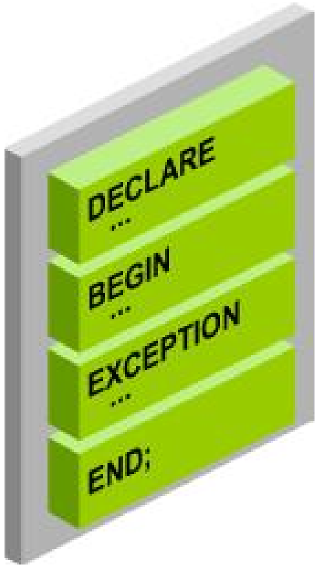
ORACLE Academy

Using Variables in PL/SQL

Tell Me/Show Me

Declaring Variables

- All PL/SQL variables must be declared in the declaration section before referencing them in the PL/SQL block.
- The purpose of a declaration is to allocate storage space for a value, specify its data type, and name the storage location so that you can reference it.
- You can declare variables in the declarative part of any PL/SQL block, subprogram, or package.



Tell Me/Show Me

Declaring and Initializing Variables Example 1

```
DECLARE
  fam_birthdate     DATE;
  fam_size          NUMBER(2) NOT NULL := 10;
  fam_location      VARCHAR2(13) := 'Florida';
  fam_bank          CONSTANT NUMBER := 50000;
  fam_population    INTEGER;
  fam_name          VARCHAR2(20) DEFAULT 'Roberts';
  fam_party_size    CONSTANT PLS_INTEGER := 20;
```

Tell Me/Show Me

Declaring and Initializing Variables Example 2

```
DECLARE
  v_emp_hiredate     DATE;
  v_emp_deptno       NUMBER(2) NOT NULL := 10;
  v_location         VARCHAR2(13)  := 'Atlanta';
  c_comm             CONSTANT NUMBER := 1400;
  v_population       INTEGER;
  v_book_type        VARCHAR2(20) DEFAULT 'fiction';
  v_artist_name      VARCHAR2(50);
  v_firstname        VARCHAR2(20):='Rajiv';
  v_lastname         VARCHAR2(20) DEFAULT 'Kumar';
  c_display_no       CONSTANT PLS_INTEGER := 20;
…
```

Tell Me/Show Me

Assigning Values in the Executable Section

After a variable is declared, you can use it in the executable section of a PL/SQL block. For example, in the following block, the variable `v_myname` is declared in the declarative section of the block. You can access this variable in the executable section of the same block. What do you think the block will print?

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

Tell Me/Show Me

Assigning Values in the Executable Section Example 1

In this example, the value `John` is assigned to the variable in the executable section. The value of the variable is concatenated with the string `My name is:` . The output is:

```
My name is:
My name is:  John


Statement process.
```

Tell Me/Show Me

Assigning Variables to PL/SQL Subprogram Output

You can use variables to hold the value that is returned by a function.

```
--function to return number of characters in string
FUNCTION num_characters (p_string IN VARCHAR2) RETURN INTEGER
IS
  v_num_characters INTEGER;
BEGIN
  SELECT LENGTH(p_string) INTO v_num_characters FROM dual;
  RETURN v_num_characters;
END;
```

```
--anonymous block: assign variable to function output
DECLARE
  v_length_of_string INTEGER;
BEGIN
  v_length_of_string := num_characters('Oracle Corporation');
  DBMS_OUTPUT.PUT_LINE(v_length_of_string);
END;
```

Recognizing PL/SQL Lexical Units

Tell Me/Show Me

Lexical Units in a PL/SQL Block

Lexical units:

- Are the building blocks of any PL/SQL block
- Are sequences of characters including letters, digits, tabs, returns, and symbols
- Can be classified as:
  - Identifiers
  - Reserved words
  - Delimiters
  - Literals
  - Comments

Tell Me/Show Me

Identifiers

An identifier is the name given to a PL/SQL object, including any of the following:

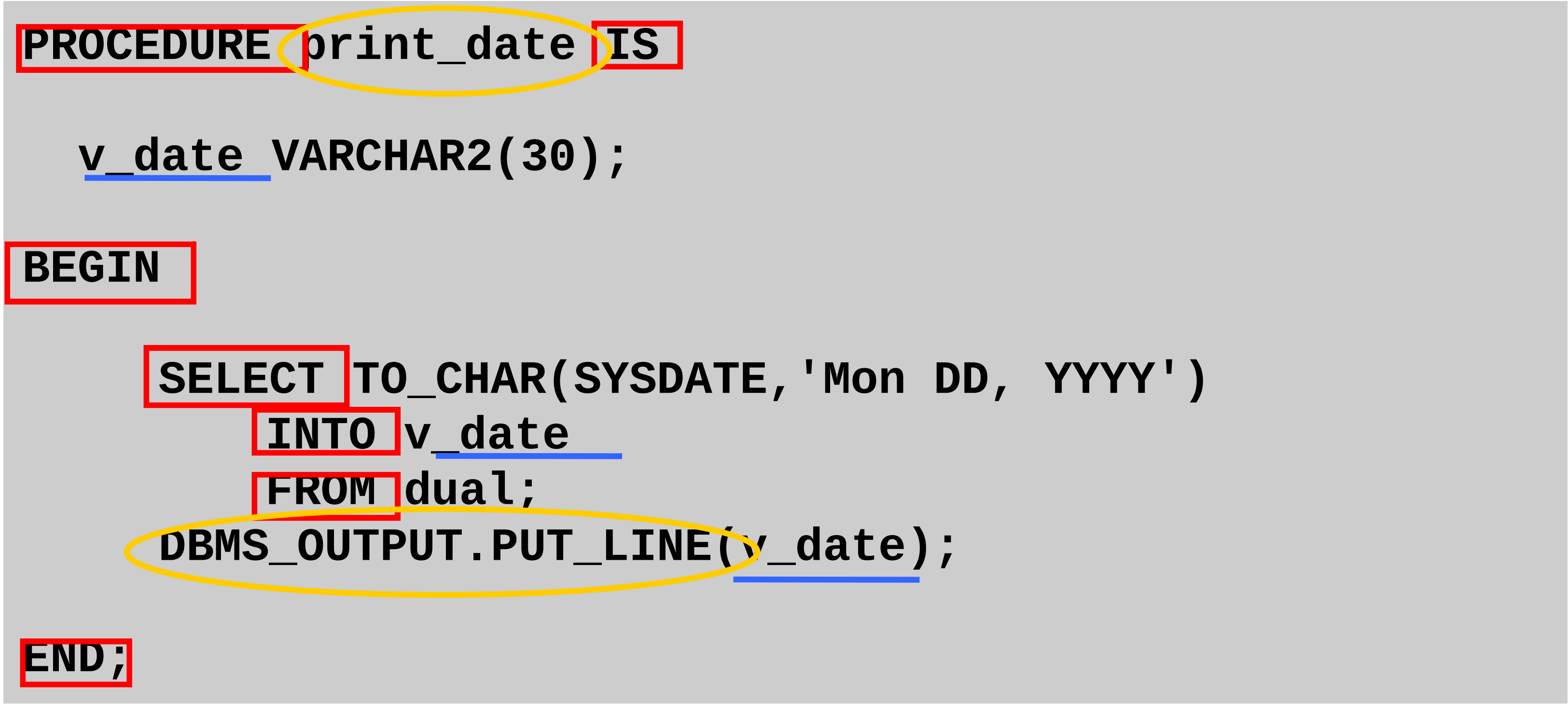
Procedure	Function	Variable
Exception	Constant	Package
Record	PL/SQL table	Cursor

(Do not be concerned if you do not know what all of the above objects are! You will learn about PL/SQL objects throughout this course.)

Tell Me/Show Me

Identifiers Highlighted

The identifiers in the following PL/SQL code are highlighted:



```
PROCEDURE print_date IS

  v_date VARCHAR2(30);

BEGIN

     SELECT TO_CHAR(SYSDATE,'Mon DD, YYYY')
         INTO v_date
         FROM dual;
     DBMS_OUTPUT.PUT_LINE(v_date);

END;
```

Key: ○ Procedure ▁▁▁ Variable □ Reserved word

Tell Me/Show Me

Identifier Properties

Identifiers:

- Are up to 30 characters in length
- Must start with a letter
- Can include $ (dollar sign), _ (underscore), and # (pound sign/hash sign)
- Cannot contain spaces
- All identifiers (variables) are case insensitive

Tell Me/Show Me

Valid and Invalid Identifiers

Examples of valid identifiers:

First_Name	LastName	address_1
ID#	Total_$	primary_department_contact

Examples of invalid identifiers:

First Name	Contains a space
Last-Name	Contains invalid "-"
1st_address_line	Begins with a number
Total_%	Contains invalid "%"
primary_building_department_contact	More than 30 characters

Tell Me/Show Me

Reserved Words

Reserved words are words that have special meaning to the Oracle database.

Reserved words cannot be used as identifiers in a PL/SQL program.

Tell Me/Show Me

Partial List of Reserved Words

The following is a partial list of reserved words.

ALL	CREATE	FROM	MODIFY	SELECT
ALTER	DATE	GROUP	NOT	SYNONYM
AND	DEFAULT	HAVING	NULL	SYSDATE
ANY	DELETE	IN	NUMBER	TABLE
AS	DESC	INDEX	OR	THEN
ASC	DISTINCT	INSERT	ORDER	UPDATE
BETWEEN	DROP	INTEGER	RENAME	VALUES
CHAR	ELSE	INTO	ROW	VARCHAR2
COLUMN	EXISTS	IS	ROWID	VIEW
COMMENT	FOR	LIKE	ROWNUM	WHERE

Note: For more information, refer to the “*PL/SQL User’s Guide and Reference*.”

Tell Me/Show Me

Delimiters

Delimiters are symbols that have special meaning to the Oracle database.

