Unit No. 1

Database System Concept

1.1 Introduction to Database:

- Data:-The information that can be recorded in system and that have some special meaning assigned to it. Example:-Customer may have data like Name, Ph.No.,Address, Product purchased etc.

- Database:-A database is nothing but set of data having some relation between them.It can be automated with help of computer and also generated and maintained by manual method.
Example:-A manual record system for daily attendance makes use of notebook for keeping records.
A computerized database is maintained by a group of application programs.

- Database Management System:-A DBMS is a collection of software or programs which helps user in creation and maintenance of a database.
- DBMS is a software system that helps the process of defining , saving, manipulating and sharing the database.

- **Steps in DBMS:-**

1. Defining:-
   In this step we decide data structure and constraints for storing data in database. Ex.-data type for employee age is integer.
2. Saving:-
   Saving data using the data storage device which will be managed by DBMS. Ex.-Database may be stored on server hard disk.

Steps in DBMS:-

3. Manipulating:-
   Represent data in software and produce user friendly reports from the available data. Ex.-Attendance report from employee DB.
4. Sharing:-
   It should allow to access DB concurrently by multiple users in order to make application multiuser. Ex.-At a time multiple customers may access the DB of a bank

Advantages of DBMS over File processing system

- Data redundancy and inconsistency
- Data sharing
- Data concurrency
- Data searching
- Data integrity
- Easy recovery
- Data security

Applications of DBMS

- Banking
- Airlines
- Universities
- Manufacturing and selling
- Etc..

- **Data Abstraction:-**
-It is defined as the process of hiding the complexity of data and representing the data which needs to be shown to users.
 -An abstract view hides the details of how the data are stored and maintained

 -There are three levels of data abstraction
 1)Physical level
 2)Logical level
 3)View level

We have three levels of data abstraction

| View 1 | View 2 | - - - - - - - - - - - - - - | View n |

Logical level

Physical level
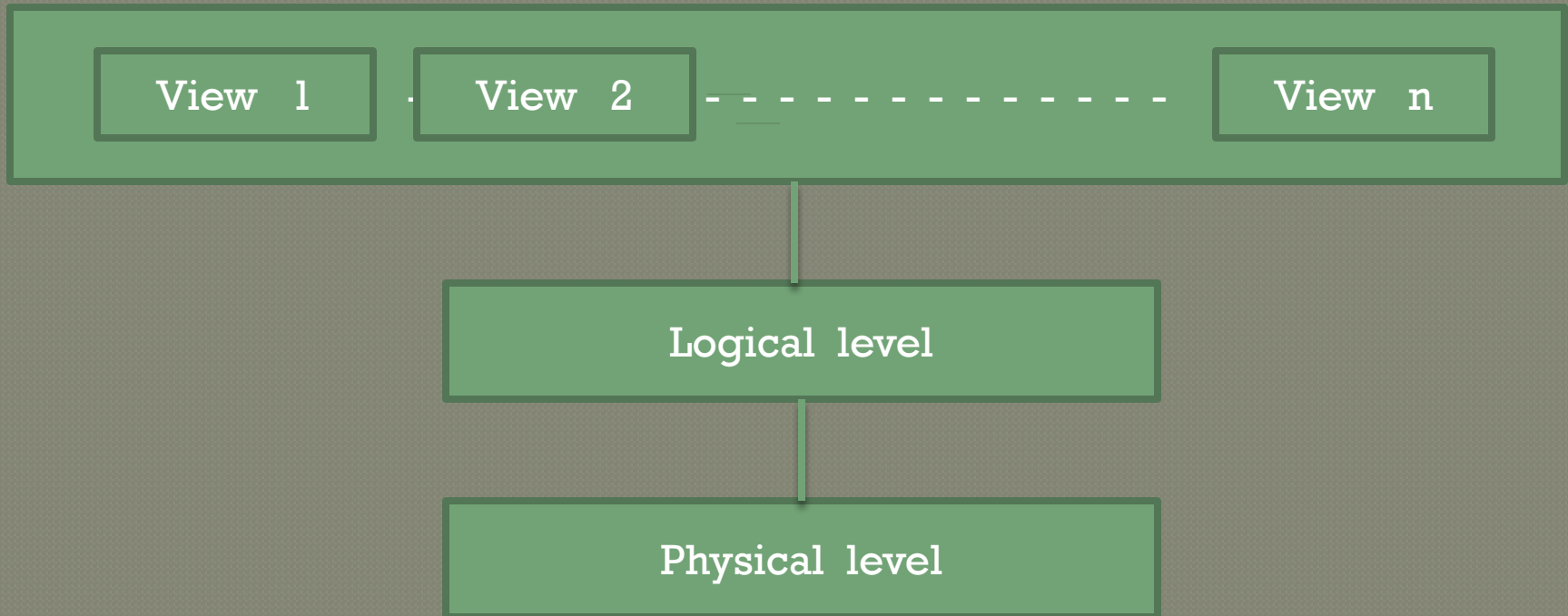
- **Data Dictionary:-**

   - A data dictionary is a file or set of files that contains database's metadata.

