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Vocabulary

Identify the vocabulary word for each definition below:

PL/SQL collection	A set of occurrences of the same kind of data
INDEX BY table	A collection which is based on a single field or column; for example, on the last_name column of EMPLOYEES
INDEX BY table of records	A collection which is based on a composite record type; for example, on the whole DEPARTMENTS row

Try It / Solve It

1. PL/SQL collections:
   a. In your own words, describe what a PL/SQL collection is.
   Answer : A PL/SQL collection is a set of two or more (usually) many occurrences of the same kind of data. It is a named variable in PL/SQL. The collection's data is stored in a private memory area, like any other PL/SQL variable

   b. Which of the following are collections and which are not?
      1. A list of all employees' last names
      2. The character value "Chang"
      3. The populations of all countries in Europe
      4. All the data stored in the employees table about a specific employee.

   Answer : 1 and 3 are collections. 2 is a scalar. 4 is a composite record structure but not a collection, since each data item occurs only once.

   c. What is the difference between an INDEX BY table and a database table such as EMPLOYEES or COUNTRIES?
   Answer : Database tables are stored in the database, ie on disk, and are therefore permanent (until DROPped). Their data can be seen and used by any database user with the correct privileges. INDEX BY tables are PL/SQL variables stored in a memory area, and are not permanent. Their contents are private to the creating session and cannot be seen by any other session or user.

   d. Describe the difference between an INDEX BY table and an INDEX BY table of records.
   Answer : In an INDEX BY table, each element or "member" of the table is a single scalar value such as a last name. In an INDEX BY table of records, each element is a record structure such as a whole employee row. Both kinds of INDEX BY table also have a numeric primary key which serves as an index into the table.

   e. Look at the following code. Describe the difference between t_pops and v_pops_tab. Is v_pops_tab an INDEX BY table or an INDEX BY table of records? How do you know?

```
DECLARE
TYPE t_pops IS TABLE OF countries.population%TYPE INDEX BY
BINARY_INTEGER;
```

v_pops_tab t_pops;
Answer : t_pops declares a type and v_pops_tab declares a variable of that type. v_pops_tab is an INDEX BY table (not of records) because each element is a single scalar variable (a population value).

2. INDEX BY tables of countries in South America:
   a. Write and execute an anonymous block that declares and populates an INDEX BY table of countries in South America (region_id = 5). The table should use country_id as a primary key, and should store the country names as the element values. The data should be stored in the table in ascending sequence of country_id. The block should not display any output. Saveyour code.
   Answer :

```
declare
 type t_country_names is table of wf_countries.country_name%type
 index by binary_integer;
 v_country_names t_country_names;

 cursor country_curs is
 select country_id, country_name
 from wf_countries
 where region_id = 5
 order by country_id asc;
 v_country_rec country_curs%rowtype;
begin
 open country_curs;
 loop
  fetch country_curs into v_country_rec;
  exit when country_curs%notfound;
  v_country_names(v_country_rec.country_id) := v_country_rec.country_name;
 end loop;
 close country_curs;
end;
```

   b. Modify the block so that after populating the INDEX BY table, it uses a FOR loop to display the contents of the INDEX BY table. You will need to use the FIRST, LAST, and EXISTS table methods. Execute the block and check the displayed results. Save your code.
   Answer :

```
declare
 type t_country_names is table of wf_countries.country_name%type
 index by binary_integer;
 v_country_names t_country_names;

 cursor country_curs is
 select country_id, country_name
 from wf_countries
 where region_id = 5
 order by country_id asc;
 v_country_rec country_curs%rowtype;
begin
 open country_curs;
 loop
  fetch country_curs into v_country_rec;
```

```
    exit when country_curs%notfound;
    v_country_names(v_country_rec.country_id) := v_country_rec.country_name;
   end loop;
   close country_curs;
   for i in v_country_names.first..v_country_names.last loop
    if v_country_names.exists(i) then
     dbms_output.put_line('country id : '|| i || ', country name : '|| v_country_names(i));
    end if;
   end loop;
  end;
```

c. Modify the block again so that instead of displaying all the contents of the table, it displays only the first and last elements and the number of elements in the INDEX BY table. Execute the block and check the displayed results.

Answer :

```
  declare
   type t_country_names is table of wf_countries.country_name%type
   index by binary_integer;
   v_country_names t_country_names;

   cursor country_curs is
   select country_id, country_name
   from wf_countries
   where region_id = 5
   order by country_id asc;
   v_country_rec country_curs%rowtype;
  begin
   open country_curs;
   loop
    fetch country_curs into v_country_rec;
    exit when country_curs%notfound;
    v_country_names(v_country_rec.country_id) := v_country_rec.country_name;
   end loop;
   close country_curs;
    dbms_output.put_line(v_country_names.first || ' ' ||
  v_country_names(v_country_names.first));
    dbms_output.put_line(v_country_names.last || ' ' ||
  v_country_names(v_country_names.last));
    dbms_output.put_line('Number of countries is: ' || v_country_names.count);
  end;
```

3. INDEX BY tables of records:

a. Write and execute an anonymous block that declares and populates an INDEX BY table of records containing employee data. The table of records should use the employee id as a primary key, and each element should contain an employee's last name, job id, and salary. The data should be stored in the INDEX BY table of records in ascending sequence of employee id. The block should not display any output.

Hint: declare a cursor to fetch the employee data, then declare the INDEX BY table as *cursor name*%ROWTYPE. Save your code.

Answer :

```
declare
   cursor c_employees is
   select employee_id, job_id, salary
   from employees
   order by employee_id asc;
   v_employees_rec   c_employees%rowtype;

   type t_employees is table of c_employees%rowtype
   index by binary_integer;
   v_employees_data  t_employees;
begin
  open c_employees;
   loop
    fetch c_employees into v_employees_rec;
    exit when c_employees%notfound;
    v_employees_data(v_employees_rec.employee_id) := v_employees_rec;
   end loop;
end;
```

b. Modify the block so that after populating the table of records, it uses a FOR loop to display to display the contents. You will need to use the FIRST, LAST and EXISTS table methods. Execute the block and check the displayed results. Save your code.
Answer :

```
declare
   cursor c_employees is
   select employee_id, job_id, salary
   from employees
   order by employee_id asc;
   v_employees_rec   c_employees%rowtype;

   type t_employees is table of c_employees%rowtype
   index by binary_integer;
   v_employees_data  t_employees;
begin
 open c_employees;
   loop
     fetch c_employees into v_employees_rec;
     exit when c_employees%notfound;
     v_employees_data(v_employees_rec.employee_id) := v_employees_rec;
   end loop;
 close c_employees;

 for i in v_employees_data.first..v_employees_data.last loop
   if v_employees_data.exists(i) then
    dbms_output.put_line('country id : '|| i || v_employees_data(i).salary);
   end if;
 end loop;
end;
```