

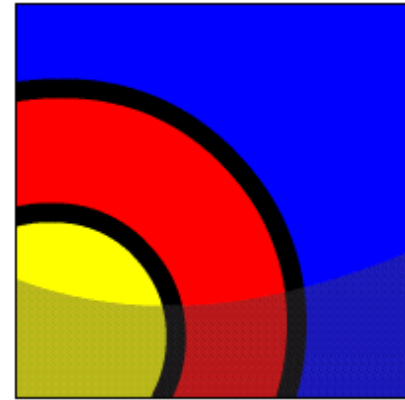
Iterative Control: WHILE and FOR Loops



What Will I Learn?

In this lesson, you will learn to:

- Construct and use the `WHILE` looping construct in PL/SQL
- Construct and use the `FOR` looping construct in PL/SQL
- Describe when a `WHILE` loop is used in PL/SQL
- Describe when a `FOR` loop is used in PL/SQL





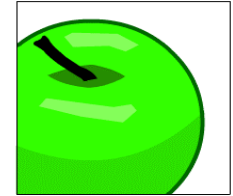
Why Learn It?

The previous lesson discussed the basic loop, which required that the statements inside the loop execute at least once.

This lesson introduces the `WHILE` loop and `FOR` loop. The `WHILE` loop is a looping construct, which requires that the `EXIT` condition be evaluated at the start of each iteration. The `FOR` loop should be used if the number of iterations is known.



Tell Me/Show Me



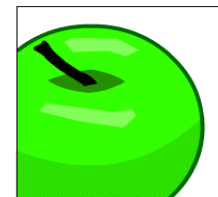
WHILE Loops:

You can use the `WHILE` loop to repeat a sequence of statements until the controlling condition is no longer `TRUE`. The condition is evaluated at the start of each iteration. The loop terminates when the condition is `FALSE` or `NULL`. If the condition is `FALSE` or `NULL` at the start of the loop, then no further iterations are performed.

Syntax:

```
WHILE condition LOOP
  statement1;
  statement2;
  . . .
END LOOP;
```

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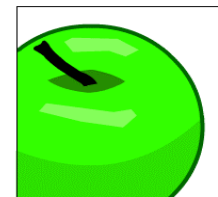


WHILE Loops (continued):

- In the syntax:
 - *condition* is a Boolean variable or expression (TRUE, FALSE, or NULL)
 - *statement* can be one or more PL/SQL or SQL statements
- If the variables involved in the conditions do not change during the body of the loop, then the condition remains TRUE and the loop does not terminate.
- **Note:** If the condition yields NULL, then the loop is bypassed and the control passes to the next statement.

```
WHILE condition LOOP
    statement1;
    statement2;
    . . .
END LOOP;
```

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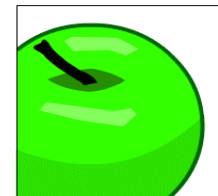


WHILE Loops (continued):

In the example in the slide, three new location IDs for the country code CA and the city of Montreal are being added. The counter is explicitly declared in this example.

```
DECLARE
  v_countryid  locations.country_id%TYPE := 'CA';
  v_loc_id     locations.location_id%TYPE;
  v_new_city   locations.city%TYPE := 'Montreal';
  v_counter    NUMBER := 1;
BEGIN
  SELECT MAX(location_id) INTO v_loc_id FROM locations
    WHERE country_id = v_countryid;
  WHILE v_counter <= 3 LOOP
    INSERT INTO locations(location_id, city, country_id)
      VALUES((v_loc_id + v_counter), v_new_city, v_countryid);
    v_counter := v_counter + 1;
  END LOOP;
END;
```

Tell Me/Show Me

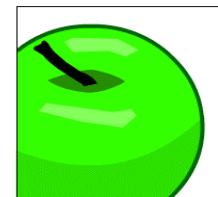


WHILE Loops (continued):

With each iteration through the WHILE loop, a counter (`v_counter`) is incremented. If the number of iterations is less than or equal to the number 3, then the code within the loop is executed and a row is inserted into the locations table. After the counter exceeds the number of new locations for this city and country, the condition that controls the loop evaluates to FALSE and the loop is terminated.

```
DECLARE
  v_countryid  locations.country_id%TYPE := 'CA';
  v_loc_id     locations.location_id%TYPE;
  v_new_city   locations.city%TYPE := 'Montreal';
  v_counter    NUMBER := 1;
BEGIN
  SELECT MAX(location_id) INTO v_loc_id FROM locations
    WHERE country_id = v_countryid;
  WHILE v_counter <= 3 LOOP
    INSERT INTO locations(location_id, city, country_id)
      VALUES((v_loc_id + v_counter), v_new_city, v_countryid);
    v_counter := v_counter + 1;
  END LOOP;
END;
```

Tell Me/Show Me



FOR Loops:

FOR loops have the same general structure as the basic loop. In addition, they have a control statement before the `LOOP` keyword to set the number of iterations that PL/SQL performs.

```
FOR counter IN [REVERSE]
    lower_bound..upper_bound LOOP
    statement1;
    statement2;
    . . .
END LOOP;
```

- Use a `FOR` loop to shortcut the test for the number of iterations.
- Do not declare the counter; it is declared implicitly.
- *lower_bound* .. *upper_bound* is the required syntax.



