**Acropolis Institute Of Technology And Research,**

**Indore(M.P.)**

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**Subject – Database Management System (DBMS)**

**(CY-405)**

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**Enrollment No. – 0827EC221022**

**Branch - CS(Cyber Security)**

**Semester- 4th (2nd year)**

**Submitted To –Mrs. Nidhi Nigam Ma’am**

**Index**

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| **Sr.No.** | **Experiment** | **Date of Exp.** | **Date of sub.** | **Grade** |
| 1. | To study DBMS and RDBMS, its characteristic comparisons and study of popular DB software. | 11/03/24 | 18/03/24 |  |
| 2. | Study of MySQL, Features of MySQL, Installation steps. | 18/3/24 | 1/4/2024 |  |
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Name: Harshit Nagar

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Experiment-1  
Aim:- To study DBMS and RDBMS, its characteristic comparisons and study of popular DB software

**Study Of Database Management System(DBMS):-**

DBMS is a software that permits the creation, employer, and control of databases. It provides a fixed set of equipment and capabilities to save, retrieve, alter, and delete information in an established way. DBMS gives a convenient manner to address massive volumes of information by way of presenting an interface between customers or programs and the underlying database.

## 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.

TYPES OF DBMS...

There are various types of databases used for storing different varieties of data:



## 1) Centralized Database

It is the type of database that stores data at a centralized database system. It comforts the users to access the stored data from different locations through several applications. These applications contain the authentication process to let users access data securely. An example of a Centralized database can be Central Library that carries a central database of each library in a college/university.

## 2) Distributed Database

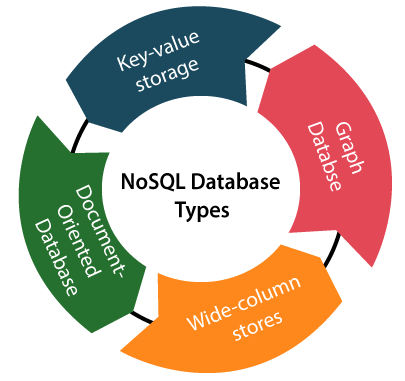
Unlike a centralized database system, in distributed systems, data is distributed among different database systems of an organization. These database systems are connected via communication links. Such links help the end-users to access the data easily. **Examples** of the Distributed database are Apache Cassandra, HBase, Ignite, etc.

## 3) Relational Database

This database is based on the relational data model, which stores data in the form of rows(tuple) and columns(attributes), and together forms a table(relation). A relational database uses SQL for storing, manipulating, as well as maintaining the data. E.F. Codd invented the database in 1970. Each table in the database carries a key that makes the data unique from others. **Examples** of Relational databases are MySQL, Microsoft SQL Server, Oracle, etc.

## 4) NoSQL Database

Non-SQL/Not Only SQL is a type of database that is used for storing a wide range of data sets. It is not a relational database as it stores data not only in tabular form but in several different ways. It came into existence when the demand for building modern applications increased. Thus, NoSQL presented a wide variety of database technologies in response to the demands. We can further divide a NoSQL database into the following four types:



## 5) Cloud Database

A type of database where data is stored in a virtual environment and executes over the cloud computing platform. It provides users with various cloud computing services (SaaS, PaaS, IaaS, etc.) for accessing the database. There are numerous cloud platforms, but the best options are:

* Amazon Web Services(AWS)
* Microsoft Azure
* Kamatera
* PhonixNAP
* ScienceSoft
* Google Cloud SQL, etc.

## 6) Object-oriented Databases

The type of database that uses the object-based data model approach for storing data in the database system. The data is represented and stored as objects which are similar to the objects used in the object-oriented programming language.

## 7) Hierarchical Databases

It is the type of database that stores data in the form of parent-children relationship nodes. Here, it organizes data in a tree-like structure.



Data get stored in the form of records that are connected via links. Each child record in the tree will contain only one parent. On the other hand, each parent record can have multiple child records.

## 8) Network Databases

It is the database that typically follows the network data model. Here, the representation of data is in the form of nodes connected via links between them. Unlike the hierarchical database, it allows each record to have multiple children and parent nodes to form a generalized graph structure.

