

Course code : **CSE2007**  
Course title : **Database Management System**  
Module : **1**  
Topic : **1**

# Introduction to Database Management System

# Objectives

This session will give the knowledge about

- What is database?
- What is database management system?
- History of database management system
- Database management systems - terminologies

# What is Database?

A database is **a collection of data**, typically describing the activities of one or more related data.

For example, a university database might contain information about the following:

- **Entities** such as students, faculty, courses, and classrooms.
- **Relationships between entities**, such as students' enrollment in courses, faculty teaching courses, and the use of rooms for courses.

# What is DBMS?

A database management system, or DBMS, is **software designed to assist in maintaining and utilizing large collections of data**. A DBMS will provide

- **Database Design**: How to describe a real-world enterprise in terms of the data
- **Data Analysis**: How to answer questions about the enterprise by posing queries over the data in the DBMS?
- **Concurrency and Robustness**: How does a DBMS allow many users to access data concurrently, and how does it protect the data in the event of system failures?
- **Efficiency and Scalability**: How does a DBMS store large datasets and answer questions against this data efficiently?

# History

The first general-purpose DBMS was designed by **Charles Bachman** at General Electric in the early 1960s and was called the **Integrated Data Store**.

In the **late 1960s**, IBM developed the **Information Management System (IMS) DBMS**, used even today in many major installations.

IMS formed the basis for an alternative data representation framework called the **hierarchical data model**.

# History

In 1970, Edgar Codd, at IBM's San Jose Research Laboratory, proposed a new data representation framework called the relational data model.

In the 1980s, The SQL query language for relational databases, developed as part of IBM's System R project, is now the standard query language.

SQL was standardized in the late 1980s, and the current standard, SQL-92, was adopted by the American National Standards Institute (ANSI) and International Standards Organization (ISO).

# Why DBMS?

In the early days, database applications were built on top of file systems.

**Drawbacks of using file systems** to store data:

- **Data redundancy and inconsistency**
  - Multiple file formats, duplication of information in different files
- **Difficulty in accessing data**
  - Need to write a new program to carry out each new task
- **Data isolation** — multiple files and formats
- **Integrity problems**
  - Integrity constraints (e.g. account balance  $> 0$ ) become part of program code
  - Hard to add new constraints or change existing ones

# Drawbacks of File Systems

- 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
- Concurrent access by multiple users
  - Concurrent accessed needed for performance
  - Uncontrolled concurrent accesses can lead to inconsistencies  
E.g. two people reading a balance and updating it at the same time
- Security problems

Database systems offer solutions to all the above problems



# Advantages of DBMS

Some **advantage** of DBMS are

- Redundancy can be reduced
- Inconsistency can be avoided
- The data can be shared
- Standards can be enforced
- Security can be enforced
- Integrity can be maintained

Some **dis-advantage** of DBMS are

- Confidentiality, Privacy and Security
- Enterprise vulnerability

# Characteristics of the Database Approach

The main characteristics of the database approach versus the file-processing approach are the following:

- Self-describing nature of a database system
- Insulation between programs and data, and data abstraction
- Support of multiple views of the data
- Sharing of data and multiuser transaction processing

