Oracle 10g for Developers: What You Need to Know

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COLLABORATE06

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Session Objectives

- Learn new Oracle 10g (and some Oracle 9i) features that are geared to developers
- Be ready to use ISO/ANSI standard SQL to make code more portable
- Know how existing database features have been improved in Oracle9i and Oracle 10g
- Become aware of some Oracle 10g DBA oriented features that will impact developers

Where We Are Going

- Oracle9i first, Oracle 10g second
  - New datatypes
  - New functions
  - New SQL statements
  - Multi-table inserts
  - New join and case syntax
  - External tables
  - PL/SQL “in-sync”
  - Object improvements
  - XML improvements
  - Regular expressions
  - Model
  - Other cool stuff…

New 9i Datatypes

- Oracle9i provides a series of new and improved datatypes:
  - Date Related:
    - TIMESTAMP, TIMESTAMP WITH TIMEZONE, TIMESTAMP WITH LOCAL TIMEZONE
    - TIMEZONE_HOUR, TIMEZONE_MINUTE, TIMEZONE_REGION
    - INTERVAL YEAR TO MONTH
    - INTERVAL DAY TO SECOND
  - Character Related changes:
    - CHAR, VARCHAR2, NCHAR, NVARCHAR2
  - UROWID: Rowid for IOT rows
  - New Oracle-supplied datatypes
    - SYS.ANYTYPE, SYS.ANYDATA, SYS.ANYDATASET
    - XMLType
    - URIType, DBURIType, HTTPURIType, URIFactoryType
    - MDSYS.SDO_GEOMETRY
    - ORDSYS.ORDAudio, ORDSYS.ORDImage, ORDSYS.ORDVideo

New 9i Date Datatypes

- Timestamps: Year, Month, Day, Hour, Minute, Second
  - TIMESTAMP or TIMESTAMP (n)
    - May specify second fraction used (0-9 decimals), 6 decimals is the default
  - TIMESTAMP WITH TIMEZONE or TIMESTAMP (n) WITH TIMEZONE
    - May specify second fraction used (0-9 decimals), 6 decimals is the default
  - TIMESTAMP WITH LOCAL TIMEZONE or TIMESTAMP (n) WITH LOCAL TIMEZONE
    - May specify second fraction used (0-9 decimals), 6 decimals is the default
- Intervals: Provide period of time
  - INTERVAL YEAR TO MONTH or INTERVAL YEAR (n) TO MONTH
    - Interval in Years and Months
    - May specify number of digits in year (0-9), 2 digits is the default
  - INTERVAL DAY TO SECOND or INTERVAL DAY(d) TO SECOND (s)
    - Interval in Days, House, Minutes, Seconds
    - May specify number of digits for days (0-9), 2 digits is the default
    - May specify second fraction used (0-9 decimals), 6 decimals is the default

9i Character Modifications

- CHAR, VARCHAR2, NCHAR, and NVARCHAR2 may specify additional size descriptor (BYTE or CHAR)
  - VARCHAR2(n)
  - VARCHAR2(n) BYTE
  - VARCHAR2(n) CHAR
  - CHAR(n)
  - CHAR(n) BYTE
  - CHAR (n) CHAR
- BYTE specifies that the size of the column is specified in bytes
- CHAR specifies that the size of the column is specified in characters
- Maximum size of VARCHAR2 is 4000 bytes (unchanged)
- Maximum size of CHAR is 2000 bytes (unchanged)

Oracle9i-Supplied "Any" Types

- Oracle supplies a datatype for use in creating tables and stored procedures when the actual type is not know, the so-called "any" types
  - SYS.ANYTYPE: May contain any known SQL datatype or an unnamed datatype
  - SYS.ANYDATA: May contain different types of data in columns of different rows
  - SYS.ANYDATASET: Allows sets of data to be passed

XMLtype Datatype

- SYS.XMLtype is an Oracle-defined datatype used to store XML data within the database as:
  - Entire document as CLOB/XMLType
  - Document elements as relational table rows and columns
- Member functions include:

– createXML()	Create XMLType instance
– existsNode()	Checks if XPath can find any valid nodes
– extract()	Uses XPath to return fragment as XMLType
– isFragment()	Checks to see if document is really a fragment
– getClobVal()	Gets document as a CLOB
– getStringVal()	Gets value as a string
– getNumberVal()	Gets numeric value as a number

- Lots of XML support is added in Oracle9i (enhanced again in Oracle 10g), check the reference manual:
  “XML Database Developer's Guide”

SQL - XML Functions

- SQL provides several functions specifically for dealing with XML data including:
  - SYS_DBURIGEN(ts) Generate DBURITYPE URL used to obtain XML data from the database
  - SYS_XMLGEN(exp) Convert specified database row and column into an XML document
  - SYS_XMLAGG(exp) Generate single XML document from aggregate of XML data specified by “exp”
  - XMLELEMENT(name,exp) Generates XML element using name and exp as data
  - XMLATTRIBUTES(exp,list) Generates XML attributes using expression list
- XMLELEMENT and XMLATTRIBUTES reflect Oracle’s support for the upcoming ANSI/ISO SQLX standard

SYS_XMLGEN

- SYS_XMLGEN
  - Uses a single input expression representing a particular row/column
    (scalar value or user-defined type)
    - For scalar value a single XML element representing the value is returned
    - For user-defined type XML elements representing each of the user-defined type’s data items is returned
  - Returns an instance of SYS.XMLType data that is an XML document
  - The example on the next page displays using getStringVal since SYS.XMLType data returns as CLOB and is not displayable by SQL*Plus

SYS.XMLGEN Example

```
select sys_xmlgen(ename).getStringVal() Name
     from emp
     where job = 'ANALYST'

NAME
---------------------------------------------------
<?xml version="1.0"?>
 <ENAME>FORD</ENAME>

<?xml version="1.0"?>
 <ENAME>SCOTT</ENAME>
```

SYS_XMLAGG

- SYS_XMLAGG aggregates all XML documents (or fragments of documents) for an expression and produces a single XML document
  - ROWSET is the default tag name
  - Use SYS.XMLGenFormatType to change tag name
- The example on the next page uses the SYS_XMLGEN function to generate an XML document for each dept 20 row of the sample EMP table
- The example on the next page displays using getClobVal since SYS.XMLType data returns as CLOB and is not displayable by SQL*Plus

SYS_XMLAGG Example

```
 select sys_xmlagg(SYS_XMLGEN(Ename)).getClobVal() emps
      from emp
      where deptno = 10

EMPS
-----------------------------------------------
<?xml version="1.0"?>
<ROWSET>
<ENAME>KING</ENAME>
<ENAME>CLARK</ENAME>
<ENAME>MILLER</ENAME>
</ROWSET>
```

SYS_XMLAGG Example 2

```
select sys_xmlagg(SYS_XMLGEN(Ename)
   ,sys.XMLGENFORMATTYPE.createFormat('depts')).getClobVal() emps
from emp group by deptno
   EMPS
   ------------------------
   <?xml version="1.0"?>
   <depts>
   <ENAME>KING</ENAME>
   <ENAME>CLARK</ENAME>
   <ENAME>MILLER</ENAME>
   </depts>
   <?xml version="1.0"?>
   <depts>
   <ENAME>JONES</ENAME>
   <ENAME>ADAMS</ENAME>
   <ENAME>SCOTT</ENAME>
   <ENAME>SMITH</ENAME>
   <ENAME>FORD</ENAME>
   </depts>
   <?xml version="1.0"?>
   <depts>
   <ENAME>BLAKE</ENAME>
   <ENAME>WARD</ENAME>
   <ENAME>JAMES</ENAME>
   <ENAME>MARTIN</ENAME>
   <ENAME>ALLEN</ENAME>
   <ENAME>TURNER</ENAME>
   </depts>
```

XMLELEMENT

- XMLELEMENT(name,exp) Generates an XML element using name and exp as data

```
select xmlelement("employee",
       xmlelement("empid",empno),
       xmlelement("empname",ename)) myxml
from emp
<employee> <empid>7369</empid>
   <empname>SMITH</empname> </employee>
<employee> <empid>7499</empid>
   <empname>ALLEN</empname> </employee>
<employee> <empid>7521</empid>
   <empname>WARD</empname> </employee>
<employee> <empid>7566</empid>
   <empname>JONES</empname> </employee>
<employee> <empid>7654</empid>
   <empname>MARTIN</empname> </employee>
```

