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Database Programming with PL/SQL

4-5

Iterative Control: Nested Loops

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Objectives

- This lesson covers the following objectives:
  - Construct and execute PL/SQL using nested loops
  - Label loops and use the labels in EXIT statements
  - Evaluate a nested loop construct and identify the exit point

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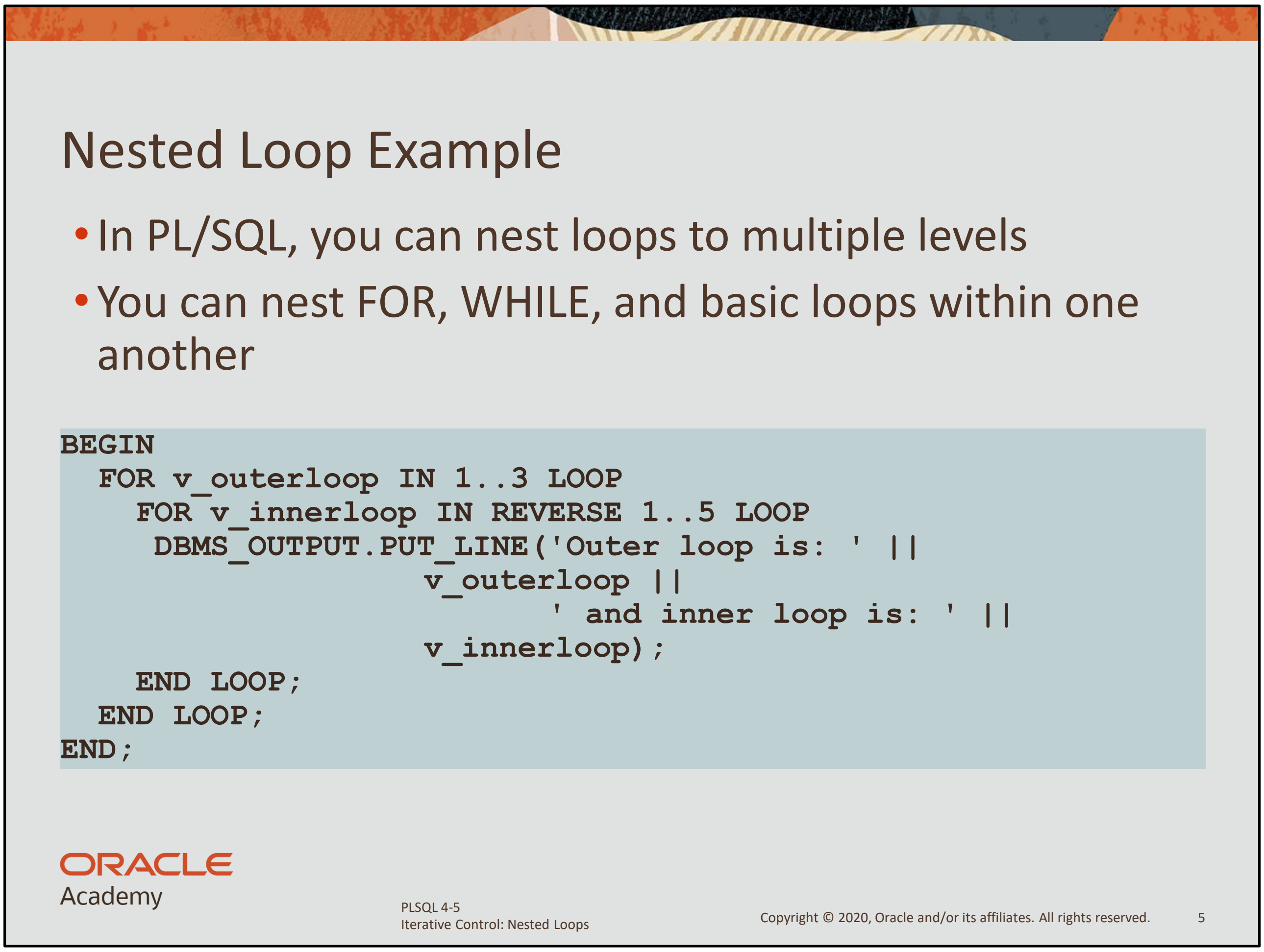
Purpose

