Introduction to Course

This course is first (fundamental) course on database management system with MYSQL**.** The course discusses different topic of the databases. We will cover both the theoretical and practical aspects of databases. As a student to have a better understanding of the subject, it is very necessary that you concentrate on the concepts discussed in the course.

What is a Data?

The collection of fact or figure in raw or unorganized form (such as alphabets, numbers, or symbols) that is called data. Data normally not clear or meaning full form.

Difference between Data and Information.

Data is the collection of raw facts collected from any specific environment for a specific purpose. Data in itself does not show any thing about its environment, so to get desired types of results from the data we transform it into information by applying certain processing on it. Once we have processed data using different methods data is converted into meaning full from and that form of the data is called information.

Data Items.

A unit of data stored in a field. Unit of data contained in a record, describing a particular attribute (such as name, age, address) and requiring one or several bits, bytes, or words to represent an entity.

Fields

The field is a data structure for a single piece of same type or categorically of data. The term "fields" refers to columns, or attribute or vertical categories of data, describing a particular attribute (such as name, age, address). In the phone book example, the four data categories of last name, first name, address and phone number are called "fields." A field is single type unit of data that is unique within each entry/row, but the overall data category is common to all entries. For instance, "address" is a field that is common to all named entries in the phone book. Following is an example of Fields or Columns or attributes Name.

ID	Name	Age	Phone Number

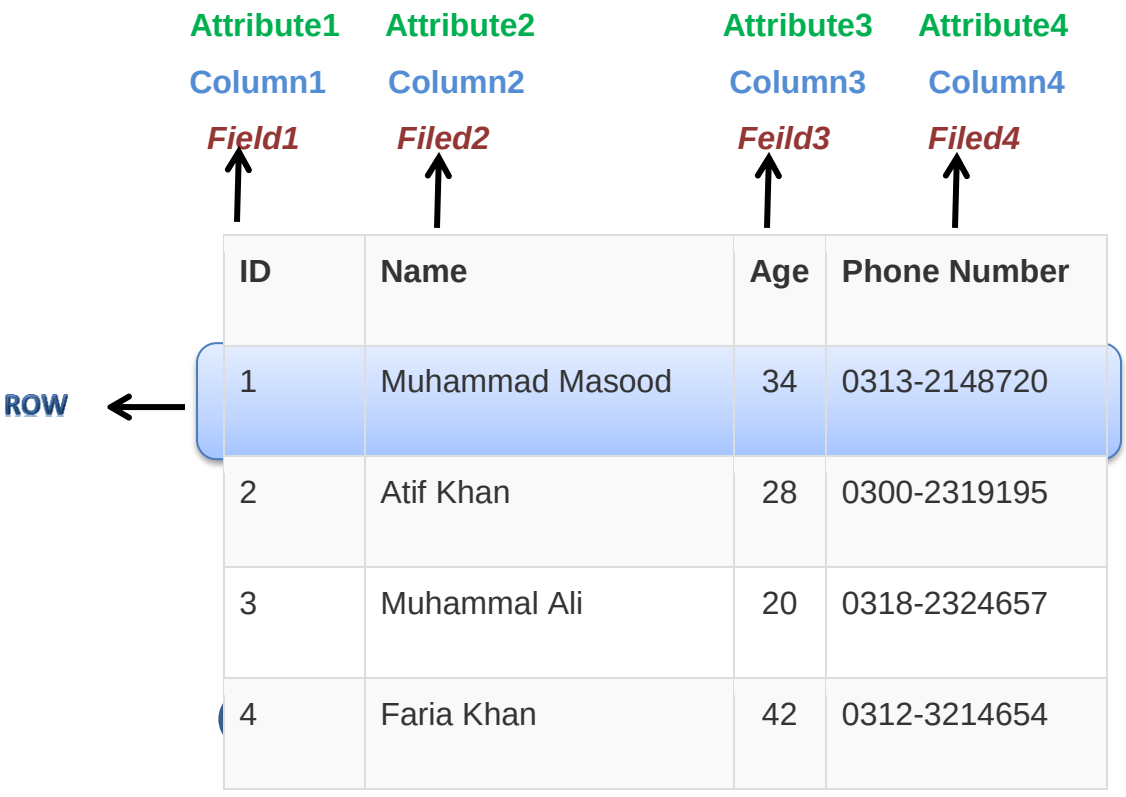
Record

The Collection of related data items that is called record. A record is, basically, a row that contains unique data in each of the fields. A record is a row of a horizontal grouping of fields. The content of those fields is unique to that row. In the phone book example, each last name begins a record/row which contains data in the name, address and phone number fields. A single entry in a table is called a Tuple or Record or Row. Following is an example of single record or tuple.

1	Muhammad Masood	34	0313-2148720

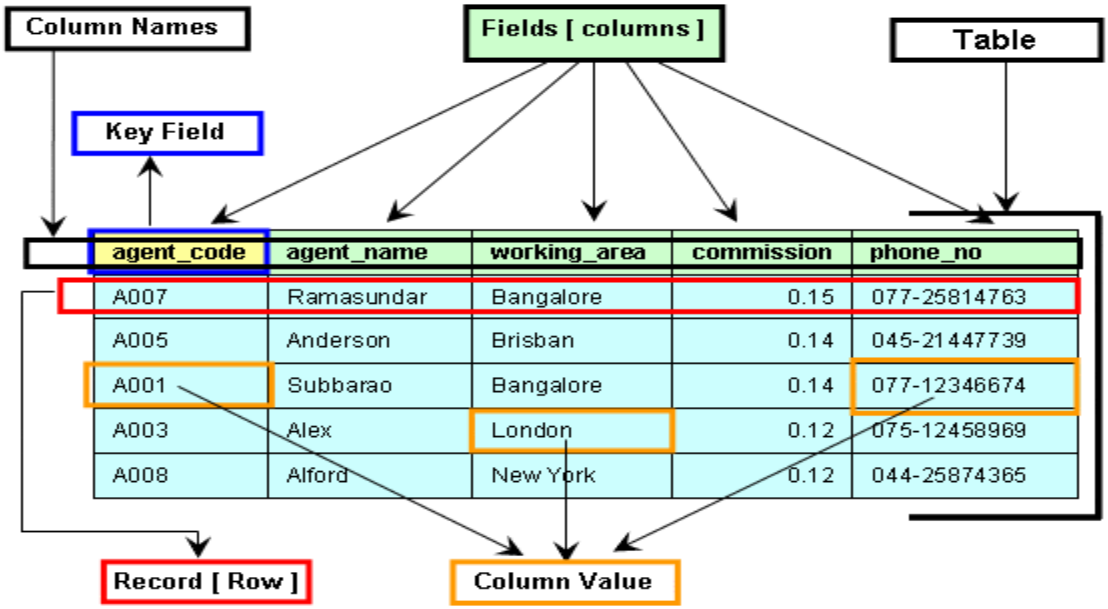
Table

A table has a specified number of columns, but can have any number of rows. A table is composed of records and fields that hold data. Tables are also called datasheets. Each table holds data about a different, but related, subject. A table is a collection of data elements organized in terms of rows and columns. A table is also considered as a convenient representation of relations. But a table can have duplicate row of data while a true relation cannot have duplicate data. Table is the simplest form of data storage. Below is an example of a Phone book table.



ID	Name	Age	Phone Number
1	Muhammad Masood	34	0313-2148720
2	Atif Khan	28	0300-2319195
3	Muhammal Ali	20	0318-2324657
4	Faria Khan	42	0312-3214654

Following image are pictorial presentation of a table and different components of it:



Database

A database is a collection related tables of information that is organized so that it can be easily accessed, managed and updated. A shared collection of logically related data, designed to meet the information needs of multiple users in an organization. The database is the collection of data about anything; the main thing is that the database stores the data.

You can probably think of many databases that you work with in everyday life. For example your Telephone book, other example of Student information of educational institution and company employee information and so on essentially, any information that can be organized into ordered sets of data, and then quickly retrieved, can be considered a database.

Database Application

Database Application is a program or group of program with is used for performing certain operations on the data stored in the database. These operations may contain insertion of data into a database or extracting some data from the database based on a certain condition, updating data in the database, producing the data as output on any device such as screen, disk or printer. The term database is often erroneously referred to as a synonym for a “database management system (DBMS)”.

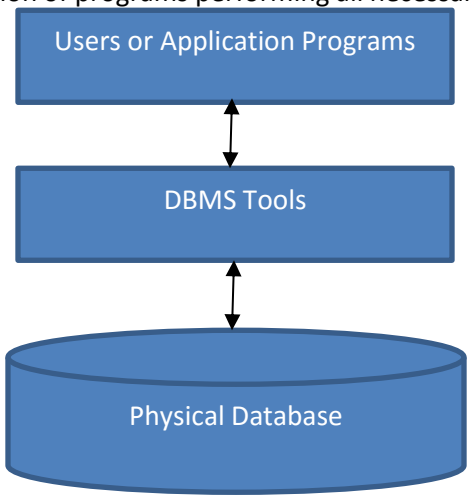
Database Management System (DBMS)

Database management system is Application software of collection of small programs to perform certain operation on data and how to manage to data. There are two basic operations performed by the DBMS are:

1) Management of data in the database.
2) Management of user associated with the database

Management of the data means to specify that how to data will be stored, structured and accessed in the database. Management of database users mean to manage the user in such a way they can perform any

desired operations on the database. DBMS also ensures that a user cannot perform any operation for which he is not allowed, and also an authorized user is not allowed to perform any action which is restricted to the user. In General DBMS is a collection of programs performing all necessary action associated to a database.



Database Management System Advantages (DBMS)

The benefits of a database management system (DBMS) include its ability to handle huge volumes of data and multiple concurrent users. Unlike flat file systems, a DBMS maintains data integrity, consistency, security, and appreciable system performance.

1. Prevents Data Redundancy

In DBMS, all the data from the different applications are integrated into a single database, on which various checks for duplicity can be performed, and multiple copies can be logically converted into a single one. This allows for a great reduction in data redundancy, and prevents the wastage of memory. However, it must be noted that some applications may require data to be duplicated.

2. Allows Data Sharing

DBMS allows sharing of the same data among numerous applications and users. The data is stored centrally (typically within servers), and a software-based locking mechanism is put in place to prevent many users from viewing it at the same time. This feature makes it possible to share and fulfill the data requirements of a newly installed application without needing to again create new data specifically for it.

3. Maintains Data Consistency

When duplicate data exists at different memory locations, there are chances that an application might update one of them while the other one will continue to contain the previous values. This will cause an inconsistency in the information that is stored. In DBMS, data redundancy is greatly reduced, and so, in almost all cases, only a single copy of data exists in the database, which all the different applications and programs share. Therefore, any changes made to it are instantly available to all the programs accessing it, and as such, the consistency of data is maintained tired into it.

4. Provides Data Security

The data in many of organizations is highly sensitive, and may even be confidential. Unauthorized access can compromise the entire functioning of the organization. This can be very effectively prevented in DBMS, where the database administrator (DBA) can block or grant access as required.

The DBA can implement a number of access procedures and authentication schemes to ensure that only the person(s) having enough privileges is granted access to critical data. Thus, a DBMS is capable of providing security to the data in an organization.

5. Maintains Data Integrity

Data integrity is said to exist when the data entered into a database is both, accurate and consistent. These systems provide centralized control over the access to data. This allows different checks to be put in place in order to verify the accuracy of the data being en

6. Automatic Backup and Restore

In a file-based computer system, the user has to create a backup of the data regularly to protect it from being damaged or lost in the event of system crash or failure. This can be a very time-consuming process, and is prone to human error. Most of the DBMS have a backup-and-recovery feature built within them that automatically backs-up all important data, and restores it when needed.

7. Data Independence

The separation of data structure from the application program used to access it is known as data independence. Typically, in a DBMS, the database and the application program are maintained separately from each other, with the DBMS acting as a mediator between them. This proves to be a big advantage, as one can easily change the database structure without affecting the application program.

8. Data Abstraction

Data abstraction results from data independence. It allows the DBMS to provide an abstract view of the data, without divulging the details of its physical storage or method of implementation.

9. Multiple Views of Data

A DBMS allows multiple accesses to the database by many users, each having a different perspective view of the data stored in it. All these views are subsets of the database, and contain virtual data derived from the database, which doesn't exist in physical form. Thus, many users can access the data, while still maintaining the consistency of the database.

10. Ease of Application Development

Many data-related issues, like concurrent access, security, data integrity, etc., are taken care of by the DBMS. Therefore, when an application programmer develops a program, he/she can focus explicitly on the needs of the users. This makes the task of application development much easier.

Thus, database management systems bring about systematization in data storage, and also provide data security. Owing to their many advantages over traditional file-based data storage systems, they are widely used in many large and small organizations alike.

Database Management System Tools

A database management system (DBMS) is computer software that enables users and applications to store, modify and analyze a database. Database management systems perform many of the same functions like creates new database files and contains interfaces that allow users to enter and manipulate data. One of the most important functions of a DBMS is the structuring and maintenance of the database file. In addition, a DBMS must ensure that data is stored correctly in a database's tables, regardless of the database format (flat-file, relational, hierarchical, or network). In the RDBMS ensures that the appropriate information is entered according to the relation-ship structure in the database tables. Today's database technology is

becoming increasingly complex, and supports previously unthinkable data volumes all driven by the demands of todays. There are many Database Management System tools are following.

- Oracle
- Microsoft SQL Server
- MySQL
- Microsoft Access
- SQLite
- FoxPro

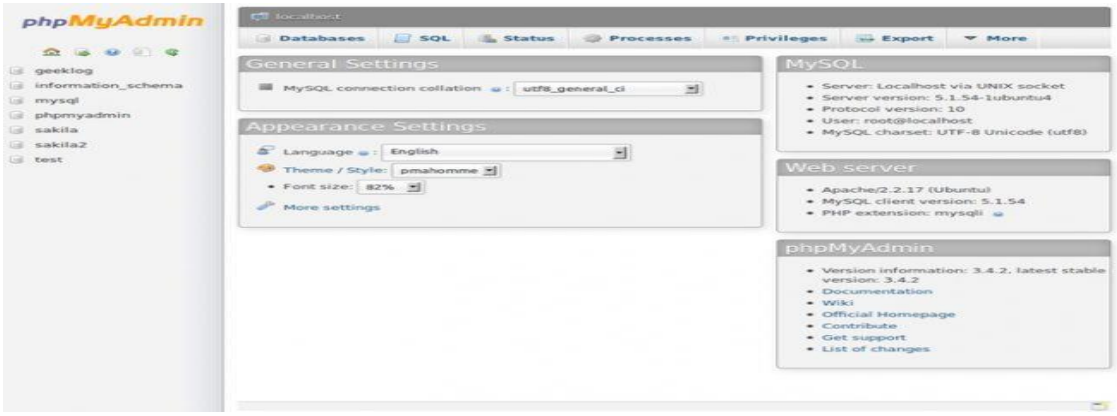
Background of MySQL

MySQL was created by a Swedish company, MySQL AB, founded by David Axmark, Allan Larsson and Michael "Monty" Widenius. Original development of MySQL by Widenius and Axmark began in 1994. The first version of MySQL appeared on 23 May 1995, which was bought by Sun Microsystems (now Oracle Corporation). In 2010, when Oracle acquired Sun, Widenius forked the open-source MySQL project to create MariaDB.

MySQL is free and open-source relational Database Management System software. MySQL is the most popular database. They make managing your databases administration, design, and creation so much easier. Using command line is fine for certain situations, but overall, using a GUI can save a lot of time and is much easier to work. As open source software, MySQL is alogical fit with Apache and PHP, both of which are also developed as open source software, but there are other reasons for MySQL's popularity: it is also fast and reliable, and it supports other programming languages besides PHP, including C, C++, and Java. MySQL is also fairly easy to use and install and is available on a number of different platforms. MySQL DBMS with so many available tools.

PHPMyAdmin GUI Tool.

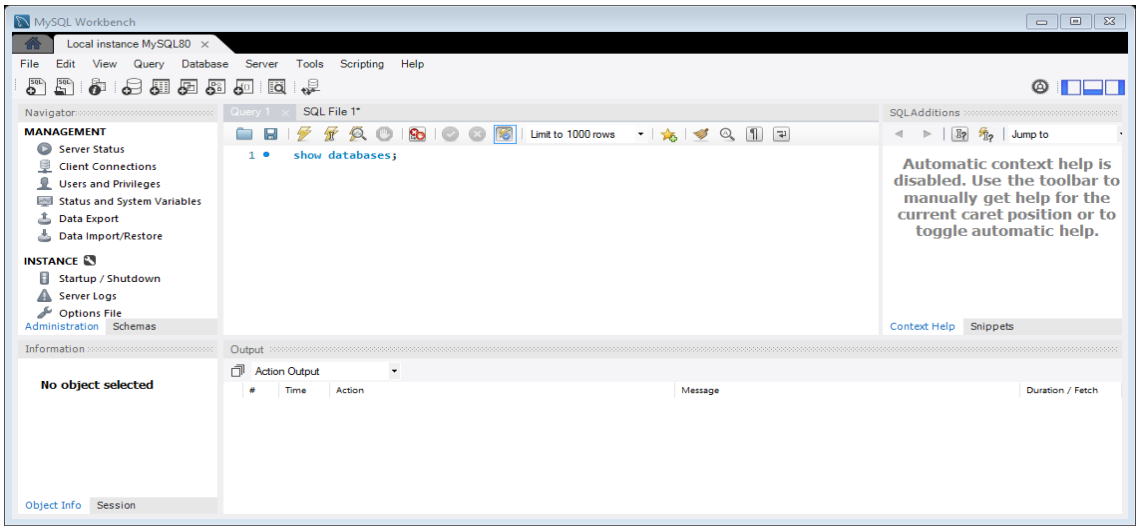
Initially released back in the 1998 phpMyAdmin was written in PHP in order to handle MySQL and MariaDB inside the web browser.



Today it is one of the most popular tools that manage MySQL database administration. It has enough functionality to create a website without technical knowledge of MYSQL. It's widely used to manage databases, tables, relations, users and much more.

MySQL Workbench

MySQL Workbench is a visual tool for database architects and developer. It offers administration tools for server configuration, user administration and much more. MySQL Workbench is the official integrated environment for MySQL. It is developed by MySQL AB, and enables users to graphically administrator MySQL databases and visually design database structures.

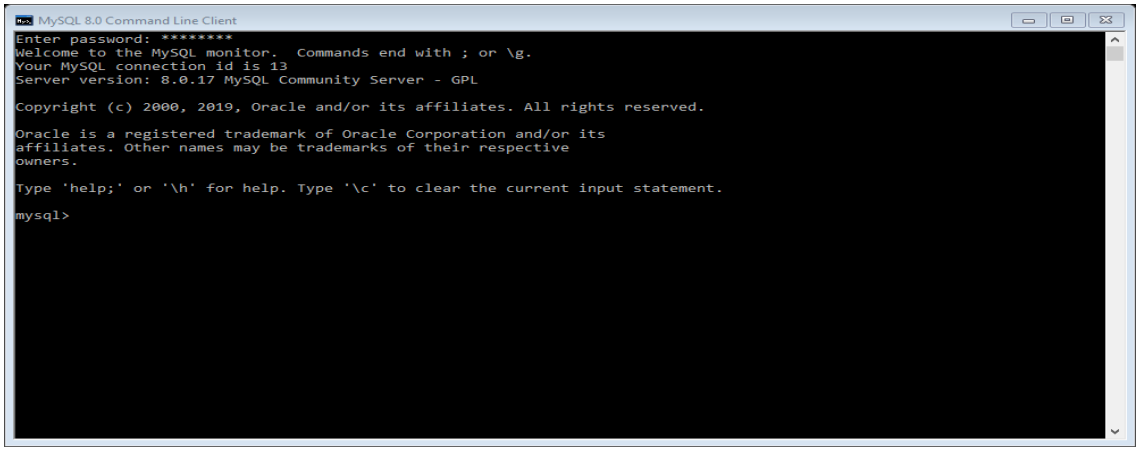


It is available on Windows, Linux, and MAC Operating system. It is recommended for anyone who wants to master Database administration. It saves SQL statements but it is more complex compared to Phpmyadmin. It is desktop application tool of MySQL DBMS.

MySQL Command Line Client

A command-line interface is a means of interacting with a computer program where the user issues commands to the program by typing in successive lines of text (command lines). MySQL sends each SQL statement that you issue to the server to be executed. There is also a set of commands that mysql itself interprets. For a list of these commands, type help or \h at the mysql> prompt:

Note that all text commands must be first on line and end with ';'



List of some MySQL commands:

? (\?) Synonym for `help'.

clear (\c) Clear the current input statement.

edit (\e) Edit command with $EDITOR.

exit (\q) Exit mysql. Same as quit.

go (\g) Send command to mysql server.

help (\h) Display this help.

print (\p) Print current command.

quit (\q) Quit mysql.

status (\s) Get status information from the server.

system (\!) Execute a system shell command.

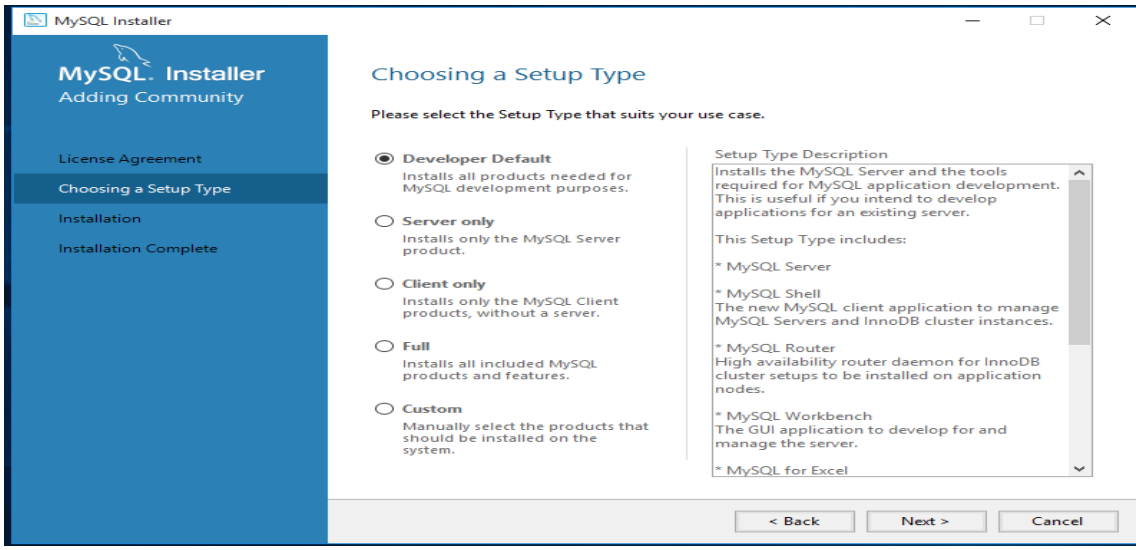
use (\u) use or select another database .

Installation or setup process of MySQL

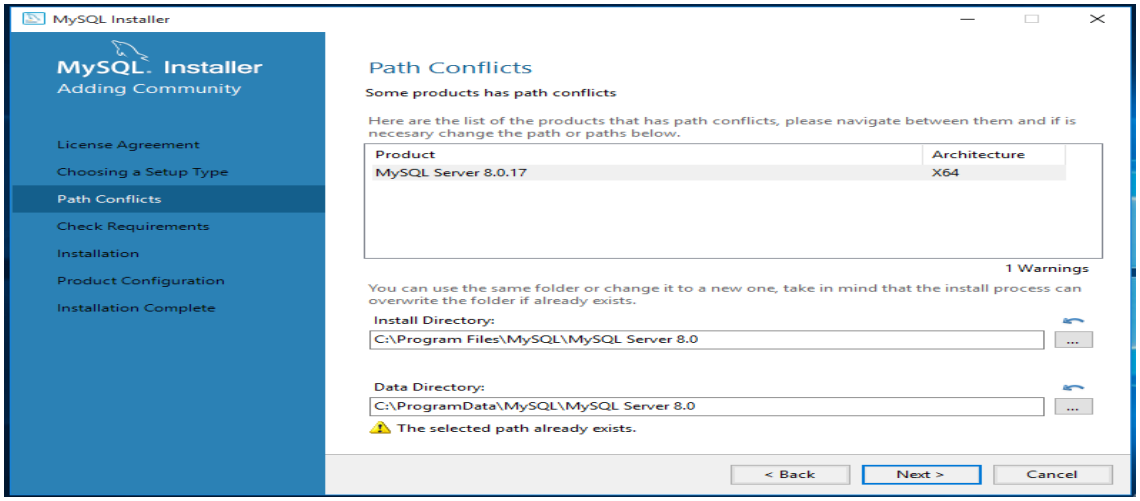
1. Type this URL ***https://dev.mysql.com/downloads/windows/installer/8.0.html*** *o*n address bar of your browser. Click the download link, and select download (mysql-installer-community-8.0.17.0.msi) Package, then prompt you want Login Now or Sign Up for a free account? We select and click at ***No thanks, just start my download***. Then save the ***my-installer-community.msi*** executable file on your download folder.

2. After the download completes, run the ***mysql-installer-community-8.0.17.0.msi*** application file on your computer then to begin the installation process. You will see the setup installer screen. If you have previous version of MYSQL installed on your computer, you may be prompted to Add, update or remove the component of MySQL. You click the checkbox of license agreement and click the next button.

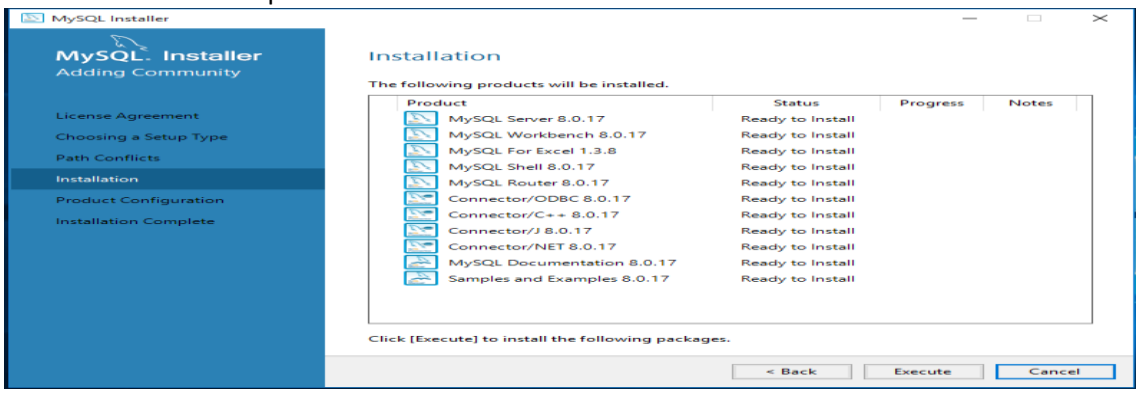
3. In this step we will see choosing a setup type, here many option like developer default, server only, client only full, and custom, we select developer default option and click next button.

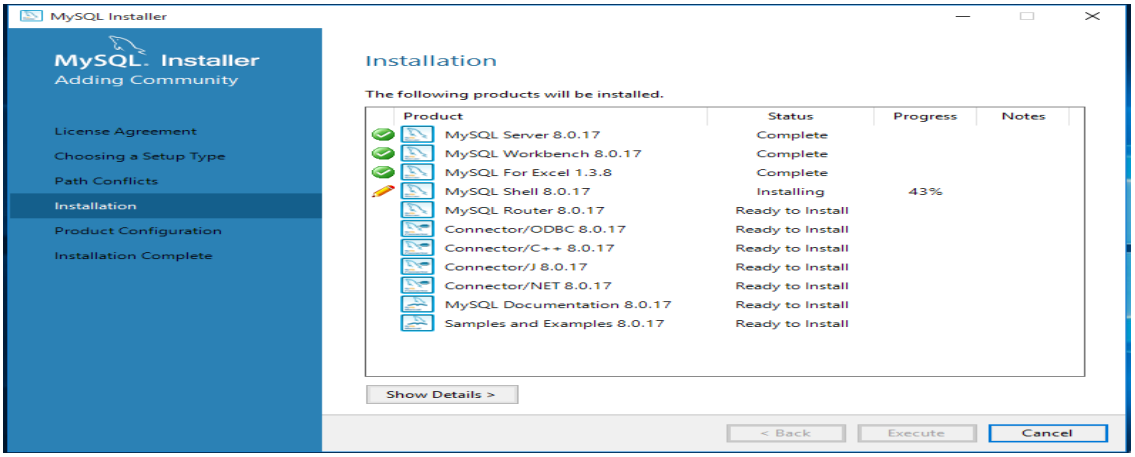


4. In this step we select the folder path name or drive. We select by default path and click next button.

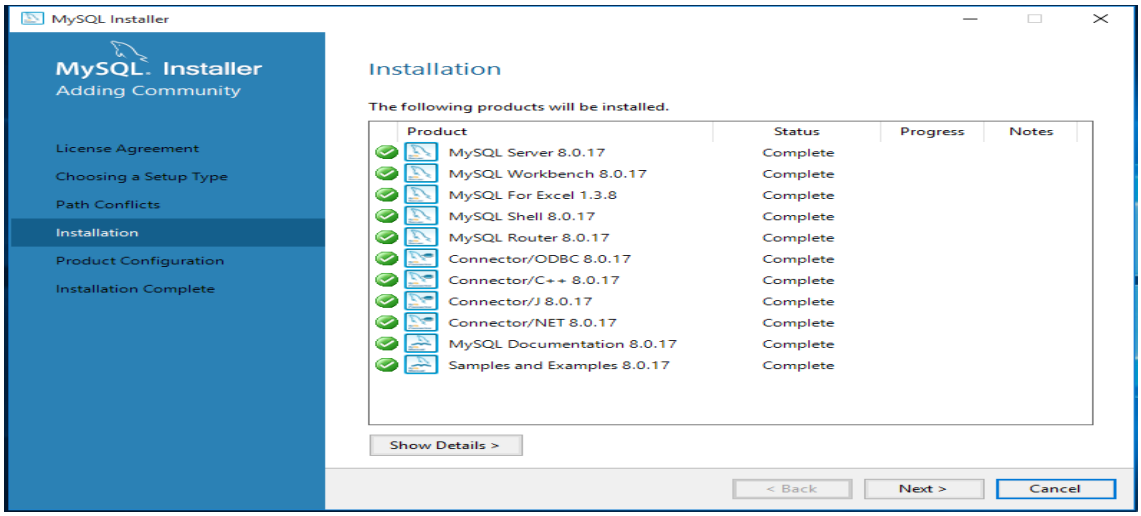


5. In this step we will see many application tools of MySQL to ready to install. We click execute button then start installation process.

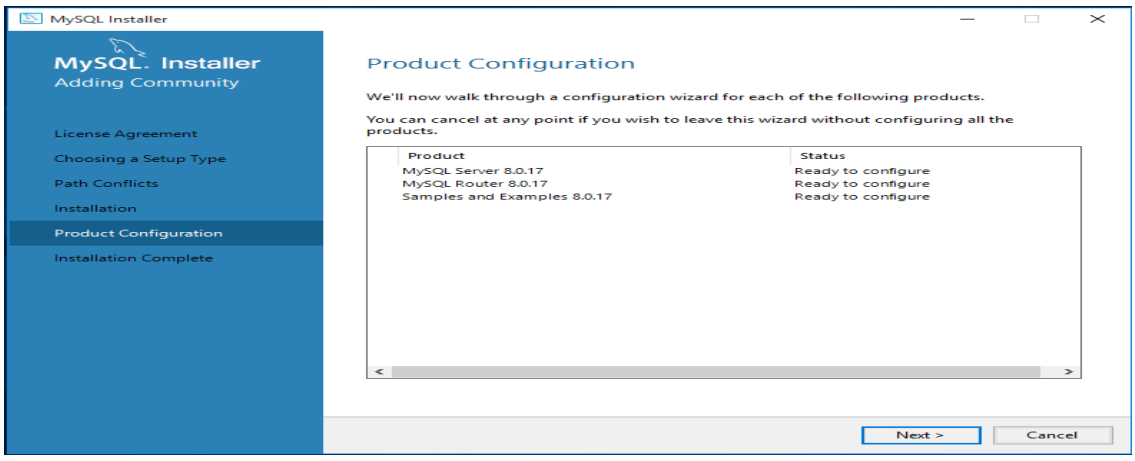




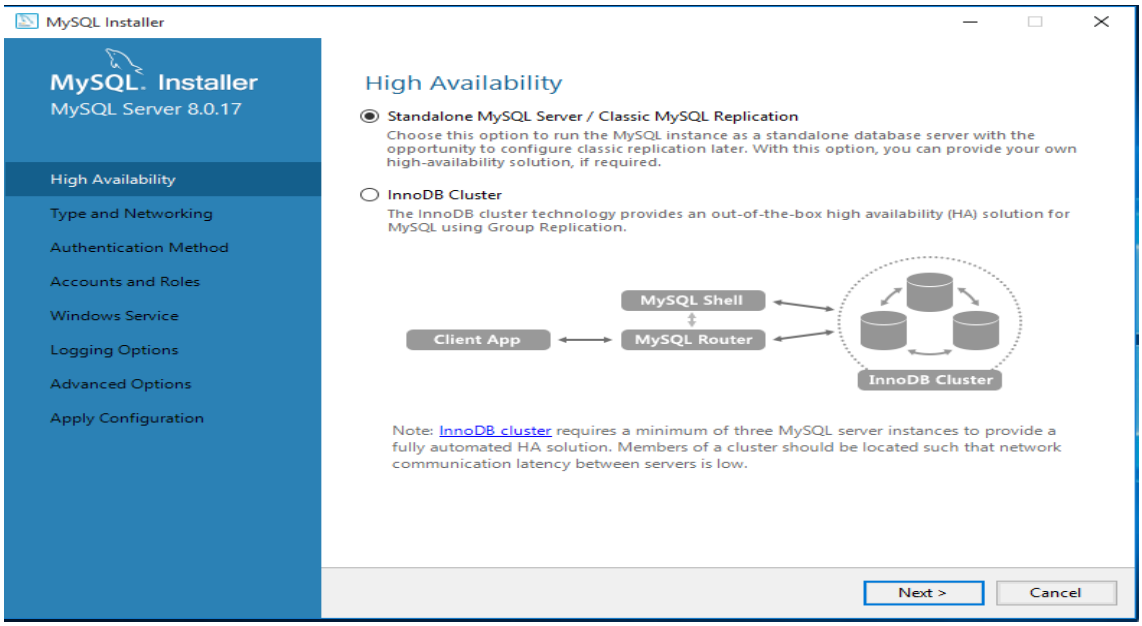
6. After completions of MySQL tools we will see tick in green color at every tool, if error or failed any one then we will see cross tick in red color. Now click the next button.



