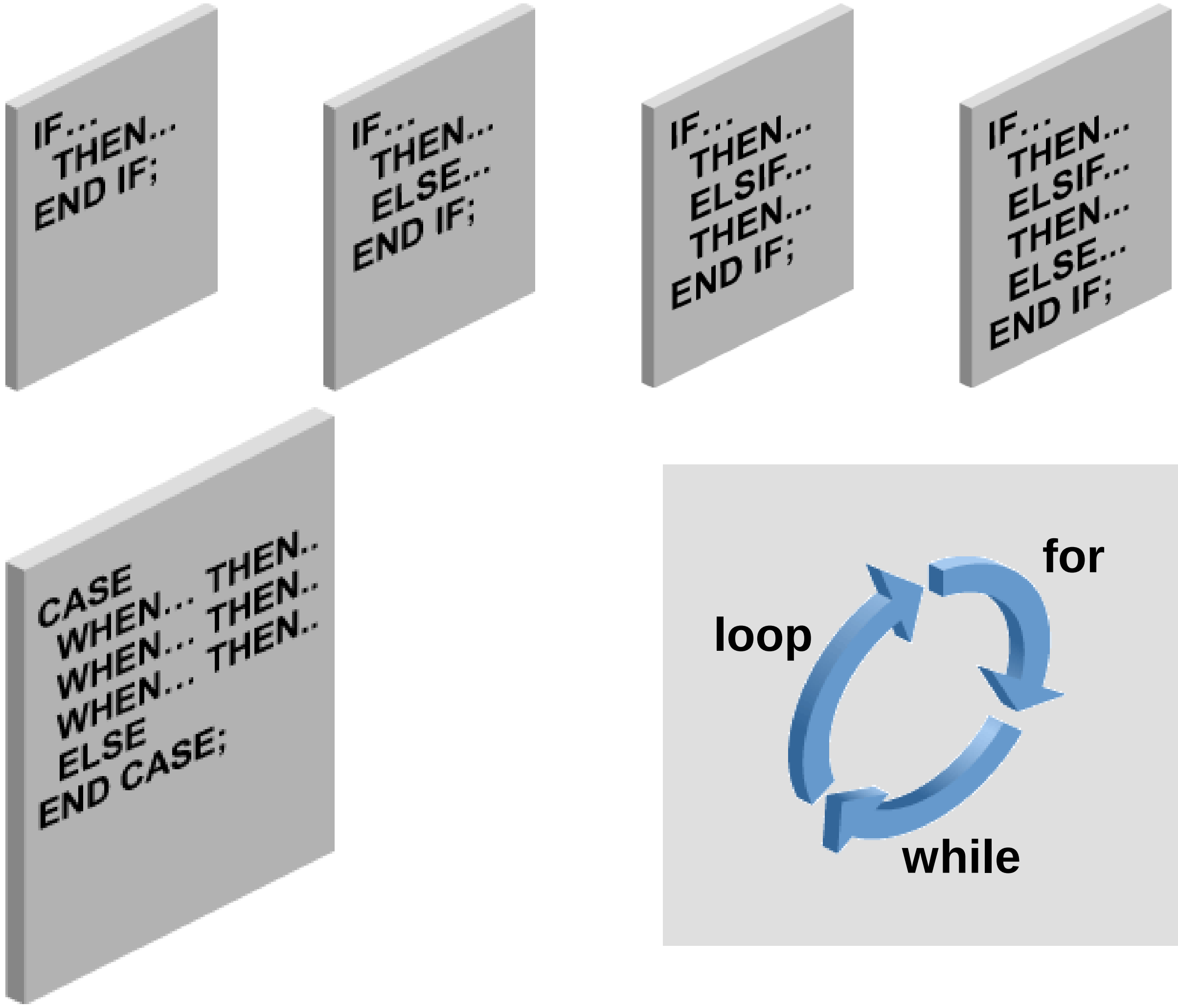
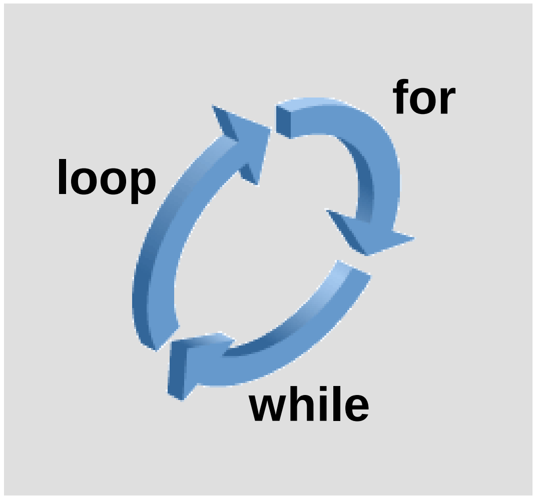
Writing Control Structures

