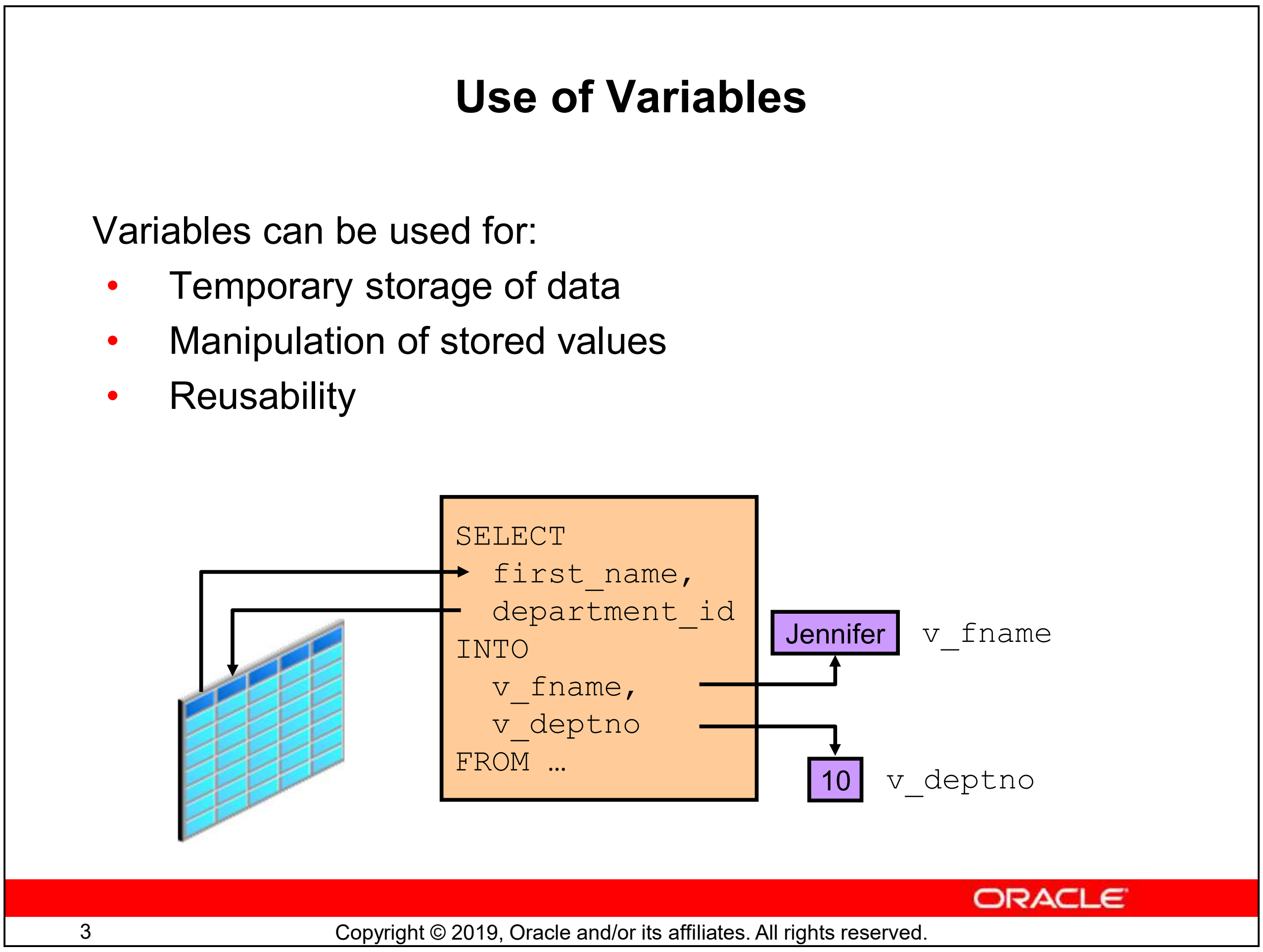
Variable Declarations

Objectives

After completing this lesson, you should be able to do the following:

- Recognize valid and invalid identifiers
- List the uses of variables
- Declare and initialize variables
- List and describe various data types
- Identify the benefits of using the `%TYPE` attribute
- Declare, use, and print bind variables

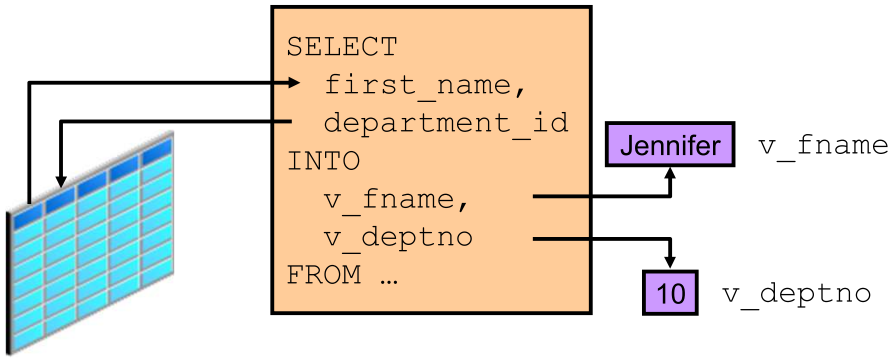
You have already learned about basic PL/SQL blocks and their sections. In this lesson, you learn about valid and invalid identifiers. You learn how to declare and initialize variables in the declarative section of a PL/SQL block. The lesson describes the various data types. You also learn about the `%TYPE` attribute and its benefits.



Use of Variables

Variables can be used for:

- Temporary storage of data
- Manipulation of stored values
- Reusability



```
SELECT
   first_name,
   department_id
INTO
   v_fname,
   v_deptno
FROM …
```

With PL/SQL, you can declare variables, and then use them in SQL and procedural statements.

Variables are mainly used for storage of data and manipulation of stored values. Consider the PL/SQL statement in the slide. The statement retrieves `first_name` and `department_id` from the table. If you have to manipulate `first_name` or `department_id`, you have to store the retrieved value. Variables are used to temporarily store the value. You can use the value stored in these variables for processing and manipulating data. Variables can store any PL/SQL object such as variables, types, cursors, and subprograms.

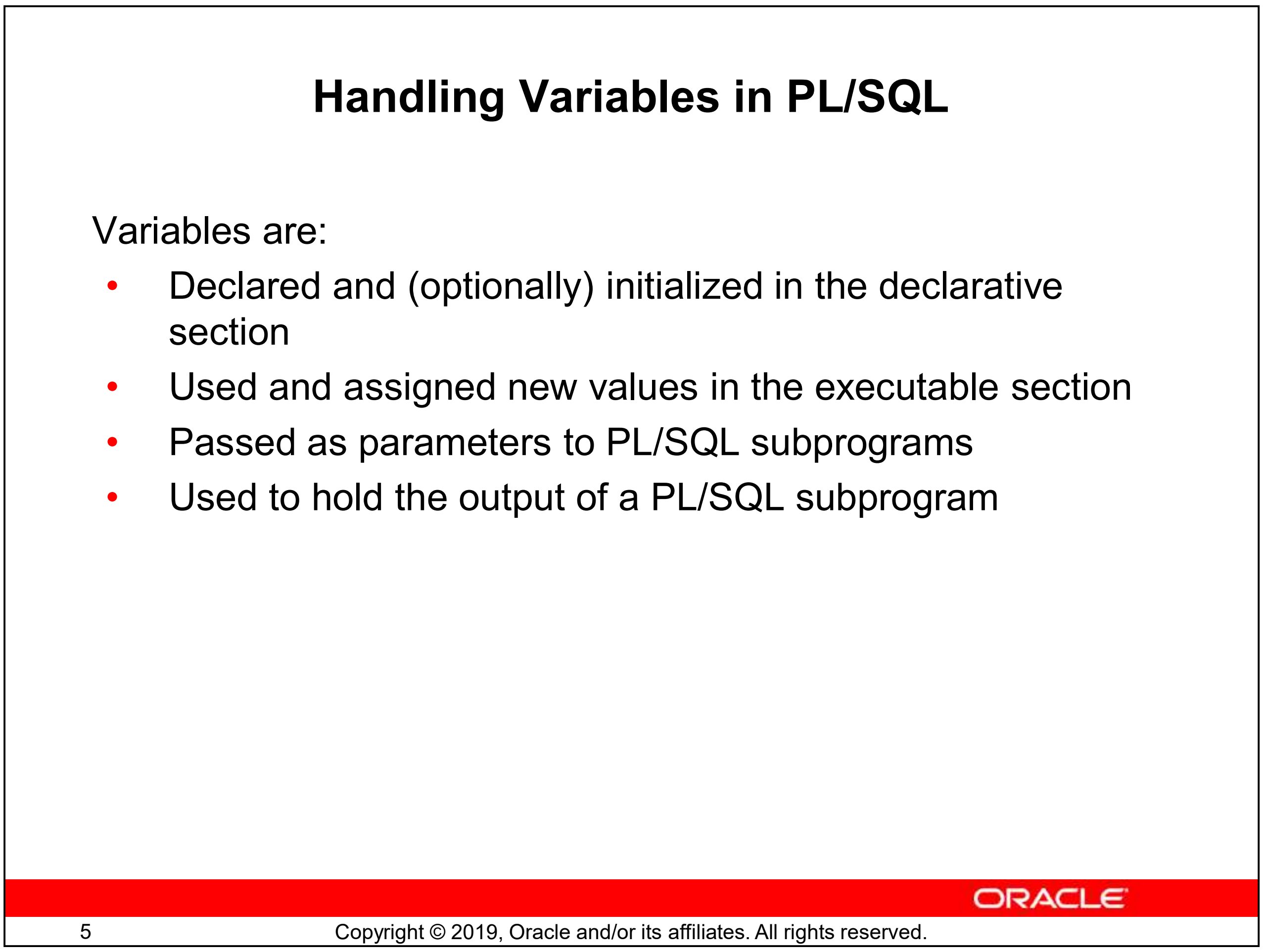
Reusability is another advantage of declaring variables. After the variables are declared, you can use them repeatedly in an application by referring to them multiple times in various statements.

