Software requirements

Download Xampp from https://www.apachefriends.org/download.html

Download latest version of php 8.2.12 + (Feb 2024)

How to open mysql server

Go to xampp control panel and start apache server and mysql server

Then go to browser and enter URL http://localhost/phpmyadmin/

From home page of mysql server select databases section and create new database.

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

MySQL RDBMS

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

The columns in the "Customers" table above are: CustomerID, CustomerName, ContactName, Address, City, PostalCode and Country.

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:

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

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

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

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`

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.

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

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*;

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

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 * Example

The following SQL statement selects ALL the columns from the "Customers" table:

Select * 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 DISTINCT city FROM students

SELECT DISTINCT fname FROM students;

SELECT Example Without DISTINCT

The following SQL statement selects all (including the duplicates) values from the "Country" column in the "Customers" table:

SELECT city from students

Select count(distinct city) from students

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.!

Text Fields vs. Numeric Fields

SQL requires single quotes around text values (most database systems will also allow double quotes).

However, numeric fields should not be enclosed in quotes:

```
Select * from students where city = 'rajkot'

Select * from students where roll > 5

Select * from students where not roll > 5;

Select * from students where roll != 5;
```

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 ...;
```

OR Syntax

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

NOT Syntax

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

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

SELECT * FROM `students` WHERE roll = 1 and fname = 'udit';

SELECT * FROM `students` WHERE roll = 1 or roll = 2;

SELECT * FROM `students` WHERE roll = 1 or city = 'rajkot';

SELECT * FROM `students` WHERE roll = 1 and  city = 'rajkot' or city = 'surat';

SELECT * from students WHERE not city = 'rajkot'
```

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 ORDER by fname

SELECT * from students ORDER by fname desc;

SELECT * FROM students ORDER by fname, city

SELECT * FROM students ORDER by fname, city desc

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, gender, dateofbirth, phone) values ("Rachit", "Chauhan", "Baroda", "rachit@gmail.com", "male", "2002-02-02", "9900009900")

INSERT into students values ("Rachit", "Chauhan", "Baroda", "rachit@gmail.com", "male", "2002-02-02", "9900009900")

Error : `Column count doesn't match value count at row 1`

Insert Data Only in Specified Columns

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

INSERT into students (fname, lname, city, email, gender) values ("Rachit", "Chauhan", "Baroda", "rachit@gmail.com", "male");

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!

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.

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

SELECT * FROM `students` WHERE dateofbirth = 'NULL'; // no data

SELECT * FROM `students` WHERE dateofbirth is NULL;

SELECT * FROM `students` WHERE dateofbirth is not NULL;
```

IS NULL Syntax

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

IS NOT NULL Syntax

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

The IS NULL Operator

The `IS NULL` operator is used to test for empty values (NULL values).

Tip: Always use IS NULL to look for NULL values.

The IS NOT NULL Operator

The `IS NOT NULL` operator is used to test for non-empty values (NOT NULL values).

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*, ... WHERE *condition*;

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!

UPDATE students set city = 'Gandhinagar' //always use where while update data

update students set fname = 'Yagnik', lname = 'Yadav', city = 'Bhavanagar' WHERE roll = 3

update students set fname = 'Yagnik', lname = 'Yadav', city = 'Bhavanagar' WHERE roll > 3 and roll < 6;

UPDATE students set city = 'Rajkot' WHERE roll >= 5

UPDATE Multiple Records

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

Update Warning!

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

UPDATE students set fname = 'tushar', lname = 'kadam' WHERE roll = 4

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
```

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

The SQL query below says "return only 3 records, start on record 4 (OFFSET 3)":

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

ADD a WHERE CLAUSE

```
SELECT * FROM `students` where city = ‘rajkot’ Limit 5
```

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 min(roll) FROM students;
```

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

```
SELECT max(fees) FROM students
```

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

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;
```

```
SELECT COUNT(fees) FROM students
```

```
SELECT COUNT(fees) FROM students WHERE fees > 10000;
```

```
SELECT sum(fees) FROM students WHERE fees > 10000;
```

```
SELECT count(fees), sum(fees) FROM students WHERE fees > 10000;
```

```
SELECT count(fees), sum(fees), avg(fees) FROM students
```

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;
```

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!

SQL DELETE Example

DELETE FROM students WHERE roll = 5

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 students

INSERT into students (fname, lname, city, email, gender, dateofbirth, phone, fees) values ("Rachit", "Chauhan", "Baroda", "rachit@gmail.com", "male", "2002-02-02", "9900009900", 15000);

- Add multiple rows and check for roll number

It is possible to delete all the data from table and reset complete structure of the table with truncate clause

TRUNCATE TABLE students

INSERT into students (fname, lname, city, email, gender, dateofbirth, phone, fees) values ("Rachit", "Chauhan", "Baroda", "rachit@gmail.com", "male", "2002-02-02", "9900009900", 15000);

- Add multiple rows and check for roll number // started from 1

Insert some data in table

INSERT INTO `students` (`roll`, `fname`, `lname`, `city`, `email`, `gender`, `dateofbirth`, `phone`, `fees`, `admissiondate`) VALUES (NULL, 'udit', 'ghetiya', 'Rajula', 'udit@gmail.com', 'male', '2004-02-11', '998899889900', '18000', current_timestamp()),(NULL, 'Gaurang', 'Pandya', 'Baroda', 'gaurang@gmail.com', 'male', '2004-02-11', '998899889900', '15000', current_timestamp()),(NULL, 'yograjsinh', 'Rana', 'Junagadh', 'yorajsinh@gmail.com', 'male', '2004-02-11', '998899889900', '22000', current_timestamp()),(NULL, 'yadav', 'yagnik', 'Bhavanagar', 'yagnik@gmail.com', 'male', '2004-02-11', '998899889900', '19000', current_timestamp()),(NULL, 'Rachit', 'Chauhan', 'Jamnagar', 'rachit@gmail.com', 'male', '2004-02-11', '998899889900', '12000', current_timestamp()),(NULL, 'adarsh', 'chavda', 'amreli', 'adarsh@gmail.com', 'male', '2004-02-11', '998899889900', '12000', current_timestamp()),(NULL, 'rohan', 'dasadiya', 'Bhuj', 'rohan@gmail.com', 'male', '2004-02-11', '998899889900', '13000', current_timestamp()),(NULL, 'Tushar', 'Kadam', 'Morbi', 'Tushar@gmail.com', 'male', '2004-02-11', '998899889900', '19000', current_timestamp()),(NULL, 'Yash', 'Vaghela', 'Vadodara', 'yash@gmail.com', 'male', '2004-02-11', '998899889900', '22000', current_timestamp()),(NULL, 'Jayrajsinh', 'Parmar', 'Limdi', 'jayrajsinh@gmail.com', 'male', '2004-02-11', '998899889900', '24000', current_timestamp());

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 '%t';

SELECT * FROM students WHERE fname like '%i%';

SELECT * FROM students WHERE fname like '_a%';

SELECT * FROM students WHERE fname like 'a_%';

SELECT * FROM students WHERE fname like 'r__%';

SELECT * FROM students WHERE fname like 'r%t';

SELECT * FROM students WHERE fname not like 'r%t';
```

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 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*, ...);

SELECT * FROM students WHERE city = 'surat' or city = 'rajkot' OR city = 'baroda' or city = 'morbi';
SELECT * FROM students WHERE city in ('rajkot', 'baroda', 'amreli', 'bhuj', 'junagadh')

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

SELECT * FROM students WHERE roll in (SELECT roll from students WHERE not city = 'rajkot');

Outer query (sub query),

First Execute sub query and get result from database, place this result data between in () and execute outer query,

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

SELECT * from students WHERE roll not in (SELECT roll FROM marks WHERE result = 'pass');

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 fees BETWEEN 5000 and 15000

SELECT * FROM students WHERE fees not BETWEEN 5000 and 15000;

SELECT * FROM students WHERE fname BETWEEN 'adarsh' and 'tushar'

