

→ Data Redundancy issue is solved by storing data in separate linked tables, which reduces duplication.

→ Data inconsistency is solved by storing most items of data only once, allowing updated items to be seen by all apps.

→ There is more than one way to organize data, not just tables.

GRAPHS are other option.

Q) What kind of Security Measures?

- using usernames & passwords to prevent unauthorized access to DB.
- encryption of data stored
- using access rights to manage actions authorized users can take.

→ DBMS uses data dictionary to store metadata, including definition of tables, attributes, relationships b/w tables & any indexing.

→ improves integrity of data stored, helping to ensure that it is accurate, complete and consistent.

→ using access rights to manage the parts of database they have access to.

→ keep data BACKED UP

MORE

A. Backup refers to process of creating a duplicate copy of data or files to ensure that they can be restored in case of accidental deletion, corruption, hardware failure. Primary purpose is to safeguard against loss.

B. Access rights controls who can access, view, modify & manage data. They ensure that only authorized users can perform certain operations.

METADATA refers to data that describes the characteristics, properties & attributes of the data stored in database.

- ↳ table definition
- ↳ relationships
- ↳ views
- ↳ data dictionary

* The database system consults DATA DICTIONARY before reading or modifying actual data.

- * Data Redundancy :- Storage space is wasted because data is duplicated.
- * Data can be altered by one application & not others, it becomes inconsistent.

Limitations of File-Based Approach

- Data Redundancy ✓ → stores data in several files
- Data inconsistency ✓ → suitable for very small applications
- Data integrity ✓
- Automatic updates
- Security problems.

→ Why database approach is beneficial?

- storage space not wasted as data stored once, no data redundant.
- data altered in one application is available in another application.
- enquiries available are not dependent on structure of the data & software.

What is Data Redundancy?

- where you store data many times.
- repeated data

Database is an organized collection of structured information, what is the solution to it? or data typically stored electronically.

→ create a relational database or storing data in separate linked tables.

Relational Database

- use two or more tables linked together (to form relationship)
- do not store all data in same table.
- repeated data is moved into its own table.

Relational Model

- ↳ each table has multiple columns, an
- ↳ tables are known as relations.
- ↳ uses collection of tables to represent relationships

→ the relational model uses a collection of tables to represent both data & the relationships among those data.

→ The entry of new data, storage of data, the alteration & deletion are managed by DBMS.

Why is it called "relational" model?

- * relation b/w two sets is a collection of pairs (2-tuples) containing one object from each set. & so on...

* relation is a set of tuples.

Application Program Interface \rightarrow ODBC/JDBC.

- it not properly managed, data is a waste incase it's database can be used.

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- Database Management System (DBMS)** is a collection of
- interrelated, integrated data
 - a set of programs that allow users to access & modify those data.

Primary goal is to provide a way to store & retrieve information that is both

- ① Convenient ② Efficient

Purpose:- manage collections of data that are

- ① Highly valuable
- ② Relatively large
- ③ Accessed by multiple users at same time.

why focus on DBMS Interface?

- \rightarrow already been around for decades.
- \rightarrow tested & trusted
- \rightarrow writing code from scratch is time consuming & prone to errors.
- \rightarrow abstracted such that not many bitty details needed.

* Application programs generally access databases through

airlines

manufacturing

- ① Language extensions to allow embedded SQL.

telecommunication

EXAMPLES

\rightarrow banking & finance

- ② Application program interface navigation which allow SQL queries to be sent to DB.

systems, universities

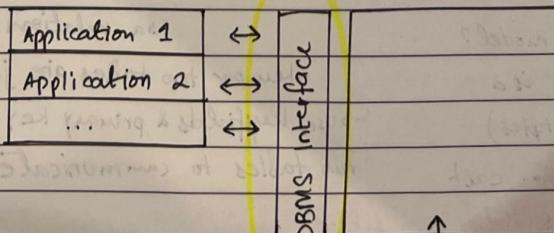
What should be DBMS Interface?

"We are looking to organize

data"

\rightarrow tables

\rightarrow trees

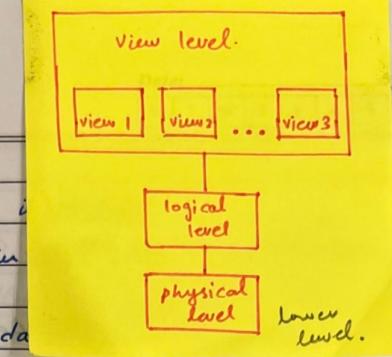


Disadvantages

- data migration from different sources into DB system can be complex & time consuming
- if not properly managed, data in database can be come inconsistent.

Levels of Abstraction

- **Physical level:** describes how data is stored in DB
- **Logical level:** what data is stored in DB among them.
- **View level:** describes part of data



department (dept-name, id, building)

Logical Schema: → overall logical structure of DB → describing data

Instance: → actual content of database at a particular point in time

(DML) Data Manipulation Lang ← LANGUAGES

- used to retrieve / manipulate data.