XMLAGG

- In the previous example, XMLELEMENT resulted in document that is not well-formed, use XMLAGG to fix it as follows (XMLAGG is SQLX and is similar to SYS_XMLAGG)

```
select xmlelement("employee",
            xmlagg(xmlelement("empid",empno,
                       xmlelement("empname",ename))
                     order by ename  )) myxml
  from emp
<employee>
  <empid>7876<empname>ADAMS</empname></empid>
  <empid>7499<empname>ALLEN</empname></empid>
  <empid>7698<empname>BLAKE</empname></empid>
  … more rows here …
  <empid>7369<empname>SMITH</empname></empid>
  <empid>7844<empname>TURNER</empname></empid>
  <empid>7521<empname>WARD</empname></empid>
</employee>
```

XMLATTRIBUTES

- XMLATTRIBUTES(exp,list) Generates XML attributes using expression list

```
select xmlelement("employee",
       xmlelement("emp",
                xmlattributes(empno as "empno",
                              ename as "ename")),
       xmlelement("job",job),
       xmlelement("hiredate",hiredate),
       xmlelement("pay",
                xmlattributes(nvl(sal,0) as "sal",
                              nvl(comm,0) as "comm"))
       ) as myxml
from emp
```

XMLATTRIBUTES Example

```
<employee>
  <emp empno="7369" ename="SMITH"/>
  <job>CLERK</job>
  <hiredate>17-DEC-80</hiredate>
  <pay sal="800" comm="0"/>
</employee>

<employee>
  <emp empno="7499" ename="ALLEN"/>
  <job>SALESMAN</job>
  <hiredate>20-FEB-81</hiredate>
  <pay sal="1600" comm="300"/>
</employee>
```

Again XMLAGG

- XMLATTRIBUTES generates a fragment, again use XMLAGG

```
select xmlelement("employee",
           xmlagg(xmlelement("emp",
                  xmlattributes(empno as “empno",
                                ename as "ename"),
                 xmlelement("job",job),
                 xmlelement("hiredate",hiredate),
                 xmlelement("pay",xmlattributes(nvl(sal,0)
    as "sal",nvl(comm,0) as "comm"))))) myxml
  from emp
<employee>
   <emp empno="7839" ename="KING">
      <job>PRESIDENT</job><hiredate>17-NOV-81</hiredate>
      <pay sal="5000" comm="0"></pay></emp>
-- more rows --
   <emp empno="7934" ename="MILLER">
      <job>CLERK</job><hiredate>23-JAN-82</hiredate>
      <pay sal="1300" comm="0"></pay></emp>
</employee>
```

Other XML Functions

• XMLColattval	Creates series of XML fragments using an element name of “column” and column names and values as attributes
• XMLConcat	Concatenates a series of XMLType objects (opposite of XMLElement)
• XMLForest	Creates XML fragments from a list of arguments/parameters
• XMLSequence	Creates Varray of XMLType instances
• XMLTransform	Uses input XMLType and XSL style sheet (also XMLType) to create a new XMLType
• UpdateXML	Uses an XMLType and an XPATH reference and returns an updated XMLType

URI Datatypes

- Oracle9i provides a series of predefined types designed to help programmers work with web applications including:
  - SYS.URITYPE
  - SYS.DBURITYPE
  - SYS.HTTPURITYPE
  - SYS.URIFACTORYTYPE

UROWID

- UROWID allows manipulation of values used to identify the base-64 value representing the address of a row in an index-organized table (IOT)

```
mycol1 UROWID
mycol2 UROWID(nn)
```

– nn Size of UROWID is optional:
default size = 4000
max = 4000

Misc. Oracle-Supplied Datatypes

- Oracle9i supplies a set of predefined types for working with multimedia:
  - ORDSYS.ORDAUDIO
  - ORDSYS.ORDIMAGE
  - ORDSYS.ORDVIDEO
- Finally, Oracle9i provides a spatial datatype:
  - MDSYS.SDO_GEOMETRY

Subqueries Almost Anywhere!

- Oracle8i allowed subqueries just about anywhere in the SQL statement, Oracle9i allows subqueries that return a single value anywhere **except** for the following:
  - default value for columns
  - check constraints
  - RETURNING clause
  - function-based indexes
  - when condition in CASE
  - GROUP BY
  - HAVING
  - START WITH
  - CONNECT BY

Silly Examples

- Here are four oddball statements that would not be possible in earlier versions

```
select ename,job,sal,(select avg(sal) from emp where job = main.job) jobavgsal
                              from emp main;

select ename,sal from emp
  where sal between (select avg(sal) from emp where job = 'SALESMAN')
                           and (select avg(sal) from emp where job = 'ANALYST');

select deptno from dept
       where (select avg(sal) from emp) > (select avg(sal) from emp
                                                             where emp.deptno = dept.deptno);
select ename,sal from emp
  order by (select dname from dept where dept.deptno = emp.deptno),ename;
```

Misc. SQL Improvements

- Most variable-character functions now allow CLOB arguments (SUBSTR, etc…)
- New operators:
  - LIKEC, LIKE2, LIKE4 similar to LIKE with Unicode, UCS2, and UCS4 data respectively
  - IS OF xxx determines the type of an object instance
- WAIT option: SELECT … FOR UPDATE WAIT waits specified number of seconds for locked row
- DEFAULT keyword for INSERT and UPDATE
- When using CONNECT BY may use ORDER BY SIBLINGS to sort within hierarchy
- New sample tables!
- Scrollable cursor support (3GLs)
- Group by Grouping Sets
- New hints

New Functions

- Many (over 50!) new functions have been added to Oracle9i including:
  - ANSI-standard functions
  - Date and Time functions
  - Analytical functions (added to those from Oracle8i)
  - Unicode functions
  - Character conversion functions
  - XML functions
  - Object functions

ISO/ANSI-Standard Functions

- COALESCE is similar to NVL, but, returns <u>first</u> non-null value:

```
COALESCE(qtr4,qtr3,qtr2,qtr1)
```

- NULLIF returns NULL if the specified value is matched

```
NULLIF(PREFCODE, 'N/A')
```

Training Resources

Date and Time Functions

- Oracle9i includes many date and time functions, among the more useful are:
  - CURRENT_DATE
  - CURRENT_TIMESTAMP
  - DBTIMEZONE
  - EXTRACT(timestamp)
  - SYSTIMESTAMP
  - TO_CHAR(timestamp)
  - TO_DSINTERVAL(instring)
  - TO_YMINTERVAL(instring)
  - TO_TIMESTAMP(instring)
- Several other functions that work with time zones have been added

Timezone Functions

- Several timezone-specific functions have also been added:

– DBTIMEZONE	Get UTC offset from database
– SESSIONTIMEZONE	Get UTC offset from current session (uses ORA_SDTZ env. variable)
– FROM_TZ	Convert timestamp at timezone to timestamp with timezone value
– TZ_OFFSET	Returns UTC offset for specified time zone
– SYS_EXTRACT_UTC	Get UTC time from specified timestamp with time zone
– DBTIMEZONE	Get UTC offset from database
– TO_TIMESTAMP_TZ	Convert string to timestamp with timezone using normal formatting

Oracle 8.1.6 Analytic Functions

- Oracle 8.1.6 included a set of functions providing expanded support for data mining operations - (topic is too rich to cover in the context of this paper)
- The analytic functions are divided into four "families"
  - **Lag/Lead** - Compares values of rows to other rows in same table: LAG, LEAD
  - **Ranking** - Supports "top n" queries: CUME_DIST, DENSE_RANK, NTILE, PERCENT_RANK, RANK, ROW_NUMBER
  - **Reporting Aggregate -** Compares aggregates to non-aggregates (pct of total): RATIO_TO_REPORT
  - **Window Aggregate -** Moving average type queries: FIRST_VALUE, LAST_VALUE
- Analytic functions allow users to divide query result sets into ordered groups of rows called partitions (not the same as database partitions)

Example Analytical Function

- Rank may be used with GROUP aggregation:

```
select dname,
       nvl(avg(sal),0) avg_sal,
       count(empno) nbr_emps,
       rank() over (order by nvl(avg(sal),0)) rank
   from emp right join dept using (deptno)
group by dname

DNAME              AVG_SAL   NBR_EMPS       RANK
-------------- ---------- ---------- ----------
OPERATIONS              0          0          1
TESTER                  0          0          1
SALES          1566.66667          6          3
RESEARCH             2175          5          4
ACCOUNTING     2916.66667          3          5
```

New Analytical Functions

- Oracle9i adds additional Analytical functions:

– FIRST	Gets first sorted group row
– LAST	Gets last sorted group row
– GROUP_ID	Group Identifier for GROUP BY
– GROUPING_ID	Number matching GROUPING
– PERCENTILE_CONT	Pct. when continuous distribution
– PERCENTILE_DISC	Pct. When discrete distribution
– WIDTH_BUCKET	Use to create same-size intervals in histogram

