

How to Start MySQL Server

Download latest version of XAMPP From <https://www.apachefriends.org/download.html>

Install XAMPP and open XAMPP Control Panel

From Control panel you need to start two services apache, mysql

Now open browser and enter URL <http://localhost/phpmyadmin/> or press admin button from XAMPP control panel.

Now you are connected with MySQL server home page

MySQL Tutorial

MySQL is a widely used relational database management system (RDBMS).

MySQL is free and open-source.

MySQL is ideal for both small and large applications.

Introduction to MySQL

MySQL is a very popular open-source relational database management system (RDBMS).

What is MySQL?

- MySQL is a relational database management system
- MySQL is open-source
- MySQL is free
- MySQL is ideal for both small and large applications
- MySQL is very fast, reliable, scalable, and easy to use
- MySQL is cross-platform
- MySQL is compliant with the ANSI SQL standard
- MySQL was first released in 1995
- MySQL is developed, distributed, and supported by **Oracle Corporation**
- MySQL is named after co-founder Monty Widenius's daughter: My

Who Uses MySQL?

- Huge websites like Facebook, Twitter, Airbnb, Booking.com, Uber, GitHub, YouTube, etc.
- Content Management Systems like WordPress, Drupal, Joomla!, Contao, etc.
- A very large number of web developers around the world

Show Data On Your Web Site

To build a web site that shows data from a database, you will need:

- An RDBMS database program (like MySQL)
- A server-side scripting language, like PHP
- To use SQL to get the data you want
- To use HTML / CSS to style the page

What is RDBMS?

RDBMS stands for Relational Database Management System.

RDBMS is a program used to maintain a relational database.

RDBMS is the basis for all modern database systems such as MySQL, Microsoft SQL Server, Oracle, and Microsoft Access.

RDBMS uses [SQL queries](#) to access the data in the database.

What is a Database Table?

A table is a collection of related data entries, and it consists of columns and rows.

A column holds specific information about every record in the table.

A record (or row) is each individual entry that exists in a table.

Look at a selection from the Northwind "Customers" table:

CustomerID	CustomerName	ContactName	Address	City	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around the Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK

The columns in the "Customers" table above are: CustomerID, CustomerName, ContactName, Address, City, PostalCode and Country. The table has 4 records (rows).

What is a Relational Database?

A relational database defines database relationships in the form of tables. The tables are related to each other - based on data common to each.

Look at the following three tables "Customers", "Orders", and "Shippers" from the Northwind database:

Customers Table

CustomerID	CustomerName	ContactName	Address	City	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around the Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

The relationship between the "Customers" table and the "Orders" table is the CustomerID column:

Orders Table

OrderID	CustomerID	EmployeeID	OrderDate	ShipperID
10278	5	8	1996-08-12	2
10280	5	2	1996-08-14	1
10308	2	7	1996-09-18	3
10355	4	6	1996-11-15	1
10365	3	3	1996-11-27	2
10383	4	8	1996-12-16	3
10384	5	3	1996-12-16	3

The relationship between the "Orders" table and the "Shippers" table is the ShipperID column:

Shippers Table

ShipperID	ShipperName	Phone
1	Speedy Express	(503) 555-9831
2	United Package	(503) 555-3199
3	Federal Shipping	(503) 555-9931

MySQL SQL

What is SQL (Structured Query Language)?

SQL is the standard language for dealing with Relational Databases.

SQL is used to insert, search, update, and delete database records.

How to Use SQL

The following SQL statement selects all the records in the "Customers" table:

```
SELECT * FROM Customers;
```

Keep in Mind That...

- SQL keywords are NOT case sensitive: `select` is the same as `SELECT`

In this tutorial we will write all SQL keywords in upper-case.

Semicolon after SQL Statements?

Some database systems require a semicolon at the end of each SQL statement.

Semicolon is the standard way to separate each SQL statement in database systems that allow more than one SQL statement to be executed in the same call to the server.

In this tutorial, we will use semicolon at the end of each SQL statement.

Some of The Most Important SQL Commands

- `SELECT` - extracts data from a database
- `UPDATE` - updates data in a database
- `DELETE` - deletes data from a database
- `INSERT INTO` - inserts new data into a database
- `CREATE DATABASE` - creates a new database
- `ALTER DATABASE` - modifies a database
- `CREATE TABLE` - creates a new table
- `ALTER TABLE` - modifies a table
- `DROP TABLE` - deletes a table
- `CREATE INDEX` - creates an index (search key)
- `DROP INDEX` - deletes an index

Create Database and Table as like following

Server: 127.0.0.1 » Database: 9211_2324 » Table: students

Browse

Structure

SQL

Search

Insert

Export

Import

Privileges

Operations

Tracking

Triggers

Table structure

Relation view

	#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1	roll	int(11)			No	None		AUTO_INCREMENT	Change Drop More
<input type="checkbox"/>	2	fname	varchar(20)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	3	lname	varchar(20)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	4	city	varchar(20)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	5	email	varchar(128)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	6	phone	varchar(15)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	7	gender	varchar(10)	utf8mb4_general_ci		No	None			Change Drop More
<input type="checkbox"/>	8	dateofbirth	date			No	None			Change Drop More
<input type="checkbox"/>	9	admissiondata	timestamp			No	current_timestamp()			Change Drop More

Console

And add some data as following

Server: 127.0.0.1 » Database: 9211_2324 » Table: students

Browse

Structure

SQL

Search

Insert

Export

Import

Privileges

Operations

Tracking

	roll	fname	lname	city	email	phone	gender	dateofbirth	admissiondata
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	1	hetvi	Maheswari	Morbi	hetvi@gmail.com	8787678678	female	2004-02-14	2024-02-14 10:03:04
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	2	kenil	sangani	Rajkot	kenil@gmail.com	2457834578	male	2004-02-13	2024-02-14 10:04:10
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	3	ridham	vishnuswami	Ahamdabad	ridham@gmail.com	989898989	male	2005-02-12	2024-02-14 10:04:10
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	4	bhalabhai	bavaliya	Rajkot	bhalabhai@gmail.com	2457834578	male	2004-02-13	2024-02-14 10:04:51
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	5	sumit	talsaniya	Ahamdabad	sumit@gmail.com	989898989	male	2005-02-12	2024-02-14 10:04:51
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	6	het	dadhaniya	Rajkot	het@gmail.com	2457834578	male	2004-02-13	2024-02-14 10:05:28
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	7	deepak	vavdiya	Ahamdabad	deepak@gmail.com	989898989	male	2005-02-12	2024-02-14 10:05:28
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	8	dhrumil	nathani	Rajkot	dhrumin@gmail.com	2457834578	male	2004-02-13	2024-02-14 10:06:01
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	9	sujal	khachariya	Ahamdabad	sujal@gmail.com	989898989	male	2005-02-12	2024-02-14 10:06:01
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	10	riya	barad	Rajkot	riya@gmail.com	2457834578	female	2004-02-13	2024-02-14 10:06:40
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	11	khushi	thakar	Ahamdabad	khushi@gmail.com	989898989	female	2005-02-12	2024-02-14 10:06:40
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	12	hasti	vala	Rajkot	hasti@gmail.com	2457834578	female	2004-02-13	2024-02-14 10:07:22
<div><div><div></div><div>Edit</div></div><div><div></div><div>Copy</div></div><div><div></div><div>Delete</div></div></div>	13	priya	thakar	Ahamdabad	priya@gmail.com	989898989	female	2005-02-12	2024-02-14 10:07:22

MySQL SELECT Statement

The MySQL SELECT Statement

The `SELECT` statement is used to select data from a database.

The data returned is stored in a result table, called the result-set.

SELECT Syntax

`SELECT column1, column2, ... FROM table_name;`

Here, column1, column2, ... are the field names of the table you want to select data from. If you want to select all the fields available in the table, use the following syntax:

`SELECT * FROM table_name;`

`SELECT * from students;`

`SELECT roll, fname, lname, city from students`

The MySQL SELECT DISTINCT Statement

The `SELECT DISTINCT` statement is used to return only distinct (different) values.

Inside a table, a column often contains many duplicate values; and sometimes you only want to list the different (distinct) values.

SELECT DISTINCT Syntax

`SELECT DISTINCT column1, column2, ... FROM table_name;`

`SELECT city from students;`

`SELECT DISTINCT city from students;`

The following SQL statement counts and returns the number of different (distinct) city in the "Students" table:

`SELECT count(DISTINCT city) from students;`

MySQL WHERE Clause

The MySQL WHERE Clause

The `WHERE` clause is used to filter records.

It is used to extract only those records that fulfill a specified condition.