Data Definition Language (DDL)

- used to define the Database

* for RELATIONAL DATABASE,

most popular language is Structured

Query Language (SQL).

* SQL vs C/C++

↳ SQL focus on describing desired outcome rather than step by step process

↳ C/C++ requires code to perform task. Complex

Structured Query Language (SQL)

→ time consuming.
→ SQL easier for user to interact.

→ standard to access/retrieve/manipulate data in relational database.

create table department

(dept-name char(20),

building char(15),

budget numeric(12, 2));

} Example of DDL

→ Physical Schema: describes the database design at physical level. changed without affecting program.

→ Logical Schema: describes the database design at the logical level.

→ Subschemas: describes different views of database.

select instructor.name
 from instructor
 where instructor.dept_name = 'History';

→ Data Security
 ↳ ensuring that only authorized users have access to data.
 ↳ without proper access control, unauthorized users may gain access to data.

→ Data Integrity
 ↳ enforcing rules & constraints to maintain accuracy
 ↳ without it, database could contain inaccurate data.

Database Design

and etc ...

- developed to meet the needs of an enterprise / business.
- design to complete database application requires attention to broad set of issues.
- what data to store → what should be user interface
- what should be architecture of the application.

Data Model.

(another term of interface) → table based data model

→ graph based data model.

- collection of conceptual tools for describing data, data relationships, data semantics & consistency constraints.

	A	B	C
relation (table is R relation)			

→ attribute.

→ tuple

→ does order of tuple matter?

→ does not matter (row)
 → order of column technically matters.

* Do the attributes have to have a unique value?

Yes, atleast one have to have unique value.

* Can rows be duplicated in table?

No, row is tuple & table is set and sets are UNIQUE

* even if you delete any value it is still NULL.

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Properties of Attributes.

- for each attribute of relation, there is a set of permitted values called domain.
- For all relations, domains of all attributes must be atomic.
- A domain is atomic if elements of the domain are considered to be indivisible units.
- The null value is a special value that signifies that the value is unknown or does not exist.

* constraints are specified through schema keys

superkeys

Foreign Keys

candidate Keys

KEYS

Primary Key

Superkeys.

It is a set of one or more attributes such that no two distinct tuples can have same values on all attributes in set K.
* two rows or the chosen super keys cannot have same value.

Constraints on the tuples in a relational model are dictated by the rules/constraints of the real-world enterprise/business being modeled.

for establishing & maintaining
Data life & it's value

transparent
care? Say No to JellyCode!

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Candidate Keys

- a superkey may contain extraneous attributes.
- such minimal superkeys are called candidate key.
- every candidate key is a superkey. (smallest superkey possible)

Primary Key

- one of the keys chosen as principle means of identifying tuples within a relation.
- it has to be a candidate key before being called Primary Key.

Foreign Key

- a foreign key is a set of attributes in one table that refer to the primary key in another table.
- the reference (existing value) in another ~~table~~ must be PK of that table. * Are foreign keys also primary key?

Database Application Design

The task of creating database application

→ design of database schema

→ design of programs that access

→ design of security scheme to control

→ design of the user interface of

① Gathering Data & Analysing

② Database Design & Defining Schema

③ DBMS Implementation

④ Data Population

⑤ Security Control

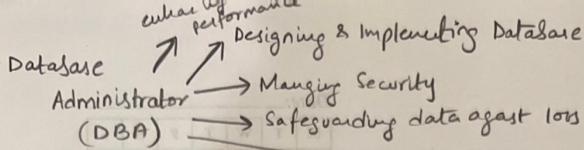
⑥ Testing.

TASK: Application to manage data about faculty.

→ we have to decide what tables to store.

→ which attributes to use?

→ define logical schema



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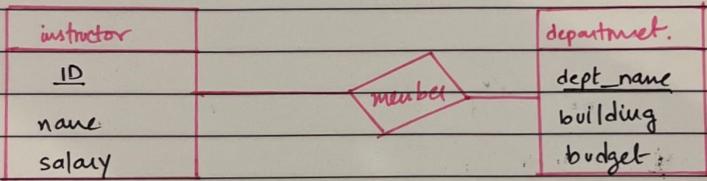
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Schema Diagram.

→ used to depict a database schema along with Primary Key and foreign key dependencies.

Schema Design.

- ① Identify tables
- ② Identify columns /Attributes associated with each table.
- ③ Identify Primary Keys.
- ④ Identify relationships among tables through Foreign Keys.



→ entity sets are represented by a rectangular box with the entity set name in the header & attributes listed below.

→ relationships sets are represented by a diamond connecting a pair of related entity sets. The name of relationship is placed inside diamond.

Web Search Query vs Database Query

→ Web Search Queries are in natural language while database queries use structured languages like SQL. Database queries are more precise & require understanding of database systems.