Objectives

- After completing this lesson, you should be able to do the following:
  - Identify the uses and types of control structures
  - Construct an `IF` statement
  - Use `CASE` statements and `CASE` expressions
  - Construct and identify different loop statements
  - Use guidelines when using conditional control structures

Controlling Flow of Execution





IF STATEMENTS

Syntax:

```
IF condition THEN
  statements;
[ELSIF condition THEN
  statements;]
[ELSE
  statements;]
END IF;
```

Simple IF Statement

```
DECLARE
  myage number:=31;
BEGIN
  IF myage < 11
  THEN
    DBMS_OUTPUT.PUT_LINE(' I am a child ');
  END IF;
END;
/
```

```
PL/SQL procedure successfully completed.
```

IF THEN ELSE STATEMENT

```
SET SERVEROUTPUT ON
DECLARE
myage number:=31;
BEGIN
IF myage < 11
 THEN
     DBMS_OUTPUT.PUT_LINE(' I am a child ');
 ELSE
     DBMS_OUTPUT.PUT_LINE(' I am not a child ');
END IF;
END;
/
```

```
I am not a child
PL/SQL procedure successfully completed.
```

IF

```
DECLARE
myage number:=31;
BEGIN
IF myage < 11
 THEN
       DBMS_OUTPUT.PUT_LINE(' I am a child ');
   ELSIF myage < 20
     THEN
       DBMS_OUTPUT.PUT_LINE(' I am young ');
   ELSIF myage < 30
     THEN
       DBMS_OUTPUT.PUT_LINE(' I am in my twenties');
   ELSIF myage < 40
     THEN
       DBMS_OUTPUT.PUT_LINE(' I am in my thirties');
 ELSE
    DBMS_OUTPUT.PUT_LINE(' I am always young ');
END IF;
END;
/
```

```
I am in my thirties
PL/SQL procedure successfully completed.
```

NULL VALUES IN IF STATEMENTS

```
DECLARE
myage number;
BEGIN
IF myage < 11
 THEN
    DBMS_OUTPUT.PUT_LINE(' I am a child ');
 ELSE
    DBMS_OUTPUT.PUT_LINE(' I am not a child ');
END IF;
END;
/
```

```
I am not a child
PL/SQL procedure successfully completed.
```

CASE EXPRESSIONS

- A CASE expression selects a result and returns it.
- To select the result, the CASE expression uses expressions. The value returned by these expressions is used to select one of several alternatives.

```
CASE selector
   WHEN expression1 THEN result1
   WHEN expression2 THEN result2
   ...
   WHEN expressionN THEN resultN
  [ELSE resultN+1]
END;
/
```

CASE Expressions: Example

```
SET SERVEROUTPUT ON
SET VERIFY OFF
DECLARE
   grade CHAR(1) := UPPER('&grade');
   appraisal VARCHAR2(20);
BEGIN
   appraisal :=
      CASE grade
         WHEN 'A' THEN 'Excellent'
         WHEN 'B' THEN 'Very Good'
         WHEN 'C' THEN 'Good'
         ELSE 'No such grade'
      END;
DBMS_OUTPUT.PUT_LINE ('Grade: '|| grade || '
                       Appraisal ' || appraisal);
END;
/
```

Searched CASE Expressions

```
DECLARE
   grade CHAR(1) := UPPER('&grade');
   appraisal VARCHAR2(20);
BEGIN
    appraisal :=
     CASE
         WHEN grade = 'A' THEN 'Excellent'
         WHEN grade IN ('B','C') THEN 'Good'
         ELSE 'No such grade'
     END;
   DBMS_OUTPUT.PUT_LINE ('Grade: '|| grade || '
                  Appraisal ' || appraisal);
END;
/
```

CA

```
DECLARE
   deptid NUMBER;
   deptname VARCHAR2(20);
   emps NUMBER;
   mngid NUMBER:= 108;
BEGIN
  CASE  mngid
   WHEN  108 THEN
    SELECT department_id, department_name
     INTO deptid, deptname FROM departments
     WHERE manager_id=108;
    SELECT count(*) INTO emps FROM employees
     WHERE department_id=deptid;
   WHEN  200 THEN
    ...
 END CASE;
DBMS_OUTPUT.PUT_LINE ('You are working in the '|| deptname||
' department. There are '||emps ||' employees in this
department');
END;
/
```

Handling Nulls

- When working with nulls, you can avoid some common mistakes by keeping in mind the following rules:
  - Simple comparisons involving nulls always yield `NULL`.
  - Applying the logical operator `NOT` to a null yields `NULL`.
  - If the condition yields `NULL` in conditional control statements, its associated sequence of statements is not executed.