   - It contains records about other objects in the database such as data ownership, data relationship to other objects etc.

   -Data dictionary is invisible to most database users. Only database administrators interact with the data dictionary.

- **Instance:-**
  -Database changes over time as information is inserted and deleted.
  -The collection of information stores in database at a particular moment is called as instance of database

- **Schema:-**
  -The overall design of database is called as database schema.
  -Schema corresponds to variable declarations, associated type definition in a program.

- **<u>Types of schema:-</u>**

1.Physical schema:-

 It describes database design at physical level.

2.Logical schema:-

 It describes database design at logical level.

3.View level:-

 It describes database design at view level also called as sub-schemas.

- <u>Data independency:-</u>

-The ability to modify schema definition in one level without affecting schema definition in next higher level is called as data independency .

-Two levels of data independence are
1)Physical Independence
2)Logical Independence
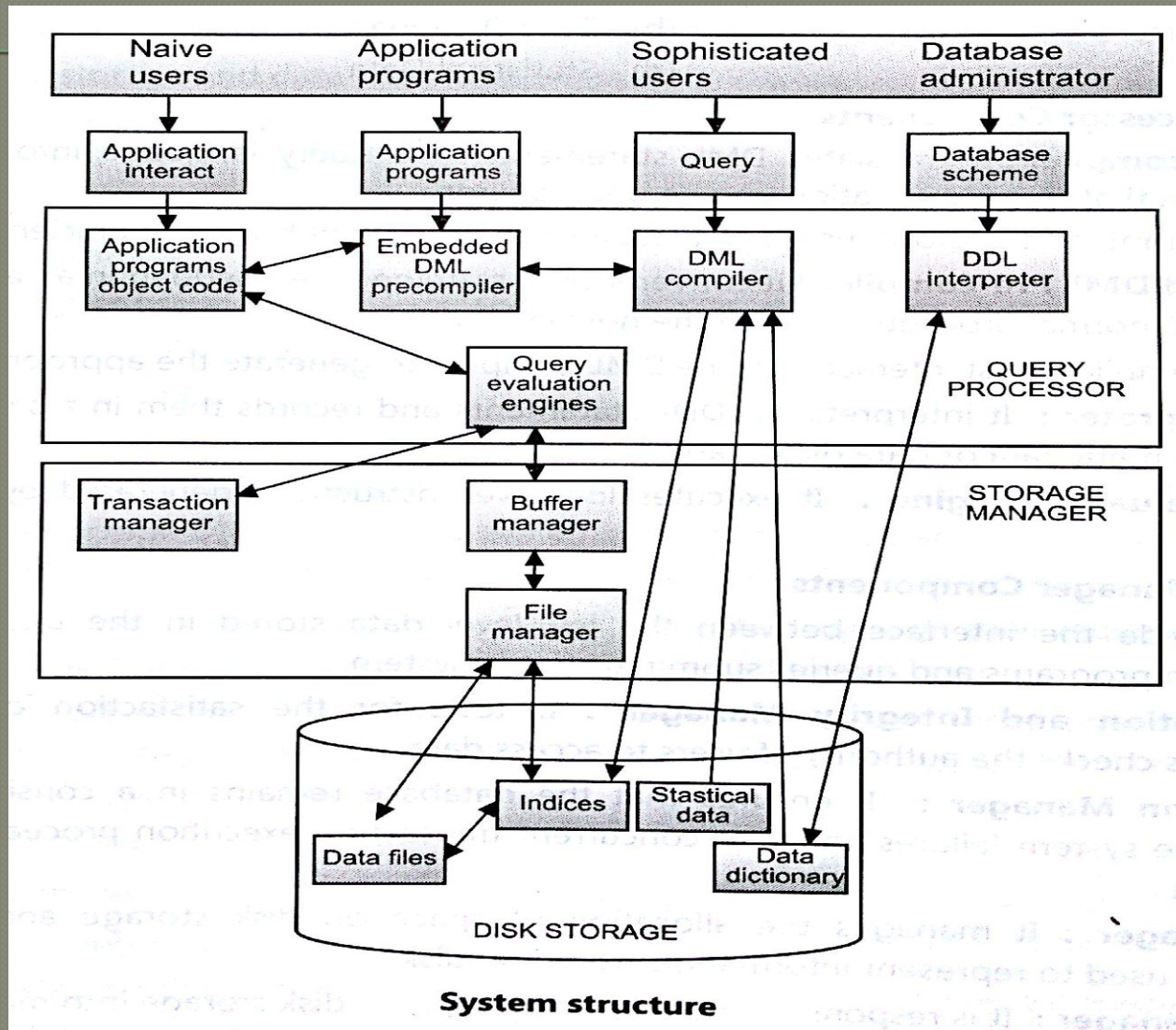
- **Data independency:-**

