

Advanced PLSQL

Lesson 04: PLSQL collection elements

Lesson Objectives

In this lesson you will learn

- PLSQL Collection elements
 - PLSQL Tables
 - Nested tables
 - Varrays
 - Associative Arrays



PLSQL Collections

- A Collection is a group of elements of the same kind
- There are three types of Collections that you can use in PL/SQL.
 - PL/SQL Tables
 - Nested Tables
 - Variable Arrays(VARRAY).
 - Associative Arrays

4.1: PLSQL tables

PLSQL Tables

- Collection of elements with the same name and same datatype.
- A PL/SQL table has two columns, one is a PRIMARY KEY called the index, and the other holds the elements
- The value column may have any datatype
- The key column must be binary_integer

PL/SQL Table Example

```
DECLARE
    TYPE num_table IS TABLE OF NUMBER
    INDEX BY binary_integer;
    num_rec num_table;
BEGIN
    SELECT salary
    INTO num_rec(1)
    FROM sales_person
    WHERE sales_person_id = 800;
    Dbms_output.Put_line (num_rec(1));
END;
```

4.2: PLSQL Nested tables


Nested Tables

- Nested Tables act as one-column database tables, which can store multiple rows of data from a database table.
- Oracle does not store rows in a nested table in any particular order, but if you retrieve a table into a PL/SQL Collection, the rows are indexed consecutively starting at 1.

Nested Tables

1	Bombay
2	Sydney
3	Oxford
4	London
..

2 GB max.



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Nested Table Example

```
DECLARE
    TYPE color IS TABLE OF VARCHAR2 (20);
    rainbow color;
BEGIN
    rainbow := color ('RED', 'ORANGE', 'YELLOW',
                     'GREEN', 'BLUE', 'INDIGO', 'VIOLET');
    FOR ctr IN 1..7 LOOP
        Dbms_output.Put_line (rainbow (ctr));
    END LOOP;
END;
```


PL/SQL tables Vs Nested tables

PL/SQL tables

- Cannot be used to define the type of a database column
- You cannot SELECT, INSERT, UPDATE, or DELETE elements in a PL/SQL Table.
- Elements can have negative indices
- Increasing the number of elements is easy you just have to assign a new element.

Nested tables

- Can be used to define the type of a database column
- You can SELECT, INSERT, UPDATE, or DELETE elements in a Nested Table
- Elements cannot have negative indices
- To increase the number of elements, you must use the EXTEND method to increase the size of the Collection


4.3: VARRAYS

Variable Arrays

- VARRAY, allow you to connect a single identifier with an entire Collection of data.
- They are different from Nested tables in that you must specify an upper limit for the number of elements
- A VARRAY is generally used when you must retrieve an entire Collection that is not very large.

VARRAY

1	Bombay
2	Sydney
3	Oxford
4	London
..
10	Tokyo

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VARARRAY Example

```
DECLARE
    TYPE temperature IS VARARRAY(52) OF NUMBER;
    weekly_temp temperature := temperature(60, 65, 70, 65, 59, 60, 74);
    temp_count binary_integer;
BEGIN
    temp_count := weekly_temp.count;
    IF weekly_temp.LIMIT - temp_count > 0 THEN
        weekly_temp.EXTEND;
        weekly_temp (temp_count + 1) := 73;
    END IF;
    FOR i IN 1..weekly_temp.COUNT LOOP
        Dbms_output.Put_line (i || chr(9) || weekly_temp(i));
    END LOOP;
END;
```

4.4: Associative arrays

Associative Arrays (INDEX BY Tables)

- An associative array is a PL/SQL collection with two columns:
 - Primary key of integer or string data type
 - Column of scalar or record data type

Key	Values
1	JONES
2	HARDEY
3	MADURO
4	KRAMER

Associative Array Structure

1

Unique key column

...
1
5
3
...

PLS_INTEGER

2

---- Values column ----


...
Jones
Smith
Maduro
...

Scalar

<or>

...		
410	ADMIN	Jones
103	ADMIN	Smith
176	IT_PROG	Maduro
...		

Record



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Associative Array Structure

Syntax:

```
1 TYPE type_name IS TABLE OF  
  {column_type | variable%TYPE  
  | table.column%TYPE} [NOT NULL]  
  | table%ROWTYPE  
  | INDEX BY PLS_INTEGER | BINARY_INTEGER  
  | VARCHAR2(<size>);  
2 identifier    type_name;
```

Example:

```
...  
TYPE ename_table_type IS TABLE OF  
  employees.last_name%TYPE  
  INDEX BY PLS_INTEGER;  
...  
ename_table ename_table_type;
```

