WORLD'S MOST ADVANCED OPEN SOURCE object-RELATIONAL DATABASE

Applications & Tools:
PGAdmin 4 (PostgreSQL GUI)
Dummy & Random Data Generator Tool: **https://www.mockaroo.com/**
https://dbdiagram.io/home **//Data Model Designing**
/? **//for help in psql**
\help <command_name>

Install Postgre on linux

1. sudo apt-get update
2. sudo apt-get upgrade
3. sudo apt-get install postgresql postgresql-contrib

Start PostgreSQL CLI

- service postgresql status //running status of PostgreSQL
- sudo su postgres //login as postgres user
- psql //start PostgreSQL cli in Terminal
- \q //to exit PostgreSQL cli

In PostgreSQL CLI (psql //start PostgreSQL cli in Terminal)

- \l (small L) //list of databases
- \du //list of users of PSQL DBMS
- CREATE DATABASE test ;
- DROP DATABASE test ;
-
- **ALTER USER postgres PASSWORD 'admin';** **\\ to alter password of a user**
- **\c test** **//to connect to a database;**
-

Connect to database (after loging as sudo su postgre)

psql --help
Default Hostname: "/var/run/postgresql"
Default Port: "5432"
Default Username: "postgres"
~~**-Default Password-**~~ I had set my postgresql password admin

CMD: psql -h localhost -p 5432 -U postgres DB_name
Exit: \q
or
\l
\c DB_name

In a Database (\c db_name //to connect to a database;)

- CREATE TABLE employee(
  id BIGSERIAL **NOT NULL PRIMARY KEY,**
  age INT **NOT NULL**,
  full_name VARCHAR(60) **NOT NULL**,
  gender VARCHAR(7) **NOT NULL**,
  dob DATE **NOT NULL**,
  );
  BIGSERIAL == BIGINT it increment by themselves.

- \d employee; //structure of table
  in pgadmin: Servers-> learn->db_name->Schemas->public->Tables

- DROP TABLE table_name;

- INSERT INTO table_name(col1,col2,...) VALUES(102, 'val2' , ...) ;
  INSERT INTO table_name VALUES(102, 'val2' , ..., 'valn') ; //no need to mention col_name if we are inserting in all colmns;
  EX: **INSERT INTO** person (first_name,last_name,gender, dob) **VALUES** ('Anne', 'Smith', DATE '1988-01-09') **;**

- SELECT ***** FROM table_name;
  SELECT col1, col2 FROM table_name;
  SELECT **DISTINCT** col1, col2 FROM table_name;

- SELECT **DISTINCT** col1, col2 FROM table_name **WHERE** col1='fdddff';
- **AND** || **OR** || **ORDER BY** col_name | col1, col2 | **ASC** (default) | **DESC**
- **LIMIT** 9 | 2*3-1;

- **UPDATE** table_name **SET** col_name = 'new updated val' **WHERE** col_name2 = 'val to search' **;**

- **DELETE FROM** table_name **WHERE** col_name2 = 'val to search' **;**
- **DROP TABLE** table_name**;** (erase the table from db + unrestorable + no log is maintained)
- **TRUNCATE TABLE** table_name; (delete all the records of the data + log is maintained)

- ALTER TABLE:
  ADD NEW COL =>**ALTER TABLE** table_name **ADD** newcol_name datatype;
  DROP A COL =>**ALTER TABLE** table_name **DROP** col_name;
  MODIFY A COL=>**ALTER TABLE** table_name **MODIFY** col_name newdatatype;

- WHERE col_name **BETWEEN** val1 **AND** val2; ==== colname>=val1 **AND** colname<=val2 **;**
- Comparison Operators: **Equal to (==): = , Not Equal to (!=): <> , rest....is same**
- WHERE col1 **IN (**val1, val2, val3**);**
- WHERE col1 **LIKE 'p%' ;** OR **'_p'** //LIKE is CASE SENSITIVE
  WHERE col1 **ILIKE 'p%' ;** OR **'_p'** ==(LIKE 'P%' + LIKE 'p%) //ILIKE is CASE IN-SENSITIVE

- **GROUP BY:**
  SELECT country, COUNT(*) FROM person **GROUP BY** country ORDER BY country;

- **HAVING:** (must be after GROUP BY and before ORDER BY)
  SELECT country, COUNT(*) FROM person GROUP BY country **HAVING** COUNT(*) > 40 ORDER BY country;

- AGGREGATORS : **MIN, MAX, COUNT,etc**
  MAX: SELECT **MAX**(price) FROM car;
  Eg: SELECT make, **MAX(**price**)** FROM car GROUP BY make;

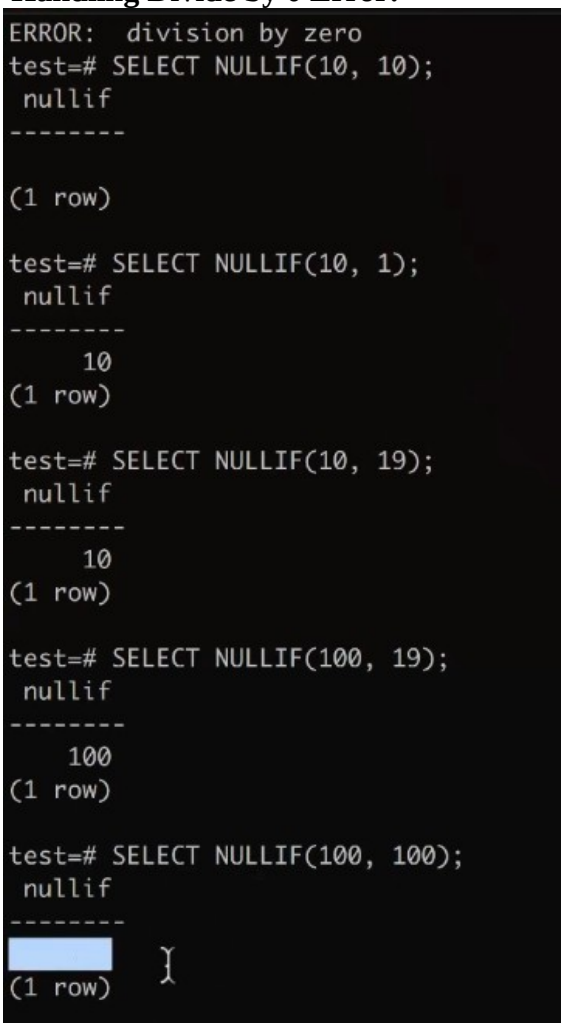
  MIN: SELECT **MIN**(price) FROM car;
  AVG: SELECT **AVG**(price) FROM car;

  ROUND: SELECT **ROUND(**AVG(price)**)** FROM car;
  EG: SELECT make, price,**ROUND(**price*.10 , 2**) AS** discount FROM car;
  //it will show 10% price of cars upto 2 precision.

  SUM: SELECT make, **SUM(**price**)** FROM car GROUP BY make;

- **Handling Null Values:**
  SELECT email FROM person; //it will print values all records on email col and if it is NULL blank will be print.
  SELECT **COALESCE(**email, **"<Default Value>")** FROM person; //it will print Default in place of NULL.

- **Handling Divide by 0 Error:**



```
test=# SELECT COALESCE(10 / NULLIF(0, 0), 0);
 coalesce
----------
        0
(1 row)

test=#
```

- **Timestamp and Date**

NOW()

```
test=# SELECT NOW();
              now
-------------------------------
 2018-12-02 22:43:41.774892+00
(1 row)

test=# SELECT NOW()::DATE;
    now
------------
 2018-12-02
(1 row)

test=# SELECT NOW()::TIME;
       now
-----------------
 22:44:35.645348
(1 row)
```

INTERVAL

```
test=# SELECT (NOW() + INTERVAL '10 MONTHS')::DATE;
    date
------------
 2019-10-02
(1 row)
```

AGE()

```
test=# SELECT first_name, last_name, gender, country_of_birth, date_of_birth, AGE(NOW(), date_of_birth) AS age FROM person;
```

```
                    age
-------------------------------------------
 65 years 1 mon 5 days 23:01:03.572283
 97 years 7 mons 29 days 23:01:03.572283
```

- **Handling CONSTRAINT:**

  Drop all CONSTRAINTs including UNIQUE and PRIMARY KEY.:

```
test=# ALTER TABLE person DROP CONSTRAINT person_pkey;
ALTER TABLE
```

  Add Back Primary Key:

```
test=# ALTER TABLE person ADD PRIMARY KEY (id);
ALTER TABLE
```

  Add UNIQUE Constraints:

```
test=# ALTER TABLE person ADD UNIQUE (email);
ALTER TABLE
```

```
test=# ALTER TABLE person ADD CONSTRAINT unique_email_address UNIQUE (email);
```

  Add CHECK Contraints:

```
test=# ALTER TABLE person ADD CONSTRAINT gender_contraint CHECK (gender = 'Female' OR gender = 'Male');
ALTER TABLE
```

  Add ON CONFLICT Constraints:

```
test-# ON CONFLICT (id) DO NOTHING;
```

```
ON CONFLICT (id) DO UPDATE SET email = EXCLUDED.email;
```

- **Update Records:**

```
test=# UPDATE person SET first_name = 'Omar', last_name = 'Montana', email = 'omar.montana@hotmail.com' WHERE id = 2011;
UPDATE 1
```

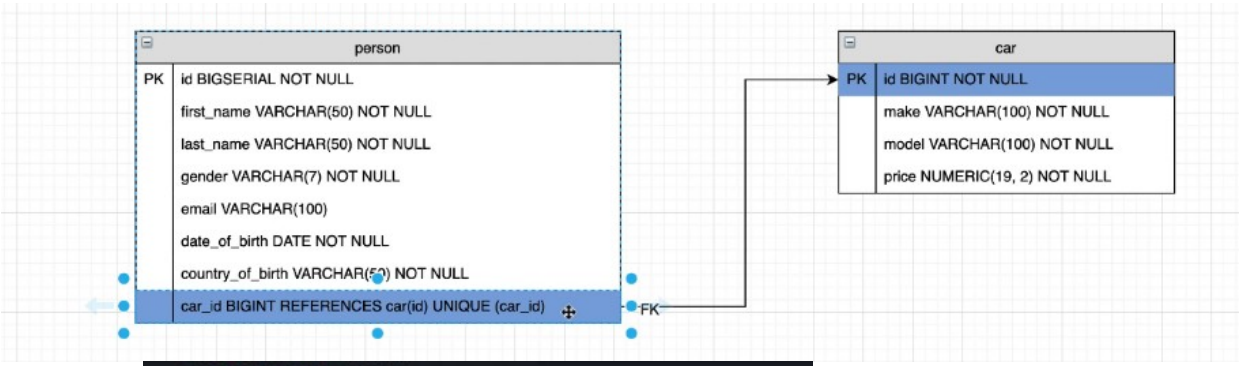
- **Execute a file in PostgreSQL**

```
test=# \i /Users/amigoscode/Downloads/person.sql
```

