

COURSE NAME: DBMS

COURSE CODE:23AD2102A

Topic: INTRODUCTION TO DATA BASES

Session - I

AIM OF THE SESSION



To familiarize students with the basic concept Database Management Systems

INSTRUCTIONAL OBJECTIVES



This Session is designed to: Characteristics of DBMS

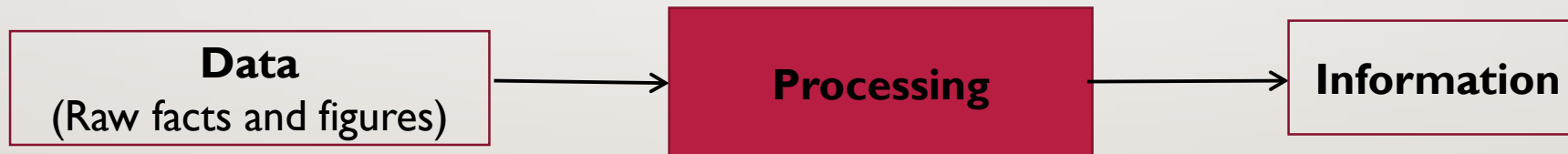
LEARNING OUTCOMES



At the end of this session, you should be able to: basic knowledge of DBMS

BASIC TERMINOLOGY (DATA, INFORMATION)

The terms “data” and “information” are often used interchangeably, but they actually aren’t the same.



WHAT IS DATA ?

- Data is defined as **a collection of individual facts or statistics**. (While “datum” is technically the singular form of “data,” it’s not commonly used in everyday language.)
- Data can come in the form of
 - **text,**
 - **observations,**
 - **figures,**
 - **images,**
 - **numbers,**
 - **graphs, or**
 - **symbols.**
- **For example,** data might include **individual prices, weights, addresses, ages, names, temperatures, dates, or distances, etc.**

WHAT IS DATA?

- Data is a **raw form of knowledge** and, on its own, doesn't carry any significance or purpose. In other words, you have to **interpret data for it to have meaning**. Data can be simple—and may even **seem useless until it is analyzed, organized, and interpreted**.
- There are two main types of data:
- **Quantitative data** is provided in numerical form, like the weight, volume, or cost of an item.
- **Qualitative data** is descriptive, but non-numerical, like the name, sex, or eye color of a person.

WHAT IS INFORMATION?

- **Information** is defined as **knowledge gained through study, communication, research, or instruction**.
- Essentially, **information** is the **result of analyzing and interpreting pieces of data**. Whereas **data** is the **individual figures, numbers, or graphs**, information is the perception of those pieces of knowledge.
- For example, a set of data could include temperature readings in a location over several years. Without any additional context, those temperatures have no meaning. However, when you analyze and organize that information, you could determine seasonal temperature patterns or even broader climate trends. Only when the data is organized and compiled in a useful way can it provide information that is beneficial to others.

DATA VS INFORMATION

- Data is a **collection of facts**, while information **puts those facts into context**.
- While data is **raw and unorganized**, information is **organized**.
- Data points are **individual and sometimes unrelated**. Information **maps out that data to provide a big-picture view of how it all fits together**.
- Data, **on its own, is meaningless**. When **it's analyzed and interpreted**, it becomes meaningful information.
- Data **does not depend on information**; however, **information depends on data**.
- Data typically comes **in the form of graphs, numbers, figures, or statistics**. Information is typically **presented through words, language, thoughts, and ideas**.
- Data **isn't sufficient for decision-making**, but you **can make decisions based on information**.

HISTORY OF DATABASE SYSTEMS

- **Databases** are a foundational element of the modern world. We interact with them even without knowing it — any time we buy something online, or log in to a service, or access our bank accounts, and so on.
- The concept of a database existed long before computers.
 - In these times, data was stored in journals, in libraries, and in hundreds of filing cabinets.
 - Everything was recorded via paper — and that meant **it took up space, was hard to find, and difficult to back up.**
- And then computers became available, and with them, the opportunity for better data management.

HISTORY OF DATABASE SYSTEMS

- **The 1960s – beginnings**

- ✓ Charles Bachman designed the first computerised database in the early 1960s. This first database was known as the **Integrated Data Store, or IDS**.
- ✓ This was shortly followed by the **Information Management System**, a database created by IBM.

Both databases were forerunners of the ‘navigational database’.

Navigational databases required users to navigate through the entire database to find the information they wanted.

There are two main models of this:

- **hierarchical model** (data is organised like a family tree)
- **network model** (a record to have more than one parent and child record)

- **The 1970s – relational databases**

A relational database is one that shows the relationship between different data records.