Example FIRST/LAST

```
select dname,
       min(salary) keep (dense_rank first order by hire_date)
             "First Hired",
       max(salary) keep (dense_rank last order by hire_date)
             "Last Hired"
   from hr.employees right join dept
          on department_id = deptno
   group by dname

DNAME          First Hired Last Hired
-------------- ----------- ----------
ACCOUNTING            4400       4400
OPERATIONS            6500       6500
RESEARCH             13000       6000
SALES                11000       2500
```

GROUPING SETS

- Oracle 9i Release 2 adds the ability to created cube-type statistics on command

```
select deptno
       ,job
       ,count(empno) nbremps
       ,sum(sal)     totpay
     from emp
     group by grouping sets (deptno,job)

 DEPTNO JOB          NBREMPS     TOTPAY
------- --------- ---------- ----------
        CLERK              4       4150
        ANALYST            2       6000
        MANAGER            3       8275
        SALESMAN           4       5600
        PRESIDENT          1       5000
     10                    3       8750
     20                    5      10875
     30                    6       9400
```

ORDER SIBLINGS BY

- Sorting data returned by CONNECT BY has been an issue for years, Oracle 9i Release 2 changes things:

```
   select lpad(' ',level*2)||empno empid,ename,mgr,deptno,level
         from emp
         connect by prior empno = mgr
         start with mgr is null
         order siblings by (ename)
EMPID        ENAME             MGR     DEPTNO      LEVEL
------------ ---------- ---------- ---------- ----------
  7839       KING                          10          1
    7698     BLAKE            7839         30          2
      7499   ALLEN            7698         30          3
      7900   JAMES            7698         30          3
      7654   MARTIN           7698         30          3
      7844   TURNER           7698         30          3
      7521   WARD             7698         30          3
    7782     CLARK            7839         10          2
      7934   MILLER           7782         10          3
```

TO_CHAR & New Dates

- TO_CHAR has been modified with attributes to describe desired TIMESTAMP components:

– FF1-FF9	Fractional Seconds
– TZD	Abbrev. Timezone with Daylight time notation
– TZH	Timezone UTC offset hours
– TZM	Timezone UTC offset minutes
– TZR	Timezone Region
– X	Local radix operator

Using TO_CHAR

- Use the new TO_CHAR attributes in the same manner as other attributes:

```
select to_char(t4,'yyyy-mm-dd hh24:mi:ssxff tzh:tzm')
            t4_value
   from timetest1;

T4_VALUE
-----------------------------------------------------
2002-10-28 16:23:50.9530000 -07:00
```

Extract Syntax

- EXTRACT is used to get specific parts of a TIMESTAMP of INTERVAL

```
EXTRACT ( YEAR  FROM  datetime   )
          MONTH       timestamp
          DAY         interval
          HOUR
          MINUTE
          SECOND
          TIMEZONE_HOUR
          TIMEZONE_MINUTE
          TIMEZONE_REGION
          TIMEZONE_ABBR
```

SYS_EXTRACT_UTC

- Query below extracts current UTC timestamp from provided timestamp with time timezone value

```
select sys_extract_utc(to_timestamp_tz(current_timestamp))
   from dual
SYS_EXTRACT_UTC(TO_TIMESTAMP_TZ(CURRENT_TIMESTAMP))
------------------------------------------------------
01-APR-02 08.56.15.013000 PM
```

Note: UTC (Coordinated Universal Time)
was formerly known as
GMT (Greenwich Mean Time)

Unicode Functions

- Oracle9i Unicode-specific functions:

– COMPOSE	Return string from Unicode
– DECOMPOSE	Return Unicode for string
– INSTRC	Search string for Unicode characters
– LENGTHC	Length of Unicode string
– SUBSTRC	Return partial Unicode string
– UNISTR	Convert string to Unicode

- INSTRC, LENGTHC, AND SUBSTRC functions are replicated as INSTR2, INSTR4, LENGTH2, LENGTH4, SUBSTR2, and SUBSTR4 for data using UCS2 and UCS4 codepoints

Character Conversion Functions

- Several functions have been added or improved:
  - ASCIISTR
  - BIN_TO_NUM
  - CAST
  - DECODE
  - NCHR
  - RAW_TO_HEX
  - ROWIDTONCHAR
  - TO_CHAR
  - TO_CLOB
  - TO_NCHAR
  - TO_NCLOB

New SQL Statements

- Oracle9i adds some new SQL statements:

– CREATE PFILE	Export database parameters as text file
– CREATE SPFILE	Create server parameters from external text file
– MERGE	Combination INSERT and UPDATE, if row exists change it, otherwise build new row

Merge

- MERGE uses a SELECT (table/view/subquery) to UPDATE or INSERT rows in another table/view

```
merge
    into bonus
    using emp
    on ( bonus.ename = emp.ename )
    when matched
    then  update  -- only one update match allowed!
           set bonus.sal = emp.sal,
           bonus.comm = emp.comm
    when not matched
        then insert
           (ename,job,sal,comm)
          values
           (emp.ename,emp.job,emp.sal,emp.comm)
```

External Tables

- Oracle9i allows access to an external sequential file as a read-only table
- Before Oracle9i external file access was:
  - – SQL*Loader
  - – UTL_FILE PL/SQL package
  - – Pro* or OCI programs written in 3GLs
  - – BFILE in Oracle8 and later for large objects

How Do External Tables Work?

- The CREATE TABLE statement uses a combination of standard syntax and field definition syntax from SQL*Loader
- CREATE TABLE has two parts:
  - Internal table description
    - Uses normal column definitions
    - Constraints are not valid
    - No indexes may be defined
  - External table description
    - Uses DIRECTORY objects to find files
    - Uses SQL*Loader-like syntax
- When an External Table is referenced in SQL, the file data is loaded and made available

External File Data

```
7402,LINCOLN,SALESMAN,7839,20-JAN-1980,2372.50,500.00,10
7418,MORRIS,CLERK,7782,01-APR-1982,1100.00,0,10
7422,LITTLE,CLERK,7782,12-NOV-1982,980.00,0,10
7437,BILLINGS,MANAGER,7839,23-FEB-1983,2923.75,0,20
7443,ALLEN,SALESMAN,7698,30-MAR-1982,1500.00,600.00,30
7456,GARCIA,ANALYST,7698,22-APR-1980,2312.50,0,30
7464,SOUK,ANALYST,7566,14-JUL-1981,3450.00,0,20
7473,CHANG,SALESMAN,7839,18-DEC-1982,2372.50,500.00,10
7484,SMITH,CLERK,7782,09-SEP-1982,925.50,0,10
7489,LIBUTTI,CLERK,7782,04-JUN-1980,1005.00,0,10
7495,HIPSON,MANAGER,7839,15-OCT-1982,3876.00,0,20
7498,MICHELL,SALESMAN,7698,16-NOV-1983,1600.00,750.00,30
7504,JORDAN,ANALYST,7698,21-APR-1982,2370.50,0,30
7518,SANCHEZ,ANALYST,7566,02-JAN-1981,3005.00,0,20
```

Create Table (Internal desc)

```
create table newemp
  ( empno        number(4)
   ,ename        char(10)
   ,job          char(9)
   ,mgr          number(4)
   ,hiredate     date
   ,sal          number(7,2)
   ,comm         number(7,2)
   ,deptno       number(2)
  )
  organization external
```

Rest of CREATE TABLE on next page!