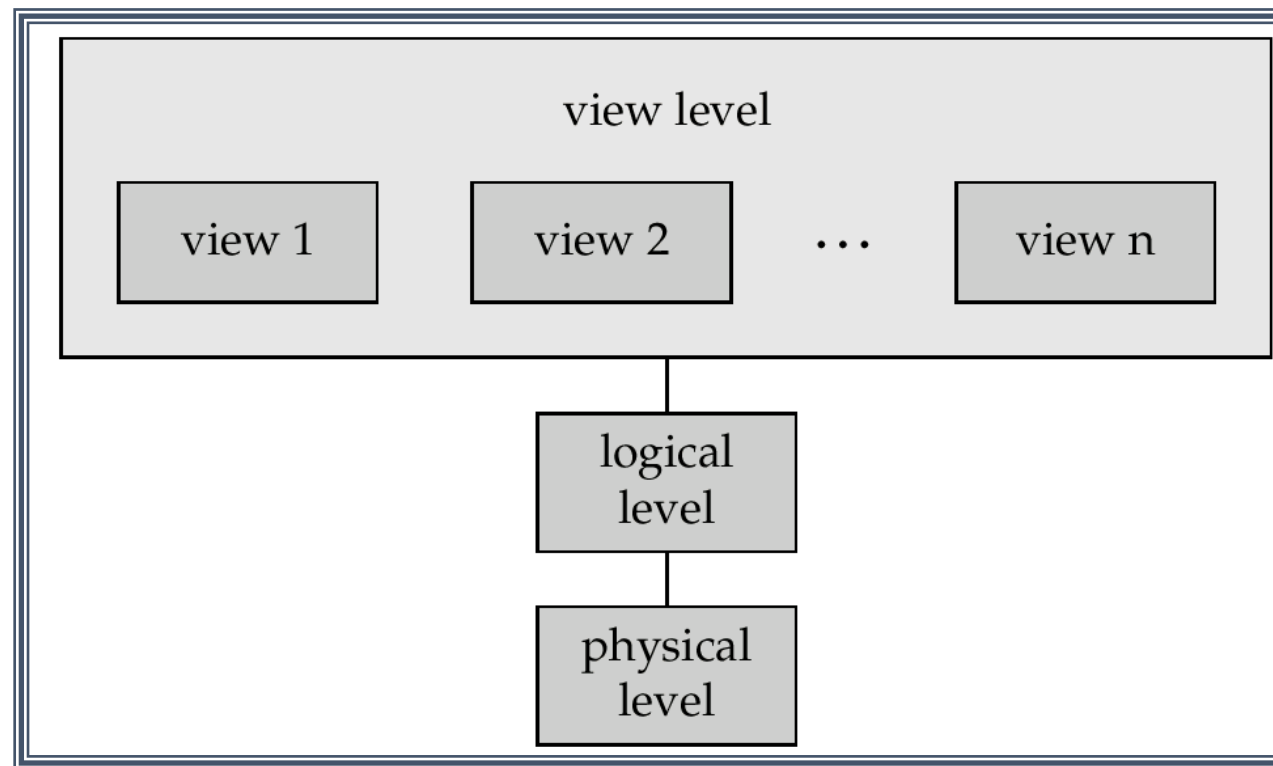
# Applications of DBMS

Typical application areas of DBMS are:

- Banking and financial services
- Culture and scientific information
- Transport
- Tourism
- Telemedicine
- Natural resource management
- Production engineering
- Computerized library system
- Automated teller machines
- Inventory and e-commerce

# View of Data

An architecture for a database system



# View of Data

The three levels are:

- **Physical level:** it is the lowest level of abstraction that describes how the data are actually stored.
- **Logical level:** it is the next higher level of abstraction that describes what data are stored in the database and what relationship exists among those data.
- **View level:** it is the highest level of abstraction that describes only part of the entire database.

# View of Data

**Schema** – the **logical structure of the database**

(E.g., the database consists of information about a set of customers and accounts and the relationship between them)

Analogous to type information of a variable in a program

- **Physical schema**: database design at the physical level
- **Logical schema**: database design at the logical level

**Instance** – the actual **content of the database at a particular point in time** Analogous to the value of a variable

# Relational Database

A relational database is a **collection of related data**.