Logic Tables

- Build a simple Boolean condition with a comparison operator.

AND	*TRUE*	*FALSE*	*NULL*
TRUE	TRUE	FALSE	NULL
FALSE	FALSE	FALSE	FALSE
NULL	NULL	FALSE	NULL

OR	*TRUE*	*FALSE*	*NULL*
TRUE	TRUE	TRUE	TRUE
FALSE	TRUE	FALSE	NULL
NULL	TRUE	NULL	NULL

NOT	
TRUE	FALSE
FALSE	TRUE
NULL	NULL

Boolean Conditions

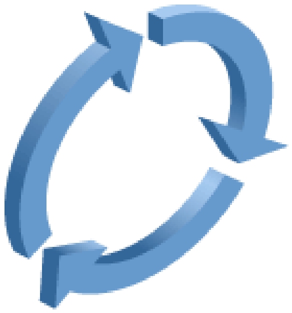
- What is the value of `flag` in each case?

```
flag := reorder_flag AND available_flag;
```

REORDER_FLAG	AVAILABLE_FLAG	FLAG
TRUE	TRUE	? (1)
TRUE	FALSE	? (2)
NULL	TRUE	? (3)
NULL	FALSE	? (4)

ITERATIVE CONTROL: `LOOP` STATEMENTS

- Loops repeat a statement or sequence of statements multiple times.
- There are three loop types:
  - Basic loop
  - `FOR` loop
  - `WHILE` loop



Basic Loops

- Syntax:

```
LOOP
  statement1;
  . . .
  EXIT [WHEN condition];
END LOOP;
```

Basic Loops

- Example

```
DECLARE
  countryid    locations.country_id%TYPE := 'CA';
  loc_id       locations.location_id%TYPE;
  counter       NUMBER(2) := 1;
  new_city     locations.city%TYPE := 'Montreal';
BEGIN
  SELECT MAX(location_id) INTO loc_id FROM locations
  WHERE country_id = countryid;
  LOOP
    INSERT INTO locations(location_id, city, country_id)
    VALUES((loc_id + counter), new_city, countryid);
    counter := counter + 1;
    EXIT WHEN counter > 3;
  END LOOP;
END;
/
```

WHILE Loops

- Syntax:

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

- Use the `WHILE` loop to repeat statements while a condition is `TRUE`.

WHILE LOOPS

- Example

```
DECLARE
  countryid   locations.country_id%TYPE := 'CA';
  loc_id      locations.location_id%TYPE;
  new_city    locations.city%TYPE := 'Montreal';
  counter     NUMBER := 1;
BEGIN
  SELECT MAX(location_id) INTO loc_id FROM locations
  WHERE country_id = countryid;
  WHILE counter <= 3 LOOP
    INSERT INTO locations(location_id, city, country_id)
    VALUES((loc_id + counter), new_city, countryid);
    counter := counter + 1;
  END LOOP;
END;
/
```

FOR LOOPS

- 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 required syntax.

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

FOR LOOPS

- Example

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

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`.

Guidelines for Loops

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

Nested Loops and Labels

- You can nest loops to multiple levels.
- Use labels to distinguish between blocks and loops.
- Exit the outer loop with the `EXIT` statement that references the label.

Nested Loops and Labels

```
...
BEGIN
  <<Outer_loop>>
  LOOP
    counter := counter+1;
  EXIT WHEN counter>10;
    <<Inner_loop>>
    LOOP
      ...
      EXIT Outer_loop WHEN total_done = 'YES';
      -- Leave both loops
      EXIT WHEN inner_done = 'YES';
      -- Leave inner loop only
      ...
    END LOOP Inner_loop;
    ...
  END LOOP Outer_loop;
END;
/
```

SUMMARY

- In this lesson, you should have learned how to change the logical flow of statements by using the following control structures:
  - Conditional (`IF` statement)
  - `CASE` expressions and `CASE` statements
  - Loops:
    - Basic loop
    - `FOR` loop
    - `WHILE` loop
  - `EXIT` statements

Practice 5: Overview

- This practice covers the following topics:
  - Performing conditional actions by using the `IF` statement
  - Performing iterative steps by using the loop structure