Simple delimiters

Symbol	Meaning
+	Addition operator
–	Subtraction/negation operator
*	Multiplication operator
/	Division operator
=	Equality operator
’	Character string delimiter
;	Statement terminator

Compound delimiters

Symbol	Meaning
<>	Inequality operator
!=	Inequality operator
||	Concatenation operator
--	Single-line comment indicator
/*	Beginning comment delimiter
*/	Ending comment delimiter
:=	Assignment operator

Tell Me/Show Me

Literals

A literal is an explicit numeric, character string, date, or Boolean value that is not represented by an identifier.

Literals are classified as:

- Character (also known as string literals)
- Numeric
- Boolean

Tell Me/Show Me

Character Literals

- Character literals include all the printable characters in the PL/SQL character set: letters, numerals, spaces, and special symbols.
- Character literals have the data type CHAR and must be enclosed in single quotation marks.
- Character literals can be composed of zero or more characters from the PL/SQL character set.
- Character literals are case sensitive and, therefore, PL/SQL is not equivalent to pl/sql.

```
v_first_name := 'John';
v_classroom  := '12C';
v_date_today := '20-MAY-2005';
```

Tell Me/Show Me

Numeric Literals

- Values that represent an integer or real value are numeric literals
- You can represent numeric literals either by a simple value (for example, `–32.5`) or by a scientific notation (for example, 2E5, meaning `2* (10 to the power of 5) = 200000`).
- Examples: `428`, `1.276`, `2.09E14`

```
v_elevation       := 428;
v_order_subtotal := 1025.69;
v_growth_rate    := .56;
v_distance_sun_to_centauri := 4.3E13;
```

Tell Me/Show Me

Boolean Literals

- Values that are assigned to Boolean variables are Boolean literals. They are not surrounded by quotes.
- TRUE, FALSE, and NULL are Boolean literals or keywords.

```
v_new_customer              := FALSE;
v_paid_in_full              := TRUE;
v_authorization_approved := FALSE;
v_high_school_diploma     := NULL;
v_island                    := FALSE;
```

Tell Me/Show Me

Comments

Comments explain what a piece of code is trying to achieve. Well-placed comments are extremely valuable for code readability and future code maintenance. It is good programming practice to comment code.

Comments are ignored by PL/SQL. They make no difference to how a PL/SQL block executes or the results it displays.

Tell Me/Show Me

Syntax for Commenting Code

Commenting a single line:

- Two dashes **--** are used for commenting a single line.

Commenting multiple lines:

- /* */ is used for commenting multiple lines.

```
DECLARE
...
  v_annual_sal NUMBER (9,2);
BEGIN    -- Begin the executable section

/* Compute the annual salary based on the
   monthly salary input from the user */
  v_annual_sal := v_monthly_sal * 12;
END;     -- This is the end of the block
```

Recognizing Data Types

Tell Me/Show Me

Scalar Data Types: Character (or String)

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 1.
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.
LONG	Character data of variable length (a bigger version of the VARCHAR2 data type).
LONG RAW	Raw binary data of variable length (not interpreted by PL/SQL).

Tell Me/Show Me

Scalar Data Types: Number

NUMBER [(*precision, scale*)]	Number having precision *p* and scale *s*. The precision *p* can range from 1 to 38. The scale *s* can range from –84 to 127.
BINARY_INTEGER	Base type for signed integers between -2,147,483,647 and 2,147,483,647.
PLS_INTEGER	Base type for signed integers between -2,147,483,647 and 2,147,483,647. PLS_INTEGER and BINARY_INTEGER values require less storage and are faster than NUMBER values.
BINARY_FLOAT BINARY_DOUBLE	New data types introduced in Oracle Database 10*g*. They represent a floating-point number in the IEEE 754 format. BINARY_FLOAT requires 5 bytes to store the value and BINARY_DOUBLE requires 9 bytes.

Tell Me/Show Me

Scalar Data Types: Date

DATE	Base type for dates and times. DATE values include the time of day in seconds since midnight. The range for dates is between 4712 B.C. and A.D. 9999.
TIMESTAMP	The TIMESTAMP data type, which extends the DATE data type, stores the year, month, day, hour, minute, second, and fraction of seconds.
TIMESTAMP WITH TIME ZONE	The TIMESTAMP WITH TIME ZONE data type, which extends the TIMESTAMP data type, includes a time-zone displacement—that is, the difference (in hours and minutes) between local time and Coordinated Universal Time (UTC), formerly known as Greenwich Mean Time.

Tell Me/Show Me

Scalar Data Types: Date (continued)

`TIMESTAMP WITH LOCAL TIME ZONE`	This data type differs from `TIMESTAMP WITH TIME ZONE` in that when you insert a value into a database column, the value is normalized to the database time zone, and the time-zone displacement is not stored in the column. When you retrieve the value, the Oracle server returns the value in your local session time zone.
`INTERVAL YEAR TO MONTH`	You use the `INTERVAL YEAR TO MONTH` data type to store and manipulate intervals of years and months.
`INTERVAL DAY TO SECOND`	You use the `INTERVAL DAY TO SECOND` data type to store and manipulate intervals of days, hours, minutes, and seconds.