WHERE Syntax

`SELECT column1, column2, ...`

`FROM table_name`

`WHERE condition;`

Note: The *WHERE* clause is not only used in *SELECT* statements, it is also used in *UPDATE*, *DELETE*, etc.!

```
SELECT * FROM students WHERE roll = 1
```

```
SELECT * FROM students WHERE roll > 5;
```

```
SELECT * FROM students WHERE not roll > 5;
```

```
SELECT * FROM students WHERE city = 'rajkot';
```

```
SELECT * FROM students WHERE city <> 'rajkot';
```

```
SELECT * FROM students WHERE not city = 'rajkot';
```

```
SELECT * FROM students WHERE roll BETWEEN 1 and 5
```

MySQL AND, OR and NOT Operators

The MySQL AND, OR and NOT Operators

The `WHERE` clause can be combined with `AND`, `OR`, and `NOT` operators.

The `AND` and `OR` operators are used to filter records based on more than one condition:

- The `AND` operator displays a record if all the conditions separated by `AND` are `TRUE`.
- The `OR` operator displays a record if any of the conditions separated by `OR` is `TRUE`.

The `NOT` operator displays a record if the condition(s) is `NOT TRUE`.

AND Syntax

```
SELECT column1, column2, ... FROM table_name WHERE condition1 AND condition2 AND condition3 ...;
```

```
SELECT * from students WHERE roll = 1
```

```
SELECT * from students WHERE roll = 1 and city = 'Rajkot';
```

OR Syntax

```
SELECT column1, column2, ... FROM table_name WHERE condition1 OR condition2 OR condition3 ...;
```

```
SELECT * from students WHERE city = 'morbi' or city = 'Rajkot';
```

NOT Syntax

```
SELECT column1, column2, ... FROM table_name WHERE NOT condition;
```

```
SELECT * from students WHERE not city = 'morbi' ;
```

Combining AND, OR and NOT

You can also combine the `AND`, `OR` and `NOT` operators.

```
SELECT * from students WHERE roll = 1 and city = 'rajkot' or city = 'morbi'
```

```
SELECT * from students WHERE roll = 1 and (city = 'rajkot' or city = 'morbi')
```

MySQL ORDER BY Keyword

The MySQL ORDER BY Keyword

The `ORDER BY` keyword is used to sort the result-set in ascending or descending order.

The `ORDER BY` keyword sorts the records in ascending order by default. To sort the records in descending order, use the `DESC` keyword.

ORDER BY Syntax

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

```
SELECT * from students;
```

```
SELECT * from students ORDER by fname;
```

ORDER BY DESC Example

The following SQL statement selects all customers from the "students" table, sorted DESCENDING by the "fname" column:

```
SELECT * from students ORDER by fname DESC;
```

ORDER BY Several Columns Example

```
SELECT * from students ORDER by fname, city;
```

```
SELECT * from students ORDER by fname asc, city DESC;
```

MySQL INSERT INTO Statement

The MySQL INSERT INTO Statement

The `INSERT INTO` statement is used to insert new records in a table.

INSERT INTO Syntax

It is possible to write the `INSERT INTO` statement in two ways:

1. Specify both the column names and the values to be inserted:

```
INSERT INTO table_name (column1, column2, column3, ...) VALUES (value1, value2, value3, ...);
```

2. If you are adding values for all the columns of the table, you do not need to specify the column names in the SQL query. However, make sure the order of the values is in the same order as the columns in the table. Here, the `INSERT INTO` syntax would be as follows:

```
INSERT INTO table_name VALUES (value1, value2, value3, ...);
```

```
INSERT into students (fname, lname, city, email, phone, gender, dateofbirth) VALUES  
( 'Demo', 'text', 'example', 'demo@example.com', '9876543210', 'male', '2001-01-01')
```

Did you notice that we did not insert any number into the CustomerID field?

The CustomerID column is an [auto-increment](#) field and will be generated automatically when a new record is inserted into the table.

Insert Data Only in Specified Columns

It is also possible to only insert data in specific columns.

```
INSERT into students (fname, lname, city, email, phone) VALUES ( 'Demo', 'text', 'example',  
'demo@example.com', '9876543210')
```

MySQL NULL Values

What is a NULL Value?

A field with a NULL value is a field with no value.

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, the field will be saved with a NULL value.

Note: A NULL value is different from a zero value or a field that contains spaces. A field with a NULL value is one that has been left blank during record creation!

```
INSERT into students (fname, lname, city, email, phone) VALUES ('Demo', 'text', 'example', 'demo@example.com', '9876543210')
```

```
SELECT * FROM `students` WHERE gender = '';
```

```
SELECT * FROM `students` WHERE gender = 'NULL';
```

```
SELECT * FROM `students` WHERE gender is null;
```

How to Test for NULL Values?

It is not possible to test for NULL values with comparison operators, such as =, <, or <>.

We will have to use the `IS NULL` and `IS NOT NULL` operators instead.

IS NULL Syntax

```
SELECT column_names FROM table_name WHERE column_name IS NULL;
```

```
SELECT * FROM `students` WHERE gender is null;
```

IS NOT NULL Syntax

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

```
SELECT * FROM `students` WHERE gender is not null;
```

MySQL UPDATE Statement

The MySQL UPDATE Statement

The `UPDATE` statement is used to modify the existing records in a table.

UPDATE Syntax

`UPDATE table_name SET column1 = value1, column2 = value2, ...`

Note: Be careful when updating records in a table! Notice the `WHERE` clause in the `UPDATE` statement. The `WHERE` clause specifies which record(s) that should be updated. If you omit the `WHERE` clause, all records in the table will be updated!`WHERE condition;`

```
UPDATE students set gender = 'male' WHERE roll = 15 or roll = 16
```

```
UPDATE students set city = 'rajkot'
```

```
UPDATE students set city = 'surat' WHERE roll > 10
```

```
UPDATE students set city = 'ahamdabad' WHERE roll > 5 and roll < 10;
```

UPDATE Multiple Records

It is the `WHERE` clause that determines how many records will be updated.

```
UPDATE students set gender = 'female', dateofbirth = '2001-01-15' WHERE roll >= 15
```

Update Warning!

Be careful when updating records. If you omit the `WHERE` clause, ALL records will be updated!

MySQL LIMIT Clause

The MySQL LIMIT Clause

The `LIMIT` clause is used to specify the number of records to return.

The `LIMIT` clause is useful on large tables with thousands of records. Returning a large number of records can impact performance.

LIMIT Syntax

`SELECT column_name(s) FROM table_name WHERE condition LIMIT number;`

```
SELECT * FROM `students`
```

```
SELECT * FROM `students` limit 5;
```

What if we want to select records 6-10 (inclusive)?

MySQL provides a way to handle this: by using `OFFSET`.

The SQL query below says "return only 5 records, start on record 6 (`OFFSET 5`)":

```
SELECT * FROM `students` limit 5 OFFSET 5;
```

```
SELECT * FROM `students` limit 5 OFFSET 10;
```

```
SELECT * FROM students WHERE city = 'rajkot' LIMIT 10 ;
```

```
SELECT * from students LIMIT 5 OFFSET 10
```

```
SELECT * from students LIMIT 10, 5; -- offset 10 limit 5
```

MySQL MIN() and MAX() Functions

MySQL MIN() and MAX() Functions

The `MIN()` function returns the smallest value of the selected column.

The `MAX()` function returns the largest value of the selected column.

MIN() Syntax

```
SELECT MIN(column_name)  
FROM table_name  
WHERE condition;
```

MAX() Syntax

```
SELECT MAX(column_name)  
FROM table_name  
WHERE condition;
```

```
SELECT max(dateofbirth) FROM students
```

```
SELECT min(dateofbirth) FROM students;
```

```
SELECT min(roll) FROM students;
```

```
SELECT max(roll) FROM students;
```

MySQL COUNT(), AVG() and SUM() Functions

MySQL COUNT(), AVG() and SUM() Functions

The `COUNT()` function returns the number of rows that matches a specified criterion.

`COUNT()` Syntax

```
SELECT COUNT(column_name)  
FROM table_name  
WHERE condition;
```

The `AVG()` function returns the average value of a numeric column.

`AVG()` Syntax

```
SELECT AVG(column_name)  
FROM table_name  
WHERE condition;
```

The `SUM()` function returns the total sum of a numeric column.

`SUM()` Syntax

```
SELECT SUM(column_name)  
FROM table_name  
WHERE condition;
```

```
SELECT COUNT(roll) from students
```

```
SELECT COUNT(roll) from students WHERE city = 'rajkot';
```

```
SELECT COUNT(roll) from students WHERE not city = 'rajkot';
```

```
SELECT sum(roll) from students
```

```
SELECT avg(roll) from students
```

```
SELECT sum(roll), avg(roll) from students;
```

MySQL DELETE Statement

The MySQL DELETE Statement

The `DELETE` statement is used to delete existing records in a table.

DELETE Syntax

`DELETE FROM table_name WHERE condition;`

Note: Be careful when deleting records in a table! Notice the `WHERE` clause in the `DELETE` statement. The `WHERE` clause specifies which record(s) should be deleted. If you omit the `WHERE` clause, all records in the table will be deleted!