SELECT * FROM students WHERE dateofbirth BETWEEN '2000-01-01' and '2005-12-31'
```

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 fname as FirstName FROM students

SELECT fname as "First Name" FROM students;

SELECT roll as "Roll Number", fname as "First Name", lname as "Last Name" FROM students;

SELECT concat_ws(" - ", roll, fname, lname, city) as "Student Data" FROM students

---

Without join and alias

SELECT students.roll, students.fname, students.lname, students.city, students.email, students.gender, students.dateofbirth, students.phone, students.fees, marks.total, marks.result FROM students, marks WHERE students.fname = 'bhavdeep' and students.roll = marks.roll;

With alias

SELECT s.roll, s.fname, s.lname, s.city, s.email, s.gender, s.dateofbirth, s.phone, s.fees, m.total, m.result FROM students as s, marks as m WHERE s.fname = 'bhavdeep' and s.roll = m.roll;

SELECT CURRENT_TIMESTAMP

SELECT CURRENT_TIMESTAMP as "Today is :";

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

MySQL Joins

MySQL Joining Tables

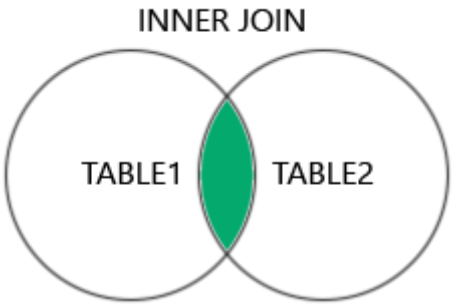
A `JOIN` clause is used to combine rows from two or more tables, based on a related column between them.

SELECT students.roll, students.fname, students.lname, students.city, students.email, students.gender, students.dateofbirth, students.phone, students.course, students.course, students.admissiondate, marks.total, marks.result from students inner JOIN marks on students.roll = marks.roll

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

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 s.roll, s.fname, s.lname, s.city, s.email, s.gender, s.dateofbirth, s.phone, s.course, s.course, s.admissiondate, 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;

SELECT s.*, 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;

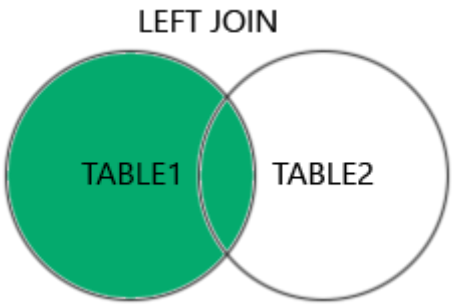
SELECT s.*, m.*, a.absents, a.presents from students s inner JOIN marks m on s.roll = m.roll INNER join attendance a on s.roll = a.roll;

/// never do this

SELECT s.*, m.*, a.* 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

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*;

Note: The `LEFT JOIN` keyword returns all records from the left table (Customers), even if there are no matches in the right table (Orders).

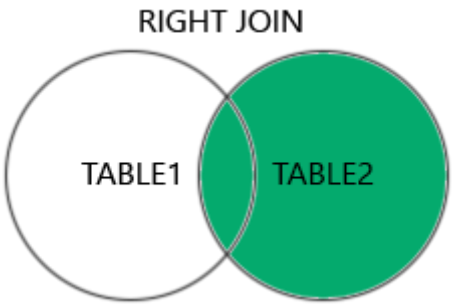
select s.roll, s.fname, s.lname, s.city, s.email, s.gender, s.dateofbirth, s.phone, s.fees, s.course, s.admissiondate, m.total, m.result from students s left join marks m on s.roll = m.roll;

grab all the data from left table (students) if there is no data in right table (marks) then sql show NULL for empty values

Note: The `LEFT JOIN` keyword returns all records from the left table (Customers), even if there are no matches in the right table (Orders).

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

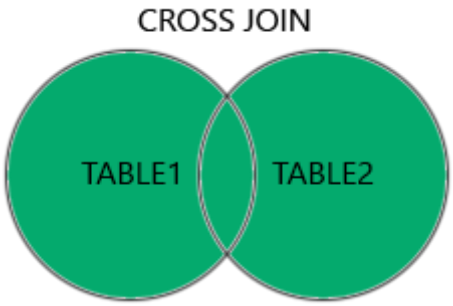
SELECT *column_name(s)* FROM *table1* RIGHT JOIN *table2* ON *table1.column_name* = *table2.column_name*;

select s.roll, s.fname, s.lname, s.city, s.email, s.gender, s.dateofbirth, s.phone, s.fees, s.course, s.admissiondate, 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).

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

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*;

SELECT t1.fname, t1.lname from students t1, students t2 WHERE t1.roll != t2.roll and t1.city = t2.city;

SELECT t1.roll, t1.fname, t1.lname, t1.city from students t1, students t2 WHERE t1.roll != t2.roll and t1.city = t2.city;

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*;

SELECT * from students

UNION

SELECT * FROM students1

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*;

SELECT * from students

UNION ALL

SELECT * FROM students1;

SELECT * from students

UNION ALL

SELECT * FROM students1 ORDER by city;

SELECT * from students where city = 'rajkot'

UNION ALL

SELECT * 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 city, count(city) FROM students GROUP by (city)
```

GROUP BY With JOIN Example

```
SELECT students.roll, COUNT(marks.marksid), sum(marks.total) from students INNER join marks on students.roll = marks.roll GROUP by (roll);
```

The MySQL HAVING Clause

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

HAVING Syntax

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

```
SELECT city, count(city) from students GROUP by (city) having count(city) = 1;
```

```
SELECT city, count(city) from students GROUP by (city) having count(city) > 1;
```

```
SELECT students.roll, COUNT(marks.marksid), sum(marks.total) from students INNER join marks on students.roll = marks.roll GROUP by (roll) HAVING sum(marks.total) >= 400;
```

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

```
SELECT * from students WHERE EXISTS (SELECT roll FROM marks WHERE result = 'ATKT');
```

```
SELECT students.roll, students.fname, students.lname from students where EXISTS (SELECT roll FROM marks WHERE students.roll = marks.roll and marks.result = 'pass')
```

```
SELECT students.roll, students.fname, students.lname from students where not EXISTS (SELECT roll FROM marks WHERE students.roll = marks.roll and marks.result = 'pass');
```

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.

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

```
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.

```
SELECT all fname FROM students WHERE true
```

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 (fname, lname, city, email, gender, dateofbirth, phone, fees, course) SELECT fname, lname, city, email, gender, dateofbirth, phone, fees, course from students

INSERT into students1 (fname, lname, city, email, gender, dateofbirth, phone, fees, course) SELECT fname, lname, city, email, gender, dateofbirth, phone, fees, course from students where city = 'rajkot';

MySQL INSERT INTO SELECT Examples

The following SQL statement copies "Suppliers" into "Customers" (the columns that are not filled with data, will contain NULL):

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, gender, city, email FROM students

SELECT roll, fname, lname, gender, city,

case

        WHEN city = 'Rajkot' THEN "Home Town"

        WHEN city = 'Surat' THEN "Too much Far from Home Town"

        WHEN city = 'morbi' THEN "Near by Home Town"

        WHEN city = 'limdi' THEN "Far from Home Town"

        WHEN city = 'Bhavanagar' THEN "Far from Home Town"

        WHEN city = 'Amreli' THEN "Near by Home Town"

        WHEN city = 'Jamnagar' THEN "Near by Home Town"

        WHEN city = 'Bhuj' THEN "Far from Home Town"

        WHEN city = 'Rajula' THEN "Far from Home Town"

        WHEN city = 'vadodara' or city = 'baroda' THEN "Far from Home Town"

        else "Unkonown istance"

end as "Distance From Rajkot", email FROM students;
```

MySQL NULL Functions

MySQL IFNULL() and COALESCE() Functions

SELECT roll, sum(absents + presents) as "Total Working 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, sum(ifnull(absents, 0) + ifnull(presents, 0)) as "Total Working Days" from attendance GROUP by (roll);

MySQL COALESCE() Function

SELECT roll, sum(coalesce(absents, 0) + coalesce(presents, 0)) as "Total Working Days" from attendance GROUP by (roll);

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).

```
-- find null values and replace with 0

SELECT roll, sum(coalesce(absents, 0) + coalesce(presents, 0)) as "Total Working Days" from attendance GROUP by (roll);
```

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:

Example

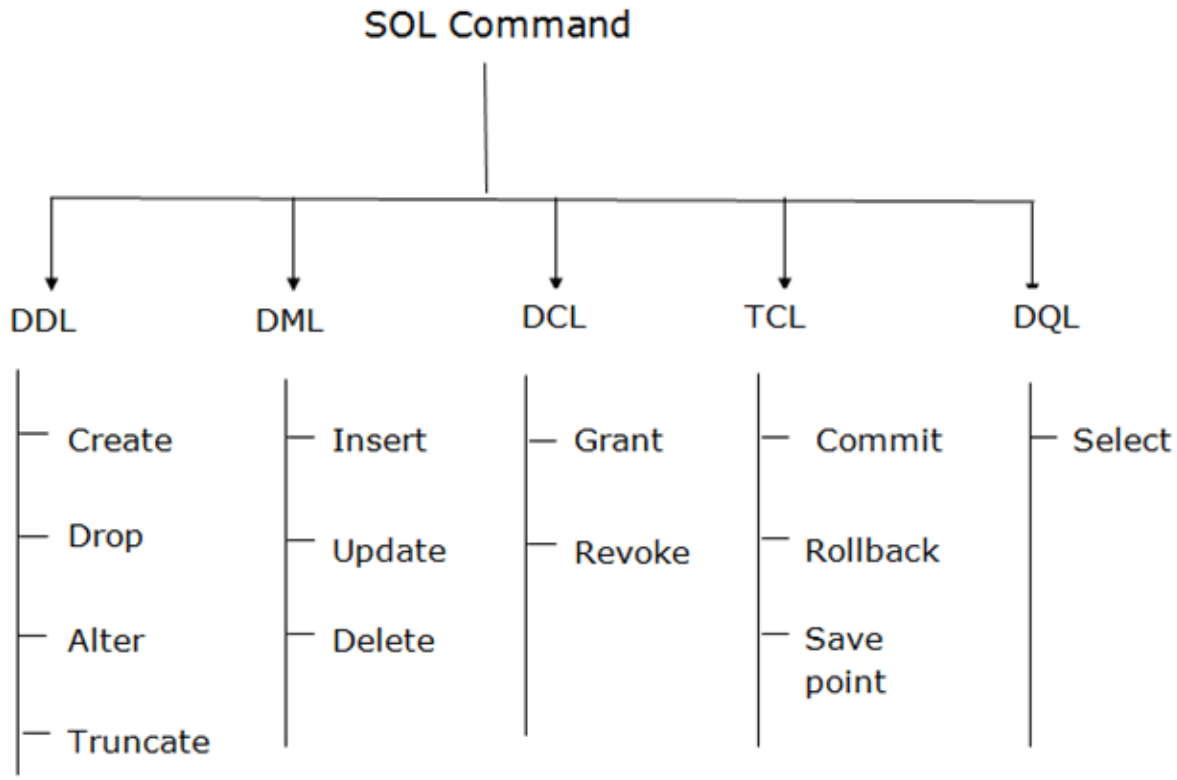
```
/*Select all the columns
of all the records
in the Customers table:*/
SELECT * FROM Customers;


/* find null values and replace with 0 (this is multiline comment in MySql)*/

SELECT roll, sum(coalesce(absents, 0) + coalesce(presents, 0)) as "Total Working Days" from attendance GROUP by (roll);
```

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

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.

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

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

5. Data Query Language

DQL is used to fetch the data from the database.

