

# Manipulation

## Column Constraints

Column constraints are the rules applied to the values of individual columns:

- **PRIMARY KEY** constraint can be used to uniquely identify the row.
- **UNIQUE** columns have a different value for every row.
- **NOT NULL** columns must have a value.
- **DEFAULT** assigns a default value for the column when no value is specified.

There can be only one **PRIMARY KEY** column per table and multiple **UNIQUE** columns.

```
CREATE TABLE student (  
    id INTEGER PRIMARY KEY,  
    name TEXT UNIQUE,  
    grade INTEGER NOT NULL,  
    age INTEGER DEFAULT 10  
);
```

## CREATE TABLE Statement

The **CREATE TABLE** statement creates a new table in a database. It allows one to specify the name of the table and the name of each column in the table.

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

## INSERT Statement

The **INSERT INTO** statement is used to add a new record (row) to a table.

It has two forms as shown:

- Insert into columns in order.
- Insert into columns by name.

```
-- Insert into columns in order:  
INSERT INTO table_name  
VALUES (value1, value2);  
  
-- Insert into columns by name:  
INSERT INTO table_name (column1, column2)  
VALUES (value1, value2);
```

## ALTER TABLE Statement

The `ALTER TABLE` statement is used to modify the columns of an existing table. When combined with the `ADD COLUMN` clause, it is used to add a new column.

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

## DELETE Statement

The `DELETE` statement is used to delete records (rows) in a table. The `WHERE` clause specifies which record or records that should be deleted. If the `WHERE` clause is omitted, all records will be deleted.

```
DELETE FROM table_name
WHERE some_column = some_value;
```

## UPDATE Statement

The `UPDATE` statement is used to edit records (rows) in a table. It includes a `SET` clause that indicates the column to edit and a `WHERE` clause for specifying the record(s).

```
UPDATE table_name
SET column1 = value1, column2 = value2
WHERE some_column = some_value;
```

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# Queries

## AND Operator

The `AND` operator allows multiple conditions to be combined. Records must match both conditions that are joined by `AND` to be included in the result set. The given query will match any car that is blue and made after 2014.

```
SELECT model
FROM cars
WHERE color = 'blue'
      AND year > 2014;
```

## AS Clause

Columns or tables can be aliased using the `AS` clause. This allows columns or tables to be specifically renamed in the returned result set. The given query will return a result set with the column for `name` renamed to `movie_title`.

```
SELECT name AS 'movie_title'
FROM movies;
```

## OR Operator

The `OR` operator allows multiple conditions to be combined. Records matching either condition joined by the `OR` are included in the result set. The given query will match customers whose state is either `'CA'` or `'NY'`.

```
SELECT name
FROM customers
WHERE state = 'CA'
      OR state = 'NY';
```

## % Wildcard

The `%` wildcard can be used in a `LIKE` operator pattern to match zero or more unspecified character(s). The given query will match any movie that begins with `The`, followed by zero or more of any characters.

```
SELECT name
FROM movies
WHERE name LIKE 'The%';
```

## SELECT Statement

The `SELECT *` statement returns all columns from the provided table in the result set. The given query will fetch all columns and records (rows) from the `movies` table.

```
SELECT *  
FROM movies;
```

## \_ Wildcard

The `_` wildcard can be used in a `LIKE` operator pattern to match any single unspecified character. The given query will match any movie which begins with a single character, followed by `ove`.

```
SELECT name  
FROM movies  
WHERE name LIKE '_ove';
```

## ORDER BY Clause

The `ORDER BY` clause can be used to sort the result set by a particular column either alphabetically or numerically. It can be ordered in two ways:

- `DESC` is a keyword used to sort the results in descending order.
- `ASC` is a keyword used to sort the results in ascending order (default).

```
SELECT *  
FROM contacts  
ORDER BY birth_date DESC;
```

## LIKE Operator

The `LIKE` operator can be used inside of a `WHERE` clause to match a specified pattern. The given query will match any movie that begins with `Star` in its title.

```
SELECT name  
FROM movies  
WHERE name LIKE 'Star%';
```