EXAMPLE OF DBMS:

1. Oracle Database

### 2. MySQL Database

### 3. PostgreSQL Database

### 4. MongoDB

### 5. MS Access

### 6. Microsoft SQL Server and so on ......

What is MYSQL?

MySQL is the world’s most popular open source database. According to [DB-Engines](https://db-engines.com/en/ranking), MySQL ranks as the second-most-popular database, behind [Oracle Database](https://www.oracle.com/in/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 is a relational database management system**

[Databases](https://www.oracle.com/in/database/what-is-database/) are the essential data repository for all software applications. For example, whenever someone conducts a web search, logs in to an account, or completes a transaction, a database system is storing the information so it can be accessed in the future.

A [relational database](https://www.oracle.com/in/database/what-is-a-relational-database/) stores data in separate tables rather than putting all the data in one big storeroom. The database structure is organized into physical files optimized for speed. The logical data model, with objects such as data tables, views, rows, and columns, offers a flexible programming environment. You set up rules governing the relationships between different data fields, such as one to one, one to many, unique, required, or optional, and “pointers” between different tables. The database enforces these rules so that with a well-designed database your application never sees data that’s inconsistent, duplicated, orphaned, out of date, or missing.

The “SQL” part of “MySQL” stands for “Structured Query Language.” SQL is the most common standardized language used to access databases. Depending on your programming environment, you might enter SQL directly (for example, to generate reports), embed SQL statements into code written in another language, or use a language-specific API that hides the SQL syntax.

## **MySQL works in client/server or embedded systems**

MySQL Database is a client/server system that consists of a multithreaded SQL server that supports different back ends, several different client programs and libraries, administrative tools, and a wide range of application-programming interfaces (APIs). We also provide MySQL as an embedded multithreaded library that you can link into your application to get a smaller, faster, easier-to-manage standalone product.

IS MYSQL IS OPEN SOURCE ?

[Open source](https://developer.oracle.com/open-source/what-is-open-source/) means it’s possible for anyone to use and modify the software. Anybody can download MySQL software from the internet and use it without paying for it. You can also change its source code to suit your needs. MySQL software uses the [GNU General Public License](http://www.fsf.org/licenses/) (GPL) to define what you may and may not do with the software in different situations.

If you feel uncomfortable with the GNU GPL or need to embed MySQL code into a commercial application, you can buy a commercially licensed version from Oracle. See the [MySQL Licensing Information section](https://www.mysql.com/about/legal/) for more information.

**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)

**Security:** [Data security](https://www.oracle.com/in/security/database-security/what-is-data-security/) entails protection and compliance with industry and government regulations, including the European Union General Data Protection Regulation, the Payment Card Industry Data Security Standard, the Health Insurance Portability and Accountability Act, and the Defense Information Systems Agency’s Security Technical Implementation Guides. MySQL Enterprise Edition provides advanced security features, including authentication/authorization, transparent data encryption, auditing, data masking, and a database firewall.

**Flexibility:** The MySQL Document Store gives users maximum flexibility in developing traditional SQL and NoSQL schema-free database applications. Developers can mix and match relational data and JSON documents in the same database and application.

