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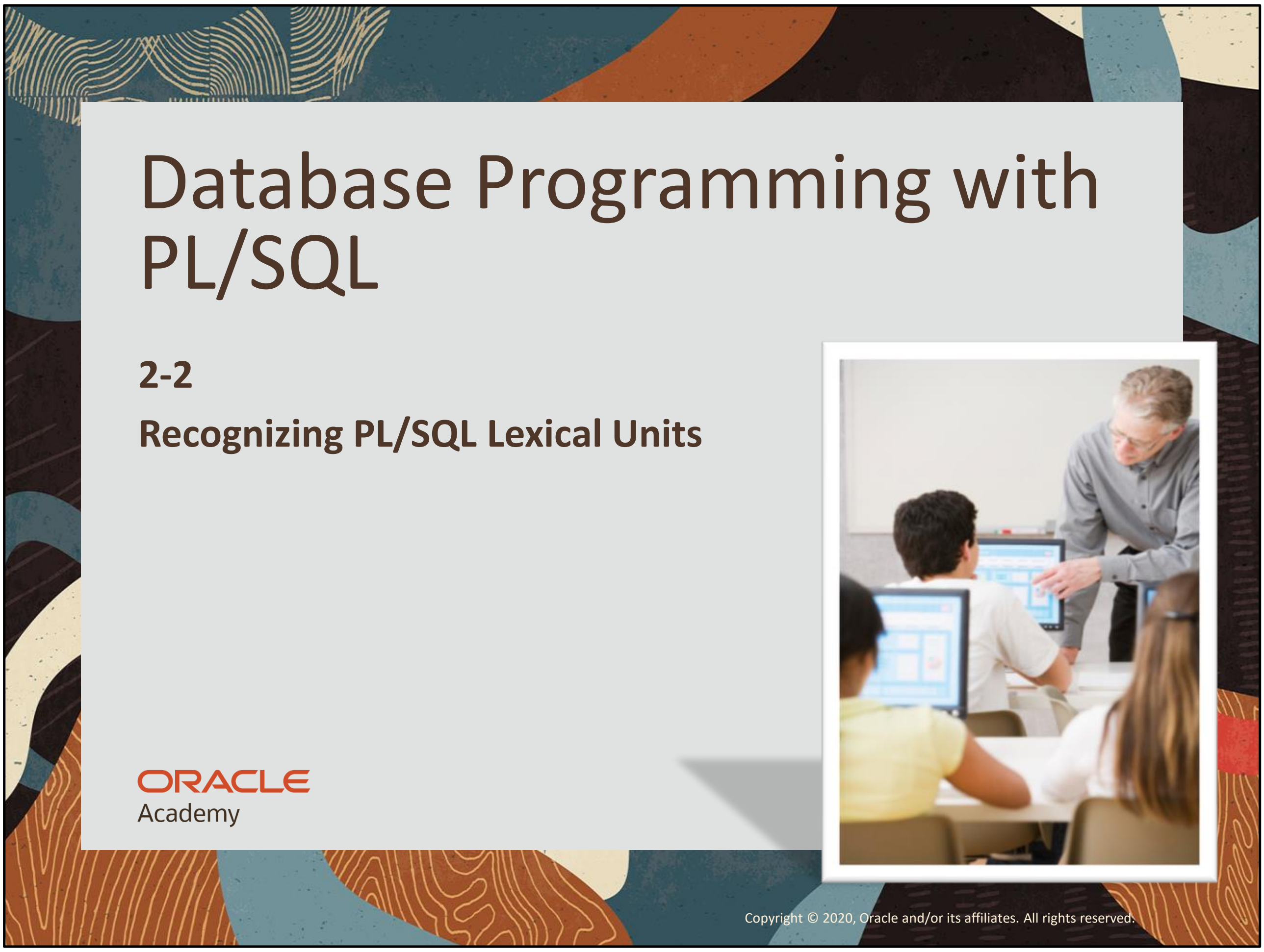