It uses only one command:

- SELECT

a. 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*;

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

show DATABASES;

create DATABASE demo729;

show DATABASES

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 demo729

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;`

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.).

```
CREATE TABLE persons (personid int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname varchar(20), email varchar(128), phone varchar(15), gender varchar(6), `dateof birth` date)
```

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.

Syntax

```
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 from persons;
```

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 city varchar(30)

ALTER TABLE persons add COLUMN state varchar(30), add COLUMN country varchar(20)

ALTER TABLE persons add COLUMN zipcode int after city

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 zipcode

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 gender varchar(10)

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;
```

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

```
drop TABLE persons_backup1
```

MySQL TRUNCATE TABLE

The `TRUNCATE TABLE` statement is used to delete (reset the table structure to new – auto Increment) the data inside a table, but **not** the table itself.

Syntax

```
TRUNCATE TABLE table_name;
```

```
TRUNCATE TABLE students1
```

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 **persons1** (personid int AUTO_INCREMENT PRIMARY key, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null)

INSERT INTO persons1 (fname, lname, city) values ('Bhavdeep', 'Sorathiya', 'Rajkot')

INSERT INTO persons1 (fname, lname, city) values ('Bhavdeep', 'Sorathiya', NULL);

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

NOT NULL on ALTER TABLE

ALTER table persons1 add COLUMN age int

ALTER TABLE persons1 MODIFY COLUMN age int not null

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

INSERT INTO persons1 (fname, lname, city, age) values ('Bhavdeep', 'Sorathiya', 'baroda', 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

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

```
create table persons (personid int not null, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, UNIQUE(personid))

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'patel', 'Rajkot');

#1062 - Duplicate entry '1' for key 'personid'

INSERT into persons (personid, fname, lname, city) values (2, 'Udit', 'patel', 'Rajkot');
```

To name a `UNIQUE` constraint, and to define a `UNIQUE` constraint on single columns, use the following SQL syntax:

```
drop table persons;

create table persons (personid int not null, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, CONSTRAINT unqid UNIQUE (personid))

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')

#1062 - Duplicate entry '1' for key 'unqid'

Following query drop named constrained unqid from persons table.

alter TABLE persons drop CONSTRAINT unqid

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (1, 'Udit', 'Ghetiya', 'Rajkot')
```

UNIQUE Constraint on ALTER TABLE

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

Truncate table persons

alter TABLE persons add UNIQUE(personid)

INSERT into persons (personid, fname, lname, city) values (**1**, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (**1**, 'Udit', 'Ghetiya', 'Rajkot')

To name a `UNIQUE` constraint, and to define a `UNIQUE` constraint on multiple columns, use the following SQL syntax:

drop table persons

create table persons (personid int not null, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null)

ALTER TABLE persons add CONSTRAINT unqid UNIQUE (personid)

INSERT into persons (personid, fname, lname, city) values (**1**, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (**1**, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (null, 'Udit', 'Ghetiya', 'Rajkot')

INSERT into persons (personid, fname, lname, city) values (null, 'Udit', 'Ghetiya', 'Rajkot')

- Major drawback of unique constraint is it allows NULL values in column.

DROP a UNIQUE Constraint

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

ALTER table persons drop CONSTRAINT unqid

To name a `UNIQUE` constraint, and to define a `UNIQUE` constraint on multiple columns, use the following SQL syntax:

create table listoftown (townid int AUTO_INCREMENT PRIMARY key, townname varchar(20) UNIQUE, cityname varchar(20), district varchar(20), state varchar(20))

INSERT INTO listoftown (townname, cityname, district, state) values ('Navagam', 'Rajkot', 'Rajkot', 'Gujarat')

INSERT INTO listoftown (townname, cityname, district, state) values ('Navagam', 'Bhuj', 'Kutchh', 'Gujarat');

```
#1062 - Duplicate entry 'Navagam' for key 'townname'
```

drop table listoftown

create table listoftown (townid int AUTO_INCREMENT PRIMARY key, townname varchar(20), cityname varchar(20), district varchar(20), state varchar(20), CONSTRAINT unqtown UNIQUE(townname, cityname, district))

INSERT INTO listoftown (townname, cityname, district, state) values ('Navagam', 'Rajkot', 'Rajkot', 'Gujarat')

INSERT INTO listoftown (townname, cityname, district, state) values ('Navagam', 'Bhuj', 'Kutchh', 'Gujarat');

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

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

Note: In the example above there is only ONE `PRIMARY KEY` (PK_Person). However, the VALUE of the primary key is made up of TWO COLUMNS (ID + LastName).

```
CREATE TABLE person (id int, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, PRIMARY key(id))
```

```
INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')
```

```
INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')
```

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

```
drop TABLE person
```

CREATE TABLE person (id int, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null, CONSTRAINT prikey_id PRIMARY key (id))

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

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

ALTER TABLE person drop PRIMARY KEY

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

Drop table person

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).

CREATE TABLE person (id int, fname varchar(20) not null, lname varchar(20) not null, city varchar(20) not null)

ALTER TABLE person add PRIMARY key (id)

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

INSERT into person (id, fname, lname, city) VALUES(1, 'bhavdeep', 'sorathiya', 'rajkot')

ALTER TABLE person drop PRIMARY key

ALTER TABLE person add PRIMARY key (id, fname)

INSERT into person (id, fname, lname, city) VALUES(**1, 'bhavdeep'**, 'sorathiya', 'rajkot');

INSERT into person (id, fname, lname, city) VALUES(**1, 'bhavdip'**, 'sorathiya', 'rajkot')

INSERT into person (id, fname, lname, city) VALUES(**2, 'bhavdip',** 'sorathiya', 'rajkot');

INSERT into person (id, fname, lname, city) VALUES(**2, 'bhavdip'**, 'sorathiya', 'rajkot');

```
#1062 - Duplicate entry '2-bhavdip' for key 'PRIMARY'
```

DROP a PRIMARY KEY Constraint

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

ALTER TABLE Person DROP PRIMARY KEY;

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	LastName	FirstName	Age
1	Hansen	Ola	30
2	Svendson	Tove	23
3	Pettersen	Kari	20

Orders Table

OrderID	OrderNumber	PersonID
1	77895	3
2	44678	3
3	22456	2
4	24562	1

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)
);
```

create TABLE fees (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdate date, amount int, paymentmode varchar(10), paymenttimestamp timestamp DEFAULT CURRENT_TIMESTAMP)

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '123', '2024-02-17', '5000', 'cash', current_timestamp());

Above data is invalid because we don't have student with roll 123

drop TABLE fees

create TABLE fees (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdate date, amount int, paymentmode varchar(10), paymenttimestamp timestamp DEFAULT CURRENT_TIMESTAMP, FOREIGN key (roll) REFERENCES students(roll))

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '123', '2024-02-17', '5000', 'cash', current_timestamp());

```
#1452 - Cannot add or update a child row: a foreign key constraint fails
(`729_2324`.`fees`, CONSTRAINT `fees_ibfk_1` FOREIGN KEY (`roll`)
REFERENCES `students` (`roll`))
```

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

drop TABLE fees

create TABLE fees (feesid int AUTO_INCREMENT PRIMARY key, roll int, paymentdate date, amount int, paymentmode varchar(10), paymenttimestamp timestamp DEFAULT CURRENT_TIMESTAMP, CONSTRAINT fk_roll FOREIGN key (roll) REFERENCES students(roll))

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '123', '2024-02-17', '5000', 'cash', current_timestamp());

```
#1452 - Cannot add or update a child row: a foreign key constraint fails
(`729_2324`.`fees`, CONSTRAINT `fk_roll` FOREIGN KEY (`roll`) REFERENCES
`students` (`roll`))
```

DROP a FOREIGN KEY Constraint

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

ALTER TABLE fees DROP CONSTRAINT fk_roll

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '123', '2024-02-17', '5000', 'cash', current_timestamp());

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '1234', '2024-02-17', '5000', 'cash', current_timestamp());

FOREIGN KEY on ALTER TABLE

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

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

```
#1452 - Cannot add or update a child row: a foreign key constraint fails
(`729_2324`.`#sql-2668_353`, CONSTRAINT `fk_roll` FOREIGN KEY (`roll`)
REFERENCES `students` (`roll`))
```

TRUNCATE TABLE fees

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

INSERT INTO `fees` (`feesid`, `roll`, `paymentdate`, `amount`, `paymentmode`, `paymenttimestamp`) VALUES (NULL, '1', '2024-02-17', '4000', 'cash', current_timestamp()), (NULL, '2', '2024-02-17', '3500', 'case', current_timestamp());

DELETE from students WHERE roll = 1

```
#1451 - Cannot delete or update a parent row: a foreign key constraint
fails (`729_2324`.`fees`, CONSTRAINT `fk_roll` FOREIGN KEY (`roll`)
REFERENCES `students` (`roll`))
```

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

The following SQL creates a CHECK constraint on the "Age" column when the "Persons" table is created. The CHECK constraint ensures that the age of a person must be 18, or older:

```
CREATE TABLE Persons (
   ID int NOT NULL,
   LastName varchar(255) NOT NULL,
   FirstName varchar(255),
   Age int,
   CHECK (Age>=18)
);
```

drop TABLE person

CREATE TABLE Persons (ID int NOT NULL, LastName varchar(255) NOT NULL, FirstName varchar(255) not null, Age int, CHECK (Age>=18));

INSERT into persons (id, lastname, firstname, age) VALUES (1, 'bhavdeep', 'sorathiya', 21)

INSERT into persons (id, lastname, firstname, age) VALUES (1, 'bhavdeep', 'sorathiya', 17);

```
#4025 - CONSTRAINT `CONSTRAINT_1` failed for `729_2324`.`persons`
```

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

drop TABLE persons

CREATE TABLE persons (id int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname varchar(20), city varchar(20), age int, CONSTRAINT **checkAge** CHECK (age >= 18 and age <=50))