DIFFERENCE BETWEEN DBMS AND RDBMS

|  |  |
| --- | --- |
| **DBMS** | **RDBMS** |
| Data is stored in a database management system (DBMS) as a file | Tables are used to store information |
| Data is stored in a database management system (DBMS) in either a navigational or hierarchical format | RDBMS employs a tabular format, with column names as headers and associated data as rows |
| Only a single user is supported by the DBMS | It may be used by numerous people |
| The data in a typical database may not be stored according to the ACID model  This can lead to database discrepancies | Relational databases are more difficult to create, but they are more consistent and organised  They follow the rules of ACID (Atomicity, Consistency, Isolation, Durability) |
| It is an application that is used to manage databases over computer networks as well as the system hard drives | The database systems are used to keep track of the relationships between the tables |
| Software and hardware requirements are minimal | Higher hardware and software requirements are required |
| The integrity constraints are not supported by DBMS  At the file level, the integrity constraints are not imposed | At the schema level, RDBMS provides integrity restrictions  Values outside of a certain range cannot be stored in the RDBMS column |
| Normalization is not supported by DBMS. | A relational database management system (RDBMS) can be normalised. |
| Distributed databases are not supported by DBMS | Distributed databases are supported by RBMS |
| The DBMS system is mostly used to manage tiny amounts of data | The RDBMS database is built to manage a vast volume of data |
| Dbms only meet seven of Dr E.F. Codd’s rules | Dbms meet 8 to 10 of Dr E.F. Codd’s rules |
| Client-server architecture is not supported by DBMS | Client-server architecture is supported by RDBMS |
| For complicated and vast amounts of data, data retrieval takes longer | Because of its relational methodology, data retrieval is quick |
| In this architecture, data redundancy is common | Data redundancy is not possible using keys and indexes |
| There is no correlation between the data | Data is kept in the form of tables that are linked together via foreign keys |
| There is no sense of safety | Multiple security levels are available. At the OS, command, and object levels, log files are produced |
| Individual data items must be accessed | SQL queries make it simple to retrieve data  At the same time, many data items can be accessed |
| A file system, XML, the Windows Registry, and other | MySQL, Oracle, SQL Server, and other RDBMS |

**LAB WORK 2**

Study of MySQL, Features of MySQL, Installation steps.

