

Using Advanced SQL

Outline

1. Revisiting the select command
2. Table views

1. Revisiting the select command

The SELECT command format

```
[ WITH [ RECURSIVE ] with_query [, ...] ]  
SELECT [ ALL | DISTINCT [ ON ( expression [, ...] ) ] ] * | expression [ [ AS ]  
output_name ] [, ...]  
[ FROM from_item [, ...] ]  
[ WHERE condition ]  
[ GROUP BY expression [, ...] ]  
[ HAVING condition [, ...] ]  
[ WINDOW window_name AS ( window_definition ) [, ...] ]  
[ { UNION | INTERSECT | EXCEPT } [ ALL | DISTINCT ] select ]  
[ ORDER BY expression [ ASC | DESC | USING operator ] [ NULLS { FIRST |  
LAST } ] [, ...] ]  
[ LIMIT { count | ALL } ]  
[ OFFSET start [ ROW | ROWS ] ]  
[ FETCH { FIRST | NEXT } [ count ] { ROW | ROWS } ONLY ]  
[ FOR { UPDATE | SHARE } [ OF table_name [, ...] ] [ NOWAIT ] [...] ]
```

<file:///C:/Program%20Files/PostgreSQL/9.4/doc/postgresql/html/sql-select.html>

The DISTINCT Clause

- **[ALL | DISTINCT [ON (expression [,...])]]**
 - **ALL** = all records returned in the result set (default)
 - Default: **DISTINCT** only eliminates records that are complete duplicates
 - **SELECT DISTINCT ON (expression [, ...])** keeps only the **first row** of each set of rows where the given expressions evaluate to equal.

(The DISTINCT ON expressions are interpreted using the same rules as for ORDER BY; and *must match the leftmost* ORDER BY expression(s))

```
SELECT "City", "State" FROM store."Customer";
```

```
SELECT distinct on ("City") "City", "State" FROM store."Customer";
```

```
SELECT distinct on ("State") "State", "City" FROM store."Customer";
```

```
SELECT distinct on ("State") "State", "City" FROM store."Customer"  
ORDER BY "State" DESC, "City" DESC;
```

The SELECT List

- *** | *expression* [AS *output_name*] [,...]**
 - AS option allows you to change the column heading label in the output to a value different from the column name
 - AS: optional, but it is recommended that you always either **write AS** or **double-quote** the output name (for protection against possible future keyword)
 - Output name: can be **used to in ORDER BY and GROUP BY** clauses, but **not in the WHERE or HAVING** clauses

```
SELECT "CustomerID" AS "ID", "LastName" "Family", "FirstName" "Person"  
FROM store."Customer";
```

The FROM Clause

- **FROM** *from_list* [,...]
- The **most complex part** of the SELECT command
 - [ONLY] *table_name* [*] [[AS] *alias* [(*column_alias* [, ...])]]
 - (*select*) [AS] *alias* [(*column_alias* [, ...])]
 - *with_query_name* [[AS] *alias* [(*column_alias* [, ...])]]
 - *function_name* ([*argument* [, ...]]) [AS] *alias* [(*column_alias* [, ...] | *column_definition* [, ...])]
 - *function_name* ([*argument* [, ...]]) AS (*column_definition* [, ...])
 - *from_item* [NATURAL] *join_type* *from_item* [ON *join_condition* | USING (*join_column* [, ...])]

Standard Table Names

[ONLY] *table_name* [*] [[AS] *alias* [(*column_alias* [,...])]]

- ONLY option directs PostgreSQL to search only the table specified, and not any tables that inherit the specified table
- * directs PostgreSQL to search all child tables of the specified table

The Sub-select

- (*select*) [*AS*] *alias* [(*column_alias* [,...])]

SELECT *

FROM (select "CustomerID", "FirstName"
from store."Customer") as test ("ID",
"Name");

Functions

- The result set of the declared function is used as the input to the first SELECT command

```
function_name ( [argument [...]] ) [ AS ] alias [ (column_alias [...]  
    column_definition [...]) ]
```

```
function_name ( [ argument [...]] AS (column_definition [...]) )
```