## DISTINCT Clause

Unique values of a column can be selected using a `DISTINCT` query. For a table `contact_details` having five rows in which the `city` column contains Chicago, Madison, Boston, Madison, and Denver, the given query would return:

- Chicago
- Madison
- Boston
- Denver

```
SELECT DISTINCT city
FROM contact_details;
```

## BETWEEN Operator

The `BETWEEN` operator can be used to filter by a range of values. The range of values can be text, numbers, or date data. The given query will match any movie made between the years 1980 and 1990, inclusive.

```
SELECT *
FROM movies
WHERE year BETWEEN 1980 AND 1990;
```

## LIMIT Clause

The `LIMIT` clause is used to narrow, or limit, a result set to the specified number of rows. The given query will limit the result set to 5 rows.

```
SELECT *
FROM movies
LIMIT 5;
```

## NULL Values

Column values can be `NULL`, or have no value. These records can be matched (or not matched) using the `IS NULL` and `IS NOT NULL` operators in combination with the `WHERE` clause. The given query will match all addresses where the address has a value or is not `NULL`.

```
SELECT address
FROM records
WHERE address IS NOT NULL;
```

## WHERE Clause

The `WHERE` clause is used to filter records (rows) that match a certain condition. The given query will select all records where the `pub_year` equals `2017`.

```
SELECT title
FROM library
WHERE pub_year = 2017;
```

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# Aggregate Functions

## Column References

The `GROUP BY` and `ORDER BY` clauses can reference the selected columns by number in which they appear in the `SELECT` statement. The example query will count the number of movies per rating, and will:

- `GROUP BY` column 2 ( rating )
- `ORDER BY` column 1 ( total\_movies )

```
SELECT COUNT(*) AS 'total_movies',  
       rating  
FROM movies  
GROUP BY 2  
ORDER BY 1;
```

## `SUM()` Aggregate Function

The `SUM()` aggregate function takes the name of a column as an argument and returns the sum of all the value in that column.

```
SELECT SUM(salary)  
FROM salary_disbursement;
```

## `MAX()` Aggregate Function

The `MAX()` aggregate function takes the name of a column as an argument and returns the largest value in a column. The given query will return the largest value from the `amount` column.

```
SELECT MAX(amount)  
FROM transactions;
```

## `COUNT()` Aggregate Function

The `COUNT()` aggregate function returns the total number of rows that match the specified criteria. For instance, to find the total number of employees who have less than 5 years of experience, the given query can be used.

**Note:** A column name of the table can also be used instead of `*`. Unlike `COUNT(*)`, this variation `COUNT(column)` will not count `NULL` values in that column.

```
SELECT COUNT(*)  
FROM employees  
WHERE experience < 5;
```

## GROUP BY Clause

The `GROUP BY` clause will group records in a result set by identical values in one or more columns. It is often used in combination with aggregate functions to query information of similar records. The `GROUP BY` clause can come after `FROM` or `WHERE` but must come before any `ORDER BY` or `LIMIT` clause.

The given query will count the number of movies per rating.

```
SELECT rating,
       COUNT(*)
FROM movies
GROUP BY rating;
```

## MIN() Aggregate Function

The `MIN()` aggregate function returns the smallest value in a column. For instance, to find the smallest value of the `amount` column from the table named `transactions`, the given query can be used.

```
SELECT MIN(amount)
FROM transactions;
```

## AVG() Aggregate Function

The `AVG()` aggregate function returns the average value in a column. For instance, to find the average salary for the employees who have less than 5 years of experience, the given query can be used.

```
SELECT AVG(salary)
FROM employees
WHERE experience < 5;
```

## HAVING Clause

The `HAVING` clause is used to further filter the result set groups provided by the `GROUP BY` clause. `HAVING` is often used with aggregate functions to filter the result set groups based on an aggregate property. The given query will select only the records (rows) from only years where more than 5 movies were released per year.

