

DATABASE MANAGEMENT SYSTEMS

WHAT IS DATA?

- Data is a collection of raw facts and figures.
- Data is the raw material that can be processed by any computing machine.
- It is 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.

WHAT IS INFORMATION?

- ◉ Information is data that has been converted into a more useful information.
- ◉ Knowledge acquired through study or experience or instruction .
- ◉ Information helps human beings in their decision making.
- ◉ Examples: Time table, Account returns etc.

DATABASE

- An organized collection of related information is called database.
- A database is a collection of information that is organized so that it can easily be accessed, managed, and updated.
- E.g.:
 - Dictionary
 - Student Record Register
 - Address Book

OPERATIONS ON DATABASE

- **Insert:**
 - To add new information.
- **Update:**
 - To modify the existing information.
- **Delete:**
 - To remove the unwanted information.
- **Retrieve:**
 - To view or retrieve the stored information.
- **Sort:**
 - Arrange the information in ascending or descending order.

MANUAL DATABASE

- Manual database is the record keeping system in which human manages the whole database without the support of the computers.
- It becomes very difficult task when no. of records increase.
- It has many problems, like searching, retrieving etc. the records.

LIMITATIONS OF MANUAL DATABASE

- ◉ **Redundancy:**

- Repetition of data in the files.

- ◉ **Inconsistency:**

- Copy of same data in different files may contain different information.

- ◉ **Isolation:** As the data is scattered in various files and it is very difficult to access the required data.

- ◉ **Atomicity problem:**

- ◉ **Security Problem:**

LIMITATIONS OF MANUAL DATABASE

◉ Security:

- Unauthorized person can easily access the data.

◉ Time Consuming:

- More time was required to search, retrieve and update.

◉ Data Recovery:

- In case of damage, the data was not recoverable.

DATABASE MANAGEMENT SYSTEMS

- ◉ A DBMS is a complex set of software programs that controls the organization, storage, management, and retrieval of data in a database. DBMS are categorized according to their data structures or types, sometime DBMS is also known as Data base Manager. It is a set of prewritten programs that are used to store, update and retrieve a Database.

A DBMS includes:

- ◉ A modeling language to define the schema of each database hosted in the DBMS, according to the DBMS data model

WHAT IS A DBMS?

- ◉ Consists of two things- a Database and a set of programs.
- ◉ Database is a very large, integrated collection of data.
- ◉ The set of programs are used to Access and Process the database.
- ◉ So DBMS can be defined as the software package designed to store and manage or process the database.
- ◉ Management of data involves
 - ✓ Definition of structures for the storage of information
 - ✓ Methods to manipulate information
 - ✓ Safety of the information stored despite system crashes.
- ◉ Database models real-world enterprise by entities and relationships.
 - ✓ Entities (e.g., students, courses, class, subject)
 - ✓ Relationships (e.g., Pranav studies in Class –UKG 'B')

DBMS BENEFITS

- ◉ Improved strategic use of corporate data
- ◉ Reduced complexity of the organization's information systems environment
- ◉ Reduced data redundancy and inconsistency
- ◉ Enhanced data integrity
- ◉ Application-data independence
- ◉ Improved security
- ◉ Reduced application development and maintenance costs
- ◉ Improved flexibility of information systems
- ◉ Increased access and availability of data and information
- ◉ Logical & Physical data independence
- ◉ Concurrent access anomalies.
- ◉ Facilitate atomicity problem.
- ◉ Provides central control on the system through DBA.

DISADVANTAGES OF DBMS

- To store objects (e.g., drawings) in a relational database, the objects have to be 'flattened' into tables
 - e.g., a digital representation of a parcel must be separated from the behaviour of other parcels
- Complex objects have to be taken apart and the parts stored in different tables
- When retrieved from the database, the object has to be reassembled from the parts in different tables

Instances and Schemas

Instance

The collection of information stored in the database at a particular moment.

Schema

The overall design of a database is called the database schema.