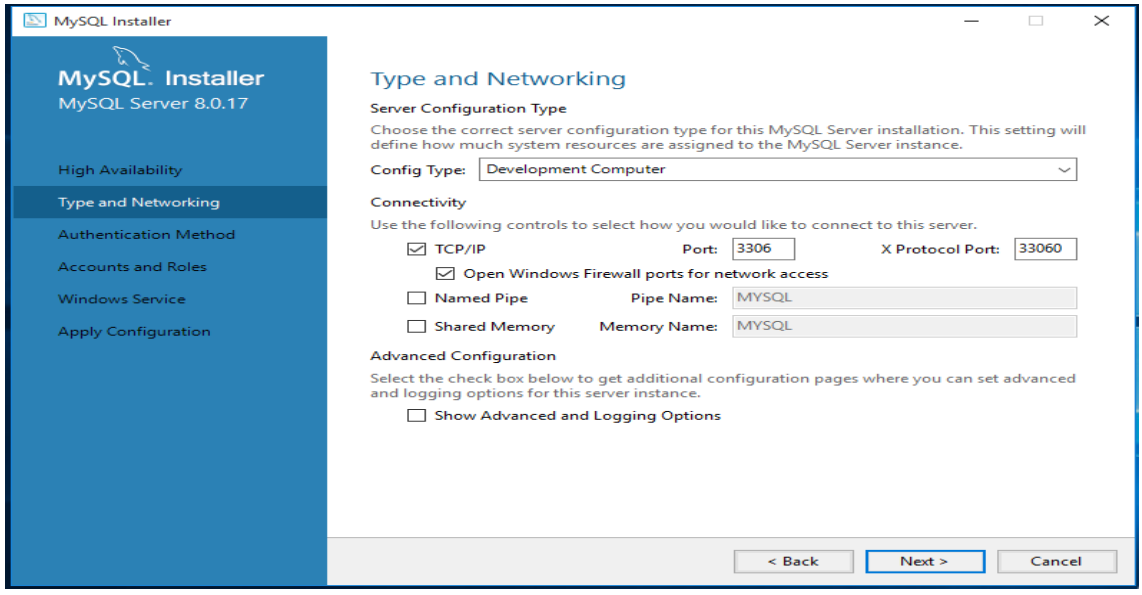
7. Now in this step start product configuration, MySQL server, MySQL Router and sample and example we click next button.



8. In this step we select by default standard MySQL server/ Classic MySQL Replications and click next button.

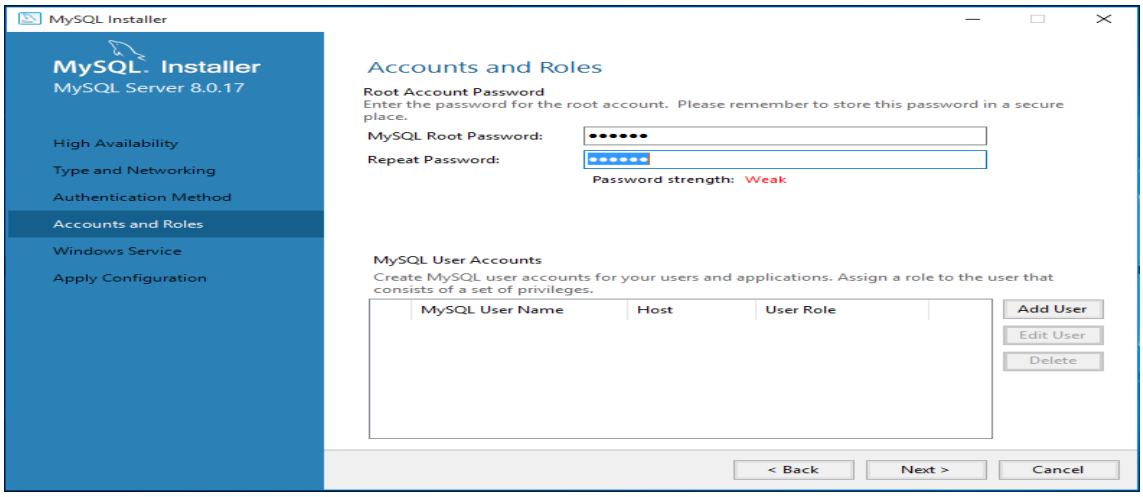


9. In this step we setup the type of Server, Networking and Connectivity TCP/IP and Port number we remain the by default setting and click next button



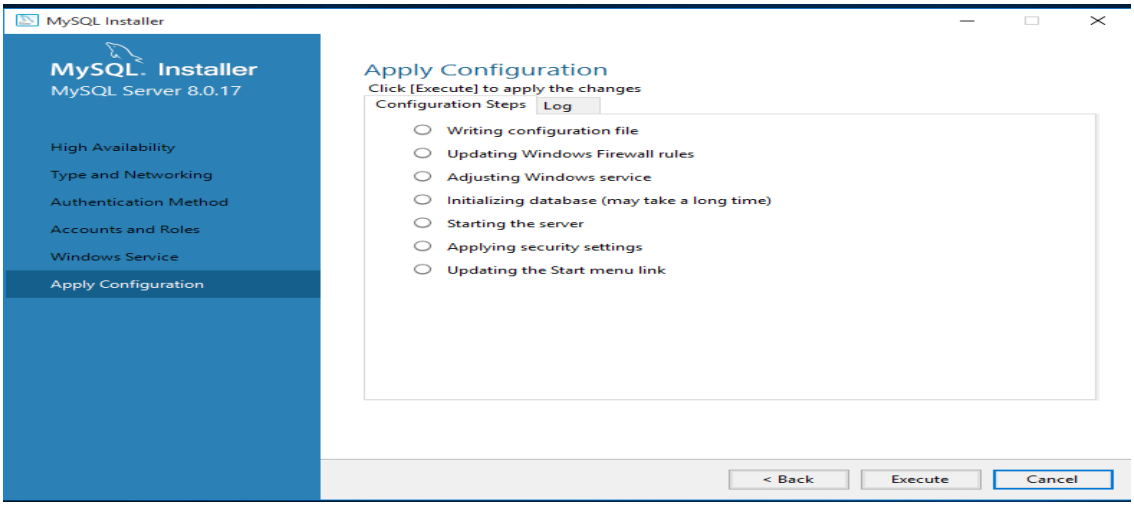
10. In this step start Authentication Method, here two option one is use strong password Encryption got Authentication (Recommended) and second option Use legacy Authentication Method, we select by default to first option and click next button.