- **DELETE a record:**

```
test=# DELETE FROM person WHERE gender = 'Female' AND country_of_birth = 'Nigeria';
DELETE 3
```

Relationship:



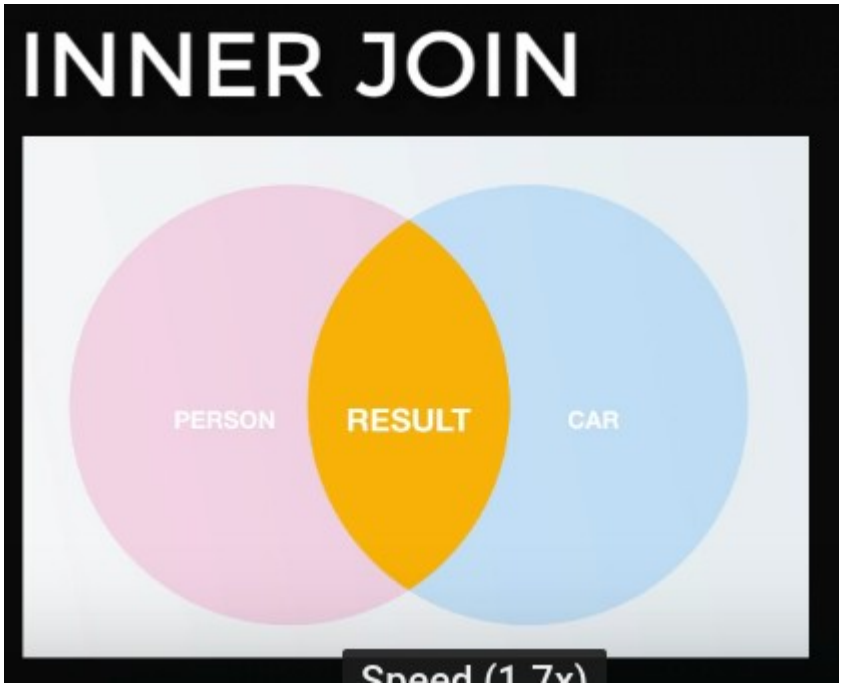

```sql
create table car (
    id BIGSERIAL NOT NULL PRIMARY KEY,
    make VARCHAR(100) NOT NULL,
    model VARCHAR(100) NOT NULL,
    price NUMERIC(19, 2) NOT NULL
);

create table person (
    id BIGSERIAL NOT NULL PRIMARY KEY,
    first_name VARCHAR(50) NOT NULL,
    last_name VARCHAR(50) NOT NULL,
    gender VARCHAR(7) NOT NULL,
    email VARCHAR(100),
    date_of_birth DATE NOT NULL,
    country_of_birth VARCHAR(50) NOT NULL,
    car_id BIGINT REFERENCES car (id),
    UNIQUE(car_id)
);
```

```
test=# SELECT * FROM person;
 id | first_name | last_name | gender |          email           | date_of_birth | country_of_birth | car_id
----+------------+-----------+--------+--------------------------+---------------+------------------+--------
  1 | Fernanda   | Beardon   | Female | fernandab@is.gd          | 1953-10-28    | Comoros          |
  2 | Omar       | Colmore   | Male   |                          | 1921-04-03    | Finland          |
  3 | Adriana    | Matuschek | Female | amatuschek2@feedburner.com | 1965-02-28    | Cameroon         |
(3 rows)

test=# SELECT * FROM car;
 id |    make     |  model   |  price
----+-------------+----------+----------
  1 | Land Rover  | Sterling | 87665.38
  2 | GMC         | Acadia   | 17662.69
(2 rows)

test=# UPDATE person SET car_id = 2 WHERE id = 1;
UPDATE 1
test=# SELECT * FROM car;
 id |    make     |  model   |  price
----+-------------+----------+----------
  1 | Land Rover  | Sterling | 87665.38
  2 | GMC         | Acadia   | 17662.69
(2 rows)

test=# SELECT * FROM person;
 id | first_name | last_name | gender |          email           | date_of_birth | country_of_birth | car_id
----+------------+-----------+--------+--------------------------+---------------+------------------+--------
  2 | Omar       | Colmore   | Male   |                          | 1921-04-03    | Finland          |
  3 | Adriana    | Matuschek | Female | amatuschek2@feedburner.com | 1965-02-28    | Cameroon         |
  1 | Fernanda   | Beardon   | Female | fernandab@is.gd          | 1953-10-28    | Comoros          |      2
(3 rows)
```

- **JOINS:**

  Inner Join

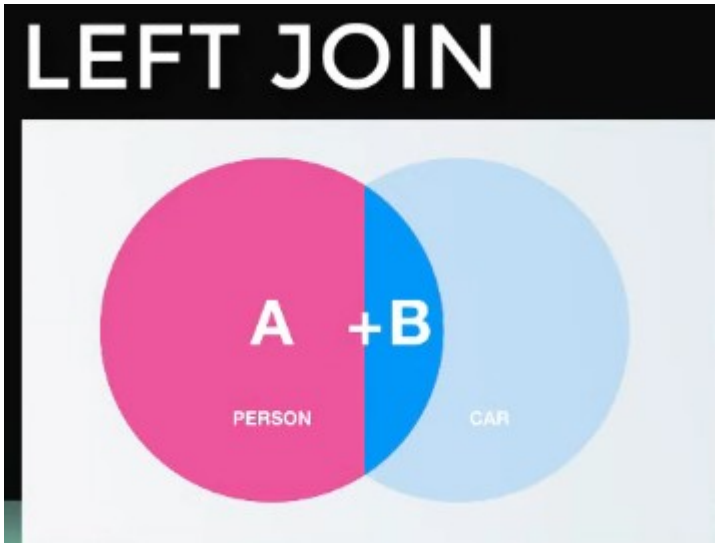
```
test=# SELECT * FROM person
test-# JOIN car ON person.car_id = car.id;
```




```
test=# SELECT person.first_name, car.make, car.model, car.price
test-# FROM person
test-# JOIN car ON person.car_id = car.id;
```

  LEFT JOIN

```
test=# SELECT * FROM person
test-# LEFT JOIN car ON car.id = person.car_id;
 id | first_name | last_name | gender |          email          | date_of_birth | country_of_birth | car_id | id |    make    |  model   |  price
----+------------+-----------+--------+-------------------------+---------------+------------------+--------+----+------------+----------+----------
  2 | Omar       | Colmore   | Male   |                         | 1921-04-03    | Finland          |      1 |  1 | Land Rover | Sterling | 87665.38
  1 | Fernanda   | Beardon   | Female | fernandab@is.gd         | 1953-10-28    | Comoros          |      2 |  2 | GMC        | Acadia   | 17662.69
  3 | Adriana    | Matuschek | Female | amatuschek2@feedburner.com | 1965-02-28 | Cameroon         |        |    |            |          |
(3 rows)
```



```
test=# SELECT * FROM person
LEFT JOIN car ON car.id = person.car_id;
 id | first_name | last_name | gender |          email           | date_of_birth | country_of_birth | car_id | id |    make    |  model   |  price
----+------------+-----------+--------+--------------------------+---------------+------------------+--------+----+------------+----------+----------
  2 | Omar       | Colmore   | Male   |                          | 1921-04-03    | Finland          |      1 |  1 | Land Rover | Sterling | 87665.38
  1 | Fernanda   | Beardon   | Female | fernandab@is.gd          | 1953-10-28    | Comoros          |      2 |  2 | GMC        | Acadia   | 17662.69
  3 | Adriana    | Matuschek | Female | amatuschek2@feedburner.com | 1965-02-28    | Cameroon         |        |    |            |          |
(3 rows)

test=# SELECT * FROM person
JOIN car ON person.car_id = car.id;
 id | first_name | last_name | gender |      email      | date_of_birth | country_of_birth | car_id | id |    make    |  model   |  price
----+------------+-----------+--------+-----------------+---------------+------------------+--------+----+------------+----------+----------
  2 | Omar       | Colmore   | Male   |                 | 1921-04-03    | Finland          |      1 |  1 | Land Rover | Sterling | 87665.38
  1 | Fernanda   | Beardon   | Female | fernandab@is.gd | 1953-10-28    | Comoros          |      2 |  2 | GMC        | Acadia   | 17662.69
```

DELETING RECORDS IN REFERNCED AND REFRENCING TABLE:

```
test=# DELETE FROM car WHERE id = 13;
ERROR:  update or delete on table "car" violates foreign key constraint "person_car_id_fkey" on table "person"
DETAIL:  Key (id)=(13) is still referenced from table "person".
test=# DELETE FROM person WHERE id = 9000;
DELETE 1
test=# SELECT * FROM person WHERE id = 9000;
 id | first_name | last_name | gender | email | date_of_birth | country_of_birth | car_id
----+------------+-----------+--------+-------+---------------+------------------+--------
(0 rows)

test=# DELETE FROM car WHERE id = 13;
DELETE 1
test=# SELECT * FROM car WHERE id = 13;
 id | make | model | price
----+------+-------+-------
(0 rows)
```

we can also use CASADE DELETE, it will delete other linked records also (but it is a bad practice)

- **Exporting Query Result to CSV file**

```
test=# \copy (SELECT * FROM person LEFT JOIN car ON car.id = person.car_id) TO '/Users/amigoscode/Desktop/results.csv' DELIMITER ',' CSV HEADER;
COPY 3
test=#
```