INSERT into persons (fname, lname, city, age) VALUES ('bhavdeep', 'sorathiya', 'Rajkot', 19)

INSERT into persons (fname, lname, city, age) VALUES ('bhavdeep', 'sorathiya', 'Rajkot', 51);

```
#4025 - CONSTRAINT `checkAge` failed for `729_2324`.`persons`
```

ALTER TABLE persons drop CONSTRAINT checkage

INSERT into persons (fname, lname, city, age) VALUES ('bhavdeep', 'sorathiya', 'Rajkot', 51);

INSERT into persons (fname, lname, city, age) VALUES ('bhavdeep', 'sorathiya', 'Rajkot', 15);

ALTER TABLE persons add CONSTRAINT checkAge check (age >= 18 and age <= 50)

TRUNCATE TABLE persons

ALTER TABLE persons add CONSTRAINT checkAge check (age >= 18 and age <= 50)

INSERT into persons (fname, lname, city, age) VALUES ('bhavdeep', 'sorathiya', 'Rajkot', 15);

```
#4025 - CONSTRAINT `checkAge` failed for `729_2324`.`persons`
```

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'
);
```

```
drop TABLE persons
```

```
CREATE TABLE persons (id int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname varchar(20), city varchar(20) DEFAULT 'Rajkot', age int)
```

```
INSERT into persons (fname, lname, age) VALUES ('Udit', 'Ghetiya', 22)
```

```
Select * from persons
```

The `DEFAULT` constraint can also be used to insert system values, by using functions like `CURRENT_DATE()`:

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

```
INSERT into persons (fname, lname, age) VALUES ('Udit', 'Ghetiya', 22)
```

```
Select * from persons
```

```
ALTER TABLE persons add COLUMN state varchar(20) after city
```

```
ALTER TABLE persons MODIFY COLUMN state varchar(20) DEFAULT 'Gujarat'
```

```
INSERT into persons (fname, lname, age) VALUES ('Udit', 'Ghetiya', 22)
```

```
Select * from persons
```

```
ALTER TABLE persons ALTER state DROP DEFAULT
```

```
INSERT into persons (fname, lname, age) VALUES ('Udit', 'Ghetiya', 22)
```

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 index fnameData on students(fname)

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*, ...);

ALTER TABLE students drop index fnamedata

CREATE UNIQUE index fnameData on students(fname)

MySQL AUTO INCREMENT Field

What is an AUTO INCREMENT Field?

Auto-increment allows a unique number to be generated automatically when a new record is inserted into a table.

Often this is the **primary key** field that we would like to be created automatically every time a new record is inserted.

MySQL AUTO_INCREMENT Keyword

MySQL uses the AUTO_INCREMENT keyword to perform an auto-increment feature.

By default, the starting value for AUTO_INCREMENT is 1, and it will increment by 1 for each new record.

The following SQL statement defines the "Personid" column to be an auto-increment primary key field in the "Persons" table:

CREATE TABLE persons (id int AUTO_INCREMENT PRIMARY key, fname varchar(20), lname varchar(20), city varchar(20))

INSERT into persons (fname, lname, city) VALUES ('yadav', 'yagnik', 'rajkot')

Select * from persons

ALTER TABLE persons AUTO_INCREMENT = 1000

INSERT into persons (fname, lname, city) VALUES ('yadav', 'yagnik', 'rajkot')

SELECT * FROM `persons`

MySQL Working with Dates

MySQL Dates

The most difficult part when working with dates is to be sure that the format of the date you are trying to insert, matches the format of the date column in the database.

As long as your data contains only the date portion, your queries will work as expected. However, if a time portion is involved, it gets more complicated.

MySQL Date Data Types

MySQL comes with the following data types for storing a date or a date/time value in the database:

- `DATE` - format YYYY-MM-DD
- `DATETIME` - format: YYYY-MM-DD HH:MI:SS
- `TIMESTAMP` - format: YYYY-MM-DD HH:MI:SS
- `YEAR` - format YYYY or YY

Note: The date data type are set for a column when you create a new table in your database!

Working with Dates

SELECT * from students WHERE dateofbirth > '2004-12-31'

SELECT * from students WHERE dateofbirth < '2004-12-31'

SELECT * from students WHERE dateofbirth = '2004-02-11';

SELECT * from students WHERE dateofbirth = '2004-2-11';

SELECT * from students WHERE dateofbirth = '04-2-11';

SELECT * from students WHERE dateofbirth BETWEEN '2000-01-01' and '2003-12-31'

SELECT * from students WHERE dateofbirth BETWEEN '2000-01-01' and '2003-12-31' ORDER by (dateofbirth);

Note: Two dates can easily be compared if there is no time component involved!

SELECT * from students WHERE admissiondate = '2024-02-09'

SELECT * from students WHERE admissiondate like '2024-02-09%';

SELECT * from students WHERE admissiondate not like '2024-02-09%';

SELECT * from students WHERE date(admissiondate) = '2024-02-09';

Tip: To keep your queries simple and easy to maintain, do not use time-components in your dates, unless you have to!

MySQL Views

MySQL CREATE VIEW Statement

In SQL, a view is a virtual table based on the result-set of an SQL statement.

A view contains rows and columns, just like a real table. The fields in a view are fields from one or more real tables in the database.

You can add SQL statements and functions to a view and present the data as if the data were coming from one single table.

A view is created with the `CREATE VIEW` statement.

CREATE VIEW Syntax

CREATE VIEW *view_name* AS SELECT *column1*, *column2*, ... FROM *table_name* WHERE *condition*;

CREATE view getStudents as SELECT * from students

SELECT * from getstudents

CREATE or REPLACE VIEW getstudents as SELECT students.roll, students.fname, students.lname, students.city, students.email, students.gender, students.dateofbirth, students.phone, students.fees, students.course, 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 * FROM getstudents;

SELECT * FROM getstudents WHERE roll = 5;

Note: A view always shows up-to-date data! The database engine recreates the view, every time a user queries it.

CREATE or REPLACE VIEW **`get students`** as SELECT students.roll, students.fname, students.lname, students.city, students.email, students.gender, students.dateofbirth, students.phone, students.fees, students.course, 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;

MySQL Updating a View

A view can be updated with the `CREATE OR REPLACE VIEW` statement.

CREATE OR REPLACE VIEW Syntax

CREATE OR REPLACE VIEW *view_name* AS SELECT *column1*, *column2*, ... FROM *table_name* WHERE *condition*;

MySQL Dropping a View

A view is deleted with the `DROP VIEW` statement.

DROP VIEW Syntax

DROP VIEW *view_name*;

DROP view `get Students`

drop VIEW getstudents

MySQL Data Types

The data type of a column defines what value the column can hold: integer, character, money, date and time, binary, and so on.

Each column in a database table is required to have a name and a data type.

An SQL developer must decide what type of data that will be stored inside each column when creating a table. The data type is a guideline for SQL to understand what type of data is expected inside of each column, and it also identifies how SQL will interact with the stored data.

In MySQL there are three main data types: **string, numeric, and date and time**.

String Data Types

Data type	Description
CHAR(size)	A FIXED length string (can contain letters, numbers, and special characters). The *size* parameter specifies the column length in characters - can be from 0 to 255. Default is 1
VARCHAR(size)	A VARIABLE length string (can contain letters, numbers, and special characters). The *size* parameter specifies the maximum column length in characters - can be from 0 to 65535
BINARY(size)	Equal to CHAR(), but stores binary byte strings. The *size* parameter specifies the column length in bytes. Default is 1
VARBINARY(size)	Equal to VARCHAR(), but stores binary byte strings. The *size* parameter specifies the maximum column length in bytes.
TINYBLOB	For BLOBs (Binary Large OBjects). Max length: 255 bytes
TINYTEXT	Holds a string with a maximum length of 255 characters
TEXT(size)	Holds a string with a maximum length of 65,535 bytes
BLOB(size)	For BLOBs (Binary Large OBjects). Holds up to 65,535 bytes of data
MEDIUMTEXT	Holds a string with a maximum length of 16,777,215 characters
MEDIUMBLOB	For BLOBs (Binary Large OBjects). Holds up to 16,777,215 bytes of data
LONGTEXT	Holds a string with a maximum length of 4,294,967,295 characters
LONGBLOB	For BLOBs (Binary Large OBjects). Holds up to 4,294,967,295 bytes of data
ENUM(val1, val2, val3, ...)	A string object that can have only one value, chosen from a list of possible values. You can list up to 65535 values in an ENUM list. If a value is inserted that is not in the list, a blank value will be inserted. The values are sorted in the order you enter them
SET(val1, val2, val3, ...)	A string object that can have 0 or more values, chosen from a list of possible values. You can list up to 64 values in a SET list

Numeric Data Types

Data type	Description
BIT(*size*)	A bit-value type. The number of bits per value is specified in *size*. The *size* parameter can hold a value from 1 to 64. The default value for *size* is 1.
TINYINT(*size*)	A very small integer. Signed range is from -128 to 127. Unsigned range is from 0 to 255. The *size* parameter specifies the maximum display width (which is 255)
BOOL	Zero is considered as false, nonzero values are considered as true.
BOOLEAN	Equal to BOOL
SMALLINT(*size*)	A small integer. Signed range is from -32768 to 32767. Unsigned range is from 0 to 65535. The *size* parameter specifies the maximum display width (which is 255)
MEDIUMINT(*size*)	A medium integer. Signed range is from -8388608 to 8388607. Unsigned range is from 0 to 16777215. The *size* parameter specifies the maximum display width (which is 255)
INT(*size*)	A medium integer. Signed range is from -2147483648 to 2147483647. Unsigned range is from 0 to 4294967295. The *size* parameter specifies the maximum display width (which is 255)
INTEGER(*size*)	Equal to INT(size)
BIGINT(*size*)	A large integer. Signed range is from -9223372036854775808 to 9223372036854775807. Unsigned range is from 0 to 18446744073709551615. The *size* parameter specifies the maximum display width (which is 255)
FLOAT(*size*, *d*)	A floating point number. The total number of digits is specified in *size*. The number of digits after the decimal point is specified in the *d* parameter. This syntax is deprecated in MySQL 8.0.17, and it will be removed in future MySQL versions
FLOAT(*p*)	A floating point number. MySQL uses the *p* value to determine whether to use FLOAT or DOUBLE for the resulting data type. If *p* is from 0 to 24, the data type becomes FLOAT(). If *p* is from 25 to 53, the data type becomes DOUBLE()
DOUBLE(*size*, *d*)	A normal-size floating point number. The total number of digits is specified in *size*. The number of digits after the decimal point is specified in the *d* parameter
DOUBLE PRECISION(*size*, *d*)	

DECIMAL(*size*, *d*)	An exact fixed-point number. The total number of digits is specified in *size*. The number of digits after the decimal point is specified in the *d* parameter. The maximum number for *size* is 65. The maximum number for *d* is 30. The default value for *size* is 10. The default value for *d* is 0.
DEC(*size*, *d*)	Equal to DECIMAL(size,d)

Note: All the numeric data types may have an extra option: UNSIGNED or ZEROFILL. If you add the UNSIGNED option, MySQL disallows negative values for the column. If you add the ZEROFILL option, MySQL automatically also adds the UNSIGNED attribute to the column.

Date and Time Data Types

Data type	Description
DATE	A date. Format: YYYY-MM-DD. The supported range is from '1000-01-01' to '9999-12-31'
DATETIME(*fsp*)	A date and time combination. Format: YYYY-MM-DD hh:mm:ss. The supported range is from '1000-01-01 00:00:00' to '9999-12-31 23:59:59'. Adding DEFAULT and ON UPDATE in the column definition to get automatic initialization and updating to the current date and time
TIMESTAMP(*fsp*)	A timestamp. TIMESTAMP values are stored as the number of seconds since the Unix epoch ('1970-01-01 00:00:00' UTC). Format: YYYY-MM-DD hh:mm:ss. The supported range is from '1970-01-01 00:00:01' UTC to '2038-01-09 03:14:07' UTC. Automatic initialization and updating to the current date and time can be specified using DEFAULT CURRENT_TIMESTAMP and ON UPDATE CURRENT_TIMESTAMP in the column definition
TIME(*fsp*)	A time. Format: hh:mm:ss. The supported range is from '-838:59:59' to '838:59:59'
YEAR	A year in four-digit format. Values allowed in four-digit format: 1901 to 2155, and 0000. MySQL 8.0 does not support year in two-digit format.

MySQL Functions

MySQL has many built-in functions.

This reference contains string, numeric, date, and some advanced functions in MySQL.

MySQL String Functions

Function	Description
ASCII	Returns the ASCII value for the specific character
CHAR_LENGTH	Returns the length of a string (in characters)
CHARACTER_LENGTH	Returns the length of a string (in characters)
CONCAT	Adds two or more expressions together
CONCAT_WS	Adds two or more expressions together with a separator
FIELD	Returns the index position of a value in a list of values
FIND_IN_SET	Returns the position of a string within a list of strings
FORMAT	Formats a number to a format like "#,###,###.##", rounded to a specified number of decimal places
INSERT	Inserts a string within a string at the specified position and for a certain number of characters
INSTR	Returns the position of the first occurrence of a string in another string
LCASE	Converts a string to lower-case
LEFT	Extracts a number of characters from a string (starting from left)
LENGTH	Returns the length of a string (in bytes)
LOCATE	Returns the position of the first occurrence of a substring in a string
LOWER	Converts a string to lower-case
LPAD	Left-pads a string with another string, to a certain length
LTRIM	Removes leading spaces from a string
MID	Extracts a substring from a string (starting at any position)
POSITION	Returns the position of the first occurrence of a substring in a string
REPEAT	Repeats a string as many times as specified

REPLACE	Replaces all occurrences of a substring within a string, with a new substring
REVERSE	Reverses a string and returns the result
RIGHT	Extracts a number of characters from a string (starting from right)
RPAD	Right-pads a string with another string, to a certain length
RTRIM	Removes trailing spaces from a string
SPACE	Returns a string of the specified number of space characters
STRCMP	Compares two strings
SUBSTR	Extracts a substring from a string (starting at any position)
SUBSTRING	Extracts a substring from a string (starting at any position)
SUBSTRING_INDEX	Returns a substring of a string before a specified number of delimiter occurs
TRIM	Removes leading and trailing spaces from a string
UCASE	Converts a string to upper-case
UPPER	Converts a string to upper-case

Examples

