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Database Management System

* Data : known facts that can be recorded and have an implicit meaning.
* Database : A collection of related data.
* Database management system : A software / system to facilitate the creation and maintenance of a computerized database.
* Database system : Dbms + database
* Example of database :

Some mini-world relationships :	Some mini-world entities :
1. sections are of specific courses	1. students
2. students take sections	2. course
3. courses have prerequisite courses	3. section
4. instructors teach sections	4. Department
5. courses are offered by departments.	5. instructor.

* Entities are called as relation in database which comprises of number of tuples (records). Relation along with relationship forms database. Database along with dbms forms database system.

Main characteristics of database approach :

(i) Self describing nature of a database system.
* A dbms catalog stores the description (meta-data) of a particular database.

(ii) Insulation between programs and data :
* Program-data independence.
* Allows changing data structures and storage organization without having to change the DBMS access programs.

(iii) Data abstraction

(iv) Support multiple views of the data

(v) Sharing of data and multi-user transaction processing

Database users :

(i) Actors on the scene : those who actually use and control the database content, and those who design, develop and maintain database applications

* Incorporating DBMS to object oriented programming is called object oriented DBMS.
* Incorporating object oriented concept to DBMS is called object-relational DBMS.

(ii) workers behind the scene : Those who actually design the DBMS software and related tools.

Actors on the scene :
(i) Database Administrators
(ii) Database Designers
(iii) end users
→ casual : access database occasionally when needed.
→ naive or parametric : they make up a large section of the end-user population.
(a) Sophisticated : includes business analysts, scientists, engineers and others who are thoroughly familiar with the system capabilities.
Use data mining tools in order to extra some useful data from the database.
(b) stand-alone : Mostly maintain personal databases using ready-to-use package applications.
(iv) System analysts and Application Developers
(a) System Analysts : Understand the user requirements of naive and sophisticated users and design applications
(b) Application Programmers :
eg system

Workers behind the scene :
(i) system Designers and Implementors
(ii) Tool developers
(iii) operators and maintenance Personnel

Advantages of using the database :
* Controlled redundancy
* Restricting unauthorized access to data
* Providing persistent storage for program objects
* Providing storage structures for efficient Query Processing
↓
Eg: indexes

* Providing optimization of queries for efficient processing.
* Providing backup and recovery services.
* Proving multiple interfaces to different classes of users.
* Representing complex relationships among data.
* Enforcing integrity constraints on the database.
* Potential for enforcing standards
* Reduced application development time.
* Flexibility to change data structure
* Availability of current information
* Economies of scales

} Additional Implications

When not to use DBMS

* High initial investment & possible need for additional hardware
* Overhead for providing security, concurrency, control & integrity.

} Main Inhibitors

* If database & applications are simple & not expect to change
* If access to data by multiple users is not required.

} DBMS may be unnecessary

* In embedded systems where purpose of DBMS may not fit in available storage. - DBMS may be infeasible.

9/24 Data model : A set of concepts to describe the structure of a database, the operations for manipulating these structures and certain constraints that the database should obey.

Data base :

(i) Data model

(ii) Data model structures and constraints

(iii) Data model operations

(a) basic model operation (insert, delete, etc)

(b) user-defined operations (calculate gpa, calculate age etc).

Categories of data model:

(i) Conceptual data models (high-level, semantic)
- Also called as entity-based or object-based data models.

(ii) Physical data models (low-level, internal)

(iii) Implementation data models (representational) eg: relational data models

(iv) Self-describing data models

Schemas versus Instances:

Database schema:
* The description of a database. Includes database structure, data types and the constraints on the database.

Schema diagram: An illustrative display of a database schema.

Schema construct: component of the schema or the entity of the schema.

Database state: The actual data stored in a database at a particular moment in time. Also called database instance.

Initial database state: Refers to the database state when it is initially loaded into the system.

Valid state: A state that satisfies the structure and constraints of the database

* The database schema changes very infrequently.
The database state changes every time the database is updated.
* Schema is also called intension.
* State is also called extension.

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(Imp) Three-schema architecture:

Proposed to support DBMS characteristics of:

(i) Program-data independence.

