Oracle 12c for Developers

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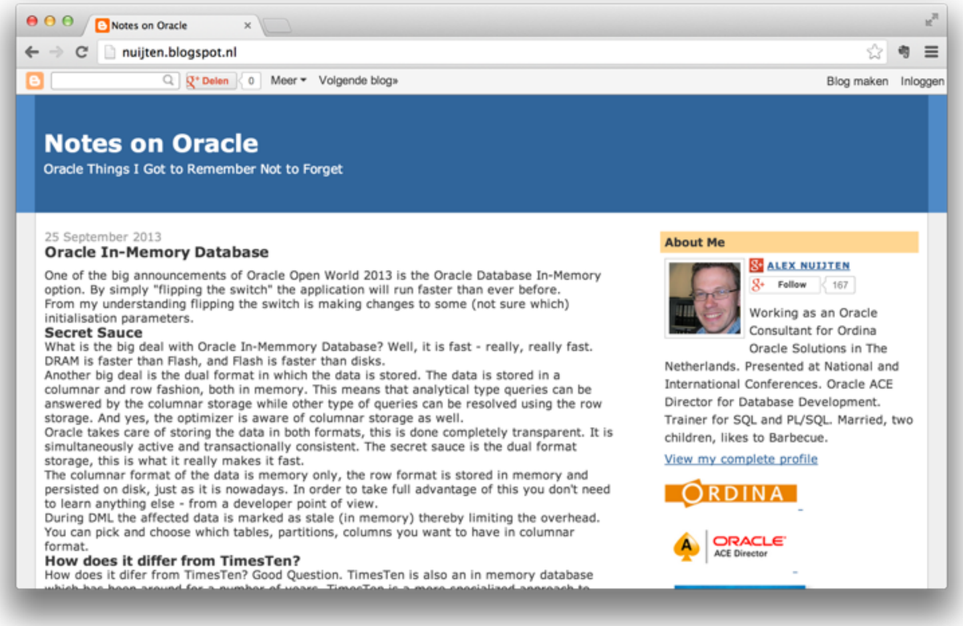
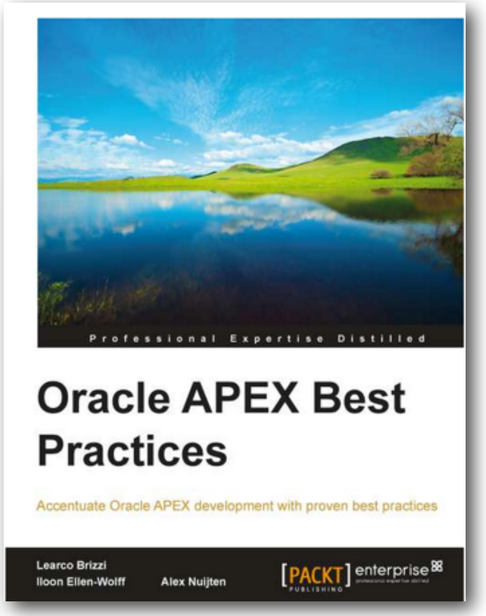
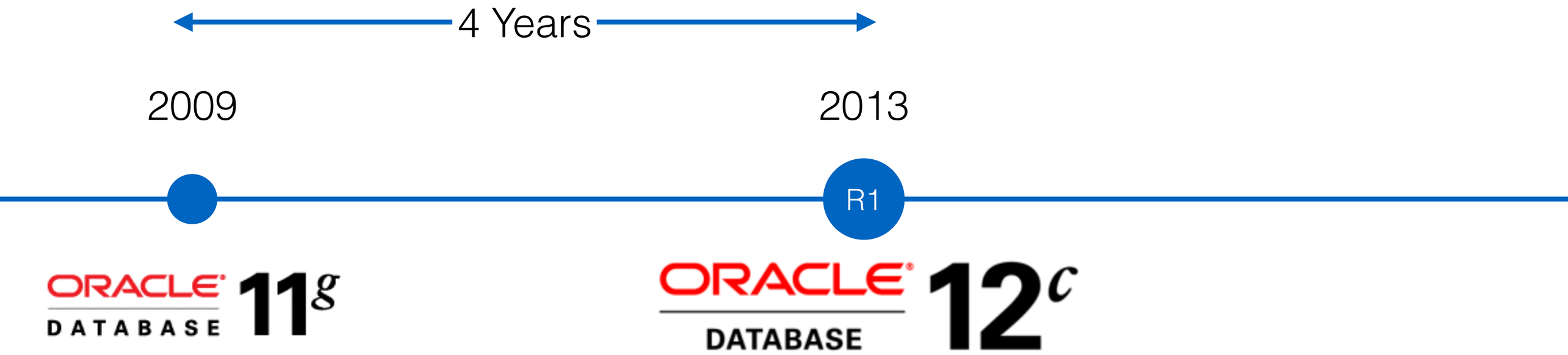





4 Years
2009
2013
R1
ORACLE DATABASE 11g
ORACLE DATABASE 12c

Multitenant
Architecture

2009

2013

R1

In Memory Option

2013

2014

R1

12.1.0.2

ORACLE DATABASE 12c

… but what's in it for the Database Developer?


Increased Size Limit

```
SQL> create table t
  2  (str varchar2(4000));

Table created.
```

```
SQL> create table t
  2  (str varchar2(4001));
(str varchar2(4001))
                *
ERROR at line 2:
ORA-00910: specified length too long for its datatype
```

```
SQL> create table t
  2  (str varchar2(32767))
  3  /
(str varchar2(32767))
                *
ERROR at line 2:
ORA-00910: specified length too long for its datatype
```

a little bit of DBA magic

```
SQL> create table t
  2  (str varchar2(32767));

Table created.
```

Top N and Pagination

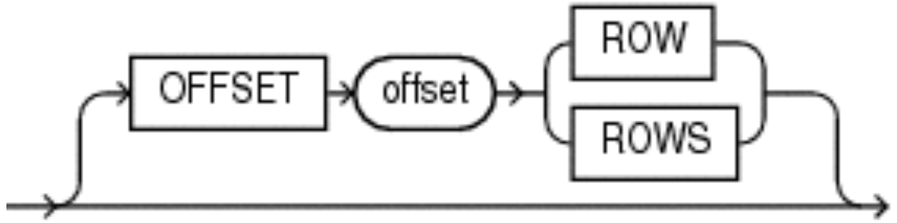
```
SQL> select ename
  2         ,sal
  3    from emp
  4   where rownum < 4
  5   order by sal desc
  6  /

ENAME      SAL
------- -------
ALLEN       1200
WARD        1250
SMITH        800
```

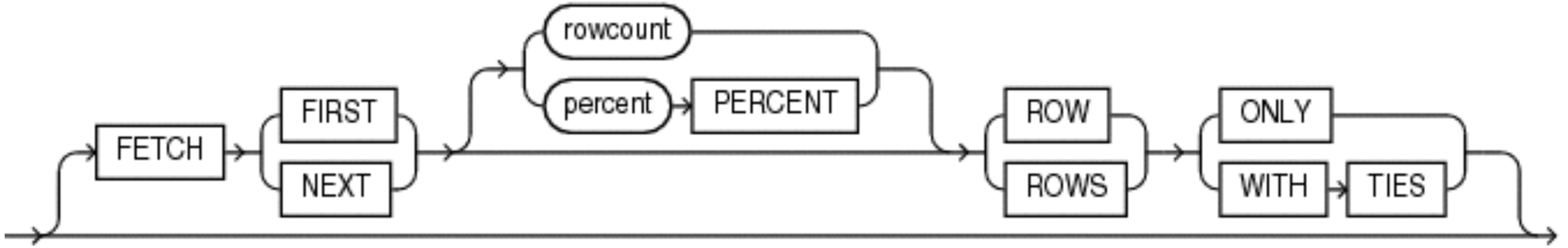
```
SQL> select *
  2    from (select ename
  3                 ,sal
  4            from emp
  5           order by sal desc
  6          )
  7   where rownum < 4
  8  /

ENAME      SAL
---------- -------
KING          5000
SCOTT         3000
FORD          3000
```

```
SQL> select ename
  2         ,sal
  3    from emp
  4   order by sal desc
  5   fetch first 3 rows only
  6  /

ENAME      SAL
---------- -------
KING          5000
SCOTT         3000
FORD          3000
```

```
SQL> select ename
  2         ,sal
  3    from emp
  4   order by sal desc
  5  offset 3 rows
  6  fetch next 3 rows only
  7  /

ENAME      SAL
---------- -------
JONES         2975
BLAKE         2850
CLARK         2450
```

```
Execution Plan
----------------------------------------------------------
Plan hash value: 3291446077

-------------------------------------------------------------------------------
| Id  | Operation                | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT         |      |    14 |   644 |     4  (25)| 00:00:01 |
|*  1 |  VIEW                    |      |    14 |   644 |     4  (25)| 00:00:01 |
|*  2 |   WINDOW SORT PUSHED RANK|      |    14 |   140 |     4  (25)| 00:00:01 |
|   3 |    TABLE ACCESS FULL     | EMP  |    14 |   140 |     3   (0)| 00:00:01 |
-------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - filter("from$_subquery$_002"."rowlimit_$$_rownumber"<=CASE  WHEN
       (3>=0) THEN 3 ELSE 0 END +3 AND "from$_subquery$_002"."rowlimit_$$_rownum
       ber">3)
   2 - filter(ROW_NUMBER() OVER ( ORDER BY INTERNAL_FUNCTION("SAL") DESC
       )<=CASE  WHEN (3>=0) THEN 3 ELSE 0 END +3)
```


OFFSET
offset
ROW
ROWS


FETCH
FIRST
NEXT
rowcount
percent
PERCENT
ROW
ROWS
ONLY
WITH
TIES

```
SQL> select ename
  2         ,sal
  3    from emp
  4   order by sal desc
  5   fetch first 25 percent row only;

ENAME      SAL
---------- ----------
KING       5000
FORD       3000
SCOTT      3000
JONES      2975
```

```
Execution Plan
----------------------------------------------------------
Plan hash value: 4130734685

-------------------------------------------------------------------------------
| Id  | Operation            | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT     |      |    14 |   826 |     4  (25)| 00:00:01 |
|*  1 |  VIEW                |      |    14 |   826 |     4  (25)| 00:00:01 |
|   2 |   WINDOW SORT        |      |    14 |   140 |     4  (25)| 00:00:01 |
|   3 |    TABLE ACCESS FULL| EMP  |    14 |   140 |     3   (0)| 00:00:01 |
-------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - filter("from$_subquery$_002"."rowlimit_$$_rownumber"<=CEIL("from$
       _subquery$_002"."rowlimit_$$_total"*25/100))
```