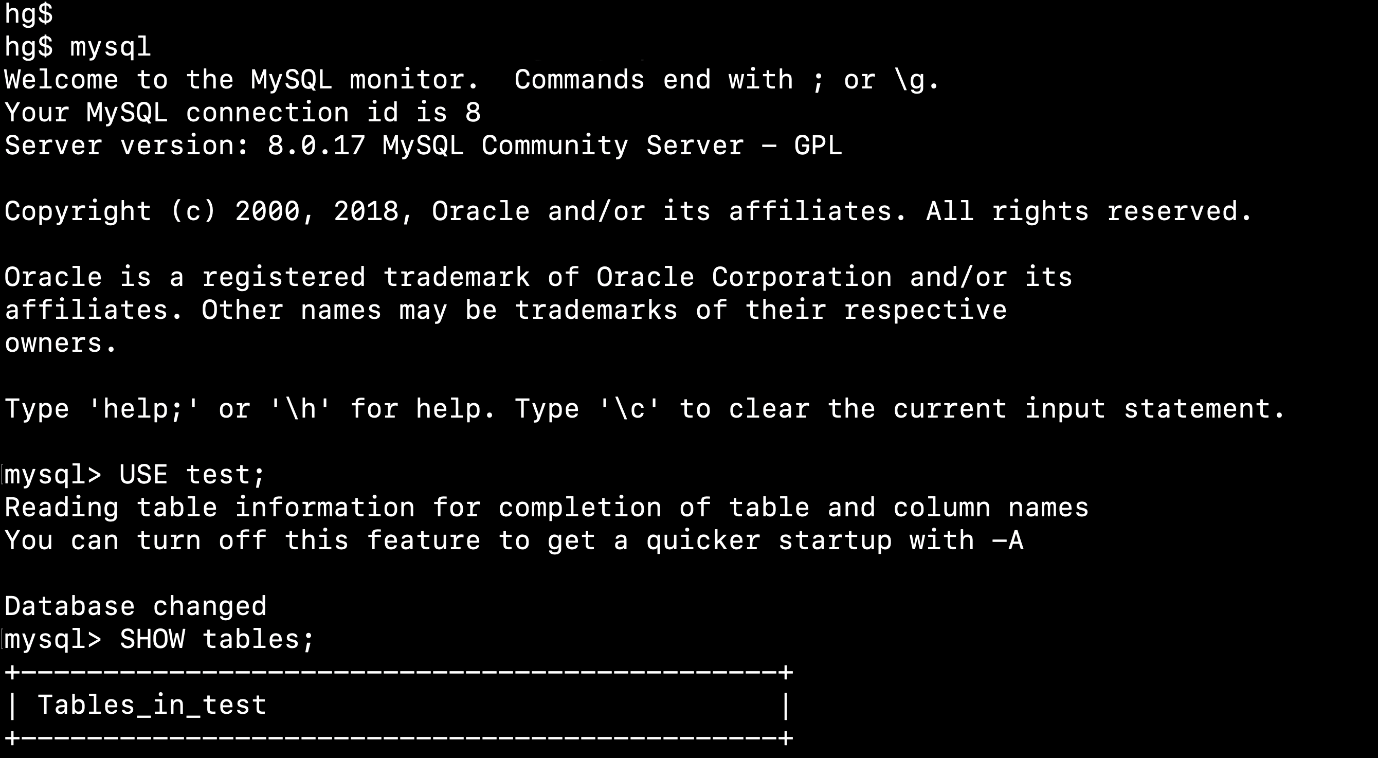
**MY SQL :**

MySQL  is an [open-source](https://en.wikipedia.org/wiki/Open-source_software) [relational database management system](https://en.wikipedia.org/wiki/Relational_database_management_system) (RDBMS). Its name is a combination of "My", the name of co-founder daughter My  and "SQL", the acronym for [Structured Query Language](https://en.wikipedia.org/wiki/Structured_Query_Language). A [relational database](https://en.wikipedia.org/wiki/Relational_database) organizes data into one or more data tables in which data may be related to each other; these relations help structure the data. SQL is a language that programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an [operating system](https://en.wikipedia.org/wiki/Operating_system) to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

MySQL is [free and open-source software](https://en.wikipedia.org/wiki/Free_and_open-source_software) under the terms of the [GNU General Public License](https://en.wikipedia.org/wiki/GNU_General_Public_License), and is also available under a variety of [proprietary](https://en.wikipedia.org/wiki/Proprietary_software) licenses. MySQL was owned and sponsored by the [Swedish](https://en.wikipedia.org/wiki/Sweden) company [MySQL AB](https://en.wikipedia.org/wiki/MySQL_AB), which was bought by [Sun Microsystems](https://en.wikipedia.org/wiki/Sun_Microsystems) (now [Oracle Corporation](https://en.wikipedia.org/wiki/Oracle_Corporation). In 2010, when [Oracle acquired Sun](https://en.wikipedia.org/wiki/Acquisition_of_Sun_Microsystems_by_Oracle_Corporation), Widenius [forked](https://en.wikipedia.org/wiki/Fork_(software_development)) the [open-source](https://en.wikipedia.org/wiki/Open-source) MySQL project to create [MariaDB](https://en.wikipedia.org/wiki/MariaDB).

MySQL has stand-alone clients that allow users to interact directly with a MySQL database using SQL, but more often, MySQL is used with other programs to implement applications that need relational database capability. MySQL is a component of the [LAMP](https://en.wikipedia.org/wiki/LAMP_(software_bundle)) [web application](https://en.wikipedia.org/wiki/Web_application) [software stack](https://en.wikipedia.org/wiki/Software_stack) (and [others](https://en.wikipedia.org/wiki/List_of_AMP_packages)), which is an acronym for [Linux](https://en.wikipedia.org/wiki/Linux), [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server), MySQL, [Perl](https://en.wikipedia.org/wiki/Perl)/[PHP](https://en.wikipedia.org/wiki/PHP)/[Python](https://en.wikipedia.org/wiki/Python_(programming_language)). MySQL is used by many database-driven web applications, including [Drupal](https://en.wikipedia.org/wiki/Drupal), [Joomla](https://en.wikipedia.org/wiki/Joomla), and [WordPress](https://en.wikipedia.org/wiki/WordPress).

SS of default my sql command:



STUDY OF MYSQL :

How MySQL Works?

MySQL follows the working of Client-Server Architecture. This model is designed for the end-users called clients to access the resources from a central computer known as a server using network services. Here, the clients make requests through a graphical user interface (GUI), and the server will give the desired output as soon as the instructions are matched. The process of MySQL environment is the same as the client-server model.



The core of the MySQL database is the MySQL Server. This server is available as a separate program and responsible for handling all the database instructions, statements, or commands. The working of MySQL database with MySQL Server are as follows:

1. MySQL creates a database that allows you to build many tables to store and manipulate data and defining the relationship between each table.
2. Clients make requests through the GUI screen or command prompt by using specific SQL expressions on MySQL.
3. Finally, the server application will respond with the requested expressions and produce the desired result on the client-side.