- You’ve learned about looping constructs in PL/SQL
- This lesson discusses how you can nest loops to multiple levels
- You can nest FOR, WHILE, and basic loops within one another



Nested Loop Example

- In PL/SQL, you can nest loops to multiple levels
- You can nest FOR, WHILE, and basic loops within one another

```
BEGIN
  FOR v_outerloop IN 1..3 LOOP
    FOR v_innerloop IN REVERSE 1..5 LOOP
     DBMS_OUTPUT.PUT_LINE('Outer loop is: ' ||
                    v_outerloop ||
                           ' and inner loop is: ' ||
                    v_innerloop);
    END LOOP;
  END LOOP;
END;
```

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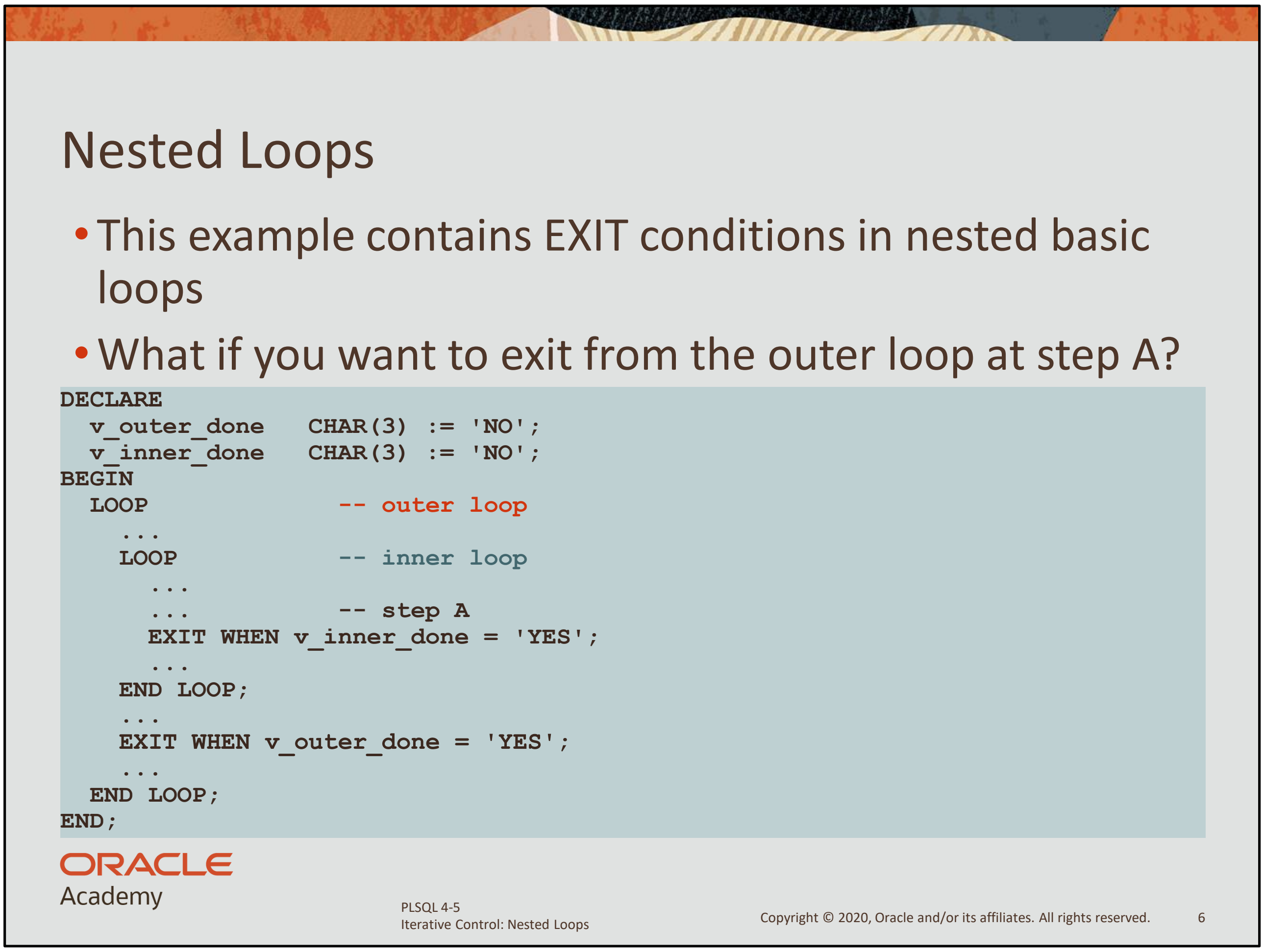
The slide example shows a FOR loop nested inside another FOR loop. But (for example) we could nest a WHILE loop inside a FOR loop; or a FOR loop inside a basic loop; or etc. All combinations are allowed.