Example: DB of an employee

Employee data base may contain the following details

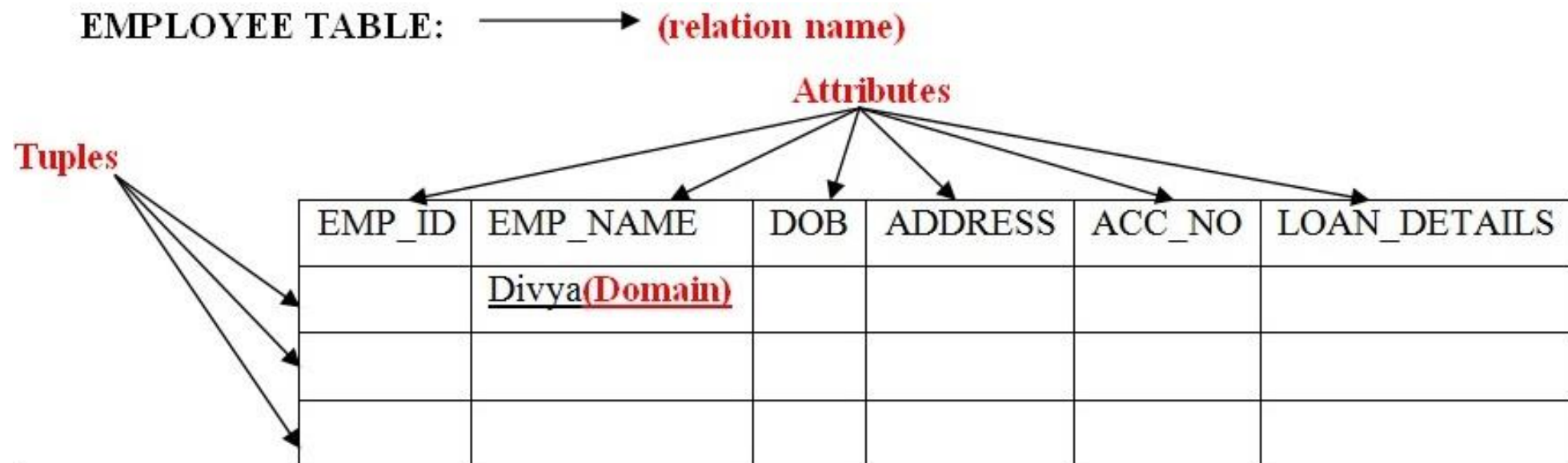
Personal details – Employee\_ID, Name, Date of Birth and Address.

Account details – Account\_No

Loan detail

# Relation

A table is called a relation.





# Terminologies

## Attribute

Attribute is a field.

## Tuples

Tuples are rows in a table.

## Domain

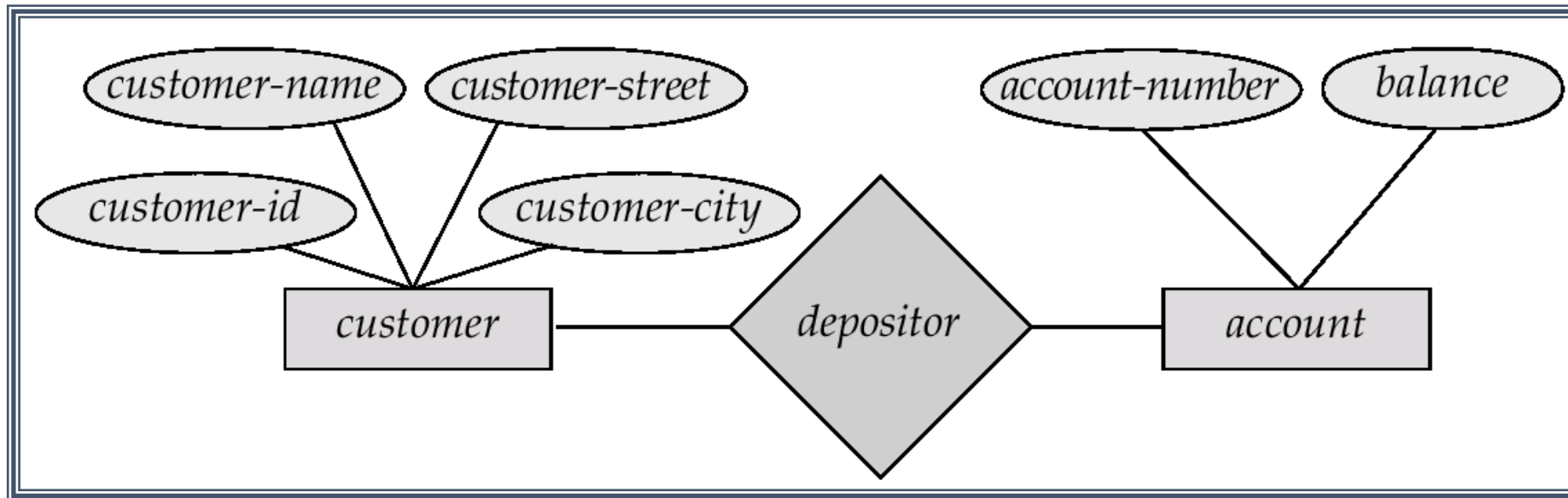
Domain is a set of permitted values for each attribute.

## ER Model

ER Model is a diagrammatic representation of entity and its relationship.

# Entity-Relationship Model

Example of schema in the entity-relationship model



# Summary

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