A client can use any MySQL [GUI](https://www.javatpoint.com/gui-full-form). But, it is making sure that your GUI should be lighter and user-friendly to make your data management activities faster and easier. Some of the most widely used MySQL GUIs are MySQL Workbench, SequelPro, DBVisualizer, and the Navicat DB Admin Tool. Some GUIs are commercial, while some are free with limited functionality, and some are only compatible with MacOS. Thus, you can choose the GUI according to your needs.

# **MySQL Features**

MySQL is a relational database management system (RDBMS) based on the SQL (Structured Query Language) queries. It is one of the most popular languages for accessing and managing the records in the table. MySQL is open-source and free software under the GNU license. Oracle Company supports it.

The following are the most important features of MySQL:

**Relational Database Management System (RDBMS)**

[MySQL](https://www.javatpoint.com/mysql-tutorial) is a relational database management system. This database language is based on the [SQL](https://www.javatpoint.com/sql-tutorial) queries to access and manage the records of the table.

**Easy to use**

MySQL is easy to use. We have to get only the basic knowledge of SQL. We can build and interact with MySQL by using only a few simple SQL statements.

**It is secure**

MySQL consists of a solid data security layer that protects sensitive data from intruders. Also, passwords are encrypted in MySQL.

**Client/ Server Architecture**

MySQL follows the working of a client/server architecture. There is a database server (MySQL) and arbitrarily many clients (application programs), which communicate with the server; that is, they can query data, save changes, etc.

**Free to download**

MySQL is free to use so that we can download it from MySQL official website without any cost.

**It is scalable**

MySQL supports multi-threading that makes it easily scalable. It can handle almost any amount of data, up to as much as 50 million rows or more. The default file size limit is about 4 GB. However, we can increase this number to a theoretical limit of 8 TB of data.

**Speed**

MySQL is considered one of the very fast database languages, backed by a large number of the benchmark test.

**High Flexibility**

MySQL supports a large number of embedded applications, which makes MySQL very flexible.

**Compatible on many operating systems**

MySQL is compatible to run on many operating systems, like Novell NetWare, Windows\* Linux\*, many varieties of UNIX\* (such as Sun\* Solaris\*, AIX, and DEC\* UNIX), OS/2, FreeBSD\*, and others. MySQL also provides a facility that the clients can run on the same computer as the server or on another computer (communication via a local network or the Internet).

**Allows roll-back**

MySQL allows transactions to be rolled back, commit, and crash recovery.

**Memory efficiency**

Its efficiency is high because it has a very low memory leakage problem.

**High Performance**

MySQL is faster, more reliable, and cheaper because of its unique storage engine architecture. It provides very high-performance results in comparison to other databases without losing an essential functionality of the software. It has fast loading utilities because of the different cache memory.

**High Productivity**

MySQL uses Triggers, Stored procedures, and views that allow the developer to give higher productivity.

**Platform Independent**

It can download, install, and execute on most of the available operating systems.

**Partitioning**

This feature improves the performance and provides fast management of the large database.

**GUI Support**

MySQL provides a unified visual database graphical user interface tool named "**MySQL Workbench**" to work with database architects, developers, and Database Administrators. [MySQL Workbench](https://www.javatpoint.com/mysql-workbench) provides SQL development, data modeling, data migration, and comprehensive administration tools for server configuration, user administration, backup, and many more. MySQL has a fully GUI supports from MySQL Server version 5.6 and higher.

**Dual Password Support**

MySQL version 8.0 provides support for dual passwords: one is the current password, and another is a secondary password, which allows us to transition to the new password.