Requirements for Variable Names

A variable name:

- Must start with a letter
- Can include letters or numbers
- Can include special characters (such as `$`, `_`, and `#`)
- Must contain no more than 30 characters
- Must not include reserved words

The rules for naming a variable are listed in the slide.



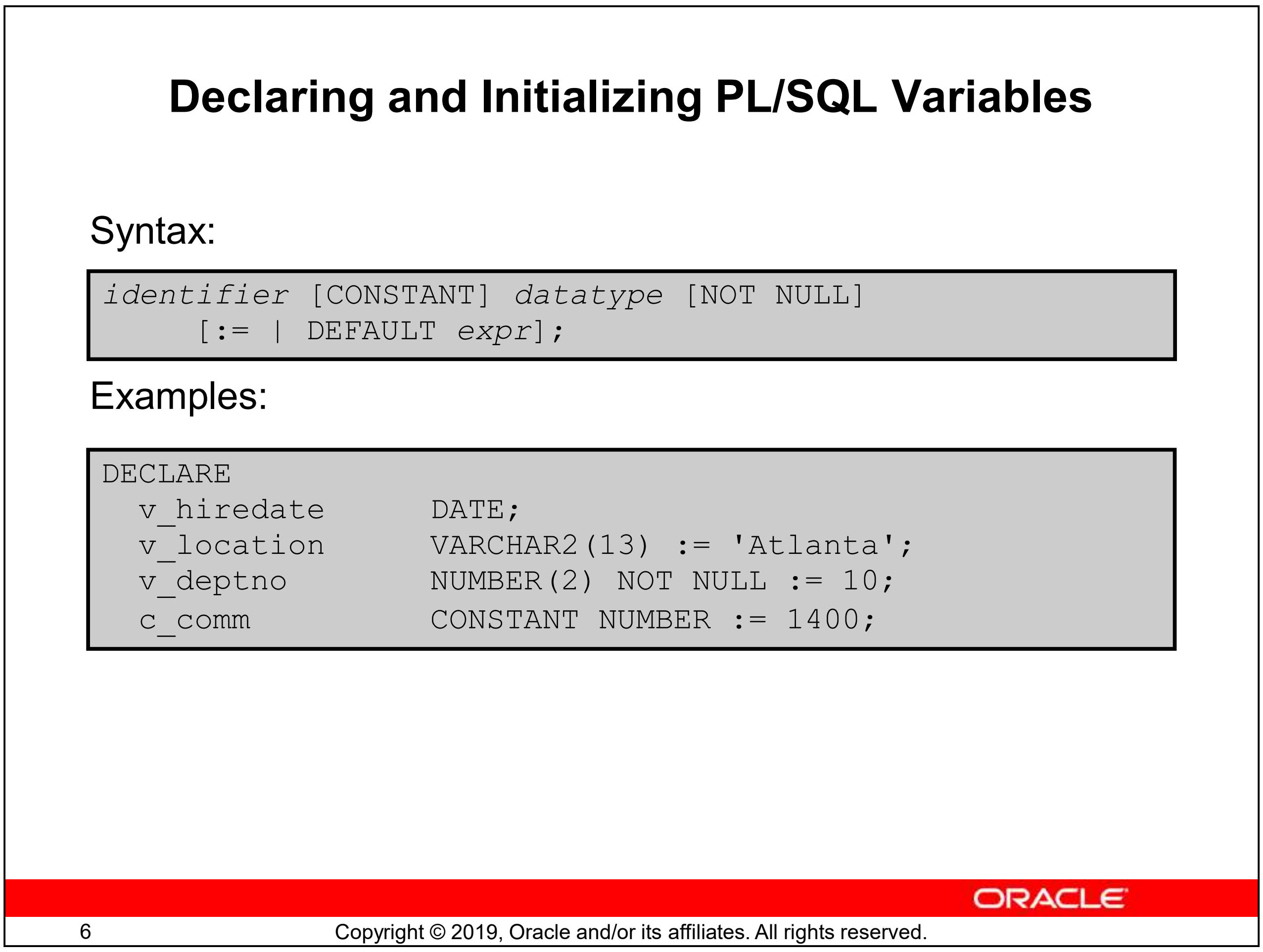
Handling Variables in PL/SQL

Variables are:

- Declared and (optionally) initialized in the declarative section
- Used and assigned new values in the executable section
- Passed as parameters to PL/SQL subprograms
- Used to hold the output of a PL/SQL subprogram

You can use variables in the following ways:

- **Declare and initialize them in the declaration section:** You can declare variables in the declarative part of any PL/SQL block, subprogram, or package. Declarations allocate storage space for a value, specify its data type, and name the storage location so that you can reference it. Declarations can also assign an initial value and impose the `NOT NULL` constraint on the variable. Forward references are not allowed. You must declare a variable before referencing it in other statements, including other declarative statements.
- **Use them and assign new values to them in the executable section:** In the executable section, the existing value of the variable can be replaced with a new value.
- **Pass them as parameters to PL/SQL subprograms:** Subprograms can take parameters. You can pass variables as parameters to subprograms.
- **Use them to hold the output of a PL/SQL subprogram:** Variables can be used to hold the value that is returned by a function.



Declaring and Initializing PL/SQL Variables

Syntax:

```
identifier [CONSTANT] datatype [NOT NULL]
     [:= | DEFAULT expr];
```

Examples:

```
DECLARE
  v_hiredate       DATE;
  v_location       VARCHAR2(13) := 'Atlanta';
  v_deptno         NUMBER(2) NOT NULL := 10;
  c_comm           CONSTANT NUMBER := 1400;
```

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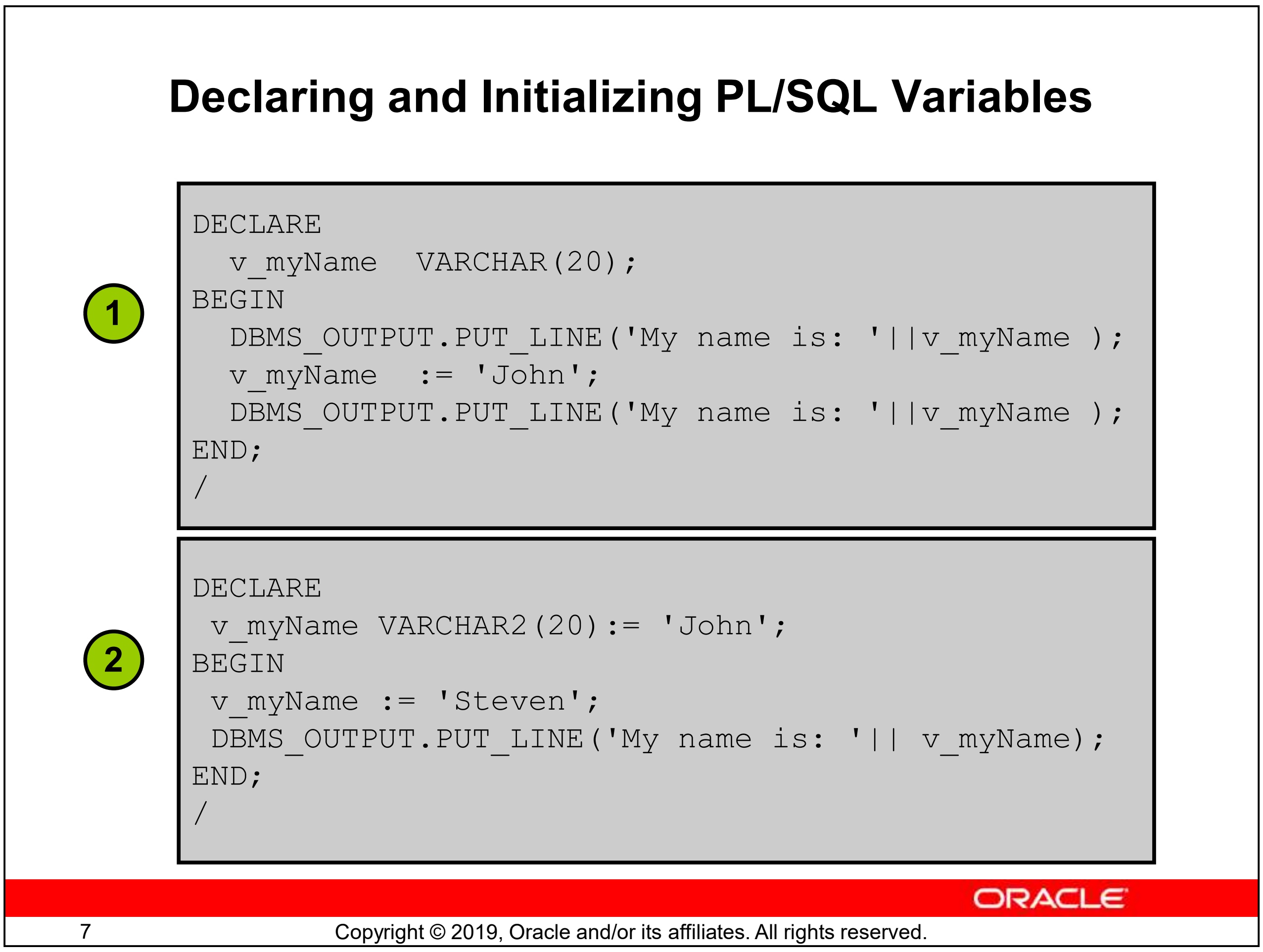
You must declare all PL/SQL identifiers in the declaration section before referencing them in the PL/SQL block. You have the option of assigning an initial value to a variable (as shown in the slide). You do not need to assign a value to a variable in order to declare it. If you refer to other variables in a declaration, be sure that they are already declared separately in a previous statement.

