

6<sup>th</sup> Semester

## Relational Database Management System

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Unit - I

### Database Management System

- A database management system (DBMS) is software that enables the creation, manipulation and administration of database.
- It provides an interface for user and application to interact with the data stored in a database.
- A DBMS is a software that helps store, manage and retrieve data efficiently. It acts as an interface between user and database.

### Data processing vs. Data management

#### Data processing

- 1) Data processing refers to the collection, transformation and organization of raw data into a more usable format.
- 2) The main goal of data processing is to convert raw data into meaningful information that can be used for decision making, reporting etc.
- 3) Common activities include data entry, data cleaning, data transformation and data analysis.

## Data management

- 1) Data management encompasses the overall practices, policies and procedure for handling data throughout its lifecycle.
- 2) The primary goal of data management is to ensure that data is accurate, accessible and secure.
- 3) Key activities include data governance, data architecture design, data storage solution, data quality.
- 4) The outcome of effective data management is a well-organized, reliable and secure data environment.

## Data Model

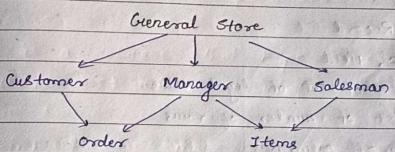
- It is a blueprint for organizing and managing data in database management systems.
- It defines how data is structured, stored and manipulated within the database.

### Types

- Network model
- Relational model
- Hierarchical model

## Network Model

- The network model was formalized by database task group in 1960s.
- This model is generalization of hierarchical model.
- Improves the performance of database.



### features

- ↳ It can manage complex relation
- ↳ Many path
- ↳ Circular link list

## Relational Model

- The Relational model was formalized by E.F. Codd in 1970.
- It is defined as a group of independent tables which are linked to each other using same common field.

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| Terminology of relational model   |                     |  |
| <ul style="list-style-type: none"> <li>Relation - Table</li> <li>Tuple - Row, Record</li> <li>Attribute - Column, field</li> <li>Domain - Consist of set of legal values</li> <li>Cardinality - Consist of number of rows</li> <li>Degree - number of columns</li> </ul>                    | Instance and Schema | <p><b>Advantage</b></p> <ul style="list-style-type: none"> <li>Simplicity</li> <li>Data Integrity</li> <li>Efficient data retrieval</li> <li>Security</li> <li>Performance</li> </ul> <p><b>Limitation</b></p> <ul style="list-style-type: none"> <li>Structural rigidity</li> <li>Lack of flexibility</li> <li>Data Redundancy</li> <li>Query Limitation</li> </ul> |
| Hierarchical Model  | Instance            | <p>It is the collection of information stored in a database at a particular moment.</p> <p>Data in instance can be changed using addition, deletion and update.</p> <p>Changes frequently.</p> <p>It is the set of information stored at a particular time.</p> <p>Affect only current state of data.</p> <p>Data entries, records in tables.</p>                    |
| <ul style="list-style-type: none"> <li>The hierarchical model is one of the oldest model in data model which was developed by IBM in 1950s.</li> <li>In hierarchical model data are viewed as a collection of tables.</li> <li>It is concept of tree structure to organize data.</li> </ul> | Schema              | <p>It is overall description of the database.</p> <p>The schema is same for whole database.</p> <p>Does not change frequently.</p> <p>Defines the basic structure of the database.</p> <p>Affect the entire database structure.</p> <p>Table structure, relationships, constraints.</p>  |
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## View of Database System

- Easy User Interaction
- focus on Relevant data
- Improved data protection
- Control access
- User friendly
- Easy data retrieve

## Difference between File oriented approach & Database Oriented approach

| file Oriented Approach   | Database Oriented Approach                      |
|--|---|
| 1) file system is a way of arranging the files in a storage medium | DBMS is software for managing the database      |
| 2) Redundant data can be present in a file system.                 | In DBMS there is no redundant data              |
| 3) Less data consistency in file system                            | More data consistency because of normalization. |
| 4) It provide less security  | Provide more security                           |
| 5) Only one user can access data at a time.                        | Multiple user can access data at a time.        |

## Data Independence

Data Independence in a DBMS refers to the ability to modify the database schema at one level without affecting the schema at the next higher level.

### Types → Logical data Independence

The ability to change the logical schema without requiring modification to application program.

### → Physical data Independence

The ability to change the physical schema without affecting the logical schema or application program.

## Different types of database user

### 1) Database Administrator (DBA)

A database administrator is a team who defines the schema and also control 3 level of database.