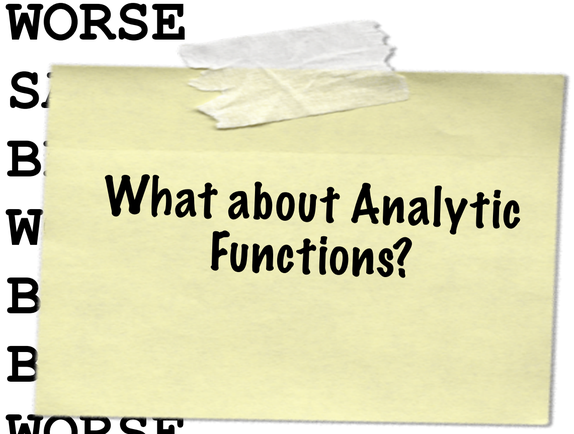

Pattern Matching

```
SQL> create table weather
  2  (dt   date   not null
  3  ,rain number not null
  4  );

Table created.
```

```
SQL> insert into weather
  2  with rsf(r)
  3  as
  4  (select 1
  5    from dual
  6   union all
  7   select r + 1
  8    from rsf
  9   where r < 31)
 10  select to_date (to_char (r)||'-08-2014', 'dd-mm-yyyy') dt
 11        ,round ((dbms_random.value * 20)) rain
 12    from rsf
 13  /

31 rows created.
```

```
SQL> select dt
  2         ,rain
  3         ,trend
  4    from weather
  5  match_recognize(
  6      order by dt
  7      measures classifier() as trend
  8      all rows per match
  9      pattern (Better* Worse* same*)
 10      define Better as Better.rain < prev (rain)
 11             ,Worse  as Worse.rain > prev (rain)
 12             ,same   as same.rain = prev (rain)
 13  );
```

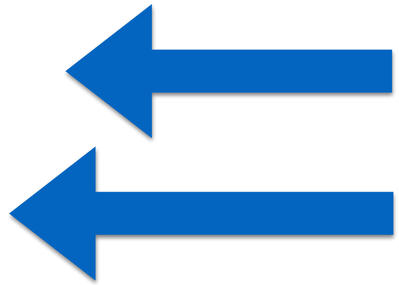
DT	RAIN	TREND
01-AUG-14	14	
02-AUG-14	0	BETTER
03-AUG-14	19	WORSE
04-AUG-14	6	BETTER
05-AUG-14	20	WORSE
06-AUG-14	1	BETTER
07-AUG-14	17	WORSE
08-AUG-14	17	S
09-AUG-14	14	B
10-AUG-14	18	W
11-AUG-14	9	B
12-AUG-14	4	B
13-AUG-14	17	WORSE
14-AUG-14	16	BETTER
15-AUG-14	5	BETTER



```
SQL> select dt
  2         ,rain
  3         ,case
  4          when rain < lag (rain) over (order by dt)
  5          then 'Better'
  6          when rain > lag (rain) over (order by dt)
  7          then 'Worse'
  8          when rain = lag (rain) over (order by dt)
  9          then 'Same'
 10          end trend
 11  from weather;
```

DT	RAIN	TREND
01-AUG-14	14	
02-AUG-14	0	Better
03-AUG-14	19	Worse
04-AUG-14	6	Better
05-AUG-14	20	Worse
06-AUG-14	1	Better
07-AUG-14	17	Worse
08-AUG-14	17	Same
09-AUG-14	14	Better
10-AUG-14	18	Worse
11-AUG-14	9	Better
12-AUG-14	4	Better
13-AUG-14	17	Worse
14-AUG-14	16	Better
15-AUG-14	5	Better


```
SQL> select *
  2     from weather
  3  match_recognize
  4  (
  5     order by dt
  6     measures first (wet.dt) as first_wetday
  7              ,dry.dt as dryday
  8              ,last (wet.dt) as last_wetday
  9     one row per match
 10     pattern (wet dry{2,} wet*)
 11     define
 12        wet as wet.rain > 10,
 13        dry as dry.rain <= 10
 14  );
```



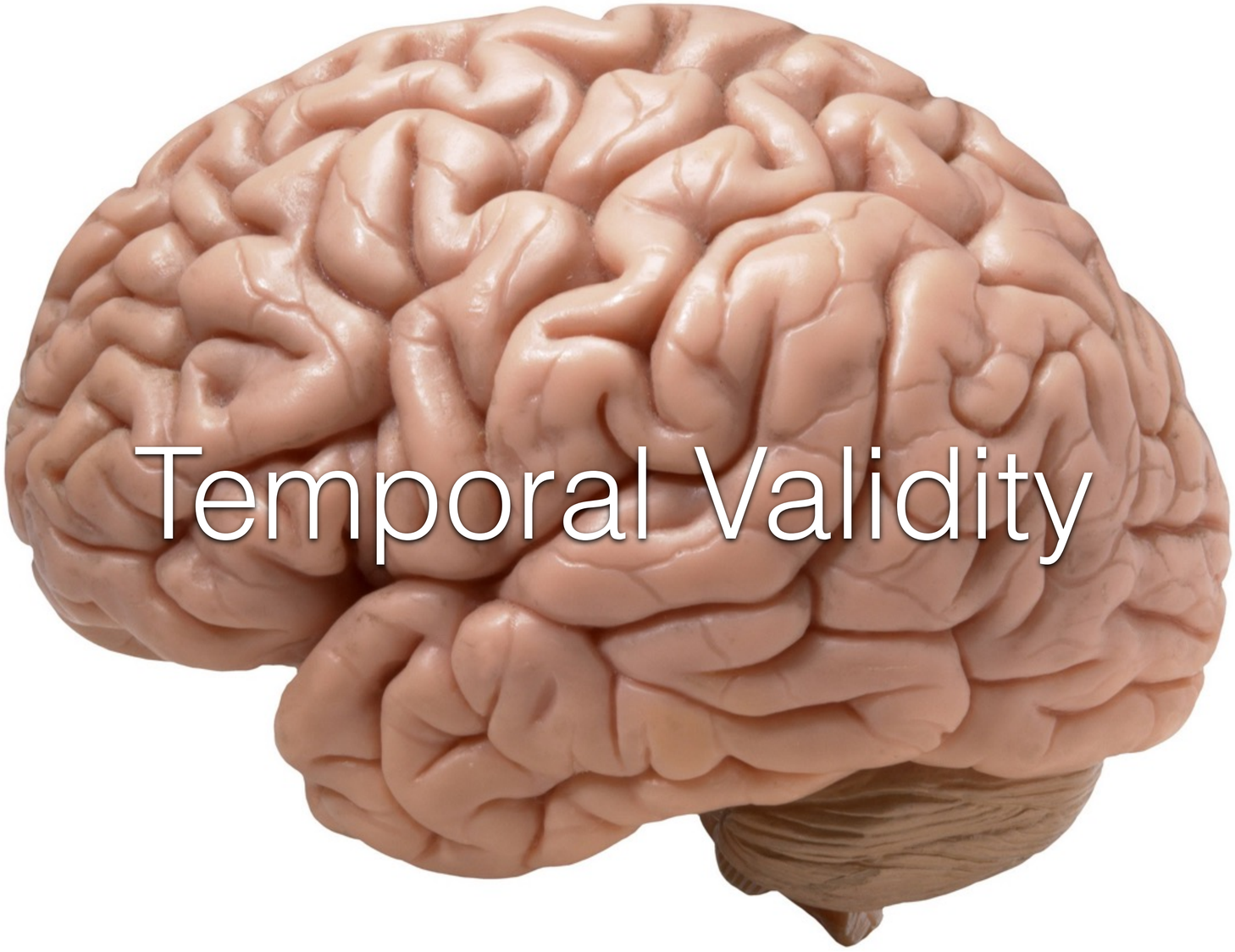
```
pattern (wet dry{2,} wet*)
```

FIRST_WET	DRYDAY	LAST_WETD
10-AUG-14	12-AUG-14	14-AUG-14
23-AUG-14	26-AUG-14	27-AUG-14

2 rows selected.

09-AUG-14	14
10-AUG-14	18
11-AUG-14	9
12-AUG-14	4
13-AUG-14	17
14-AUG-14	16
15-AUG-14	5

21-AUG-14	15
22-AUG-14	12
23-AUG-14	18
24-AUG-14	2
25-AUG-14	5
26-AUG-14	4
27-AUG-14	15
28-AUG-14	7


Temporal Validity

```
SQL> create table addresses
  2  (empno       number
  3  ,street      varchar2(50)
  4  ,houseno     number
  5  ,start_date  date
  6  ,end_date    date
  7  ,period for address_valid (start_date, end_date)
  8 );

Table created.
```

```
SQL> select street
  2         , houseno
  3         , start_date
  4         , end_date
  5     from addresses;

STREET             HOUSENO    START_DAT END_DATE
---------------- ---------- --------- ---------
Brandywine Rd           345 05-AUG-95 15-FEB-96
Spencer Run              12 16-FEB-96 30-APR-00
Via Palm Lake           741 01-MAY-00 31-JAN-13
76th Way               7616 01-FEB-13
```

```
SQL> select street
  2         ,houseno
  3         ,start_date
  4         ,end_date
  5     from addresses as of period
  6      for address_valid sysdate;

STREET           HOUSENO    START_DAT END_DATE
---------------- ---------- --------- ---------
76th Way               7616 01-FEB-13
```

```
SQL> select street
  2         ,houseno
  3         ,start_date
  4         ,end_date
  5    from addresses
  6  versions period for address_valid
  7  between date '2010-06-01'
  8      and sysdate

STREET           HOUSENO    START_DAT END_DATE
---------------- ---------- --------- ---------
Via Palm Lake           741 01-MAY-00 31-JAN-13
76th Way               7616 01-FEB-13
```

```
SQL> begin
  2     dbms_flashback_archive.enable_at_valid_time ('CURRENT');
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

```
SQL> select street
  2         ,houseno
  3         ,start_date
  4         ,end_date
  5    from addresses;

STREET             HOUSENO    START_DAT END_DATE
---------------- ---------- --------- ---------
76th Way               7616 01-FEB-13
```