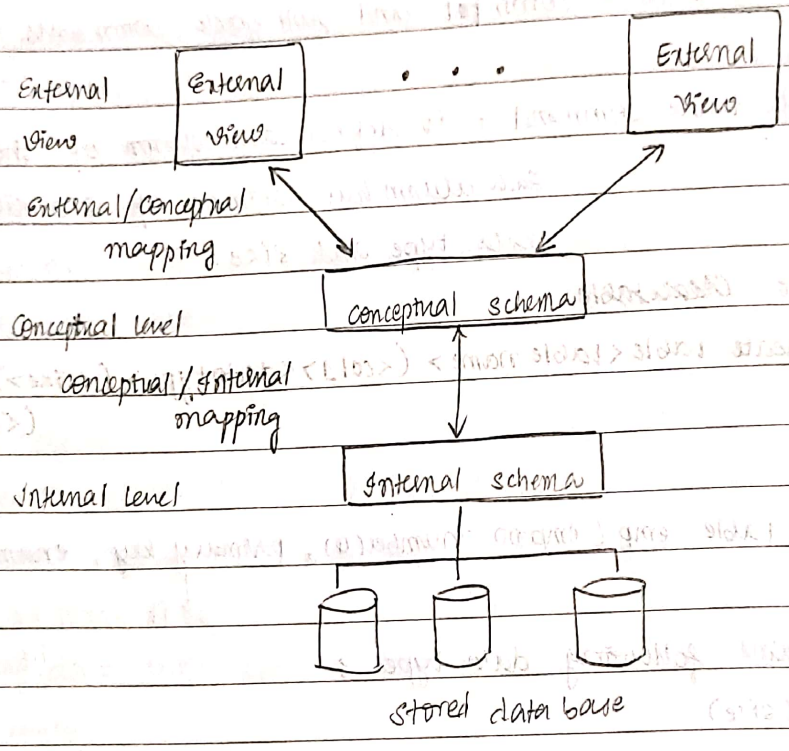
(ii) Support of multiple views of the data.

DBMS schemas at three levels:

(i) Internal schema - describe physical storage structures & access paths

(ii) conceptual schema - describe the structure and constraints for the whole database.

(iii) external schema - describe the various user views.



29/10/24 Data independence:

(i) logical data independence - capacity to change conceptual schema without having to change the external schemas

(ii) Physical data independence
- capacity to change the internal schema without having to change the conceptual schema

* When a schema at a lower level is changed, only the mapping between this schema and higher level should be modified.

DBMS languages :

(i) Data Definition language (DDL) – (create, alter, drop commands)

(ii) Data manipulation language (DML) – (insert, delete, update commands)

a) High level or Non-procedural languages : These include the relational language SQL. (Also called as declarative languages.)

b) Low level or Procedural languages

Different types of commands in SQL :

1) DDL commands - to create a database objects
2) DML commands - to manipulate data of a database objects.
3) DQL commands - to retrieve the data from a database (select command)
4) DCL/DTL commands - commit and roll back commands

* The create table command : it defines each column of the table uniquely. Each column has minimum of 3 attributes, a name, data type and size.

Syntax : Create table

Create table <table name> (<col1> <datatype> (<size>), <col2> <datatype> (<size>));

Example :

Create table emp (empno number(4) primary key, ename char (10));

* it cannot be duplicated i.e., no 2 emp can have same empno

SQL contains following data types :

1) char (size)
2) varchar2 (size)
3) integer
4) float
5) date
6) number (p, s)
7) long
8) raw / long raw.

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Modifying the structure of tables.

a) add new columns

Syntax: Alter table <tablename> add(<new col> <datatype (size)>,
<new col> datatype(size));

Example: alter table emp add (sal number(7,2));

b) Dropping a column from a table

Syntax: Alter table <tablename> drop column <col>;

Example: alter table emp drop column sal;

c) Modifying existing columns

Syntax: Alter table <tablename> modify (<col> <new datatype> (<newsize>));

Example: alter table emp modify (empname varchar2(15));

d) Renaming the tables

Syntax: Rename <old table> to <new table>;

Example: rename emp to emp1;

e) Destroying tables

Syntax: Drop table <tablename>;

Example: drop table emp;

Inserting data into Tables: loading data into the table once it is created

syntax: insert into <tablename> (<col1>, <col2>) values (<exp>, <exp>);

Example: insert into emp values (1, 'xyz', 10,000);

Delete operations

a) remove all rows

Syntax: delete from <tablename>;

Example: delete from emp;

To modify look into syntax of update

update tablename set ADDRESS = new address where EMPNO = 1

b) Removal of a specified row/s

Syntax : delete from <tablename> where <condition> ;

Example : delete from emp where empno = 5 ;

5) Viewing data in the tables (DML commands) :

a) all rows and all columns :

Syntax : Select <col> to <col n> from tablename ;

Select * from tabname ; * - all attributes.

Syntax

b) selected columns and all rows :

syntax : select <col1>, <col2> from <tabname> ;

c) selected rows and all columns :

syntax : select * from <tablename> where <condition> ;

d) selected columns and selected rows :

syntax : select <col1>, <col2> from <tablename> where <condition> ;

e) updating all rows :

syntax : Update <tablename> set <col> = <exp>, <col> = <exp> ;

f) updating selected records :

syntax : Update <tablename> set <col> = <exp>, <col> = <exp> where <condition> ;

DBMS interface :

1) Stand-alone query language interface
2) Programmer interface
3) Mobile interface