Tell Me/Show Me

Scalar Data Types: Boolean

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

Tell Me/Show Me

Composite Data Types

A scalar type has no internal components. A composite type has internal components that can be manipulated individually.

Composite data types include the following:

- `TABLE`
- `RECORD`
- `NESTED TABLE`
- `VARRAY`

`TABLE` and `RECORD` data types are covered later in this course.

Using Scalar Data Types

Tell Me/Show Me

Declaring Character Variables

Character data types include CHAR, VARCHAR2, and LONG.

```
DECLARE
  v_emp_job           VARCHAR2(9);
  v_order_no          VARCHAR2(6);
  v_product_id        VARCHAR2(10);
  v_rpt_body_part     LONG;
…
```

Tell Me/Show Me

Declaring Number Variables

Number data types include NUMBER, PLS_INTEGER, BINARY_INTEGER, and BINARY_FLOAT. In the syntax, CONSTANT constrains the variable so that its value cannot change. Constants must be initialized.

INTEGER is an alias for NUMBER(38,0).

```
DECLARE
  v_dept_total_sal   NUMBER(9,2) := 0;
  v_count_loop       INTEGER := 0;
  c_tax_rate         CONSTANT NUMBER(3,2) := 8.25;
  …
```

Tell Me/Show Me

Declaring Date Variables

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

```
DECLARE
  v_orderdate            DATE := SYSDATE + 7;
  v_natl_holiday         DATE;
  v_web_sign_on_date     TIMESTAMP;
…
```

Tell Me/Show Me

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_valid            BOOLEAN NOT NULL := TRUE;
  v_is_found         BOOLEAN := FALSE;
  v_underage         BOOLEAN;
…
```

Tell Me/Show Me

Declaring Boolean Variables Details

- 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.

Tell Me/Show Me

Guidelines for Declaring and Initializing PL/SQL Variables

- Use meaningful names and follow naming conventions.
- 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.
- Avoid using column names as identifiers.

```
DECLARE
  country_id   CHAR(2);
BEGIN
  SELECT country_id
   INTO country_id
   FROM countries
   WHERE country_name = 'Canada';
END;
```

Tell Me/Show Me

Anchoring Variables with the %TYPE Attribute

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.

Tell Me/Show Me

%TYPE Attribute

Look at this database table and the PL/SQL block that uses it:

```
CREATE TABLE myemps (
   emp_name        VARCHAR2(6),
   emp_salary      NUMBER(6,2));

DECLARE
  v_emp_salary   NUMBER(6,2);
BEGIN
  SELECT emp_salary INTO v_emp_salary
    FROM myemps WHERE emp_name = 'Smith';
END;
```

This PL/SQL block stores the correct salary in the `v_emp_salary` variable. But what if the table column is altered later?

Tell Me/Show Me

%TYPE Attribute Details

The %TYPE attribute:

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

Tell Me/Show Me

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;
...
```

Tell Me/Show Me

Advantages of the %TYPE Attribute

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

Tell Me/Show Me

%TYPE Attribute

Look again at the database table and the PL/SQL block:

```
CREATE TABLE myemps (
  emp_name        VARCHAR2(6),
  emp_salary      NUMBER(6,2));

DECLARE
  v_emp_salary   myemps.emp_salary%TYPE;
BEGIN
  SELECT emp_salary INTO v_emp_salary
  FROM myemps WHERE emp_name = 'Smith';
END;
```

Now the PL/SQL block continues to work correctly even if the column data type is altered later.

ORACLE Academy

Writing PL/SQL Executable Statements

Tell Me/Show Me

Character Functions

Valid character functions in PL/SQL include:

ASCII	LENGTH	RPAD
CHR	LOWER	RTRIM
CONCAT	LPAD	SUBSTR
INITCAP	LTRIM	TRIM
INSTR	REPLACE	UPPER

This is not an exhaustive list. Refer to the Oracle documentation for the complete list.

Tell Me/Show Me

Examples of Character Functions

- Get the length of a string:

```
v_desc_size         INTEGER(5);
v_prod_description VARCHAR2(70):='You can use this
product with your radios for higher frequency';

-- get the length of the string in prod_description
v_desc_size:= LENGTH(v_prod_description);
```

- Convert the name of the country capitol to upper case:

```
v_capitol_name:= UPPER(v_capitol_name);
```

- Concatenate the first and last names:

```
v_emp_name:= v_first_name||' '||v_last_name;
```

Tell Me/Show Me

Number Functions

Valid number functions in PL/SQL include:

ABS	EXP	ROUND
ACOS	LN	SIGN
ASIN	LOG	SIN
ATAN	MOD	TAN
COS	POWER	TRUNC

This is not an exhaustive list. Refer to the Oracle documentation for the complete list.