```
SQL> begin
  2     dbms_flashback_archive.enable_at_valid_time ('ALL');
  3  end;
  4  /

PL/SQL procedure successfully completed.
```

```
SQL> select street
  2         , houseno
  3         , start_date
  4         , end_date
  5     from addresses;

STREET             HOUSENO    START_DAT END_DATE
---------------- ---------- --------- ---------
Brandywine Rd           345 05-AUG-95 15-FEB-96
Spencer Run              12 16-FEB-96 30-APR-00
Via Palm Lake           741 01-MAY-00 31-JAN-13
76th Way               7616 01-FEB-13
```


Identity Columns

```
SQL> create table t
  2  (id number generated as identity
  3  ,name varchar2(35)
  4  );

Table created.
```

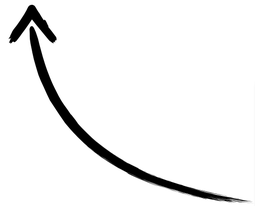
```
SQL> insert into t (name) values ('Alex');

1 row created.
```

```
SQL> insert into t (id, name) values (42, 'TEST');
insert into t (id, name) values (42, 'TEST')
                 *
ERROR at line 1:
ORA-32795: cannot insert into a generated always identity column
```

```
SQL> insert into t (id, name) values (null, 'TEST');
insert into t (id, name) values (null, 'TEST')
                 *
ERROR at line 1:
ORA-32795: cannot insert into a generated always identity column
```

```
SQL> insert into t (id, name) values (default, 'TEST');

1 row created.
```

```
GENERATED
[ ALWAYS | BY DEFAULT [ ON NULL ] ]
AS IDENTITY [ ( identity_options ) ]
```



Similar to Sequence Options

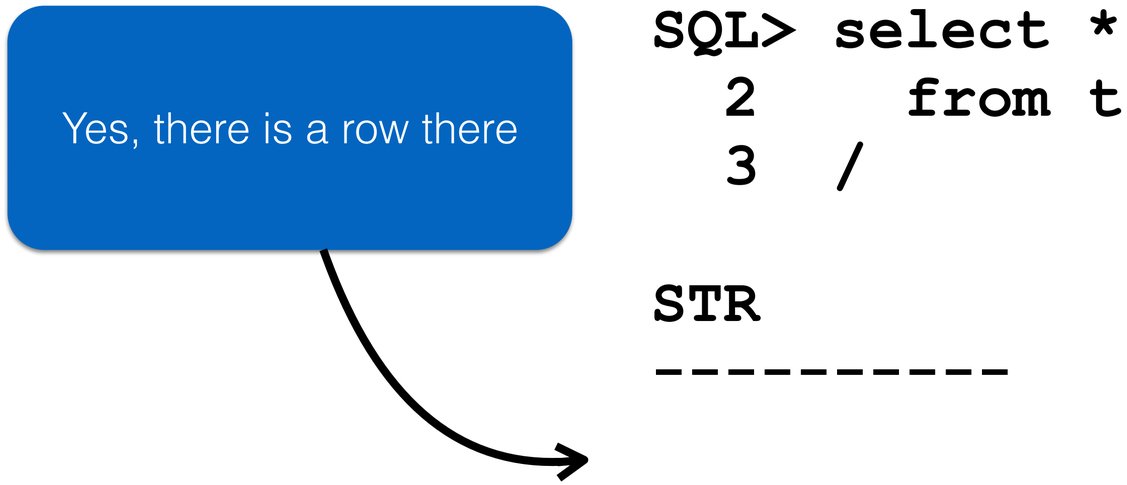
```
SQL> create table t
  2  (id number generated as identity (start with 42 increment by 2)
  3  ,name varchar2(35)
  4  );

Table created.
```

```
SQL> insert into t
  2      (name)
  3  values
  4      ('Alex');

1 row created.

SQL> select *
  2    from t
  3  /

ID    NAME
----- ----------
   42 Alex
```

```
SQL> insert into t
  2       (name)
  3  values
  4       ('Tim');

1 row created.

SQL> select *
  2    from t
  3  /

ID    NAME
----- ---------
   42 Alex
   44 Tim
```

Default Values

```
SQL> create table t
  2  (str varchar2(10) default 'hello'
  3  );


Table created.

SQL> insert into t values (null)
  2  /

1 row created.
```




```
SQL> select *
  2    from t
  3  /

STR
----------
```

```
SQL> insert into t values (default)
  2  /

1 row created.

SQL> select *
  2   from t
  3  /

STR
----------

hello
```

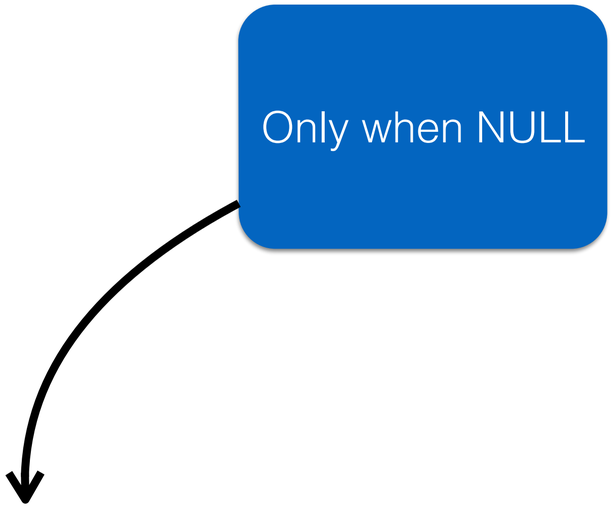
```
SQL> create table t
  2  (str varchar2(10) default on null 'Hello'
  3  );

Table created.
```

```
SQL> create sequence seq
  2  /

Sequence created.

SQL> create table t
  2  (id   number default seq.nextval
  3  ,name varchar2(35)
  4  );

Table created.
```

```
SQL> insert into t (name)
  2  values ('Testing');

1 row created.
```

```
SQL> select *
  2    from t
  3  /

ID     NAME
------ --------
     1 Testing
    42 Testing
       Testing
```

```
SQL> create sequence seq
  2  /

Sequence created.

SQL> create table t
  2  (id   number default on null seq.nextval
  3  ,name varchar2(35)
  4  );

Table created.
```



```
SQL> insert into t values (null, 'test')
  2  /

1 row created.

SQL> select * from t
  2  /

ID      NAME
------ --------------------------------
     1 test
```

```
SQL> create sequence master_seq
  2 /

Sequence created.

SQL> create sequence detail_seq
  2  /

Sequence created.
```

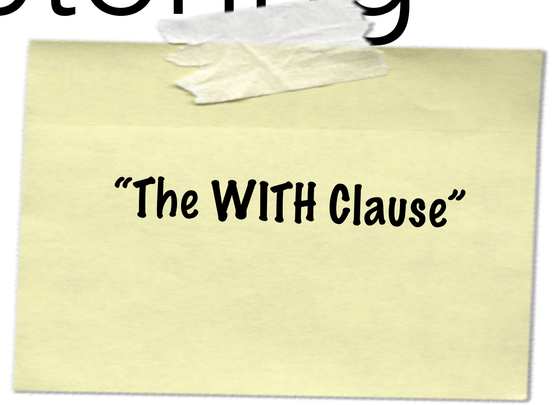
```
SQL> create table masters
  2  (id   number default master_seq.nextval
  3  ,name varchar2(35)
  4  );

Table created.

SQL> create table details
  2  (id         number default detail_seq.nextval
  3  ,master_id number default master_seq.currval
  4  ,name       varchar2(35)
  5  );

Table created.
```

```
SQL> insert into masters (name)
  2  values ('First Master')
  3  /

1 row created.

SQL> insert into details (name)
  2  select 'Detail '||to_char (rownum)
  3  from dual
  4  connect by level <= 5
  5  /

5 rows created.
```

```
SQL> insert into masters (name)
  2  values ('Second Master')
  3  /

1 row created.

SQL> insert into details (name)
  2  select 'Detail '||to_char (rownum)
  3  from dual
  4  connect by level <= 5
  5  /

5 rows created.
```

```
SQL> select *
  2    from details
  3  /

ID    MASTER_ID  NAME
----  ---------- ------------
   1          1 Detail 1
   2          1 Detail 2
   3          1 Detail 3
   4          1 Detail 4
   5          1 Detail 5
   6          2 Detail 1
   7          2 Detail 2
   8          2 Detail 3
   9          2 Detail 4
  10          2 Detail 5

10 rows selected.
```

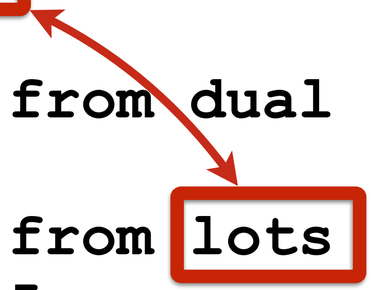
Subquery Factoring



```
SQL> select *
  2    from (select ename
  3                 ,sal
  4            from emp
  5           order by sal desc
  6          )
  7   where rownum < 4
  8  /

ENAME      SAL
-------- -------
KING        5000
SCOTT       3000
FORD        3000
```

```
SQL> with ordered_emps
  2  as
  3  (select ename
  4          ,sal
  5     from emp
  6    order by sal desc
  7  )
  9  select *
 10    from ordered_emps
 11  where rownum < 4
 12  /

ENAME      SAL
-------- -------
KING        5000
SCOTT       3000
FORD        3000
```

```
SQL> with lots(r)
  2  as
  3  (select 1 r from dual
  4    union all
  5   select r+1 from lots
  6    where r < 5
  7  )
  8  select *
  9    from lots
 10  /

         R
----------
         1
         2
         3
         4
         5

5 rows selected.
```



```
SQL> with
  2      function formatname (p_name in varchar2)
  3         return varchar2
  4      is
  5      begin
  6         return initcap (p_name);
  7      end formatname;
  8   select ename
  9         ,formatname(ename)   formatted
 10     from emp;

ENAME      FORMATTED
---------- -------------------------
SMITH      Smith
ALLEN      Allen
WARD       Ward
JONES      Jones
MARTIN     Martin
```

```
SQL> with
  2    procedure show (p_what in varchar2)
  3    is
  4    begin
  5      dbms_output.put_line (p_what);
  6    end show;
  7    function formatname (p_name in varchar2)
  8      return varchar2
  9    is
 10    begin
 11      show ('The input was: '||p_name);
 12      return initcap (p_name);
 13    end formatname;
 14  select ename
 15        ,formatname (ename) formatted
 16    from emp;
```