In the syntax:

identifier	Is the name of the variable
data type	Is a scalar, composite, reference, or `LOB` data type (This course covers only scalar, composite, and `LOB` data types.)
`CONSTANT`	Constrains the variable so that its value cannot change (Constants must be initialized.)
`NOT NULL`	Constrains the variable so that it contains a value (`NOT NULL` variables must be initialized.)
expr	Is any PL/SQL expression that can be a literal expression, another variable, or an expression involving operators and functions

Note: In addition to variables, you can also declare cursors and exceptions in the declarative section. You learn about declaring cursors in the lesson titled “Using Explicit Cursors” and about exceptions in the lesson titled “Handling Exceptions.”



Declaring and Initializing PL/SQL Variables

1

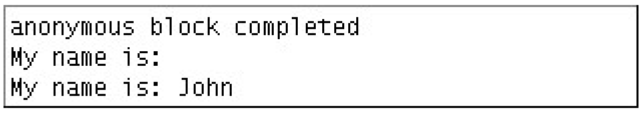
```
DECLARE
  v_myName  VARCHAR(20);
BEGIN
  DBMS_OUTPUT.PUT_LINE('My name is: '||v_myName );
  v_myName  := 'John';
  DBMS_OUTPUT.PUT_LINE('My name is: '||v_myName );
END;
/
```

2

```
DECLARE
 v_myName VARCHAR2(20):= 'John';
BEGIN
 v_myName := 'Steven';
 DBMS_OUTPUT.PUT_LINE('My name is: '|| v_myName);
END;
/
```

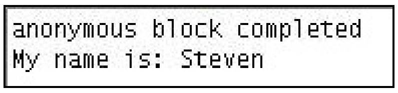
Examine the two code blocks in the slide.

1. In the first block, the `v_myName` variable is declared but not initialized. A value `John` is assigned to the variable in the executable section.
   - String literals must be enclosed in single quotation marks. If your string has a quotation mark as in "Today's Date," the string would be `'Today''s Date'`.
   - The assignment operator is: "`:=`".
   - The `PUT_LINE` procedure is invoked by passing the `v_myName` variable. The value of the variable is concatenated with the string `'My name is:'`.
   - Output of this anonymous block is:

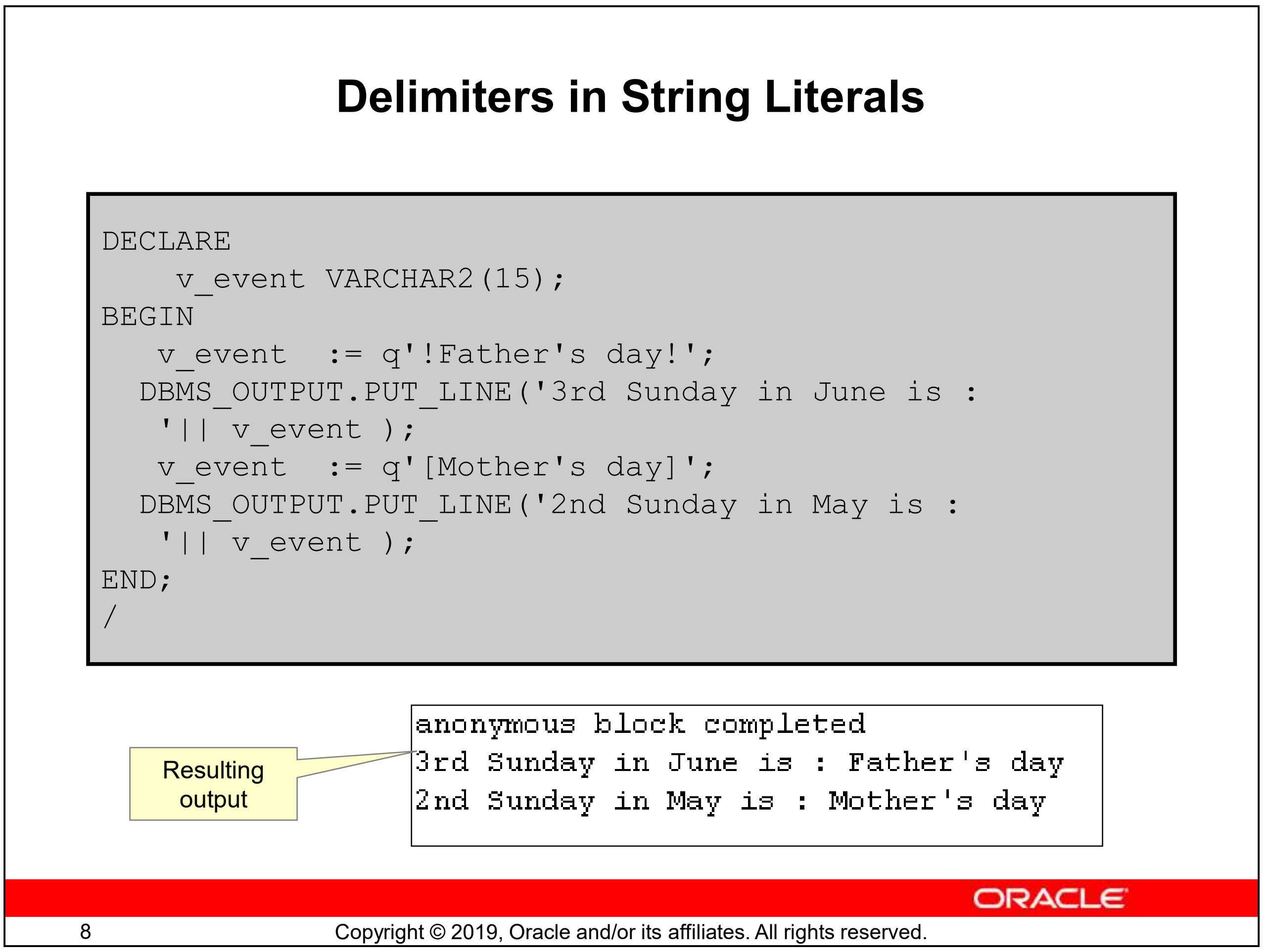


```
anonymous block completed
My name is:
My name is: John
```

2. In the second block, the `v_myName` variable is declared and initialized in the declarative section. `v_myName` holds the value `John` after initialization. This value is manipulated in the executable section of the block. The output of this anonymous block is:



```
anonymous block completed
My name is: Steven
```



Delimiters in String Literals

```
DECLARE
    v_event VARCHAR2(15);
BEGIN
   v_event  := q'!Father's day!';
  DBMS_OUTPUT.PUT_LINE('3rd Sunday in June is :
   '|| v_event );
   v_event  := q'[Mother's day]';
  DBMS_OUTPUT.PUT_LINE('2nd Sunday in May is :
   '|| v_event );
END;
/
```

Resulting output

```
anonymous block completed
3rd Sunday in June is : Father's day
2nd Sunday in May is : Mother's day
```

If your string contains an apostrophe (identical to a single quotation mark), you must double the quotation mark, as in the following example:

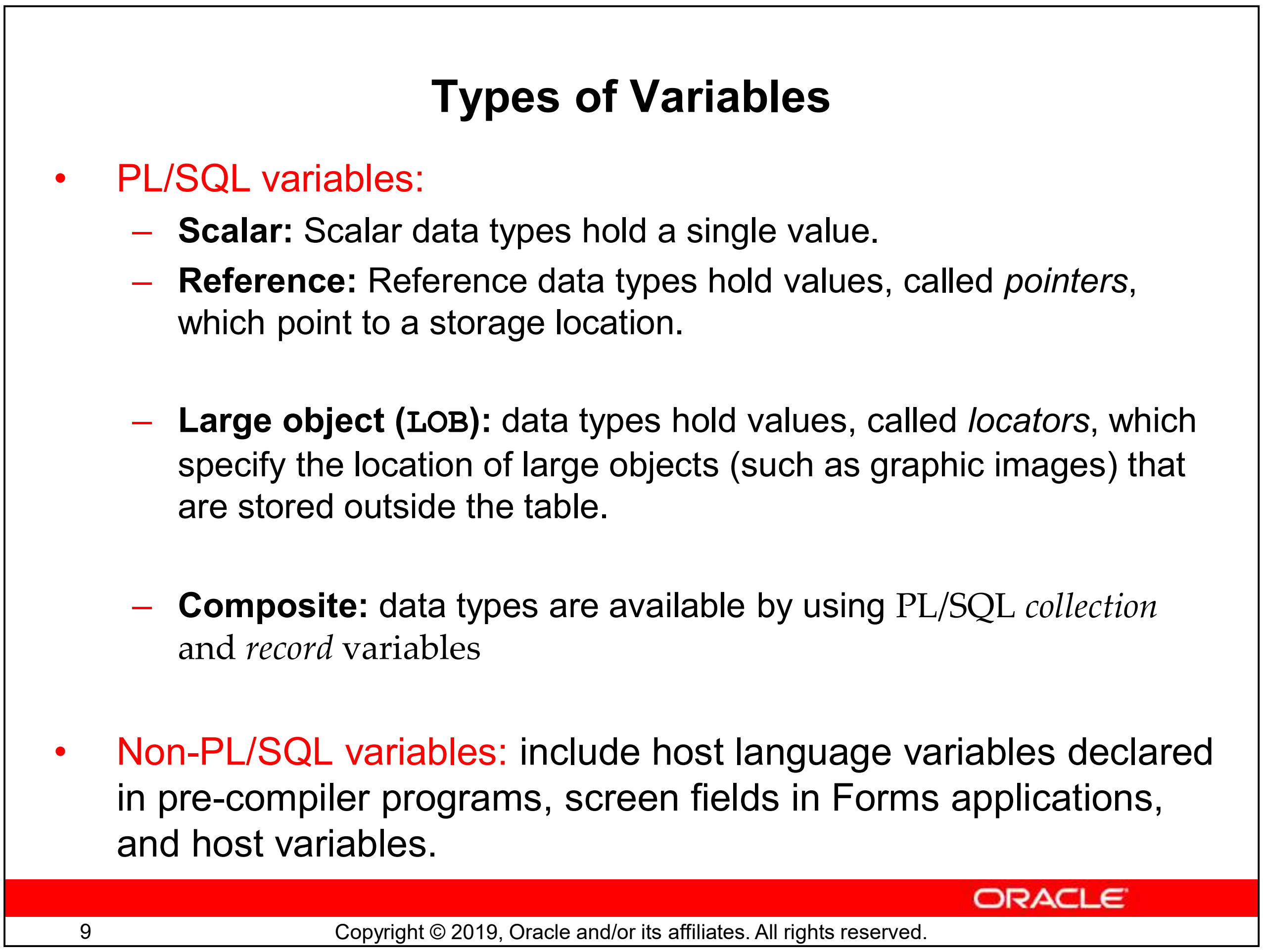
```
v_event  VARCHAR2(15):='Father''s day';
```

The first quotation mark acts as the escape character. This makes your string complicated, especially if you have SQL statements as string, the slide shows how to use the `q'` notation to specify the delimiters. You can specify any character that is not present in the string as a delimiter. The example uses `!` and `[` as delimiters. Consider the following example:

```
v_event  := q'!Father's day!';
```

You can compare this with the first example on this page. You start the string with `q'` if you want to use a delimiter. The character following the notation is the delimiter used. Enter your string after specifying the delimiter, close the delimiter, and close the notation with a single quotation mark. The following example shows how to use `[` as a delimiter:

```
v_event  := q'[Mother's day]';
```



Types of Variables

- PL/SQL variables:
  - **Scalar:** Scalar data types hold a single value.
  - **Reference:** Reference data types hold values, called *pointers*, which point to a storage location.
  - **Large object (`LOB`):** data types hold values, called *locators*, which specify the location of large objects (such as graphic images) that are stored outside the table.
  - **Composite:** data types are available by using PL/SQL *collection* and *record* variables
- Non-PL/SQL variables: include host language variables declared in pre-compiler programs, screen fields in Forms applications, and host variables.

Every PL/SQL variable has a data type, which specifies a storage format, constraints, and a valid range of values. PL/SQL supports several data type categories, including scalar, reference, large object (`LOB`), and composite.

- **Scalar data types:** Scalar data types hold a single value. The value depends on the data type of the variable. For example, the `v_myName` variable in the example in the section “Declaring and Initializing PL/SQL Variables” (in this lesson) is of type `VARCHAR2`. Therefore, `v_myName` can hold a string value. PL/SQL also supports Boolean variables.
- **Reference data types:** Reference data types hold values, called *pointers*, which point to a storage location.
- `LOB` **data types:** `LOB` data types hold values, called *locators*, which specify the location of large objects (such as graphic images) that are stored outside the table.
- **Composite data types:** Composite data types are available by using PL/SQL *collection* and *record* variables. PL/SQL collections and records contain internal elements that you can treat as individual variables.

Non-PL/SQL variables include host language variables declared in precompiler programs, screen fields in Forms applications, and host variables. You learn about host variables later in this lesson.

For more information about `LOB`s, see the *PL/SQL User’s Guide and Reference*.

Types of Variables

TRUE

15-JAN-09

Snow White
Long, long ago,
in a land far, far away,
there lived a princess called Snow White. . .

256120.08

Atlanta

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Types of Variables illustration:

- `TRUE` represents a Boolean value.
- 15-JAN-09 represents a `DATE`.
- The image represents a `BLOB`.
- The text in the callout can represent a `VARCHAR2` data type or a `CLOB`.
- 256120.08 represents a `NUMBER` data type with precision and scale.
- The film reel represents a `BFILE`.
- The city name *Atlanta* represents a `VARCHAR2` data type.

Guidelines for Declaring and Initializing PL/SQL Variables

- Follow consistent naming conventions.
- Use meaningful identifiers for variables.
- Initialize variables that are designated as `NOT NULL` and `CONSTANT`.
- Initialize variables with the assignment operator (`:=`) or the `DEFAULT` keyword:

```
v_myName VARCHAR2(20):='John';
```

```
v_myName VARCHAR2(20) DEFAULT 'John';
```

- Declare one identifier per line for better readability and code maintenance.

Here are some guidelines to follow when you declare PL/SQL variables.

- Follow consistent naming conventions—for example, you might use `name` to represent a variable and `c_name` to represent a constant. Similarly, to name a variable, you can use `v_fname`. The key is to apply your naming convention consistently for easier identification.
- Use meaningful and appropriate identifiers for variables. For example, consider using `salary` and `sal_with_commission` instead of `salary1` and `salary2`.
- If you use the `NOT NULL` constraint, you must assign a value when you declare the variable.
- In constant declarations, the `CONSTANT` keyword must precede the type specifier. The following declaration names a constant of `NUMBER` type and assigns the value of 50,000 to the constant. A constant must be initialized in its declaration; otherwise, you get a compilation error. After initializing a constant, you cannot change its value.

```
sal CONSTANT NUMBER := 50000.00;
```

Guidelines for Declaring PL/SQL Variables

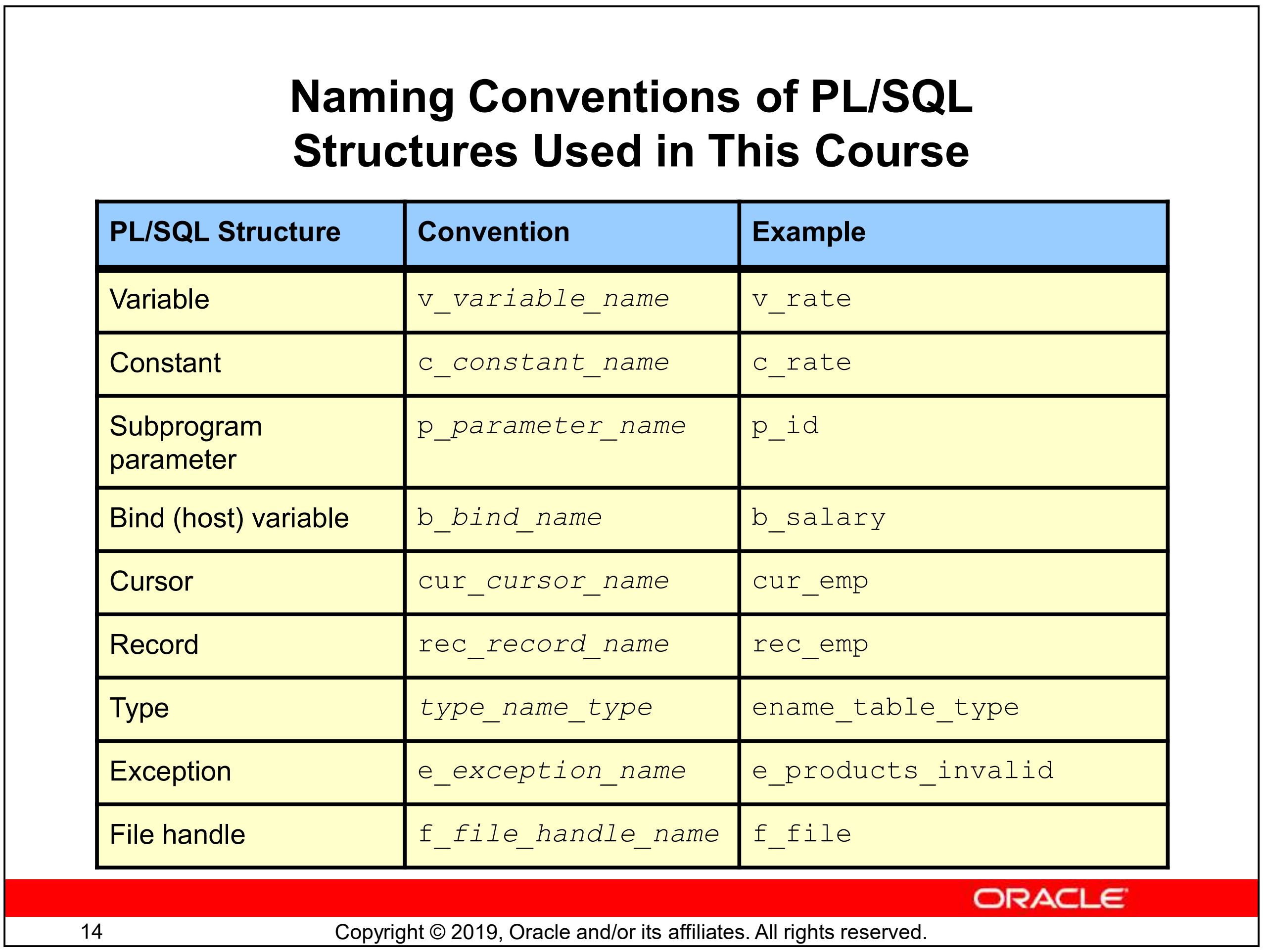
- Avoid using column names as identifiers.

```
DECLARE
  employee_id  NUMBER(6);
BEGIN
  SELECT     employee_id
  INTO       employee_id
  FROM       employees
  WHERE      last_name = 'Kochhar';
END;
/
```