Create Table (External desc.)

```
(type oracle_loader default directory ukoug_src
    access parameters
    ( records delimited by newline
      badfile ukoug_bad:'newemp.bad'
      discardfile ukoug_dis:'newemp.dis'
      logfile ukoug_log:'newemp.log'
      fields terminated by ','
      missing field values are null
     ( empno, ename, job, mgr,
        hiredate char date_format date mask "mm-dd-yyyy",
        sal, comm, deptno
      )
    )
   location ('personc.dat')
  )
  reject limit unlimited
;
```

Using External Table

```
SQL> select empno,ename,hiredate,sal from newemp
     EMPNO ENAME      HIREDATE         SAL
---------- ---------- --------- ----------
      7402 LINCOLN    20-JAN-80     2372.5
      7418 MORRIS     01-APR-82       1100
      7422 LITTLE     12-NOV-82        980
      7437 BILLINGS   23-FEB-83    2923.75
      7443 ALLEN      30-MAR-82       1500
      7456 GARCIA     22-APR-80     2312.5
      7464 SOUK       14-JUL-81       3450
      7473 CHANG      18-DEC-82     2372.5
      7484 SMITH      09-SEP-82      925.5
      7489 LIBUTTI    04-JUN-80       1005
      7495 HIPSON     15-OCT-82       3876
      7498 MICHELL    16-NOV-83       1600
      7504 JORDAN     21-APR-82     2370.5
      7518 SANCHEZ    02-JAN-81       3005
```

Multi-Table Insert

- Multi-table insert allows a single INSERT statement to insert rows into several tables:

– ALL	Unconditionally INSERT
– WHEN	Conditionally INSERT

- Rules
  - May only insert into local tables (no views)
  - RETURNING clause invalid
  - Insert subqueries may not use sequences

Unconditional Multi-Table Insert

```
insert all
  into emp
     (empno,ename,job,mgr,hiredate,sal,comm,deptno)
    values
     (empno,ename,job,mgr,hiredate,sal,comm,deptno)
  into bonus
     (ename,job,sal,comm)
    values
     (ename,job,sal,comm)
  select empno,ename,job,mgr,hiredate,sal,comm,deptno
         from newemp;
```

Conditional Multi-Table Insert

```
insert first
   when job = 'SALESMAN' then
     into emp
       (empno,ename,job,mgr,hiredate,sal,comm,deptno)
        values
       (empno,ename,job,mgr,hiredate,sal,comm,deptno)
     into bonus (ename,job,sal,comm)
         values (ename,job,sal,comm)
   else
     into emp
       (empno,ename,job,mgr,hiredate,sal,comm,deptno)
     values
       (empno,ename,job,mgr,hiredate,sal,comm,deptno)
  select empno,ename,job,mgr,hiredate,sal,comm,deptno
         from newemp;
```

New ISO/ANSI Join Syntax

- ISO/ANSI Join syntax has been used for several years in some non-Oracle SQL environments
- Oracle invented the original Outer-join syntax and was slow to accept the new style
- ISO/ANSI Join syntax is supported by many third party SQL tools
- The new semantics separate join criteria from other row selection criteria

Cross Join

- Cross Join is designed to provide a "Cartesion Product" type join. It works the same as a comma-delimited join, requiring specification of join conditions in the WHERE clause to avoid the Cartesian Product:

```
select ename,dname
  from emp cross join dept
  where emp.deptno = dept.deptno
```

Natural Join

- Natural joins indicate an equi-join automatically using any column names match to join
- Natural joins may also specify ISO/ANSI join types (INNER, LEFT, RIGHT, FULL; discussed later…)
- Additional criteria may be specified using the WHERE clause.

```
select ename,dname
  from emp natural join dept
```

Join Using

- When join column names are the same, the new syntax now allows the USING clause

```
select dname,ename
 from dept join newemp
 using (deptno)
```

Inner Join

- Traditional Inner Joins match rows tables
- The older syntax names all tables in comma-delimited form and uses the WHERE clause to name Join criteria
- Note that in the example below Join criteria is mixed with row selection criteria:

```
select distinct nvl(dname,'No Dept'),
            count(empno) nbr_emps
     from many_emps emp,many_depts dept
     where emp.deptno = dept.deptno
       and emp.job in ('MANAGER','SALESMAN','ANALYST')
     group by dname;
```

ISO/ANSI Inner Join

- Use INNER JOIN (or simply JOIN) between the table(s) involved and specify one-or-more Join criteria with the ON/USING clause
- Correlation (alias) table names may be specified
- The WHERE clause names only non-Join criteria

```
select distinct nvl(dname,'No Dept'),
            count(empno) nbr_emps
    from many_emps emp join many_depts dept
      on emp.deptno = dept.deptno
    where emp.job in ('MANAGER','SALESMAN','ANALYST')
    group by dname;
```

Joining More Then Two

```
select distinct nvl(dname,'No Dept') dept
      ,count(empno) nbr_emps
      ,round(avg(grade),1) avg_paygrade
    from      many_emps emp
         join many_depts dept
              on emp.deptno = dept.deptno
         join salgrade
              on emp.sal between losal and hisal
    where emp.job in ('MANAGER','SALESMAN','ANALYST')
    group by dname
```

Oracle Outer Join Operator

- Oracle invented the first syntax for solving the outer Join issue years ago
- This is the “(+)” notation used on the side of the Join criteria WHERE clause where null rows are to be created to match the other table

```
select distinct nvl(dname,'No Dept'),
      count(empno) nbr_emps
   from many_emps emp,many_depts dept
   where emp.deptno(+) = dept.deptno
   group by dname;
```

ISO/ANSI Outer Join

- The new ISO/ANSI Join syntax provides three separate capabilities: LEFT, RIGHT, and FULL OUTER JOIN (the word OUTER is redundant and usually omitted)
- With the new syntax, LEFT and RIGHT indicate which side of the join represents the complete set, the opposite side is where null rows will be created

Left/Right Join

- The example below solves the same problem as the Oracle Outer Join operator example earlier:

```
select distinct nvl(dname,'No Dept'),
      count(empno) nbr_emps
  from many_emps emp right join many_depts dept
    on emp.deptno = dept.deptno
   group by dname;
```

Full Outer Join (Union)

- To cause SQL to generate rows on both sides of the join required a UNION using the old Oracle Outer Join operator syntax:

```
select nvl(dname,'No Dept') deptname,
      count(empno) nbr_emps
   from many_emps emp,many_depts dept
   where emp.deptno(+) = dept.deptno
   group by dname
union
select nvl(dname,'No Dept') deptname,
      count(empno) nbr_emps
   from many_emps emp,many_depts dept
   where emp.deptno = dept.deptno(+)
   group by dname;
```

ISO/ANSI Full Outer Join

- The new ISO/ANSI Outer Join mechanism is simpler to code
- To cause rows to be created on either side of a Join as required to align the two tables use the FULL OUTER JOIN (FULL JOIN) syntax:

```
select distinct nvl(dname,'No Dept')
  deptname,count(empno) nbr_emps
  from many_emps emp full join many_depts dept
    on emp.deptno = dept.deptno
   group by dname;
```

Searched CASE Syntax

- Oracle8i added the CASE expression to allow more complex (ANSI/ISO standard) processing than DECODE
- CASE allows IF…THEN…ELSE logic to be placed anywhere in SQL that a column or literal can go
- CASE syntax is as follows:

```
CASE WHEN condition1   THEN expression1
          WHEN condition2   THEN expresssion2
           …
          WHEN conditionn   THEN expressionn
          ELSE expression
END
```

- One WHEN THEN pair is required, ELSE is optional (default is NULL), END is required
- The example on the next page shows CASE being used in three parts of the statement

Training Resources

Searched CASE Example

```
select ename,sal,
      case when job = 'CLERK' then 'GLUE’
           when job = 'MANAGER' then 'SUPER’
           else job
      end job_x
   from emp
   where case when sal < 1000 then sal + 2000
              when sal < 2000 then sal + 1000
              else sal
              end    > 2900
      order by case when sal < 1000 then sal + 9000
                    when sal < 2000 then sal + 7000
                    else sal
               end
```

Output:

```
ENAME       SAL    JOB_X
JONES      2975    SUPER
FORD       3000    ANALYST
SCOTT      3000    ANALYST
KING       5000    PRESIDENT
JAMES       950    GLUE
```

Simple CASE Syntax

- New with Oracle9i, simple CASE syntax compares values to an expression

```
select ename,sal,
       case job when 'CLERK' then 'Producer'
                when 'ANALYST' then 'Producer'
                when 'PRESIDENT' then 'Overhead'
                when 'SALESMAN' then 'Producer'
                else 'Overhead'
       end emptype
   from emp;
```

WITH Subquery Reuse

- WITH allows a subquery to be named and reused

```
with SUMMARY as
   (SELECT dname
              , sum(sal) saltot
              , round(avg(sal),2) avgsal
              , count(distinct empno) nbremps
          from emp join dept
                  on emp.deptno = dept.deptno
               group by dname
   )
 select dname, nbremps, avgsal
   from SUMMARY
   where saltot > ( select sum(saltot) * .25
                        from SUMMARY )
   ORDER BY saltot DESC;
```

Nested Cursor Expressions

- Cursor expressions are new in Oracle9i
- If a cursor expression is used in a select (below), the cursor will be opened for each value fetched by the query
- Cursor expressions may also be used to provide a REFCURSOR value being passed to a procedure or function

```
SELECT dname,
   CURSOR(SELECT sal, comm FROM emp
           WHERE emp.deptno=dept.deptno)
                curval

FROM dept;
```