```
ENAME      FORMATTED
---------- -------------
SMITH      Smith
ALLEN      Allen
WARD       Ward
JONES      Jones
MARTIN     Martin
BLAKE      Blake
CLARK      Clark
SCOTT      Scott
KING       King
TURNER     Turner
ADAMS      Adams
JAMES      James
FORD       Ford
MILLER     Miller

14 rows selected.
```

```
The input was: SMITH
The input was: ALLEN
The input was: WARD
The input was: JONES
The input was: MARTIN
The input was: BLAKE
The input was: CLARK
The input was: SCOTT
The input was: KING
The input was: TURNER
The input was: ADAMS
The input was: JAMES
The input was: FORD
The input was: MILLER
```

```
SQL> with
  2    procedure show (p_what in varchar2)
  3    is
  4    begin
  5      dbms_output.put_line ('input is: '||p_what);
  6    end show;
  7    function formatname (p_name in varchar2)
  8      return varchar2
  9    is
 10    begin
 11       show (p_name);
 12      return initcap (p_name);
 13    end formatname;
 14    ordered_emps as
 15    (select ename from emp order by ename asc)
 16  select ename
 17        ,formatname(ename) formatted
 18    from ordered_emps
 19  /
```

```
ENAME      FORMATTED
---------- -----------
ADAMS      Adams
ALLEN      Allen
BLAKE      Blake
CLARK      Clark
FORD       Ford
JAMES      James
JONES      Jones
KING       King
MARTIN     Martin
MILLER     Miller
SCOTT      Scott
SMITH      Smith
TURNER     Turner
WARD       Ward

14 rows selected.
```

```
input is: SMITH
input is: ALLEN
input is: WARD
input is: JONES
input is: MARTIN
input is: BLAKE
input is: CLARK
input is: SCOTT
input is: KING
input is: TURNER
input is: ADAMS
input is: JAMES
input is: FORD
input is: MILLER
```

Pragma UDF

```
SQL> create or replace
  2  function formatname (p_name in varchar2)
  3     return varchar2
  4  is
  5     pragma udf;
  6  begin
  7     return initcap (p_name);
  8  end;
  9  /
```

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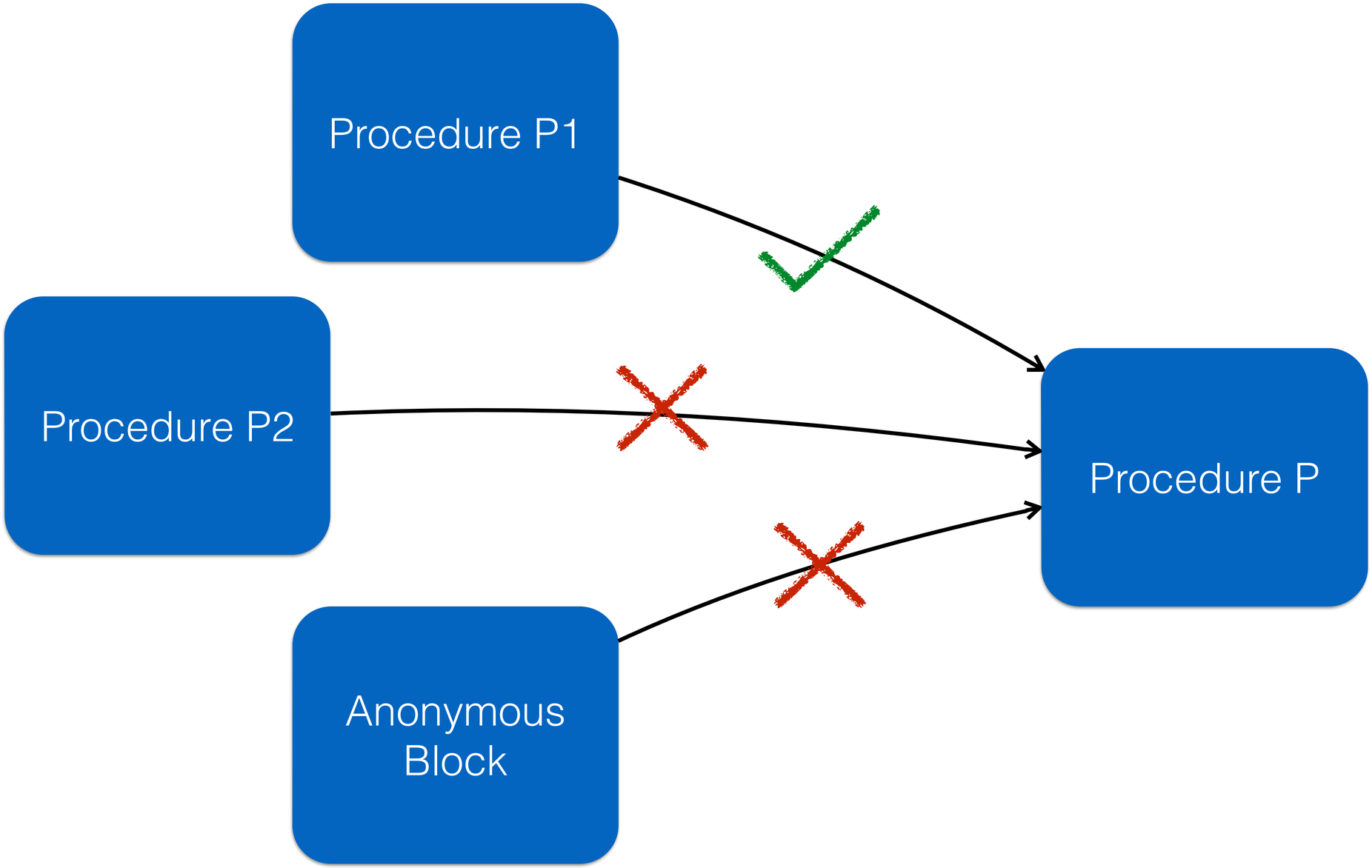
White Listing


Procedure P1
Procedure P2
Anonymous Block
Procedure P

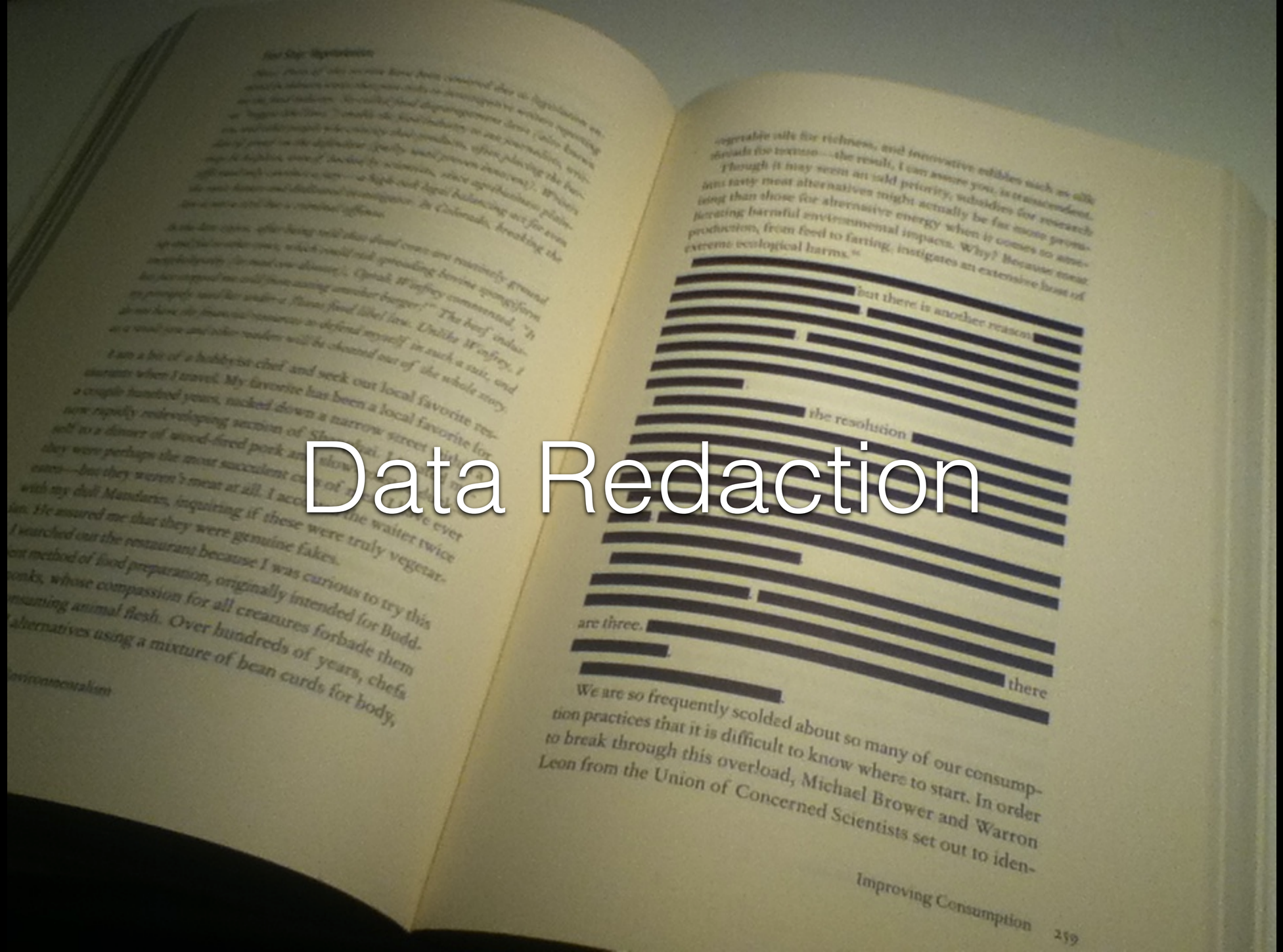
```
SQL> create or replace
  2  procedure p
  3     accessible by (p1)
  4  is
  5  begin
  6     dbms_output.put_line
  7      ('This can only be called by the p1 program');
  8 end p;
  9 /