  1)<u>Physical Independence</u>:-
  It is the ability to modify physical schema without causing application program to be rewritten.

  2)<u>Logical Independence</u>:-
  It is the ability to modify the logical schema without causing application program to be rewritten.

Components of DBMS and overall structure of DBMS:-

System structure

- DBMS acts as an interface between user and database.
- The components of DBMS perform the requested operation on database and provide necessary data to user.
- Various components of DBMS are
  1) Query processor
  2) Storage manager
  3) Disk storage
  4) Database user

1]Query Processor:- It consist of

-DDL interpreter:-(create ,alter, drop)
It interprets DDL statements and records the definition in data dictionary

-DML compiler:-(insert, delete, update, select)
It translates the DML statement into a query language that query evaluation engine can understand.

-Embedded DML pre-compiler:-
It converts DML statements embedded in an application program to normal procedure calls in programming language.

-Query evaluation engine:-
It executes low level instructions generated by DML compiler.

◉ <u>Storage Manager:-</u>
-It provides interface between low level data
   stored in database and queries submitted to
   the system.

-Components of storage manager are
 1.<u>Authorization and integrity manager:-</u>
   It ensure that database remains in consistant
   state and checks the authorization of user to
   access the data.

 2.<u>File manager:-</u>
   It manages the allocation of space on disk
   storage and data structure used to represent
   data store on the disk.

3. <u>Buffer manager:-</u>
   It is responsible for fetching data from disk storage into main memory and decides what data to cache in main memory.

4. <u>Transaction manager:-</u>
   It ensures that database remains in consistent state despite of system failure and helps in concurrent transaction execution.

3]Disk storage:-

Following data structures are required for efficiently storing data on the disk.

i)<u>Data files:-</u>It stores the database.

ii)<u>Indices:-</u>It provides faster access to the data.

iii)<u>Data dictionary:-</u>It stores metadata(data about data)about the structure of database.

iv)<u>Statistical data:-</u>It stores statistical information about the data in the database.

4]Database Users:-

Types of database users:-

1]Naïve users:-
   These are unsophisticated users who interact with database with typical user interface design .

2]Application programmer:-
   These are computer professionals who writes application programs.

3]Sophisticated user:-
   These are interacts with database using database query language.

4]DBA(Database Admin):-
 -DBA is a person who has centralized
   control over database system.
 -Functions of DBA are:-
   Creating database
   Space management
   Security administration
   Database backup and recovery
   Performance monitoring
   Routine maintenance

5]Specialized users:-
-These are the special user who are not traditional. They write some special application program which are not regular application. Ex. CAD(computer aided design)
 -These users also handle the system where data storage is complex. Data can be in the form of graphics, audio, video etc.

- **Data Models:-**
  - It is defined as a collection of tools and concepts for representing and manipulating the data and describing relationship between data.
  - Data models can be categorized into
 1]Record based data models
  2]Object based data models

- **Record based data models:-**
-Record based data models are used to describe data at logical and view level
-In this model data is structured in fix format called records.
-There are three types of records based data models:-
1]Hierarchical model
2]Network model
3]Relational model

1]Hierarchical model:-

-This model organizes the data in the form of tree structure.

-There is hierarchy of parent and child data segment. The data is represented in the form of records.

-Link between these models are parent child relationship.

-Hierarchical data model can have only one to many relationship.