Backup all the data of students table to studentsBackup table

```
create table studentsBackup as SELECT * FROM students
```

SQL DELETE Example

```
DELETE from students WHERE ROLL = 1
```

```
DELETE from students WHERE city = 'rajkot'
```

Delete All Records

It is possible to delete all rows in a table without deleting the table. This means that the table structure, attributes, and indexes will be intact:

```
DELETE FROM table_name;
```

```
DELETE from students
```

```
// restore
```

```
INSERT into students SELECT * from studentsbackup
```

```
// when you delete all the data from table the auto increment is not reset to zero
```

```
INSERT INTO `students` (`roll`, `fname`, `lname`, `city`, `email`, `phone`, `gender`, `dateofbirth`,  
`admissiondata`) VALUES (NULL, 'brijesh', 'sinojiya', 'Morbi', 'demo@gmail.com', '998899889900',  
'male', '2004-02-13', current_timestamp());
```

A new record get a roll number as you leave before delete all the data

Use truncate table to delete all the data from table and also reset all auto increments

```
TRUNCATE TABLE students
```

```
INSERT INTO `students` (`roll`, `fname`, `lname`, `city`, `email`, `phone`, `gender`, `dateofbirth`,  
`admissiondata`) VALUES (NULL, 'brijesh', 'sinojiya', 'Morbi', 'demo@gmail.com', '998899889900',  
'male', '2004-02-13', current_timestamp());
```

Tuncate table students

Insert into students select * from studentsbackup

DROP TABLE studentsbackup

MySQL LIKE Operator

The MySQL LIKE Operator

The `LIKE` operator is used in a `WHERE` clause to search for a specified pattern in a column.

There are two wildcards often used in conjunction with the `LIKE` operator:

- The percent sign (%) represents zero, one, or multiple characters
- The underscore sign (_) represents one, single character

The percent sign and the underscore can also be used in combinations!

LIKE Syntax

```
SELECT column1, column2, ... FROM table_name WHERE columnN LIKE pattern;
```

Tip: You can also combine any number of conditions using `AND` or `OR` operators.

```
SELECT * from students WHERE fname like 'a%'
```

```
SELECT * from students WHERE fname like 'a%'
```

```
SELECT * from students WHERE fname like '%a%';
```

```
SELECT * from students WHERE fname like '_a%';
```

```
SELECT * from students WHERE fname like '__a%';
```

```
SELECT * from students WHERE fname like '____';
```

Here are some examples showing different `LIKE` operators with '%' and '_' wildcards:

LIKE Operator	Description
WHERE CustomerName LIKE 'a%'	Finds any values that start with "a"
WHERE CustomerName LIKE '%a'	Finds any values that end with "a"
WHERE CustomerName LIKE '%or%'	Finds any values that have "or" in any position
WHERE CustomerName LIKE '_r%'	Finds any values that have "r" in the second position
WHERE CustomerName LIKE 'a_%'	Finds any values that start with "a" and are at least 2 characters in length
WHERE CustomerName LIKE 'a__%'	Finds any values that start with "a" and are at least 3 characters in length
WHERE ContactName LIKE 'a%o'	Finds any values that start with "a" and ends with "o"

MySQL Wildcards

MySQL Wildcard Characters

A wildcard character is used to substitute one or more characters in a string.

Wildcard characters are used with the [LIKE](#) operator. The `LIKE` operator is used in a `WHERE` clause to search for a specified pattern in a column.

Wildcard Characters in MySQL

Symbol	Description	Example
%	Represents zero or more characters	bl% finds bl, black, blue, and blob
_	Represents a single character	h_t finds hot, hat, and hit

The wildcards can also be used in combinations!

Here are some examples showing different `LIKE` operators with '%' and '_' wildcards:

LIKE Operator	Description
WHERE CustomerName LIKE 'a%'	Finds any values that starts with "a"
WHERE CustomerName LIKE '%a'	Finds any values that ends with "a"
WHERE CustomerName LIKE '%or%'	Finds any values that have "or" in any position
WHERE CustomerName LIKE '_r%'	Finds any values that have "r" in the second position
WHERE CustomerName LIKE 'a_%_%'	Finds any values that starts with "a" and are at least 3 characters in length
WHERE ContactName LIKE 'a%o'	Finds any values that starts with "a" and ends with "o"

MySQL IN Operator

The MySQL IN Operator

The `IN` operator allows you to specify multiple values in a `WHERE` clause.

The `IN` operator is a shorthand for multiple `OR` conditions.

IN Syntax

```
SELECT column_name(s) FROM table_name WHERE column_name IN (value1, value2, ...);
```

or:

```
SELECT column_name(s) FROM table_name WHERE column_name IN (SELECT STATEMENT);
```

```
SELECT * from students WHERE city = 'rajkot' or city = 'surat' or city = 'baroda'
```

```
SELECT * from students WHERE city in ('rajkot', 'baroda', 'surat')
```

```
SELECT * from students WHERE city not in ('rajkot', 'baroda', 'surat');
```


MySQL BETWEEN Operator

The MySQL BETWEEN Operator

The `BETWEEN` operator selects values within a given range. The values can be numbers, text, or dates.

The `BETWEEN` operator is inclusive: begin and end values are included.

BETWEEN Syntax

```
SELECT column_name(s) FROM table_name WHERE column_name BETWEEN value1 AND value2;
```

```
SELECT * from students WHERE roll BETWEEN 1 and 5
```

```
SELECT * from students WHERE roll not BETWEEN 1 and 5;
```

```
SELECT * from students WHERE fname BETWEEN 'bhalabhai' and 'riya';
```

```
SELECT * from students WHERE fname not BETWEEN 'bhalabhai' and 'riya';
```

```
SELECT * FROM `students` WHERE dateofbirth BETWEEN '2001-01-01' and '2004-12-31'
```

```
SELECT * FROM `students` WHERE dateofbirth not BETWEEN '2001-01-01' and '2004-12-31';
```

MySQL Aliases

MySQL Aliases

Aliases are used to give a table, or a column in a table, a temporary name.

Aliases are often used to make column names more readable.

An alias only exists for the duration of that query.

An alias is created with the `AS` keyword.

Alias Column Syntax

```
SELECT column_name AS alias_name FROM table_name;
```

Alias Table Syntax

```
SELECT column_name(s) FROM table_name AS alias_name;
```

```
SELECT roll, fname, lname, email, city, phone, dateofbirth from students
```

```
SELECT roll as "Roll Number", fname as "First Name", lname as "Last Name", email as "Email Address", city as HomeTown, phone as 'Phone Number', dateofbirth from students;
```

```
SELECT roll "Roll Number", fname "First Name", lname "Last Name", email "Email Address", city HomeTown, phone 'Phone Number', dateofbirth from students;
```

```
SELECT concat_ws("_", roll, fname, lname, email, city, phone, gender, dateofbirth) as "Student Information" from students
```

```
SELECT concat_ws(" * ", roll, fname, lname, email, city, phone, gender, dateofbirth) as "Student Information" from students;
```

The following SQL statement is the same as above, but without aliases:

```
SELECT students.roll, students.fname, students.lname, students.city, students.email, students.phone, students.gender, students.dateofbirth, students.admissiondata, marks.total, marks.result FROM students, marks WHERE students.roll = 1 and students.roll = marks.roll
```

The following SQL statement is the same as above, but with aliases:

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, s.admissiondata, m.total, m.result FROM students as s, marks as m WHERE s.roll = 1 and s.roll = m.roll;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, s.admissiondata, m.total, m.result FROM students s, marks m WHERE s.roll = 1 and s.roll = m.roll;
```

Aliases can be useful when:

- There are more than one table involved in a query
- Functions are used in the query
- Column names are big or not very readable
- Two or more columns are combined together

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, s.admissiondata,  
a.absents, a.presents FROM students s, attendance a WHERE s.roll = 1 and s.roll = a.roll;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, s.admissiondata,  
a.absents, a.presents, (a.absents+a.presents) FROM students s, attendance a WHERE s.roll = 1 and  
s.roll = a.roll;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, s.admissiondata,  
a.absents, a.presents, (a.absents+a.presents) "Total Days" FROM students s, attendance a WHERE  
s.roll = 1 and s.roll = a.roll;
```

MySQL Joins

MySQL Joining Tables

A `JOIN` clause is used to combine rows from two or more tables, based on a related column between them.