Nested Loops

- This example contains EXIT conditions in nested basic loops
- What if you want to exit from the outer loop at step A?

```
DECLARE
  v_outer_done   CHAR(3) := 'NO';
  v_inner_done   CHAR(3) := 'NO';
BEGIN
  LOOP               -- outer loop
    ...
    LOOP             -- inner loop
      ...
      ...            -- step A
      EXIT WHEN v_inner_done = 'YES';
      ...
    END LOOP;
    ...
    EXIT WHEN v_outer_done = 'YES';
    ...
  END LOOP;
END;
```

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Answer : We will discuss loop labels in the next slides to answer this question.

Notice that when V_INNER_DONE = 'YES', PL/SQL exits the inner loop but the outer loop continues executing.

Loop Labels

- Loop labels are required in this example in order to exit an outer loop from within an inner loop

```
DECLARE
  ...
BEGIN
 <<outer_loop>>
  LOOP                 -- outer loop
    ...
    <<inner_loop>>
    LOOP               -- inner loop
      EXIT outer_loop WHEN ...  -- exits both loops
      EXIT WHEN v_inner_done = 'YES';
      ...
    END LOOP;
    ...
    EXIT WHEN v_outer_done = 'YES';           ...
  END LOOP;
END;
```

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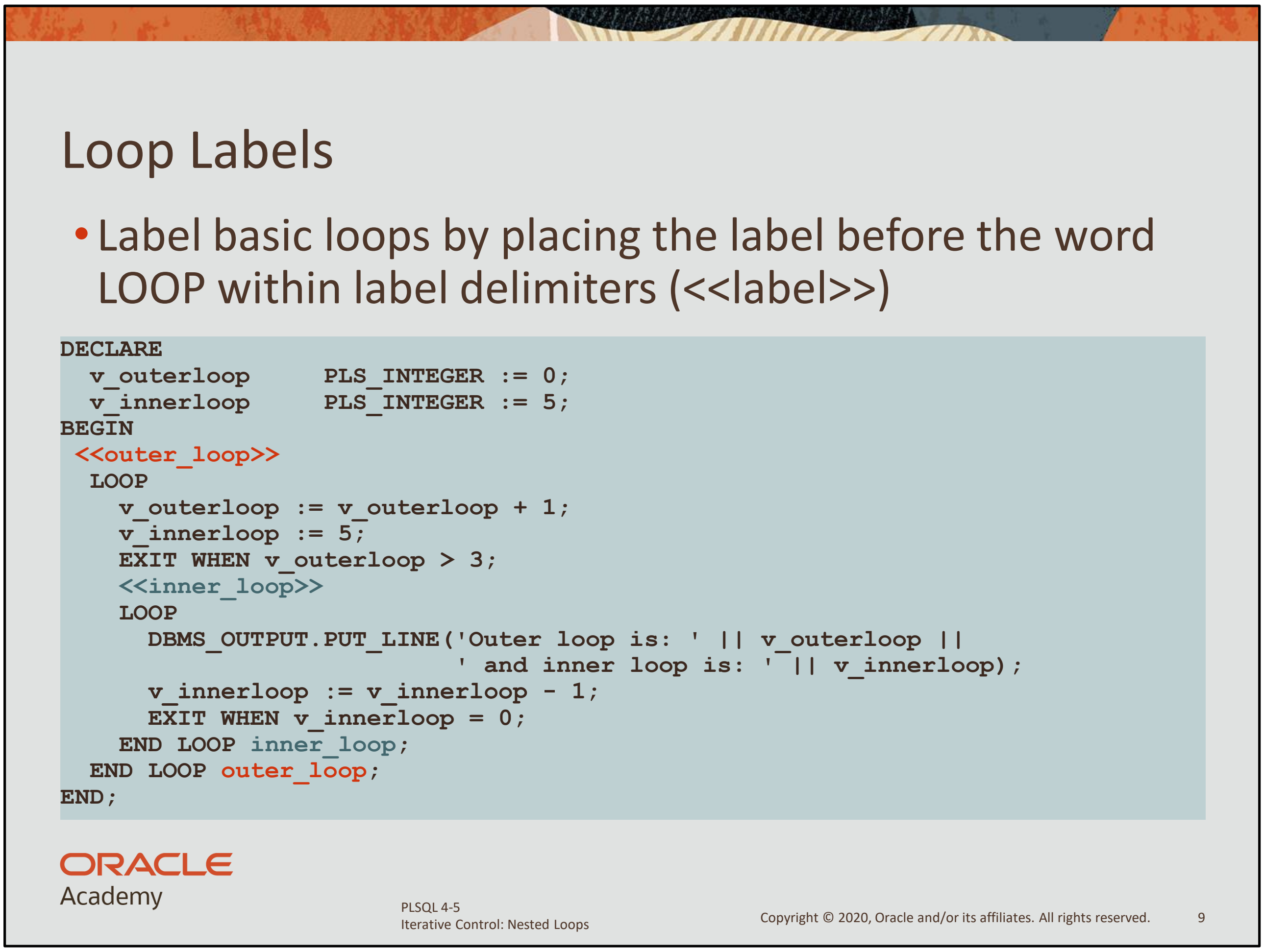
Loop Labels

- Loop label names follow the same rules as other identifiers
- A label is placed before a statement, either on the same line or on a separate line
- In FOR or WHILE loops, place the label before FOR or WHILE within label delimiters (<<label>>)
- If the loop is labeled, the label name can optionally be included after the END LOOP statement for clarity



Loop Labels

- Label basic loops by placing the label before the word LOOP within label delimiters (<<label>>)

```
DECLARE
  v_outerloop     PLS_INTEGER := 0;
  v_innerloop     PLS_INTEGER := 5;
BEGIN
 <<outer_loop>>
  LOOP
    v_outerloop := v_outerloop + 1;
    v_innerloop := 5;
    EXIT WHEN v_outerloop > 3;
    <<inner_loop>>
    LOOP
      DBMS_OUTPUT.PUT_LINE('Outer loop is: ' || v_outerloop ||
                           ' and inner loop is: ' || v_innerloop);
      v_innerloop := v_innerloop - 1;
      EXIT WHEN v_innerloop = 0;
    END LOOP inner_loop;
  END LOOP outer_loop;
END;
```