Data Types

Numeric Types:-

Name	Storage Size	Description	Range
smallint	**2 bytes**	**small-range integer**	**-32768 to +32767**
integer	**4 bytes**	**typical choice for integer**	**-2147483648 to +2147483647**
bigint	**8 bytes**	**large-range integer**	**-9223372036854775808 to 9223372036854775807**
decimal	**variable**	**user-specified precision,exact**	**up to 131072 digits before the decimal point; up to 16383 digits after the decimal point**
numeric	**variable**	**user-specified precision,exact**	**up to 131072 digits before the decimal point; up to 16383 digits after the decimal point**
real	**4 bytes**	**variable-precision,inexact**	**6 decimal digits precision**
double precision	**8 bytes**	**variable-precision,inexact**	**15 decimal digits precision**
smallserial	2 bytes		
serial	4 bytes		
bigserial	**8 bytes**	**large autoincrementing integer**	**1 to 9223372036854775807**

Monetary Types

Name	Storage Size	Description	Range
money	8 bytes	currency amount	-92233720368547758.08 to +92233720368547758.07

Character Types

S. No.	Name & Description
	character varying(n), varchar(n)
1	variable-length with limit
	character(n), char(n)
2	fixed-length, blank padded
	text
3	variable unlimited length

Binary Data Types

Name	Storage Size	Description
bytea	1 or 4 bytes plus the actual binary string	variable-length binary string

Date/Time Types

Name	Storage Size	Description	Low Value	High Value
timestamp [(p)] [without time zone]	**8 bytes**	**both date and time (no time zone)**	**4713 BC**	**294276 AD**
TIMESTAMPTZ	**8 bytes**	**both date and time, with time zone**	**4713 BC**	**294276 AD**
date	**4 bytes**	**date (no time of day)**	**4713 BC**	**5874897 AD**
time [(p)] [without time zone]	**8 bytes**	**time of day (no date)**	**00:00:00**	**24:00:00**
time [(p)] with time zone	**12 bytes**	**times of day only, with time zone**	**00:00:00+1459**	**24:00:00-1459**
interval [fields] [(p)]	**12 bytes**	**time interval**	**-178000000 years**	**178000000 years**

SELECT the last day of month:
SELECT (DATE_TRUNC('MONTH', ('201608'||'01')::DATE) + INTERVAL '1 MONTH - 1 day')::DATE;

Cast a timestamp or interval to a string:
SELECT **TO_CHAR(**'2016-08-12 16:40:32'::**TIMESTAMP**, 'DD Mon YYYY HH:MI:SSPM'**)**;
SELECT **TO_CHAR(**'2016-08-12 16:40:32'::**TIMESTAMP**,

' "Today is "FMDay", the "DDth" day of the month of "FMMonth" of "YYYY ' **);**

Count the number of records per week
SELECT DATE_TRUNC('week', <>) AS "Week" , COUNT(*)

FROM <>

GROUP BY 1

ORDER BY 1;

Boolean Type

Name	Storage Size	Description
boolean	1 byte	state of true or false

Enumerated Type

```
CREATE TYPE week AS ENUM ('Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat', 'Sun');
```

Geometric Type

Name	Storage Size	Representation	Description
point	**16 bytes**	**Point on a plane**	**(x,y)**
line	32 bytes	Infinite line (not fully implemented)	((x1,y1),(x2,y2))
lseg	32 bytes	Finite line segment	((x1,y1),(x2,y2))
box	**32 bytes**	**Rectangular box**	**((x1,y1),(x2,y2))**
path	16+16n bytes	Closed path (similar to polygon)	((x1,y1),...)
path	16+16n bytes	Open path	[(x1,y1),...]
polygon	40+16n	Polygon (similar to closed path)	((x1,y1),...)
circle	**24 bytes**	**Circle**	**<(x,y),r> (center point and radius)**

Network Address Type

Name	Storage Size	Description
cidr	**7 or 19 bytes**	**IPv4 and IPv6 networks**
inet	**7 or 19 bytes**	**IPv4 and IPv6 hosts and networks**
macaddr	**6 bytes**	**MAC addresses**

UUID Type

A UUID (Universally Unique Identifiers) is written as a sequence of lower-case hexadecimal digits,

An example of a UUID is − 550e8400-e29b-41d4-a716-446655440000

Array Type

Declaration of Arrays

SELECT INTEGER[];

SELECT INTEGER[3];
SELECT INTEGER[][];
SELECT INTEGER[3][3];
SELECT INTEGER ARRAY;
SELECT INTEGER ARRAY[3];

CREATE TABLE monthly_savings (
   name text,
   saving_per_quarter **integer ARRAY[4]**,
   scheme **text[][]**
);

By default PostgreSQL **uses a one-based numbering convention for arrays,** that is, an array of n elements starts

with ARRAY[1] and ends with ARRAY[n].

Inserting values

```
INSERT INTO monthly_savings
VALUES ('Manisha',
'{20000, 14600, 23500, 13250}',
'{{"FD", "MF"}, {"FD", "Property"}}');
```

Accessing Arrays

```
SELECT name FROM monhly_savings WHERE saving_per_quarter[2] >
saving_per_quarter[4];
```

Modifying Arrays

```
UPDATE monthly_savings SET saving_per_quarter = '{25000,25000,27000,27000}'
WHERE name = 'Manisha';
```

or using the ARRAY expression syntax −

```
UPDATE monthly_savings SET saving_per_quarter = ARRAY[25000,25000,27000,27000]
WHERE name = 'Manisha';
```

Searching Arrays

If Size of Array is known:

```
SELECT * FROM monthly_savings WHERE saving_per_quarter[1] = 10000 OR
saving_per_quarter[2] = 10000 OR
saving_per_quarter[3] = 10000 OR
saving_per_quarter[4] = 10000;
```

If Size of Array is **not known**:

```
SELECT * FROM monthly_savings WHERE 10000 = ANY (saving_per_quarter);
```

Composite Types

Declaration of Composite Types

```
CREATE TYPE inventory_item AS (
   name text,
   supplier_id integer,
   price numeric
);
```

Using:

```
CREATE TABLE on_hand (
   item inventory_item,
   count integer
);
```

Composite Value Input

```
INSERT INTO on_hand VALUES (ROW('fuzzy dice', 42, 1.99), 1000);
```

Accessing Composite Types

```
SELECT (item).name FROM on_hand WHERE (item).price > 9.99;
```

SELECT (on_hand.item).name FROM on_hand WHERE (on_hand.item).price > 9.99;

PostgreSQL - CREATE Database

```
CREATE DATABASE dbname;
or
CREATEDB dbname;    //The only difference between this command and SQL command
                      CREATE DATABASE is that the former can be directly run from
                  the command line and it allows a comment to be added into the
                  database, all in one command.
```

Syntax

createdb [option...] [dbname [description]]

Parameters

S. No.	Parameter & Description
1	**dbname** The name of a database to create.
2	**description** Specifies a comment to be associated with the newly created database.
3	**options** command-line arguments, which createdb accepts.

Options

S. No.	Option & Description
1	**-D tablespace** Specifies the default tablespace for the database.
2	**-e** Echo the commands that createdb generates and sends to the server.
3	**-E encoding** Specifies the character encoding scheme to be used in this database.
4	**-l locale** Specifies the locale to be used in this database.
5	**-T template** Specifies the template database from which to build this database.
6	**--help** Show help about createdb command line arguments, and exit.
7	**-h host** Specifies the host name of the machine on which the server is running.
8	**-p port**

Specifies the TCP port or the local Unix domain socket file extension on which the server is listening for connections.

-U username

9 User name to connect as.

-w

10 Never issue a password prompt.

-W

11 Force createdb to prompt for a password before connecting to a database.

```
createdb -h localhost -p 5432 -U postgres testdb
password ******
```

//The above given command will prompt you for password of the PostgreSQL admin user, which is **postgres**, by default. Hence, provide a password and proceed to create your new database

list of databases using \l

```
postgres-# \l
```

Command to connect/select a desired database; here, we will connect to the *testdb* database.

```
postgres=# \c testdb;
```

select your database from the command prompt itself at the time when you login to your database.

```
psql -h localhost -p 5432 -U postgress testdb
Password for user postgress: ****
```

To exit from the database, you can use the command \q.

PostgreSQL - DROP Database

Using DROP DATABASE

This command drops a database. It removes the catalog entries for the database and deletes the directory containing the data. It can only be executed by the database owner. This command cannot be executed while you or anyone else is connected to the target database (connect to postgres or any other database to issue this command).

Syntax

The syntax for DROP DATABASE is given below −

```
DROP DATABASE [ IF EXISTS ] name
```

Parameters

S. No.	Parameter & Description
1	**IF EXISTS** Do not throw an error if the database does not exist. A notice is issued in this case.
2	**name** The name of the database to remove.

We cannot drop a database that has any open connections, including our own connection from *psql* or *pgAdmin III*. We must switch to another database or *template1* if we want to delete the database we are currently connected to. Thus, it might be more convenient to use the program *dropdb* instead, which is a wrapper around this command.

Example

```
postgres=# DROP DATABASE testdb;
```

Using dropdb Command

PostgresSQL command line executable **dropdb** is a command-line wrapper around the SQL command *DROP DATABASE*. There is no effective difference between dropping databases via this utility and via other methods for accessing the server. dropdb destroys an existing PostgreSQL database. The user, who executes this command must be a database super user or the owner of the database.

Syntax

The syntax for *dropdb* is as shown below −

```
dropdb  [option...] dbname
```

Parameters

S. No.	Parameter & Description
1	**dbname** The name of a database to be deleted.
2	**option** command-line arguments, which dropdb accepts.

Options

S.	Option & Description

No.	
1	**-e** Shows the commands being sent to the server.
2	**-i** Issues a verification prompt before doing anything destructive.
3	**-V** Print the dropdb version and exit.
4	**--if-exists** Do not throw an error if the database does not exist. A notice is issued in this case.
5	**--help** Show help about dropdb command-line arguments, and exit.
6	**-h host** Specifies the host name of the machine on which the server is running.
7	**-p port** Specifies the TCP port or the local UNIX domain socket file extension on which the server is listening for connections.
8	**-U username** User name to connect as.
9	**-w** Never issue a password prompt.
10	**-W** Force dropdb to prompt for a password before connecting to a database.
11	**--maintenance-db=dbname** Specifies the name of the database to connect to in order to drop the target database.

Example

```
dropdb -h localhost -p 5432 -U postgress testdb
```

```
Password for user postgress: ****
```

The above command drops the database **testdb**. Here, I have used the **postgres** (found under the pg_roles of template1) username to drop the database.