Let's look at a selection from the "Orders" table:

OrderID	CustomerID	OrderDate
10308	2	1996-09-18
10309	37	1996-09-19
10310	77	1996-09-20

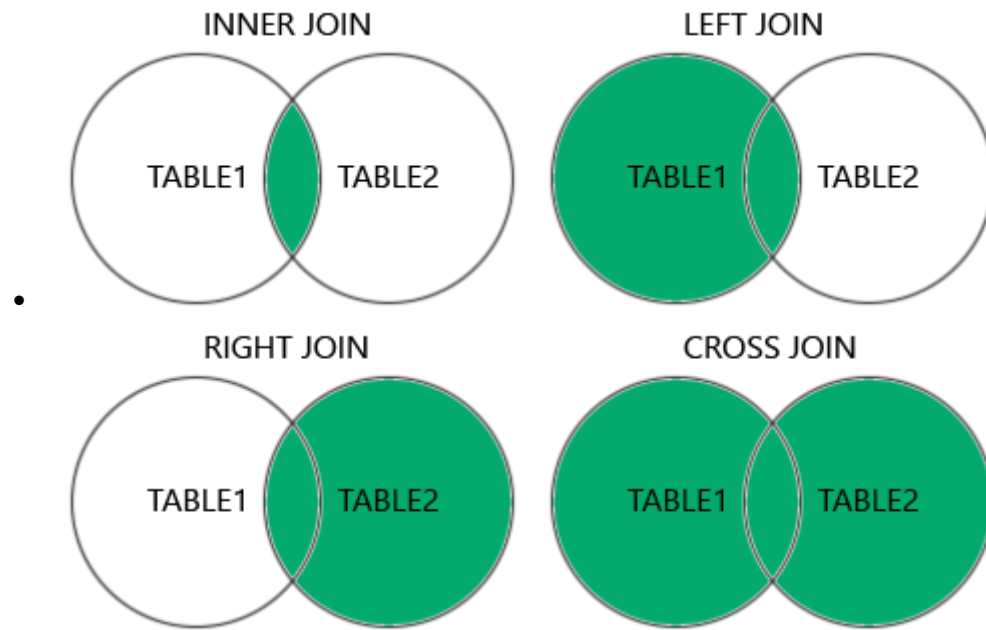
Then, look at a selection from the "Customers" table:

CustomerID	CustomerName	ContactName	Country
1	Alfreds Futterkiste	Maria Anders	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mexico

Notice that the "CustomerID" column in the "Orders" table refers to the "CustomerID" in the "Customers" table. The relationship between the two tables above is the "CustomerID" column

Supported Types of Joins in MySQL

- `INNER JOIN`: Returns records that have matching values in both tables
- `LEFT JOIN`: Returns all records from the left table, and the matched records from the right table
- `RIGHT JOIN`: Returns all records from the right table, and the matched records from the left table
- `CROSS JOIN`: Returns all records from both tables

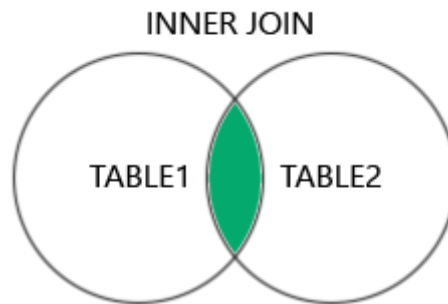


```
SELECT students.roll, students.fname, students.lname, students.city, students.email, students.phone,
students.gender, students.dateofbirth, marks.total, marks.result from students INNER join marks on
students.roll = marks.roll
```

MySQL INNER JOIN Keyword

MySQL INNER JOIN Keyword

The `INNER JOIN` keyword selects records that have matching values in both tables.



INNER JOIN Syntax

```
SELECT column_name(s) FROM table1 INNER JOIN table2 ON table1.column_name = table2.column_name;
```

```
SELECT students.roll, students.fname, students.lname, students.dateofbirth, marks.total, marks.result from students INNER join marks on students.roll = marks.roll
```

Without alias

```
SELECT students.roll, students.fname, students.lname, students.city, students.email, students.phone, students.gender, students.admissiondata, marks.total, marks.result FROM students inner JOIN marks on students.roll = marks.roll
```

With alias

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.admissiondata, m.total, m.result FROM students s inner JOIN marks m on s.roll = m.roll;
```

JOIN Three Tables

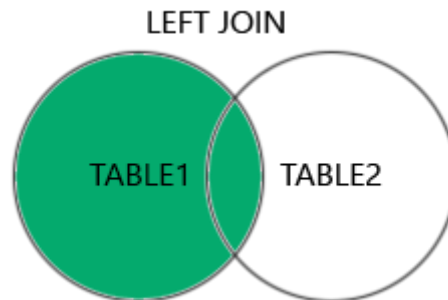
```
SELECT students.roll, students.fname, students.lname, students.city, students.email, students.phone, students.gender, students.dateofbirth, marks.total, marks.result, attendance.absents, attendance.presents from students INNER join marks on students.roll = marks.roll INNER join attendance on students.roll = attendance.roll
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, m.total, m.result, a.absents, a.presents from students s INNER join marks m on s.roll = m.roll INNER join attendance a on s.roll = a.roll;
```

MySQL LEFT JOIN Keyword

MySQL LEFT JOIN Keyword

The `LEFT JOIN` keyword returns **all records from the left table** (table1), and the matching records (if any) from the right table (table2).



LEFT JOIN Syntax

```
SELECT column_name(s) FROM table1 LEFT JOIN table2 ON table1.column_name =  
table2.column_name;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, m.total, m.result from  
students s inner join marks m on s.roll = m.roll;
```

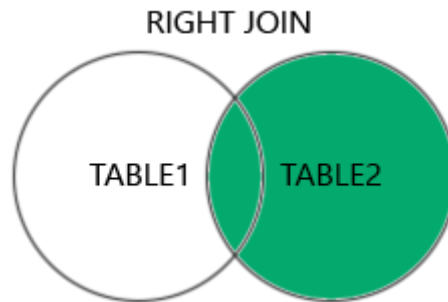
```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, m.total, m.result from  
students s left join marks m on s.roll = m.roll
```

Note: The `LEFT JOIN` keyword returns all records from the left table (Customers), even if there are no matches in the right table (Orders) even no match found mysql replace required values with NULL keyword.

MySQL RIGHT JOIN Keyword

MySQL RIGHT JOIN Keyword

The `RIGHT JOIN` keyword returns all records from the right table (table2), and the matching records (if any) from the left table (table1).



RIGHT JOIN Syntax

```
SELECT column_name(s) FROM table1 RIGHT JOIN table2 ON table1.column_name =  
table2.column_name;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, m.total, m.result from  
students s inner join marks m on s.roll = m.roll;
```

```
SELECT s.roll, s.fname, s.lname, s.city, s.email, s.phone, s.gender, s.dateofbirth, m.total, m.result from  
students s right join marks m on s.roll = m.roll;
```

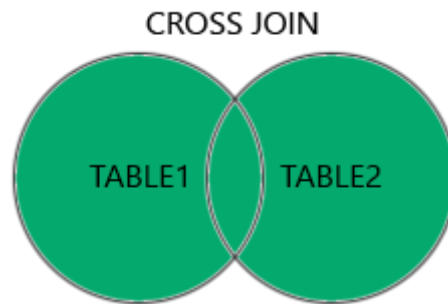
Note: The `RIGHT JOIN` keyword returns all records from the right table (Employees), even if there are no matches in the left table (Orders) even no match found mysql replace required values with NULL keyword.

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MySQL CROSS JOIN Keyword

SQL CROSS JOIN Keyword

The `CROSS JOIN` keyword returns all records from both tables (table1 and table2).



CROSS JOIN Syntax

```
SELECT column_name(s) FROM table1 CROSS JOIN table2;
```

Note: `CROSS JOIN` can potentially **return very large result-sets!**

```
SELECT * FROM students CROSS join marks
```

Note: The `CROSS JOIN` keyword returns all matching records from both tables whether the other table matches or not. So, if there are rows in "Customers" that do not have matches in "Orders", or if there are rows in "Orders" that do not have matches in "Customers", those rows will be listed as well.

If you add a `WHERE` clause (if table1 and table2 has a relationship), the `CROSS JOIN` will produce the same result as the `INNER JOIN` clause:

```
SELECT * FROM students CROSS join marks WHERE students.roll = marks.roll;
```

MySQL Self Join

MySQL Self Join

A self join is a regular join, but the table is joined with itself.

Self Join Syntax

SELECT *column_name(s)* **FROM** *table1 T1, table1 T2* **WHERE** *condition*;

T1 and *T2* are different table aliases for the same table.

```
SELECT s1.roll, s1.fname, s1.lname, s1.city, s1.email, s1.phone FROM students s1, students s2 WHERE  
s1.roll <> s2.roll and s1.city = 'Rajkot';
```

```
SELECT s1.roll, s1.fname, s1.lname, s1.city, s2.roll, s2.fname, s2.lname, s2.city FROM students s1,  
students s2 WHERE s1.roll <> s2.roll and s1.city = s2.city;
```

MySQL UNION Operator

The MySQL UNION Operator

The `UNION` operator is used to combine the result-set of two or more `SELECT` statements.

- Every `SELECT` statement within `UNION` must have the same number of columns
- The columns must also have similar data types
- The columns in every `SELECT` statement must also be in the same order

UNION Syntax

```
SELECT column_name(s) FROM table1
UNION
SELECT column_name(s) FROM table2;
```

UNION ALL Syntax

The `UNION` operator selects **only distinct values by default**. To allow duplicate values, use `UNION ALL`:

```
SELECT column_name(s) FROM table1
UNION ALL
SELECT column_name(s) FROM table2;
```

```
create table students1 as SELECT * from students
```

```
SELECT * FROM students
```

```
UNION
```

```
SELECT * FROM students1
```

```
SELECT * FROM students
```

```
UNION ALL
```

```
SELECT * FROM students1
```

```
SELECT roll, fname, lname, city FROM students
```

```
UNION ALL
```

```
SELECT roll, fname, lname, city FROM students1;
```

```
SELECT roll, fname, lname, city FROM students
```

UNION ALL

SELECT roll, fname, lname FROM students1;

#1222 - The used SELECT statements have a different number of columns

SELECT roll, fname, lname, city FROM students WHERE city = 'Rajkot'

UNION ALL

SELECT roll, fname, lname, city FROM students1 WHERE city = 'Rajkot';

MySQL GROUP BY Statement

The MySQL GROUP BY Statement

The `GROUP BY` statement groups rows that have the same values into summary rows, like "find the number of customers in each country".

The `GROUP BY` statement is often used with aggregate functions (`COUNT()`, `MAX()`, `MIN()`, `SUM()`, `AVG()`) to group the result-set by one or more columns.