Procedure created.
```

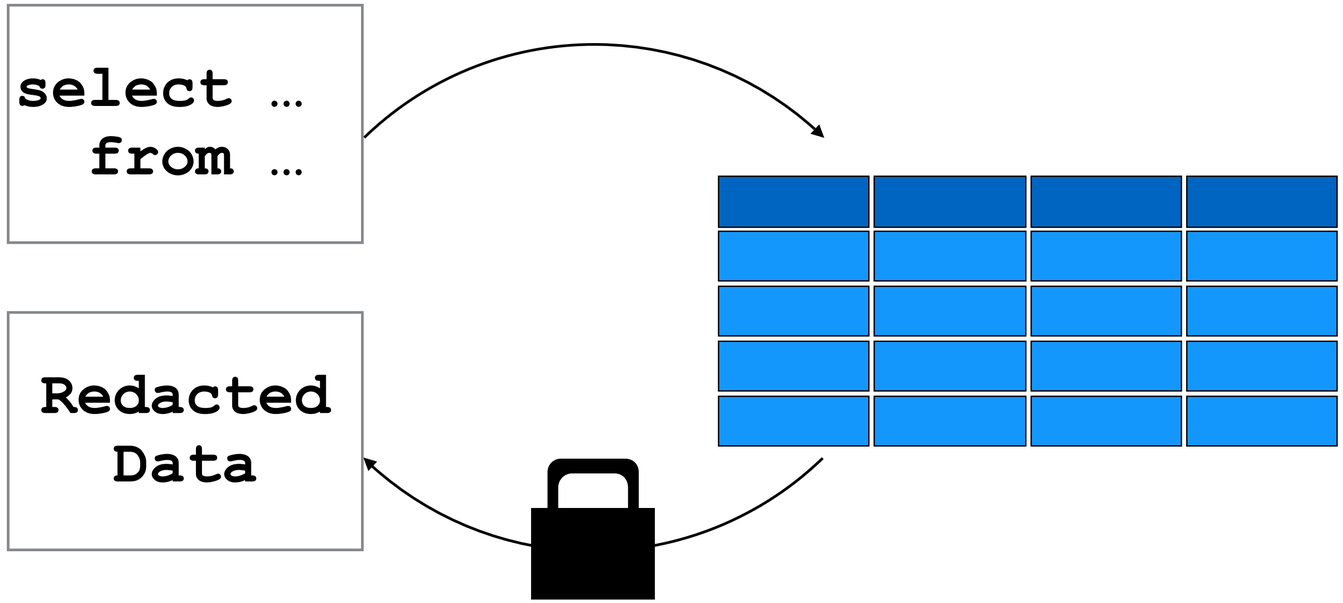
```
SQL> begin
  2      p;
  3  end;
  4  /
```

```
SQL> create or replace
  2  procedure p1
  3  is
  4  begin
  5      dbms_output.put_line ('This is the p1 program');
  6      p;
  7  end p1;
  8  /

Procedure created.
```

```
SQL> begin
  2     p1;
  3  end;
  4  /
This is the p1 program
This can only be called by the p1 program

PL/SQL procedure successfully completed.
```

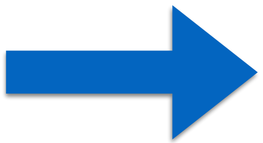
```
SQL> create or replace
  2  procedure p2
  3  is
  4  begin
  5      dbms_output.put_line ('This is the p2 program');
  6      p;
  7  end p1;
  8  /
```


Data Redaction


select …
from …
Redacted
Data

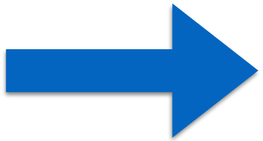
```
SQL> select ename
  2         ,hiredate
  3         ,credit_card
  4     from emp
  5 /

ENAME      HIREDATE  CREDIT_CARD
---------- --------- ----------------
SMITH      17-DEC-80 4916328952854172
ALLEN      20-FEB-81 4539313944751949
WARD       22-FEB-81 4716066949870198
JONES      02-APR-81 5535742924238587
MARTIN     28-SEP-81 5570058606015920
BLAKE      01-MAY-81 5103520492409737
CLARK      09-JUN-81 377819476595275
SCOTT      19-APR-87 349683522367948
```

```
begin
    dbms_redact.add_policy
       (object_schema   => 'ALEX'
       ,object_name     => 'EMP'
       ,policy_name     => 'Hide Creditcard'
       ,expression      => '1=1'
       ,column_name     => 'CREDIT_CARD'
       ,function_type   => dbms_redact.regexp
       ,regexp_pattern => dbms_redact.re_pattern_any_digit
       ,regexp_replace_string => 'X'
       );
end;
/
```



ENAME	HIREDATE	CREDIT_CARD
SMITH	17-DEC-80	XXXXXXXXXXXXXXXX
ALLEN	20-FEB-81	XXXXXXXXXXXXXXXX
WARD	22-FEB-81	XXXXXXXXXXXXXXXX
JONES	02-APR-81	XXXXXXXXXXXXXXXX
MARTIN	28-SEP-81	XXXXXXXXXXXXXXXX
BLAKE	01-MAY-81	XXXXXXXXXXXXXXXX
CLARK	09-JUN-81	XXXXXXXXXXXXXXXX
SCOTT	19-APR-87	XXXXXXXXXXXXXXXX

```
begin
    dbms_redact.add_policy
      (object_schema   => 'ALEX'
      ,object_name     => 'EMP'
      ,policy_name     => 'Hide Creditcard'
      ,expression      => '1=1'
      ,column_name     => 'CREDIT_CARD'
      ,function_type   => dbms_redact.partial
      ,function_parameters => dbms_redact.redact_ccn16_f12
      );
end;
/
```



ENAME	HIREDATE	CREDIT_CARD
SMITH	17-DEC-80	****-****-****-2
ALLEN	20-FEB-81	****-****-****-9
WARD	22-FEB-81	****-****-****-8
JONES	02-APR-81	****-****-****-7
MARTIN	28-SEP-81	****-****-****-0
BLAKE	01-MAY-81	****-****-****-7
CLARK	09-JUN-81	****-****-****-
SCOTT	19-APR-87	****-****-****-

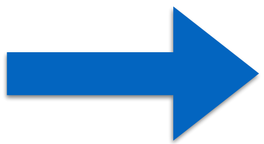
```
begin
 dbms_redact.add_policy(
   object_schema             => 'ALEX'
   ,object_name               => 'EMP'
   ,column_name               => 'CREDIT_CARD'
   ,policy_name               => 'Hide Credit Card'
   ,function_type             => dbms_redact.regexp
   ,function_parameters       => null
   ,expression                => '1=1'
   ,regexp_pattern            => dbms_redact.re_pattern_cc_l6_t4
   ,regexp_replace_string     => dbms_redact.re_redact_cc_middle_digits
   ,regexp_position           => dbms_redact.re_beginning
   ,regexp_occurrence         => dbms_redact.re_first
   );
end;
/
```

ENAME	HIREDATE	CREDIT_CARD
SMITH	17-DEC-80	491632XXXXXX4172
ALLEN	20-FEB-81	453931XXXXXX1949
WARD	22-FEB-81	471606XXXXXX0198
JONES	02-APR-81	553574XXXXXX8587
MARTIN	28-SEP-81	557005XXXXXX5920
BLAKE	01-MAY-81	510352XXXXXX9737
CLARK	09-JUN-81	377819XXXXXX5275
SCOTT	19-APR-87	349683XXXXXX7948

```
begin
 dbms_redact.add_policy(
    object_schema     => 'ALEX'
   ,object_name       => 'EMP'
   ,column_name       => 'CREDIT_CARD'
   ,policy_name       => 'gibberish'
   ,function_type     => DBMS_REDACT.RANDOM
   ,expression        => '1=1'
   );
END;
/
```

```
ENAME      HIREDATE  CREDIT_CARD
---------- --------- ------------------------
SMITH      17-DEC-80 _Z^\1LYqgbfd9Tay
ALLEN      20-FEB-81 dN9Vpp_.lVA^xxg6
WARD       22-FEB-81 ?8!%`:BQG@)-hBJY
JONES      02-APR-81 \~+bn/Mad'3jv7Ui
MARTIN     28-SEP-81 hg}BQ8etpo&JY@m|
BLAKE      01-MAY-81 *PJ" ,qL2XR*(4yT
CLARK      09-JUN-81 !e5`E)g))m=hM1o
SCOTT      19-APR-87 *|V]>n%y2%^eFv-
```

```
ENAME      HIREDATE  CREDIT_CARD
---------- --------- ------------------------
SMITH      17-DEC-80 _;T99'L@gC\AA/TH
ALLEN      20-FEB-81 J/Zs)aE@R7b{1iMH
WARD       22-FEB-81 {?-Z#/b0$G5b+7j8
JONES      02-APR-81 IKn4cRczQSv<kZk#
MARTIN     28-SEP-81 qX=>90;?y`EFA8CG
BLAKE      01-MAY-81 oTSNzmVhw\[V#u^p
CLARK      09-JUN-81 <$/9d5T'D,7Al=\
SCOTT      19-APR-87 au$O]"P|i},We*X
```