- **searchable**
- **more space-efficient (reduced data storage costs)**
- Ted Codd defined the relational data model
 - ✓ Won the ACM Turing Award for this work
- IBM then released their relational database, named as, System R
 - ✓ The first in the history of databases to use structured query language (SQL)

- **The 1980s – growth and standardisation**
 - emergence of Object-oriented database management systems (OODBMS)
 - view data as ‘objects’
 - work with programming languages that supported the ‘object-oriented’ approach
- **The 1990s – the internet**
 - object oriented database systems grow more popular in the 90s.
 - the creation of the World Wide Web
 - demand for client-server database systems
 - the creation of MySQL in 1995

- **The 2000s – NoSQL**

- In 1998, the term NoSQL (not only structured query language) was coined.
- It refers to databases that use query language other than SQL to store and retrieve data.
- NoSQL databases are useful for unstructured data, and they saw a growth in the 2000s.
- This is a notable development in the history of databases because NoSQL allowed for faster processing of larger, more varied datasets

- **The 2010s – distributed databases and cybersecurity**

- The 2010s were a decade of increased data awareness, with the rise of big data and an increased emphasis on data protection.
- Big data was a major buzzword of the 2010 — and big data meant big databases to house it.

APPROACHES TO STORE DATA

There are two approaches for storing data in computers:

- File-based approach.
- Database-approach.

FILE BASED APPROACH

- A **filesystem** is a method for storing and organizing computer files and the data they contain to make it easy to find and access them.
- File systems may use a **storage device** such as a hard disk or CD ROM and involve maintaining the physical location of the files.
- Programmers used **programming languages** such as COBOL, C++ to write applications that directly accessed files to perform data management services and provide information for users.

UNIVERSITY DATABASE IN FILE BASED SYSTEM

General Office	Library	Hostel	Account Office
<u>Rollno</u> Name Class Father_Name Date_of_birth Address Phone_No Previous_Record Attendance Marks Etc.	<u>Rollno</u> Name Class Address Date of birth Phone No No of books issued Fine etc.	<u>Rollno</u> Name Class <u>Father Name</u> <u>Date of birth</u> Address Phone No Mess Bill RoomNo etc.	<u>Rollno</u> Name Class Address Phone_No Fee Installments Discount Balance Total etc.

PROBLEMS IN TRADITIONAL APPROACH

- Data Security
- Data Redundancy
- Data Isolation
- Program / Data Dependence
- Lack of Flexibility
- Concurrent Access Anomalies

DATABASE APPROACH

Database: “**A collection of related data**”

“**A database system is referred as a collection of related data, which contains information about one particular organization**”

DATABASE DEFINITIONS

- ❖ The database is a single, large repository of data, which can be used simultaneously by many departments and users.
- ❖ The related information when placed in an organized form, then it is called a database.
- ❖ It can also be defined as
 - Specifying data types, structures and constraints of the data to be stored.

DATABASE

- ❖ A database system is **a collection of related information stored**, so that it is available to many users for different purposes.
- ❖ A database system is essentially nothing more than **a computerized record-keeping system**. i.e. it is a computerized system whose overall purpose is to **maintain information and make that information available on demand**.
- ❖ A database system is **an electronic filing system**, as it is a repository for a collection of computerized data files.

UNIVERSITY DATABASE IN DATABASE BASED SYSTEM

General Office	Library	Hostel	Account Office
Rollno Name Class Father_Name Address Phone_No Date_of_birth Previous_Record Attendance Marks etc.	Rollno No_of_books_issued Fine etc.	Rollno RoomNo Mess_Bill etc.	Rollno Fee Installments Discount Balance Total etc.

OPERATIONS ON DATABASES

- To add new information
- To view or retrieve the stored information
- To modify or edit the existing
- To remove or delete the unwanted information
- Arranging the information in a desired order etc.

COMPONENTS OF DATABASE

Database system involves four major components:

1. Data

2. Hardware

- **Secondary storage** (magnetic disks) together with **the I/O devices, device controllers, I/O channels**, to hold the stored data.
- **Processor(s)** and associated **Main memory**, to support the execution of the database system software.

3. Software

- The **database manager (DB manager)** or, more usually **database management system (DBMS)**.

