DZone

Ranking Functions: ROW_NUMBER(), RANK(), and DENSE_RANK()

by Lukas Eder MVB · Aug. 20, 14 · Database Zone

One of the best features in SQL are window functions. Dimitri Fontaine put it bluntly:

There was SQL before window functions and SQL after window functions

If you're lucky enough to be using any of these databases, then you can use window functions yourself:

- CUBRID
- DB2
- Firebird
- Informix
- Oracle
- PostgreSQL
- SQL Server
- Sybase SQL Anywhere
- Teradata

(source here)

One of the most obvious and useful set of window functions are ranking functions where rows from your result set are ranked according to a certain scheme. There are three ranking functions:

- `ROW_NUMBER()`
- `RANK()`
- `DENSE_RANK()`

The difference is easy to remember. For the examples, let's assume we have this table (using PostgreSQL syntax):

```
CREATE TABLE t(v) AS
SELECT * FROM (
  VALUES('a'),('a'),('a'),('b'),
        ('c'),('c'),('d'),('e')
) t(v)
```

ROW_NUMBER()

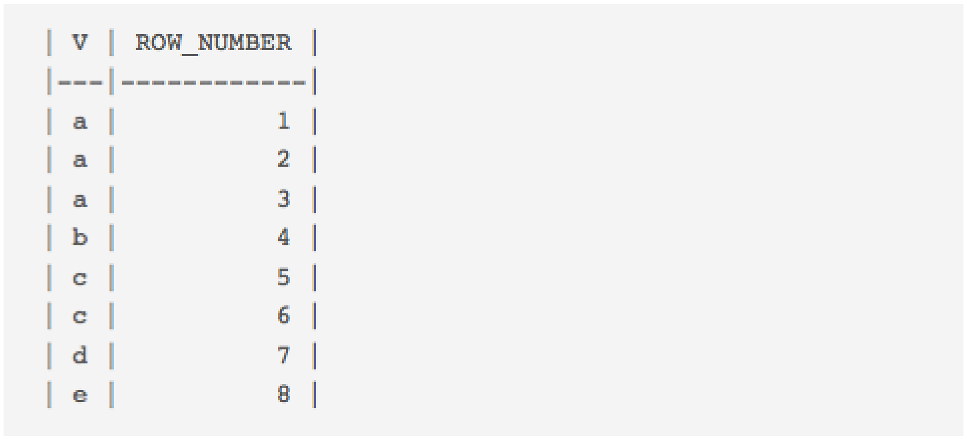
… assigns unique numbers to each row within the `PARTITION` given the `ORDER BY` clause. So you'd get:

```
SELECT v, ROW_NUMBER() OVER()
FROM t
```

Note that some SQL dialects (e.g. SQL Server) require an explicit `ORDER BY` clause in the `OVER()` clause:

```
SELECT v, ROW_NUMBER() OVER(ORDER BY v)
FROM t
```

The above query returns:



```
| V | ROW_NUMBER |
|---|------------|
| a |          1 |
| a |          2 |
| a |          3 |
| b |          4 |
| c |          5 |
| c |          6 |
| d |          7 |
| e |          8 |
```

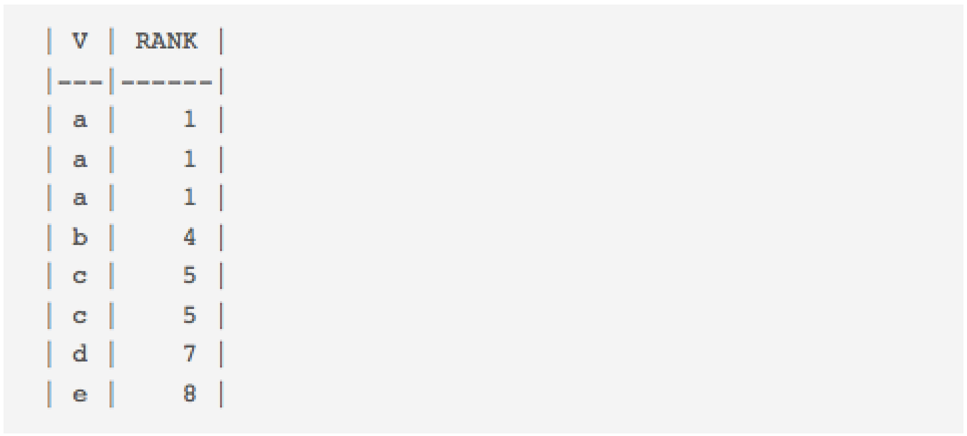
(see also this SQLFiddle)

RANK()