```
begin
    dbms_redact.add_policy
       (object_schema   => 'ALEX'
       ,object_name     => 'EMP'
       ,policy_name     => 'Hide Hire Date'
       ,expression      => '1=1'
       ,column_name     => 'HIREDATE'
       ,function_type   => dbms_redact.partial
       ,function_parameters => dbms_redact.redact_date_millennium
       );
end;
/
```

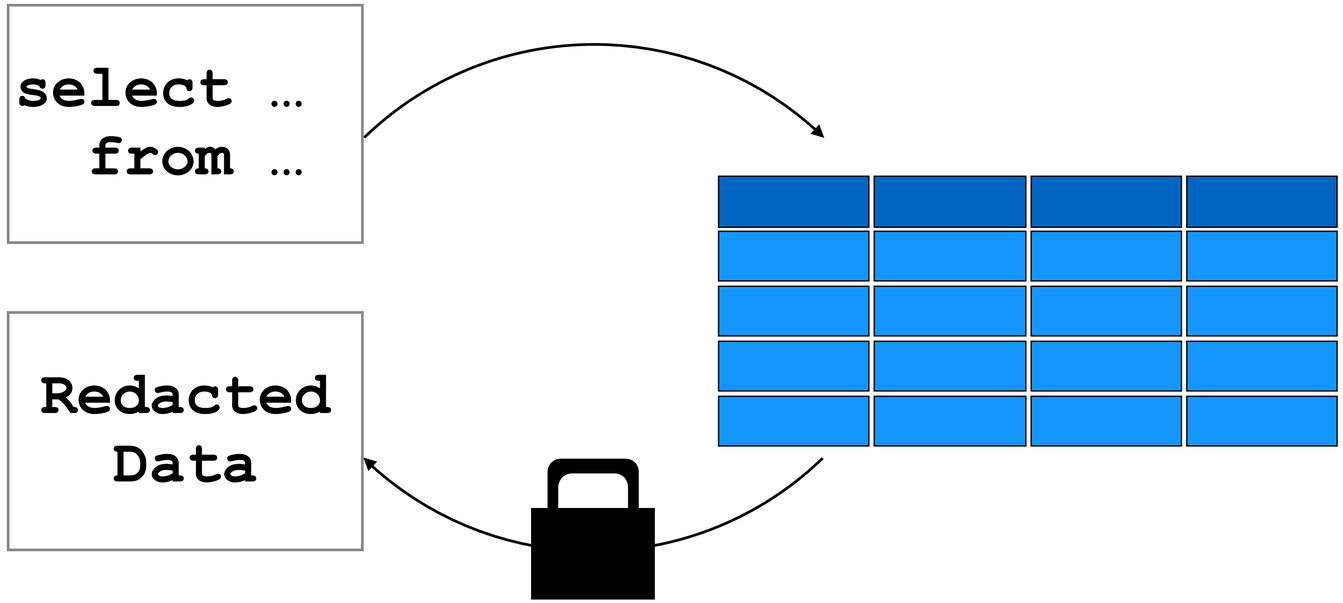
ENAME	HIREDATE	CREDIT_CARD
SMITH	01-JAN-00	4916328952854172
ALLEN	01-JAN-00	4539313944751949
WARD	01-JAN-00	4716066949870198
JONES	01-JAN-00	5535742924238587
MARTIN	01-JAN-00	5570058606015920
BLAKE	01-JAN-00	5103520492409737
CLARK	01-JAN-00	377819476595275
SCOTT	01-JAN-00	349683522367948

Same Policy Name

```
begin
   dbms_redact.alter_policy(
       object_schema                => 'ALEX'
      ,object_name                  => 'EMP'
      ,policy_name                  => 'Obscure some data'
      ,action                       => dbms_redact.ADD_COLUMN
      ,column_name                  => 'HIREDATE'
      ,function_type                => dbms_redact.partial
      ,function_parameters          => dbms_redact.redact_date_epoch
      );
end;
/
```

ENAME	HIREDATE	CREDIT_CARD
SMITH	01-JAN-70	491632XXXXXX4172
ALLEN	01-JAN-70	453931XXXXXX1949
WARD	01-JAN-70	471606XXXXXX0198
JONES	01-JAN-70	553574XXXXXX8587
MARTIN	01-JAN-70	557005XXXXXX5920
BLAKE	01-JAN-70	510352XXXXXX9737
CLARK	01-JAN-70	377819XXXXXX5275
SCOTT	01-JAN-70	349683XXXXXX7948

a word of warning


select …
from …
Redacted
Data

```
SQL> select ename
  2         ,hiredate
  3         ,credit_card
  4     from emp
  5    where substr (credit_card, 1, 1) = 4
  6    /
```

```
ENAME      HIREDATE  CREDIT_CARD
---------- --------- ------------------------
SMITH      17-DEC-80 XXXXXXXXXXXXXXXX
ALLEN      20-FEB-81 XXXXXXXXXXXXXXXX
WARD       22-FEB-81 XXXXXXXXXXXXXXXX
```

```
1  with
2  function show_cc (p_ename in varchar2)
3     return varchar2
4  is
5     digit varchar2(25);
6     buff varchar2(25);
7  begin
8     for cc in 1..17
9     loop
10    for i in 0..9
11    loop
12    for r_emp in (select credit_card
13                    from alex.emp
14                   where ename = upper (p_ename)
15                     and substr (credit_card, cc, 1) = i
16                 )
17    loop
18       buff := buff ||to_char (i);
19       end loop;
20    end loop;
21    end loop;
22    return 'Credit Card for '||upper (p_ename)||' is '||buff;
23 end show_cc;
24 select ename,CREDIT_CARD, show_cc (p_ename => ename)
25   from alex.emp
```

Query Result

SQL | All Rows Fetched: 14 in 0.363 seconds

	ENAME	CREDIT_CARD	SHOW_CC(P_ENAME=>ENAME)
1	SMITH	XXXXXXXXXXXXXXXX	Credit Card for SMITH is 4916328952854172
2	ALLEN	XXXXXXXXXXXXXXXX	Credit Card for ALLEN is 4539313944751949
3	WARD	XXXXXXXXXXXXXXXX	Credit Card for WARD is 4716066949870198

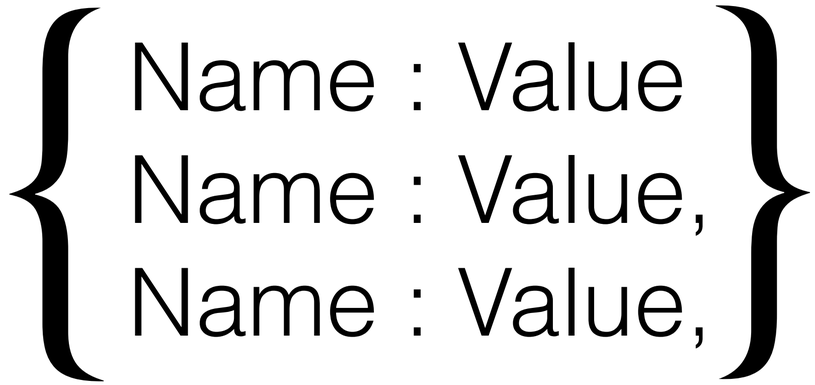

JSON

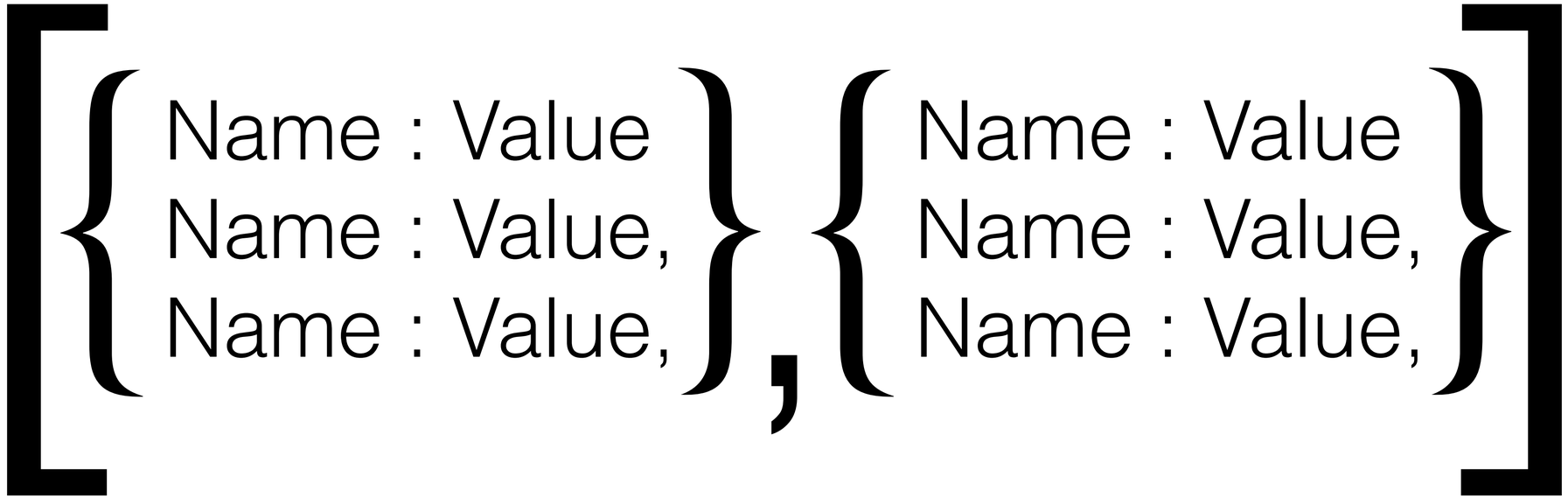
ORACLE DATABASE 12c

12.1.0.2

Store
Query
Index

{Name : Value}


{
Name : Value
Name : Value,
Name : Value,
}


[
{
Name : Value
Name : Value,
Name : Value,
},
{
Name : Value
Name : Value,
Name : Value,
}
]

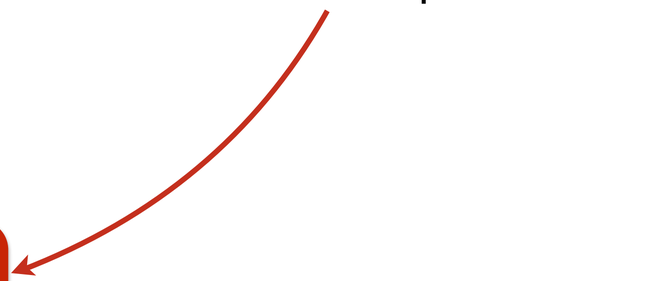
```
{"ACCOUNTING" : {
     "EMPLOYEES" : [
     {"ENAME" : "KING",
      "JOB" : "PRESIDENT",
      "SAL" : 5000
     },
     {"ENAME" : "MILLER",
      "JOB" : "CLERK",
      "SAL" : 1300
     }]
   }
}
```

```
SQL> create table t
  2  (json_data varchar2(4000)
  3  );

Table created.
```

```
SQL> insert into t
  2  values ('{"valid":"json"}');

1 row created.
```

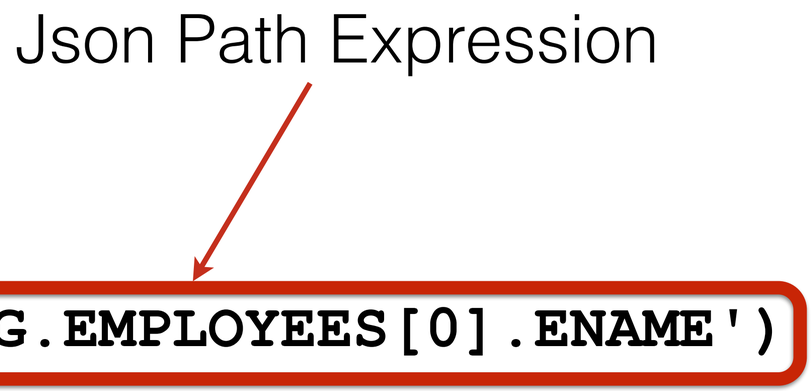
```
SQL> insert into t
  2  values ('Just a string');
```

Json Path Expression