4. Users

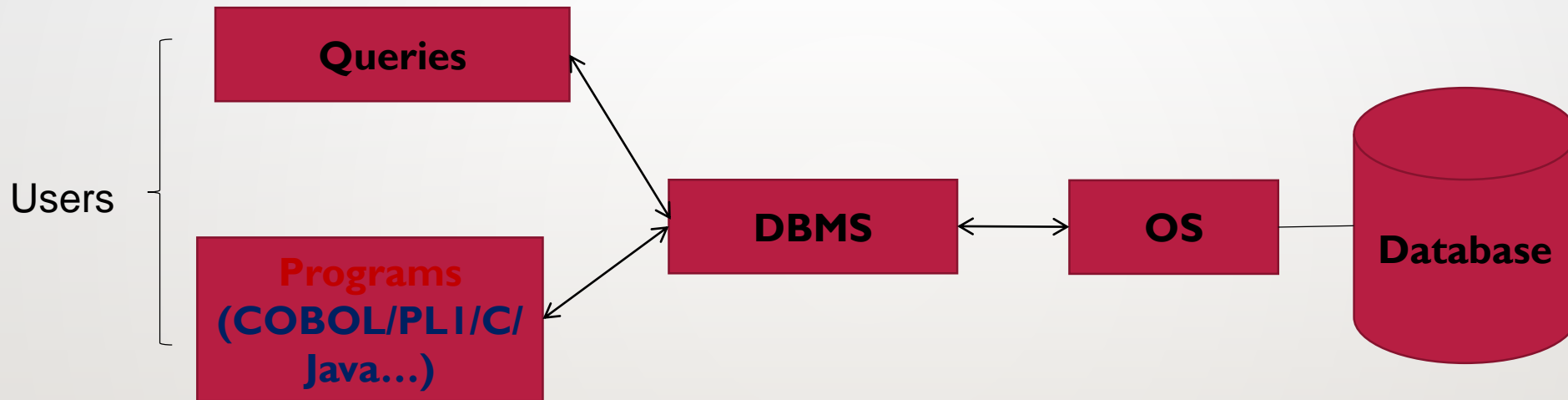
- **Casual end-users, Naïve users, DBA, System analyst, Sophisticated users, Database designers, Application Programmers.**

DATABASE MANAGEMENT SYSTEM (DBMS)

- ❖ DBMS is the major **software component** of database system to **manage database**, thus, it is called as **database manager** (DB manager).
- ❖ All **requests/queries** from users for accessing to the database are **handled by the DBMS**.
- ❖ DBMS **interprets and processes user's requests to retrieve information** from a Database.
- ❖ DBMS is a **collection of interrelated files** and a set of programs that **allows several users to access and modify these files**.
- ❖ DBMS is a **software package/ system** to facilitate the **creation and maintenance of a computerized database**.

DBMS

❖ The DBMS acts as an **intermediary/interface** between the **Database** and the **Users**.



DBMS as an interface between physical Database and User's requests

- DBMS, A database management system is the software system that allows users to define, create and maintain a database and provides controlled access to the data.
- A database management system (DBMS) is basically a collection of programs that enables users to store, modify, and extract information from a database as per the requirements.

SESSION INTRODUCTION

DBMS	File System
DBMS is a collection of data. In DBMS, the user is not required to write the procedures.	File system is a collection of data. In this system, the user has to write the procedures for managing the database.
DBMS gives an abstract view of data that hides the details.	File system provides the detail of the data representation and storage of data.
DBMS provides a crash recovery mechanism, i.e., DBMS protects the user from the system failure.	File system doesn't have a crash mechanism, i.e., if the system crashes while entering some data, then the content of the file will lost.
DBMS provides a good protection mechanism.	It is very difficult to protect a file under the file system.
DBMS contains a wide variety of sophisticated techniques to store and retrieve the data.	File system can't efficiently store and retrieve the data.
DBMS takes care of Concurrent access of data using some form of locking.	In the File system, concurrent access has many problems like redirecting the file while other deleting some information or updating some information.

APPLICATION AREAS OF DBMS

- Banking
- Airline
- Universities
- Credit card Transactions
- Telecommunications
- Finance
- Sales
- Manufacturing

Advantages of DBMS

- Data can be shared.
- Data Independence.
- Concurrent access.
- Recovery from crashes.
- Providing Backup and Recovery.
- Restricting unauthorized access.

Disadvantages of DBMS

- Complexity
- Higher impact of a failure.
- Cost of DBMS.
- Additional Hardware costs.

SELF-ASSESSMENT QUESTIONS

1. Data is

- (a) Used in decision making
- (b) Raw facts or events
- (c) Transformed facts
- (d) Information

2. What is a database?

- (a) Organized collection of information that cannot be accessed, updated, and managed
- b) Collection of data or information without organizing
- c) Organized collection of data or information that can be accessed, updated, and managed
- d) Organized collection of data that cannot be updated

SUMMARY

- The session also emphasizes the key differences between data and information. While data is a collection of individual facts, information contextualizes and organizes those facts, providing comprehension and understanding. Information is dependent on data, and it relies on data for its foundation.
- In the file-based approach, data is stored and organized using file systems. However, this approach came with inherent problems such as data security issues, data redundancy, and difficulties in data isolation and concurrent access.
- In a database management system, data models are often used to show how data is connected, stored, accessed, and changed.

TERMINAL QUESTIONS

1. Describe the history of DBMS.
2. List out the application areas of DBMS.
3. Analyze DBMS and file systems.
4. Summarize the characteristics of database approach.
5. List out the different datamodels in DBMS.

Reference Books:

1. I. Database System Concepts, Sixth Edition, Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.
2. Fundamentals of Database Systems, 7th Edition, RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.

Web Link:

1. <https://nptel.ac.in/courses/106105175>

THANK YOU



Team – DBMS