Scrollable Cursors

- Oracle9i adds support for scrollable cursors to provide compatibility with other database products
- Scrollable cursors are read-only and allow fetch of specific rows, or, previous rows
- So far, OCI programs and Java programs are the only place where these may be used

PL/SQL “In-Sync”

- Oracle9i provides a PL/SQL engine that uses the same SQL as the database!
- SQL inside PL/SQL may use the full SQL provided by the database
- This means that developers no longer need be concerned that some SQL capabilities supported by the database will not be available to PL/SQL code
- All new SQL features are supported by PL/SQL
- Bulk bind may now apply to EXECUTE IMMEDIATE statements

PL/SQL Native Compilation

- Stored PL/SQL may now be compiled into native binary files to improve performance
  - This requires DBA involvement
  - System parameters must be set in the configuration file, using ALTER SYSTEM, or using ALTER SESSION to modify the PLSQL_COMPILER_FLAGS setting

• Native	Compile to native binary
• Interpreted	The default, the way it has always worked

- To the user of the PL/SQL procedure/function there is no difference other than speed of execution

Oracle C++ Call Interface

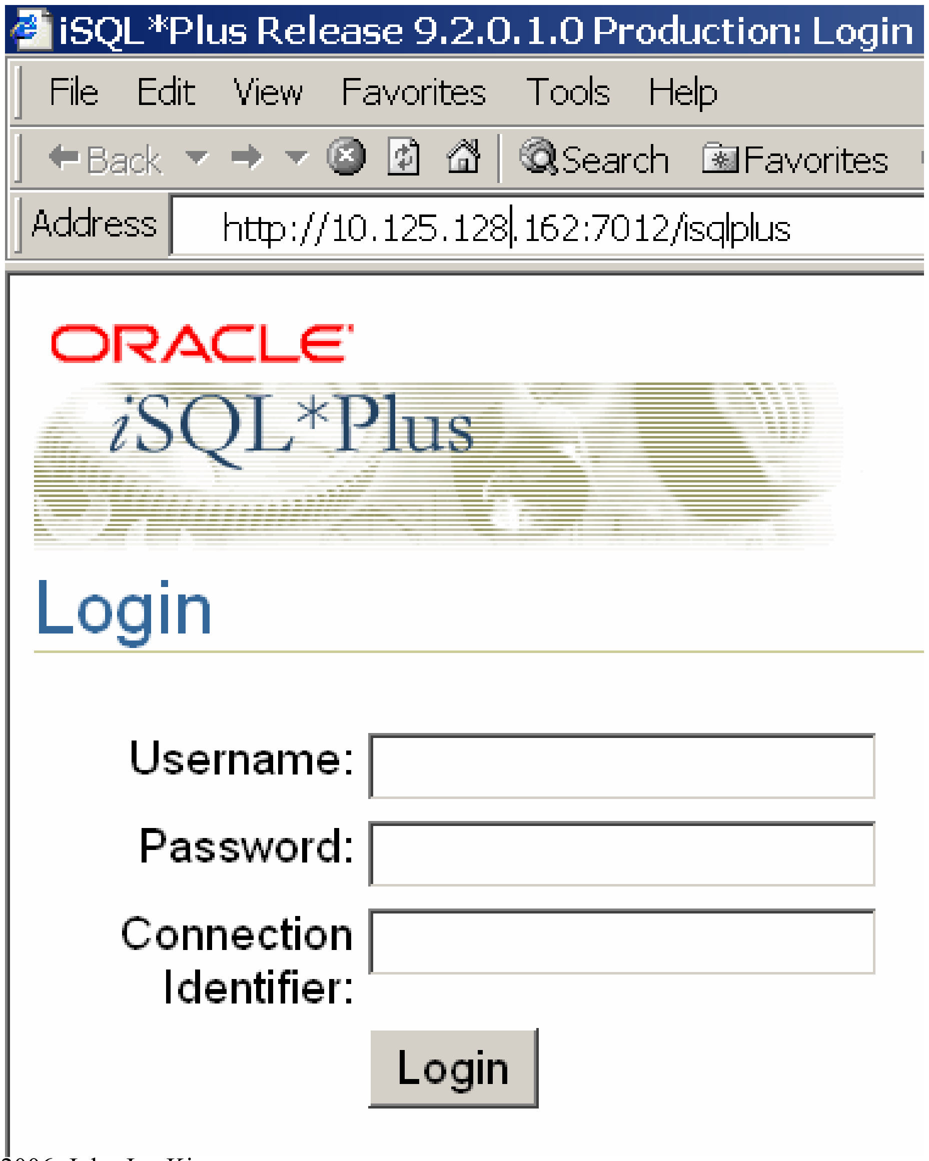
- The Oracle C++ Call Interface (OCCI) allows C++ programmers to create fast database applications
  - Speed of OCI
  - Object-oriented flavor of C++

Object Improvements

- SQL type inheritance and synonyms
- Object view hierarchies
- Type evolution
- User-defined aggregate functions
- User-defined constructors
- Generic and transient data types
- Function-based index support
- Multi-level collections
- C++ interface to Oracle
- Java object storage

iSQL*Plus

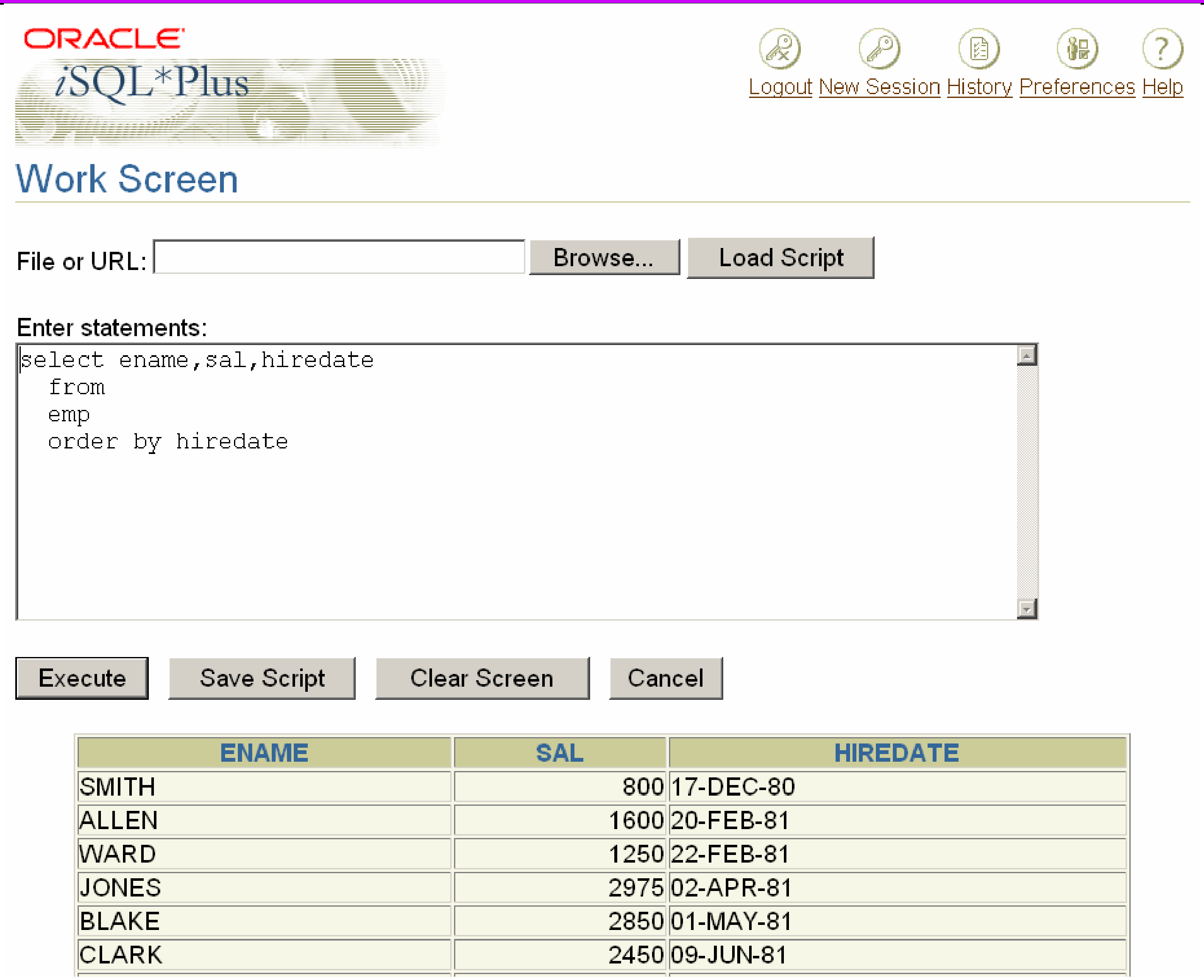
- Oracle9i introduced the iSQL*Plus product allowing SQL*Plus testing from any browser
- No Oracle client required
- No Oracle Net (Net 8 / SQL*Net) connection required


iSQL*Plus Release 9.2.0.1.0 Production: Login
File Edit View Favorites Tools Help
Back Search Favorites
Address
ORACLE
iSQL*Plus
Login
Login

http://10.125.128.162:7012/isqlplus

Username:
Password:
Connection Identifier:

iSQL*Plus Query Results



Work Screen

File or URL:

Enter statements:

```
select ename,sal,hiredate
  from
  emp
  order by hiredate
```

ENAME	SAL	HIREDATE
SMITH	800	17-DEC-80
ALLEN	1600	20-FEB-81
WARD	1250	22-FEB-81
JONES	2975	02-APR-81
BLAKE	2850	01-MAY-81
CLARK	2450	09-JUN-81

DBA-Oriented Features

- As developers, you should be aware of some of the new features at the DBA-level
  - Flashback Query, point-in-time queries
  - Cost-Based Optimizer improvements, new hints
  - Multiple block sizes in a single database
  - Constraints on views

Oracle 10g

- New and improved data types
- SQL improvements
- SQL*Plus improvements
- Enhancements to PL/SQL
- Java and XML improvements

10g Binary_double & Binary_float

- Oracle provides support for the IEEE754 floating-point specification
- BINARY_FLOAT is a 32-bit, single-precision floating-point number stored as 5 bytes, including a length byte
- BINARY_DOUBLE is a 64-bit, double-precision floating-point number stored as 9 bytes, including a length byte
- When processing a NUMBER column, floating point numbers have decimal precision. In a BINARY_
- FLOAT or BINARY_DOUBLE column, floating-point numbers have binary precision
- Both binary floating-point numbers support the special values infinity and NaN (not a number)
- binary_double and binary_float should significantly speed some calculations

	Binary-Float	Binary-Double
Maximum finite value	3.40282E+38F	1.79769313486231E+308
Minimum finite value	1.17549E-38F	2.22507485850720E-308

10g Sdo_georaster & Si_stillimage

- SDO_GEORASTER is an object type defined as follows:

```
CREATE TYPE SDO_GEORASTER AS OBJECT (
        rasterType NUMBER,
        spatialExtent SDO_GEOMETRY,
        rasterDataTable VARCHAR2(32),
        rasterID NUMBER,
        metadata XMLType);
```

- SI_StillImage is an object type that represents digital images and metadata including height, width, and format

10g Limitless LOB

- Since first introduced the Oracle LOB type has been limited to 4GB (enough for most of us)
- Oracle 10g allows LOB data to be limited only by tablespace page size
- Current limit:
  - 8–128 terabytes
- Supported environments:
  - PL/SQL using DBMS_LOB
  - Java using JDBC
  - **C/C++** using OCI

New Oracle 10g Functions

• CARDINALITY	Returns number of elements in nested tables
• CV	Current value of dimension in model clause
• ITERATION_NUMBER	Returns iteration number in model clause rules
• LNNVL	Returns TRUE if condition is FALSE or UNKNOWN
• NANVL	Return alternate value if floating-point is NAN
• ORA_HASH	Computes hash value for given expression
• POWERMULTISET	Return nested table of non-empty sets in nested table
• POWERMULTISET_BY_CARDINALITY	Returns POWERMULTISET for given cardinality
• PRESENTNNV	Present Value of cell in model clause (nulls converted)
• PRESENTV	Present Value of cell in model clause
• PREVIOUS	Returns cell value at beginning of model clause iteration
• REGEXP_INSTR	INSTR using regular expression syntax
• REGEXP_REPLACE	REPLACE using regular expression syntax
• REGEXP_SUBSTR	SUBSTR using regular expression syntax
• REMAINDER	Returns remainder after expression evaluated
• SCN_TO_TIMESTAMP	Returns timestamp for given SCN
• SESSIONTIMEZONE	Timezone of current session
• SET	Converts nested table to set by removing duplicates
• TIMESTAMP_TO_SCN	Returns SCN for given timestamp
• TO_BINARY_DOUBLE	Return binary_double for given char, number, binary
• TO_BINARY_FLOAT	Return binary_float for given char, number, binary

Oracle 10g SQL

- Oracle 10g adds the following SQL statements
  - ALTER DISKGROUP
  - CREATE DISKGROUP
  - DROP DATABASE
  - DROP DISKGROUP
  - FLASHBACK DATABASE
  - FLASHBACK TABLE
  - PURGE
- Oracle 10g removes the following SQL statement
  - CREATE TEMPORARY TABLESPACE
- Oracle 10g modifies 119 SQL statement (too many to list here)

Really Cool 10g Change!!

- Oracle 10g adds two exciting changes to the ALTER SYSTEM statement
- When testing and tuning statements, the values returned by tuning tools are impacted by the actions of Oracle's shared SQL area and buffer cache – take a look at these!!!

```
ALTER SYSTEM FLUSH BUFFER_CACHE
ALTER SYSTEM FLUSH SHARED_POOL
```

(should probably be used in test systems only)

10g New Statistical Functions

- CORR returns the coefficient of correlation of a set of number pairs
- CORR_S calculates the Spearman's rho correlation coefficient
- CORR_K calculates the Kendall's tau-b correlation coefficient
- MEDIAN calculates the statistical median
- STATS_BINOMIAL_TEST an exact probability test
- STATS_CROSSTAB method used to analyze two nominal variables
- STATS_F_TEST tests whether two variances are significantly different
- STATS_KS_TEST compares two samples see if they are from the same population or from populations that have the same distribution
- STATS_MODE returns most frequently occurring value from a set
- STATS_MW_TEST this Mann Whitney test compares two independent samples to test the null hypothesis that two populations have the same distribution function against the alternative hypothesis that the two distribution functions are different
- STATS_ONE_WAY_ANOVA) tests differences in means (for groups or variables) for statistical significance by comparing two different estimates of variance
- STATS_T_TEST_ONE is a one-sample *t*-test
- STATS_T_TEST_PAIRED two-sample, paired *t*-test (also known as a crossed *t*-test)
- STATS_T_TEST_INDEP is a *t*-test of two independent groups with the same variance (pooled variances)
- STATS_T_TEST_INDEPU A *t*-test of two independent groups with unequal variance (unpooled variances)
- STATS_WSR_TEST test of paired samples to determine whether the median of the differences between the samples is significantly different from zero

Example CORR Function

```
select  country,
        corr(sale,cnt)
  from sales_view
  group by country
```

10g Fast Dual

- For years, developers have used the Dual table for “quick and dirty” queries only to find during performance tuning that scans involving dual could be expensive
- In Oracle 10g the optimizer knows about dual and implements an operation called “fast dual” greatly speeding access

10g Connect login.sql/glogin.sql

- The login.sql and glogin.sql files are automatically executed upon entering SQL*Plus,
- In Oracle 10g login.sql and glogin.sql are also executed upon execution of CONNECT
- This is either a blessing or a curse, just be aware that it is happening…

10g SQL*Plus Misc.

- SET SERVEROUTPUT ON now works immediately within PL/SQL block where executed
- Recycle Bin keeps deleted database objects until Purged
- DESCRIBE now validates before display
- White space now allowed in file names
- Substitution variables allowed in SET PROMPT
- APPEND, CREATE, REPLACE extensions to SPOOL

10g Recycle Bin

- SQL*Plus now provides an “oops” capability for object drops (if database is running in “Flashback mode”
- After issuing “DROP ***object*** xyz” the user may issue the following SQL*Plus command to see “dropped objects:

```
SHOW RECYCLEBIN
```

- Then, one of these SQL statements might be executed:

```
PURGE table xx|index yy |recyclebin|tablespace zz;
```

```
FLASHBACK TABLE xxx TO BEFORE DROP;
```