- Use the `NOT NULL` constraint when the variable must hold a value.

- Initialize the variable to an expression with the assignment operator (`:=`) or with the `DEFAULT` reserved word. If you do not assign an initial value, the new variable contains `NULL` by default until you assign a value. To assign or reassign a value to a variable, you write a PL/SQL assignment statement. However, it is good programming practice to initialize all variables.
- Two objects can have the same name only if they are defined in different blocks. Where they coexist, you can qualify them with labels and use them.
- Avoid using column names as identifiers. If PL/SQL variables occur in SQL statements and have the same name as a column, the Oracle Server assumes that it is the column that is being referenced. Although the code example in the slide works, code that is written using the same name for a database table and a variable is not easy to read or maintain.
- Impose the `NOT NULL` constraint when the variable must contain a value. You cannot assign nulls to a variable that is defined as `NOT NULL`. The `NOT NULL` constraint must be followed by an initialization clause.

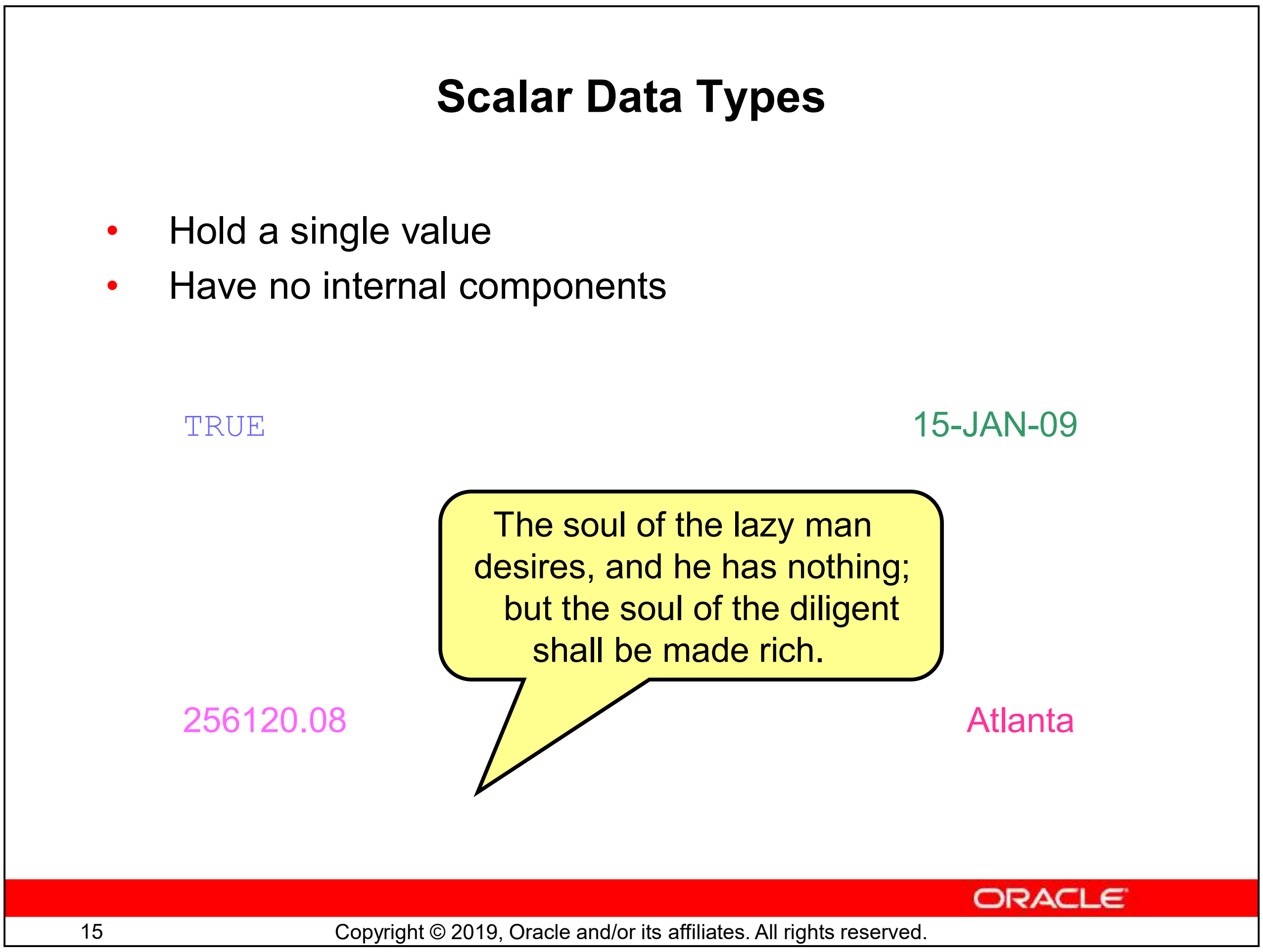
```
pincode VARCHAR2(15) NOT NULL := 'Oxford';
```



Naming Conventions of PL/SQL Structures Used in This Course

PL/SQL Structure	Convention	Example
Variable	v_*variable_name*	v_rate
Constant	c_*constant_name*	c_rate
Subprogram parameter	p_*parameter_name*	p_id
Bind (host) variable	b_*bind_name*	b_salary
Cursor	cur_*cursor_name*	cur_emp
Record	rec_*record_name*	rec_emp
Type	*type_name*_type	ename_table_type
Exception	e_*exception_name*	e_products_invalid
File handle	f_*file_handle_name*	f_file

The table in the slide displays some examples of the naming conventions for PL/SQL structures that are used in this course.



Scalar Data Types

- Hold a single value
- Have no internal components

`TRUE`

15-JAN-09

The soul of the lazy man desires, and he has nothing; but the soul of the diligent shall be made rich.

256120.08

Atlanta

PL/SQL provides a variety of predefined data types. For instance, you can choose from integer, floating point, character, Boolean, date, collection, and LOB types. This lesson covers the basic types that are used frequently in PL/SQL programs.

A scalar data type holds a single value and has no internal components. Scalar data types can be classified into four categories: number, character, date, and Boolean. Character and number data types have subtypes that associate a base type to a constraint. For example, `INTEGER` and `POSITIVE` are subtypes of the `NUMBER` base type.

For more information about scalar data types (as well as the complete list), see the *PL/SQL User's Guide and Reference*.

Base Scalar Data Types

- `CHAR [(maximum_length)]`
- `VARCHAR2 (maximum_length)`
- `NUMBER [(precision, scale)]`
- `BINARY_INTEGER`
- `PLS_INTEGER`
- `BOOLEAN`
- `BINARY_FLOAT`
- `BINARY_DOUBLE`

Data Type	**Description**
CHAR [(*maximum_length*)]	Base type for fixed-length character data up to 32,767 bytes. If you do not specify a maximum length, the default length is set to 1byte.
VARCHAR2 (*maximum_length*)	Base type for variable-length character data up to 32,767 bytes. There is no default size for VARCHAR2 variables and constants.
NUMBER [(*precision, scale*)]	Number having precision *p* and scale *s*. The precision *p* can range from 1 through 38. The scale *s* can range from –84 through 127.
BINARY_INTEGER	Base type for integers between –2,147,483,647 and 2,147,483,647
PLS_INTEGER	Base type for signed integers between –2,147,483,648 and 2,147,483,647. PLS_INTEGER values require less storage and are faster than NUMBER values. In Oracle Database 11*g* and Oracle Database 12*c*, the PLS_INTEGER and BINARY_INTEGER data types are identical. The arithmetic operations on PLS_INTEGER and BINARY_INTEGER values are faster than on NUMBER values.
BOOLEAN	Base type that stores one of the three possible values used for logical calculations: TRUE, FALSE, and NULL
BINARY_FLOAT	Represents floating-point number in IEEE 754 format. It requires 5 bytes to store the value.
BINARY_DOUBLE	Represents floating-point number in IEEE 754 format. It requires 9 bytes to store the value.