-The drawback of this model is we can not represent many to many relationship that's why there is duplicacy of data which leads to higher storage

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1	DBMS		2	MPR		3	DT
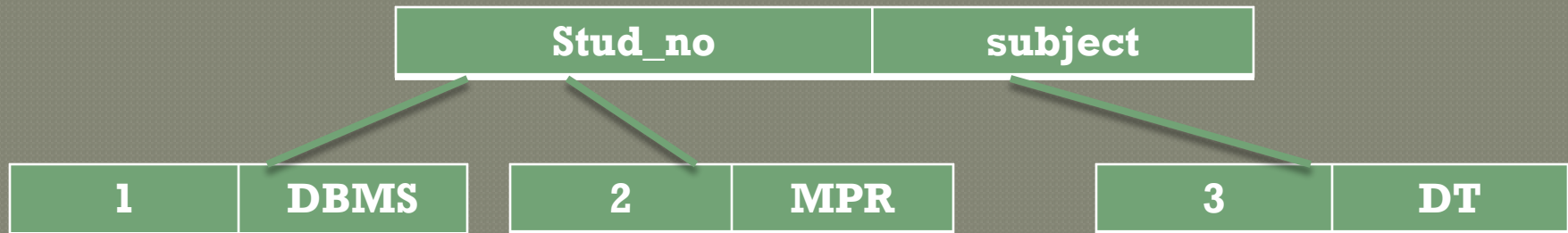
2]Network model:-

-In order to overcome the drawback of hierarchical model, the network model come into existence.

-In network model many to many relationship is possible.

-The data is represented in the form of records these records can be connected by link or pointer.

-As shown in figure a student can register more than one course and information about student and course is there in database that is there is less redundancy but drawback of this model is complexity associated with pointers and data structures used in model.

S1	ABC

C1	DBMS

S2	PQR

C2	MPR

S3	XYZ

C3	DT
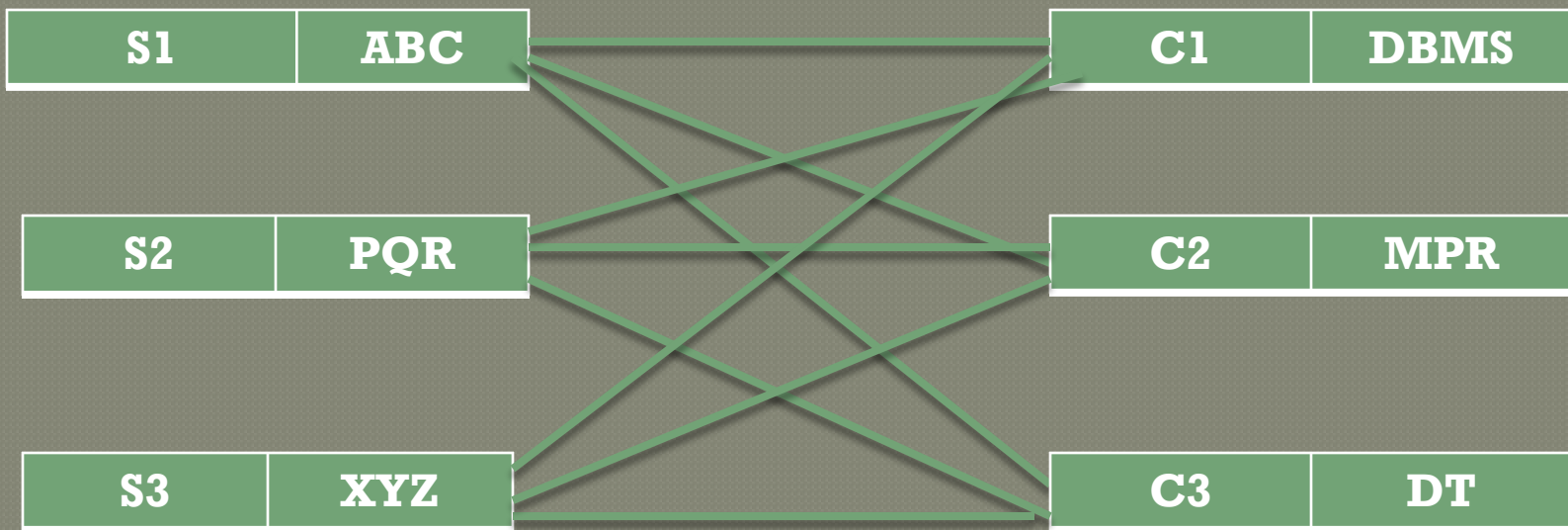
3]Relational model:-

-Relational data model is most simplified and widely used data model. It was developed by E. F. Codd.

-Relational model uses a collection of tables (relation) to represent the data and relationship among data.

-Relational model allows you to group data items into one or more independent tables that can be related to one another using fields common to each other.

-Each table have multiple columns(fields and records) and multiple rows(records or tuples).

-In relational model certain fields can be designated as keys.

Student Table

Roll-no.	Name	Address	Contact	Course
1	ABC	DADAR	9768576455	C1,C2
2	DEF	BANDRA	9678865435	C3,C2
3	XYZ	CST	7768549870	C1,C2

-In this table field Roll_no is the primary key by
which each record can be identified uniquely.
-In relational model there is less redundancy and less coplexity.