```
SQL> select json_value (json_data
  2                     ,'$.valid'
  3                     )
  4    from t
  5  /

JSON_VALUE(JSON_DATA,'$.VALID')
--------------------------------
json
```

```
insert into t
values ('{"ACCOUNTING" : {
    "EMPLOYEES" : [
    {"ENAME" : "KING",
     "JOB" : "PRESIDENT",
     "SAL" : 5000
    },
    {"ENAME" : "MILLER",
     "JOB" : "CLERK",
     "SAL" : 1300
    }]
  }
}');
```




```
SQL> select json_value (json_data
  2                     ,'$.ACCOUNTING.EMPLOYEES[0].ENAME')
  2    from t;

JSON_VALUE(JSON_DATA,'$.ACCOUNTING.EMPLOYEES[0].ENAME')
--------------------------------------------------------

KING

2 rows selected.
```

```
SQL> select ename
  2         ,job
  3         ,sal
  4     from t
  5         ,json_table (json_data, '$.ACCOUNTING.EMPLOYEES[*]'
  6           columns (ename varchar2(20) path '$.ENAME'
  7                   ,job   varchar2(20) path '$.JOB'
  8                   ,sal   number       path '$.SAL'
  9     ));

ENAME          JOB                       SAL
-------------- ------------- ----------
KING           PRESIDENT               5000
MILLER         CLERK                   1300

2 rows selected.
```

```
SQL> select *
  2    from t
  3   where json_exists (json_data
  4                      ,'$.*.EMPLOYEES');

JSON_DATA
--------------------------------------------------
{"ACCOUNTING" : {
    "EMPLOYEES" : [
    {"ENAME" : "KING",
      "JOB" : "PRESIDENT",
      "SAL" : 5000
    },
    {"ENAME" : "MILLER",
      "JOB" : "CLERK",
      "SAL" : 1300
    }]
  }
}
```

JSON Generation

post 12.1.0.2

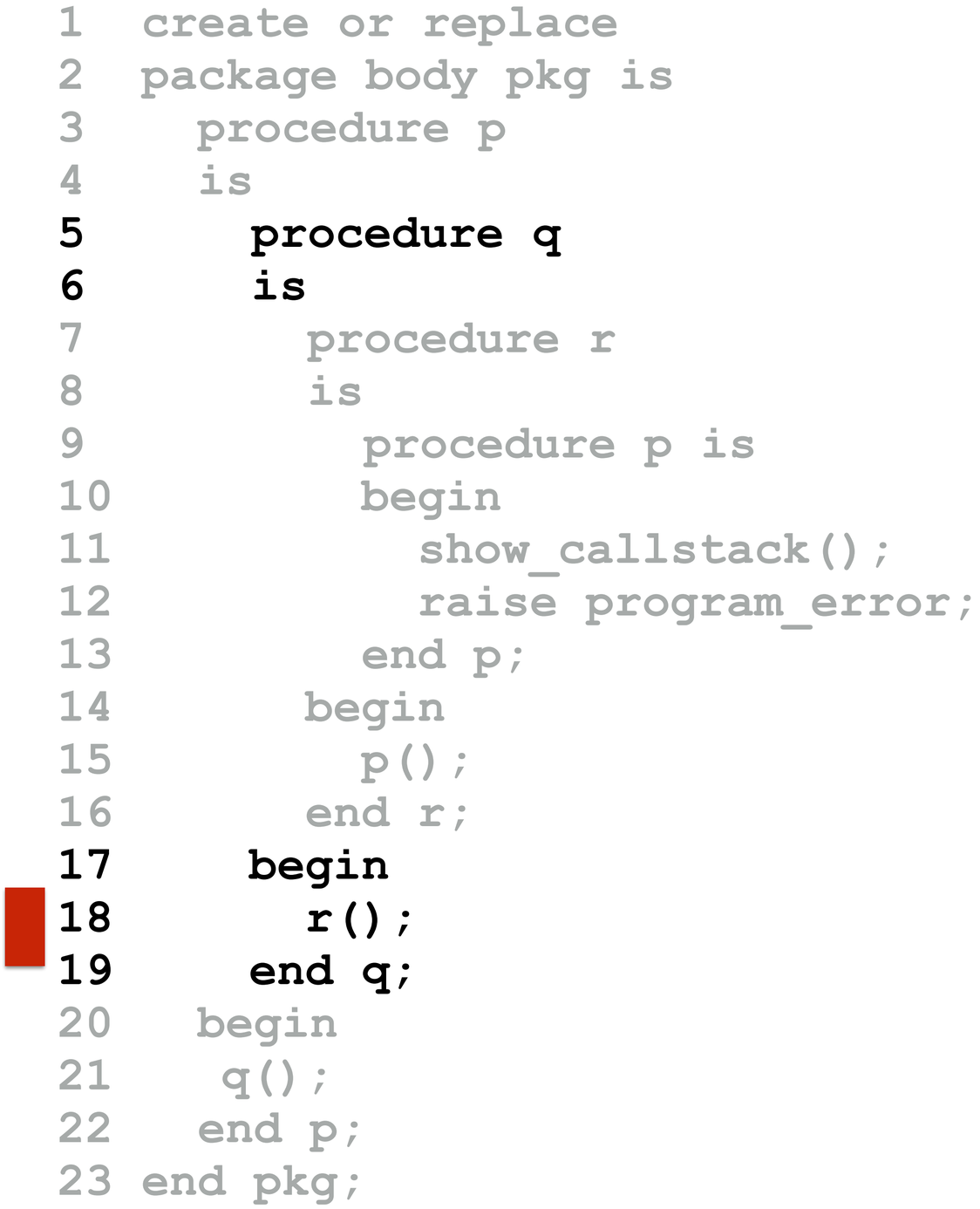
`JSON_OBJECT`
`JSON_ARRAY`

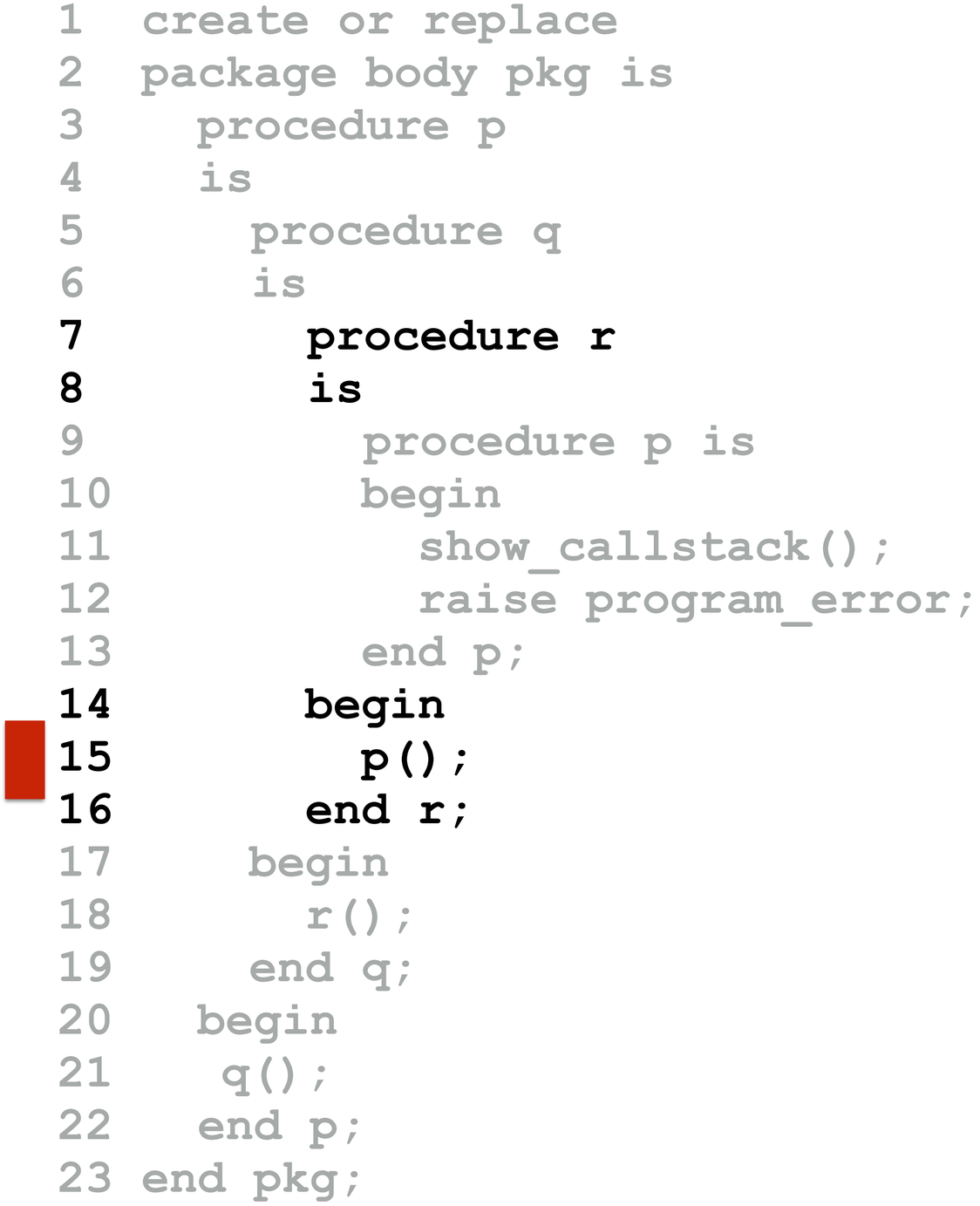

Callstack

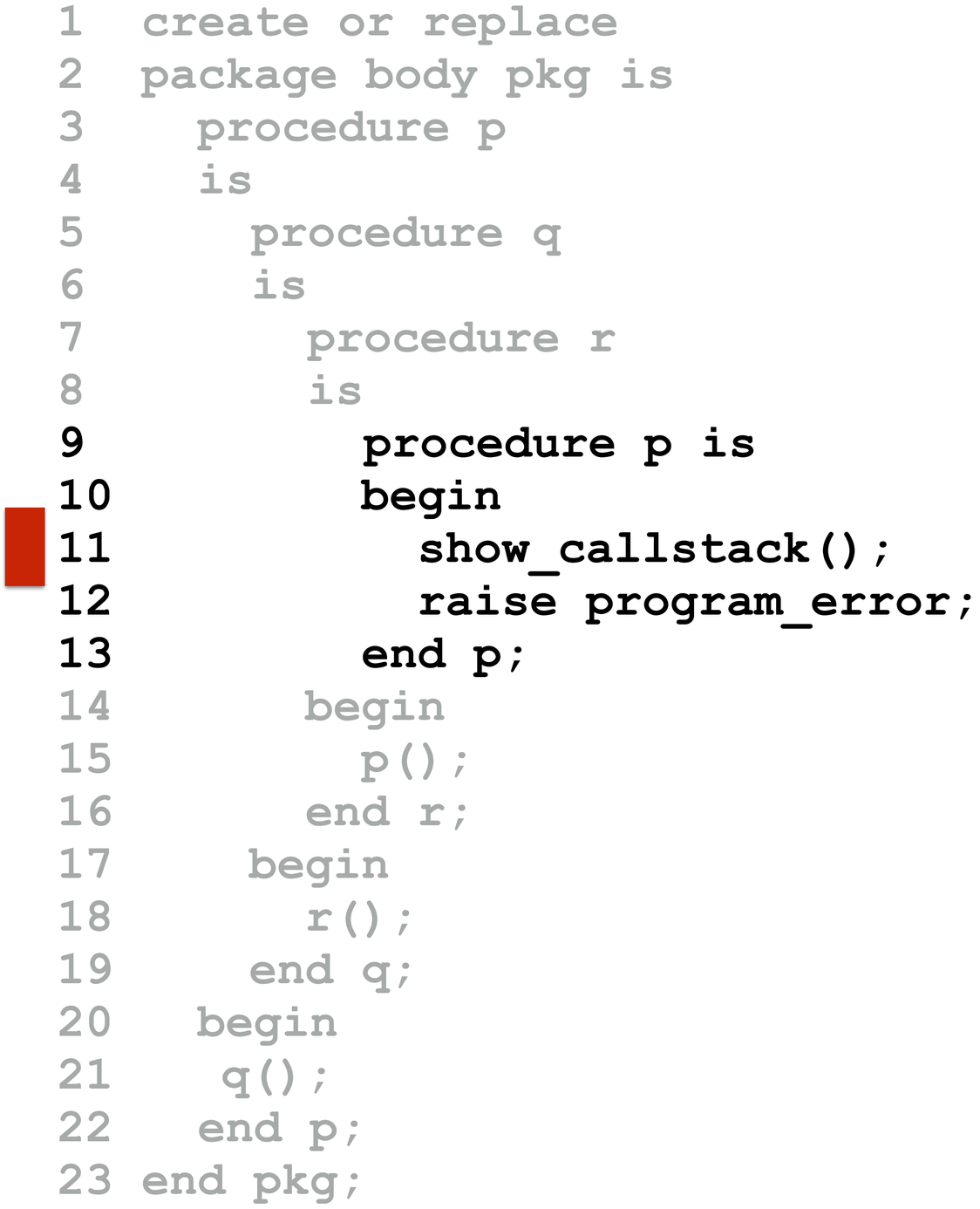
```
SQL> create or replace
  2  procedure show_callstack
  3  is
  4  begin
  5    dbms_output.put_line (dbms_utility.format_call_stack());
  6  end show_callstack;
  7  /