Tell Me/Show Me

Examples of Number Functions

- Get the sign of a number:

```
DECLARE
  v_my_num BINARY_INTEGER :=-56664;
BEGIN
  DBMS_OUTPUT.PUT_LINE(SIGN(v_my_num));
END;
```

- Round a number to 0 decimal places:

```
DECLARE
  v_median_age NUMBER(6,2);
BEGIN
  SELECT median_age INTO v_median_age
    FROM wf_countries WHERE country_id=27;
  DBMS_OUTPUT.PUT_LINE(ROUND(v_median_age,0));
END;
```

Tell Me/Show Me

Date Functions

Valid date functions in PL/SQL include:

ADD_MONTHS	MONTHS_BETWEEN
CURRENT_DATE	ROUND
CURRENT_TIMESTAMP	SYSDATE
LAST_DAY	TRUNC

This is not an exhaustive list. Refer to the Oracle documentation for the complete list.

Tell Me/Show Me

Examples of Date Functions

- Add months to a date:

```
DECLARE
  v_new_date   DATE;
  v_num_months NUMBER := 6;
BEGIN
  v_new_date := ADD_MONTHS(SYSDATE,v_num_months);
  DBMS_OUTPUT.PUT_LINE(v_new_date);
END;
```

- Calculate the number of months between two dates:

```
DECLARE
  v_no_months  PLS_INTEGER:=0;
BEGIN
  v_no_months := MONTHS_BETWEEN('31-JAN-06','31-MAY-05');
  DBMS_OUTPUT.PUT_LINE(v_no_months);
END;
```

Tell Me/Show Me

Data-Type Conversion

In any programming language, converting one data type to another is a common requirement. PL/SQL can handle such conversions with scalar data types. Data-type conversions can be of two types:

- Implicit conversions
- Explicit conversions

Tell Me/Show Me

Implicit Conversions

In implicit conversions, PL/SQL attempts to convert data types dynamically if they are mixed in a statement. Implicit conversions can happen between many types in PL/SQL, as illustrated by the following chart.

	DATE	LONG	NUMBER	PLS_INTEGER	VARCHAR2
DATE	N/A	X			X
LONG		N/A			X
NUMBER		X	N/A	X	X
PLS_INTEGER		X	X	N/A	X
VARCHAR2	X	X	X	X	N/A

Tell Me/Show Me

Example of Implicit Conversion

Consider the following example:

```
DECLARE
  v_salary            NUMBER(6):=6000;
  v_sal_increase      VARCHAR2(5):='1000';
  v_total_salary      v_salary%TYPE;
BEGIN
  v_total_salary:= v_salary + v_sal_increase;
  DBMS_OUTPUT.PUT_LINE(v_total_salary);
END;
```

In this example, the variable `v_sal_increase` is of type VARCHAR2. While calculating the total salary, PL/SQL first converts `v_sal_increase` to NUMBER and then performs the operation. The result of the operation is the NUMBER type.

Tell Me/Show Me

Drawbacks of Implicit Conversions

At first glance, implicit conversions might seem useful; however, there are several drawbacks:

- Implicit conversions can be slower.
- When you use implicit conversions, you lose control over your program because you are making an assumption about how Oracle handles the data. If Oracle changes the conversion rules, then your code can be affected.

Tell Me/Show Me

Drawbacks of Implicit Conversions (continued)

- Implicit conversion rules depend upon the environment in which you are running. For example, the date format varies depending on the language setting and installation type. Code that uses implicit conversion might not run on a different server or in a different language.
- Code that uses implicit conversion is harder to read and understand.

Tell Me/Show Me

Drawbacks of Implicit Conversions (continued)

It is the programmer’s responsibility to ensure that values can be converted. For instance, PL/SQL can convert the `CHAR` value `'02-JUN-92'` to a `DATE` value, but cannot convert the `CHAR` value `‘Yesterday’` to a `DATE` value. Similarly, PL/SQL cannot convert a `VARCHAR2` value containing alphabetic characters to a `NUMBER` value.

Valid?	**Statement**
Yes	`v_new_date  DATE := '02-JUN-1992';`
No	`v_new_date  DATE := 'Yesterday';`
Yes	`v_my_number NUMBER := '123';`
No	`v_my_number NUMBER := 'abc';`

Tell Me/Show Me

Explicit Conversions

Explicit conversions convert values from one data type to another by using built-in functions. Examples of conversion functions include:

TO_NUMBER()	ROWIDTONCHAR()
TO_CHAR()	HEXTORAW()
TO_CLOB()	RAWTOHEX()
CHARTOROWID()	RAWTONHEX()
ROWIDTOCHAR()	TO_DATE()

Tell Me/Show Me

Examples of Explicit Conversions

TO_CHAR

```
BEGIN
  DBMS_OUTPUT.PUT_LINE(TO_CHAR(SYSDATE,'Month YYYY'));
END;
```

TO_DATE

```
BEGIN
  DBMS_OUTPUT.PUT_LINE(TO_DATE('April-1999','Month-
YYYY'));
END;
```

Tell Me/Show Me

Examples of Explicit Conversions (continued)