```
select ascii('a');
select char_length('Rajkot');
SELECT roll, fname, char_length(fname) from students
SELECT roll, fname, character_length(fname) from students;
SELECT roll, concat(fname, lname) as "Full Name" from students;
SELECT roll, concat(fname, " ",lname) as "Full Name" from students;
SELECT roll, concat_ws(" ",fname,lname,city) as "Full Name" from students;
SELECT roll, concat_ws(" - ",fname,lname,city) as "Full Name" from students;
SELECT field("s", "s", "q", "l")
SELECT field("k", "r", "a", "j", "k", "o", "t");
SELECT find_in_set("k", "r,a,j,k,o,t");
```

```
SELECT find_in_set("a", "r,a,j,k,o,t");

SELECT format(12345.6789, 2);

SELECT INSERT("W3Schools.com", 1, 9, "Example");

SELECT INSTR("W3Schools.com", "3") AS MatchPosition;

SELECT lcase(fname), lcase(lname), lcase(city) from students

SELECT lcase(concat_ws(" ", fname, lname, city)) from students;

SELECT roll, fname, left(fname, 4) from students

SELECT roll, fname, right(fname, 4) from students;

SELECT roll, fname, length(fname) from students;

SELECT LOCATE("3", "W3Schools.com") AS MatchPosition;

SELECT roll, fname, lower(fname), lcase(fname) FROM students

SELECT roll, fname, lpad(fname, 20) FROM students;

SELECT roll, fname, rpad(fname, 20) FROM students;

SELECT ltrim("       Rajkot     ")

SELECT rtrim("       Rajkot     ");

SELECT mid("Rajkot", 1, 3)

SELECT POSITION("3" IN "W3Schools.com") AS MatchPosition;

SELECT fname, REPEAT(fname, 5) from students

SELECT REPLACE("SQL Tutorial", "SQL", "HTML");

SELECT roll, fname, reverse(fname) from students

SELECT space(10)

SELECT strcmp("Rajkot", "Rajkot")

SELECT strcmp("Rajkot", "tajkot");

SELECT strcmp("tajkot", "rajkot");

SELECT SUBSTR("SQL Tutorial", 5, 3) AS ExtractString;

SELECT SUBSTRING("SQL Tutorial", 5, 3) AS ExtractString;

SELECT SUBSTRING_INDEX("www.w3schools.com", ".", 1);

SELECT trim("   www.w3schools.com    ");

SELECT roll, fname, ucase(fname), upper(fname) FROM students
```

MySQL Advanced Functions

Function	Description
BIN	Returns a binary representation of a number
BINARY	Converts a value to a binary string
CASE	Goes through conditions and return a value when the first condition is met
CAST	Converts a value (of any type) into a specified datatype
COALESCE	Returns the first non-null value in a list
CONNECTION_ID	Returns the unique connection ID for the current connection
CONV	Converts a number from one numeric base system to another
CONVERT	Converts a value into the specified datatype or character set
CURRENT_USER	Returns the user name and host name for the MySQL account that the server used to authenticate the current client
DATABASE	Returns the name of the current database
IF	Returns a value if a condition is TRUE, or another value if a condition is FALSE
IFNULL	Return a specified value if the expression is NULL, otherwise return the expression
ISNULL	Returns 1 or 0 depending on whether an expression is NULL
LAST_INSERT_ID	Returns the AUTO_INCREMENT id of the last row that has been inserted or updated in a table
NULLIF	Compares two expressions and returns NULL if they are equal. Otherwise, the first expression is returned
SESSION_USER	Returns the current MySQL user name and host name
SYSTEM_USER	Returns the current MySQL user name and host name
USER	Returns the current MySQL user name and host name
VERSION	Returns the current version of the MySQL database

```
SELECT bin(12)

SELECT BINARY "W3Schools.com";

SELECT roll, fname, lname, gender, case  when gender = 'male' then 'Bike'   when gender = 'female' then 'Scooter'    else 'City Bus' end as "Vehicle" from students
```

```
SELECT cast(CURRENT_TIMESTAMP as DATE)

SELECT roll, absents, presents, (COALESCE(absents, 0)+ COALESCE(presents,0)) as "Total Days" from attendance;

SELECT roll, absents, presents, (ifnull(absents, 0)+ ifnull(presents,0)) as "Total Days" from attendance;

SELECT CONNECTION_ID();

SELECT CONV(15, 10, 2); --convert 15 decimal to binary

SELECT CONV(15, 10, 16);

SELECT CONV(1110011010101000101, 2, 10);

SELECT CURRENT_USER()

SELECT SESSION_USER()

SELECT SYSTEM_USER();

SELECT USER();

SELECT DATABASE()

SELECT roll, if(roll > 5, "2024-02-25", "2024-02-26") as "Exam Date", fname, lname from students;

SELECT  roll, absents, isnull(absents), presents, isnull(presents) from attendance;

SELECT * from attendance WHERE isnull(absents);

SELECT * from attendance WHERE isnull(absents) or isnull(presents);

SELECT last_insert_id()

SELECT NULLIF(25, "Hello");

SELECT NULLIF(25,25);

