Paper PO17

Oracle's RANK() Smells Good

Using RANK() in Pass-through Queries

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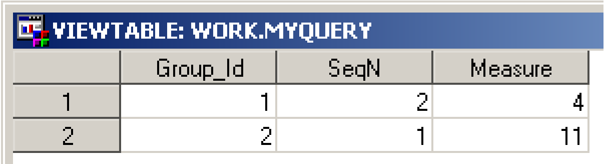
Introduction

Proc SQL in SAS® software is a powerful tool. For many years SAS users have enjoyed an automatic self join that occurs when an groupwise aggregate function is used in a having clause.

Simple SAS Example

```
data MyResults;
input Group_Id SeqN Measure;
cards;
1 1 13
1 2 4
1 3 16
1 4 11
2 1 11
2 2 56
2 3 55
run;

proc sql;
  create table MyQuery as
  select group_id,seqn,measure
  from MyResults
  group by group_id
  having measure = min(measure)
;
```



VIEWTABLE: WORK.MYQUERY

	Group_Id	SeqN	Measure
1	1	2	4
2	2	1	11

The select statement is not valid SQL when passed through to Oracle.

Robust Example

A company is developing a new material. The composition is based on a recipe. Material samples are obtained and sent to various laboratories to be destructively tested according to a standard procedure.

In Oracle four inter-related tables were designed to capture the situation.

Table 1. Recipes

ID
NAME
...more...

Table 2. Samples

ID
RECIPE_ID
...more...

Table 3. Results

ID
SAMPLE_ID
LAB_ID
DATE
...more...

Table 4. Labs

ID
NAME
...more...

The boss wants to know "*For recipe X, what were the first day results and where were they generated?*"

Proc SQL

```
proc sql;
  create table first_X_tests as
  select
        RECIPES.NAME as RECIPE_NAME
      , RESULTS.*
      , LABS.NAME as LAB_NAME
   from
        RECIPE
      , SAMPLES as B
      , RESULTS as C
      , LABS as D
   where
        RECIPES.NAME = 'X'
    and SAMPLES.RECIPE_ID = RECIPES.ID
    and RESULTS.SAMPLE_ID = SAMPLES.ID
    and RESULTS.LAB_ID = LABS.ID
  group by RECIPES.ID, LABS.ID
  having
     C.DATE = MIN(C.DATE)
;
```

The query in SAS SQL is relatively simple.

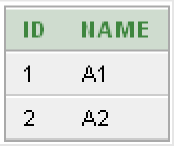
Again, the syntax is invalid in Oracle.

Let's detail the situation more generically using table names A, B, C, D.

Table A

Maintains a list of unique names and their corresponding ids.

```
create table a
( ID number not null
, NAME char(2)
, constraint a_pk primary key (id)
, constraint name_unique unique (name)
);
insert into a values(1,'A1');
insert into a values(2,'A2');
```

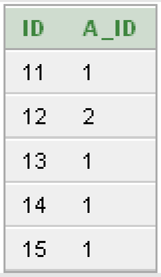


ID	NAME
1	A1
2	A2

Table B

Acts as an organizer; it lets the rows of C determine which A they belong to.

```
create table b
( ID number not null
, A_ID number
, constraint b_pk primary key (id)
, constraint fk_ba foreign key (a_id) references a
);
insert into b values(11, 1);
insert into b values(12, 2);
insert into b values(13, 1);
insert into b values(14, 1);
insert into b values(15, 1);
```

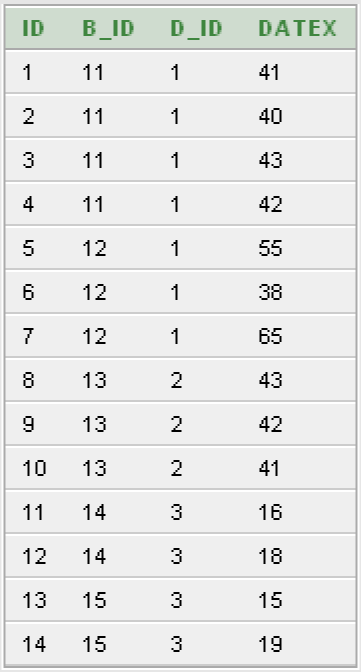


ID	A_ID
11	1
12	2
13	1
14	1
15	1

Table C

Records transactions. For demonstration sake the sample table has a number DATEX.

```
create table c
( ID number not null
, B_ID number
, D_ID number
, DATEX number
, constraint c_pk primary key (id)
, constraint fk_cb foreign key (b_id) references b
, constraint fk_cd foreign key (d_id) references d
);
insert into c values (1, 11, 1, 41);
insert into c values (2, 11, 1, 40);
insert into c values (3, 11, 1, 43);
insert into c values (4, 11, 1, 42);
insert into c values (5, 12, 1, 55);
insert into c values (6, 12, 1, 38);
insert into c values (7, 12, 1, 65);
insert into c values (8, 13, 2, 43);
insert into c values (9, 13, 2, 42);
insert into c values (10, 13, 2, 41);
insert into c values (11, 14, 3, 16);
insert into c values (12, 14, 3, 18);
insert into c values (13, 15, 3, 15);
insert into c values (14, 15, 3, 19);
```