Data Abstraction: Three-Level Architecture of DBMS:

Since many of the database system users are not computer trained, developers hide the complexity from users through several level of abstraction, to simplify user's interaction with the system:

Physical Level

Logical Level

View Level

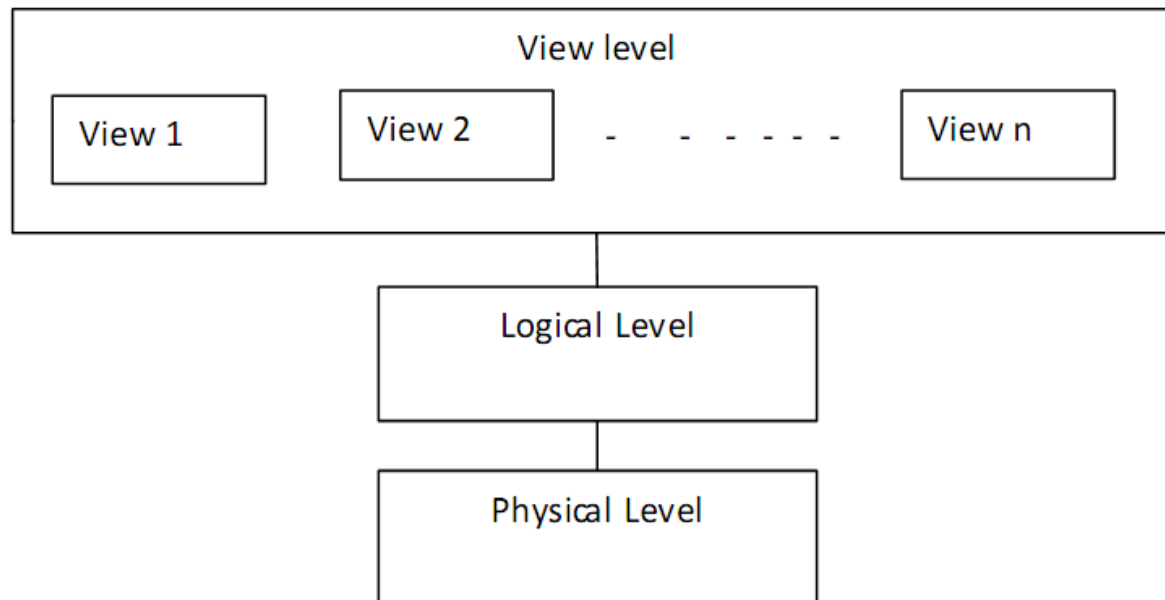
- Physical Level:
 - o Lowest level of abstraction o Describes 'how' the data are actually stored
 - o Complex low-level data structures are defined by system programs which are generally hidden from high level computer programs also.
 - o In the case of relational database management systems the files and indexes used are described at physical level of abstraction.
 - o It is similar as a programming language hides exact way of storing the values defined by variables or records or arrays. Thus defining exact way of storing a record or an array defined by suppose C language will be called physical level of abstraction.
- Physical schema is used at the physical level of abstraction.

Logical Level:

- o Describes what data are stored in the database and what relationships exist among those data.
- o Entire database is represented in simple structure which may be specified by very complex structures at physical level.
- o In the case of relational database management systems definitions of Tables and their fields are defined at logical level of abstraction.
- o An analogy with programming language for logical level of data abstraction is the definitions of record structures or arrays in a programming language (say C).
- o Logical Schema is used at logical level of abstraction.

View Level:

- o Describes only part of the entire database.
- o Many users will not be concerned with all the information stored in a database
- o System may provide several views for the several type of users of the database which will show only the concerned part of the database.
- o View schema is used at view level of abstraction.



DATA MODELS

MODEL

- A Model is representation of reality, 'real world' objects and events and their associations.
- A database model is an organizing principle that specifies particular mechanism of data storage and retrieval.
- The model explains, in terms of services available to an interfacing application, how to access a data element when other related elements are known.

COMPONENTS OF DATA MODELS

◉ Structure Part:

- Consisting of *set of rules* according to which databases can be constructed.

◉ Manipulative Part:

- Define the *types of operation* that are allowed on the data.