SELECT version()
```

MySQL Numeric Functions

Function	Description
ABS	Returns the absolute value of a number
ACOS	Returns the arc cosine of a number
ASIN	Returns the arc sine of a number
ATAN	Returns the arc tangent of one or two numbers
ATAN2	Returns the arc tangent of two numbers
AVG	Returns the average value of an expression
CEIL	Returns the smallest integer value that is >= to a number
CEILING	Returns the smallest integer value that is >= to a number
COS	Returns the cosine of a number
COT	Returns the cotangent of a number
COUNT	Returns the number of records returned by a select query
DEGREES	Converts a value in radians to degrees
DIV	Used for integer division
EXP	Returns e raised to the power of a specified number
FLOOR	Returns the largest integer value that is <= to a number
GREATEST	Returns the greatest value of the list of arguments
LEAST	Returns the smallest value of the list of arguments
LN	Returns the natural logarithm of a number
LOG	Returns the natural logarithm of a number, or the logarithm of a number to a specified base
LOG10	Returns the natural logarithm of a number to base 10
LOG2	Returns the natural logarithm of a number to base 2
MAX	Returns the maximum value in a set of values
MIN	Returns the minimum value in a set of values
MOD	Returns the remainder of a number divided by another number
PI	Returns the value of PI

POW	Returns the value of a number raised to the power of another number
POWER	Returns the value of a number raised to the power of another number
RADIANS	Converts a degree value into radians
RAND	Returns a random number
ROUND	Rounds a number to a specified number of decimal places
SIGN	Returns the sign of a number
SIN	Returns the sine of a number
SQRT	Returns the square root of a number
SUM	Calculates the sum of a set of values
TAN	Returns the tangent of a number
TRUNCATE	Truncates a number to the specified number of decimal places

```
SELECT abs(-123)
SELECT acos(0.3)
SELECT asin(0.3);
SELECT atan(0.3);
SELECT atan2(0.3);
SELECT avg(presents) from attendance;
SELECT ceil(12.34)
SELECT ceiling(12.34);
SELECT cos(0.12)
SELECT cot(0.12);
SELECT COUNT(roll) from students WHERE city = 'rajkot'
SELECT degrees(1.2)
SELECT 100 div 5
SELECT 100 mod 6;
SELECT exp(1)
SELECT floor(12.34)
SELECT greatest(11, 22, 33, 44, 55, 66, 77, 88, 99)
```

```
SELECT least(11, 22, 33, 44, 55, 66, 77, 88, 99);

SELECT ln(0.12)

SELECT log(0.12);

SELECT log2(0.12);

SELECT log10(0.12);

SELECT max(roll) FROM students

SELECT min(roll) FROM students;

SELECT pi()

SELECT pow(2, 10)

SELECT power(2, 10);

SELECT radians(180)

SELECT rand();

SELECT round(12345.6789, 6);

SELECT sign(10)

SELECT sin(0.12);

SELECT sqrt(144)

SELECT sum(absents) from attendance;

SELECT tan(0.12)

SELECT TRUNCATE(123.456, 1)
```

MySQL Date Functions

Function	Description
ADDDATE	Adds a time/date interval to a date and then returns the date
ADDTIME	Adds a time interval to a time/datetime and then returns the time/datetime
CURDATE	Returns the current date
CURRENT_DATE	Returns the current date
CURRENT_TIME	Returns the current time
CURRENT_TIMESTAMP	Returns the current date and time
CURTIME	Returns the current time
DATE	Extracts the date part from a datetime expression
DATEDIFF	Returns the number of days between two date values
DATE_ADD	Adds a time/date interval to a date and then returns the date
DATE_FORMAT	Formats a date
DATE_SUB	Subtracts a time/date interval from a date and then returns the date
DAY	Returns the day of the month for a given date
DAYNAME	Returns the weekday name for a given date
DAYOFMONTH	Returns the day of the month for a given date
DAYOFWEEK	Returns the weekday index for a given date
DAYOFYEAR	Returns the day of the year for a given date
EXTRACT	Extracts a part from a given date
FROM_DAYS	Returns a date from a numeric datevalue
HOUR	Returns the hour part for a given date
LAST_DAY	Extracts the last day of the month for a given date
LOCALTIME	Returns the current date and time
LOCALTIMESTAMP	Returns the current date and time
MAKEDATE	Creates and returns a date based on a year and a number of days value
MAKETIME	Creates and returns a time based on an hour, minute, and second value

MICROSECOND	Returns the microsecond part of a time/datetime
MINUTE	Returns the minute part of a time/datetime
MONTH	Returns the month part for a given date
MONTHNAME	Returns the name of the month for a given date
NOW	Returns the current date and time
PERIOD_ADD	Adds a specified number of months to a period
PERIOD_DIFF	Returns the difference between two periods
QUARTER	Returns the quarter of the year for a given date value
SECOND	Returns the seconds part of a time/datetime
SEC_TO_TIME	Returns a time value based on the specified seconds
STR_TO_DATE	Returns a date based on a string and a format
SUBDATE	Subtracts a time/date interval from a date and then returns the date
SUBTIME	Subtracts a time interval from a datetime and then returns the time/datetime
SYSDATE	Returns the current date and time
TIME	Extracts the time part from a given time/datetime
TIME_FORMAT	Formats a time by a specified format
TIME_TO_SEC	Converts a time value into seconds
TIMEDIFF	Returns the difference between two time/datetime expressions
TIMESTAMP	Returns a datetime value based on a date or datetime value
TO_DAYS	Returns the number of days between a date and date "0000-00-00"
WEEK	Returns the week number for a given date
WEEKDAY	Returns the weekday number for a given date
WEEKOFYEAR	Returns the week number for a given date
YEAR	Returns the year part for a given date
YEARWEEK	Returns the year and week number for a given date

```
SELECT adddate(CURRENT_DATE, INTERVAL 30 day)
```

```
SELECT adddate(CURRENT_DATE, INTERVAL 30 month);

SELECT CURRENT_TIMESTAMP, addtime(CURRENT_TIMESTAMP, 2);

SELECT CURRENT_DATE

SELECT CURRENT_TIME

SELECT CURRENT_TIMESTAMP

SELECT CURTIME()

SELECT year(CURRENT_TIMESTAMP)

SELECT month(CURRENT_TIMESTAMP);

SELECT day(CURRENT_TIMESTAMP);

SELECT date(CURRENT_TIMESTAMP);

SELECT hour(CURRENT_TIMESTAMP);

SELECT minute(CURRENT_TIMESTAMP);

SELECT second(CURRENT_TIMESTAMP);

SELECT datediff(CURRENT_DATE, "2001-04-26")

SELECT date_add(CURRENT_DATE, INTERVAL 20 day)

SELECT date_format(CURRENT_DATE, "%d / %m / %Y %h : %i : %s");

SELECT date_sub(CURRENT_TIMESTAMP, INTERVAL 50 month)

SELECT dayname(CURRENT_TIMESTAMP)

SELECT dayofmonth(CURRENT_TIMESTAMP);

SELECT dayofweek(CURRENT_TIMESTAMP);

SELECT dayofyear(CURRENT_TIMESTAMP);

SELECT extract(month from CURRENT_TIMESTAMP)

SELECT from_days(739303);

SELECT last_day(CURRENT_TIMESTAMP)

SELECT LOCALTIME

SELECT LOCALTIMESTAMP

SELECT makedate(2022, 5)

SELECT maketime(15, 15, 15)

SELECT microsecond(“2024-02-22 15:15:14.0384”)

SELECT monthname(CURRENT_TIMESTAMP)

SELECT now()
```

```
SELECT period_add(202401, 30);

SELECT period_diff(202401, 202003);

SELECT quarter(CURRENT_TIMESTAMP)

SELECT SEC_TO_TIME(3600);

SELECT STR_TO_DATE("August 10 2017", "%M %d %Y");

SELECT subdate(CURRENT_TIMESTAMP, INTERVAL 10 year)

SELECT sysdate()

SELECT time(CURRENT_TIMESTAMP)

SELECT TIME_FORMAT(CURRENT_TIMESTAMP, "%H %i %s");

SELECT TIME_TO_SEC(CURRENT_TIMESTAMP);

SELECT TIMEDIFF("13:10:11", "13:10:10");

SELECT TIMESTAMP("2017-07-23",  "13:10:11");

SELECT to_days(CURRENT_TIMESTAMP)

SELECT week(CURRENT_TIMESTAMP);

SELECT weekday(CURRENT_TIMESTAMP);

SELECT weekofyear(CURRENT_DATE);