PostgreSQL - CREATE Table

Syntax

```
CREATE TABLE table_name(
   column1 datatype,
   column2 datatype,
   column3 datatype,
   .....
   columnN datatype,
   PRIMARY KEY( one or more columns )
);
```

Examples

```
CREATE TABLE COMPANY(
   ID INT PRIMARY KEY     NOT NULL,
   NAME           TEXT    NOT NULL,
   AGE            INT     NOT NULL,
   ADDRESS        CHAR(50),
   SALARY         REAL
);
```

You can verify if your table has been created successfully using **\d** command, which will be used to list down all the tables in an attached database.

```
testdb-# \d
```

```
testdb-# \d tablename
```

PostgreSQL - DROP Table

You have to be careful while using this command because once a table is deleted then all the information available in the table would also be lost forever.

Syntax

Basic syntax of DROP TABLE statement is as follows −

```
DROP TABLE table_name;
```

Example

```
testdb-# \d
```

```
testdb=# drop table department, company;
testdb=# \d
```

PostgreSQL - Schema

A **schema** is a named collection of tables. A schema can also contain views, indexes, sequences, data types, operators, and functions. Schemas are analogous to directories at the operating system level, except that schemas cannot be nested.

Syntax

```
CREATE SCHEMA name;
```

Where *name* is the name of the schema.

Syntax to Create Table in Schema

The basic syntax to create table in schema is as follows −

```
CREATE TABLE myschema.mytable (
...
);
```

Example

```
testdb=# create schema myschema;
CREATE SCHEMA

testdb=# create table myschema.company(
   ID   INT              NOT NULL,
   NAME VARCHAR (20)     NOT NULL,
   AGE  INT              NOT NULL,
   ADDRESS  CHAR (25),
   SALARY   DECIMAL (18, 2),
   PRIMARY KEY (ID)
);

testdb=# select * from myschema.company;
```

Syntax to Drop Schema

```
DROP SCHEMA myschema;    //if it is empty (all objects in it have been dropped)

DROP SCHEMA myschema CASCADE;  //To drop a schema including all contained
                                  objects,
```

??

PostgreSQL - INSERT Query

```
INSERT INTO TABLE_NAME (column1, column2, column3,...columnN)
VALUES (value1, value2, value3,...valueN);
```

```
You may not need to specify the column(s) name in the SQL query if you are
adding values for all the columns of the table.
```

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

Example:

```
INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,JOIN_DATE) VALUES (2, 'Allen', 25,
'Texas', '2007-12-13');

INSERT INTO COMPANY (ID,NAME,AGE,ADDRESS,SALARY,JOIN_DATE) VALUES (4, 'Mark',
25, 'Rich-Mond ', 65000.00, '2007-12-13' ), (5, 'David', 27, 'Texas', 85000.00,
'2007-12-13');
```

PostgreSQL - SELECT Query

Syntax

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

SELECT * FROM table_name;
```

PostgreSQL - Operators.

- Arithmetic operators
- Comparison operators
- Logical operators
- Bitwise operators

PostgreSQL Arithmetic Operators

Assume variable **a** holds 2 and variable **b** holds 3, then −

Operator	Description	Example
+	Addition - Adds values on either side of the operator	a + b will give 5
-	Subtraction - Subtracts right hand operand from left hand operand	a - b will give -1
*	Multiplication - Multiplies values on either side of the operator	a * b will give 6
/	Division - Divides left hand operand by right hand operand	b / a will give 1
%	Modulus - Divides left hand operand by right hand operand and returns remainder	b % a will give 1
^	**Exponentiation - This gives the exponent value of the right hand operand**	**a ^ b will give 8**
|/	**square root**	**|/ 25.0 will give 5**
||/	**Cube root**	**||/ 27.0 will give 3**
!	**factorial**	**5 ! will give 120**
!!	**factorial (prefix operator)**	**!! 5 will give 120**

PostgreSQL Comparison Operators

Assume variable a holds 10 and variable b holds 20, then −

Operator	Description	Example
=	Checks if the values of two operands are equal or not, if yes then condition becomes true.	(a = b) is not true.
!=	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true.	(a != b) is true.
<>	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true.	(a <> b) is true.
>	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true.	(a > b) is not true.
<	Checks if the value of left operand is less than the value of right operand, if yes then condition becomes true.	(a < b) is true.
>=	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true.	(a >= b) is not true.
<=	Checks if the value of left operand is less than or equal to the value of right operand, if yes then condition becomes true.	(a <= b) is true.

PostgreSQL Logical Operators

Here is a list of all the logical operators available in PostgresSQL.

S. No.	Operator & Description
	AND
1	The AND operator allows the existence of multiple conditions in a PostgresSQL statement's WHERE clause.
	NOT
2	The NOT operator reverses the meaning of the logical operator with which it is used. Eg. NOT EXISTS, NOT BETWEEN, NOT IN etc. **This is negate operator**.
	OR
3	The OR operator is used to combine multiple conditions in a PostgresSQL statement's WHERE clause.

PostgreSQL Bit String Operators

The Bitwise operators supported by PostgreSQL are listed in the following table −

Operator	Description	Example
&	Binary AND Operator copies a bit to the result if it exists in both operands.	(A & B) will give 12 which is 0000 1100
|	Binary OR Operator copies a bit if it exists in either operand.	(A | B) will give 61 which is 0011 1101
~	**Binary Ones Complement Operator is unary and has the effect of 'flipping' bits.**	**(~A) will give -61 which is 1100 0011 in 2's complement form due to a signed binary number.**
<<	**Binary Left Shift Operator. The left operands value is moved left by the number of bits specified by the right operand.**	**A << 2 will give 240 which is 1111 0000**
>>	**Binary Right Shift Operator. The left operands value is moved right by the number of bits specified by the right operand.**	**A >> 2 will give 15 which is 0000 1111**
#	**bitwise XOR.**	**A # B will give 49 which is 00110001**

PostgreSQL - Expressions

```
SELECT * FROM COMPANY WHERE SALARY = 10000;

SELECT (15 + 6) AS ADDITION ;

SELECT COUNT(*) AS "RECORDS" FROM COMPANY;

SELECT CURRENT_TIMESTAMP;
```

PostgreSQL - WHERE Clause

```
SELECT * FROM COMPANY WHERE AGE >= 25 AND SALARY >= 65000;

SELECT * FROM COMPANY WHERE AGE IS NOT NULL;

SELECT * FROM COMPANY WHERE NAME LIKE 'Pa%';

SELECT * FROM COMPANY WHERE AGE NOT IN ( 25, 27 );

SELECT * FROM COMPANY WHERE AGE BETWEEN 25 AND 27;

SELECT * FROM COMPANY
        WHERE AGE > (SELECT AGE FROM COMPANY WHERE SALARY > 65000);
```

PostgreSQL - AND and OR Conjunctive Operators

```
SELECT * FROM COMPANY WHERE AGE >= 25 AND SALARY >= 65000;

SELECT * FROM COMPANY WHERE AGE >= 25 OR SALARY >= 65000;
```

PostgreSQL - UPDATE Query

Syntax

```
UPDATE table_name
SET column1 = value1, column2 = value2...., columnN = valueN
WHERE [condition];
```

Example

```
UPDATE COMPANY SET SALARY = 15000 WHERE ID = 3;
```

If you want to modify all ADDRESS and SALARY column values in COMPANY table, you do not need to use WHERE clause and UPDATE query would be as follows −

```
testdb=# UPDATE COMPANY SET ADDRESS = 'Texas', SALARY=20000;
```

PostgreSQL - DELETE Query

```
DELETE FROM COMPANY WHERE ID = 2;
```

If you want to DELETE all the records from COMPANY table, you do not need to use WHERE clause with DELETE queries, which would be as follows −

```
testdb=# DELETE FROM COMPANY;
```

PostgreSQL - LIKE Clause

There are two wildcards used in conjunction with the LIKE operator −

- The percent sign (%)
- The underscore (_)

Syntax

```
SELECT FROM table_name
WHERE column LIKE 'XXXX%'
```

WHERE SALARY::text LIKE '2_%_%'

Finds any values that start with 2 and are at least 3 characters in length

WHERE SALARY::text LIKE '_2%3'

Finds any values that have 2 in the second position and end with a 3

Example:

```
SELECT * FROM COMPANY WHERE AGE::text LIKE '2%';
```

PostgreSQL - LIMIT Clause

Syntax

```
SELECT column1, column2, columnN
FROM table_name
LIMIT [no of rows]

SELECT column1, column2, columnN
FROM table_name
LIMIT [no of rows] OFFSET [row num]
```

Example

```
# select * from COMPANY;
 id | name  | age | address   | salary
----+-------+-----+-----------+--------
  1 | Paul  |  32 | California|  20000
  2 | Allen |  25 | Texas     |  15000
  3 | Teddy |  23 | Norway    |  20000
  4 | Mark  |  25 | Rich-Mond |  65000
  5 | David |  27 | Texas     |  85000
  6 | Kim   |  22 | South-Hall|  45000
  7 | James |  24 | Houston   |  10000
(7 rows)
```

testdb=# SELECT * FROM COMPANY LIMIT 4;

This would produce the following result −

```
 id | name  | age | address     | salary
----+-------+-----+-------------+--------
  1 | Paul  |  32 | California  |  20000
  2 | Allen |  25 | Texas       |  15000
  3 | Teddy |  23 | Norway      |  20000
  4 | Mark  |  25 | Rich-Mond   |  65000
(4 rows)
```

testdb=# SELECT * FROM COMPANY **LIMIT 3 OFFSET 2**; // Limit will display 3 records
Offset will skip first 2 records.

This would produce the following result −

```
 id | name  | age | address   | salary
----+-------+-----+-----------+--------
  3 | Teddy |  23 | Norway    |  20000
  4 | Mark  |  25 | Rich-Mond |  65000
  5 | David |  27 | Texas     |  85000
(3 rows)
```

PostgreSQL - ORDER BY Clause

```
SELECT column-list
FROM table_name
[WHERE condition]
[ORDER BY column1, column2, .. columnN] [ASC | DESC];

SELECT * FROM COMPANY ORDER BY AGE ASC;

SELECT * FROM COMPANY ORDER BY NAME DESC;

SELECT * FROM COMPANY ORDER BY NAME, SALARY ASC;
```

PostgreSQL - GROUP BY

```
SELECT column-list
FROM table_name
WHERE [ conditions ]
GROUP BY column1, column2....columnN
ORDER BY column1, column2....columnN

SELECT NAME, SUM(SALARY) FROM COMPANY GROUP BY NAME;

SELECT NAME, SUM(SALARY) FROM COMPANY GROUP BY NAME ORDER BY NAME;

SELECT NAME, SUM(SALARY)
         FROM COMPANY GROUP BY NAME ORDER BY NAME DESC;
```

PostgreSQL - WITH Clause

The WITH query being CTE query, is particularly useful when subquery is executed multiple times. **It is equally helpful in place of temporary tables**.

Syntax

```
WITH
   name_for_summary_data AS (
      SELECT Statement)
   SELECT columns
   FROM name_for_summary_data
   WHERE conditions <=> (
      SELECT column
      FROM name_for_summary_data)
   [ORDER BY columns]
```

```
WITH
   cte_name AS (
      CTE Query)
   Main Query using CTE query result


EXAMPLE:
With CTE AS
(Select ID, NAME, AGE, ADDRESS, SALARY FROM COMPANY )
Select * From CTE;
```

Recursive WITH

Recursive WITH or Hierarchical queries, is a form of CTE where a CTE can reference to itself, i.e., a WITH query can refer to its own output, hence the name recursive.