◉ Set of Integrity Rules:

- Which ensures that data is accurate.

PURPOSE OF DATA MODEL

- ◉ To represent data.
- ◉ To make the data understandable.

TYPES OF DATA MODELS

- ◉ Object Based Data Models
- ◉ Record Based Logical Data Models
- ◉ Physical Data Models

OBJECT BASED DATA MODELS

- It use concepts such as entities, attributes and relationships.
- Types of Object Based Data Models:
 - * Entity Relationship
 - * Object Oriented
 - * Semantic
 - * Functional

ENTITY- RELATIONSHIP MODEL

- Entity :- **an entity** is a “*thing*” of “*object*” in the real world that is distinguishable from other objects
 - entities are described in a database by a set of *attributes*
- Relationship:- **a relationship** is association among several entities.

The entity-relationship (E-R) data model is based on a perception of a real world that consists of a collection of basic objects, called entities, and of relationships

PHYSICAL DATA MODELS

- It describe how data is stored in the computer, representing information such as record structures, record ordering and access paths.
- Less no. of models are there.

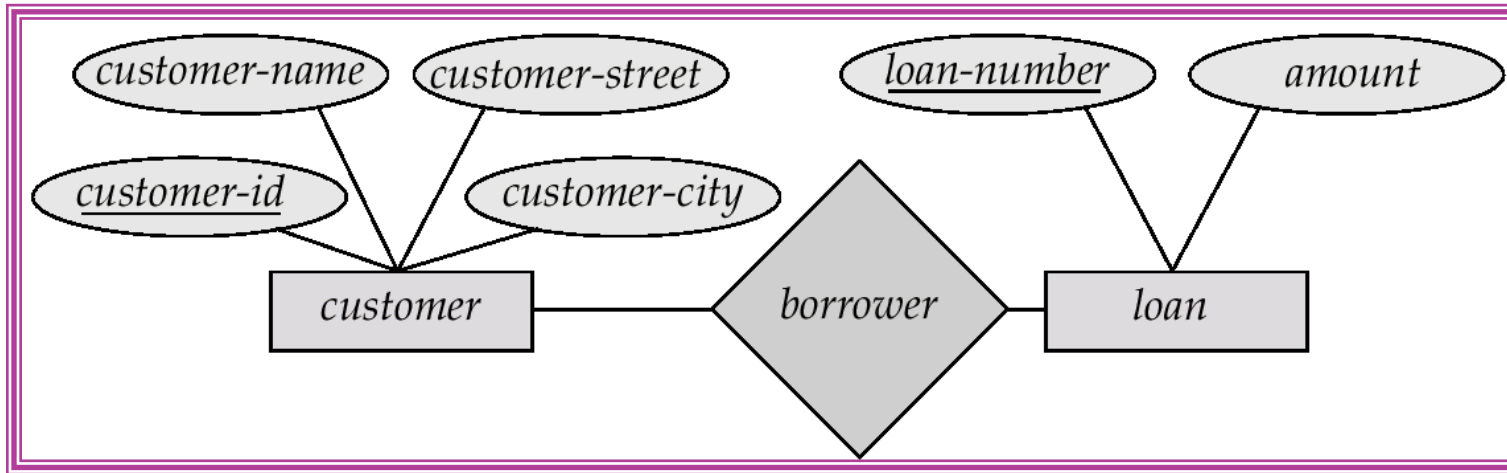
RECORD BASED LOGICAL DATA MODELS

- It is used to specify the overall logical structure of the database and to provide a higher-level description of the implementation.
- Structured database in fixed formats.

TYPES OF RECORD BASED DATA MODELS

- ◉ Hierarchical Model
- ◉ Network Model
- ◉ Relational Model

E-R DIAGRAMS



- Rectangles represent entity sets.
- Diamonds represent relationship sets.
- Lines link attributes to entity sets and entity sets to relationship sets.
- Ellipses represent attributes
 - Double ellipses represent multivalued attributes.
 - Dashed ellipses denote derived attributes.
- Underline indicates primary key attributes (will study later)