SELECT yearweek(CURRENT_DATE);
```

Normalization

A large database defined as a single relation may result in data duplication. This repetition of data may result in:

- Making relations very large.
- It isn't easy to maintain and update data as it would involve searching many records in relation.
- Wastage and poor utilization of disk space and resources.
- The likelihood of errors and inconsistencies increases.

So to handle these problems, we should analyze and decompose the relations with redundant data into smaller, simpler, and well-structured relations that are satisfy desirable properties. Normalization is a process of decomposing the relations into relations with fewer attributes.

What is Normalization?

- Normalization is the process of organizing the data in the database.
- Normalization is used to minimize the redundancy from a relation or set of relations. It is also used to eliminate undesirable characteristics like Insertion, Update, and Deletion Anomalies.
- Normalization divides the larger table into smaller and links them using relationships.
- The normal form is used to reduce redundancy from the database table.

Why do we need Normalization?

The main reason for normalizing the relations is removing these anomalies. Failure to eliminate anomalies leads to data redundancy and can cause data integrity and other problems as the database grows. Normalization consists of a series of guidelines that helps to guide you in creating a good database structure.

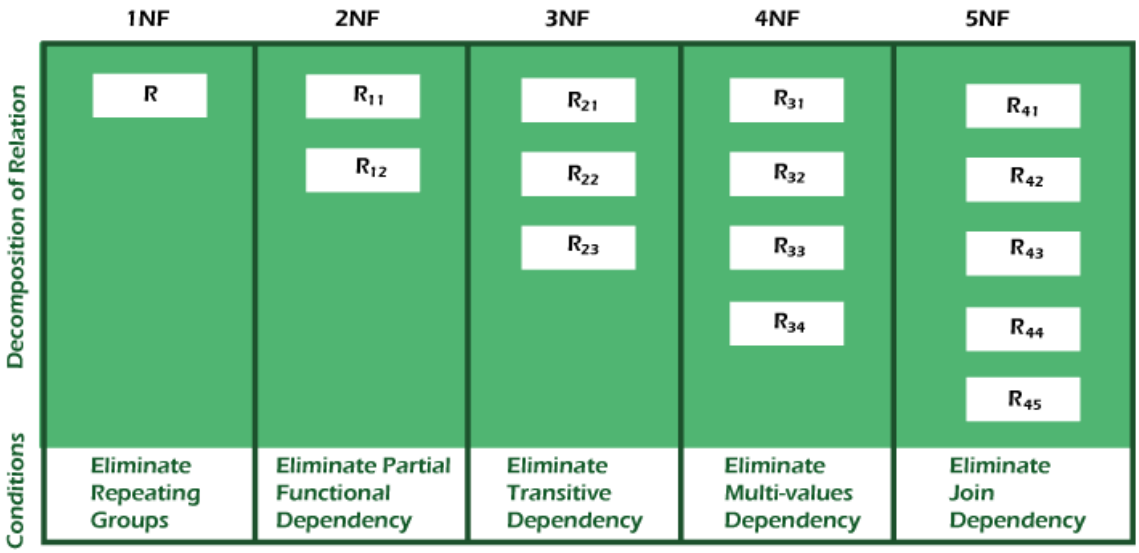
Data modification anomalies can be categorized into three types:

- **Insertion Anomaly:** Insertion Anomaly refers to when one cannot insert a new tuple into a relationship due to lack of data.
- **Deletion Anomaly:** The delete anomaly refers to the situation where the deletion of data results in the unintended loss of some other important data.
- **Updatation Anomaly:** The update anomaly is when an update of a single data value requires multiple rows of data to be updated.

Types of Normal Forms:

Normalization works through a series of stages called Normal forms. The normal forms apply to individual relations. The relation is said to be in particular normal form if it satisfies constraints.

Following are the various types of Normal forms:



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

Advantages of Normalization

- Normalization helps to minimize data redundancy.
- Greater overall database organization.
- Data consistency within the database.
- Much more flexible database design.
- Enforces the concept of relational integrity.

Disadvantages of Normalization

- You cannot start building the database before knowing what the user needs.
- The performance degrades when normalizing the relations to higher normal forms, i.e., 4NF, 5NF.
- It is very time-consuming and difficult to normalize relations of a higher degree.
- Careless decomposition may lead to a bad database design, leading to serious problems.

First Normal Form (1NF)

- A relation will be 1NF if it contains an atomic value.
- It states that an attribute of a table cannot hold multiple values. It must hold only single-valued attribute.
- First normal form disallows the multi-valued attribute, composite attribute, and their combinations.

Example: Relation EMPLOYEE is not in 1NF because of multi-valued attribute EMP_PHONE.

EMPLOYEE table:

EMP_ID	EMP_NAME	EMP_PHONE	EMP_STATE
14	John	7272826385, 9064738238	UP
20	Harry	8574783832	Bihar
12	Sam	7390372389, 8589830302	Punjab

The decomposition of the EMPLOYEE table into 1NF has been shown below:

EMP_ID	EMP_NAME	EMP_PHONE	EMP_STATE
14	John	7272826385	UP
14	John	9064738238	UP
20	Harry	8574783832	Bihar
12	Sam	7390372389	Punjab
12	Sam	8589830302	Punjab

Second Normal Form (2NF)

- In the 2NF, relational must be in 1NF.
- In the second normal form, all non-key attributes are fully functional dependent on the primary key

Example: Let's assume, a school can store the data of teachers and the subjects they teach. In a school, a teacher can teach more than one subject.

TEACHER table

TEACHER_ID	SUBJECT	TEACHER_AGE
25	Chemistry	30
25	Biology	30
47	English	35
83	Math	38
83	Computer	38

In the given table, non-prime attribute TEACHER_AGE is dependent on TEACHER_ID which is a proper subset of a candidate key. That's why it violates the rule for 2NF.

To convert the given table into 2NF, we decompose it into two tables:

TEACHER table:

TEACHER_ID (PK)	Firstname
25	bhavdeep
47	Yagnik
83	udit

TEACHER_DETAIL table:

DETAILS_ID (PK)	TEACHER_ID (FK)	TEACHER_AGE
1	25	30
2	47	35
3	83	38

TEACHER_SUBJECT table:

TEACHER_ID	SUBJECT
25	Chemistry
25	Biology
47	English

83	Math
83	Computer

Third Normal Form (3NF)

- A relation will be in 3NF if it is in 2NF and not contain any transitive partial dependency.
- 3NF is used to reduce the data duplication. It is also used to achieve the data integrity.
- If there is no transitive dependency for non-prime attributes, then the relation must be in third normal form.

A relation is in third normal form if it holds atleast one of the following conditions for every non-trivial function dependency X → Y.

X is a super key.

Y is a prime attribute, i.e., each element of Y is part of some candidate key.

Example:

EMPLOYEE_DETAIL table:

EMP_ID	EMP_NAME	EMP_ZIP	EMP_STATE	EMP_CITY
222	Harry	201010	UP	Noida
333	Stephan	02228	US	Boston
444	Lan	60007	US	Chicago
555	Katharine	06389	UK	Norwich
666	John	462007	MP	Bhopal

Super key in the table above:

{EMP_ID}, {EMP_ID, EMP_NAME}, {EMP_ID, EMP_NAME, EMP_ZIP}....so on

Candidate key: {EMP_ID}

Non-prime attributes: In the given table, all attributes except EMP_ID are non-prime.

Here, EMP_STATE & EMP_CITY dependent on EMP_ZIP and EMP_ZIP dependent on EMP_ID. The non-prime attributes (EMP_STATE, EMP_CITY) transitively dependent on super key(EMP_ID). It violates the rule of third normal form.

That's why we need to move the EMP_CITY and EMP_STATE to the new <EMPLOYEE_ZIP> table, with EMP_ZIP as a Primary key.

EMPLOYEE table:

EMP_ID	EMP_NAME	EMP_ZIP
222	Harry	201010
333	Stephan	02228
444	Lan	60007

555	Katharine	06389
666	John	462007
456	Udit	02228

EMPLOYEE_ZIP table:

EMP_ZIP	EMP_STATE	EMP_CITY
201010	UP	Noida
02228	US	Boston
60007	US	Chicago
06389	UK	Norwich
462007	MP	Bhopal

Boyce Codd normal form (BCNF)

- BCNF is the advance version of 3NF. It is stricter than 3NF.
- A table is in BCNF if every functional dependency X → Y, X is the super key of the table.
- For BCNF, the table should be in 3NF, and for every FD, LHS is super key.
- **Example:** Let's assume there is a company where employees work in more than one department.
- **EMPLOYEE table:**

EMP_ID	EMP_COUNTRY	EMP_DEPT	DEPT_TYPE	EMP_DEPT_NO
264	India	Designing	D394	283
264	India	Testing	D394	300
364	UK	Stores	D283	232
364	UK	Developing	D283	549

In the above table Functional dependencies are as follows:

1. EMP_ID → EMP_COUNTRY
2. EMP_DEPT → {DEPT_TYPE, EMP_DEPT_NO}

Candidate key: {EMP-ID, EMP-DEPT}

The table is not in BCNF because neither EMP_DEPT nor EMP_ID alone are keys.

To convert the given table into BCNF, we decompose it into three tables:

EMP_COUNTRY table:

EMP_ID	EMP_COUNTRY
264	India
264	India

EMP_DEPT table:

EMP_DEPT	DEPT_TYPE	EMP_DEPT_NO
Designing	D394	283
Testing	D394	300
Stores	D283	232
Developing	D283	549

EMP_DEPT_MAPPING table:

EMP_ID	EMP_DEPT
D394	283
D394	300
D283	232
D283	549

1. EMP_ID → EMP_COUNTRY
2. EMP_DEPT → {DEPT_TYPE, EMP_DEPT_NO}

Candidate keys:

For the first table: EMP_ID
For the second table: EMP_DEPT
For the third table: {EMP_ID, EMP_DEPT}

Now, this is in BCNF because left side part of both the functional dependencies is a key.

Fourth normal form (4NF)

- A relation will be in 4NF if it is in Boyce Codd normal form and has no multi-valued dependency.
- For a dependency A → B, if for a single value of A, multiple values of B exists, then the relation will be a multi-valued dependency.

Example

STUDENT

STU_ID	COURSE	HOBBY
21	Computer	Dancing
21	Math	Singing
34	Chemistry	Dancing
74	Biology	Cricket
59	Physics	Hockey

The given STUDENT table is in 3NF, but the COURSE and HOBBY are two independent entity. Hence, there is no relationship between COURSE and HOBBY.

In the STUDENT relation, a student with STU_ID, **21** contains two courses, **Computer** and **Math** and two hobbies, **Dancing** and **Singing**. So there is a Multi-valued dependency on STU_ID, which leads to unnecessary repetition of data.

So to make the above table into 4NF, we can decompose it into two tables:

STUDENT_COURSE

STU_ID	COURSE
21	Computer
21	Math
34	Chemistry
74	Biology
59	Physics

STUDENT_HOBBY

STU_ID	HOBBY
21	Dancing

21	Singing
34	Dancing
74	Cricket
59	Hockey

Fifth normal form (5NF)

- A relation is in 5NF if it is in 4NF and not contains any join dependency and joining should be lossless.