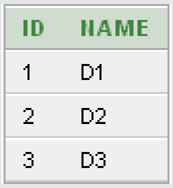


ID	B_ID	D_ID	DATEX
1	11	1	41
2	11	1	40
3	11	1	43
4	11	1	42
5	12	1	55
6	12	1	38
7	12	1	65
8	13	2	43
9	13	2	42
10	13	2	41
11	14	3	16
12	14	3	18
13	15	3	15
14	15	3	19

Table D

Is a simple look up table similar in nature to A.

```
create table d
( ID number not null
, NAME char(2)
, constraint d_pk primary key (id)
);
insert into d values (1, 'D1');
insert into d values (2, 'D2');
insert into d values (3, 'D3');
```



ID	NAME
1	D1
2	D2
3	D3

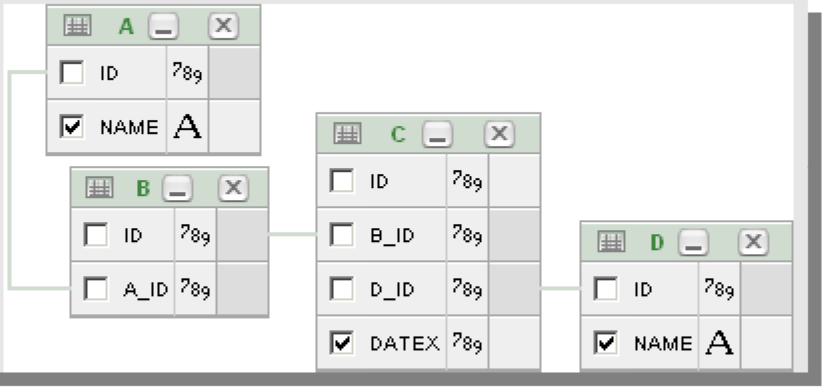
The Join

The objective is to pick one row from C (having the earliest DATEX) for each name of D that corresponds to a name of A.

Try 1

A first attempt gets close enough to see what is wanted.

```
select A.NAME A_NAME
     , C.*
     , D.NAME D_NAME
  from
       A,B,C,D
  where
       A.NAME = 'A1'
   and B.A_ID = A.ID
   and C.B_ID = B.ID
   and C.D_ID = D.ID
 order by D.ID, C.DATEX
```



The bold rows are the ones that meet the objective.

```
A_   ID  B_ID  D_ID DATEX D_
-- ---- ----- ----- ----- --
A1    2    11     1    40 D1
A1    1    11     1    41 D1
A1    4    11     1    42 D1
A1    3    11     1    43 D1

A1   10    13     2    41 D2
A1    9    13     2    42 D2
A1    8    13     2    43 D2

A1   13    15     3    15 D3
A1   11    14     3    16 D3
A1   12    14     3    18 D3
A1   14    15     3    19 D3
```

What query would select only the yellow rows?

Try 2

A SAS software Proc SQL style query with auto-remerge (having C.DATEX = MIN(C.DATEX)) is tried. The query is not accepted by the Oracle parser and thus not acceptable for pass-through.

```
select A.NAME A_NAME
     , C.*
     , D.NAME D_NAME
 from
       A,B,C,D
 where
       A.NAME = 'A1'
   and B.A_ID = A.ID
   and C.B_ID = B.ID
   and C.D_ID = D.ID
 group by
       D.ID
 having
       C.DATEX = MIN(C.DATEX) ;
```

Oracle error message.

```
       C.DATEX = min(C.DATEX)
       *
ERROR at line 14:
ORA-00979: not a GROUP BY expression
```

Try 3

Update the Try 1 query with a new column based on the Oracle RANK function. DATEX values within each combination of a.name and d.name are ranked.