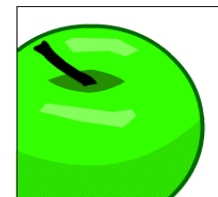
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FOR Loops (continued):

- In the syntax:
 - *Counter* is an implicitly declared integer whose value automatically increases or decreases (decreases if the REVERSE keyword is used) by 1 on each iteration of the loop until the upper or lower bound is reached.
 - REVERSE causes the counter to decrement with each iteration from the upper bound to the lower bound. (Note that the lower bound is still referenced first.)
 - *lower_bound* specifies the lower bound for the range of counter values.
 - *upper_bound* specifies the upper bound for the range of counter values.
- Do not declare the counter; it is declared implicitly as an integer.

```
FOR counter IN [REVERSE]
    lower_bound..upper_bound LOOP
    statement1;
    statement2;
    . . .
END LOOP;
```

Tell Me/Show Me



FOR Loops (continued):

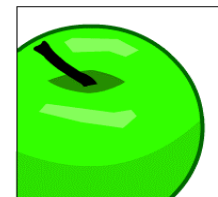
- **Note:** The sequence of statements is executed each time the counter is incremented, as determined by the two bounds. The lower bound and upper bound of the loop range can be literals, variables, or expressions, but must evaluate to integers. The bounds are rounded to integers—that is, $1\frac{1}{3}$ or $8\frac{5}{5}$ are valid upper or lower bounds. The lower bound and upper bound are inclusive in the loop range. If the lower bound of the loop range evaluates to a larger integer than the upper bound, then the sequence of statements will not be executed.

For example, the following statement is executed only once:

```
FOR i in 3..3  
LOOP  
    statement1;  
END LOOP;
```



Tell Me/Show Me



FOR Loops (continued):

You have already learned how to insert three new locations for the country code CA and the city Montreal by using the simple LOOP and the WHILE loop. The slide shows you how to achieve the same by using the FOR loop.

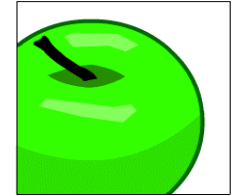
```
DECLARE
  v_countryid  locations.country_id%TYPE := 'CA';
  v_loc_id     locations.location_id%TYPE;
  v_new_city   locations.city%TYPE := 'Montreal';
BEGIN
  SELECT MAX(location_id) INTO v_loc_id
    FROM locations
   WHERE country_id = v_countryid;
  FOR i IN 1..3 LOOP
    INSERT INTO locations(location_id, city, country_id)
      VALUES((v_loc_id + i), v_new_city, v_countryid );
  END LOOP;
END;
```

Tell Me/Show Me

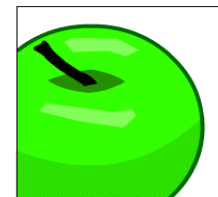
FOR Loops:

Guidelines

- Reference the counter within the loop only; it is undefined outside the loop.
- Do not reference the counter as the target of an assignment.
- Neither loop bound should be `NULL`.



Tell Me/Show Me



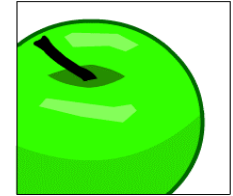
FOR Loops:

While writing a FOR loop, the lower and upper bounds of a LOOP statement do not need to be numeric literals. They can be expressions that convert to numeric values.

Example:

```
DECLARE
  v_lower  NUMBER := 1;
  v_upper  NUMBER := 100;
BEGIN
  FOR i IN v_lower..v_upper LOOP
    ...
  END LOOP;
END;
```

Tell Me/Show Me



Guidelines For Using Loops :

- Use the basic loop when the statements inside the loop must execute at least once.
- Use the `WHILE` loop if the condition has to be evaluated at the start of each iteration.
- Use a `FOR` loop if the number of iterations is known.

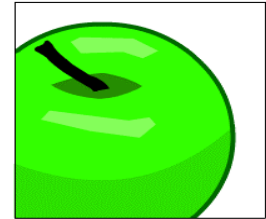
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Terminology

Key terms used in this lesson include:

WHILE loops

FOR loops

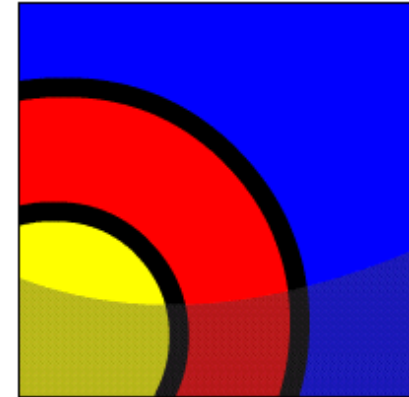




Summary

In this lesson, you learned to:

- Construct and use the `WHILE` looping construct in PL/SQL
- Construct and use the `FOR` looping construct in PL/SQL
- Describe when a `WHILE` loop is used in PL/SQL
- Describe when a `FOR` loop is used in PL/SQL





Try It/Solve It

The exercises in this lesson cover the following topics:

- Constructing and using `WHILE` loops in PL/SQL
- Constructing and using `FOR` loops in PL/SQL
- Describing when a `WHILE` loop is used in PL/SQL
- Describing when a `FOR` loop is used in PL/SQL