… behaves like `ROW_NUMBER()`, except that "equal" rows are ranked the same. If we substitute `RANK()` into our previous query:

```
SELECT v, RANK() OVER(ORDER BY v)
FROM t
```

… then the result we're getting is this:



```
| V | RANK |
|---|------|
| a |    1 |
| a |    1 |
| a |    1 |
| b |    4 |
| c |    5 |
| c |    5 |
| d |    7 |
| e |    8 |
```

(see also this SQLFiddle)

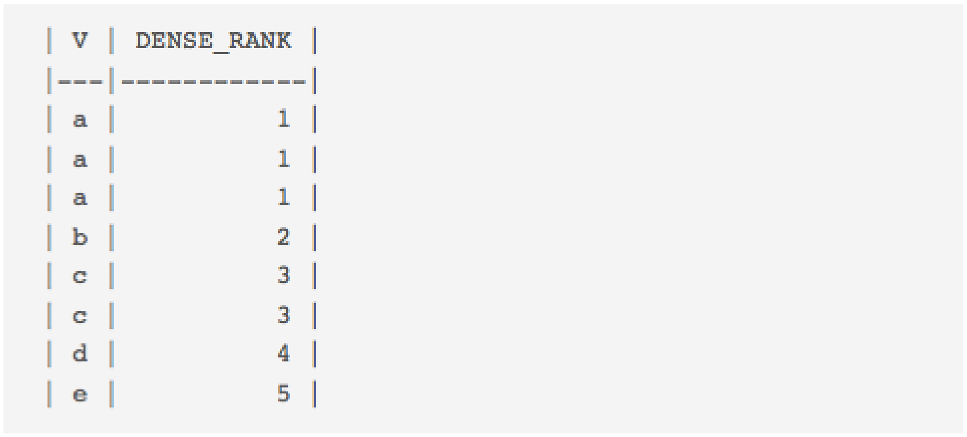
As you can see, much like in a sports ranking, we have *gaps* between the different ranks. We can avoid those gaps by using

DENSE_RANK()

Trivially, `DENSE_RANK()` is a rank with no gaps, i.e. it is *"dense"*. We can write:

```
SELECT v, DENSE_RANK() OVER(ORDER BY v)
FROM t
```

... to obtain



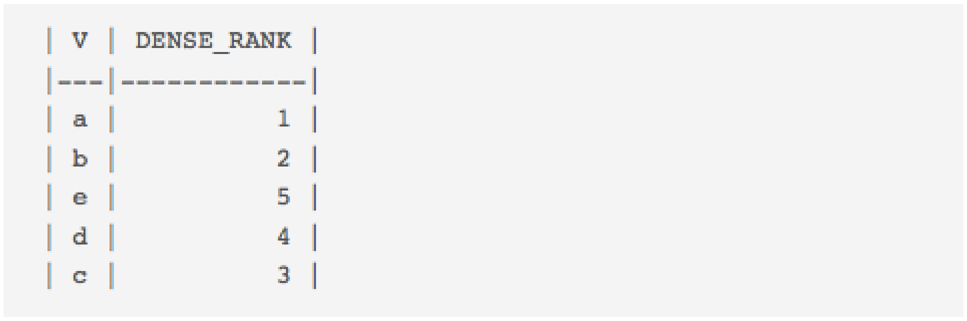
```
| V | DENSE_RANK |
|---|------------|
| a |          1 |
| a |          1 |
| a |          1 |
| b |          2 |
| c |          3 |
| c |          3 |
| d |          4 |
| e |          5 |
```

(see also this SQLFiddle)

One interesting aspect of `DENSE_RANK()` is the fact that it "behaves like" `ROW_NUMBER()` when we add the `DISTINCT` keyword.

```
SELECT DISTINCT v, DENSE_RANK() OVER(ORDER BY v)
FROM t
```

... to obtain



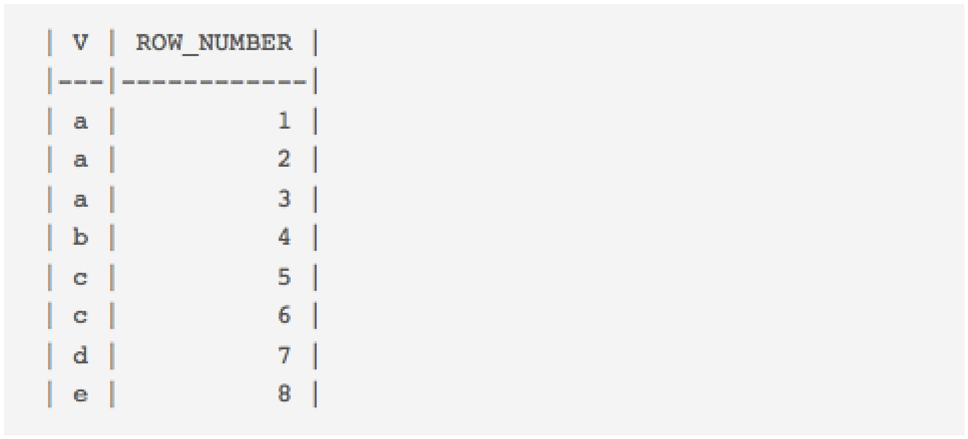
```
| V | DENSE_RANK |
|---|------------|
| a |          1 |
| b |          2 |
| e |          5 |
| d |          4 |
| c |          3 |
```

