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# Database Programming with PL/SQL

## 2-4
## Using Scalar Data Types

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# Objectives

This lesson covers the following objectives:

- Declare and use scalar data types in PL/SQL
- Define guidelines for declaring and initializing PL/SQL variables
- Identify the benefits of anchoring data types with the %TYPE attribute

# Purpose

- Most of the variables you define and use in PL/SQL have scalar data types.
- A variable can have an explicit data type, such as VARCHAR2, or it can automatically have the same data type as a table column in the database.
- You will learn the benefits of basing some variables on table columns.

# Declaring Character Variables

- All variables must be declared.
- The data itself will determine what data type you assign to each variable.
- Commonly used character data types include CHAR and VARCHAR2.
- Columns that may exceed the 32,767 character limit of a VARCHAR2 could be defined using LONG, but should be defined using CLOB.

```
DECLARE
 v_country_id        CHAR(2);
 v_country_name      VARCHAR2(70);
 v_country_rpt       CLOB;
...
```

# Declaring Number Variables

- Number data types include NUMBER, INTEGER, PLS_INTEGER, BINARY_FLOAT and several others.
- Adding the keyword CONSTANT constrains the variable so that its value cannot change.
- Constants must be initialized.

```
DECLARE
 v_employee_id      NUMBER(6,0);
 v_loop_count       INTEGER := 0;
 c_tax_rate         CONSTANT NUMBER(3,2) := 8.25;
...
```

# Declaring Date Variables

- Date data types include DATE, TIMESTAMP, and TIMESTAMP WITH TIMEZONE.

```
DECLARE
 v_date1     DATE := '05-Apr-2015';
 v_date2     DATE := v_date1 + 7;
 v_date3     TIMESTAMP := SYSDATE;
 v_date4     TIMESTAMP WITH TIME ZONE := SYSDATE;
BEGIN
 DBMS_OUTPUT.PUT_LINE(v_date1);
 DBMS_OUTPUT.PUT_LINE(v_date2);
 DBMS_OUTPUT.PUT_LINE(v_date3);
 DBMS_OUTPUT.PUT_LINE(v_date4);
END;
```

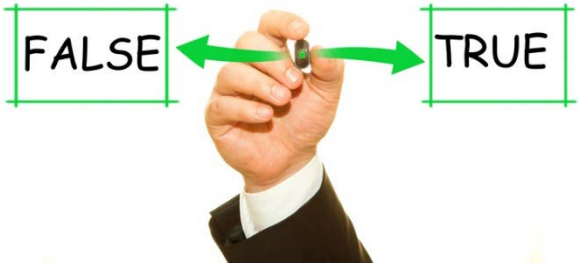
- Choosing between DATE, TIMESTAMP, etc., is determined by what data you need to know in the future.

# Declaring BOOLEAN Variables

- BOOLEAN is a data type that stores one of the three possible values used for logical calculations: TRUE, FALSE, or NULL.

```
DECLARE
 v_valid1        BOOLEAN := TRUE;
 v_valid2        BOOLEAN;
 v_valid3        BOOLEAN NOT NULL := FALSE;
BEGIN
 IF v_valid1 THEN
  DBMS_OUTPUT.PUT_LINE('Test is TRUE');
 ELSE
  DBMS_OUTPUT.PUT_LINE('Test is FALSE');
 END IF;
END;
```

# Using BOOLEAN Variables




When using BOOLEAN variables:

- Only the values TRUE, FALSE, and NULL can be assigned to a BOOLEAN variable.
- Conditional expressions use the logical operators AND and OR, and the operator NOT to check the variable values.
- The variables always yield TRUE, FALSE, or NULL.
- You can use arithmetic, character, and date expressions to return a BOOLEAN value.

# Guidelines for Declaring PL/SQL Variables

- Use meaningful and appropriate variable names.
- Follow naming conventions. Use v_name to represent a variable and c_name to represent a constant.
- Declare one identifier per line for better readability, code maintenance, and easier commenting.
- Use the NOT NULL constraint when the variable must hold a value.
- Use the CONSTANT constraint when the variable value should not change within the block.