Preventing PLS_INTEGER Overflow

- A calculation with two PLS_INTEGER values that overflows the PLS_INTEGER range raises an overflow exception.
- For calculations outside the PLS_INTEGER range, use INTEGER, a predefined subtype of the NUMBER data type.

```
DECLARE
  p1 PLS_INTEGER := 2147483647;
  p2 PLS_INTEGER := 1;
  n NUMBER;
BEGIN
  n := p1 + p2;
END;
/
```

Preventing numeric Overflow

```
DECLARE
  p1 PLS_INTEGER := 2147483647;
  p2 INTEGER := 1;
  n NUMBER;
BEGIN
  n := p1 + p2;
END;
/
```

PL/SQL BOOLEAN data type

- Stores **logical values**, which are the boolean values TRUE and FALSE and the value NULL. NULL represents an unknown value.

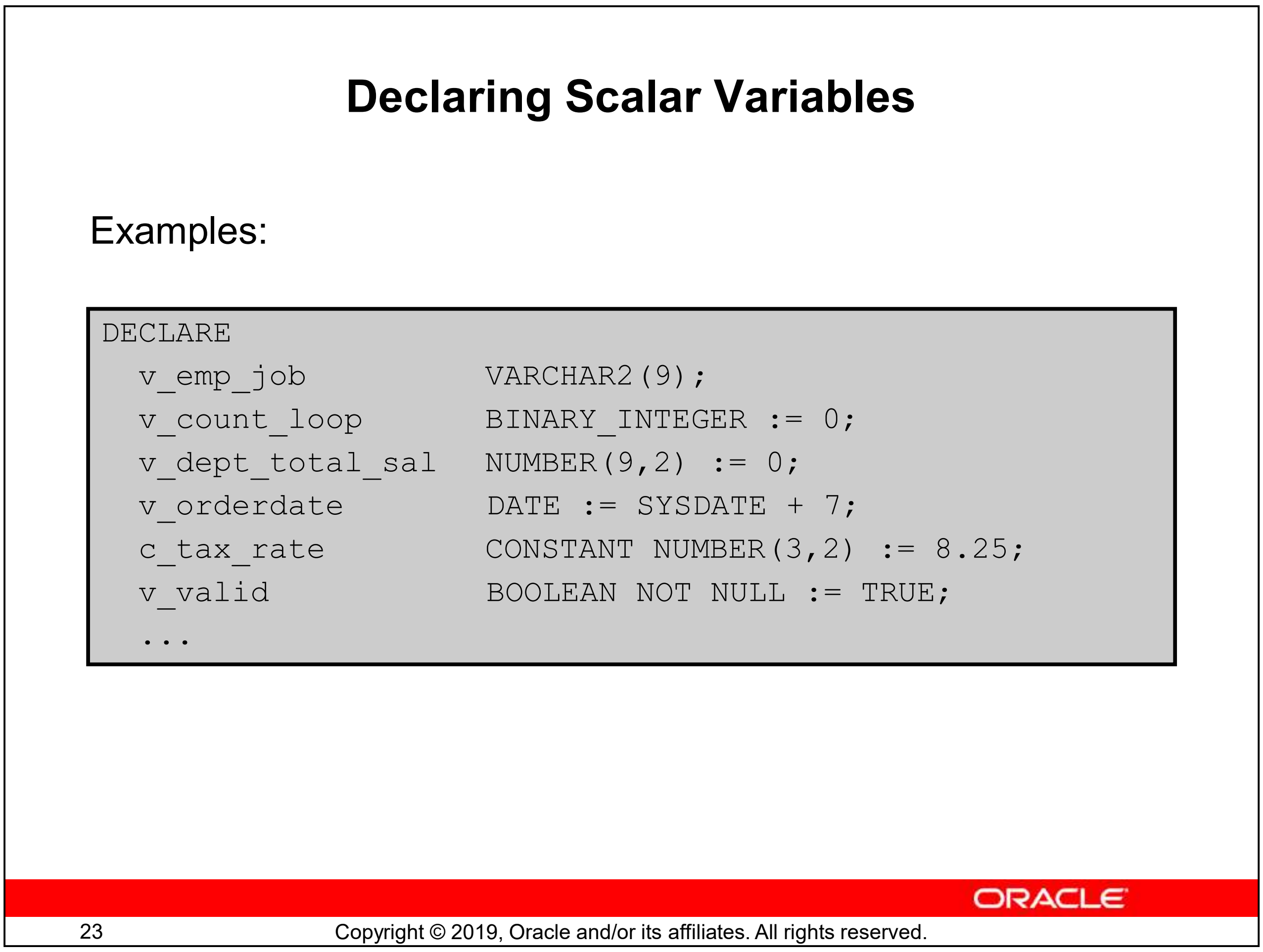
- Because SQL has no data type equivalent to BOOLEAN, you cannot:
  - Assign a BOOLEAN value to a database table column
  - Select or fetch the value of a database table column into a BOOLEAN variable
  - Use a BOOLEAN value in a SQL function

BINARY_FLOAT and BINARY_DOUBLE data type

- The SQL data types BINARY_FLOAT and BINARY_DOUBLE represent single-precision.
- BINARY_FLOAT and BINARY_DOUBLE computations do not raise exceptions, so you must check the values that they produce for conditions such as overflow.

```
CREATE TABLE table1 (n1 NUMBER);
INSERT INTO table1 VALUES(1234.56);
SELECT n1, TO_BINARY_FLOAT(n1) FROM table1;
```

TO_BINARY_FLOAT returns a single-precision floating-point number



Declaring Scalar Variables

Examples:

```
DECLARE
  v_emp_job          VARCHAR2(9);
  v_count_loop       BINARY_INTEGER := 0;
  v_dept_total_sal   NUMBER(9,2) := 0;
  v_orderdate        DATE := SYSDATE + 7;
  c_tax_rate         CONSTANT NUMBER(3,2) := 8.25;
  v_valid            BOOLEAN NOT NULL := TRUE;
  ...
```

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The examples of variable declaration shown in the slide are defined as follows:

- `v_emp_job`: Variable to store an employee job title
- `v_count_loop`: Variable to count the iterations of a loop; initialized to `0`
- `v_dept_total_sal`: Variable to accumulate the total salary for a department; initialized to `0`
- `v_orderdate`: Variable to store the ship date of an order; initialized to one week from today
- `c_tax_rate`: Constant variable for the tax rate (which never changes throughout the PL/SQL block); set to `8.25`
- `v_valid`: Flag to indicate whether a piece of data is valid or invalid; initialized to `TRUE`

%TYPE Attribute

- PL/SQL variables are usually declared to hold and manipulate data stored in a database.
- When you declare PL/SQL variables to hold column values, you must ensure that the variable is of the correct data type and precision.
- If it is not, a PL/SQL error occurs during execution. If you have to design large subprograms, this can be time-consuming and error-prone.
- Rather than hard-coding the data type and precision of a variable, you can use the `%TYPE` attribute to declare a variable according to another previously declared variable or database column.

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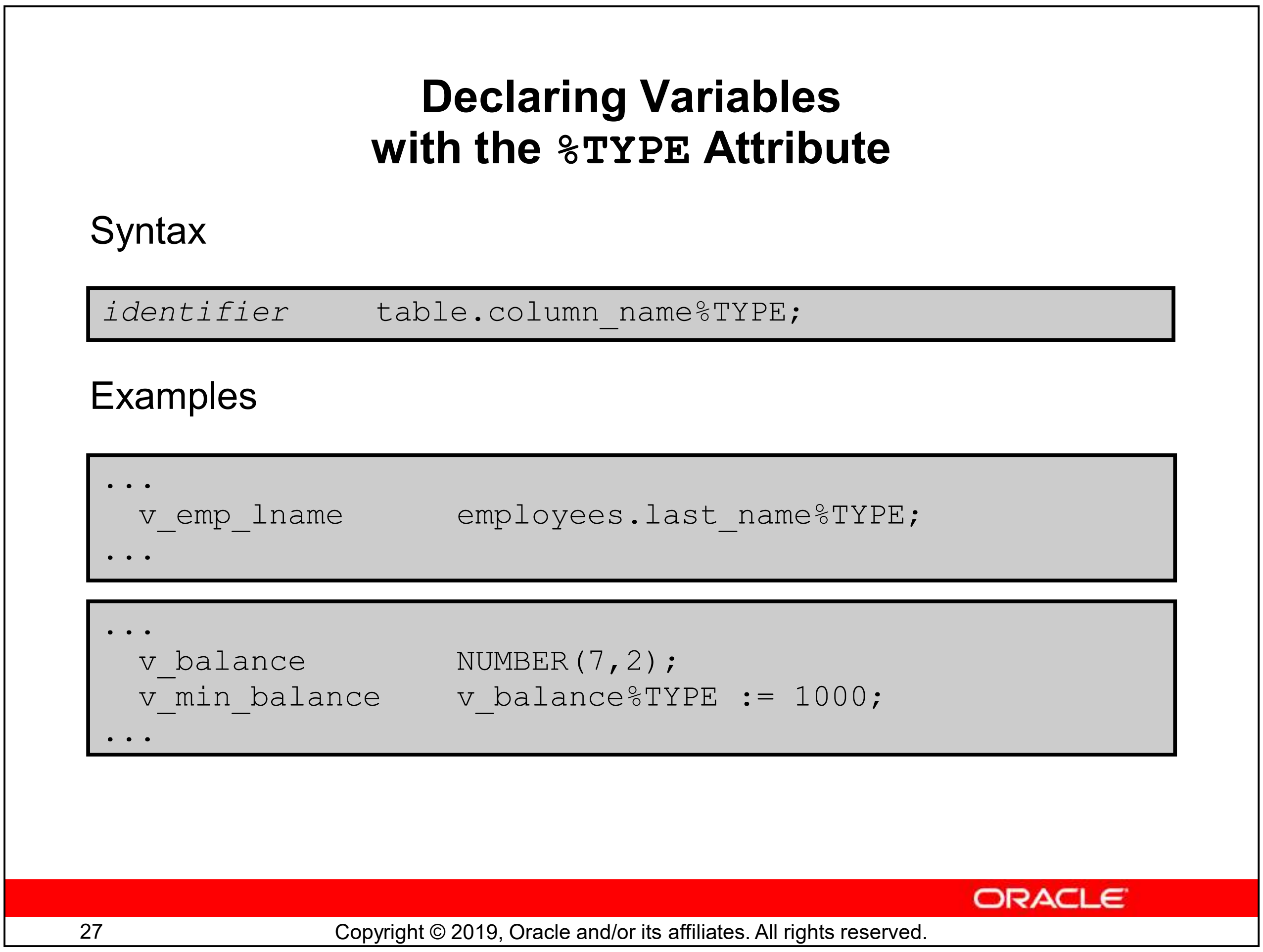
%TYPE Attribute