Joins

- ***from_item [NATURAL] join_type from_item [ON join_condition | USING (join_column [...])]***
 - NATURAL keyword is used to join tables on common column names
 - USING keyword to define specific matching column names in both tables
 - ON keyword to define a join condition
- ***join_type: [INNER] JOIN, LEFT [OUTER] JOIN, RIGHT [OUTER] JOIN, FULL [OUTER] JOIN, CROSS JOIN***

```
SELECT "Customer"."LastName", "Customer"."FirstName",  
       "Product"."ProductName", "Order"."TotalCost"  
FROM store."Order"
```

```
NATURAL INNER JOIN store."Customer"  
NATURAL INNER JOIN store."Product";
```

Joins

```
SELECT "Customer"."LastName", "Customer"."FirstName",  
       "Product"."ProductName", "Order"."TotalCost"  
FROM   store."Order" INNER JOIN store."Customer" USING  
       ("CustomerID")  
       INNER JOIN store."Product" USING ("ProductID");
```

```
SELECT "Customer"."LastName", "Customer"."FirstName",  
       "Product"."ProductName", "Order"."TotalCost"  
FROM   store."Order" INNER JOIN store."Customer" ON  
       (store."Order"."CustomerID" = store."Customer"."CustomerID")  
       INNER JOIN store."Product" USING ("ProductID");
```

The WHERE Clause

- **WHERE *condition* [,...]**

The GROUP BY Clause

- **GROUP BY *expression* [...]**
- GROUP BY clause be always used with a PostgreSQL function that aggregates values from similar records
SELECT "Product"."ProductID", "ProductName ", **sum**("Quantity"),
FROM store."Order" NATURAL INNER JOIN store."Product"
GROUP BY "Product"."ProductID";
- Be careful with the GROUP BY and ORDER BY clauses
 - GROUP BY clause groups similar records **BEFORE** the rest of the SELECT command is evaluated
 - ORDER BY clause orders records **AFTER** the SELECT commands are processed

<file:///C:/Program%20Files/PostgreSQL/9.4/doc/postgresql/html/sql-select.html#SQL-GROUPBY>

The HAVING Clause

- **HAVING condition [,...]**
- The HAVING clause is similar to the WHERE clause, in that it is used to define a filter condition to limit records used in the GROUP BY clause
- Records that do not satisfy the WHERE conditions are not processed by the GROUP BY clause
- If there is no GROUP BY clause, the presence of HAVING turns all the selected rows as a single group.

The Set Operation Clauses

- ***select1* [(UNION | INTERSECT | EXCEPT) [ALL] *select2***
- The Set Operation clause types are
 - UNION Display all result set records in both *select1* and *select2*
 - INTERSECT Display only result set records that are in both *select1* and *select2*
 - EXCEPT Display only result set records that are in *select1* but not in *select2*
- By default, **duplicate records** in the output set **are not displayed** → ALL

The ORDER BY Clause

- [ORDER BY *expression* [ASC | DESC | USING *operator*] [NULLS { FIRST | LAST }] [,...]]
- By default, the ORDER BY clause orders records in ascending order
- The USING parameter declares an alternative operator to use for ordering
 - (<) is equivalent to the ASC keyword
 - (>) is equivalent to the DESC keyword
- **NULLS LAST**: null values sort **after** all non-null values
- **NULLS FIRST**: null values sort **before** all non-null values

The LIMIT Clause

- **[LIMIT (*count* | ALL)] [OFFSET *start*]**
- The **LIMIT** clause specifies a maximum number of records to return in the result set
- The default behavior is **LIMIT ALL**, which returns all records in the result set
- The **OFFSET** parameter allows you to specify the number of result set records to skip before displaying records in the output
 - first record in the result set is at *start* value 0
 - *Start* value 1 is the second record

```
SELECT * FROM store."Customer"  
ORDER BY "CustomerID" LIMIT 3 OFFSET 1;
```

The FOR Clause

- **[FOR (UPDATE | SHARE) [OF *table_name* [,...] [NOWAIT]]**
- **FOR UPDATE** locks the records (viewing, deleting, or modifying)
- **NOWAIT** parameter, the SELECT command does not wait, but instead exits with an error stating that the records are locked
- **FOR SHARE** clause allows other users to view the records
- If you do not want to lock all of the records returned in the result set, combine the FOR clause with the LIMIT clause
- More details:

<file:///C:/Program%20Files/PostgreSQL/9.4/doc/postgresql/html/sql-select.html#SQL-FOR-UPDATE-SHARE>

The WITH Clause

- **[WITH [RECURSIVE] *with_query* [, ...]]**
- WITH provides a way to write auxiliary statements for use in a larger query
- Each auxiliary statement in a WITH clause can be a SELECT, INSERT, UPDATE, or DELETE;
- All queries in the WITH list are computed → temporary tables that can be referenced in the FROM list. A WITH query that is **referenced more than once** in FROM is **computed only once**.