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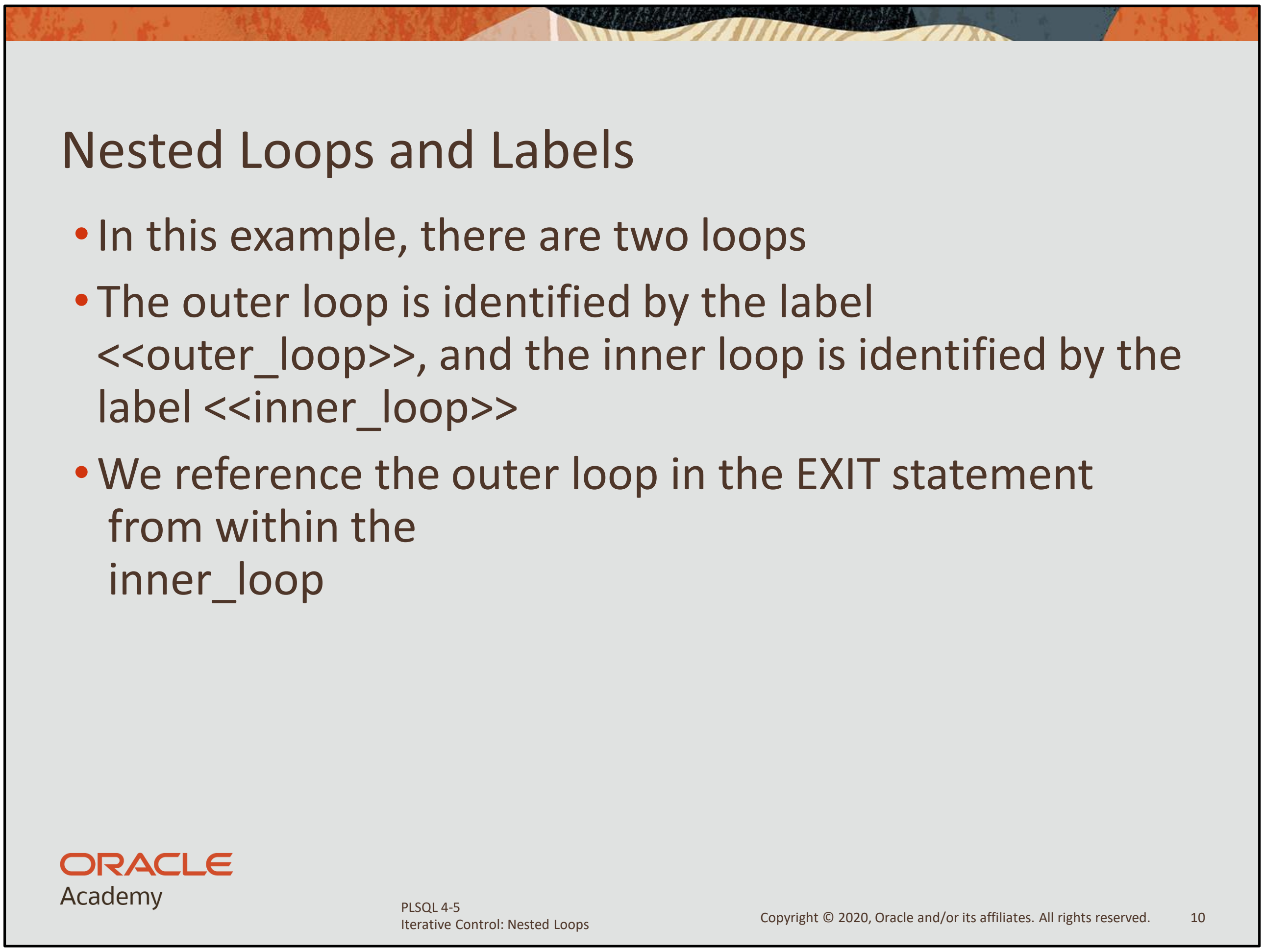
The loop labels are not required in this example, but they do make the code more readable.



Nested Loops and Labels

- In this example, there are two loops
- The outer loop is identified by the label <<outer_loop>>, and the inner loop is identified by the label <<inner_loop>>
- We reference the outer loop in the EXIT statement from within the inner_loop

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Nested Loops and Labels

```
...BEGIN
  <<outer_loop>>
  LOOP
    v_counter := v_counter + 1;
  EXIT WHEN v_counter > 10;
    <<inner_loop>>
    LOOP              ...
      EXIT outer_loop WHEN v_total_done = 'YES';
      -- Leave both loops
      EXIT WHEN v_inner_done = 'YES';
      -- Leave inner loop only             ...
    END LOOP inner_loop;          ...
  END LOOP outer_loop;
END;
```