(see also this SQLFiddle)

In fact, `ROW_NUMBER()` prevents you from using `DISTINCT`, because `ROW_NUMBER()` generates unique values across the partition *before* `DISTINCT` is applied:

```
SELECT DISTINCT v, ROW_NUMBER() OVER(ORDER BY v)
FROM t
ORDER BY 1, 2
```

`DISTINCT` has no effect:



```
| V | ROW_NUMBER |
|---|------------|
| a |          1 |
| a |          2 |
| a |          3 |
| b |          4 |
| c |          5 |
| c |          6 |
| d |          7 |
| e |          8 |
```

(see also this SQLFiddle)

Putting it all together

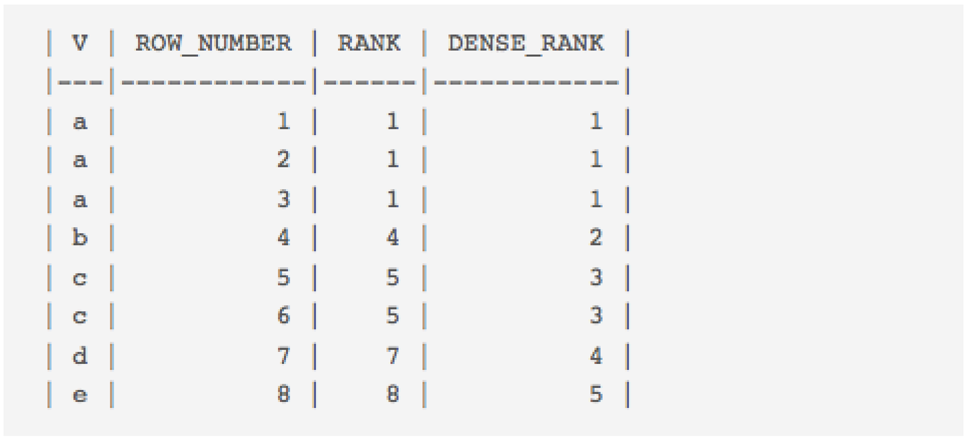
A good way to understand the three ranking functions is to see them all in action side-by-side. Run this query

```
SELECT
  v,
  ROW_NUMBER() OVER(ORDER BY v),
  RANK()       OVER(ORDER BY v),
  DENSE_RANK() OVER(ORDER BY v)
FROM t
ORDER BY 1, 2
```

... or this one (using the SQL standard `WINDOW` clause, to reuse window specifications):

```
SELECT
  v,
  ROW_NUMBER() OVER(w),
  RANK()       OVER(w),
  DENSE_RANK() OVER(w)
FROM t
WINDOW w AS (ORDER BY v)
```

... to obtain:



```
| V | ROW_NUMBER | RANK | DENSE_RANK |
|---|------------|------|------------|
| a |          1 |    1 |          1 |
| a |          2 |    1 |          1 |
| a |          3 |    1 |          1 |
| b |          4 |    4 |          2 |
| c |          5 |    5 |          3 |
| c |          6 |    5 |          3 |
| d |          7 |    7 |          4 |
| e |          8 |    8 |          5 |
```

(see also this SQLFiddle)

Note that unfortunately, the `WINDOW` clause is not supported in all databases.

SQL is awesome

These things can be written very easily using SQL window functions. Once you get a hang of the syntax, you won't want to miss this killer feature in your every day SQL statements any more. Excited?

The Best Way to Write SQL in Java

For further reading, consider:

- The jOOQ manual sections about window functions
- Dimitri Fontaine's excellent article "Understanding Window Functions"
- A real-world use-case: Counting neighboring colours in a stadium choreography

- A real-world use-case: Calculating running totals (not only with window functions)
- SQL 101: A Window into the World of Analytic Functions

Topics: SQL, WINDOW FUNCTIONS, DATABASE