UNIT 1: Introduction

What is Database

The database is a collection of inter-related data which is used to retrieve, insert and delete the data efficiently. It is also used to organize the data in the form of a table, schema, views, and reports, etc.

For example: The college Database organizes the data about the admin, staff, students and faculty etc.

Using the database, you can easily retrieve, insert, and delete the information.

Database Management System

- o Database management system is a software which is used to manage the database. For example: *MySQL*, *Oracle*, etc are a very popular commercial database which is used in different applications.

- o DBMS provides an interface to perform various operations like database creation, storing data in it, updating data, creating a table in the database and a lot more.

- o It provides protection and security to the database. In the case of multiple users, it also maintains data consistency.

DBMS allows users the following tasks:

- o Data Definition: It is used for creation, modification, and removal of definition that defines the organization of data in the database.

- o Data Updation: It is used for the insertion, modification, and deletion of the actual data in the database.

- o Data Retrieval: It is used to retrieve the data from the database which can be used by applications for various purposes.

- User Administration: It is used for registering and monitoring users, maintain data integrity, enforcing data security, dealing with concurrency control, monitoring performance and recovering information corrupted by unexpected failure.

Characteristics of DBMS

- It uses a digital repository established on a server to store and manage the information.
- It can provide a clear and logical view of the process that manipulates data.
- DBMS contains automatic backup and recovery procedures.
- It contains ACID properties which maintain data in a healthy state in case of failure.
- It can reduce the complex relationship between data.
- It is used to support manipulation and processing of data.
- It is used to provide security of data.
- It can view the database from different viewpoints according to the requirements of the user.

Advantages of DBMS

- Controls database redundancy: It can control data redundancy because it stores all the data in one single database file and that recorded data is placed in the database.
- Data sharing: In DBMS, the authorized users of an organization can share the data among multiple users.
- Easily Maintenance: It can be easily maintainable due to the centralized nature of the database system.
- Reduce time: It reduces development time and maintenance need.
- Backup: It provides backup and recovery subsystems which create automatic backup of data from *hardware* and *software* failures and restores the data if required.
- multiple user interface: It provides different types of user interfaces like graphical user interfaces, application program interfaces

Disadvantages of DBMS

- Cost of Hardware and Software: It requires a high speed of data processor and large memory size to run DBMS software.

- Size: It occupies a large space of disks and large memory to run them efficiently.
- Complexity: Database system creates additional complexity and requirements.
- Higher impact of failure: Failure is highly impacted the database because in most of the organization, all the data stored in a single database and if the database is damaged due to electric failure or database corruption then the data may be lost forever.

Characteristics of Data in a Database

The data in the database possess several characteristics data in the database are consistent, integral, non redundant, secured, centrally managed and shared among multiple applications. There are sever advantages of using database approach, such as the following:

- Single repository of data is maintained
- All users access the data from the same resource
- Quick retrieval of data
- Reduce application development time
- Flexibility in change of database structure
- Enforce standardization
- Up-to-date information availability
- Authorized access security of data
- Enforce integrity constraints and business rules
- Provide backup and recovery procedure

Significance of Database Management System

The database management system has various focal points when contrasted with conventional PC record based preparing approach. The DBA must remember these advantages or capacities amid databases and observing the DBMS.

The Main focal points of DBMS are depicted beneath.

Controlling Data Redundancy

In non-database systems every application program has its own private records. For this situation, the copied duplicates of similar data is made in many spots. In DBMS, all data of an association is coordinated into a solitary database document. The data is recorded in just a single place in the database and it is not copied.

Sharing of Data

In *DBMS*, data can be shared by approved clients of the association. The database chairman manages the data and offers rights to clients to get to the data. Numerous clients can be approved to get to a similar snippet of data at the same time. The remote clients can likewise share same data. So also, the data of same database can be shared between various application programs.

Data Consistency

By controlling the data excess, the data consistency is gotten. In the event that a data thing seems just once, any refresh to its esteem must be performed just once and the refreshed esteem is promptly accessible to

all clients. On the off chance that the DBMS has controlled repetition, the database system implements consistency.

Integration Constraints

Trustworthiness limitations or consistency principles can be connected to database so that the right data can be gone into database. The limitations might be connected to data thing inside a solitary record or the might be connected to connections between records.
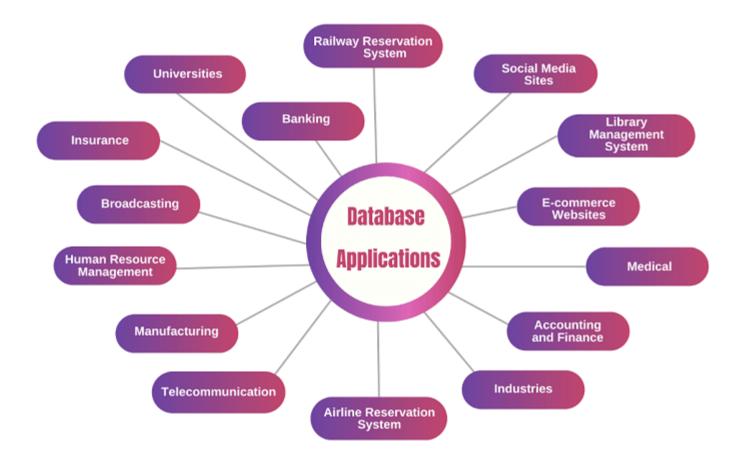
Data Security