10g Using Recyclebin

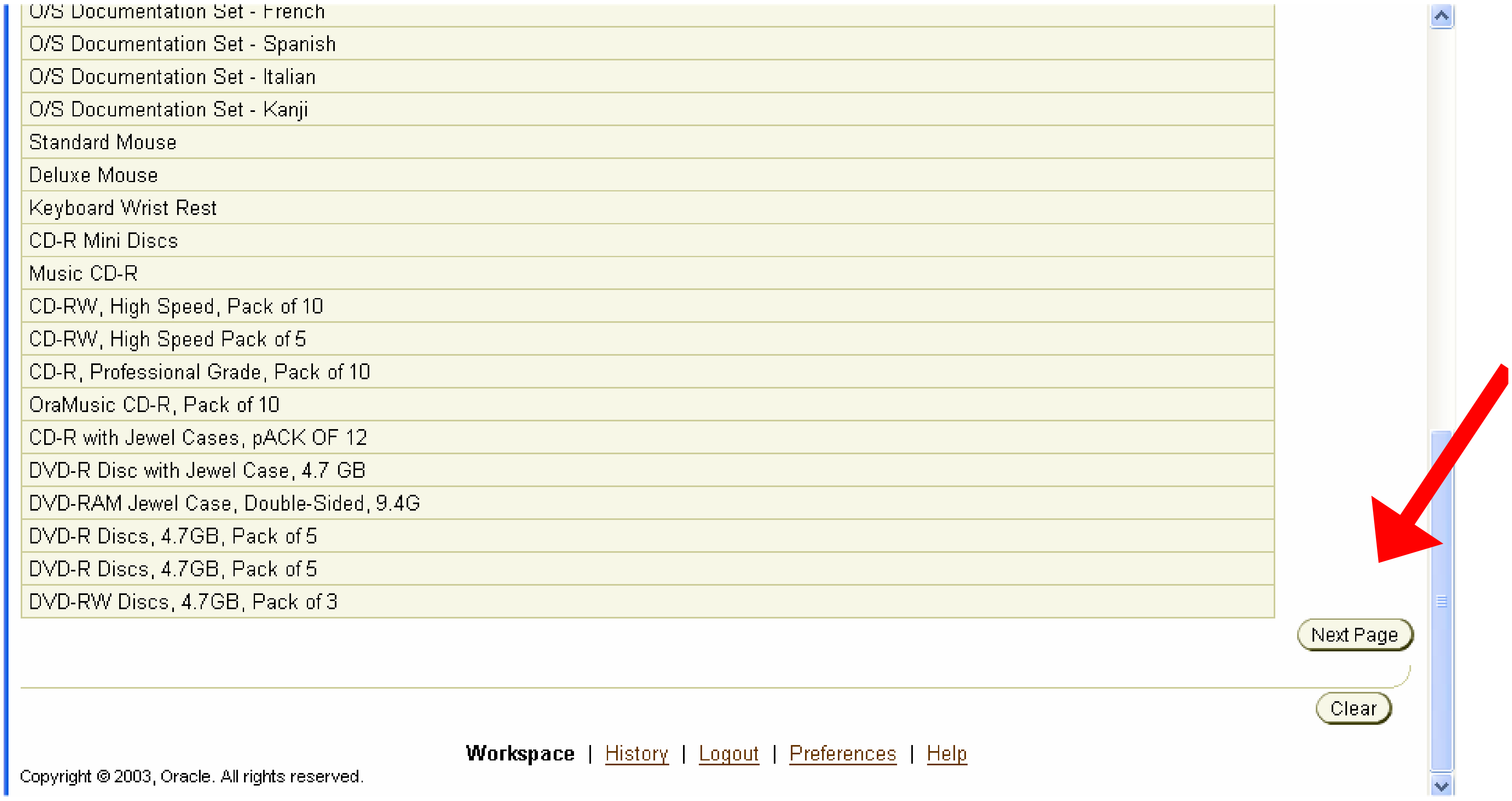
- Careful! Dropping tables no longer really drops them… This might be a problem for applications with lots of “temp”-type tables

```
drop table myTable;

show recyclebin

ORIGINAL     RECYCLEBIN NAME     TYPE  DROP TIME
myTable      RB$$41506$TABLE$0   TABLE 2004-04-01:22:11:13

flashback table myTable to before drop;

drop table myTable purge;
purge recyclebin;
```

iSqlPlus Changes

- Multi-page output
- Prompting for input values

Multi-Page Output



O/S Documentation Set - French
O/S Documentation Set - Spanish
O/S Documentation Set - Italian
O/S Documentation Set - Kanji
Standard Mouse
Deluxe Mouse
Keyboard Wrist Rest
CD-R Mini Discs
Music CD-R
CD-RW, High Speed, Pack of 10
CD-RW, High Speed Pack of 5
CD-R, Professional Grade, Pack of 10
OraMusic CD-R, Pack of 10
CD-R with Jewel Cases, pACK OF 12
DVD-R Disc with Jewel Case, 4.7 GB
DVD-RAM Jewel Case, Double-Sided, 9.4G
DVD-R Discs, 4.7GB, Pack of 5
DVD-R Discs, 4.7GB, Pack of 5
DVD-RW Discs, 4.7GB, Pack of 3

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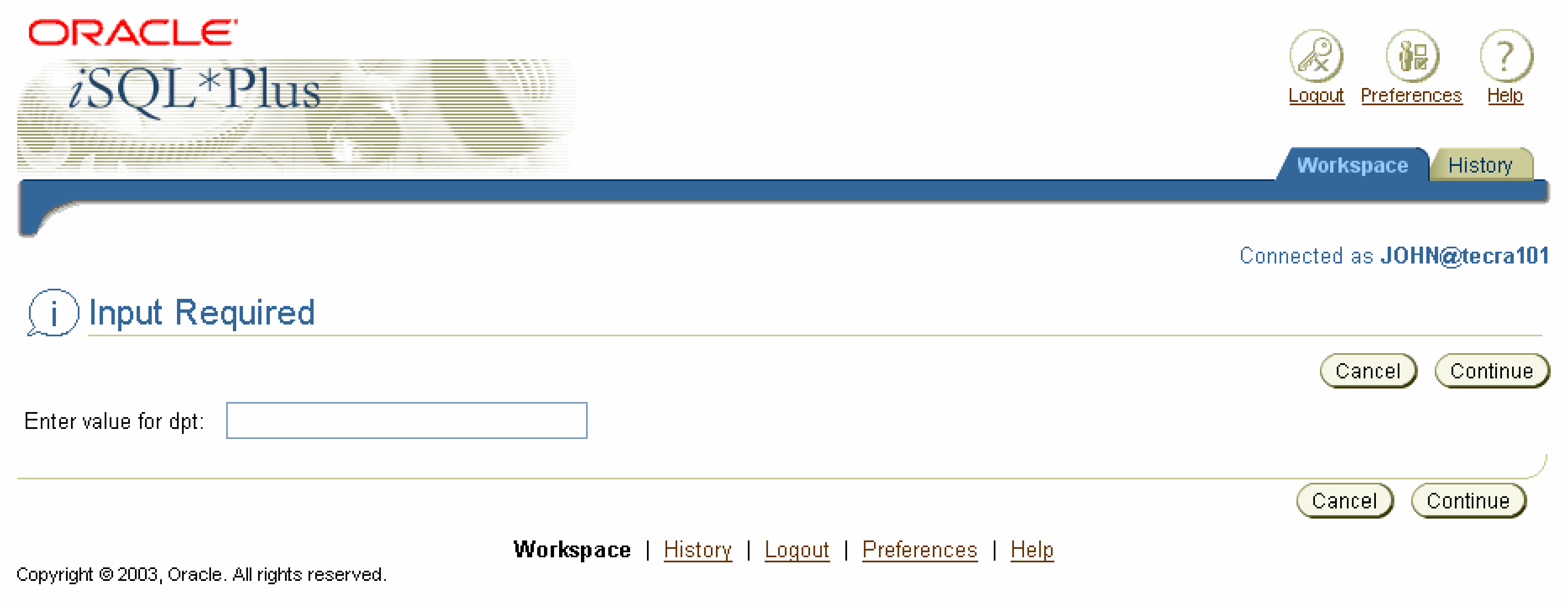
Input Variables

- SQL*Plus panel below displays for this query:

```
select ename
     from emp
     where deptno = &dpt
```



Connected as JOHN@tecra101

Input Required

Enter value for dpt:

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10g Regular Expressions

- Oracle now has three functions that allow the use of POSIX-compliant regular expressions in SQL

– REGEXP_LIKE	Allows pattern matching
– REGEXP_INSTR	Search for string matching pattern and return position
– REGEXP_REPLACE	Find string matching pattern and replace it
– REGEXP_SUBSTR	Search for string matching pattern and return substring

Regular Expression Examples

```
select employee_id,phone_number
    from hr.employees
    where REGEXP_LIKE(phone_number,
          '[[:digit:]]{3}[[:punct:]][[:digit:]]{2}[[:punct:]]');
```

```
select first_name, last_name
    from hr.employees
    where REGEXP_LIKE (first_name, '^ste(v|ph)en$');
```

