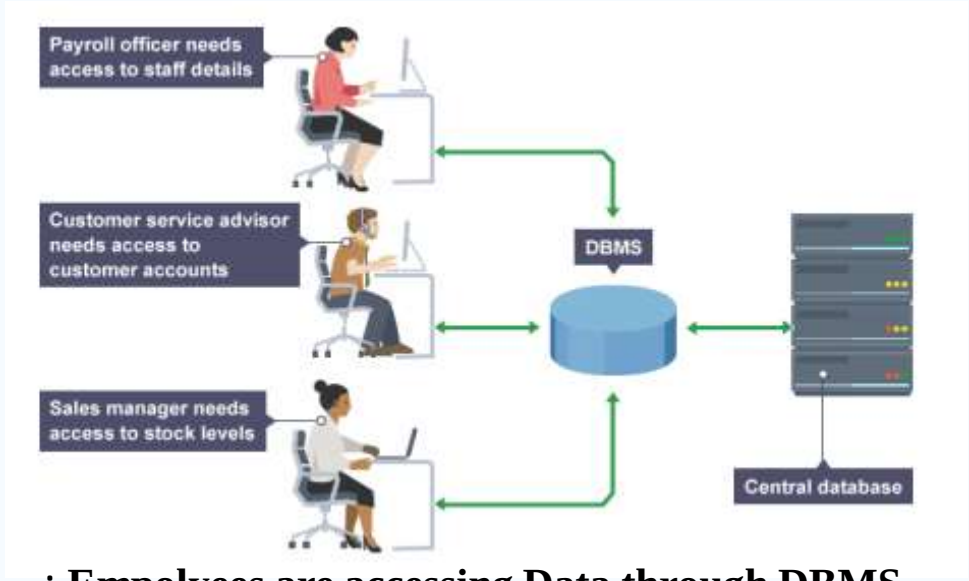
T4

Year	Hostel
I	H1
II	H2

Cont…

- A database in a DBMS could be viewed by lots of different people with different responsibilities.

For example, within a company there are different departments, as well as customers, who each need to see different kinds of data. Each employee in the company will have different levels of access to the database with their own customized front-end application.



: **Empolyees are accessing Data through DBMS**

Cont…

- In a database, data is organized strictly in row and column format. The rows are called Tuple or Record. The data items within one row may belong to different data types. On the other hand, the columns are often called Domain or Attribute. All the data items within a single attribute are of the same data type.

What is Management System?

- A database-management system (DBMS) is a collection of interrelated data and a set of programs to access those data. This is a collection of related data with an implicit meaning and hence is a database. The collection of data, usually referred to as the database, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both convenient and efficient. By data, we mean known facts that can be recorded and that have implicit meaning

Database Management System (DBMS)???

- A Database management system is a computerized record-keeping system. It is a repository or a container for collection of computerized data files. The overall purpose of DBMS is to allow he users to define, store, retrieve and update the information contained in the database on demand. Information can be anything that is of significance to an individual or organization.

In ALL DBMS is…

- **Data-** **Any fact that can be recorded**

e.g. texts, numbers, alphanumeric, audio, video, image.

- **Database-** **Collection of interrelated data**
  - **Types of Database-**
    - **Traditional database**
    - **Multimedia database**
    - **Geographic Information System (GIS) database**
    - **Real time database**
    - **Data Warehouse (huge volume of historical data)**

- **DBMS:** **Collection of interrelated data and a set of programs to access those data. It helps us to store and retrieve database information in a convenient and efficient manner**

Need of DBMS???

- **Provide a highly efficient method for handling large amount of different types of data with ease.**
- **Database allows data to be stored systematically.**
- **Data can be easily retrieved, filtered, sorted and updated efficiently and accurately.**


THANK YOU