TO_NUMBER

```
DECLARE
  v_a VARCHAR2(10) := '-123456';
  v_b VARCHAR2(10) := '+987654';
  v_c PLS_INTEGER;
BEGIN
  v_c := TO_NUMBER(v_a) + TO_NUMBER(v_b);
  DBMS_OUTPUT.PUT_LINE(v_c);
END;
```

Tell Me/Show Me

Operators in PL/SQL

The following table shows the default order of operations from high priority to low priority:

Operator	Operation
`**`	Exponentiation
`+, -`	Identity, negation
`*, /`	Multiplication, division
`+, -, ||`	Addition, subtraction, concatenation
`=, <, >, <=, >=, <>, !=, ~=, ^=, IS NULL, LIKE, BETWEEN, IN`	Comparison
`NOT`	Logical negation
`AND`	Conjunction
`OR`	Inclusion

Tell Me/Show Me

Operators in PL/SQL Examples

- Increment the counter for a loop.

```
v_loop_count := v_loop_count + 1;
```

- Set the value of a Boolean flag.

```
v_good_sal := v_sal BETWEEN 50000 AND 150000;
```

- Validate whether an employee number contains a value.

```
v_valid       := (v_empno IS NOT NULL);
```

Nested Blocks and Variable Scope

Tell Me / Show Me

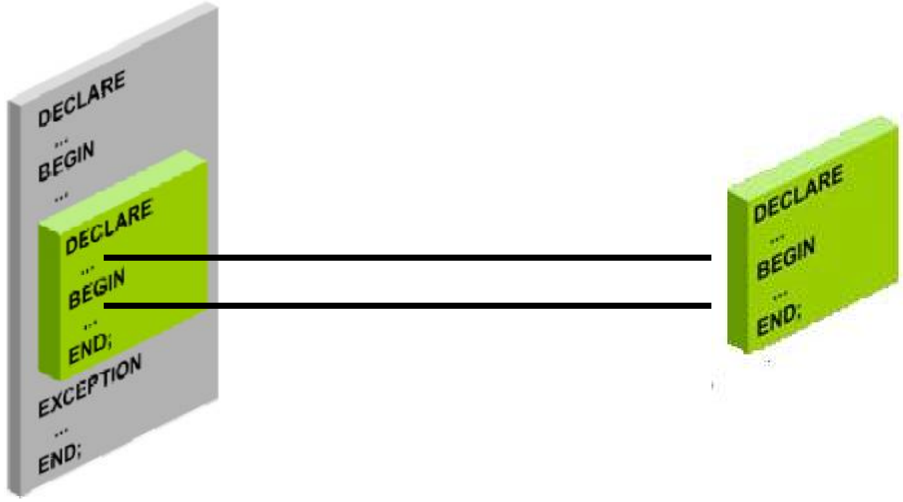
Nested Blocks

PL/SQL is a block-structured language. The basic units (procedures, functions, and anonymous blocks) are logical blocks, which can contain any number of nested sub-blocks. Each logical block corresponds to a problem to be solved.

Tell Me / Show Me

Nested Blocks Illustrated

Nested blocks are blocks of code inside blocks of code. There is an outer block and an inner block. You can nest blocks within blocks as many times as you need to; there is no practical limit to the depth of nesting Oracle allows.



Tell Me / Show Me

Nested Block Example

The example shown in the slide has an outer (parent) block (illustrated in normal text) and a nested (child) block (illustrated in bold text). The variable `v_outer_variable` is declared in the outer block and the variable `v_inner_variable` is declared in the inner block.

```
DECLARE
  v_outer_variable VARCHAR2(20):='GLOBAL VARIABLE';
BEGIN
  DECLARE
    v_inner_variable VARCHAR2(20):='LOCAL VARIABLE';
  BEGIN
    DBMS_OUTPUT.PUT_LINE(v_inner_variable);
    DBMS_OUTPUT.PUT_LINE(v_outer_variable);
  END;
  DBMS_OUTPUT.PUT_LINE(v_outer_variable);
END;
```

Tell Me / Show Me

Variable Scope

The scope of a variable is the block or blocks in which the variable is accessible, that is, it can be named and used. In PL/SQL, a variable’s scope is the block in which it is declared plus all blocks nested within the declaring block. What are the scopes of the two variables declared in this example?

```
DECLARE
  v_outer_variable VARCHAR2(20):='GLOBAL VARIABLE';
BEGIN
  DECLARE
    v_inner_variable VARCHAR2(20):='LOCAL VARIABLE';
  BEGIN
    DBMS_OUTPUT.PUT_LINE(v_inner_variable);
    DBMS_OUTPUT.PUT_LINE(v_outer_variable);
  END;
  DBMS_OUTPUT.PUT_LINE(v_outer_variable);
END;
```

Tell Me / Show Me

Variable Scope Example

Examine the following code. What is the scope of each of the variables?

```
DECLARE
  v_father_name   VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name  VARCHAR2(20):='Mike';
  BEGIN
    DBMS_OUTPUT.PUT_LINE('Father''s Name: '||v_father_name);
    DBMS_OUTPUT.PUT_LINE('Date of Birth: '||v_date_of_birth);
    DBMS_OUTPUT.PUT_LINE('Child''s Name: '||v_child_name);
  END;
  DBMS_OUTPUT.PUT_LINE('Date of Birth: '||v_date_of_birth);
END;
```