```
WITH RECURSIVE t(n) AS (
   VALUES (0)
   UNION ALL
   SELECT SALARY FROM COMPANY WHERE SALARY < 20000
)
SELECT sum(n) FROM t;
```

??

PostgreSQL - HAVING Clause

The HAVING clause must follow the GROUP BY clause in a query and must also precede the ORDER BY clause if used. The following is the syntax of the SELECT statement, including the HAVING clause −

```
SELECT column1, column2
FROM table1, table2
WHERE [ conditions ]
GROUP BY column1, column2
HAVING [ conditions ]
ORDER BY column1, column2
```

```
SELECT NAME FROM COMPANY GROUP BY name HAVING count(name) < 2;
```

PostgreSQL - DISTINCT Keyword

DISTINCT keyword to eliminate duplicate records

```
SELECT DISTINCT column1, column2,.....columnN
FROM table_name
WHERE [condition]
```

```
SELECT DISTINCT name FROM COMPANY;
```

PostgreSQL - CONSTRAINTS

commonly used constraints available in PostgreSQL.

- **NOT NULL Constraint** − Ensures that a column cannot have NULL value.
- **UNIQUE Constraint** − Ensures that all values in a column are different.
- **PRIMARY Key** − Uniquely identifies each row/record in a database table.
- **FOREIGN Key** − Constrains data based on columns in other tables.
- **CHECK Constraint** − The CHECK constraint ensures that all values in a column satisfy certain conditions.
- **EXCLUSION Constraint** − The EXCLUDE constraint ensures that if any two rows are compared on the specified column(s) or expression(s) using the specified operator(s), not all of these comparisons will return TRUE.

```
CREATE TABLE COMPANY7(
   ID INT PRIMARY KEY     NOT NULL,
   NAME           TEXT,
   AGE            INT  DEFAULT 0,
   ADDRESS        CHAR(50) UNIQUE,
   EMP_ID         INT      references COMPANY6(ID)
   SALARY         REAL    CHECK(SALARY > 0),
   EXCLUDE USING gist
   (NAME WITH =,
   AGE WITH <>)
);

ERROR:  conflicting key value violates exclusion constraint
"company7_name_age_excl"
DETAIL:  Key (name, age)=(Paul, 42) conflicts with existing key (name,
age)=(Paul, 32).
```

PostgreSQL - JOINS

A. INNER JOIN

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
INNER JOIN table2
ON table1.matching_column = table2.matching_column;
```

table1: First table.
table2: Second table
matching_column: Column common to both the tables.

Note: We can also write JOIN instead of INNER JOIN. JOIN is same as INNER JOIN.

B. LEFT JOIN

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
LEFT JOIN table2
ON table1.matching_column = table2.matching_column;
```

table1: First table.
table2: Second table
matching_column: Column common to both the tables.

Note: We can also use LEFT OUTER JOIN instead of LEFT JOIN, both are the same.

C. RIGHT JOIN

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
RIGHT JOIN table2
```

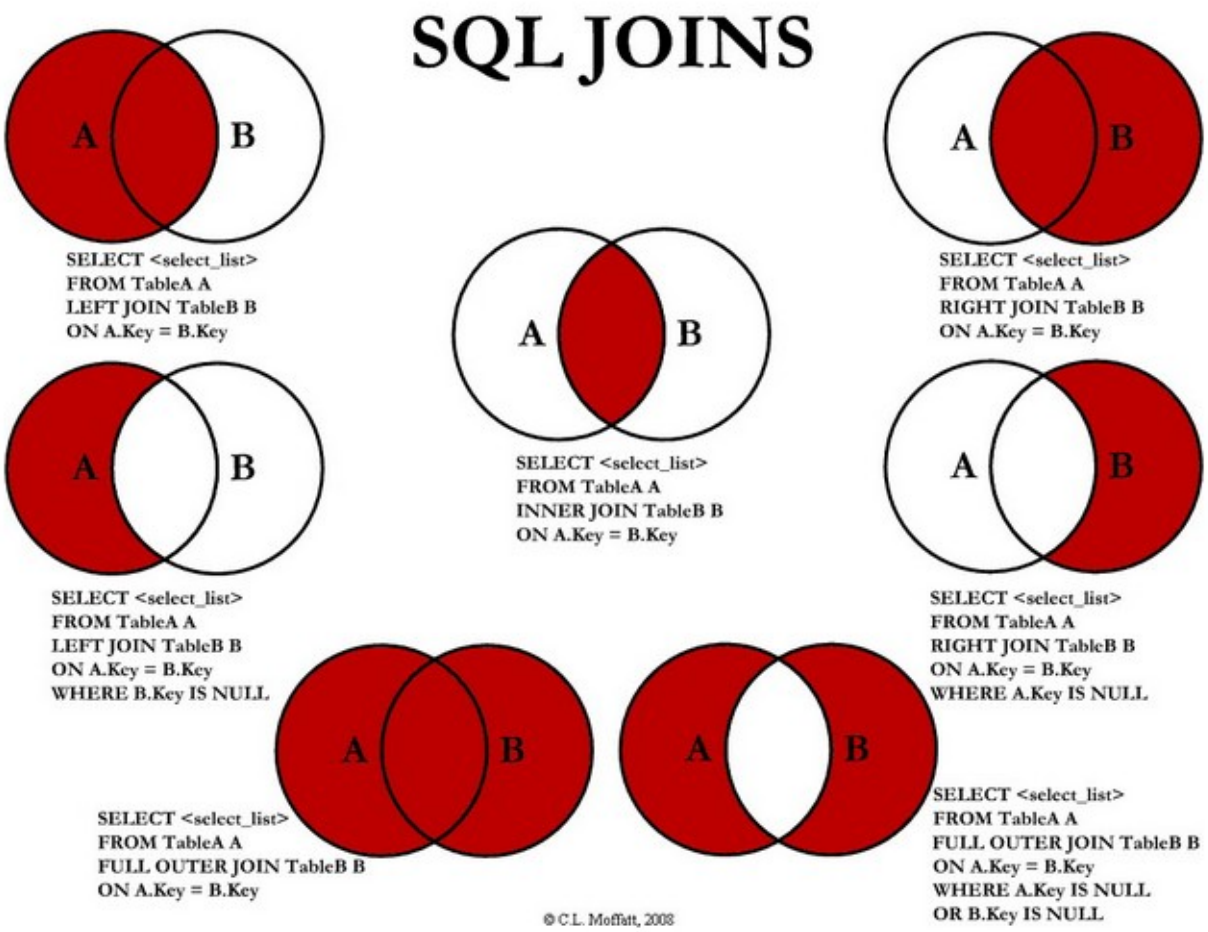
```
ON table1.matching_column = table2.matching_column;


table1: First table.
table2: Second table
matching_column: Column common to both the tables.
```

> **Note**: We can also use RIGHT OUTER JOIN instead of RIGHT JOIN, both are the same.

D. FULL JOIN

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
FULL JOIN table2
ON table1.matching_column = table2.matching_column;


table1: First table.
table2: Second table
matching_column: Column common to both the tables.
```

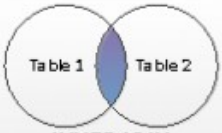


MySQL JOIN Types

Created by Steve Stedman

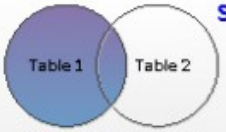
SELECT from two tables

```
SELECT *
  FROM Table1;

SELECT *
  FROM Table2;
```



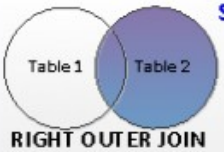
INNER JOIN

```
SELECT *
  FROM Table1 t1
INNER JOIN Table2 t2
  ON t1.fk = t2.id;
```



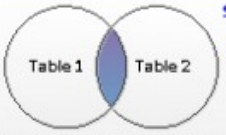
LEFT OUTER JOIN

```
SELECT *
  FROM Table1 t1
LEFT OUTER JOIN Table2 t2
  ON t1.fk = t2.id;
```



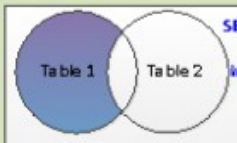
RIGHT OUTER JOIN

```
SELECT *
  FROM Table1 t1
RIGHT OUTER JOIN Table2 t2
  ON t1.fk = t2.id;
```



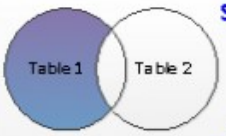
SEMI JOIN – Similar to INNER JOIN, with less duplication.