```
SELECT DISTINCT city FROM students
```

GROUP BY Syntax

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

```
SELECT city, count(roll) from students GROUP by(city)
```

```
SELECT city, count(roll) from students GROUP by(city) ORDER by (COUNT(roll));
```

```
SELECT city, count(roll) from students GROUP by(city) ORDER by (COUNT(roll)) desc;
```

GROUP BY With JOIN Example

```
SELECT students.roll, students.fname, students.lname, students.city, students.gender,  
students.phone, students.email, students.admissiondata, marks.total, marks.result from students  
inner join marks on students.roll = marks.roll
```

```
SELECT students.roll, students.fname, students.lname, students.city, students.gender,  
students.phone, students.email, students.admissiondata, marks.total, marks.result, count(marks.roll)  
as "Exam Attempt" from students inner join marks on students.roll = marks.roll GROUP by  
(marks.roll);
```

MySQL HAVING Clause

The MySQL HAVING Clause

The `HAVING` clause was added to SQL because the `WHERE` keyword **cannot** be used with aggregate functions.

```
SELECT students.roll, students.fname, students.lname, students.city, students.gender,  
students.phone, students.email, students.admissiondata, marks.total, marks.result, count(marks.roll)  
as "Exam Attempt" from students inner join marks on students.roll = marks.roll GROUP by  
(marks.roll) where count(marks.roll) > 2;
```

```
SELECT students.roll, students.fname, students.lname, students.city, students.gender,  
students.phone, students.email, students.admissiondata, marks.total, marks.result, count(marks.roll)  
as "Exam Attempt" from students inner join marks on students.roll = marks.roll GROUP by  
(marks.roll) having count(marks.roll) > 2;
```

```
SELECT city, COUNT(roll) from students GROUP by (city);
```

```
SELECT city, COUNT(roll) from students GROUP by (city) HAVING COUNT(roll) > 3;
```

```
SELECT city, COUNT(roll) from students GROUP by (city) HAVING COUNT(roll) > 3 ORDER by  
(COUNT(roll));
```

MySQL EXISTS Operator

The MySQL EXISTS Operator

The `EXISTS` operator is used to test for the existence of any record in a subquery.

The `EXISTS` operator returns `TRUE` if the subquery returns one or more records.

EXISTS Syntax

`SELECT column_name(s) FROM table_name WHERE EXISTS (SELECT column_name FROM table_name WHERE condition);`

`SELECT roll from marks WHERE result = 'pass';`

`SELECT * from students WHERE EXISTS (SELECT roll from marks WHERE result = 'pass' and students.roll = marks.roll);`

`SELECT * from students WHERE not EXISTS (SELECT roll from marks WHERE result = 'pass' and students.roll = marks.roll);`

MySQL ANY and ALL Operators

The MySQL ANY and ALL Operators

The `ANY` and `ALL` operators allow you to perform a comparison between a single column value and a range of other values.

The ANY Operator

The `ANY` operator:

- returns a boolean value as a result
- returns TRUE if ANY of the subquery values meet the condition

`ANY` means that the condition will be true if the operation is true for any of the values in the range.

ANY Syntax

```
SELECT column_name(s) FROM table_name WHERE column_name operator ANY (SELECT column_name FROM table_name WHERE condition);
```

Note: The *operator* must be a standard comparison operator (`=`, `<>`, `!=`, `>`, `>=`, `<`, or `<=`).

```
SELECT * from students WHERE roll = any (SELECT roll FROM marks WHERE result = 'pass');
```

The ALL Operator

The `ALL` operator:

- returns a boolean value as a result
- returns TRUE if ALL of the subquery values meet the condition
- is used with `SELECT`, `WHERE` and `HAVING` statements

`ALL` means that the condition will be true only if the operation is true for all values in the range.

ALL Syntax With SELECT

```
SELECT ALL column_name(s) FROM table_name WHERE condition;
```

ALL Syntax With WHERE or HAVING

```
SELECT column_name(s) FROM table_name WHERE column_name operator ALL (SELECT column_name FROM table_name WHERE condition);
```

Note: The *operator* must be a standard comparison operator (`=`, `<>`, `!=`, `>`, `>=`, `<`, or `<=`).

This will of course return FALSE because the Quantity column has many different values (not only the value of pass):

```
SELECT * from students WHERE roll = all (SELECT roll FROM marks WHERE result = 'pass');
```


MySQL INSERT INTO SELECT Statement

The MySQL INSERT INTO SELECT Statement

The `INSERT INTO SELECT` statement copies data from one table and inserts it into another table.

The `INSERT INTO SELECT` statement requires that the data types in source and target tables matches.

Note: The existing records in the target table are unaffected.

INSERT INTO SELECT Syntax

Copy all columns from one table to another table:

```
INSERT INTO table2 SELECT * FROM table1 WHERE condition;
```

```
INSERT into students1 SELECT * FROM students
```

```
INSERT into students1 SELECT * FROM students WHERE City = 'rajkot'
```

Copy only some columns from one table into another table:

```
INSERT INTO table2 (column1, column2, column3, ...) SELECT column1, column2, column3, ... FROM table1 WHERE condition;
```

```
INSERT into students1 (Fname, lname, city) SELECT fname, lname, city from students
```

MySQL CASE Statement

The MySQL CASE Statement

The `CASE` statement goes through conditions and returns a value when the first condition is met (like an if-then-else statement). So, once a condition is true, it will stop reading and return the result. If no conditions are true, it returns the value in the `ELSE` clause.

If there is no `ELSE` part and no conditions are true, it returns `NULL`.

CASE Syntax

CASE

`WHEN condition1 THEN result1`

`WHEN condition2 THEN result2`

`WHEN conditionN THEN resultN`

`ELSE result`

`END;`

```
SELECT roll, fname, lname, city, email, phone, gender, dateofbirth from students
```

```
SELECT roll, fname, lname, city, email, phone, gender, case
```

```
WHEN gender = 'male' then 'Blue'
```

```
WHEN gender = 'female' then 'Pink'
```

```
else 'Black'
```

```
end as "Bag Color",
```

```
dateofbirth from students
```

```
SELECT roll, fname, lname, city, case
```

```
    WHEN city = 'Rajkot' THEN 'Home Town'
```

```
    WHEN city = 'Ahmedabad' THEN 'Far Town'
```

```
    WHEN city = 'Gandhinagar' THEN 'Far Town'
```

```
    WHEN city = 'Bhuj' THEN 'Much Far Town'
```

```
    WHEN city = 'Baroda' THEN 'Too Much Far Town'
```

```
    WHEN city = 'Surat' THEN 'Remote Town'
```

```
end as "Distance",email, phone, gender,dateofbirth from students;
```

MySQL NULL Functions

MySQL IFNULL() and COALESCE() Functions

```
SELECT roll, absents, presents, (absents + presents) as "Total Days" FROM attendance GROUP by (roll);
```

MySQL IFNULL() Function

The MySQL [IFNULL\(\)](#) function lets you return an alternative value if an expression is NULL.

The example below returns 0 if the value is NULL:

```
SELECT roll, absents, presents, (ifnull(absents, 0) + ifnull(presents, 0)) as "Total Days" FROM attendance GROUP by (roll);
```

MySQL COALESCE() Function

```
SELECT roll, absents, presents, (COALESCE(absents, 0) + COALESCE(presents, 0)) as "Total Days" FROM attendance GROUP by (roll);
```

MySQL Comments

MySQL Comments

Comments are used to explain sections of SQL statements, or to prevent execution of SQL statements.

Single Line Comments

Single line comments start with --.

Any text between -- and the end of the line will be ignored (will not be executed).

The following example uses a single-line comment as an explanation:

```
-- this is single line comment in MYSQL
```

```
SELECT * FROM `students`
```

```
SELECT * FROM `students`; -- this is another example of single line comment
```

Multi-line Comments

Multi-line comments start with /* and end with */.

Any text between /* and */ will be ignored.

The following example uses a multi-line comment as an explanation:

```
/*Select all the columns
```

```
of all the records
```

```
in the Customers table:*/
```

```
SELECT * FROM Customers;
```

```
SELECT roll, fname, lname, city, email, phone, gender, dateofbirth from students
```

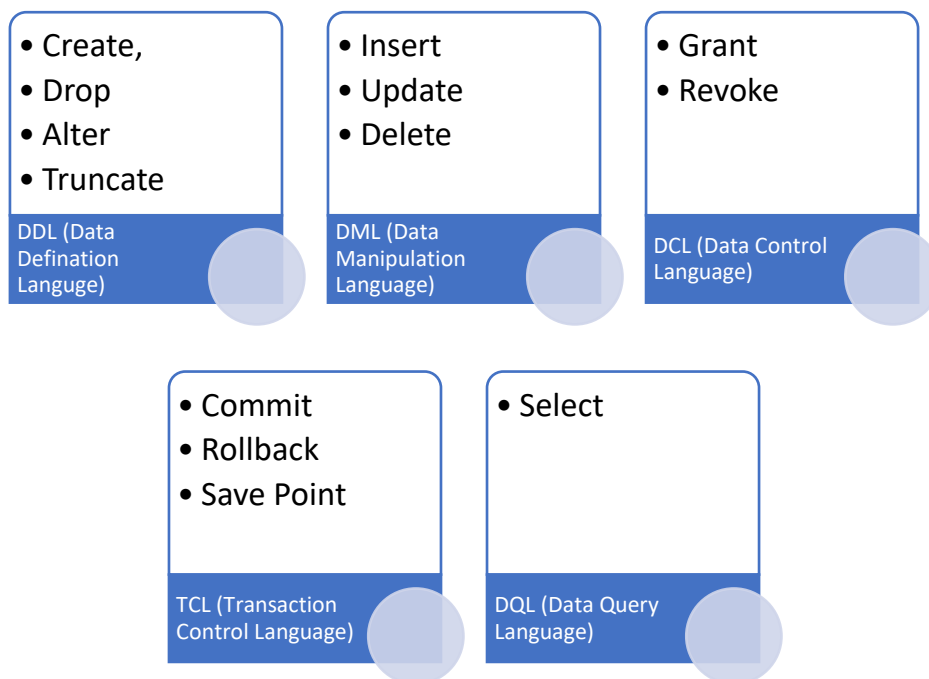
```
SELECT roll, fname, lname, city, /*email, phone,*/ gender, dateofbirth from students;
```

SQL Commands

- SQL commands are instructions. It is used to communicate with the database. It is also used to perform specific tasks, functions, and queries of data.
- SQL can perform various tasks like create a table, add data to tables, drop the table, modify the table, set permission for users.

Types of SQL Commands

There are five types of SQL commands: DDL, DML, DCL, TCL, and DQL.



1. Data Definition Language (DDL)

- DDL changes the structure of the table like creating a table, deleting a table, altering a table, etc.
- All the command of DDL are auto-committed that means it permanently save all the changes in the database.

Here are some commands that come under DDL:

- CREATE
- ALTER
- DROP
- TRUNCATE

CREATE It is used to create a new table in the database.

DROP: It is used to delete both the structure and record stored in the table.

ALTER: It is used to alter the structure of the database. This change could be either to modify the characteristics of an existing attribute or probably to add a new attribute.

TRUNCATE: It is used to delete all the rows from the table and free the space containing the table

2. Data Manipulation Language

- DML commands are used to modify the database. It is responsible for all form of changes in the database.
- The command of DML is not auto-committed that means it can't permanently save all the changes in the database. They can be rollback.

Here are some commands that come under DML:

- INSERT
- UPDATE
- DELETE

INSERT: The INSERT statement is a SQL query. It is used to insert data into the row of a table.

UPDATE: This command is used to update or modify the value of a column in the table.

DELETE: It is used to remove one or more row from a table.

3. Data Control Language

DCL commands are used to grant and take back authority from any database user.

Here are some commands that come under DCL:

- Grant
- Revoke

Grant: It is used to give user access privileges to a database.

Revoke: It is used to take back permissions from the user.

4. Transaction Control Language

TCL commands can only use with DML commands like INSERT, DELETE and UPDATE only.

These operations are automatically committed in the database that's why they cannot be used while creating tables or dropping them.

Here are some commands that come under TCL:

- COMMIT
- ROLLBACK
- SAVEPOINT

Commit: Commit command is used to save all the transactions to the database.

Rollback: Rollback command is used to undo transactions that have not already been saved to the database.

SAVEPOINT: It is used to roll the transaction back to a certain point without rolling back the entire transaction

5. Data Query Language

DQL is used to fetch the data from the database.

It uses only one command:

- SELECT

SELECT: This is the same as the projection operation of relational algebra. It is used to select the attribute based on the condition described by WHERE clause.

MySQL CREATE DATABASE Statement

The MySQL CREATE DATABASE Statement

The `CREATE DATABASE` statement is used to create a new SQL database.

Syntax

```
CREATE DATABASE databasename;
```

CREATE DATABASE Example

```
CREATE DATABASE testDB;
```

```
show DATABASES
```

```
create DATABASE example9211
```

```
show DATABASES
```


MySQL DROP DATABASE Statement

The MySQL DROP DATABASE Statement

The `DROP DATABASE` statement is used to drop an existing SQL database.

Syntax

`DROP DATABASE databasename;`

Note: Be careful before dropping a database. Deleting a database will result in loss of complete information stored in the database!

```
show DATABASES;
```

```
drop DATABASE example9211
```

```
show DATABASES;
```

Tip: Make sure you have admin privilege before dropping any database. Once a database is dropped, you can check it in the list of databases with the following SQL command: `SHOW DATABASES;`

MySQL CREATE TABLE Statement

The MySQL CREATE TABLE Statement

The `CREATE TABLE` statement is used to create a new table in a database.

Syntax

```
CREATE TABLE table_name ( column1 datatype, column2 datatype, column3 datatype, ...);
```

The column parameters specify the names of the columns of the table.

The datatype parameter specifies the type of data the column can hold (e.g. varchar, integer, date, etc.).

Tip: For an overview of the available data types, go to our complete [Data Types Reference](#).

MySQL CREATE TABLE Example

```
create TABLE persons (personid int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null,  
lname varchar(20), city varchar(20), gender varchar(10), email varchar(128), phone varchar(15),  
createdat timestamp DEFAULT CURRENT_TIMESTAMP)
```

Create Table Using Another Table

A copy of an existing table can also be created using `CREATE TABLE`.

The new table gets the same column definitions. All columns or specific columns can be selected.

If you create a new table using an existing table, the new table will be filled with the existing values from the old table.

```
CREATE TABLE new_table_name AS  
SELECT column1, column2,...  
FROM existing_table_name  
WHERE ....;
```

```
create TABLE persons_backup as SELECT * from persons
```

```
create TABLE persons_backup1 as SELECT personid, fname, lname, city from persons
```

MySQL DROP TABLE Statement

The MySQL DROP TABLE Statement

The `DROP TABLE` statement is used to drop an existing table in a database.

Syntax

```
DROP TABLE table_name;
```

```
drop TABLE persons_backup;
```

Note: Be careful before dropping a table. Deleting a table will result in loss of complete information stored in the table!

MySQL TRUNCATE TABLE

The `TRUNCATE TABLE` statement is used to delete the data inside a table, but not the table itself.

Syntax

```
TRUNCATE TABLE table_name;
```

```
create table studentsBackup as SELECT * FROM students
```

```
TRUNCATE TABLE studentsbackup
```

* truncate table reset auto increment field to 1

MySQL ALTER TABLE Statement

MySQL ALTER TABLE Statement

The `ALTER TABLE` statement is used to add, delete, or modify columns in an existing table.

The `ALTER TABLE` statement is also used to add and drop various constraints on an existing table.

ALTER TABLE - ADD Column

To add a column in a table, use the following syntax:

```
ALTER TABLE table_name  
ADD column_name datatype;
```

```
ALTER TABLE persons add COLUMN dateofbirth date
```

ALTER TABLE - MODIFY COLUMN

To change the data type of a column in a table, use the following syntax:

```
ALTER TABLE table_name  
MODIFY COLUMN column_name datatype;
```

```
alter TABLE persons MODIFY COLUMN phone varchar(20)
```

ALTER TABLE - DROP COLUMN

To delete a column in a table, use the following syntax (notice that some database systems don't allow deleting a column):

```
ALTER TABLE table_name  
DROP COLUMN column_name;
```

```
ALTER TABLE persons DROP COLUMN dateofbirth
```

```
ALTER TABLE persons add COLUMN dateofbirth date AFTER city
```

MySQL Constraints

SQL constraints are used to specify rules for data in a table.

Create Constraints

Constraints can be specified when the table is created with the `CREATE TABLE` statement, or after the table is created with the `ALTER TABLE` statement.

Syntax