Tell Me / Show Me

Local and Global Variables

Variables declared in a PL/SQL block are considered local to that block and global to all its subblocks. `v_outer_variable` is local to the outer block but global to the inner block. When you access this variable in the inner block, PL/SQL first looks for a local variable in the inner block with that name. If there are no similarly named variables, PL/SQL looks for the variable in the outer block.

```
DECLARE
  v_outer_variable VARCHAR2(20):='GLOBAL VARIABLE';
BEGIN
  DECLARE
    v_inner_variable VARCHAR2(20):='LOCAL VARIABLE';
  BEGIN
    DBMS_OUTPUT.PUT_LINE(v_inner_variable);
    DBMS_OUTPUT.PUT_LINE(v_outer_variable);
  END;
  DBMS_OUTPUT.PUT_LINE(v_outer_variable);
END;
```

Tell Me / Show Me

Local and Global Variables (continued)

The `v_inner_variable` variable is local to the inner block and is not global because the inner block does not have any nested blocks. This variable can be accessed only within the inner block. If PL/SQL does not find the variable declared locally, it looks upward in the declarative section of the parent blocks. PL/SQL does not look downward in the child blocks.

```
DECLARE
  v_outer_variable VARCHAR2(20):='GLOBAL VARIABLE';
BEGIN
  DECLARE
    v_inner_variable VARCHAR2(20):='LOCAL VARIABLE';
  BEGIN
    DBMS_OUTPUT.PUT_LINE(v_inner_variable);
    DBMS_OUTPUT.PUT_LINE(v_outer_variable);
  END;
  DBMS_OUTPUT.PUT_LINE(v_outer_variable);
END;
```

Tell Me / Show Me

Variable Scope Accessible to Outer Block

The variables v_father_name and v_date_of_birth are declared in the outer block. They are local to the outer block and global to the inner block. Their scope includes both blocks.

```
DECLARE
  v_father_name   VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name  VARCHAR2(20):='Mike';
  ...
```

The variable v_child_name is declared in the inner (nested) block. This variable is accessible only within the nested block and is not accessible in the outer block.

Tell Me / Show Me

A Scoping Example:

Why will this code not work correctly?

```
DECLARE
  v_first_name   VARCHAR2(20);
BEGIN
  DECLARE
    v_last_name    VARCHAR2(20);
  BEGIN
    v_first_name := 'Carmen';
    v_last_name  := 'Miranda';
    DBMS_OUTPUT.PUT_LINE
               (v_first_name || ' ' || v_last_name);
  END;
  DBMS_OUTPUT.PUT_LINE
               (v_first_name || ' ' || v_last_name);
END;
```

Tell Me / Show Me

A Second Scoping Example:

Will this code work correctly? Why or why not?

```
DECLARE
  v_first_name   VARCHAR2(20);
  v_last_name    VARCHAR2(20);
BEGIN
  BEGIN                    '
    v_first_name := 'Carmen';
    v_last_name  := 'Miranda';
    DBMS_OUTPUT.PUT_LINE
               (v_first_name || ' ' || v_last_name);
  END;
  DBMS_OUTPUT.PUT_LINE
               (v_first_name || ' ' || v_last_name);
END;
```

Tell Me / Show Me

Three Levels of Nested Block

What is the scope of each of these variables?

```
DECLARE                 -- outer block
  v_outervar VARCHAR2(20);
BEGIN
  DECLARE                -- middle-level block
    v_middlevar VARCHAR2(20);
  BEGIN
    BEGIN               -- innermost block
      v_outervar := 'Joachim';
      v_middlevar := 'Chang';
    END;
  END;
END;
```

Tell Me / Show Me

Variable Naming

You cannot declare two variables with the same name in the same block. However, you can declare variables with the same name in two different blocks (nested blocks). The two items represented by the same name are distinct, and any change in one does not affect the other.

Tell Me / Show Me

Example of Variable Naming

Are the following declarations valid?

```
DECLARE                         -- outer block
  v_myvar VARCHAR2(20);
BEGIN
  DECLARE                       -- inner block
    v_myvar   VARCHAR2(15);
  BEGIN
    ...
  END;
END;
```

Tell Me / Show Me

Variable Visibility

What if the same name is used for two variables, one in each of the blocks? In this example, the variable v_date_of_birth is declared twice.

```
DECLARE
  v_father_name   VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name    VARCHAR2(20):='Mike';
    v_date_of_birth DATE:='12-Dec-2002';
  BEGIN
    DBMS_OUTPUT.PUT_LINE('Date of Birth:'
                         ||v_date_of_birth);
    ...
```

Which v_date_of_birth is referenced in the DBMS_OUTPUT.PUT_LINE statement?