A shape is a critical object of DBMS. You can make frames effectively and rapidly in DBMS. Once a shape is made, it can be utilized commonly and it can be adjusted effectively. The made structures are additionally spared alongside database and carry on like a product segment. A frame gives a simple way (easy to understand) to enter data into the database, alter data and show data from the database. The non-technical clients can likewise perform different operations on the database through structures without going into technical subtle elements of a database.

Database Applications

Nowadays, any business that has small or large amounts of data needs a database to store and manage the information. The database is an easy, reliable, secure, and efficient way to maintain business information. There are many applications where databases are used.

In this article, we will discuss some of the applications of databases, which are mentioned below:

1. Universities:

It is an undeniable application of the database. Universities have so much data which can be stored in the database, such as student information, teacher information, non-teaching staff information, course information, section information, grade report information, and many more. University information is kept safe and secure in the database.

Anyone who needs information about the student, teacher, or course can easily retrieve it from the database. Everything needs to be maintained because even after ten years, information may be required, and the information may be useful, so maintaining complete information is the primary responsibility of any university or educational institution.

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2. Banking:

It is one of the major applications of databases. Banks have a huge amount of data as millions of people have accounts that need to be maintained properly. The database keeps the record of each user in a systematic manner. Banking databases store a lot of information about account holders. It stores customer details, asset details, banking transactions, balance sheets, credit card

and debit card details, loans, fixed deposits, and much more. Everything is maintained with the help of a database.

3. Railway Reservation System:

It is an inevitable area of application of databases. They store information such as passenger name, mobile number, booking status, reservation details, train schedule, employee information, account details, seating arrangement, route & alternate route details, etc. All the information needs to be maintained, so railways use a database management system for their efficient storage and retrieval purpose.

4. Social Media Sites:

Nowadays, everyone has a smartphone and accounts on various social media sites like Facebook, LinkedIn, Pinterest, Twitter, Instagram, etc. People can chat with their friends and family and make new friends from all over the world. Social media has millions of accounts, which means they have a huge amount of data that needs to be stored and maintained. Social media sites use databases to store information about users, images, videos, chats, etc.

5. Library Management System:

There are hundreds and thousands of books in the library, so it is not easy to maintain the records of the books in a register or diary, so a database management system is used which maintains the information of the library efficiently. The library database stores information like book name, issue date, author name, book availability, book issuer name, book return details, etc.

6. E-commerce Websites:

E-commerce websites are one of the prominent applications of the database. Websites such as Flipkart, Myntra, Amazon, Nykaa, Snapdeal, Shopify, and many more, are online shopping websites where people buy items online. These websites have so much data. These websites use databases to securely store and maintain customer details, product details, dealer details, purchase details, bank & card details, transactions details, invoice details, etc. You can analyze the sales and maintain the inventory with the help of a database.

7. Medical:

There is a lot of important data collection in the medical field, so it is necessary to use the database to store data related to the medical field, such as patient details, medicine details, practitioner details, surgeon details, appointment details, doctor schedule, patient discharge details, payment detail, invoices, and other medical records. The database management system is a boon for the medical field because it helps doctors to monitor their patients and provide better care.

8. Accounting and Finance:

When there is big data regarding accounting and finance, there is a need to maintain a large amount of data, which is done with the help of a database. The database stores data such as

accounting details, bank details, purchases of stocks, invoice details, sales records, asset details, etc. Accounting and finance database helps in maintaining and analyzing historical data.

9. Industries:

The database management system is the main priority of industries because they need to store huge amounts of data. The industry database stores customer details, sales records, product lists, transactions, etc. All the information is kept secure and maintained by the database.

10. Airline Reservation System:

It is one of the applications of database management systems that contain data such as passenger name, passenger check-in, passenger departure, flight schedule, number of flights, distance from source to destination, reservation information, pilot details, accounting detail, route detail, etc. The database provides maintenance and security to airline data.

11. Telecommunication:

We cannot deny that telecommunication has brought a remarkable revolution worldwide. The Telecom field has huge data, and it is very difficult to manage big data without a database; that is why a telecom database is required, which stores data such as customer names, phone numbers, calling details, prepaid & post-paid connection records, network usage, bill details, balance details, etc.

12. Manufacturing:

In the manufacturing field, a lot of data needs to be maintained regarding supply chain management, so the database maintains the data such as product details, customer information, order details, purchase details, payment info, worker's details, invoice, etc. Manufacturing companies produce and supply products every day, so it is important to use a database.

13. Human Resource Management:

Any organization will definitely have employees, and if there are a large number of employees, then it becomes essential to store data in a database as it maintains and securely saves the data, which can be retrieved and accessed when required. The human resource database stores data such as employee name, joining details, designation, salary details, tax information, benefits & goodies details, etc.

14. Broadcasting:

Broadcasting is distributing video and audio content to a dispersed audience by television, radio, or other means. Broadcasting database stores data such as subscriber information, event recordings, event schedules, etc., so it becomes important to store broadcasting data in the database.

15. Insurance:

An insurance company needs a database to store large amounts of data. Insurance database stores data such as policy details, user details, buyer details, payment details, nominee details, address details, etc.

Data Independence

- o Data independence can be explained using the three-schema architecture.
- o Data independence refers characteristic of being able to modify the schema at one level of the database system without altering the schema at the next higher level.

There are two types of data independence:

1. Logical Data Independence

- o Logical data independence refers characteristic of being able to change the conceptual schema without having to change the external schema.
- o Logical data independence is used to separate the external level from the conceptual view.
- o If we do any changes in the conceptual view of the data, then the user view of the data would not be affected.
- o Logical data independence occurs at the user interface level.

2. Physical Data Independence

- o Physical data independence can be defined as the capacity to change the internal schema without having to change the conceptual schema.
- o If we do any changes in the storage size of the database system server, then the Conceptual structure of the database will not be affected.
- o Physical data independence is used to separate conceptual levels from the internal levels.
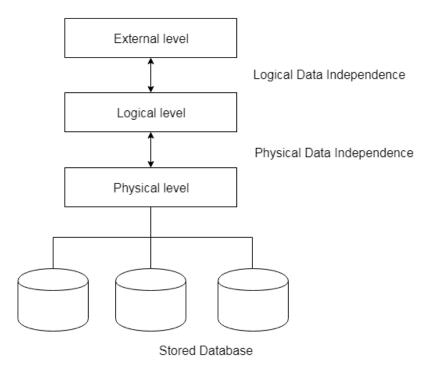- o Physical data independence occurs at the logical interface level.

Fig: Data Independence

RDBMS and DBMS

Database Management System (DBMS) is a software that is used to define, create and maintain a database and provides controlled access to the data.

Why DBMS Required?

Database management system, as the name suggest, is a management system which is used to manage the entire flow of data, i.e, insertion of data or the retrieval of data, how the data is inserted into the database or how fast the data should be retrieved, so DBMS takes care of all these features, as it maintains the uniformity of the database as well does the faster insertions as well as retrievals.

Why RDBMS Required?

RDBMS on the other hand is a type of DBMS, as the name suggest it deals with relations as well as various key constraints. So here we have tables which is called as schema and we have rows which are called as tuples. It also aids in the reduction of data redundancy and the preservation of database integrity.

Relational Database Management System is an advanced version of a DBMS.

DBMS	RDBMS
DBMS stores data as file.	*RDBMS* stores data in tabular form.
Data elements need to access individually.	Multiple data elements can be accessed at the same time.
No relationship between data.	Data is stored in the form of tables which are related to each other.
Normalization is not present.	Normalization is present.
DBMS does not support distributed database.	RDBMS supports distributed database.
It stores data in either a navigational or hierarchical form.	It uses a tabular structure where the headers are the column names, and the rows contain corresponding values.
It deals with small quantity of data.	It deals with large amount of data.
Data redundancy is common in this model.	Keys and indexes do not allow Data redundancy.
It is used for small organization and deal with small data.	It is used to handle large amount of data.

DBMS	RDBMS
Not all Codd rules are satisfied.	All 12 Codd rules are satisfied.
Security is less	More security measures provided.
It supports single user.	It supports multiple users.
Data fetching is slower for the large amount of data.	Data fetching is fast because of relational approach.
The data in a DBMS is subject to low security levels with regards to data manipulation.	There exists multiple levels of data security in a RDBMS.
Low software and hardware necessities.	Higher software and hardware necessities.
Examples: *XML*, Window Registry, Forxpro, dbaseIIIplus etc.	Examples: *MySQL*, *PostgreSQL*, SQL Server, Oracle, Microsoft Access etc.

Conclusion

Hence, it can be deduced that the administration system for databases is a software that oversees diverse operations like the technique of information input, the rapidity of information acquisition, and the capability to manage diverse categories of information encompassing structured, semi-structured, and unstructured. It is beneficial when dealing with a limited quantity of data. Alternatively, a relational database pertains to a database that manages organised data. It comprises of distinct elements such as tuples (also known as rows) and schema (also known as tables). It stores data in a tabular form and establishes relationships between tables through key constraints. This type of database is beneficial when handling vast quantities of data.