- Is used to declare a variable according to:
  - A database column definition
  - Another declared variable
- Is prefixed with:
  - The database table and column name
  - The name of the declared variable
- The `%TYPE` attribute is most often used when the value stored in the variable is derived from a table in the database. When you use the `%TYPE` attribute to declare a variable, you should prefix it with the database table and column name.
- If you refer to a previously-declared variable, prefix the variable name of the previously-declared variable to the variable being declared.



Declaring Variables with the `%TYPE` Attribute

Syntax

```
identifier     table.column_name%TYPE;
```

Examples

```
...
  v_emp_lname       employees.last_name%TYPE;
...
```

```
...
  v_balance         NUMBER(7,2);
  v_min_balance     v_balance%TYPE := 1000;
...
```

Declare variables to store the last name of an employee. The `v_emp_lname` variable is defined to be of the same data type as the `last_name` column in the `employees` table. The `%TYPE` attribute provides the data type of a database column.

Declare variables to store the balance of a bank account, as well as the minimum balance, which is 1,000. The `v_min_balance` variable is defined to be of the same data type as the `v_balance` variable. The `%TYPE` attribute provides the data type of a variable.

A `NOT NULL` database column constraint does not apply to variables that are declared using `%TYPE`. Therefore, if you declare a variable using the `%TYPE` attribute that uses a database column defined as `NOT NULL`, you can assign the `NULL` value to the variable.

Declaring Boolean Variables

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

With PL/SQL, you can compare variables in both SQL and procedural statements. These comparisons, called Boolean expressions, consist of simple or complex expressions separated by relational operators. In a SQL statement, you can use Boolean expressions to specify the rows in a table that are affected by the statement. In a procedural statement, Boolean expressions are the basis for conditional control. NULL stands for a missing, inapplicable, or unknown value.

Examples

```
emp_sal1 := 50000;
emp_sal2 := 60000;
```

The following expression yields TRUE:

```
emp_sal1 < emp_sal2
```

Declare and initialize a Boolean variable:

```
DECLARE
 flag BOOLEAN := FALSE;
BEGIN
 flag := TRUE;
END;
/
```

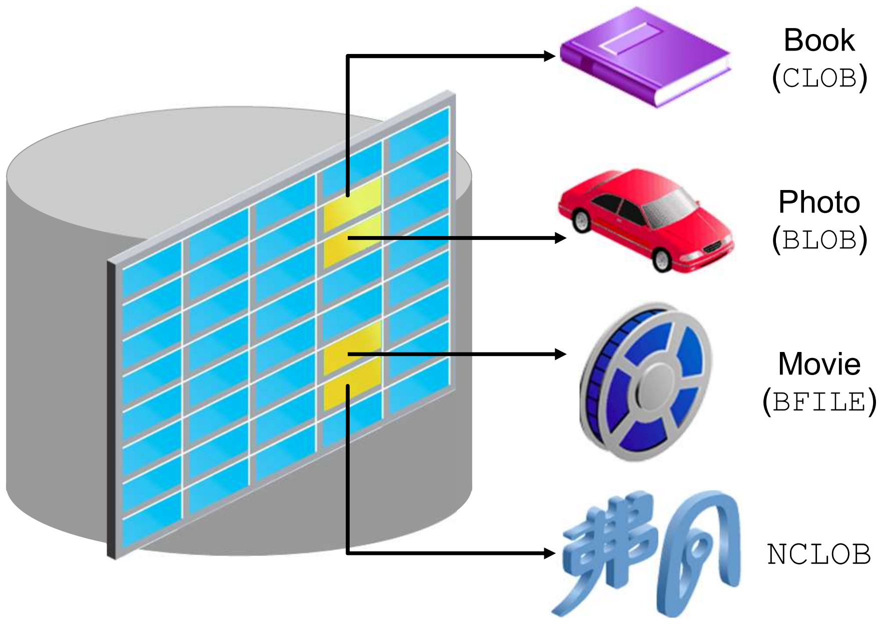
LOB Data Type Variables

- Large objects (LOBs) are meant to store a large amount of data.
- A database column can be of the LOB category.
- With the LOB category of data types (BLOB, CLOB, and so on), you can store blocks of unstructured data (such as text, graphic images, video clips, and sound wave forms) of up to 128 terabytes depending on the database block size.
- LOB data types allow efficient, random, piecewise access to data and can be attributes of an object type.

LOB Data Type Variables

- The CLOB data type is used to store large blocks of character data in the database.
- The BLOB data type is used to store large unstructured or structured binary objects in the database.
- The binary file (BFILE) data type is used to store large binary files. Unlike other LOBs, BFILES are stored outside the database and not in the database. They could be operating system files. Only a pointer to the BFILE is stored in the db.
- The national language character large object (NCLOB) data type is used to store large blocks of single-byte or fixed-width multibyte NCHAR unicode data in the database.

LOB Data Type Variables



Composite Data Types: PL/SQL Records

- Scalar data type holds a single value and has no internal components.
- Composite data types called PL/SQL Records and PL/SQL Collections, have internal components that you can treat as individual variables.

- PL/SQL record, the internal components can be of different data types, and are called fields.

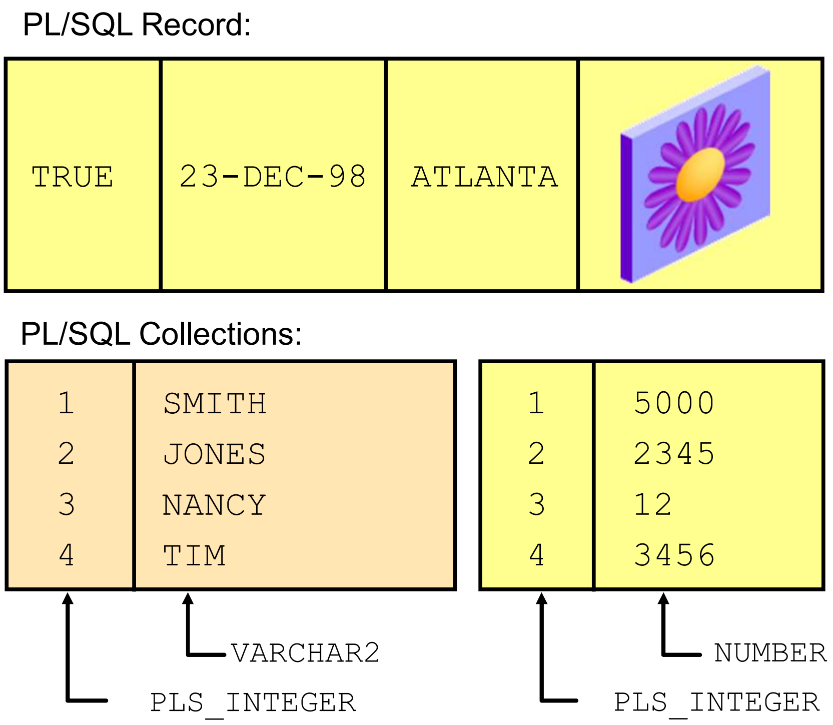
- You access each field with this syntax: `record_name.field_name`

- A record variable can hold a table row, or some columns from a table row. Each record field corresponds to a table column.

