Lab Work 1

What is DBMS?

Database Management Systems (DBMS) are software systems used to store, retrieve, and run queries on data. A DBMS serves as an interface between an end-user and a database, allowing users to create, read, update, and delete data in the database.

DBMS manage the data, the database engine, and the database schema, allowing for data to be manipulated or extracted by users and other programs. This helps provide data security, data integrity, concurrency, and uniform data administration procedures.

DBMS optimizes the organization of data by following a database schema design technique called normalization, which splits a large table into smaller tables when any of its attributes have redundancy in values. DBMS offer many benefits over traditional file systems, including flexibility and a more complex backup system.

Examples of DBMS

There is a wide range of database software solutions, including both enterprise and open source solutions, available for database management.

Here are some of the most popular database management systems:

### **Oracle**

Oracle Database is a commercial relational database management system. It utilizes enterprise-scale database technology with a robust set of features right out of the box. It can be stored in the cloud or on-premises.

### **MySQL**

MySQL is a relational database management system that is commonly used with open-source content management systems and large platforms like Facebook, Twitter, and Youtube.

### **SQL Server**

Developed by Microsoft, SQL Server is a relational database management system built on top of structured query language (SQL), a standardized programming language that allows database administrators to manage databases and query data.

### **MongoDB**

MongoDB is a**cross-platform NoSQL database**, written in C, C++, and JavaScript. It is a high-speed database where data is stored in the form of JSON-style documents. You can use this database for building mobile apps, real-time analytics, IoT, etc. MongoDB handles document data to avoid challenges in loading and accessing data into RDBMS using OOPs. Being a scalable and flexible database platform overcoming the relational database approach.

### **SQLite**

SQLite is an **open-source, lightweight database management system**, written in C. It implements a self-contained, zero-configuration, serverless, and transactional SQL database engine. It has an integrated RDBMS and the tool's engine is highly reliable and self-contained.

### **Difference Between DBMS and RDBMS**

|  |  |
| --- | --- |
| [DBMS](https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/) stores data as file. | [RDBMS](https://www.geeksforgeeks.org/rdbms-architecture/) 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. |
| 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](https://www.geeksforgeeks.org/xml-basics/), Window Registry, Forxpro, | Examples: [MySQL](https://www.geeksforgeeks.org/architecture-of-mysql/), [PostgreSQL](https://www.geeksforgeeks.org/what-is-postgresql-introduction/), [SQL](https://www.geeksforgeeks.org/what-is-sql/) Server, Oracle, Microsoft Access etc. |

### **Distributed database management system**

A distributed DBMS is a set of logically interrelated databases distributed over a network that is managed by a centralized database application. This type of DBMS synchronizes data periodically and ensures that any change to data is universally updated in the database.

### **Hierarchical database management system**

Hierarchical databases organize model data in a tree-like structure. Data storage is either a top-down or bottom-up format and is represented using a parent-child relationship.

### **Network database management system**

The network database model addresses the need for more complex relationships by allowing each child to have multiple parents. Entities are organized in a graph that can be accessed through several paths.

### **Relational database management system**

Relational database management systems (RDBMS) are the most popular data model because of its user-friendly interface. It is based on normalizing data in the rows and columns of the tables. This is a viable option when you need a data storage system that is scalable, flexible, and able to manage lots of information.

### **Object-oriented database management system**

Object-oriented models store data in objects instead of rows and columns. It is based on object-oriented programming (OOP) that allows objects to have members such as fields, properties, and methods.

**Key Features of DBMS**

* Data modeling: A DBMS provides tools for creating and modifying data models, which define the structure and relationships of the data in a database.
* Data storage and retrieval: A DBMS is responsible for storing and retrieving data from• the database, and can provide various methods for searching and querying the data.
* Concurrency control: A DBMS provides mechanisms for controlling concurrent access to the database, to ensure that multiple users can access the data without conflicting with each other.
* Data integrity and security: A DBMS provides tools for enforcing data integrity and security constraints, such as constraints on the values of data and access controls that restrict who can access the data.
* Backup and recovery: A DBMS provides mechanisms for backing up and recovering the data in the event of a system failure.
* DBMS can be classified into two types: Relational Database Management System (RDBMS) and Non-Relational Database Management System (NoSQL or Non-SQL)
* RDBMS: Data is organized in the form of tables and each table has a set of rows and columns. The data are related to each other through primary and foreign keys.
* NoSQL: Data is organized in the form of key-value pairs, documents, graphs, or column based. These are designed to handle large-scale, high-performance scenarios.

**Applications of DBMS**

* Enterprise Information: Sales, accounting, human resources, Manufacturing, online retailers.
* Banking and Finance Sector: Banks maintaining the customer details, accounts, loans, banking transactions, credit card transactions. Finance: Storing the information about sales and holdings, purchasing of financial stocks and bonds.
* University: Maintaining the information about student course enrolled information, student grades, staff roles.
* Airlines: Reservations and schedules.
* Telecommunications: Prepaid, postpaid bills maintance.

**What is MySQL**

MySQL is the world’s most popular open source database. According to DB-Engines, MySQL ranks as the second-most-popular database, behind Oracle Database. MySQL powers many of the most accessed applications, including Facebook, Twitter, Netflix, Uber, Airbnb, Shopify, and Booking.com. Since MySQL is open source, it includes numerous features developed in close cooperation with users over more than 25 years. So it’s very likely that your favorite application or programming language is supported by MySQL Database. How do you pronounce “MySQL”? “My ess-cue-el” is the “official” way to pronounce “MySQL,” but pronouncing it “my sequel” is common too.

**MySQL Benefits**

MySQL’s key benefits include

* Ease of use: Developers can install MySQL in minutes, and the database is easy to manage.
* Reliability: MySQL is one of the most mature and widely used databases. It has been tested in a wide variety of scenarios for more than 25 years, including by many of the world’s largest companies. Organizations depend on MySQL to run business-critical applications because of its reliability.
* Scalability: MySQL scales to meet the demands of the most accessed applications. MySQL’s native replication architecture enables organizations such as Facebook to scale applications to support billions of users.
* Performance: MySQL HeatWave is faster and less expensive as demonstrated by multiple standard industry benchmarks, including TPC-H, TPC-DS, and CH-benCHmark
* High availability: MySQL delivers a complete set of native, fully integrated replication technologies for high availability and disaster recovery. For business-critical applications, and to meet service-level agreement commitments, customers can achieve Recovery point objective = 0 (zero data loss) Recovery time objective = seconds (automatic failover)