### **Disadvantages/Drawback of MySQL**

Following are the few disadvantages of MySQL:

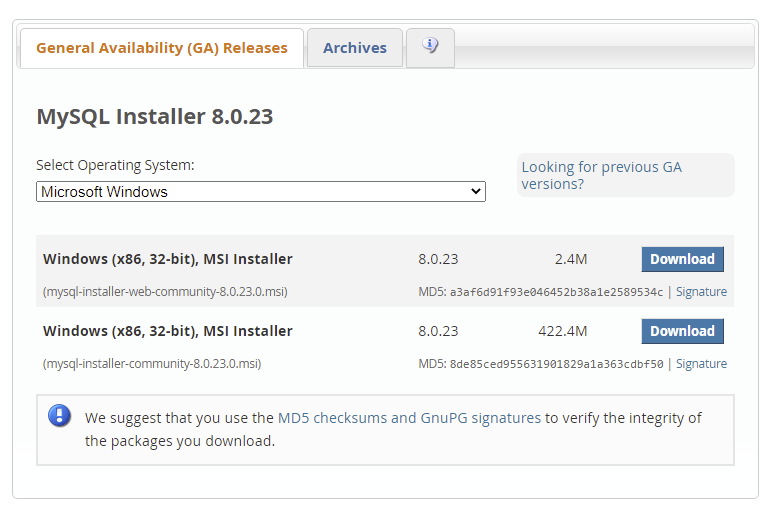
* MySQL version less than 5.0 doesn't support ROLE, COMMIT, and stored procedure.
* MySQL does not support a very large database size as efficiently.
* MySQL doesn't handle transactions very efficiently, and it is prone to data corruption.
* MySQL is accused that it doesn't have a good developing and debugging tool compared to paid databases.
* MySQL doesn't support SQL check constraints.

# **MySQL Installation on Windows:**

Here we will show you step by step how to install MySQL on the Windows platform using the MySQL Installer.

## Download MySQL

The simplest and recommended method is to download MySQL Installer for Windows from <https://dev.mysql.com/downloads/installer/> and execute it.



Select mysql-installer-web-community-8.0.23.msi if you have good internet connection, otherwise choose mysql-installer-community-8.0.23.msi.

## Install MySQL

After downloading, unzip it, and double click the MSI installer .exe file.

Then follow the steps below:

1. **"Choosing a Setup Type"** screen: Choose "Full" setup type. This installs all MySQL products and features. Then click the "Next" button to continue.

2. **"Check Requirements"** screen: The installer checks if your pc has the requirements needed. If there is some failing requirements, click on each item to try to resolve them by clicking on the Execute button that will install all requirements automatically. Click "Next".

3. **"Installation"** screen: See what products that will be installed. Click "Execute" to download and install the Products. After finishing the installation, click "Next".

4. **"Product Configuration"** screen: See what products that will be configured. Click the "MySQL Server 8.0.23" option to configure the MySQL Server. Click the "Next" button. Choose the "Standalone MySQL Server/Classic MySQL Replication" option and click on the "Next" button. In page  "Type and Networking" set Config Type to "Development Computer" and "Connectivity" to "TCP/IP" and "Port" to "3006". Then, click the "Next" button.

5. **"Authentication Method"** screen: Choose "Use Strong Password Encryption for Authentication". Click "Next".

6. **"Accounts and Roles"** screen: Set a password for the root account. Click "Next".

7. **"Windows Service"** screen: Here, you configure the Windows Service to start the server. Keep the default setup, then click "Next".

8. **"Apply Configuration"** screen: Click the "Execute" button to apply the Server configuration. After finishing, click the "Finish" button.

9. **"Product Configuration"** screen: See that the Product Configuration is completed. Keep the default setting and click on the "Next" and "Finish" button to complete the MySQL package installation.

10. In the next screen, you can choose to configure the Router. Click on "Next", "Finish" and then click the "Next" button.

11. **"Connect To Server"** screen: Type in the root password (from step 6). Click the "Check" button to check if the connection is successful or not. Click on the "Next" button.

12. **"Apply Configuration"** screen: Select the options and click the "Execute" button. After finishing, click the "Finish" button.

13. **"Installation Complete"** screen: The installation is complete. Click the "Finish" button.

## Verify MySQL Installation

Open the **MySQL Command Line Client** from cmd.

You should see a mysql> prompt. If you have set any password, write your password here.

Now, you are connected to the MySQL server, and you can execute all the SQL command at mysql> prompt as follows:

For example: Check the already created databases with show databases command: