



# DBMS LEARN

## Documentation

### Abstract

[Draw your reader in with an engaging abstract. It is typically a short summary of the document.  
When you're ready to add your content, just click here and start typing.]

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## INTRODUCTION TO DATABASE

### 1.1 INTRODUCTION

#### **Data:**

- Fact that can be recorded or stored
- For ex: Person Name, Age, Gender and Weight...

#### **Database:**

- Collection of logically related data
- For ex: Books Database in Library, Student Database in University...

#### **Management:**

- Manipulation, Searching and Securing of data.
- Viewing result in GTU website, Searching exam papers in GTU website...

#### **System:**

- Program or tool that used to manage database
- MS SQL, MySQL, PostgreSQL, Oracle...

#### **Database Management System:**

- It is a software designed to define, manipulate, retrieve and manage data in a database.

### 1.2 ADVANTAGES

- Reduce data duplication
- Remove inconsistency
- Data isolation
- Guaranty of atomicity(0% or 100%)
- Allow implementing integrity constraints
- Sharing among the multiple user
- Restricted unauthorized access
- Provides backup and recovery services

### 1.3 BASIC TERMS

#### **Data:**

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- Data is raw, unorganized facts that need to be processed.
- For ex: Marks of students...

## Information:

- When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.
- For ex: Result of students (Pass or Fail)...

## Metadata:

- Metadata is data about data.
- Data such as table name, column name, data type, authorized user and user access privileges for any table is called metadata for that table.

## Data Dictionary:

- A data dictionary is an information repository which contains metadata.

## Data Warehouse:

- A data warehouse is an information repository which stores data.

## Field:

- A field is a character or group of characters that have a specific meaning.
- For ex: The value of Emp\_Name, Address, Mobile\_No etc are all fields of Faculty table.

## Record/ Tuple:

- A record is a collection of logically related fields.
- For ex: The collection of fields (Emp\_Name, Address, Mobile\_No, Subject) forms a record for the Faculty.

## Primary Key:

- A key which is unique as well as not null.

## Unique Key:

- A key which is unique but it could be null.

## Foreign Key:

- A key which linked two table.

## **Compose Key:**

- A key that consists of multiple columns, because one column is not sufficiently identify record uniquely.

### 2.1 INTRODUCTION

- MySQL is a fast, easy-to-use RDBMS being used for many small and big businesses.
- MySQL is developed, marketed and supported by MySQL AB, which is a Swedish company.
- MySQL is released under an open-source license.
- So you have nothing to pay to use it.
- MySQL is a very powerful program in its own right.
- It handles a large subset of the functionality of the most expensive and powerful database packages.
- MySQL uses a standard form of the well-known SQL data language.
- MySQL works on many operating systems and with many languages including PHP, PERL, C, C++, JAVA, etc.
- MySQL works very quickly and works well even with large data sets.
- MySQL is very friendly to PHP, the most appreciated language for web development.
- MySQL supports large databases, up to 50 million rows or more in a table.
- The default file size limit for a table is 4GB, but you can increase this (if your operating system can handle it) to a theoretical limit of 8 million terabytes (TB).
- MySQL is customizable.
- The open-source GPL license allows programmers to modify the MySQL software to fit their own specific environments.

## OVERVIEW OF MYSQL WORKBENCH

### 3.1 INTRODUCTION

- MySQL Workbench is graphical user interface tool that used for working with database architects, developers, and Database Administrators.
- It is developed and maintained by Oracle.
- It provides SQL development, data modelling, data migration, and comprehensive administration tools for server configuration, user administration, backup, and many more.
- We can use this Server Administration for creating new physical data models, E-R diagrams, and for SQL development (run queries, etc.).
- It is available for all major operating systems like Mac OS, Windows, and Linux.
- MySQL Workbench fully supports MySQL Server version v5.6 and higher.

### 3.2 FUNCTIONALITY

#### **SQL Development:**

- This functionality provides the capability that enables you to execute SQL queries, create and manage connections to the database Servers with the help of built-in SQL editor.

#### **Data Modelling (Design):**

- This functionality provides the capability that enables you to create models of the database Schema graphically, performs reverse and forward engineering between a Schema and a live database, and edit all aspects of the database using the comprehensive Table editor.
- The Table editor gives the facilities for editing tables, columns, indexes, views, triggers, partitioning, etc.

#### **Server Administration:**

- This functionality enables you to administer MySQL Server instances by administering users, inspecting audit data, viewing database health, performing backup and recovery, and monitoring the performance of MySQL Server.

#### **Data Migration:**



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- This functionality allows you to migrate from Microsoft SQL Server, SQLite, Microsoft Access, PostgreSQL, Sybase ASE, SQL Anywhere, and other RDBMS tables, objects, and data to MySQL.
- It also supports migrating from the previous versions of MySQL to the latest releases.

## MySQL Enterprise Supports:

- This functionality gives the support for Enterprise products such as MySQL firewall, MySQL Enterprise Backup, and MySQL Audit.

## 3.3 EDITIONS

- MySQL Workbench is mainly available in three editions...
  - Community Edition (Open Source, GPL)
  - Standard Edition (Commercial)
  - Enterprise Edition (Commercial)

### Community Edition:

- The Community Edition is an open-source and freely downloadable version of the most popular database management system.
- It came under the GPL license and is supported by a huge community of developers.

### Standard Edition:

- It is the commercial edition that provides the capability to deliver high-performance and scalable Online Transaction Processing (OLTP) applications.
- It has made MySQL famous along with industrial-strength, performance, and reliability.

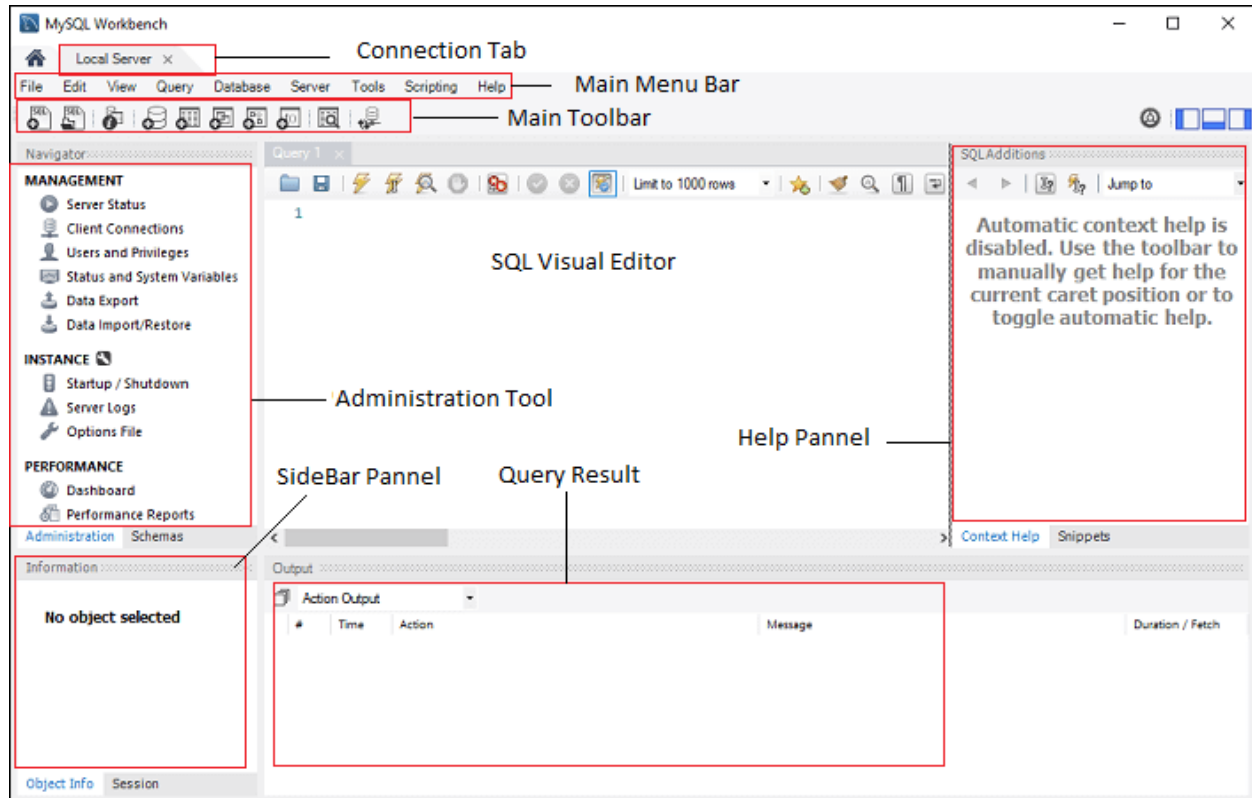
### Enterprise Edition:

- It is the commercial edition that includes a set of advanced features, management tools, and technical support to achieve the highest scalability, security, reliability, and uptime.
- This edition also reduces the risk, cost, complexity in the development, deployment, and managing MySQL applications.

## 3.4 OVERVIEW

- When we open my sql workbench we have this type of window open.

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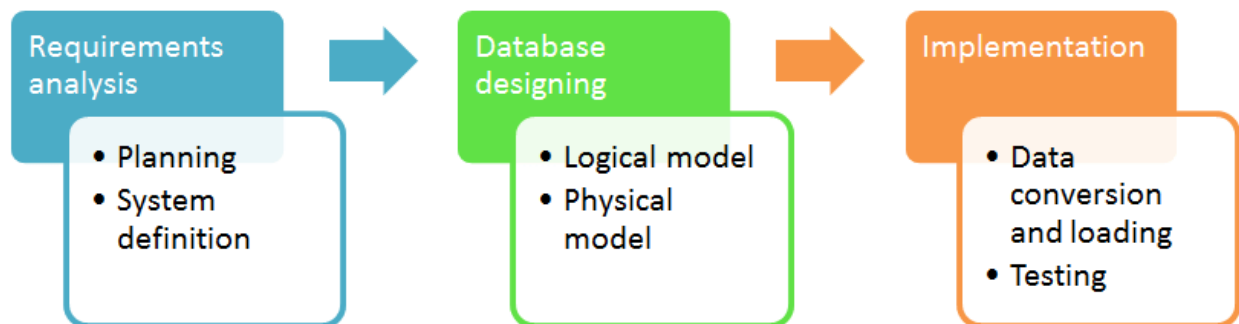
## DATABASE DESIGN

### 4.1 INTRODUCTION

- Database Design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems.
- Properly designed database are easy to maintain, improves data consistency and are cost effective in terms of disk storage space.
- The database designer decides how the data elements correlate and what data must be stored.

### 4.2 DATABASE DEVELOPMENT LIFE CYCLE

- The database development life cycle has a number of stages that are followed when developing database systems.
- But it is not necessary to follow every stages.



#### 4.2.1 REQUIREMENT ANALYSIS:

##### Planning:

- This stages of database design concepts are concerned with planning of entire Database Development Life Cycle.
- It takes into consideration the Information Systems strategy of the organization.

##### System definition:

- This stage defines the scope and boundaries of the proposed database system.

#### 4.2.2 DATABASE DESIGNING:

##### Logical model:

- This stage is concerned with developing a database model based on requirements.
- The entire design is on paper without any physical implementations or specific DBMS considerations.

## **Physical model:**

- This stage implements the logical model of the database taking into account the DBMS and physical implementation factors.

### **4.2.3 IMPLEMENTATION:**

#### **Data conversion and loading:**

- This stage of relational databases design is concerned with importing and converting data from the old system into the new database.

#### **Testing:**

- This stage is concerned with the identification of errors in the newly implemented system.
- It checks the database against requirement specifications.

## **4.3 DATABASE DESIGN TECHNIQUE**

- We have two types of database design techniques.
  - Normalization
  - ER Modeling

### **4.3.1 ER MODELING**

- Entity Relationship Model (ER Modeling) is a graphical approach to database design.
- It is a high-level data model that defines data elements and their relationship for a specified software system.
- An ER model is used to represent real-world objects.

### **4.3.2 NORMALIZATION**

- Normalization is the process of removing redundant data from tables to improve data integrity(completeness, accuracy and consistency of data), scalability and storage efficiency.
- We have 6 type of normal forms
  - 1NF
  - 2NF
  - 3NF
  - BCNF

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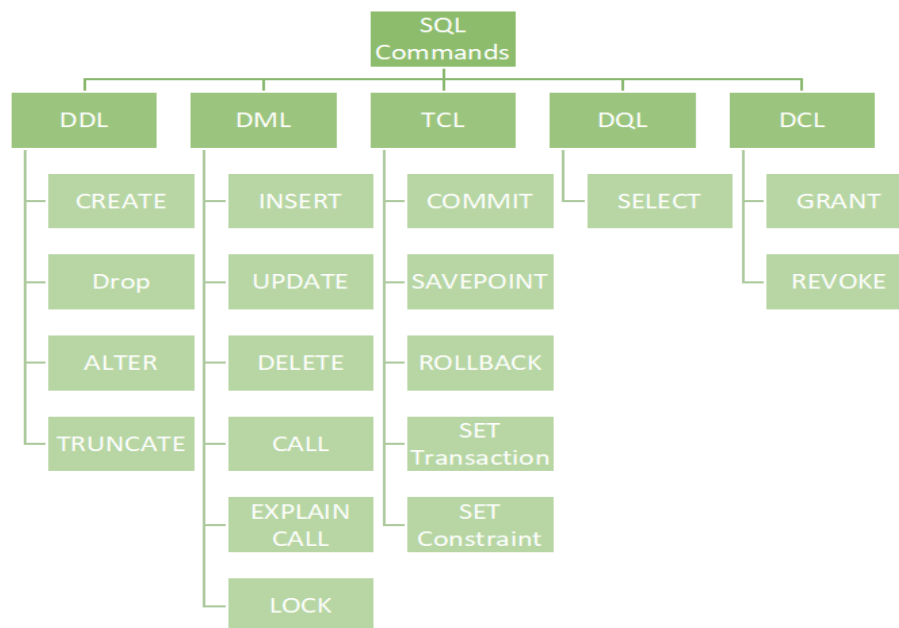
- 4NF
- 5NF

Normal Form	Description
<b>1NF</b>	A relation is in 1NF if it contains an atomic value.
<b>2NF</b>	A relation will be in 2NF if it is in 1NF and all non-key attributes are fully functional dependent on the primary key.
<b>3NF</b>	A relation will be in 3NF if it is in 2NF and no transition dependency exists.
<b>BCNF</b>	A stronger definition of 3NF is known as Boyce Codd's normal form.
<b>4NF</b>	A relation will be in 4NF if it is in Boyce Codd's normal form and has no multi-valued dependency.
<b>5NF</b>	A relation is in 5NF. If it is in 4NF and does not contain any join dependency, joining should be lossless.

## BASIC SQL

### 5.1 INTRODUCTION

- SQL have basic five components,
  - Data Definition Language
  - DQL – Data Query Language
  - DML – Data Manipulation Language
  - DCL – Data Control Language
  - TCL – Transaction Control Language



### 5.2 DATA DEFINITION LANGUAGE

- It contains SQL command that used for define schema.
- DDL is a set of SQL commands used to create, modify, and delete database structures but not data.
- DDL contains following commands,
  - Create
  - Drop
  - Alter

# DBMS Learn

- Truncate
- Comment
- Rename

## Create:

- This command is used to create the database or its objects (like table, index, function, views, store procedure, and triggers).

## Example:

```
Create Database CollageDB;

Create Table Student(
    Id int Not Null Auto_Increment,
    Name Varchar(250) Not Null,
    DateOfBirth Date Not Null,
    ContactNo Varchar(25),
    Gender Varchar(1),
    Primary Key(Id)
);
```

## Drop:

- This command is used to delete objects from the database.

## Example:

```
Drop Database CollageDB;

Drop Table Faculty;
```

## Alter:

- This is used to update the structure of the database.

## Example:

```
-- For Single Column
-- Add new column in table
Alter Table Faculty
Add Email Varchar(50);

-- Edit column in table
Alter Table Faculty
Modify Column Email Varchar(250);
```

# DBMS Learn

```
-- Delete column in table
Alter Table Faculty
Drop Column Email;

-- For Multiple Column
-- Add new columns in table
Alter Table Faculty
Add Email Varchar(50),
Add Subject Varchar(50);

-- Edit columns in table
Alter Table Faculty
Modify Column Email Varchar(250),
Modify Column Subject Varchar (25);

-- Delete colomuns in table
Alter Table Faculty
Drop Column Email,
Drop Column Subject;
```

## Truncate:

- This is used to remove all records from a table, including all spaces allocated for the records are removed.

## Example:

```
Truncate Table student;
```

## Comment:

- This is used to add comments to the data dictionary.

## Example:

## Rename:

- This is used to rename an object existing in the database.

## Example:

```
-- Raname table name
Alter Table Faculty
Rename To FacultyNew
```

## 5.3 DATA QUERY LANGUAGE



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- DQL is used to perform a query on schema.
- It is used to retrieve data from schema.
- It have only one command which is select.
- When we fired select command on table that time data stored in temporary table and this table we should see in output window.

## Example:

```
-- Select all fields
Select * From Student;

-- select specific fields
Select Id, Name, Email From Student;

-- Where condition
Select * from Student
Where Id = 1;

Select * from Student
Where Id != 1;
-- OR
Where Id <> 1;

SELECT * from Student
Where RollNo > 5 and RollNo <= 10

SELECT * from Student
Where RollNo = 5 or RollNo = 10

SELECT * from Student
Where RollNo In(5, 10, 15, 20)

SELECT * from Student
Where RollNo BETWEEN 5 and 10
-- Between include uper bound and lower bound

SELECT * from Student
Where RollNo not BETWEEN 5 and 10

Select * from Student
Where Email is not Null;

-- Lilke
-- (_) represent one character
-- (%) represent more the one character

Select * from Student
Where RollNo like "1_";

Select * from Student
```

# DBMS Learn

```
Where Name like "a%";
-- starting name from a

Select * from Student
Where Name like "%e";
-- starting name from e

Select * from Student
Where Name like "a%e";
-- starting name from a and ending from b

-- orderby
Select * from Student
ORDER BY Name, Email, RollNo, Id;

Select * from Student
ORDER BY Name Desc;

Select DISTINCT RollNo from Student

Select Name from Student
Limit 5;

Select Name as Username from Student;
```

## 5.4 DATA MANIPULATION LANGUAGE

- These commands is used for data manipulation in existing schema.
- It is the component of the SQL statement that controls access to data and to the database.
- Basically, DCL statements are grouped with DML statements.
- It contains following commands,
  - Insert
  - Update
  - Delete
  - Lock
  - Call
  - Explain Plan

### Insert:

- It is used to insert data into a table.

### Example:

```
-- Insert one record
Insert into Student (Name, DateOfBirth, ContactNo, Gender) values ("Dhruvil Dobariya", "2002-04-04", "9487587380", "M");
```

```
-- Insert multiple record
Insert into Student (Name, DateOfBirth, ContactNo, Gender) values
    ("Dhaval Dobariya", "2001-04-12", "", "M"),
    ("Bhargav Vachhani", "2002-01-04", "9408574858", ""),
    ("Jenil Vasoya", "2002-04-11", "", ""),
    ("Dhruv Rathod", "2002-07-11", "8594003858", "M");
```

## Update:

- It is used to update existing data within a table.

## Example:

```
Update Student
Set Name = "Dhruvi Savaliya", Gender = "F"
Where Id = 5
```

## Delete:

- It is used to delete records from a database table.

## Example:

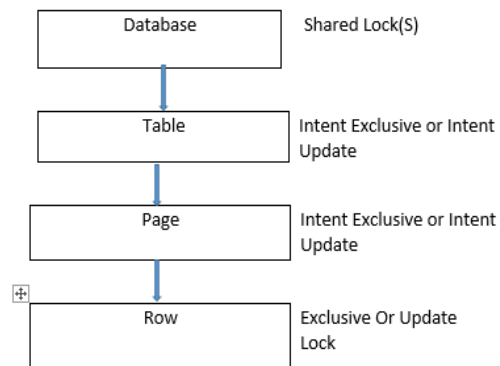
```
Delete From Student Where Id = 6
```

## Lock:

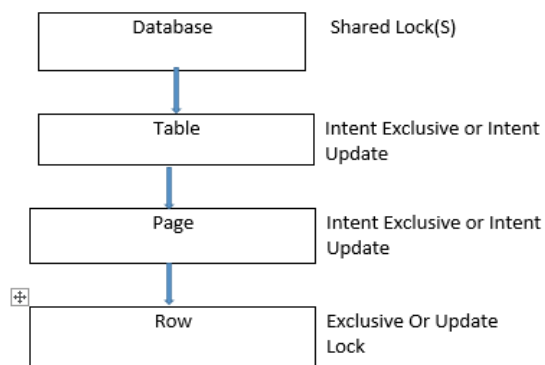
- Data consistency is an important mechanism, and it can be done by means of SQL Locks.
- A lock is established in SQL Server when a transaction starts, and it will be released when it is ended.
- We have different types of locks available in relational database,
  - **Shared (S) Locks:**
    - When the object needs to be read, this type of lock will occur.
    - But this is not harmful.
  - **Exclusive (X) Locks:**
    - It prevents other transactions like inserting/updating/deleting.
    - So no modifications can be done when we apply this type of lock on object.
  - **Update (U) Locks:**
    - It's like Exclusive lock but here the operation can be viewed as "read phase" and "write phase".
    - During the read phase, other transactions are prevented.
  - **Intent Locks:**

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- Intent lock happens on a table, when the shared (S) lock or exclusive (X) lock or Update (U) lock happens on the row.
  - **Regular intent locks:**
    - Intent exclusive (IX)
    - Intent shared (IS)
    - Intent update (IU).
  - **Conversion locks:**
    - Shared with intent exclusive (SIX)
    - Shared with intent update (SIU)
    - Update with intent exclusive (UIX)
- We have hierarchy for lock.



(Select)



(Update/Insert/Delete)

**Call:**

- Call a PL/SQL

**Explain Plan:**

- It describes the access path to data.

## 5.5 DATA CONTROL LANGUAGE

- DCL includes commands which mainly use for user rights, permissions and other controls on database.
- It contains two command,
  - Grant
  - Revoke

**Grant:**

- This command is used to give user access privileges of database to user.

**Example:**

```
GRANT insert,  
select on studentdb to root  
-- We give permission of insrt into studentdb to root
```

**Revoke:**

- This command revoke the user privileges of database from the user.

**Example:**

```
REVOKE insert,  
select on studentdb from root  
-- We revoke permission of insrt into studentdb from root
```

## 5.6 TRANSACTION CONTROL LANGUAGE

- We have group of some transection which used for execute single query.
- Transection done when this group of transections id done,
- If any one is failed then whole transection is failed.
- So transection have only two result, success and failure.
- Transection contains some commands,

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- Begin
- Commit
- Rollback
- Savepoint
- Set Transaction

## **Begin:**

- Opens a Transaction.

## **Commit:**

- Commits a Transaction.

## **Rollback:**

- Rollback transaction if any error occur during transaction.

## **Savepoint:**

- Set a save point within the transaction.

## **Set Transaction:**

- Specify characteristics for transaction.

## DATA SORTING

### 6.1 INTRODUCTION

- We have “Order By” key word to sort our result set.
- By default it's sort in ascending order, But we can specify if we want to sort in descending using “Desc” Key word.

#### Syntax:

```
SELECT column1, column2, ...  
FROM table_name  
ORDER BY column1, column2, ... ASC|DESC;
```

#### Example:

```
-- ascending order  
SELECT * FROM Customers  
ORDER BY Country;  
  
-- descending order  
SELECT * FROM Customers  
ORDER BY Country; DESC
```

## NULL VALUE & KEYWORD

### 7.1 INTRODUCTION

- If a field in a table is optional, it is possible to insert a new record or update a record without adding a value to this field.
- Then, that field will be saved with a NULL value.
- Null value different from zero or empty.
- Null means nothing.
- We have two key work to check null value, “Is Null” and “Is Not Null”.

#### Syntax:

```
SELECT column_names
FROM table_name
WHERE column_name IS NULL | IS NOT NULL;
```

#### Example:

```
-- Get rows which have address is null
SELECT CustomerName, ContactName, Address
FROM Customers
WHERE Address IS NULL;

-- Get rows which have address is not null
SELECT CustomerName, ContactName, Address
FROM Customers
WHERE Address IS NOT NULL;
```



## KEYS AND AUTO INCREMENT

### 8.1 PRIMARY KEY

- Primary key is key that used to uniquely identify record in table.
- Primary key must be unique and not null.
- One table contains one, primary key, but this primary key may combination one or more column.
- We are use “Primary Key” key word to define primary key.

```
-- Define Primary Key
CREATE TABLE Persons (
    ID int NOT NULL,
    LastName varchar(255) NOT NULL,
    FirstName varchar(255),
    Age int,
    PRIMARY KEY (ID)
);

-- OR

CREATE TABLE Persons (
    ID int NOT NULL,
    LastName varchar(255) NOT NULL,
    FirstName varchar(255),
    Age int,
    CONSTRAINT PK_Person PRIMARY KEY (ID,LastName)
);

-- Alter Primary Key
ALTER TABLE Persons
ADD PRIMARY KEY (ID);
-- OR
ALTER TABLE Persons
ADD CONSTRAINT PK_Person PRIMARY KEY (ID,LastName);

-- Drop Primary Key
ALTER TABLE Persons
DROP PRIMARY KEY;
```

### 8.2 AUTO INCREMENT

- Auto Increment generate automatic unique and incremental number in particular field.

**Example:**

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```
CREATE TABLE Persons (
    Personid int NOT NULL AUTO_INCREMENT,
    LastName varchar(255) NOT NULL,
    FirstName varchar(255),
    Age int,
    PRIMARY KEY (Personid)
);
```

## 8.3 FOREIGN KEY

- Foreign key is the key that used to linked two table.
- Parent table primary key is used as a foreign key in child table.
- We have “Foreign Key” keyword to define foreign key.

```
CREATE TABLE Orders (
    OrderID int NOT NULL,
    OrderNumber int NOT NULL,
    PersonID int,
    PRIMARY KEY (OrderID),
    FOREIGN KEY (PersonID) REFERENCES Persons(PersonID)
);
-- OR
CREATE TABLE Orders (
    OrderID int NOT NULL,
    OrderNumber int NOT NULL,
    PersonID int,
    PRIMARY KEY (OrderID),
    CONSTRAINT FK_PersonOrder FOREIGN KEY (PersonID)
    REFERENCES Persons(PersonID)
);
```

## 8.4 UNIQUE KEY

- Unique key is the key that used to set unique behavior of particular field.
- Unique key may null, primary key must not.
- Unique key may one or more in table.
- We have “Unique Key” keyword to define unique key.

```
CREATE TABLE Persons (
    ID int NOT NULL,
    LastName varchar(255) NOT NULL,
    FirstName varchar(255),
    Age int,
    UNIQUE (ID)
);
-- OR
CREATE TABLE Persons (
    ID int NOT NULL,
    LastName varchar(255) NOT NULL,
```

```
    FirstName varchar(255),  
    Age int,  
    CONSTRAINT UC_Person UNIQUE (ID,LastName)  
);
```

## AGGREGATE FUNCTIONS

### 9.1 INTRODUCTION

- Aggregate function is used to perform calculation on row of single column.
- It return only single value.
- It is also used to summarize the data.

### 9.2 AGGREGATE FUNCTION

- We have five types of aggregate function,
  - Count
  - Sum
  - Avg
  - Min
  - Max

#### Count:

- Count number is used to count number of rows in table.

#### Example:

```
select Count(*) from Product;  
select count(distinct Company) from Product;
```

#### Sum:

- Sum is used to calculate sum of all selected column.
- It works on only numeric fields.

#### Example:

```
SELECT Sum(Quantity) As TotalQuantity from Product;
```

#### Avg:

- Avg function is used to calculate average of selected column.
- It works on only numeric fields.

#### Example:

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```
SELECT AVG(Cost) from Product;
```

## Min:

- Min is used to find minimum value of particular column.
- It works on only numeric fields.

## Example:

```
SELECT Min(Quantity) from Product;
```

## Max:

- Max is used to find maximum value of particular column.
- It works on only numeric fields.

## Example:

```
SELECT Max(Quantity) from Product;
```

## 9.3 GROUP BY

- Group By is used to make collection of same value so we can summarize data.
- Group By statement is used with aggregate functions.

## Example:

```
SELECT Company, Sum(Quantity) from Product  
Group By Company
```

## 9.4 HAVING

- Having is used to specify condition after group by with aggregate function.
- We must use “Having” with aggregate function we can’t use “Where”.

## Example:

```
SELECT Company, Count(Company) From Product  
Group By Company  
Having Count(Company) >= 5;  
  
SELECT Company, Sum(Quantity) As TotalQuantity from Product  
Group By Company  
HAVING TotalQuantity > 50;
```

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```
SELECT Company, Sum(Quantity) As TotalQuantity from Product
Where Quantity >= 4
Group By Company
HAVING TotalQuantity > 50;
```

```
SELECT Company, Sum(Quantity) As TotalQuantity from Product
Where Quantity >= 4
Group By Company
HAVING TotalQuantity > 40
ORDER BY Company
LIMIT 2;
```

## 9.5 SEQUENCE OF STATEMENT

- We have particular sequence that we must follow in SQL queries.

### Syntax:

```
SELECT column_name(s)
FROM table_name
WHERE condition
GROUP BY column_name(s)
HAVING condition
ORDER BY column_name(s)
LIMIT number;
```