Tell Me / Show Me

Variable Visibility (continued)

The visibility of a variable is the portion of the program where the variable can be accessed without using a qualifier. What is the visibility of each of the variables?

```
   DECLARE
     v_father_name   VARCHAR2(20):='Patrick';
     v_date_of_birth DATE:='20-Apr-1972';
   BEGIN
     DECLARE
       v_child_name    VARCHAR2(20):='Mike';
       v_date_of_birth DATE:='12-Dec-2002';
     BEGIN
1      DBMS_OUTPUT.PUT_LINE('Father''s Name: '||v_father_name);
       DBMS_OUTPUT.PUT_LINE('Date of Birth: '||v_date_of_birth);
2      DBMS_OUTPUT.PUT_LINE('Child''s Name: '||v_child_name);
     END;
     DBMS_OUTPUT.PUT_LINE('Date of Birth: '||v_date_of_birth);
   END;
```

Tell Me / Show Me

Variable Visibility (continued)

The `v_date_of_birth` variable declared in the outer block has scope even in the inner block. This variable is visible in the outer block. However, it is not visible in the inner block because the inner block has a local variable with the same name. The `v_father_name` variable is visible in the inner and outer blocks. The `v_child_name` variable is visible only in the inner block.

```
DECLARE
  v_father_name   VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name    VARCHAR2(20):='Mike';
    v_date_of_birth DATE:='12-Dec-2002';
  …
```

What if you want to reference the outer block's `v_date_of_birth` within the inner block?

Tell Me / Show Me

Qualifying an Identifier

A qualifier is a label given to a block. You can use this qualifier to access the variables that have scope but are not visible. In this example, the outer block has the label, <<outer>>.

```
<<outer>>
DECLARE
  v_father_name   VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name    VARCHAR2(20):='Mike';
    v_date_of_birth DATE:='12-Dec-2002';
  …
```

Labeling is not limited to the outer block; you can label any block.

Tell Me / Show Me

Qualifying an Identifier (continued)

Using the `outer` label to qualify the `v_date_of_birth` identifier, you can now print the father's date of birth in the inner block.

```
<<outer>>
DECLARE
  v_father_name VARCHAR2(20):='Patrick';
  v_date_of_birth DATE:='20-Apr-1972';
BEGIN
  DECLARE
    v_child_name VARCHAR2(20):='Mike';
    v_date_of_birth DATE:='12-Dec-2002';
  BEGIN
   DBMS_OUTPUT.PUT_LINE('Father''s Name: '||v_father_name);
   DBMS_OUTPUT.PUT_LINE('Date of Birth: ' ||outer.v_date_of_birth);
   DBMS_OUTPUT.PUT_LINE('Child''s Name: '||v_child_name);
   DBMS_OUTPUT.PUT_LINE('Date of Birth: '||v_date_of_birth);
  END;
END;
```

```
Father's Name:   Patrick
Date of Birth:   20-APR-72
Child's Name:    Mike
Date of Birth:   12-DEC-02

Statement processed.
```

Good Programming Practices

Tell Me/Show Me

Programming Practices

You’ve already learned several good programming practices in this course:

- Conversions:
  - Do not rely on implicit data type conversions because they can be slower and the rules can change in later software releases.
- Declaring and initializing PL/SQL variables:
  - Use meaningful names
  - Declare one identifier per line for better readability and code maintenance.
  - Use the `NOT NULL` constraint when the variable must hold a value.
  - Avoid using column names as identifiers.
  - Use the `%TYPE` attribute to declare a variable according to another previously declared variable or database column.

Tell Me/Show Me

Programming Guidelines

Other programming guidelines include:

- Documenting code with comments
- Developing a case convention for the code
- Developing naming conventions for identifiers and other objects
- Enhancing readability by indenting

Tell Me/Show Me

Commenting Code Example

Prefix single-line comments with two dashes (--).

Place multiple-line comments between the symbols “/*” and “*/”.

```
DECLARE
...
  v_annual_sal NUMBER (9,2);
BEGIN    -- Begin the executable section

/* Compute the annual salary based on the
   monthly salary input from the user */
  v_annual_sal := v_monthly_sal * 12;
END;     -- This is the end of the block
```

Tell Me/Show Me

Case Conventions

The following table provides guidelines for writing code in uppercase or lowercase to help you distinguish keywords from named objects.

Category	Case Convention	Examples
SQL keywords	Uppercase	`SELECT`, `INSERT`
PL/SQL keywords	Uppercase	`DECLARE`, `BEGIN`, `IF`
Data types	Uppercase	`VARCHAR2`, `BOOLEAN`
Identifiers and parameters	Lowercase	`v_sal`, `emp_cursor`, `g_sal`, `p_empno`
Database tables and columns	Lowercase	`employees`, `employee_id`, `department_id`

Tell Me/Show Me

Naming Conventions

The naming of identifiers should be clear, consistent, and unambiguous. One commonly-used convention is to name:

- Variables starting with v_
- Constants starting with c_
- Parameters (passed to procedures and functions) starting with p_

Examples: `v_date_of_birth`; `c_tax_rate`; `p_empno`;