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.

Muhammad Masood	34	0313-2148720	
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Table

1

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.

	Attribute1	Attribute2	Attribu	te3 Attribute4
	Column1	Column2	Colum	n3 Column4
	Field1	Filed2	Feild3	Filed4
	ID	Name	Age	Phone Number
ROW <	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

Copy Right http://www.sirmasood.com 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.

phpMyAdmin	Constant.		
	🕞 Databases 🚑 SQL 🦓 Status 🧼 Processes 🍨	Privileges 🖶 Export 🔻 More	
Ω Los te le.) St Gi geeklog	General Settings MySQL		
information_schema mysql phpmyadmin sakila sakila2	MySQL connection collation e : utf8_general_ci	Server: Localhost via UNIX socket Server version: 5.1.54-1ubuntu4 Protocol version: 10	
	Appearance Settings	User: root@localhost MySQL charset: UTF-8 Unicode (utf8)	
C Teat	Congoing a Congo	Web server • Apacher 2:17 (Uburtu) • MySQL client version: 5.1.54 • PHP extension: mysgli	
		phpMyAdmin Version information: 3.4.2, latest stable version: 3.4.2 Documentation Wiki Official Homepage Contribute tist of changes List of changes	
		-	

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.

MySQL Workbench				
Local instance MySQL80 ×				
File Edit View Query Databas	e Server Tools Scripting Help			
				Ø – – –
Navigator	Query 1 × SQL File 1*		SQLAdditions	
MANAGEMENT	🗀 🖬 🗲 🞢 🕵 🔘 🔂 🤮) 💿 🔞 Limit to 1000 rows 🔹 🌟 🛫 🔍 [9 🌴 Iump to
Server Status Contentions Users and Privileges Status and System Variables Data Import/Restore INSTANCE Status / Shutdown Server Logs P Options File Administration Schemas	1 ● show databases;		Automa disabled manual current toggle	atic context help is . Use the toolbar to ly get help for the caret position or to e automatic help. Snippets
Information	Output			
No object selected	Action Output	Message		Duration / Fetch
Object Info Session				

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

- Type this URL *https://dev.mysql.com/downloads/windows/installer/8.0.html* on 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.

MySQL Installer	- · · ×
MySQL. Installer Adding Community	Path Conflicts Some products has path conflicts
License Agreement	Here are the list of the products that has path conflicts, please navigate between them and if is necessary change the path or paths below.
Choosing a Setup Type	MySQL Server 8.0.17 X64
Path Conflicts	
Check Requirements	
Installation	
Product Configuration	1 Warnings You can use the same folder or change it to a new one, take in mind that the install process can overwrite the folder if already exists.
Installation Complete	Install Directory:
	C:\Program Files\MySQL\MySQL Server 8.0
	Data Directory:
	C:\ProgramData\MySQL\MySQL Server 8.0
	1 The selected path already exists.
	< Back Next > Cancel

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

MySQL. Installer Adding Community	Installation			
License Agreement Choosing a Setup Type Path Conflicts Installation Product Configuration Installation Complete	Product MySQL Server 8.0.17 MySQL Workbench 8.0.17 MySQL For Excel 1.3.8 MySQL South 8.0.17 MySQL Router 8.0.17 Connector/OBEC 8.0.17 Connector/J8.0.17 Connector/VET 8.0.17 MySQL Documentation 8.0.17 MySQL Documentation 8.0.17	Status Ready to Install Ready to Install	Progress	Notes
	Click [Execute] to install the following package	ges.	Execute	Cancel

MySQL. Installer Adding Community	Installation			
	The following products will be installed.			
	Product	Status	Progress	Notes
License Agreement	MySQL Server 8.0.17	Complete		
Choosing a Setup Type	SQL Workbench 8.0.17	Complete		
Path Conflicts	SQL For Excel 1.3.8	Complete		
Path connets	MySQL Shell 8.0.17	Installing	43%	
Installation	MySQL Router 8.0.17	Ready to Install		
Product Configuration	Connector/ODBC 8.0.17	Ready to Install		
Installation Complete	Connector/C++ 8.0.17	Ready to Install		
Installation complete	Connector/J 8.0.17	Ready to Install		
	Connector/NET 8.0.17	Ready to Install		
	MySQL Documentation 8.0.17	Ready to Install		
	Samples and Examples 8.0.17	Ready to Install		
	Show Details >			

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.

MySQL Installer			-		\times
MySQL. Installer Adding Community	Installation The following products will be installed.				
	Product	Status	Progress	Notes	
License Agreement	SQL Server 8.0.17	Complete			
Choosing a Setup Type	🐼 📐 MySQL Workbench 8.0.17	Complete			
Path Conflicts	🐼 📐 MySQL For Excel 1.3.8	Complete			
	MySQL Shell 8.0.17	Complete			
Installation	MySQL Router 8.0.17	Complete			
Product Configuration	Connector/ODBC 8.0.17	Complete			
Installation Complete	Connector/C++ 8.0.17	Complete			
	Connector/J 8.0.17	Complete			
	Connector/NET 8.0.17	Complete			
	MySQL Documentation 8.0.17	Complete			
	Samples and Examples 8.0.17	Complete			
	Show Details >				
		< Back	Next >	Canc	el

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

MySQL Installer		×
MySQL. Installer Adding Community	Product Configuration	ard for each of the following products.
License Agreement	You can cancel at any point if you wish to le products.	eave this wizard without configuring all the
Choosing a Setup Type Path Conflicts Installation	Product MySQL Server 8.0.17 MySQL Router 8.0.17 Samples and Examples 8.0.17	Status Ready to configure Ready to configure Ready to configure
Product Configuration		
Installation Complete	c	>
		Next > Cancel

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

MySQL Installer	
MySQL. Installer	Type and Networking
MySQL Server 8.0.17	Server Configuration Type
	Choose the correct server configuration type for this MySQL Server installation. This setting wil define how much system resources are assigned to the MySQL Server instance.
High Availability	Config Type: Development Computer ~
Type and Networking	Connectivity
Authentication Method	Use the following controls to select how you would like to connect to this server.
Accounts and Roles	✓ Open Windows Firewall ports for network access
Windows Service	Named Pipe Pipe Name: MYSQL
Apply Configuration	Shared Memory Memory Name: MYSQL
	Advanced Configuration
	Select the check box below to get additional configuration pages where you can set advanced and logging options for this server instance.
	Show Advanced and Logging Options

Introduction To DBMS and MySQL

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.

MySQL Installer	>	×
MySQL. Installer MySQL Server 8.0.17	Accounts and Roles Root Account Password Enter the password for the root account. Please remember to store this password in a secure place.	
High Availability Type and Networking Authentication Method	MySQL Root Password: •••••• Repeat Password: •••••• Password strength: Weak	
Accounts and Roles		
Windows Service Apply Configuration	MySQL User Accounts Create MySQL user accounts for your users and applications. Assign a role to the user that consists of a set of nivielanes.	
	MySQL User Name Host User Role Add User Edit User Delete	
	< Back Next > Cancel	

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.

invysce instance	
MySQL. Installer MySQL Server 8.0.17	Windows Service ☑ Configure MySQL Server as a Windows Service
High Availability Type and Networking	Windows Service Details Please specify a Windows Service name to be used for this MySQL Server instance. A unique name is required for each instance. Windows Service Name: MySQL Comparison
Authentication Method	Start the MySQL Server at System Startup
Accounts and Roles	
Windows Service	Run Windows Service as The MySQL Server needs to run under a given user account. Based on the security
Apply Configuration	Requirements of your system you need to pick one of the options below. Standard System Account Recommended for most scenarios. Oustom User An existing user account can be selected for advanced scenarios.
	< Back Next > Cancel

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

MySQL Installer		_		\times
MySQL. Installer MySQL Server 8.0.17	Apply Configuration Click [Execute] to apply the changes Configuration Steps Log			
High Availability Type and Networking Authentication Method Accounts and Roles Windows Service	 Writing configuration file Updating Windows Firewall rules Adjusting Windows service Initializing database (may take a long time) Starting the server Applying security settings Updating the Start menu link 			
Apply Configuration	< Back Exec	cute	Canc	el

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

S MySQL Installer	- 🗆 ×					
MySQL. Installer	MySQL Router Configuration					
MySQL Router 8.0.17	Bootstrap MySQL Router for use with InnoDB cluster This wizard can bootstrap MySQL Router to direct traffic between MySQL applications and a MySQL innoDB cluster, Applications that connect to the router will be automatically directed to					
MySQL Router Configuration	an available readywrite or read-only member of the cluster. The boostrapping process requires a connection to the InnoDB cluster. In order to register the MVSQL Router for monitoring, use the current Read/Write instance of the cluster.					
	Hostname:					
	Port: 3310					
	Management User: root					
	Password: Test Connection					
	MySQL Router requires specification of a base port (between 80 and 65532). The first port is used for classic read/write connections. The other ports are computed sequentially after the first port. If any port is indicated to be in use, please change the base port.					
	Classic MySQL protocol connections to InnoDB cluster:					
	Read/Write: 6446					
	Read Only: 6447					
	MySQL X protocol connections to InnoDB cluster:					
	Read/Write: 6448					
	Read Only: 6449					
	Finish Cancel					

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

MySQL Installer		-		\times
MySQL. Installer Samples and Examples	Apply Configuration The configuration operation has finished. Configuration Steps Log			
Connect To Server	 Checking if there are any features installed that need configuration. Running Scripts 			
Apply Configuration				
	The configuration for Samples and Examples 8.0.17 was successful. Click Finish to continue.			_
			Finish	

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.

MySQL Installer				_	\sim
MySQL. Installer Samples and Examples	Connect To Serve	r			
	Select the MySQL server instances from the list to receive sample schemas and data.				
Connect To Server	Show MySQL Server instances that may be running in read-only mode				
Apply Configuration	Server MySQL Server 8.0.17	Port Arch. 3306 X64	Type Stand-alone Server	Status Connection succeed	ed.
	Provide the credentials that Click "Check" to ensure the	should be use y work.	ed (requires root privile	eges).	
	User name: root		Credentials prov	vided in Server configu	ration
	Password:				
	Check	~			
				Next >	Cancel

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



MySQL Workbench			-		×
*					
File Edit View Database Tools	Scripting Help				
	Velcome to	MySQL	Workbench	ו	×
	MySQL Workbench is the official g create and browse your databa: design and run SQL queries to work datal	raphical user interface (GUI) too e schemas, work with database with stored data. You can also pase vendors to your MySQL da	ol for MySQL. It allows you to design, e objects and insert data as well as migrate schemas and data from other tabase.		
	Browse Documentation >	Read the Blog >	Discuss on the Forums >		
MySQL Con	nections 🕀 🕲		٩		
Local instance troot trial localhost:3306	MySQL8U				

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