```
CREATE TABLE table_name (  
    column1 datatype constraint,  
    column2 datatype constraint,  
    column3 datatype constraint,  
    ....  
);
```

MySQL Constraints

SQL constraints are used to specify rules for the data in a table.

Constraints are used to limit the type of data that can go into a table. This ensures the accuracy and reliability of the data in the table. If there is any violation between the constraint and the data action, the action is aborted.

Constraints can be column level or table level. Column level constraints apply to a column, and table level constraints apply to the whole table.

The following constraints are commonly used in SQL:

- [NOT NULL](#) - Ensures that a column cannot have a NULL value
- [UNIQUE](#) - Ensures that all values in a column are different
- [PRIMARY KEY](#) - A combination of a `NOT NULL` and `UNIQUE`. Uniquely identifies each row in a table
- [FOREIGN KEY](#) - Prevents actions that would destroy links between tables
- [CHECK](#) - Ensures that the values in a column satisfies a specific condition
- [DEFAULT](#) - Sets a default value for a column if no value is specified
- [CREATE INDEX](#) - Used to create and retrieve data from the database very quickly

MySQL NOT NULL Constraint

MySQL NOT NULL Constraint

By default, a column can hold NULL values.

The `NOT NULL` constraint enforces a column to NOT accept NULL values.

This enforces a field to always contain a value, which means that you cannot insert a new record, or update a record without adding a value to this field.

NOT NULL on CREATE TABLE

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname varchar(20), city varchar(20), email varchar(20))
```

```
INSERT into persons (fname, lname, city, email) values ('Ridham', 'Vishnuswami', 'Rajkot', 'Ridham@gmail.com')
```

```
INSERT into persons (fname, lname, city, email) values ('Ridham', 'Vishnuswami', null, null);
```

```
drop TABLE persons
```

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, email varchar(20) not null)
```

```
INSERT into persons (fname, lname, city, email) values ('Ridham', 'Vishnuswami', 'Rajkot', 'Ridham@gmail.com')
```

```
INSERT into persons (fname, lname, city, email) values ('Ridham', 'Vishnuswami', null, null);
```

```
#1048 - Column 'city' cannot be null
```

NOT NULL on ALTER TABLE

To create a `NOT NULL` constraint on the "Age" column when the "Persons" table is already created, use the following SQL:

```
ALTER TABLE persons add COLUMN age int
```

```
ALTER TABLE persons MODIFY COLUMN age int not null
```

```
INSERT into persons (fname, lname, city, email, age) values ('Ridham', 'Vishnuswami', 'Rajkot', 'rv@gmail.com', null);
```

```
#1048 - Column 'age' cannot be null
```

MySQL UNIQUE Constraint

MySQL UNIQUE Constraint

The `UNIQUE` constraint ensures that all values in a column are different.

Both the `UNIQUE` and `PRIMARY KEY` constraints provide a guarantee for uniqueness for a column or set of columns.

A `PRIMARY KEY` constraint automatically has a `UNIQUE` constraint.

However, you can have many `UNIQUE` constraints per table, but only one `PRIMARY KEY` constraint per table.

UNIQUE Constraint on CREATE TABLE

drop TABLE persons

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, email varchar(128) not null)
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'kenil', 'sangani', 'rajkot', 'kenil@gmail.com'), (NULL, 'ridham', 'vishnuswami', 'rajkot', 'ridham@gmail.com');
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

drop TABLE persons

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, email varchar(128) not null, UNIQUE(email))
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'kenil', 'sangani', 'rajkot', 'kenil@gmail.com'), (NULL, 'ridham', 'vishnuswami', 'rajkot', 'ridham@gmail.com');
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

```
#1062 - Duplicate entry 'kenil@gmail.com' for key 'email'
```

drop TABLE persons

Add unique with named constraint

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, email varchar(128) not null, CONSTRAINT unq_email UNIQUE(email))
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'kenil', 'sangani', 'rajkot', 'kenil@gmail.com'), (NULL, 'ridham', 'vishnuswami', 'rajkot', 'ridham@gmail.com');
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

#1062 - Duplicate entry 'kenil@gmail.com' for key 'unq_email'

UNIQUE Constraint on ALTER TABLE

ALTER table persons drop CONSTRAINT **unq_email**

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

Select * from persons

alter TABLE persons add CONSTRAINT unq_email UNIQUE(email)

#1062 - Duplicate entry 'kenil@gmail.com' for key 'unq_email'

TRUNCATE TABLE persons

alter TABLE persons add CONSTRAINT unq_email UNIQUE(email)

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', 'kenil@gmail.com'), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', 'ridham@gmail.com');
```

DROP a UNIQUE Constraint

To drop a **UNIQUE** constraint, use the following SQL

ALTER table persons drop CONSTRAINT **unq_email**

The major drawback of unique constraint is its accept null values

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', null), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', null);
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`, `email`) VALUES (NULL, 'sumit', 'talsaniya', 'rajkot', null), (NULL, 'bhalabahi', 'bavaliya', 'rajkot', null);
```


Unique Constraint allows multiple columns to create unique key

```
create TABLE listofVilalges (villageid int AUTO_INCREMENT PRIMARY key,villageName varchar(20),
cityname varchar(20), taluka varchar(20), district varchar(20), state varchar(20), country varchar(20),
pincode int, CONSTRAINT unq_villagename UNIQUE(villageName))
```

```
INSERT INTO `listofvilalges` (`villageid`, `villageName`, `cityname`, `taluka`, `district`, `state`,
`country`, `pincode`) VALUES (NULL, 'Navagam', 'Rajkot', 'Rajkot', 'Rajkot', 'Gujarat', 'India',
'360009');
```

```
INSERT INTO `listofvilalges` (`villageid`, `villageName`, `cityname`, `taluka`, `district`, `state`,
`country`, `pincode`) VALUES (NULL, 'Navagam', 'Gondal', 'Gondal', 'Rajkot', 'Gujarat', 'India',
'360009');
```

#1062 - Duplicate entry 'Navagam' for key '**unq_villagename**'

```
ALTER table listofvilalges drop CONSTRAINT unq_villagename
```

```
ALTER TABLE listofvilalges add CONSTRAINT unq_villageName UNIQUE(villageName, cityname,
taluka)
```

```
INSERT INTO `listofvilalges` (`villageid`, `villageName`, `cityname`, `taluka`, `district`, `state`,
`country`, `pincode`) VALUES (NULL, 'Navagam', 'Gondal', 'Gondal', 'Rajkot', 'Gujarat', 'India',
'360009');
```

```
INSERT INTO `listofvilalges` (`villageid`, `villageName`, `cityname`, `taluka`, `district`, `state`,
`country`, `pincode`) VALUES (NULL, 'Navagam', 'Gondal', 'Gondal', 'Rajkot', 'Gujarat', 'India',
'360009');
```

#1062 - Duplicate entry 'Navagam-Gondal-Gondal' for key '**unq_villageName**'

```
INSERT INTO `listofvilalges` (`villageid`, `villageName`, `cityname`, `taluka`, `district`, `state`,
`country`, `pincode`) VALUES (NULL, 'Navagam', 'patan', 'patan', 'Rajkot', 'Gujarat', 'India', '360009');
```

MySQL PRIMARY KEY Constraint

MySQL PRIMARY KEY Constraint

The `PRIMARY KEY` constraint uniquely identifies each record in a table.

Primary keys must contain `UNIQUE` values, and cannot contain `NULL` values.

A table can have only **ONE** primary key; and in the table, this primary key can consist of single or multiple columns (fields).

PRIMARY KEY on CREATE TABLE

drop TABLE persons

```
CREATE table persons (person_id int, fname varchar(20), lname varchar(20), city varchar(20))
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`) VALUES ('1', 'brijesh', 'sinojiya', 'Morbi'), ('1', 'ansh', 'amrutiya', 'Ahamdabad');
```

```
Select * from persons
```

drop TABLE persons

```
CREATE table persons (person_id int PRIMARY key, fname varchar(20), lname varchar(20), city varchar(20))
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`) VALUES ('1', 'brijesh', 'sinojiya', 'Morbi'), ('1', 'ansh', 'amrutiya', 'Ahamdabad');
```

```
#1062 - Duplicate entry '1' for key 'PRIMARY'
```

The following SQL creates a `PRIMARY KEY` on the "ID" column when the "Persons" table is created:

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

To allow naming of a `PRIMARY KEY` constraint, and for defining a `PRIMARY KEY` constraint on multiple columns, use the following SQL syntax:

```
CREATE TABLE Persons (  
    ID int NOT NULL,
```

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

drop TABLE persons

```
create TABLE persons (person_id int, fname varchar(20), lname varchar(20), city varchar(20),  
CONSTRAINT pk_pid PRIMARY key (person_id))
```

DROP a PRIMARY KEY Constraint

To drop a PRIMARY KEY constraint, use the following SQL:

```
ALTER TABLE Persons DROP PRIMARY KEY;
```

PRIMARY KEY on ALTER TABLE

To create a PRIMARY KEY constraint on the "ID" column when the table is already created, use the following SQL:

```
ALTER TABLE Persons  
ADD PRIMARY KEY (ID);
```

To allow naming of a PRIMARY KEY constraint, and for defining a PRIMARY KEY constraint on multiple columns, use the following SQL syntax:

```
ALTER TABLE Persons  
ADD CONSTRAINT PK_Person PRIMARY KEY (ID,LastName);
```

Note: If you use ALTER TABLE to add a primary key, the primary key column(s) must have been declared to not contain NULL values (when the table was first created).