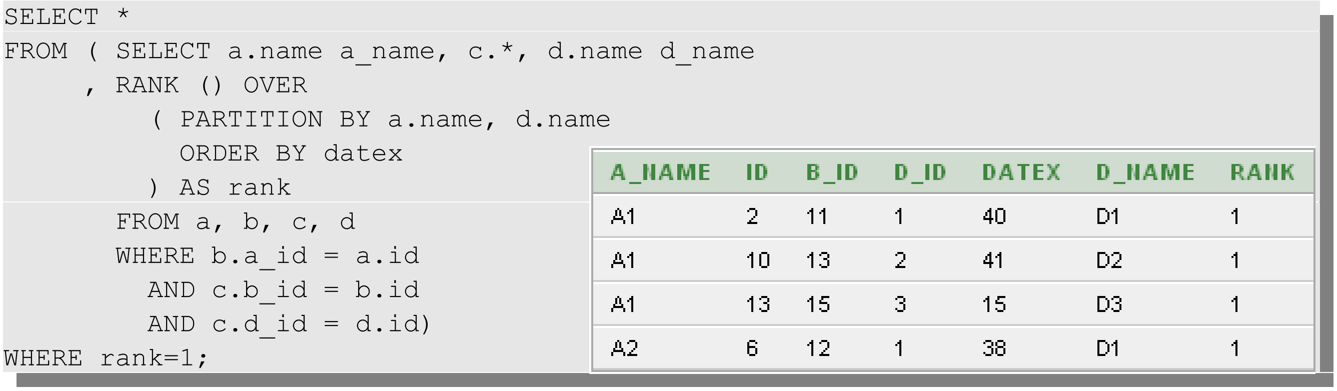
```
SELECT a.name a_name, c.*, d.name d_name
     , RANK () OVER
         ( PARTITION BY a.name, d.name
           ORDER BY datex
         ) AS rank
  FROM a, b, c, d
 WHERE a.name = 'A1'
   AND b.a_id = a.id
   AND c.b_id = b.id
   AND c.d_id = d.id;
```

The rows with the lowest DATEX (within group A_NAME, D_NAME) can now be easily identified by RANK=1.

```
A_ ID B_ID D_ID DATEX D_ RANK
-- -- ---- ---- ----- -- ----
A1  2   11    1    40 D1    1
A1  1   11    1    41 D1    2
A1  4   11    1    42 D1    3
A1  3   11    1    43 D1    4
A1 10   13    2    41 D2    1
A1  9   13    2    42 D2    2
A1  8   13    2    43 D2    3
A1 13   15    3    15 D3    1
A1 11   14    3    16 D3    2
A1 12   14    3    18 D3    3
A1 14   15    3    19 D3    4
```

Final query

The Try 3 query is used as a sub-query, and only the pertinent rows are selected.



```
SELECT *
FROM ( SELECT a.name a_name, c.*, d.name d_name
     , RANK () OVER
         ( PARTITION BY a.name, d.name
           ORDER BY datex
         ) AS rank
       FROM a, b, c, d
       WHERE b.a_id = a.id
         AND c.b_id = b.id
         AND c.d_id = d.id)
WHERE rank=1;
```

A_NAME	ID	B_ID	D_ID	DATEX	D_NAME	RANK
A1	2	11	1	40	D1	1
A1	10	13	2	41	D2	1
A1	13	15	3	15	D3	1
A2	6	12	1	38	D1	1

RANK is one of many Analytic Functions introduced into Oracle at release 8.1.6.

You can learn more about them at http://www.akadia.com/services/ora_analytic_functions.html and

http://www.orafaq.com/node/55

SAS software can access remote DBMS tables using a SAS/ACCESS LIBNAME engine. Some automatic optimization is performed by the ACCESS engine, however, not all capabilities of the remote system are necessarily utilized. The author does not know if the ORACLE engine utilizes analytics functions in its optimizations.

Real World

The join demonstrated in this paper was used as a sub-query within a much, much larger Oracle pass-through query in a production application. Pass-through was used due to a significant amount of legacy code and the large number of rows and tables being processed.

Names have been changed to protect both the innocent and guilty.

Conclusion

Proc SQL offers the SAS software user the ability to submit a query to a remote systems using SQL dialects and features specific to that system. The ORACLE RDBMS has many features that can be taken advantage of when old programmers learn new tricks.

About the Author

Richard A. DeVenezia has previously presented papers at SUGI, SESUG and NESUG, and is an active contributor on SAS-L. He is an independent consultant with fifteen years of SAS experience. He has worked with an extensive mix of SAS products in a variety of industries, including manufacturing, retail and pharmaceutical companies.

This paper and others can be found at the author's website. Visit http://www.devenezia.com and follow the link to Papers.

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