- 5NF is satisfied when all the tables are broken into as many tables as possible in order to avoid redundancy.
- 5NF is also known as Project-join normal form (PJ/NF).

Example

SUBJECT	LECTURER	SEMESTER
Computer	Anshika	Semester 1
Computer	John	Semester 1
Math	John	Semester 1
Math	Akash	Semester 2
Chemistry	Praveen	Semester 1

In the above table, John takes both Computer and Math class for Semester 1 but he doesn't take Math class for Semester 2. In this case, combination of all these fields required to identify a valid data.

Suppose we add a new Semester as Semester 3 but do not know about the subject and who will be taking that subject so we leave Lecturer and Subject as NULL. But all three columns together acts as a primary key, so we can't leave other two columns blank.

So to make the above table into 5NF, we can decompose it into three relations P1, P2 & P3:

P1

SEMESTER	SUBJECT
Semester 1	Computer
Semester 1	Math
Semester 1	Chemistry
Semester 2	Math

P2

SUBJECT	LECTURER
Computer	Anshika
Computer	John
Math	John

Math	Akash
Chemistry	Praveen

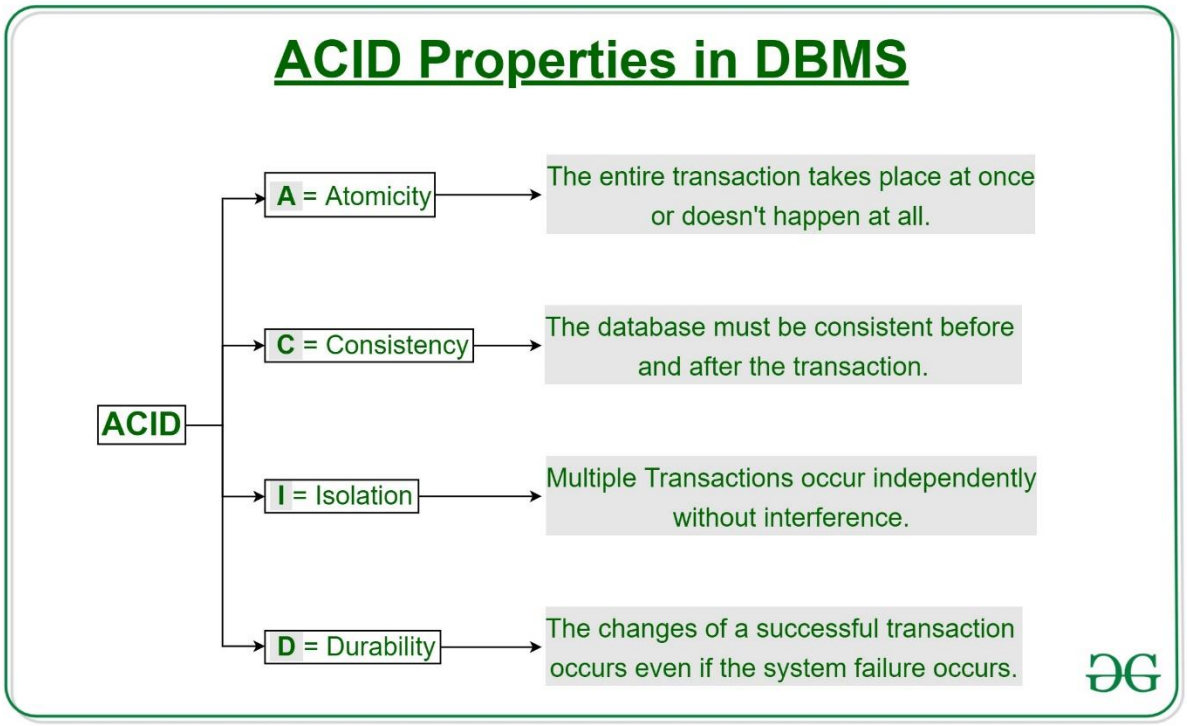
P3

SEMSTER	**LECTURER**
Semester 1	Anshika
Semester 1	John
Semester 1	John
Semester 2	Akash
Semester 1	Praveen

ACID Properties in DBMS

A **transaction** is a single logical unit of work that accesses and possibly modifies the contents of a database. Transactions access data using read and write operations.

In order to maintain consistency in a database, before and after the transaction, certain properties are followed. These are called **ACID** properties.



Atomicity:

By this, we mean that either the entire transaction takes place at once or doesn't happen at all. There is no midway i.e. transactions do not occur partially. Each transaction is considered as one unit and either runs to completion or is not executed at all. It involves the following two operations.

—**Abort**: If a transaction aborts, changes made to the database are not visible.
—**Commit**: If a transaction commits, changes made are visible.
Atomicity is also known as the 'All or nothing rule'.

Consider the following transaction **T** consisting of **T1** and **T2**: Transfer of 100 from account **X** to account **Y**.

Before: X : 500	Y: 200
Transaction T	
T1	**T2**
Read (X) X: = X − 100 Write (X)	Read (Y) Y: = Y + 100 Write (Y)
After: X : 400	Y : 300

If the transaction fails after completion of **T1** but before completion of **T2**.(say, after **write(X)** but before **write(Y)**), then the amount has been deducted from **X** but not added to **Y**. This results in an inconsistent database state. Therefore, the transaction must be executed in its entirety in order to ensure the correctness of the database state.

Consistency:

This means that integrity constraints must be maintained so that the database is consistent before and after the transaction. It refers to the correctness of a database. Referring to the example above, The total amount before and after the transaction must be maintained.
Total **before T** occurs = **500 + 200 = 700**.
Total **after T occurs** = **400 + 300 = 700**.
Therefore, the database is **consistent**. Inconsistency occurs in case **T1** completes but **T2** fails. As a result, T is incomplete.

Isolation:

This property ensures that multiple transactions can occur concurrently without leading to the inconsistency of the database state. Transactions occur independently without interference. Changes occurring in a particular transaction will not be visible to any other transaction until that particular change in that transaction is written to memory or has been committed. This property ensures that the execution of transactions concurrently will result in a state that is equivalent to a state achieved these were executed serially in some order.
Let **X**= 500, **Y** = 500.
Consider two transactions **T** and **T".**

T	T''
Read (X) X: = X*100 Write (X) Read (Y) Y: = Y – 50 Write (Y)	Read (X) Read (Y) Z: = X + Y Write (Z)

Suppose **T** has been executed till **Read (Y)** and then **T''** starts. As a result, interleaving of operations takes place due to which **T''** reads the correct value of **X** but the incorrect value of **Y** and sum computed by

T'': (X+Y = 50, 000+500=50, 500)
is thus not consistent with the sum at end of the transaction:
T: (X+Y = 50, 000 + 450 = 50, 450).

This results in database inconsistency, due to a loss of 50 units. Hence, transactions must take place in isolation and changes should be visible only after they have been made to the main memory.

Durability:

This property ensures that once the transaction has completed execution, the updates and modifications to the database are stored in and written to disk and they persist even if a system failure occurs. These updates now become permanent and are stored in non-volatile memory. The effects of the transaction, thus, are never lost.

Some important points:

Property	Responsibility for maintaining properties
Atomicity	Transaction Manager
Consistency	Application programmer
Isolation	Concurrency Control Manager
Durability	Recovery Manager

The **ACID** properties, in totality, provide a mechanism to ensure the correctness and consistency of a database in a way such that each transaction is a group of operations that acts as a single unit, produces consistent results, acts in isolation from other operations, and updates that it makes are durably stored.

ACID properties are the four key characteristics that define the reliability and consistency of a transaction in a Database Management System (DBMS). The acronym ACID stands for Atomicity, Consistency, Isolation, and Durability. Here is a brief description of each of these properties:

Atomicity: Atomicity ensures that a transaction is treated as a single, indivisible unit of work. Either all the operations within the transaction are completed successfully, or none of them are. If any part of the transaction fails, the entire transaction is rolled back to its original state, ensuring data consistency and integrity.

Consistency: Consistency ensures that a transaction takes the database from one consistent state to another consistent state. The database is in a consistent state both before and after the transaction is executed. Constraints, such as unique keys and foreign keys, must be maintained to ensure data consistency.

Isolation: Isolation ensures that multiple transactions can execute concurrently without interfering with each other. Each transaction must be isolated from other transactions until it is completed. This isolation prevents dirty reads, non-repeatable reads, and phantom reads.

Durability: Durability ensures that once a transaction is committed, its changes are permanent and will survive any subsequent system failures. The transaction's changes are saved to the database permanently, and even if the system crashes, the changes remain intact and can be recovered.

Overall, ACID properties provide a framework for ensuring data consistency, integrity, and reliability in DBMS. They ensure that transactions are executed in a reliable and consistent manner, even in the presence of system failures, network issues, or other problems. These properties make DBMS a reliable and efficient tool for managing data in modern organizations.

Advantages of ACID Properties in DBMS:

1. Data Consistency: ACID properties ensure that the data remains consistent and accurate after any transaction execution.
2. Data Integrity: ACID properties maintain the integrity of the data by ensuring that any changes to the database are permanent and cannot be lost.
3. Concurrency Control: ACID properties help to manage multiple transactions occurring concurrently by preventing interference between them.
4. Recovery: ACID properties ensure that in case of any failure or crash, the system can recover the data up to the point of failure or crash.

Disadvantages of ACID Properties in DBMS:

1. Performance: The ACID properties can cause a performance overhead in the system, as they require additional processing to ensure data consistency and integrity.
2. Scalability: The ACID properties may cause scalability issues in large distributed systems where multiple transactions occur concurrently.
3. Complexity: Implementing the ACID properties can increase the complexity of the system and require significant expertise and resources.
   Overall, the advantages of ACID properties in DBMS outweigh the disadvantages. They provide a reliable and consistent approach to data
4. management, ensuring data integrity, accuracy, and reliability. However, in some cases, the overhead of implementing ACID properties can cause performance and scalability issues. Therefore, it's important to balance the benefits of ACID properties against the specific needs and requirements of the system.