11. In this step we will keep the password of MySQL root user and if we want to add new user then click add user button. After this setting then click next button.

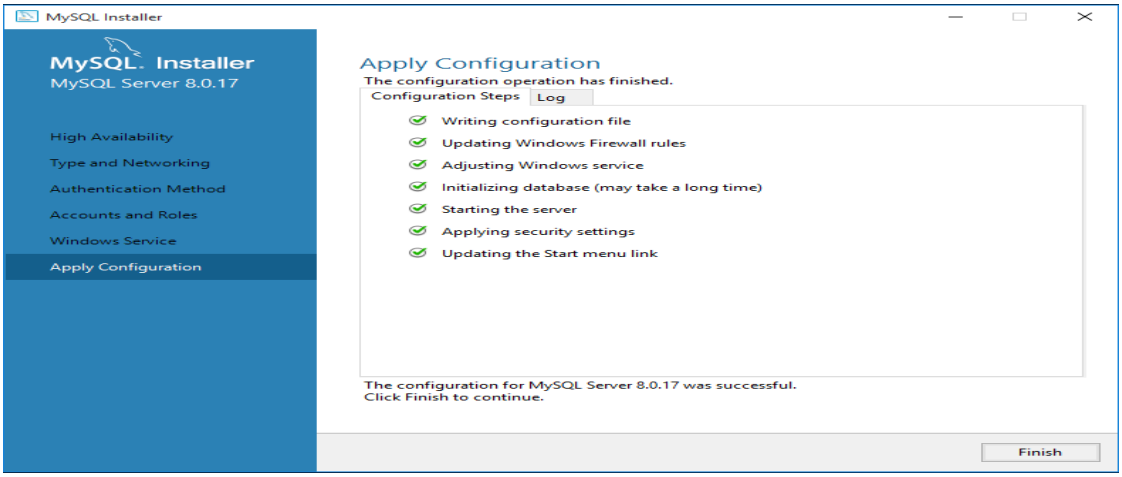


12. In this step we select Configure MySQL Server as a window service and run window service at standard System ***root*** account and we can choose custom account after the setting we click next button.

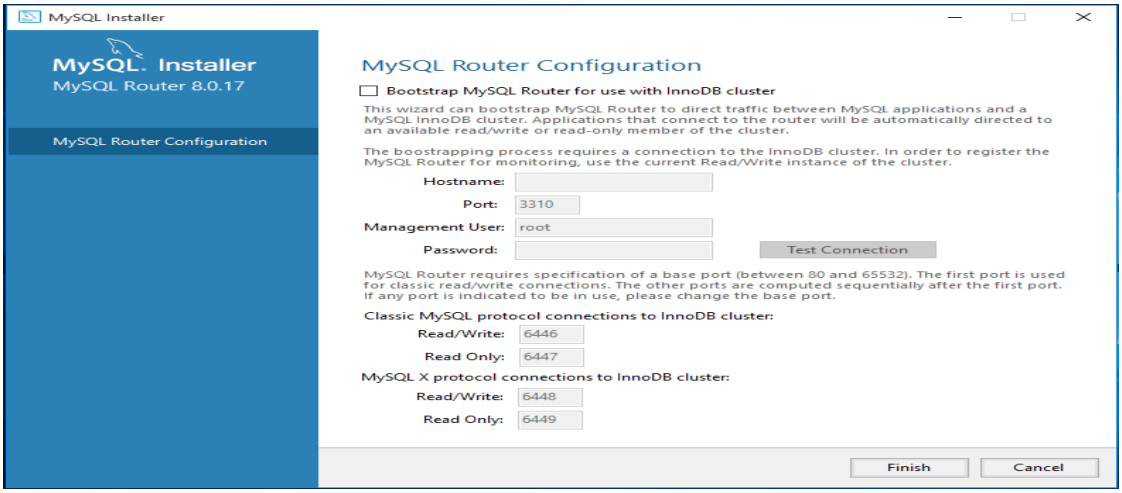
13. Apply the Configuration wizard, here click execute button for apply configurations setting.