```
SELECT *
  FROM Table1 t1
WHERE EXISTS (SELECT 1
                FROM Table2 t2
               WHERE t1.fk = t2.id
              );
```



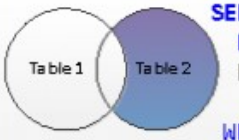
ANTI SEMI JOIN

```
SELECT *
  FROM Table1 t1
WHERE NOT EXISTS (SELECT 1
                    FROM Table2 t2
                   WHERE t1.fk = t2.id
                  );
```



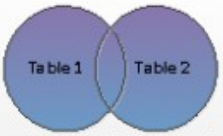
LEFT OUTER JOIN with exclusion

```
SELECT *
  FROM Table1 t1
LEFT OUTER JOIN Table2 t2
  ON t1.fk = t2.id
WHERE t2.id is null;
```



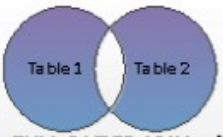
RIGHT OUTER JOIN with exclusion

```
SELECT *
  FROM Table1 t1
RIGHT OUTER JOIN Table2 t2
  ON t1.fk = t2.id
WHERE t1.fk is null;
```



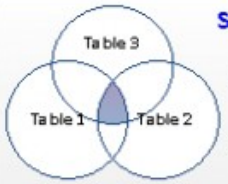
FULL OUTER JOIN

```
SELECT * FROM Table1 t1
  LEFT OUTER JOIN Table2 t2
    ON t1.fk = t2.id
UNION
SELECT * FROM Table1 t1
 RIGHT OUTER JOIN Table2 t2
    ON t1.fk = t2.id;
```



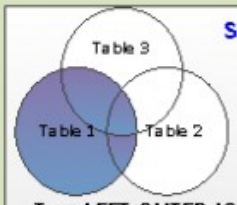
FULL OUTER JOIN with exclusion

```
SELECT * FROM Table1 t1
  LEFT OUTER JOIN Table2 t2
    ON t1.fk = t2.id
 WHERE t2.id IS NOT NULL
UNION
SELECT * FROM Table1 t1
 RIGHT OUTER JOIN Table2 t2
    ON t1.fk = t2.id
 WHERE t1.ID IS NOT NULL;
```



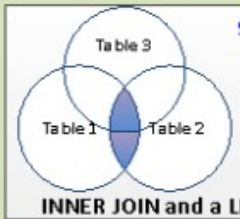
Two INNER JOINs

```
SELECT *
  FROM Table1 t1
INNER JOIN Table2 t2
  ON t1.fk = t2.id
INNER JOIN Table3 t3
  ON t1.fk_table3 = t3.id;
```



Two LEFT OUTER JOINS

```
SELECT *
  FROM Table1 t1
LEFT OUTER JOIN Table2 t2
  ON t1.fk = t2.id
LEFT OUTER JOIN Table3 t3
  ON t1.fk_table3 = t3.id;
```



INNER JOIN and a LEFT OUTER JOIN

```
SELECT *
  FROM Table1 t1
INNER JOIN Table2 t2
  ON t1.fk = t2.id
LEFT OUTER JOIN Table3 t3
  ON t1.fk_table3 = t3.id;
```

NATURAL JOIN:

```
SELECT *
FROM Student NATURAL JOIN Marks;  //common attribute must have same name
```

INNER JOIN:

```
SELECT *
FROM student S INNER JOIN Marks M ON S.Roll_No = M.Roll_No;
```

Difference between Natural JOIN and INNER JOIN in SQL :

SR.NO.	NATURAL JOIN	INNER JOIN
1.	Natural Join joins two tables based on same attribute name and datatypes.	Inner Join joins two table on the basis of the column which is explicitly specified in the ON clause.
2.	In Natural Join, The resulting table will contain all the attributes of both the tables but keep only one copy of each common column	In Inner Join, The resulting table will contain all the attribute of both the tables including duplicate columns also
3.	In Natural Join, If there is no condition specifies then it returns the rows based on the common column	In Inner Join, only those records will return which exists in both the tables
4.	SYNTAX: SELECT * FROM table1 NATURAL JOIN table2;	SYNTAX: SELECT * FROM table1 INNER JOIN table2 ON table1.Column_Name = table2.Column_Name;

Join = cross product + some condition;

CARTESIAN JOIN:

- In the absence of a WHERE condition the CARTESIAN JOIN will behave like a CARTESIAN PRODUCT . i.e., the number of rows in the result-set is the product of the number of rows of the two tables.
- In the presence of WHERE condition this JOIN will function like a INNER JOIN.
- Generally speaking, Cross join is similar to an inner join where the join-condition will always evaluate to True

Syntax:

```
SELECT table1.column1 , table1.column2, table2.column1...
FROM table1
CROSS JOIN table2;
```

Example:

```
SELECT Student.NAME, Student.AGE, StudentCourse.COURSE_ID
FROM Student
CROSS JOIN StudentCourse;
```

SELF JOIN:

```
SELECT a.ROLL_NO , b.NAME
FROM Student a, Student b
WHERE a.ROLL_NO < b.ROLL_NO;
```

EQUI JOIN :

Syntax :

```
SELECT column_list
FROM table1, table2....
WHERE table1.column_name =
table2.column_name;
```

Example –

```
SELECT student.name, student.id, record.class, record.city
            FROM student, record WHERE student.city = record.city;
```

PostgreSQL - UNION

The PostgreSQL **UNION** clause/operator is used to combine the results of two or more SELECT statements **without returning any duplicate rows**.

EXAMPLE:

```
testdb=# SELECT EMP_ID, NAME, DEPT FROM COMPANY INNER JOIN DEPARTMENT
   ON COMPANY.ID = DEPARTMENT.EMP_ID
   UNION
      SELECT EMP_ID, NAME, DEPT FROM COMPANY LEFT OUTER JOIN DEPARTMENT
         ON COMPANY.ID = DEPARTMENT.EMP_ID;
```

The UNION ALL Clause

The **UNION ALL** operator is used to combine the results of two SELECT statements **including duplicate rows**. The same rules that apply to UNION apply to the UNION ALL operator as well.

Example

```
testdb=# SELECT EMP_ID, NAME, DEPT FROM COMPANY INNER JOIN DEPARTMENT
   ON COMPANY.ID = DEPARTMENT.EMP_ID
   UNION ALL
      SELECT EMP_ID, NAME, DEPT FROM COMPANY LEFT OUTER JOIN DEPARTMENT
         ON COMPANY.ID = DEPARTMENT.EMP_ID;
```

PostgreSQL - NULL value

A field with a NULL value is a field with no value. It is very important to understand that a NULL value is different from a zero value or a field that contains spaces.

EXAMPLE:

```
testdb=# UPDATE COMPANY SET ADDRESS = NULL, SALARY = NULL where ID
IN(6,7);
```

PostgreSQL - ALIAS

```
testdb=# SELECT C.ID AS COMPANY_ID, C.NAME AS COMPANY_NAME, C.AGE,
D.DEPT
   FROM COMPANY AS C, DEPARTMENT AS D
   WHERE  C.ID = D.EMP_ID;
```

PostgreSQL - ALTER TABLE

Syntax

ALTER TABLE to **add a new column** in an existing table

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

DROP COLUMN in an existing table −

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

to change the **DATA TYPE** of a column in a table is as follows −

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

to add a **NOT NULL** constraint to a column in a table is as follows −

```
ALTER TABLE table_name MODIFY column_name datatype NOT NULL;
```

to **ADD UNIQUE CONSTRAINT** to a table is as follows −

```
ALTER TABLE table_name
ADD CONSTRAINT MyUniqueConstraint UNIQUE(column1, column2...);
```

to **ADD CHECK CONSTRAINT** to a table is as follows −

```
ALTER TABLE table_name
ADD CONSTRAINT MyUniqueConstraint CHECK (CONDITION);
```

The basic syntax of ALTER TABLE to **ADD PRIMARY KEY** constraint to a table is as follows −

```
ALTER TABLE table_name
ADD CONSTRAINT MyPrimaryKey PRIMARY KEY (column1, column2...);
```

to **DROP CONSTRAINT** from a table is as follows −

```
ALTER TABLE table_name
DROP CONSTRAINT MyUniqueConstraint;
```

to **DROP PRIMARY KEY** constraint from a table is as follows −

```
ALTER TABLE table_name
DROP CONSTRAINT MyPrimaryKey;
```

PostgreSQL - TRUNCATE TABLE

The PostgreSQL **TRUNCATE TABLE** command is used to delete complete data from an existing table. You can also use DROP TABLE command to delete complete table but it would remove complete table structure from the database and you would need to re-create this table once again if you wish to store some data.

It has the same effect as DELETE on each table, but since it does not actually scan the tables, it is faster.

Syntax

```
TRUNCATE TABLE  table_name;
```

EXAMPLE:

```
testdb=# TRUNCATE TABLE COMPANY;
```

PostgreSQL -VIEWS

Views are pseudo-tables.

Since views are not ordinary tables, you may not be able to execute a DELETE, INSERT, or UPDATE statement on a view. However, you can create a RULE to correct this problem of using DELETE, INSERT or UPDATE on a view.

testdb=# **CREATE VIEW COMPANY_VIEW AS**

```
SELECT ID, NAME, AGE
FROM  COMPANY;
```

testdb=# SELECT * FROM COMPANY_VIEW;

testdb=# **DROP VIEW** COMPANY_VIEW;

PostgreSQL - Transaction Control

The following commands are used to control transactions −

BEGIN TRANSACTION − To start a transaction.

COMMIT − To save the changes, alternatively you can use **END TRANSACTION** command

ROLLBACK − To rollback the changes.

Transactional control commands are only used with the DML commands INSERT, UPDATE and DELETE only. They cannot be used while creating tables or dropping them because these operations are automatically committed in the database.

The BEGIN TRANSACTION Command

Transactions can be started using BEGIN TRANSACTION or simply BEGIN command. Such transactions usually persist until the next COMMIT or ROLLBACK command is encountered. But a transaction will also ROLLBACK if the database is closed or if an error occurs.

```
BEGIN;
```

or

```
BEGIN TRANSACTION;
```

The COMMIT Command

The COMMIT command is the transactional command used to save changes invoked by a transaction to the database.

The COMMIT command saves all transactions to the database since the last COMMIT or ROLLBACK command.

```
COMMIT;
```

or

```
END TRANSACTION;
```

The ROLLBACK Command

The ROLLBACK command is the transactional command used to undo transactions that have not already been saved to the database.

The ROLLBACK command can only be used to undo transactions since the last COMMIT or ROLLBACK command was issued.