Composite Data Types: Collections

- In a PL/SQL collection, the internal components are always of the same data type, and are called elements.
- You access each element by its unique subscript.
- Lists and arrays are classic examples of collections.
- There are three types of PL/SQL collections: Associative Arrays, Nested Tables, and `VARRAY` types.
- **Note**
  - PL/SQL Records and Associative Arrays are covered in the lesson titled: “Working with Composite Data Types.”
  - `NESTED TABLE` and `VARRAY` data types are covered in the course titled *Advanced PL/SQL.*

Composite Data Types: Records and Collections



Bind Variables

- Bind variables are variables that you create in a host environment and not in the declarative section of PL/SQL block.
- For this reason, they are sometimes called *host* variables.

Bind variables are:

- Created with the `VARIABLE` keyword*
- Used in SQL statements and PL/SQL blocks
- Accessed even after the PL/SQL block is executed
- Referenced with a preceding colon

- **Note:** A bind variable is an environment variable, but is not a global variable.

Uses of Bind Variables

Bind variables are created in the environment and not in the declarative section of a PL/SQL block. Therefore, bind variables are accessible even after the block is executed. When created, bind variables can be used and manipulated by multiple subprograms. They can be used in SQL statements and PL/SQL blocks just like any other variable. These variables can be passed as run-time values into or out of PL/SQL subprograms.

Referencing Bind Variables

- You can reference a bind variable in a PL/SQL program by preceding the variable with a colon.
- For example, the following PL/SQL block creates and uses the bind variable `b_result`.

```
VARIABLE b_result NUMBER
BEGIN
  SELECT (SALARY*12) + NVL(COMMISSION_PCT,0) INTO
:b_result
  FROM employees WHERE employee_id = 144;
END;
/
PRINT b_result
```

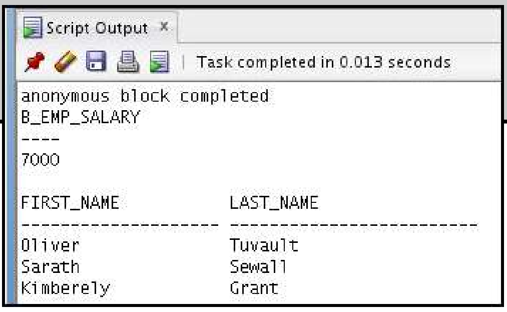
- **Note:** If you are creating a bind variable of the `NUMBER` type, you cannot specify the precision and scale.

Referencing Bind Variables

Example:

```
VARIABLE b_emp_salary NUMBER
BEGIN
   SELECT salary  INTO :b_emp_salary
   FROM  employees WHERE employee_id = 178;
END;
/
PRINT b_emp_salary
SELECT first_name, last_name
FROM employees
WHERE salary=:b_emp_salary;
```

Output



```
anonymous block completed
B_EMP_SALARY
----
7000

FIRST_NAME           LAST_NAME
-------------------- -------------------------
Oliver               Tuvault
Sarath               Sewall
Kimberely            Grant
```

As stated previously, after you create a bind variable, you can reference that variable in any other SQL statement or PL/SQL program.

In the example, `b_emp_salary` is created as a bind variable in the PL/SQL block. Then, it is used in the `SELECT` statement that follows.

When you execute the PL/SQL block shown in the slide, you see the following output:

- The `PRINT` command executes:

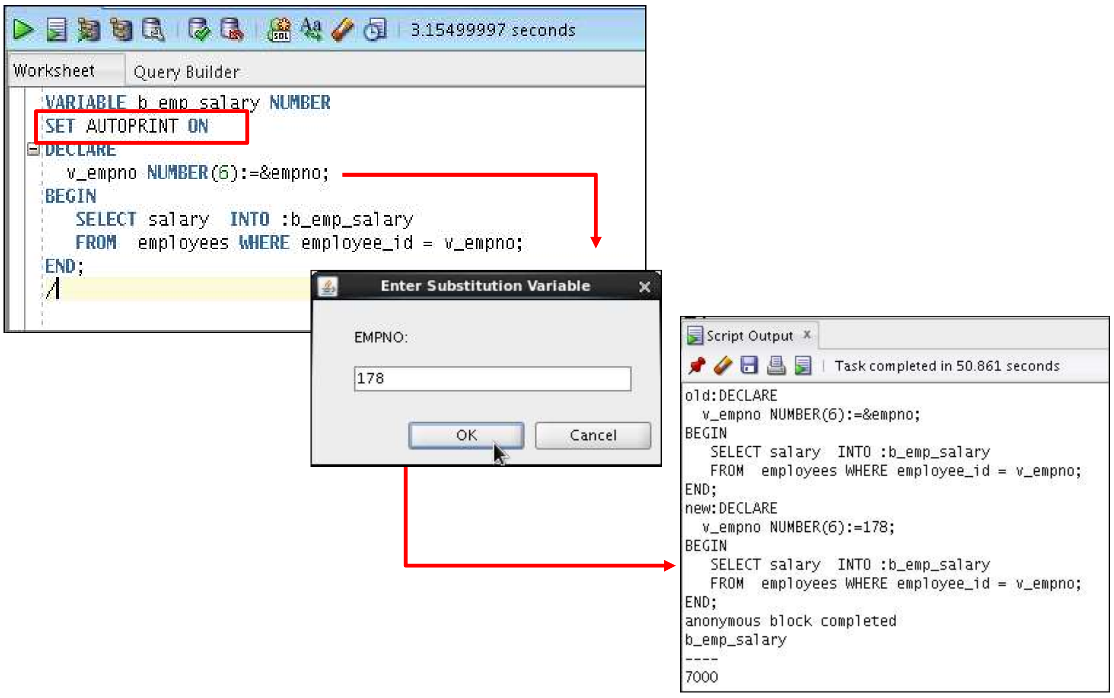
```
b_emp_salary
------------------
7000
```

- Then, the output of the SQL statement follows:

```
FIRST_NAME          LAST_NAME
------------------  ----------------------
Oliver              Tuvault
Sarath              Sewall
Kimberely           Grant
```

Note: To display all bind variables, use the `PRINT` command without a variable.

Using `AUTOPRINT` with Bind Variables



```
VARIABLE b_emp_salary NUMBER
SET AUTOPRINT ON
DECLARE
  v_empno NUMBER(6):=&empno;
BEGIN
   SELECT salary  INTO :b_emp_salary
   FROM  employees WHERE employee_id = v_empno;
END;
/
```

```
old:DECLARE
  v_empno NUMBER(6):=&empno;
BEGIN
   SELECT salary  INTO :b_emp_salary
   FROM  employees WHERE employee_id = v_empno;
END;
new:DECLARE
  v_empno NUMBER(6):=178;
BEGIN
   SELECT salary  INTO :b_emp_salary
   FROM  employees WHERE employee_id = v_empno;
END;
anonymous block completed
b_emp_salary
----
7000
```

Use the `SET AUTOPRINT ON` command to automatically display the bind variables used in a successful PL/SQL block.

Example

In the code example:

- A bind variable named `b_emp_salary` is created and `AUTOPRINT` is turned on.
- A variable named `v_empno` is declared, and a substitution variable is used to receive user input.
- Finally, the bind variable and temporary variables are used in the executable section of the PL/SQL block.

When a valid employee number is entered—in this case 178—the output of the bind variable is automatically printed. The bind variable contains the salary for the employee number that is provided by the user.

Quiz

The `%TYPE` attribute:

a. Is used to declare a variable according to a database column definition

b. Is used to declare a variable according to a collection of columns in a database table or view

c. Is used to declare a variable according to the definition of another declared variable

d. Is prefixed with the database table and column name or the name of the declared variable

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Answer: a, c, d

The `%TYPE` Attribute

PL/SQL variables are usually declared to hold and manipulate data stored in a database. When you declare PL/SQL variables to hold column values, you must ensure that the variable is of the correct data type and precision. If it is not, a PL/SQL error occurs during execution. If you have to design large subprograms, this can be time-consuming and error-prone.

Rather than hard-coding the data type and precision of a variable, you can use the `%TYPE` attribute to declare a variable according to another previously declared variable or database column. The `%TYPE` attribute is most often used when the value stored in the variable is derived from a table in the database. When you use the `%TYPE` attribute to declare a variable, you should prefix it with the database table and column name. If you refer to a previously declared variable, prefix the variable name of the previously-declared variable to the variable being declared. The benefit of `%TYPE` is that you do not have to change the variable if the column is altered. Also, if the variable is used in any calculations, you need not worry about its precision.

The `%ROWTYPE` Attribute

The `%ROWTYPE` attribute is used to declare a record that can hold an entire row of a table or view. You learn about this attribute in the lesson titled “Working with Composite Data Types.”

Summary

In this lesson, you should have learned how to:

- Recognize valid and invalid identifiers
- Declare variables in the declarative section of a PL/SQL block
- Initialize variables and use them in the executable section
- Differentiate between scalar and composite data types
- Use the `%TYPE` attribute
- Use bind variables

An anonymous PL/SQL block is a basic, unnamed unit of a PL/SQL program. It consists of a set of SQL or PL/SQL statements to perform a logical function. The declarative part is the first part of a PL/SQL block and is used for declaring objects such as variables, constants, cursors, and definitions of error situations called *exceptions*.

In this lesson, you learned how to declare variables in the declarative section. You saw some of the guidelines for declaring variables. You learned how to initialize variables when you declare them.

The executable part of a PL/SQL block is the mandatory part and contains SQL and PL/SQL statements for querying and manipulating data. You learned how to initialize variables in the executable section and also how to use them and manipulate the values of variables.