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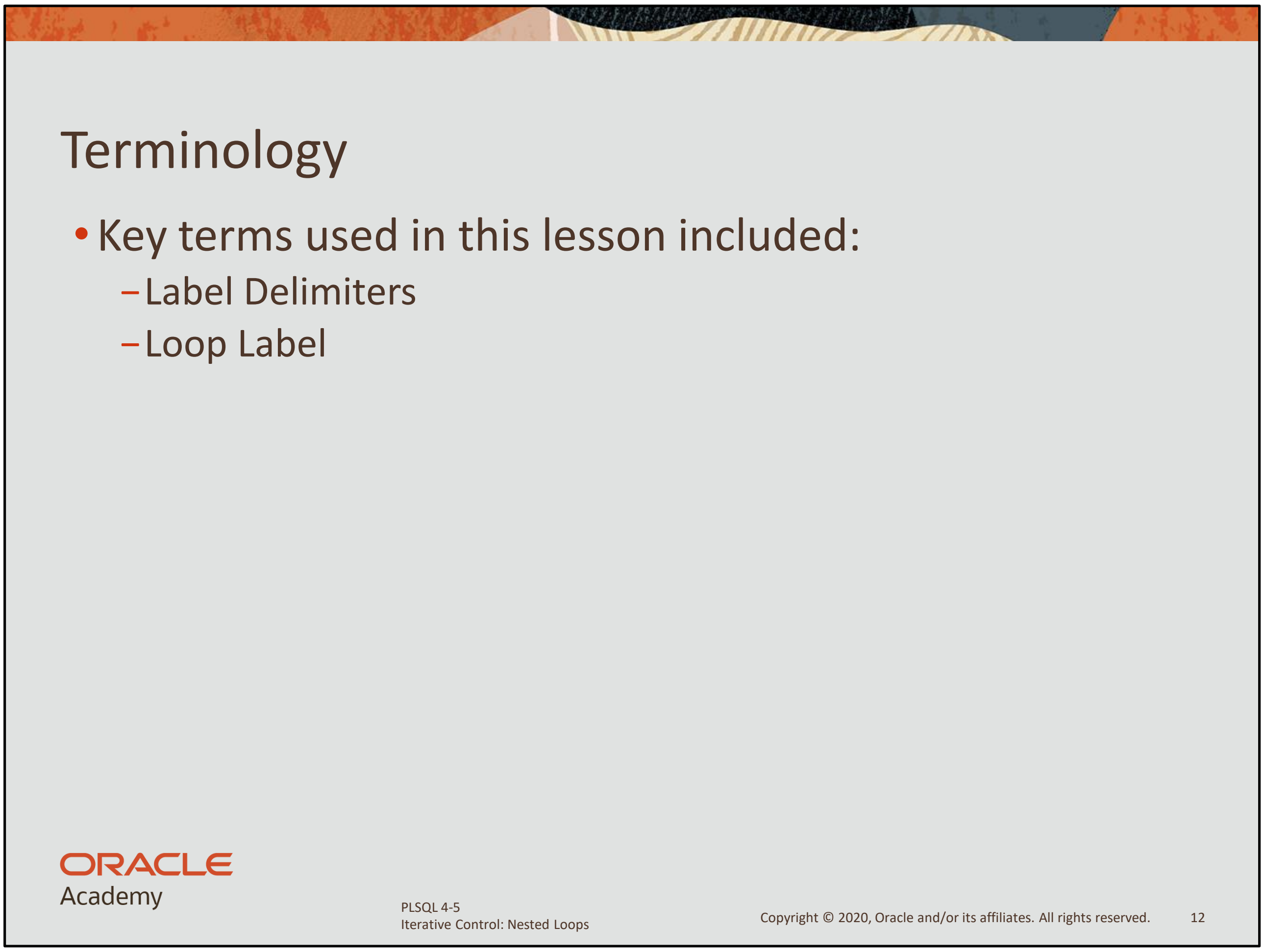
Terminology

- Key terms used in this lesson included:
  - Label Delimiters
  - Loop Label

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- Label Delimiters – Characters placed before (<<) and after (>>) a loop label to identify the label as a loop label.
- Loop Label – A loop identifier that is required in order to exit an outer loop from within an inner loop.

Summary

- In this lesson, you should have learned how to:
  - Construct and execute PL/SQL using nested loops
  - Label loops and use the labels in EXIT statements
  - Evaluate a nested loop construct and identify the exit point

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