The `HAVING` clause must always come after a `GROUP BY` clause but must come before any `ORDER BY` or `LIMIT` clause.

```
SELECT year,
       COUNT(*)
FROM movies
GROUP BY year
HAVING COUNT(*) > 5;
```



## Aggregate Functions

Aggregate functions perform a calculation on a set of values and return a single value:

- COUNT()
- SUM()
- MAX()
- MIN()
- AVG()

### ROUND() Function

The `ROUND()` function will round a number value to a specified number of places. It takes two arguments: a number, and a number of decimal places. It can be combined with other aggregate functions, as shown in the given query. This query will calculate the average rating of movies from 2015, rounding to 2 decimal places.

```
SELECT year,  
       ROUND(AVG(rating), 2)  
FROM movies  
WHERE year = 2015;
```

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# Multiple Tables

## Outer Join

An outer join will combine rows from different tables even if the join condition is not met. In a `LEFT JOIN`, every row in the *left* table is returned in the result set, and if the join condition is not met, then `NULL` values are used to fill in the columns from the *right* table.

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

## WITH Clause

The `WITH` clause stores the result of a query in a temporary table ( `temporary_movies` ) using an alias. Multiple temporary tables can be defined with one instance of the `WITH` keyword.

```
WITH temporary_movies AS (
    SELECT *
    FROM movies
)
SELECT *
FROM temporary_movies
WHERE year BETWEEN 2000 AND 2020;
```

## UNION Clause

The `UNION` clause is used to combine results that appear from multiple `SELECT` statements and filter duplicates.

For example, given a `first_names` table with a column `name` containing rows of data "James" and "Hermione", and a `last_names` table with a column `name` containing rows of data "James", "Hermione" and "Cassidy", the result of this query would contain three `name` s: "Cassidy", "James", and "Hermione".

```
SELECT name
FROM first_names
UNION
SELECT name
FROM last_names
```

## CROSS JOIN Clause


The `CROSS JOIN` clause is used to combine each row from one table with each row from another in the result set. This `JOIN` is helpful for creating all possible combinations for the records (rows) in two tables.

The given query will select the `shirt_color` and `pants_color` columns from the result set, which will contain all combinations of combining the rows in the `shirts` and `pants` tables. If there are 3 different shirt colors in the `shirts` table and 5 different pants colors in the `pants` table then the result set will contain  $3 \times 5 = 15$  rows.


```
SELECT shirts.shirt_color,  
       pants.pants_color  
FROM shirts  
CROSS JOIN pants;
```

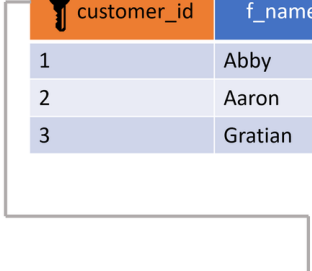
## Foreign Key

A *foreign key* is a reference in one table's records to the primary key of another table. To maintain multiple records for a specific row, the use of foreign key plays a vital role. For instance, to track all the orders of a specific customer, the table `order` (illustrated at the bottom of the image) can contain a foreign key.

 customer_id	f_name	l_name
1	Abby	Caren
2	Aaron	Paul
3	Gratian	Joseph


  

 order_id	customer_id	order_qty
1	2	5
2	2	6
3	1	2



## Primary Key

A *primary key* column in a SQL table is used to uniquely identify each record in that table. A primary key cannot be `NULL`. In the example, `customer_id` is the primary key. The same value cannot re-occur in a primary key column. Primary keys are often used in `JOIN` operations.

 customer_id	f_name	l_name
1	Abby	Caren
2	Aaron	Paul
3	Gratian	Joseph

## Inner Join

The `JOIN` clause allows for the return of results from more than one table by joining them together with other results based on common column values specified using an `ON` clause. `INNER JOIN` is the default `JOIN` and it will only return results matching the condition specified by `ON`.

```
SELECT *  
FROM books  
JOIN authors  
  ON books.author_id = authors.id;
```

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