```
ALTER TABLE persons add CONSTRAINT pk_pid PRIMARY key(person_id)
```

```
alter table persons drop PRIMARY key
```

```
ALTER TABLE persons add CONSTRAINT pk_pid PRIMARY key(person_id, fname)
```

```
INSERT INTO `persons` (`person_id`, `fname`, `lname`, `city`) VALUES ('1', 'Bhavdeep', 'sinojiya',  
'Morbi'), ('1', 'kenil', 'Sangani', 'Ahamdabad');
```

MySQL FOREIGN KEY Constraint

MySQL FOREIGN KEY Constraint

The `FOREIGN KEY` constraint is used to prevent actions that would destroy links between tables.

A `FOREIGN KEY` is a field (or collection of fields) in one table, that refers to the [PRIMARY KEY](#) in another table.

The table with the **foreign key** is called the **child table**, and the table with the **primary key** is called the referenced or **parent table**.

Look at the following two tables:

Persons Table

PersonID (Primary Key)	LastName	FirstName	Age
1	Hansen	Ola	30
2	Svendson	Tove	23
3	Pettersen	Kari	20
4	Ridham	Vishniswami	19

Orders Table

OrderID	OrderNumber	PersonID (Foreign key)
1	77895	3
2	44678	3
3	22456	2
4	24562	1
5	112233	4
6	1234543	4
7	12322	1
8	12121	5

Data row number 8 can not inserted because perosn id 5 is not exist in persons table

Notice that the "PersonID" column in the "Orders" table points to the "PersonID" column in the "Persons" table.

The "PersonID" column in the "Persons" table is the `PRIMARY KEY` in the "Persons" table.

The "PersonID" column in the "Orders" table is a `FOREIGN KEY` in the "Orders" table.

The `FOREIGN KEY` constraint prevents invalid data from being inserted into the foreign key column, because it has to be one of the values contained in the parent table.

FOREIGN KEY on CREATE TABLE

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

The following SQL creates a `FOREIGN KEY` on the "PersonID" column when the "Orders" table is created:

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int,  
paymentdata date, amount int, paymentmode varchar(20))
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03', 12500, 'cash')
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (41, '2024-02-03', 12500, 'cash');
```

```
drop table feesinformation
```

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdata date,  
amount int, paymentmode varchar(20), FOREIGN key(roll) REFERENCES students(roll))
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03', 12500, 'cash')
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (51, '2024-02-03', 12500, 'cash');
```

```
#1452 - Cannot add or update a child row: a foreign key constraint fails  
(`9211_2324`.`feesinformation`, CONSTRAINT `feesinformation_ibfk_1` FOREIGN  
KEY (`roll`) REFERENCES `students` (`roll`))
```

```
Drop table feesinformation
```

To allow naming of a `FOREIGN KEY` constraint, and for defining a `FOREIGN KEY` constraint on multiple columns, use the following SQL syntax:

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdata date, amount int, paymentmode varchar(20), CONSTRAINT fk_roll FOREIGN key(roll) REFERENCES students(roll))
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03', 12500, 'cash')
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (31, '2024-02-03', 12500, 'cash');
```

```
#1452 - Cannot add or update a child row: a foreign key constraint fails (`9211_2324`.`feesinformation`, CONSTRAINT `fk_roll` FOREIGN KEY (`roll`) REFERENCES `students` (`roll`))
```

FOREIGN KEY on ALTER TABLE

```
drop TABLE feesinformation
```

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdata date, amount int, paymentmode varchar(20))
```

Graphically add foreign key

Go to Table structure and open relation view add constraint name, select column

Select primary table and column from table for reference and press save

Foreign key with query

```
ALTER TABLE feesinformation add CONSTRAINT fk_roll FOREIGN key(roll) REFERENCES students(roll)
```

To create a `FOREIGN KEY` constraint on the "PersonID" column when the "Orders" table is already created, use the following SQL:

```
ALTER TABLE Orders
```

```
ADD FOREIGN KEY (PersonID) REFERENCES Persons(PersonID);
```

To allow naming of a `FOREIGN KEY` constraint, and for defining a `FOREIGN KEY` constraint on multiple columns, use the following SQL syntax:

```
ALTER TABLE Orders
```

```
ADD CONSTRAINT FK_PersonOrder
```

DROP a FOREIGN KEY Constraint

To drop a `FOREIGN KEY` constraint, use the following SQL:

`ALTER TABLE Orders DROP FOREIGN KEY FK_PersonOrder;`

`ALTER TABLE feesinformation drop CONSTRAINT fk_roll`

Alter table feesinformation drop foreign key

You cannot delete data from parent table if any of the record referred by any of the foreign key column.

MySQL CHECK Constraint

MySQL CHECK Constraint

The `CHECK` constraint is used to limit the value range that can be placed in a column.

If you define a `CHECK` constraint on a column it will allow only certain values for this column.

If you define a `CHECK` constraint on a table it can limit the values in certain columns based on values in other columns in the row.

CHECK on CREATE TABLE

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdata date, amount int, check(amount >=0), paymentmode varchar(20), CONSTRAINT fk_roll FOREIGN key(roll) REFERENCES students(roll))
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03',-12500, 'cash');
```

```
drop TABLE feesinformation
```

```
create TABLE feesInformation (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdata date, amount int, paymentmode varchar(20), CONSTRAINT fk_roll FOREIGN key(roll) REFERENCES students(roll), CONSTRAINT check_amount CHECK (amount >= 0))
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03',12500, 'cash');
```

```
#4025 - CONSTRAINT `check_amount` failed for `9211_2324`.`feesinformation`
```

CHECK on ALTER TABLE

```
ALTER TABLE feesinformation add CONSTRAINT pay_mode CHECK (paymentmode = 'Cash' or paymentmode = 'cheque' or paymentmode = 'online')
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03',12500, 'cash');
```

```
INSERT into feesinformation (roll, paymentdata, amount, paymentmode) values (1, '2024-02-03',12500, 'baki');
```

```
#4025 - CONSTRAINT `pay_mode` failed for `9211_2324`.`feesinformation`
```

DROP a CHECK Constraint

```
alter TABLE feesinformation drop CONSTRAINT pay_mode
```


MySQL DEFAULT Constraint

MySQL DEFAULT Constraint

The `DEFAULT` constraint is used to set a default value for a column.

The default value will be added to all new records, if no other value is specified.

DEFAULT on CREATE TABLE

The following SQL sets a `DEFAULT` value for the "City" column when the "Persons" table is created:

```
CREATE TABLE Persons (  
  ID int NOT NULL,  
  LastName varchar(255) NOT NULL,  
  FirstName varchar(255),  
  Age int,  
  City varchar(255) DEFAULT 'Sandnes'  
);
```

```
CREATE table persons (person_id int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname  
varchar(20), city varchar(20) DEFAULT 'Rajkot')
```

```
INSERT into persons (fname, lname) VALUES ('kenil', 'sangani')
```

```
ALTER TABLE persons add COLUMN created_at timestamp DEFAULT CURRENT_TIMESTAMP
```

```
INSERT into persons (fname, lname) VALUES ('kenil', 'sangani')
```

```
ALTER TABLE persons ALTER lname set DEFAULT 'NA'
```

```
INSERT into persons (fname) VALUES ('kenil')
```

DROP a DEFAULT Constraint

To drop a `DEFAULT` constraint, use the following SQL:

```
ALTER TABLE Persons ALTER City DROP DEFAULT;
```

```
alter TABLE persons ALTER lname DROP DEFAULT
```

```
INSERT into persons (fname) VALUES ('kenil')
```

Warning: #1364 Field 'lname' doesn't have a default value

MySQL CREATE INDEX Statement

MySQL CREATE INDEX Statement

The `CREATE INDEX` statement is used to create indexes in tables.

Indexes are used to retrieve data from the database more quickly than otherwise. The users cannot see the indexes, they are just used to speed up searches/queries.

Note: Updating a table with indexes takes more time than updating a table without (because the indexes also need an update). So, only create indexes on columns that will be frequently searched against.

CREATE INDEX Syntax

Creates an index on a table. Duplicate values are allowed:

```
CREATE INDEX index_name ON table_name (column1, column2, ...);
```

CREATE UNIQUE INDEX Syntax

Creates a unique index on a table. Duplicate values are not allowed:

```
CREATE UNIQUE INDEX index_name ON table_name (column1, column2, ...);
```

```
CREATE INDEX index_fname on students(fname)
```

```
drop INDEX index_fname on students;
```

```
CREATE UNIQUE INDEX index_fname on students(fname)
```

DROP INDEX Statement

The `DROP INDEX` statement is used to delete an index in a table.

```
ALTER TABLE table_name DROP INDEX index_name;
```