<file:///C:/Program%20Files/PostgreSQL/9.4/doc/postgresql/html/sql-select.html#SQL-WITH>

The WITH Clause

```
WITH customer_totalorder AS(  
    SELECT "CustomerID", sum("Quantity") as total_quantity  
    FROM store."Order"  
    GROUP BY "CustomerID")  
SELECT * FROM store."Customer"  
WHERE "CustomerID" IN  
    (SELECT "CustomerID"  
     FROM customer_totalorder  
     WHERE total_quantity = (SELECT  
        MAX(total_quantity)  
                             FROM customer_totalorder) );
```

The WITH RECURSIVE

- **[WITH [RECURSIVE] *with_query* [, ...]]**
 - If RECURSIVE is specified, it allows a SELECT subquery to **reference itself** by name. Such a subquery must have the form:

non_recursive_term

UNION [ALL | DISTINCT] *recursive_term*

The WITH RECURSIVE

```
WITH RECURSIVE tmp_table(n) AS (  
    values (1)  
    UNION ALL  
    SELECT n+1 FROM tmp_table WHERE n  
    <10)  
SELECT * FROM tmp_table;
```

WITH RECURSIVE: Recursive queries are typically used to deal with **hierarchical or tree-structured data**

The WITH RECURSIVE

\c test

```
CREATE TABLE subjects (  
    sid char(5) primary key,  
    sname varchar(20),  
    scredits int,  
    sid_required char(5) );  
  
INSERT INTO subjects VALUES  
    ('IT010', 'Trí tuệ nhân tạo', 3, 'IT005'),  
    ('IT005', 'Cau truc DL va GT', 2, 'IT001'),  
    ('IT001', 'Tin hoc dai cuong', 2, NULL),  
    ('IT006', 'CSDL', 3, 'IT001');
```


The WITH RECURSIVE

```
WITH RECURSIVE subjects_required(sid, sid_required)
AS (
    SELECT sid, sid_required
    FROM subjects
    WHERE sid = 'IT010'
    UNION ALL
    SELECT s1.sid, s1.sid_required
    FROM subjects s1, subjects_required s2
    WHERE s1.sid = s2.sid_required)
SELECT * FROM subjects_required;
```

2. Table views

Customers table

Customer ID	Last name	First name	Address	City	State	Zip	Phone

Products table

Product ID	Product name	Supplier	Inventory

Orders table

Customer ID	Product ID	Quantity	Cost

Customer ID	Last name	First name	Product ID	Product name	Quantity	Cost

Customer orders view

Creating a view from table columns

CREAT VIEW

- CREATE [OR REPLACE] [TEMP | TEMPORARY] VIEW
viewname
[(*column_name*,...)] AS *query*
[WITH [CASCADED | LOCAL] CHECK OPTION]
- create view store."CustomerOrders" AS
 select "Customer"."LastName", "Customer"."FirstName",
 "Product"."ProductName", "Order"."TotalCost"
 from store."Order" natural inner join store."Customer"
 natural inner join store."Product";
- grant select on store."CustomerOrders" to "Salesman";
- \dv store.
- select * from store."CustomerOrders";

VIEW

- CREATE VIEW defines a view of a query.
- The view is **not physically materialized**. Instead, the query is run every time the view is referenced in a query.
- TEMPORARY or TEMP: Temporary views are **automatically dropped at the end** of the current session

<file:///C:/Program%20Files/PostgreSQL/9.4/doc/postgresql/html/sql-createview.html>

Updatable VIEWS

- A view is automatically updatable (allow INSERT, UPDATE and DELETE statements) if it satisfies all of the following conditions:
 - The view must have exactly one entry in its FROM list, which must be a table or another updatable view.
 - The view definition must not contain WITH, DISTINCT, GROUP BY, HAVING, LIMIT, or OFFSET clauses at the top level.
 - The view definition must not contain set operations (UNION, INTERSECT or EXCEPT) at the top level.
 - The view's select list must not contain any aggregates, window functions or set-returning functions

Read-only VIEW

- A more complex view, views are **read only**:
 - the system will **not allow an insert, update, or delete on a view.**
 - You can get the effect of **an updatable view** by creating **INSTEAD triggers** on the view, which must *convert attempted inserts, etc. on the view into appropriate actions on other tables*