LIKE vs REGEXP_LIKE

- Here are two statement that generate exactly the same output and nearly the same execution plan

```
select prod_id
     , substr(prod_name,1,20) prod_name
     , substr(prod_desc,1,30) prod_desc
     from sh.products
     where prod_name like ('E%')
        or prod_name like ('P%')
     order by prod_id;

select prod_id
     , substr(prod_name,1,20) prod_name
     , substr(prod_desc,1,30) prod_desc
     from sh.products
     where regexp_like (prod_name,'^E|^P')
     order by prod_id;
```

10g Model Clause

- The SQL MODEL clause is a powerful extension of the SELECT statement
- MODEL provides the ability to present the output of a SELECT in the form of multi-dimensional arrays and apply formulas to the array values
- The Model clause defines a multidimensional array by mapping the columns of a query into three groups: partitioning, dimension, and measure columns
  - Partitions define logical blocks of the result set in a way similar to the partitions of the analytical functions; each partition is viewed by the formulas as an independent array
  - Dimensions identify each measure cell within a partition; each column identifies characteristics such as date, region and product name
  - Measures are similar to the measures of a fact table in a star schema, they normally contain numeric values such as sales units or cost; each cell is accessed within its partition by specifying its full combination of dimensions

10g Model Syntax

```
SELECT
  -- rest of SELECT goes here –
  MODEL [main]
  [reference models]
  [PARTITION BY (<cols>)]
  DIMENSION BY (<cols>)
  MEASURES (<cols>)
  [IGNORE NAV] | [KEEP NAV]
  [RULES
  [UPSERT | UPDATE]
  [AUTOMATIC ORDER | SEQUENTIAL ORDER]
  [ITERATE (n) [UNTIL <condition>] ]
  ( <cell_assignment> = <expression> ... )
```

10g Model Example

```
SELECT SUBSTR(country,1,20) country, SUBSTR(prod,1,15) prod, year, sales
   FROM sales_view
   WHERE country IN ('Canada','Germany')
   MODEL RETURN UPDATED ROWS
        PARTITION BY (country)
        DIMENSION BY (prod, year)
        MEASURES (sale sales)
        RULES (
                sales['Zoop Tube', 2002] = sales['Zoop Tube', 2001] +
                                           sales['Zoop Tube', 2000],
                sales['Hula Twirl', 2002] = sales['Hula Twirl', 2001],
                sales['HulaZoop Pkg', 2002] = sales['Zoop Tube', 2002] +
                                              sales['Hula Twirl', 2002])
   ORDER BY country, prod, year;

COUNTRY                   PROD              YEAR              SALES
--------------------      ---------------   ----------        ----------
Canada                    HulaZoop Pkg      2002               92613.16
Canada                    Zoop Tube         2002                9299.08
Canada                    Hula Twirl        2002               83314.08
Germany                   HulaZoop Pkg      2002              103816.6
Germany                   Zoop Tube         2002               11631.13
Germany                   Hula Twirl        2002               92185.47
```

10g Model Example Explained

- The statement on the preceding page calculates sales values for two products and defines sales for a new product based upon the other two products
  - Statement partitions data by country, so formulas are applied to one country at a time, sales fact data ends with 2001, any rules defining values for 2002 or later will insert new cells
  - First rule defines sales of “Zoop Tube” game in 2002 as the sum of its sales in 2000 and 2001
  - The second rule defines sales for “Hula Twirl” in 2002 to be the same value they were for 2001
  - Third rule defines "HulaZoop Pkg" that is the sum of the Zoop Tube and Hula Twirl values for 2002 -- the rules for Zoop Tube and Hula Twirl must be executed before the HulaZoop Pkg rule

10g Merge Enhanced

- MERGE now allows:
  - Specification of either update, or insert, or both
  - Deletion of rows during update

```
merge
    into bonus
    using emp
    on ( bonus.ename = emp.ename )
    when matched
    then  update -- only one update match allowed!
           set bonus.sal = emp.sal,
               bonus.comm = emp.comm
          delete
           where bonus.sal > 3999  -- values after merge
    when not matched
        then insert
           (ename,job,sal,comm)
          values
           (emp.ename,emp.job,emp.sal,emp.comm);
```

FROM Clause SEED

- For years Oracle SQL has allowed “sampling” to occur using randomized value
- Beginning with Oracle 10g you may now use a SEED to get the same (pretty close anyway) randomized value each time

```
select count(*) nbr_rows
   from sh.sales;                          NBR_ROWS = 918843
select count(*) * 10 nbr_rows
   from sh.sales sample(10);               NBR_ROWS = 921400
select count(*) * 10 nbr_rows
   from sh.sales sample(10);               NBR_ROWS = 917400
select count(*) * 10 nbr_rows
   from sh.sales sample(10) seed(1);       NBR_ROWS = 913280
select count(*) * 10 nbr_rows
   from sh.sales sample(10) seed(1);       NBR_ROWS = 913280
```

10g HTML DB

- Oracle HMTL DB is a complete web development and deployment environment built into Oracle 10g
- HTML DB is based upon the home-grown software that helped make Tom Kyte's "Ask Tom" website so powerful
- HTML DB is designed to make building web applications easy without compromising flexibility when building web applications
- Pre-built components are assembled using wizards and declarative programming eliminating most need to write code
- Some of the built-in features include:
  - Page Rendering and Processing Engine Rather than generating code, Oracle HTML DB stores user interface properties and data access and logic behaviors in an application definition; when an HTML DB application is run pages are rendered in real time based upon an application definition stored in the database
  - Logic to determine how a user flows from page to page, data validation and form handlers are all built in to the processing engine
  - Deployment is automatic, immediately after an application is built or changed users can start using it
- Pre-Built components are used with wizards, to assemble applications with forms, reports, and charts without writing code; the pre-built components include: navigational controls, authentication schemes and user interface themes

Recent Developments

- Oracle SQL Developer
  - Oracle's 'TOAD' – only up to date & free!
- Conditional PL/SQL statements
- Error logging for INSERT, UPDATE, DELETE based upon subquery SELECT

```
INSERT INTO newtable
        AS SELECT ....
         LOG ERRORS (mylabel)
     INTO myuser.mylogtable
     REJECT LIMIT unlimited
```

Oracle Documentation

- Oracle9i and Oracle10g
  - Oracle9i SQL Reference
  - Oracle9i PL/SQL User’s Guide and Reference
  - Oracle9i Application Developer's Guide - Object-Relational Features
  - Oracle9i Concepts
  - Oracle XML DB Developer’s Guide
- Oracle10g
  - Oracle10g SQL Reference
  - Oracle10g PL/SQL User’s Guide and Reference
  - Oracle10g Application Developer's Guide - Object-Relational Features
  - Oracle10g Concepts
  - Oracle XML DB Developer’s Guide
- Lots of papers and examples:
  http://technet.oracle.com
  http://tahiti.oracle.com

Wrapping it all Up

- Oracle9i adds significant new functionality to the already robust database environment;
  10g goes even further
- While an emphasis is sometimes placed on the features of Oracle that support the Data Base Administrator, this paper shows many Developer-oriented features of great usefulness
- The importance of ISO/ANSI constructs cannot be underestimated, with the frequent use of third-party tools and occasional movement of applications; following an international standard makes sense

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Oracle 10g for Developers:
What You Need to Know

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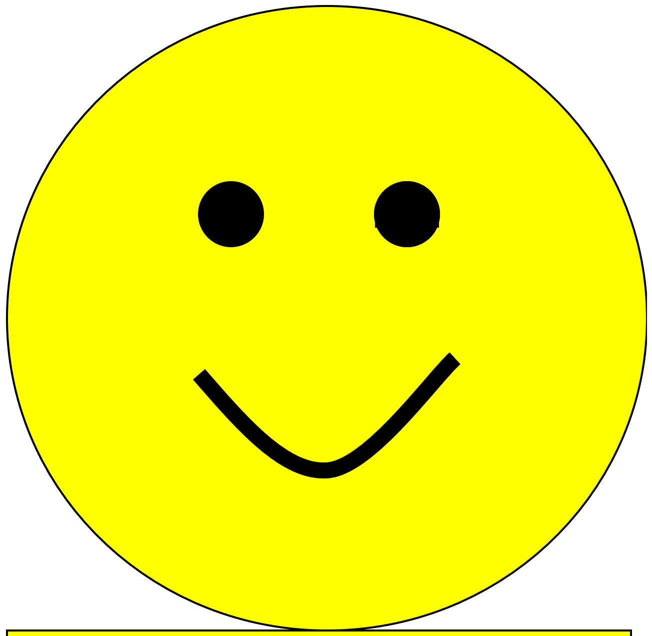

Thanks for your attention!

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