Procedure created.
```

```
1  create or replace
2  package body pkg is
3    procedure p
4    is
5      procedure q
6      is
7        procedure r
8        is
9          procedure p is
10         begin
11           show_callstack();
12           raise program_error;
13         end p;
14       begin
15         p();
16       end r;
17     begin
18       r();
19     end q;
20   begin
21    q();
22   end p;
23 end pkg;
```

```
1  create or replace
2  package body pkg is
3    procedure p
4    is
5      procedure q
6      is
7        procedure r
8        is
9          procedure p is
10         begin
11           show_callstack();
12           raise program_error;
13         end p;
14       begin
15         p();
16       end r;
17     begin
18       r();
19     end q;
20   begin
21    q();
22   end p;
23 end pkg;
```


1 create or replace
2 package body pkg is
3 procedure p
4 is
5 procedure q
6 is
7 procedure r
8 is
9 procedure p is
10 begin
11 show_callstack();
12 raise program_error;
13 end p;
14 begin
15 p();
16 end r;
17 begin
18 r();
19 end q;
20 begin
21 q();
22 end p;
23 end pkg;


1 create or replace
2 package body pkg is
3 procedure p
4 is
5 procedure q
6 is
7 procedure r
8 is
9 procedure p is
10 begin
11 show_callstack();
12 raise program_error;
13 end p;
14 begin
15 p();
16 end r;
17 begin
18 r();
19 end q;
20 begin
21 q();
22 end p;
23 end pkg;


1 create or replace
2 package body pkg is
3 procedure p
4 is
5 procedure q
6 is
7 procedure r
8 is
9 procedure p is
10 begin
11 show_callstack();
12 raise program_error;
13 end p;
14 begin
15 p();
16 end r;
17 begin
18 r();
19 end q;
20 begin
21 q();
22 end p;
23 end pkg;

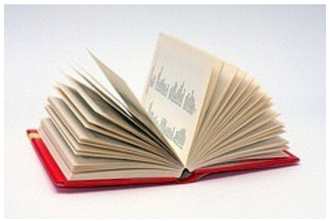
```
----- PL/SQL Call Stack -----
  object      line  object
  handle    number
name
0x9faa8f18     4  procedure ALEX.SHOW_CALLSTACK
0x9dbd2c00    10
package body ALEX.PKG
0x9dbd2c00    14  package body ALEX.PKG
0x9dbd2c00
17  package body ALEX.PKG
0x9dbd2c00    20  package body ALEX.PKG
0x9fc73e18
2  anonymous block

begin
*
ERROR at line 1:
ORA-06501: PL/SQL: program error
ORA-06512: at "ALEX.PKG", line 11
ORA-06512: at "ALEX.PKG", line 14
ORA-06512: at "ALEX.PKG", line 17
ORA-06512: at "ALEX.PKG", line 20
ORA-06512: at line 2
```

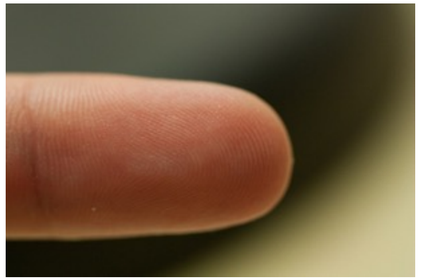
UTL_CALL_STACK

```
SQL> create or replace
  2  procedure show_callstack
  3  as
  4    depth pls_integer := utl_call_stack.dynamic_depth();
  5    procedure headers
...
 11    end headers;
 12  begin
 13    headers;
 14    for j in reverse 1..depth loop
 15      dbms_output.put_line(
 16       rpad( utl_call_stack.lexical_depth(j), 10 ) ||
 17       rpad( j, 7) ||
 18       rpad( to_char(utl_call_stack.unit_line(j), '99'), 9 ) ||
 19       utl_call_stack.concatenate_subprogram
 20         (utl_call_stack.subprogram(j)));
 21    end loop;
 22  end show_callstack;
```

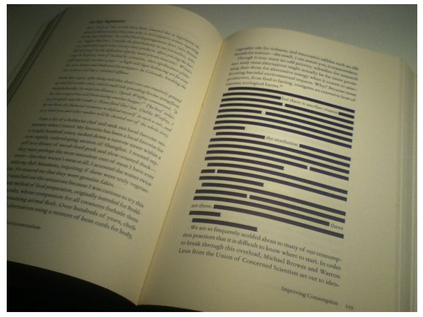
```
SQL> create or replace
  2  procedure show_callstack
  3  as
  4    depth pls_integer := utl_call_stack.dynamic_depth();
  5    procedure headers
...
 11    end headers;
 12  begin
 13    headers;
 14    for j in reverse 1..depth loop
 15      dbms_output.put_line(
 16       rpad( utl_call_stack.lexical_depth(j), 10 ) ||
 17       rpad( j, 7) ||
 18       rpad( to_char(utl_call_stack.unit_line(j), '99'), 9 ) ||
 19       utl_call_stack.concatenate_subprogram
 20         (utl_call_stack.subprogram(j)));
 21    end loop;
 22  end show_callstack;
```

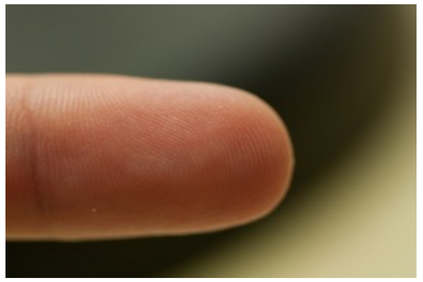
```
Lexical   Depth    Line   Name
Depth     Number
-------    -----    ----   ----
0    6     2       __anonymous_block
1    5    20       PKG.P
2    4    17       PKG.P.Q
3    3    14       PKG.P.Q.R
4    2    10       PKG.P.Q.R.P
0    1    14       SHOW_CALLSTACK
begin
*
ERROR at line 1:
ORA-06501: PL/SQL: program error
ORA-06512: at "ALEX.PKG", line 11
ORA-06512: at "ALEX.PKG", line 14
ORA-06512: at "ALEX.PKG", line 17
ORA-06512: at "ALEX.PKG", line 20
ORA-06512: at line 2
```





Subquery Factoring





Geoffrey Fairchild

https://flic.kr/p/6tKgHz

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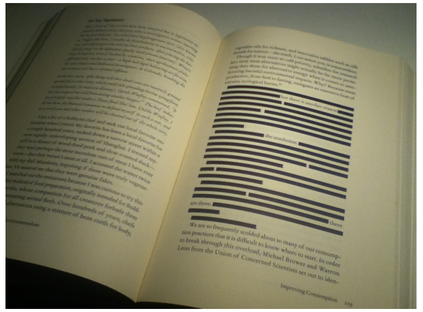
https://flic.kr/p/dLbzPm



Mutant669

http://bit.ly/1tqcAJu

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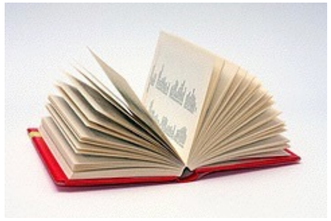
http://savethestack.blogspot.com

Monica Arellano-Ongpin

https://flic.kr/p/cZ6YT9



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