Creating and Accessing Associative Arrays

```
...  
DECLARE  
  TYPE ename_table_type IS TABLE OF  
    employees.last_name%TYPE  
    INDEX BY PLS_INTEGER;  
  TYPE hiredate_table_type IS TABLE OF DATE  
    INDEX BY PLS_INTEGER;  
  ename_table    ename_table_type;  
  hiredate_table hiredate_table_type;  
BEGIN  
  ename_table(1) := 'CAMERON';  
  hiredate_table(8) := SYSDATE + 7;  
  IF ename_table.EXISTS(1) THEN  
    INSERT INTO ...  
  END;
```

anonymous block completed
ENAME HIREDT

CAMERON 23-JUN-09
1 rows selected

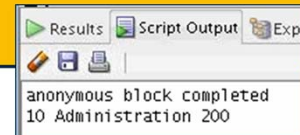
Using INDEX BY Table Methods

- The following methods make associative arrays easier to use:
 - EXISTS
 - COUNT
 - FIRST
 - LAST
 - PRIOR
 - NEXT
 - DELETE

INDEX BY Table of Records Option

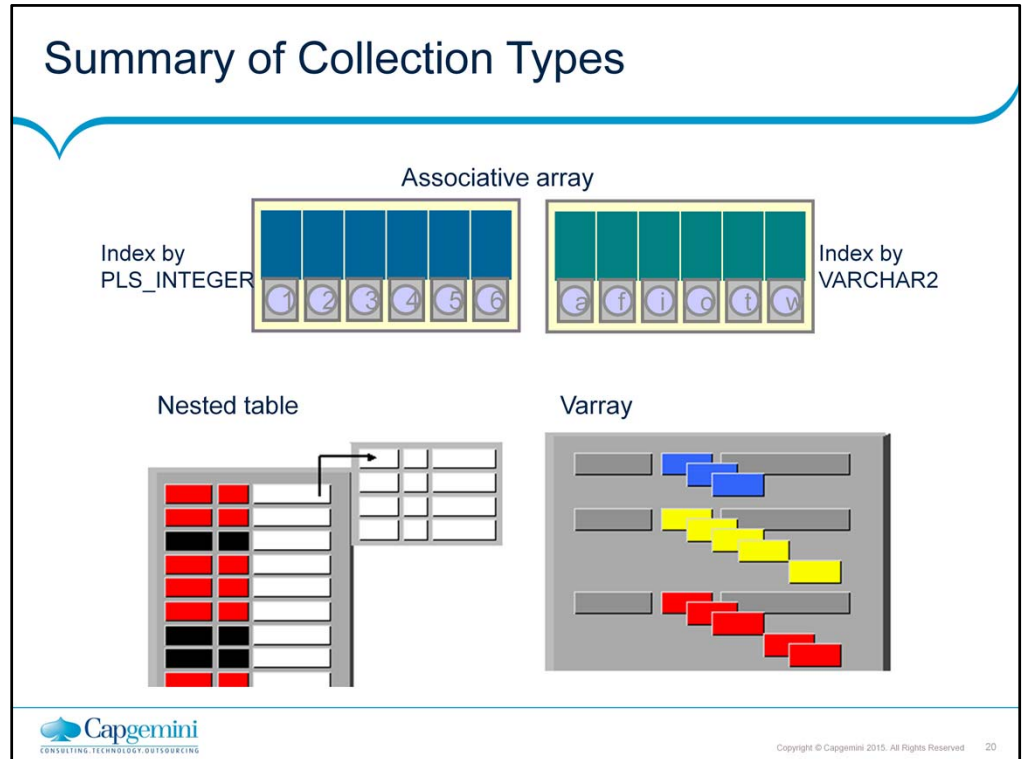
- Define an associative array to hold an entire row from a table.

```
DECLARE
  TYPE dept_table_type IS TABLE OF
    departments%ROWTYPE INDEX PLS_INTEGER;
  dept_table dept_table_type;
  -- Each element of dept_table is a record
Begin
  SELECT * INTO dept_table(1) FROM departments
    WHERE department_id = 10;
  DBMS_OUTPUT.PUT_LINE(dept_table(1).department_id || ||
    dept_table(1).department_name || ||
    dept_table(1).manager_id);
END;
/
```



INDEX BY Table of Records Option: Example 2

```
DECLARE
  TYPE emp_table_type IS TABLE OF
    employees%ROWTYPE INDEX BY PLS_INTEGER;
  my_emp_table emp_table_type;
  max_count    NUMBER(3):= 104;
BEGIN
  FOR i IN 100..max_count
  LOOP
    SELECT * INTO my_emp_table(i) FROM employees
    WHERE employee_id = i;
  END LOOP;
  FOR i IN my_emp_table.FIRST..my_emp_table.LAST
  LOOP
    DBMS_OUTPUT.PUT_LINE(my_emp_table(i).last_name);
  END LOOP;
END;
/
```



Summary

- In this lesson you have learnt:
- Collection elements like
 - PLSQL Tables
 - Nested tables
 - Varrays
 - Associative Arrays



Add the notes here.

Review Question

- List PLSQL collections elements.
- Nested Table is known as a sparse collection because a nested table can contain empty elements.
 - True/False
- _____ can be opened on the server and passed to the client as a unit rather than fetching one row at a time.



Add the notes here.