14. Complete the applying configuration setting wizard. And click finish button.

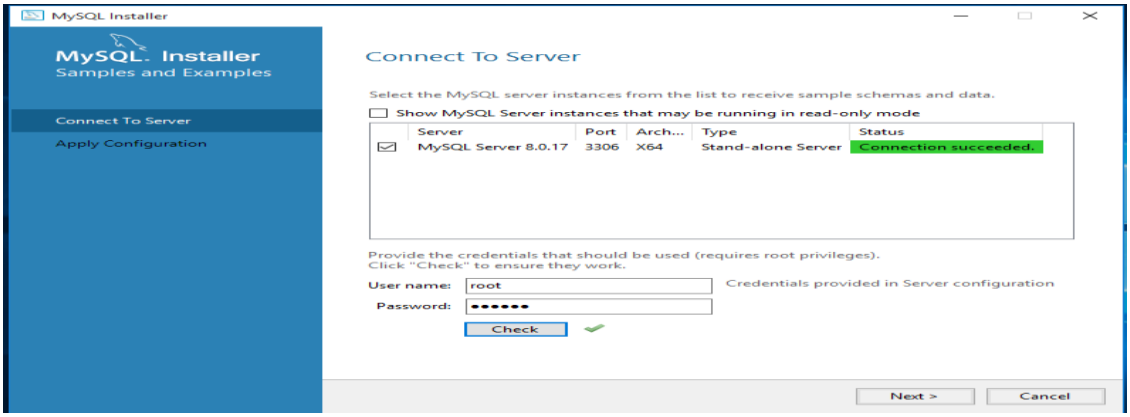


15. In the next step MySQL Router configuration setting finish and click finish button

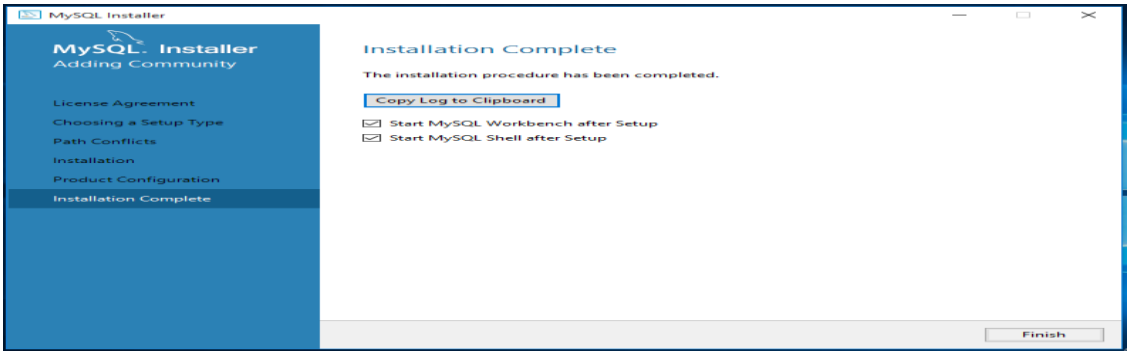


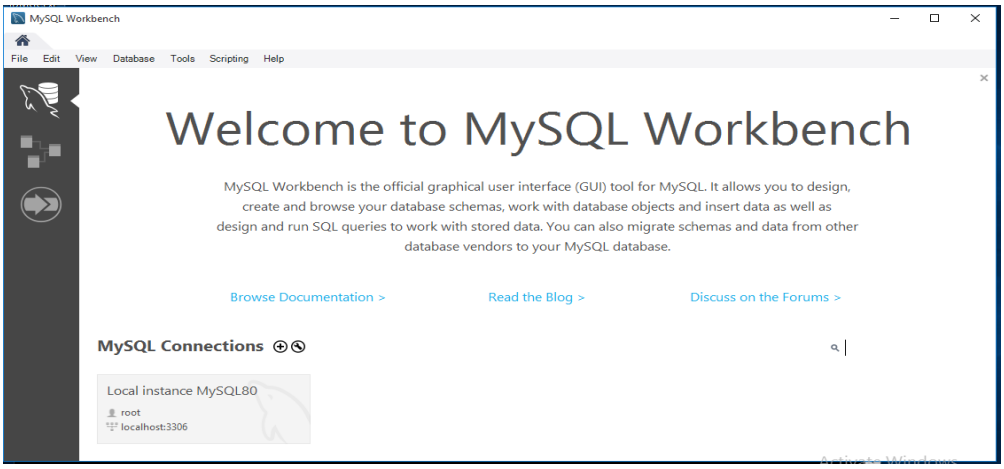
16. In the next step, applying the configuration setting has been finish, now click finish button.

17. Now start Connect the MySQL server wizard, in this step here enter the root password and check connect to the server and click next button.



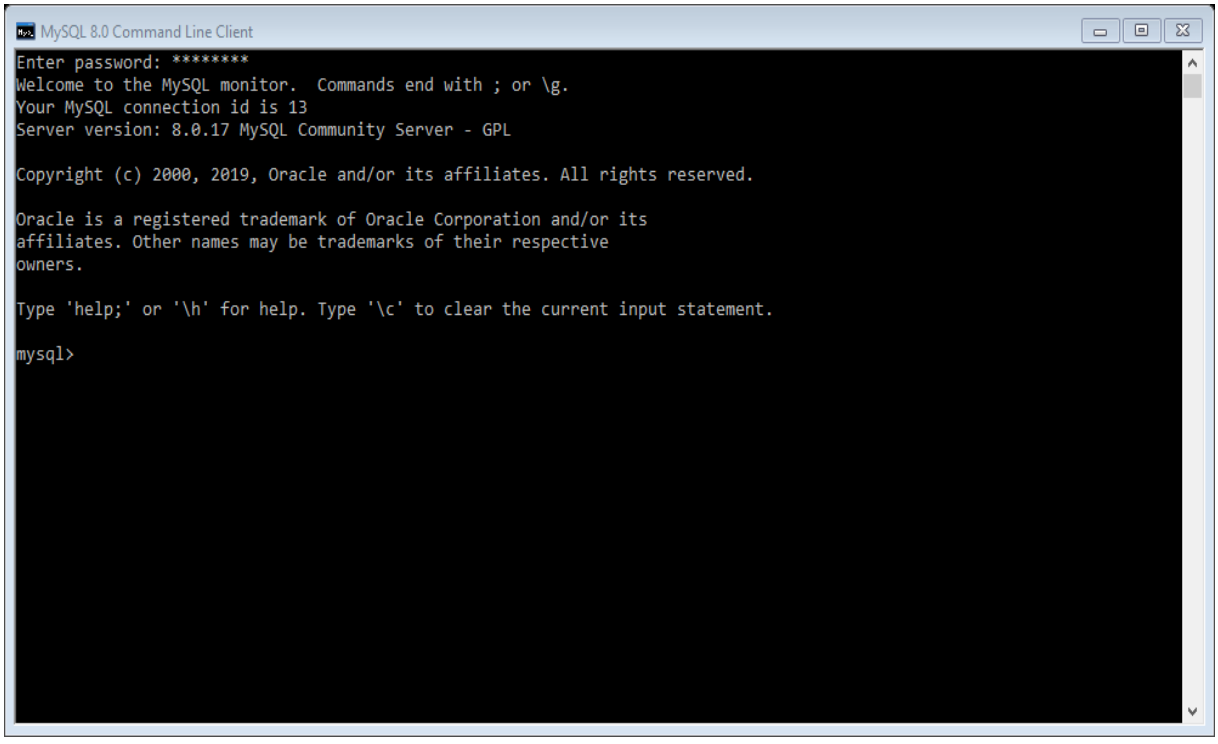
18. In the this step we will see the installation complete wizard show and now start MySQL workbench and MySQL shell services start now and click finish button





19. Now we will see welcome to MySQL workbench screen and now we can start MySQL 8.0 Command Line Client tools. And ready to work on MySQL database management System DBMS tools.

    After the complete MySQL database Management system (DBMS) tool now we can start working on MySQL server, MySQL Workbench, MySQL shell and MySQL Command Client tools. We can learn SQL command on the command line system; therefore we start MySQL 8.0 Command Line Client tools. here we give the root password than will see following the screen with **mysql>** prompt where we apply the SQL commands.



Exercise

Theory Question

1) What is database?
2) What is Difference between the data and information.
3) Write Role or advantages of Database management system.
4) Write list of Database Management System (DBMS) tools.
5) Describe the data items, fields, record and table.

Practical Question

1) Write steps installation and configuration of MySQL.

Objective and MCQ's

1) Collection of related tables and its information that is called _____.
   a) Records
   b) Data
   c) Information
   d) Database
2) How to manage the data and information this is called _____.
   a) Database management System (DBMS)
   b) Information System
   c) Internet information
   d) Database file system.
3) Original development of MySQL by _____
   a) Bill gates
   b) Widenius and Axmark.
   c) Mark Zuckerberg.
   d) Rasmus Lerdorf.
4) Reduce of Duplication of records that is called
   a) Data Redundancy
   b) Data security
   c) Data sharing
   d) Data management.
5) Which command is use to exit from the mysql command prompt
   a) Exit
   b) Break
   c) Quit
   d) End