```
ROLLBACK;
```

```
testdb=# BEGIN;
DELETE FROM COMPANY WHERE AGE = 25;
ROLLBACK;

testdb=# BEGIN;
DELETE FROM COMPANY WHERE AGE = 25;
COMMIT;
```

PostgreSQL - LOCKS

The database performs locking automatically. In certain cases, however, locking must be controlled manually. Manual locking can be done by using the LOCK command. It allows specification of a transaction's lock type and scope.

Syntax for LOCK command

```
LOCK [ TABLE ]
name
 IN
lock_mode
```

- **name** − The name (optionally schema-qualified) of an existing table to lock. If ONLY is specified before the table name, only that table is locked. If ONLY is not specified, the table and all its descendant tables (if any) are locked.
- **lock_mode** − The lock mode specifies which locks this lock conflicts with. If no lock mode is specified, then ACCESS EXCLUSIVE, the most restrictive mode, is used. Possible values are: ACCESS SHARE, ROW SHARE, ROW EXCLUSIVE, SHARE UPDATE EXCLUSIVE, SHARE, SHARE ROW EXCLUSIVE, EXCLUSIVE, ACCESS EXCLUSIVE.

> Once obtained, the lock is held for the remainder of the current transaction. There is no UNLOCK TABLE command; locks are always released at the transaction end.

PostgreSQL - Subqueries

Subqueries with the INSERT Statement

```
testdb=# INSERT INTO COMPANY_BKP
   SELECT * FROM COMPANY
```

```
   WHERE ID IN (SELECT ID
      FROM COMPANY) ;
```

Subqueries with the UPDATE Statement

```
testdb=# UPDATE COMPANY
   SET SALARY = SALARY * 0.50
   WHERE AGE IN (SELECT AGE FROM COMPANY_BKP
      WHERE AGE >= 27 );
```

Subqueries with the DELETE Statement

```
testdb=# DELETE FROM COMPANY
   WHERE AGE IN (SELECT AGE FROM COMPANY_BKP
      WHERE AGE > 27 );
```

PostgreSQL - PRIVILEGES

Syntax for GRANT

```
GRANT privilege [, ...]
ON object [, ...]
TO { PUBLIC | GROUP group | username }
```

- **privilege** − values could be: SELECT, INSERT, UPDATE, DELETE, RULE, ALL.
- **object** − The name of an object to which to grant access. The possible objects are: table, view, sequence
- **PUBLIC** − A short form representing all users.
- GROUP **group** − A group to whom to grant privileges.
- **username** − The name of a user to whom to grant privileges. PUBLIC is a short form representing all users.

The privileges can be revoked using the REVOKE command.

Syntax for REVOKE

Basic syntax for REVOKE command is as follows −

```
REVOKE privilege [, ...]
ON object [, ...]
FROM { PUBLIC | GROUP groupname | username }
```

- **privilege** − values could be: SELECT, INSERT, UPDATE, DELETE, RULE, ALL.
- **object** − The name of an object to which to grant access. The possible objects are: table, view, sequence
- **PUBLIC** − A short form representing all users.
- GROUP **group** − A group to whom to grant privileges.
- **username** − The name of a user to whom to grant privileges. PUBLIC is a short form representing all users.

Example

```
testdb=# CREATE USER manisha WITH PASSWORD 'password';
CREATE ROLE

testdb=# GRANT ALL ON COMPANY TO manisha;
GRANT

testdb=# REVOKE ALL ON COMPANY FROM manisha;
REVOKE

testdb=# DROP USER manisha;
DROP ROLE
```

PostgreSQL - DATE/TIME Functions and Operators

Operator	Example	Result
+	date '2001-09-28' + integer '7'	date '2001-10-05'
+	date '2001-09-28' + interval '1 hour'	timestamp '2001-09-28 01:00:00'
+	date '2001-09-28' + time '03:00'	timestamp '2001-09-28 03:00:00'
+	interval '1 day' + interval '1 hour'	interval '1 day 01:00:00'
+	timestamp '2001-09-28 01:00' + interval '23 hours'	timestamp '2001-09-29 00:00:00'
+	time '01:00' + interval '3 hours'	time '04:00:00'
-	- interval '23 hours'	interval '-23:00:00'
-	date '2001-10-01' - date '2001-09-28'	integer '3' (days)
-	date '2001-10-01' - integer '7'	date '2001-09-24'
-	date '2001-09-28' - interval '1 hour'	timestamp '2001-09-27 23:00:00'
-	time '05:00' - time '03:00'	interval '02:00:00'
-	time '05:00' - interval '2 hours'	time '03:00:00'
-	timestamp '2001-09-28 23:00' - interval '23 hours'	timestamp '2001-09-28 00:00:00'
-	interval '1 day' - interval '1 hour'	interval '1 day -01:00:00'
-	timestamp '2001-09-29 03:00' - timestamp '2001-09-27 12:00'	interval '1 day 15:00:00'
*	900 * interval '1 second'	interval '00:15:00'

*	21 * interval '1 day'	interval '21 days'
*	double precision '3.5' * interval '1 hour'	interval '03:30:00'
/	interval '1 hour' / double precision '1.5'	interval '00:40:00'

The following is the list of all important Date and Time related functions available.

S. No.	Function & Description
1	AGE() Subtract arguments
2	CURRENT DATE/TIME() Current date and time
3	DATE_PART() Get subfield (equivalent to extract)
4	EXTRACT() Get subfield
5	ISFINITE() Test for finite date, time and interval (not +/-infinity)
6	JUSTIFY Adjust interval

AGE(timestamp, timestamp), AGE(timestamp)

S. No.	Function & Description
1	**AGE(timestamp, timestamp)** When invoked with the TIMESTAMP form of the second argument, AGE() subtract arguments, producing a "symbolic" result that uses years and months and is of type INTERVAL.
2	**AGE(timestamp)** When invoked with only the TIMESTAMP as argument, AGE() subtracts from the current_date (at midnight).

Example of the function AGE(timestamp, timestamp) is −

```
testdb=# SELECT AGE(timestamp '2001-04-10', timestamp '1957-06-13');
```

The above given PostgreSQL statement will produce the following result −

```
              age
-------------------------
 43 years 9 mons 27 days
```

Example of the function AGE(timestamp) is −

```
testdb=# select age(timestamp '1957-06-13');
```

The above given PostgreSQL statement will produce the following result −

```
              age
--------------------------
 55 years 10 mons 22 days
```

CURRENT DATE/TIME()

PostgreSQL provides a number of functions that return values related to the current date and time. Following are some functions −

S. No.	Function & Description
1	**CURRENT_DATE** Delivers current date.
2	**CURRENT_TIME** Delivers values with time zone.
3	**CURRENT_TIMESTAMP** Delivers values with time zone.
4	**CURRENT_TIME(precision)** Optionally takes a precision parameter, which causes the result to be rounded to that many fractional digits in the seconds field.
5	**CURRENT_TIMESTAMP(precision)** Optionally takes a precision parameter, which causes the result to be rounded to that many fractional digits in the seconds field.
6	**LOCALTIME** Delivers values without time zone.
7	**LOCALTIMESTAMP** Delivers values without time zone.
8	**LOCALTIME(precision)**

	Optionally takes a precision parameter, which causes the result to be rounded to that many fractional digits in the seconds field.
9	**LOCALTIMESTAMP(precision)** Optionally takes a precision parameter, which causes the result to be rounded to that many fractional digits in the seconds field.

Examples using the functions from the table above −

```
testdb=# SELECT CURRENT_TIME;
          timetz
--------------------
 08:01:34.656+05:30
(1 row)


testdb=# SELECT CURRENT_DATE;
     date
------------
 2013-05-05
(1 row)


testdb=# SELECT CURRENT_TIMESTAMP;
                  now
-------------------------------
 2013-05-05 08:01:45.375+05:30
(1 row)


testdb=# SELECT CURRENT_TIMESTAMP(2);
            timestamptz
```

```
---------------------------
 2013-05-05 08:01:50.89+05:30
(1 row)


testdb=# SELECT LOCALTIMESTAMP;
          timestamp
----------------------
 2013-05-05 08:01:55.75
(1 row)
```

PostgreSQL also provides functions that return the start time of the current statement, as well as the actual current time at the instant the function is called. These functions are −

S. No.	Function & Description
1	**transaction_timestamp()** It is equivalent to CURRENT_TIMESTAMP, but is named to clearly reflect what it returns.
2	**statement_timestamp()** It returns the start time of the current statement.
3	**clock_timestamp()** It returns the actual current time, and therefore its value changes even within a single SQL command.
4	**timeofday()**

	It returns the actual current time, but as a formatted text string rather than a timestamp with time zone value.
5	**now()** It is a traditional PostgreSQL equivalent to transaction_timestamp().

DATE_PART(text, timestamp), DATE_PART(text, interval), DATE_TRUNC(text, timestamp)

S. No.	Function & Description
1	**DATE_PART('field', source)** These functions get the subfields. The *field* parameter needs to be a string value, not a name. The valid field names are: *century, day, decade, dow, doy, epoch, hour, isodow, isoyear, microseconds, millennium, milliseconds, minute, month, quarter, second, timezone, timezone_hour, timezone_minute, week, year.*
2	**DATE_TRUNC('field', source)** This function is conceptually similar to the *trunc* function for numbers. *source* is a value expression of type timestamp or interval. *field* selects to which precision to truncate the input value. The return value is of type *timestamp* or *interval*. The valid values for *field* are : *microseconds, milliseconds, second, minute, hour, day, week, month, quarter, year, decade, century, millennium*

The following are examples for DATE_PART(*'field'*, source) functions −

```
testdb=# SELECT date_part('day', TIMESTAMP '2001-02-16 20:38:40');
 date_part
-----------
          16
(1 row)


testdb=# SELECT date_part('hour', INTERVAL '4 hours 3 minutes');
 date_part
-----------
           4
(1 row)
```

The following are examples for DATE_TRUNC(*'field'*, source) functions −

```
testdb=# SELECT date_trunc('hour', TIMESTAMP '2001-02-16 20:38:40');
       date_trunc
---------------------
 2001-02-16 20:00:00
(1 row)


testdb=# SELECT date_trunc('year', TIMESTAMP '2001-02-16 20:38:40');
       date_trunc
---------------------
 2001-01-01 00:00:00
(1 row)
```

EXTRACT(field from timestamp), EXTRACT(field from interval)

The **EXTRACT(field FROM source)** function retrieves subfields such as year or hour from date/time values. The *source* must be a value expression of

type *timestamp, time, or interval*. The *field* is an identifier or string that selects what field to extract from the source value. The EXTRACT function returns values of type *double precision*.

The following are valid field names (similar to DATE_PART function field names): century, day, decade, dow, doy, epoch, hour, isodow, isoyear, microseconds, millennium, milliseconds, minute, month, quarter, second, timezone, timezone_hour, timezone_minute, week, year.

The following are examples of EXTRACT(*'field'*, source) functions −