# Guidelines for Declaring PL/SQL Variables

- Set initial values for BOOLEANs and NUMBERs.
- Avoid using column names as identifiers.

```
DECLARE
 first_name  VARCHAR2(20);
BEGIN
 SELECT first_name
  INTO first_name
  FROM employees
  WHERE last_name = 'Vargas';
 DBMS_OUTPUT.PUT_LINE(first_name);
END;
```

# Defining Variables with the %TYPE Attribute

- Variables derived from database fields should be defined using the %TYPE attribute, which has several advantages.
- For example, in the EMPLOYEES table, the column first_name is defined as VARCHAR2(20).
- In a PL/SQL block, you could define a matching variable with either:

```
v_first_name  VARCHAR2(20);
```

- Or

```
v_first_name  employees.last_name%TYPE;
```

# Using the %TYPE Attribute

- Look at this partial table definition from the EMPLOYEES table.
- Then look at the code in the next slide.

| Column Name | Data Type |
|---|---|
| EMPLOYEE_ID | NUMBER(6,0) |
| FIRST_NAME | VARCHAR2(20) |
| LAST_NAME | VARCHAR2(25) |
| EMAIL | VARCHAR2(25) |

# Using the %TYPE Attribute

- This PL/SQL block stores the correct first name in the v_first_name variable.
- But what if the table column is later altered to be VARCHAR2(25) and a name longer than 20 characters is added?

```
DECLARE
 v_first_name  VARCHAR2(20);
BEGIN
 SELECT first_name
  INTO v_first_name
  FROM employees
  WHERE last_name = 'Vargas';
 DBMS_OUTPUT.PUT_LINE(v_first_name);
END;
```

# Using the %TYPE Attribute

- Using the %TYPE attribute to define an "anchored data type" for v_first_name would solve the problem.
- Otherwise, a programmer would have to find and modify every place in every program with a variable defined to hold an employee's first name.

```
DECLARE
  v_first_name   employees.first_name%TYPE;
BEGIN
  SELECT first_name
    INTO v_first_name
    FROM employees
    WHERE last_name = 'Vargas';
  DBMS_OUTPUT.PUT_LINE(v_first_name);
END;
```

# Using the %TYPE Attribute

- The %TYPE attribute:
- Is used to automatically give a variable the same data type and size as:
  - A database column
  - Another declared variable
- Is prefixed with either of the following:
  - The database table name and column name
  - The name of the other declared variable

# Using the %TYPE Attribute

- Syntax:

```
identifier      table_name.column_name%TYPE;
identifier      identifier%TYPE;
```

- Examples:

```
DECLARE
 v_first_name       employees.first_name%TYPE;
 v_salary           employess.salary%TYPE;
 v_old_salary       v_salary%TYPE;
 v_new_salary       v_salary%TYPE;
 v_balance          NUMBER(10,2);
 v_min_balance     v_balance%TYPE := 1000;
...
```

# Advantages of the %TYPE Attribute

Advantages of the %TYPE attribute are:

- You can avoid errors caused by data type mismatch or wrong precision.
- You need not change the variable declaration if the table column definition changes.
- Otherwise, if you have already declared some variables for a particular table column without using the %TYPE attribute, then the PL/SQL block can return errors if the table column is altered.

# Advantages of the %TYPE Attribute

Advantages of the %TYPE attribute are:

- When you use the %TYPE attribute, PL/SQL determines the data type and size of the variable when the block is compiled.
- This ensures that such a variable is always compatible with the column that is used to populate it.

# Terminology

Key terms used in this lesson included:

- %TYPE
- BOOLEAN

# Summary

In this lesson, you should have learned how to:

- Declare and use scalar data types in PL/SQL
- Define guidelines for declaring and initializing PL/SQL variables
- Identify the benefits of anchoring data types with the %TYPE attribute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