### 2) Native / Parametric End user

Parametric end user are unsophisticated who don't have any DBMS' knowledge but they frequently use the database applications.

### 3) A System Analyst

A system analyst is a user who analyzes the requirement of parametric end user. Check whether all the requirement of end user are satisfied.

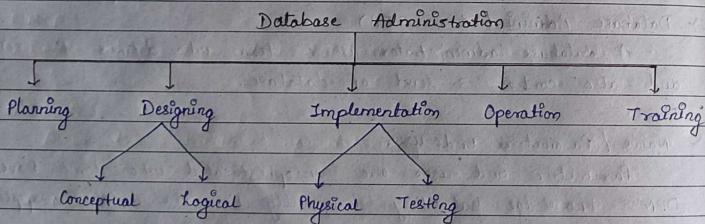
## Database Administration

A Database Administrator (DBA) is an individual or team responsible for controlling, maintaining, coordinating and operating a database management system.

- Managing, securing and taking care of database system is a prime responsibility.

### Role and duties of DBA

- Decides Hardware
- Manages data integrity and security
- Database accessibility
- Database design
- Database Implementation



## SQL (Structured Query Language)

Structured Query Language is a standard Database language that is used to create, maintain and retrieve the relational database.

SQL is case insensitive but it is recommended to use keywords like SELECT, UPDATE, CREATE in capital letters and user defined things like table name, column name in small letter.

We can write comment in SQL using "--" at the beginning of any line. SQL is the programming language for relational database.

## Database Language

A database language is a type of programming language used to interact with and manage database.

### Types of database language

- DDL (Data Definition Language)
- DML (Data Manipulation Language)
- DCL (Data Control Language)
- TCL (Transaction Control Language)

## SQL Commands

SQL commands are crucial for managing database effectively. SQL command are the fundamental building block for communicating

with a database management system (DBMS)

- SQL Commands are categorized into :-

#### 1) DDL - Data Definition Language

DDL or Data Definition Language actually consist of SQL command that can be used for defining, altering and deleting database structure such as tables, indexes and schemas.

- Common DDL commands are :-

##### → CREATE

Create database or its objects (tables, index, function, view, triggers)

##### → DROP

Delete object from the database

##### → ALTER

Alter the structure of database

##### → TRUNCATE

Remove all records from a table.

##### → COMMENT

Add comment to data dictionary.

#### 2) DQL - Data Query Language

DQL statements are used for performing queries on the data within schema object.

##### , DQL command :-

##### → SELECT

It is used to retrieve data from the database.

#### 3) DML - Data Manipulation Language

DML or Data Manipulation Language deals with the manipulation of data present in the database.

- Common DML commands are :-

##### → INSERT

Insert data into a table

##### → UPDATE

Update existing table data within a table

##### → DELETE

Delete record from database table

#### 4) DCL - Data Control Language

DCL or Data Control Language includes commands such as GRANT and REVOKE which mainly deal with rights, permission and other control of database systems.

- Common Commands of DCL are:-

##### → GRANT

Assigns new privileges to a user account, allowing access to specific database object.

##### → REVOKE

Removes previously granted privileges from a user account.

#### 5) TCL - Transaction Control Languages

Transaction is a group of tasks into a single execution. Each transaction begins with a specific task and ends when all the tasks in the group are successfully completed.

- Common TCL Commands are:-

##### → COMMIT

Saves all changes made during the transaction.

##### → ROLLBACK

Undoes all the changes made during the transaction.

#### Aggregate function

SQL Aggregate functions are used to perform calculation on multiple rows of data and return a single summarized result.

##### Key features

- Operates on group of rows
- Ignore NULLS
- Used with GROUP BY
- Can be combined with other SQL clause

##### Commonly used SQL Aggregate functions are:-

- COUNT()
- SUM()
- AVG()
- MIN() and MAX()

#### Set Operation

Set operation are standard mathematical operation on set. These operations are binary operation that are operated on 2 relations.

##### 1) Union operation

$A \cup B$ ,  $\cup$  is symbol of union

##### 2) Intersection operation

$A \cap B$ ,  $\cap$  is symbol of intersection

##### 3) Minus operation

$A - B$ ,  $-$  is used to denote minus operator.

## Join Operation

- Join is an operation in DBMS that combine the rows of two or more tables based on related columns between them.
- The main purpose of join is to retrieve the data from multiple tables.

## Data Dictionary

Data dictionary consist of two words data which represent data collected from several source and dictionary which represent where this data is available.

- A data dictionary can be defined as a component that stores a collection of names, definition and attribute for data element used in the database.