```
testdb=# SELECT EXTRACT(CENTURY FROM TIMESTAMP '2000-12-16 12:21:13');
 date_part
-----------
          20
(1 row)


testdb=# SELECT EXTRACT(DAY FROM TIMESTAMP '2001-02-16 20:38:40');
 date_part
-----------
          16
(1 row)
```

ISFINITE(date), ISFINITE(timestamp), ISFINITE(interval)

S. No.	Function & Description
1	**ISFINITE(date)** Tests for finite date.
2	**ISFINITE(timestamp)** Tests for finite time

	stamp.
3	**ISFINITE(interval)** Tests for finite interval.

The following are the examples of the ISFINITE() functions −

```
testdb=# SELECT isfinite(date '2001-02-16');
 isfinite
----------
 t
(1 row)


testdb=# SELECT isfinite(timestamp '2001-02-16 21:28:30');
 isfinite
----------
 t
(1 row)


testdb=# SELECT isfinite(interval '4 hours');
 isfinite
----------
 t
(1 row)
```

JUSTIFY_DAYS(interval), JUSTIFY_HOURS(interval), JUSTIFY_INTERVAL(interval)

S. No.	Function & Description
1	**JUSTIFY_DAYS(interval)**

	Adjusts interval so 30-day time periods are represented as months. Return the **interval** type
2	**JUSTIFY_HOURS(interval)** Adjusts interval so 24-hour time periods are represented as days. Return the **interval** type
3	**JUSTIFY_INTERVAL(interval)** Adjusts interval using JUSTIFY_DAYS and JUSTIFY_HOURS, with additional sign adjustments. Return the **interval** type

The following are the examples for the ISFINITE() functions −

```
testdb=# SELECT justify_days(interval '35 days');
 justify_days
--------------
 1 mon 5 days
(1 row)


testdb=# SELECT justify_hours(interval '27 hours');
 justify_hours
---------------
 1 day 03:00:00
(1 row)


testdb=# SELECT justify_interval(interval '1 mon -1 hour');
 justify_interval
------------------
 29 days 23:00:00
```

```
(1 row)
```

PostgreSQL - Functions

Syntax

The basic syntax to create a function is as follows −

```
CREATE [OR REPLACE] FUNCTION function_name (arguments)
RETURNS return_datatype AS $variable_name$
   DECLARE
      declaration;
      [...]
   BEGIN
      < function_body >
      [...]
      RETURN { variable_name | value }
   END; LANGUAGE plpgsql;
```

Where,

- **function-name** specifies the name of the function.
- [OR REPLACE] option allows modifying an existing function.
- The function must contain a **return** statement.
- **RETURN** clause specifies that data type you are going to return from the function. The **return_datatype** can be a base, composite, or domain type, or can reference the type of a table column.
- **function-body** contains the executable part.
- The AS keyword is used for creating a standalone function.
- **plpgsql** is the name of the language that the function is implemented in. Here, we use this option for PostgreSQL, it Can be SQL, C, internal, or the name of a user-defined procedural language. For backward compatibility, the name can be enclosed by single quotes.

Example

Function totalRecords() is as follows −

```
sCREATE OR REPLACE FUNCTION totalRecords ()
RETURNS integer AS $total$
declare
        total integer;
BEGIN
   SELECT count(*) into total FROM COMPANY;
   RETURN total;
END;
$total$ LANGUAGE plpgsql;
```

testdb# CREATE FUNCTION

testdb=# select totalRecords();

PostgreSQL - Triggers

PostgreSQL Triggers are database callback functions, which are automatically performed/invoked when a specified database event occurs.

The following are important points about PostgreSQL triggers −

1. PostgreSQL trigger can be specified to fire
   - **Before** the operation is attempted on a row (before constraints are checked and the INSERT, UPDATE or DELETE is attempted)
   - **After** the operation has completed (after constraints are checked and the INSERT, UPDATE, or DELETE has completed)
   - **Instead of** the operation (in the case of inserts, updates or deletes on a view)
2. A trigger that is marked **FOR EACH ROW** is called once for every row that the operation modifies. In contrast, a trigger that is marked FOR **EACH STATEMENT** only executes once for any given operation, regardless of how many rows it modifies.
3. Both, the WHEN clause and the trigger actions, may access elements of the row being inserted, deleted or updated using references of the form **NEW.column-name** and **OLD.column-name**, where column-name is the name of a column from the table that the trigger is associated with.
4. **If multiple triggers of the same kind are defined for the same event, they will be fired in alphabetical order by name.**
5. The table to be modified **must exist in the same database as the table** or view to which the trigger is attached and one must use just **tablename,** not **database.tablename**.
6. Triggers are automatically dropped when the table that they are associated with is dropped.

Syntax

The basic syntax of creating a **trigger** is as follows −

```
CREATE  TRIGGER trigger_name [BEFORE|AFTER|INSTEAD OF] event_name
ON table_name
[
 -- Trigger logic goes here....
];
```

Here, event_name could be INSERT, DELETE, UPDATE, and TRUNCATE database operation on the mentioned table table_name. You can optionally specify FOR EACH ROW after table name.

```
CREATE  TRIGGER trigger_name [BEFORE|AFTER] UPDATE OF column_name
ON table_name
[
 -- Trigger logic goes here....
];
```

EXAMPLE:

.

```
testdb=# CREATE TABLE COMPANY(
   ID INT PRIMARY KEY     NOT NULL,
   NAME           TEXT    NOT NULL,
   AGE            INT     NOT NULL,
   ADDRESS        CHAR(50),
   SALARY         REAL
);
```

–

```
testdb=# CREATE TABLE AUDIT(
   EMP_ID INT NOT NULL,
   ENTRY_DATE TEXT NOT NULL
);
```

–

```
testdb=# CREATE TRIGGER example_trigger AFTER INSERT ON COMPANY
FOR EACH ROW EXECUTE PROCEDURE auditlogfunc();
```

–

```
CREATE OR REPLACE FUNCTION auditlogfunc() RETURNS TRIGGER AS
$example_table$
    BEGIN
        INSERT INTO AUDIT(EMP_ID, ENTRY_DATE) VALUES (new.ID,
current_timestamp);
        RETURN NEW;
    END;
$example_table$ LANGUAGE plpgsql;
```

Dropping TRIGGERS

```
testdb=# DROP TRIGGER trigger_name;
```

PostgreSQL - Indexing

`an index is a pointer to data in a table`

The CREATE INDEX Command

```
CREATE INDEX index_name ON table_name;
```

Index Types

PostgreSQL provides several index types: B-tree, Hash, GiST, SP-GiST and GIN. Each Index type uses a different algorithm that is best suited to different types of queries. **By default, the CREATE INDEX command creates B-tree indexes**, which fit the most common situations.

Single-Column Indexes

A single-column index is one that is created based on only one table column.

```
CREATE INDEX index_name
ON table_name (column_name);
```

Multicolumn Indexes

A multicolumn index is defined on more than one column of a table.

```
CREATE INDEX index_name
ON table_name (column1_name, column2_name);
```

Unique Indexes

Unique indexes are used not only for performance, but also for data integrity. A unique index does not allow any duplicate values to be inserted into the table. The basic syntax is as follows −

```
CREATE UNIQUE INDEX index_name
on table_name (column_name);
```

Partial Indexes

A partial index is an index built over a subset of a table; the subset is defined by a conditional expression (called the predicate of the partial index). The index contains entries only for those table rows that satisfy the predicate. The basic syntax is as follows −

```
CREATE INDEX index_name
on table_name (conditional_expression);
```

Implicit Indexes

Implicit indexes are indexes that are automatically created by the database server when an object is created. Indexes are automatically created for primary key constraints and unique constraints.

Example

The following is an example where we will create an index on COMPANY table for salary column −

```
# CREATE INDEX salary_index ON COMPANY (salary);
```

Now, let us list down all the indices available on COMPANY table using **\d company** command.

```
# \d company
```

This will produce the following result, where *company_pkey* is an implicit index, which got created when the table was created.

```
        Table "public.company"
 Column  |     Type      | Modifiers
```

```
---------+---------------+-----------
 id      | integer       | not null
 name    | text          | not null
 age     | integer       | not null
 address | character(50) |
 salary  | real          |
Indexes:
    "company_pkey" PRIMARY KEY, btree (id)
    "salary_index" btree (salary)
```

You can list down the entire indexes database wide using the **\di** command −

The DROP INDEX Command

An index can be dropped using PostgreSQL **DROP** command. Care should be taken when dropping an index because performance may be slowed or improved.

The basic syntax is as follows −

```
DROP INDEX index_name;
```

You can use following statement to delete previously created index −

```
# DROP INDEX salary_index;
```

When Should Indexes be Avoided?

Although indexes are intended to enhance a database's performance, there are times when they should be avoided. The following guidelines indicate when the use of an index should be reconsidered −

- Indexes should not be used on small tables.
- Tables that have frequent, large batch update or insert operations.
- Indexes should not be used on columns that contain a high number of NULL values.
- Columns that are frequently manipulated should not be indexed.

PostgreSQL - EXTRA

ADD REFRENCE USING ALTER:

ALTER TABLE sample.public.employee
ADD FOREIGN KEY (col_name1) **REFERENCES** public.department (col_name2);

ADD NOT NULL CONSTRAINT:

```
ALTER TABLE table_name
ALTER COLUMN column_name SET NOT NULL;
```

DROP NOT NULL CONSTRAINT:

ALTER TABLE YourTable **ALTER COLUMN** YourColumn **DROP NOT NULL;**

Rename Database:

ALTER DATABASE db RENAME TO newdb; //if it doesnot work close terminal and retry

Execute a sql file in PostgreSQL:

\i Desktop\file.sql

PostgreSQL allows you to **convert the values of a column to the new ones** while changing its data type by adding a USING clause as follows:

```
ALTER TABLE table_name
ALTER COLUMN column_name TYPE new_data_type USING expression;
```

The expression after the USING keyword can be as simple as column_name::new_data_type such as price::numeric or as complex as a custom function.