Database Programming with PL/SQL

2-2

Recognizing PL/SQL Lexical Units

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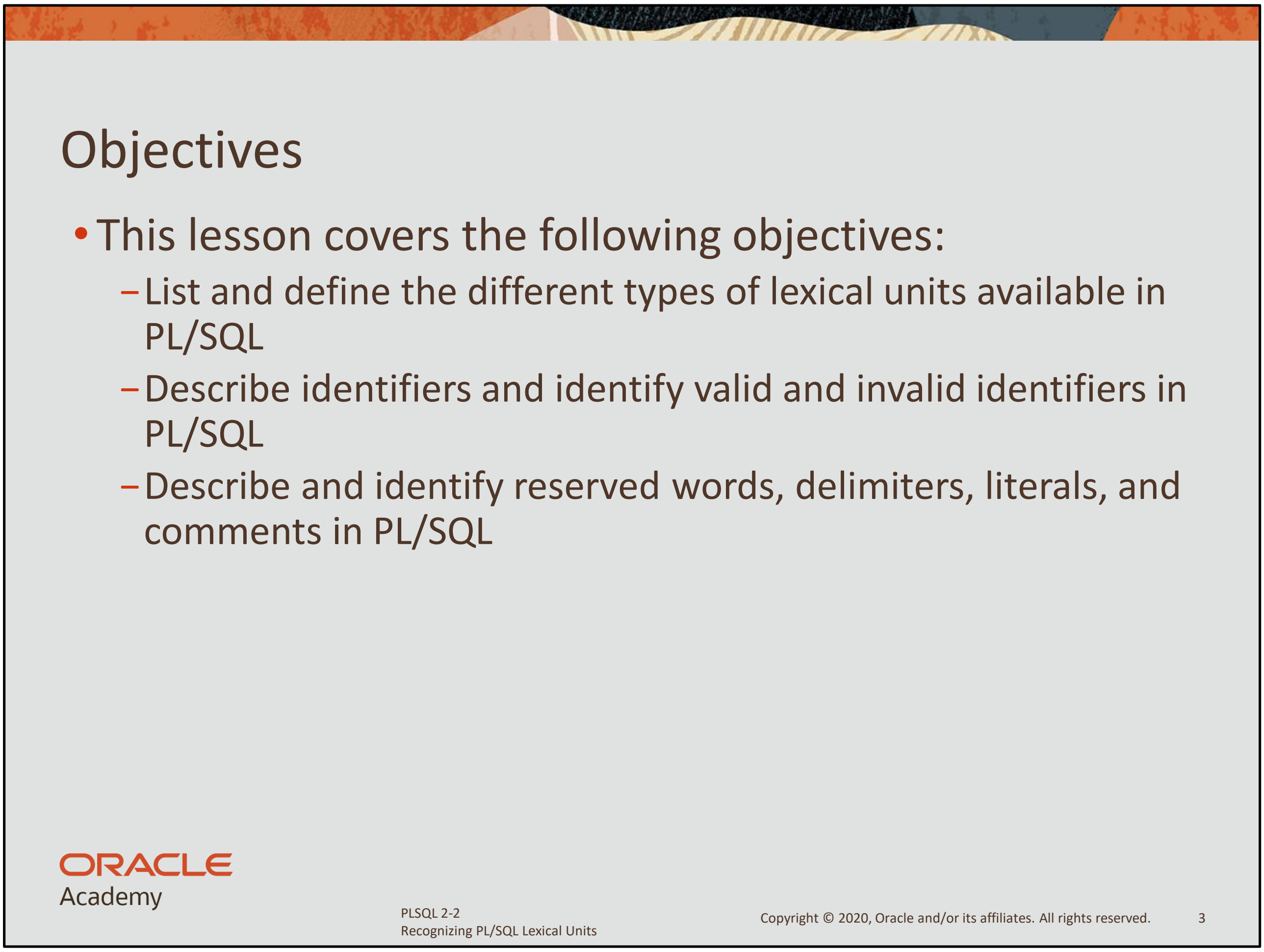
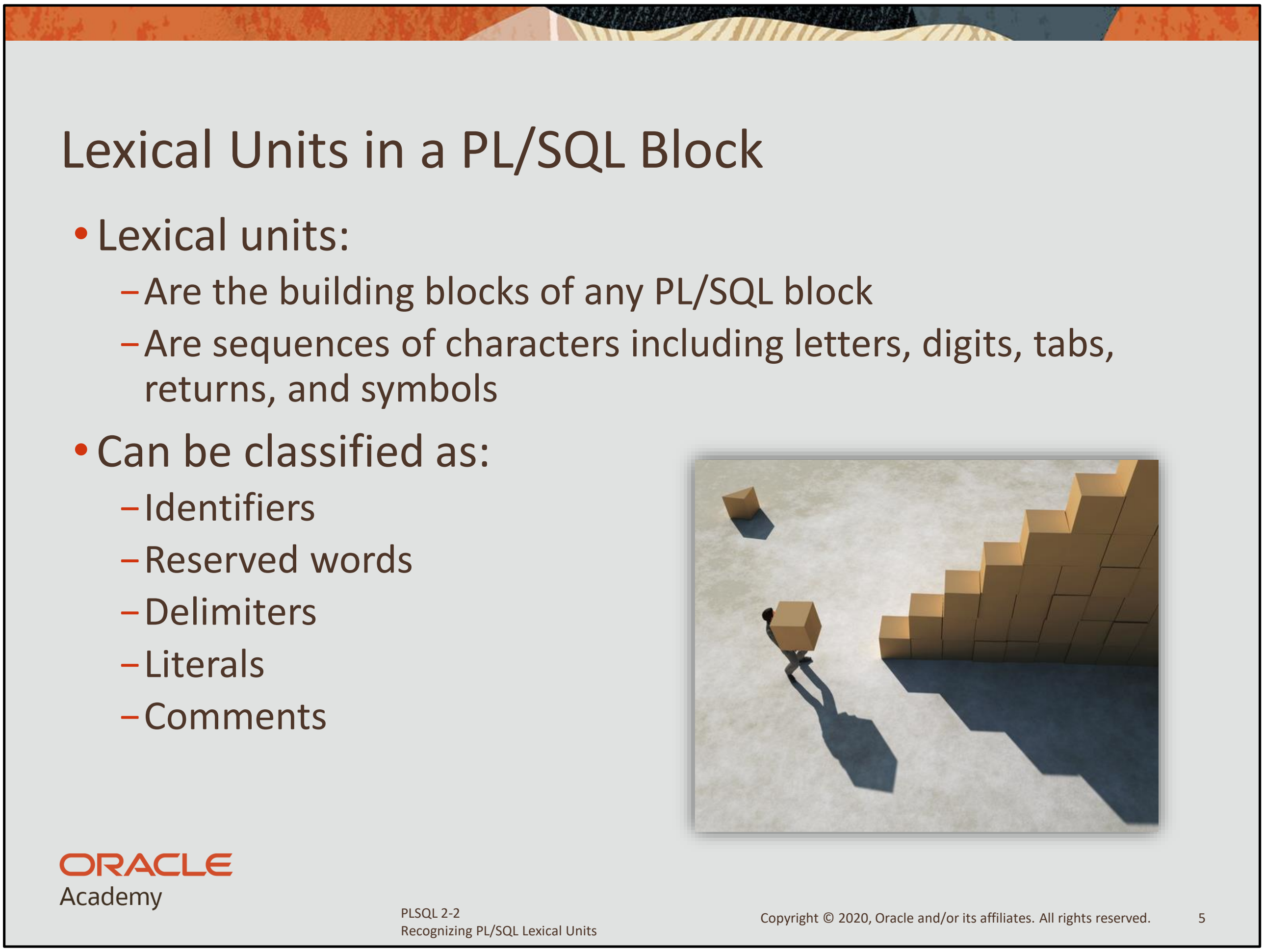


Objectives

- This lesson covers the following objectives:
  - List and define the different types of lexical units available in PL/SQL
  - Describe identifiers and identify valid and invalid identifiers in PL/SQL
  - Describe and identify reserved words, delimiters, literals, and comments in PL/SQL

Purpose

- A spoken language has different parts of speech
- Each part of speech (such as an adjective, noun, and verb) is used differently and must follow rules
- Similarly, a programming language has different parts of speech that are used differently and must follow rules
- These parts of speech are called lexical units



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

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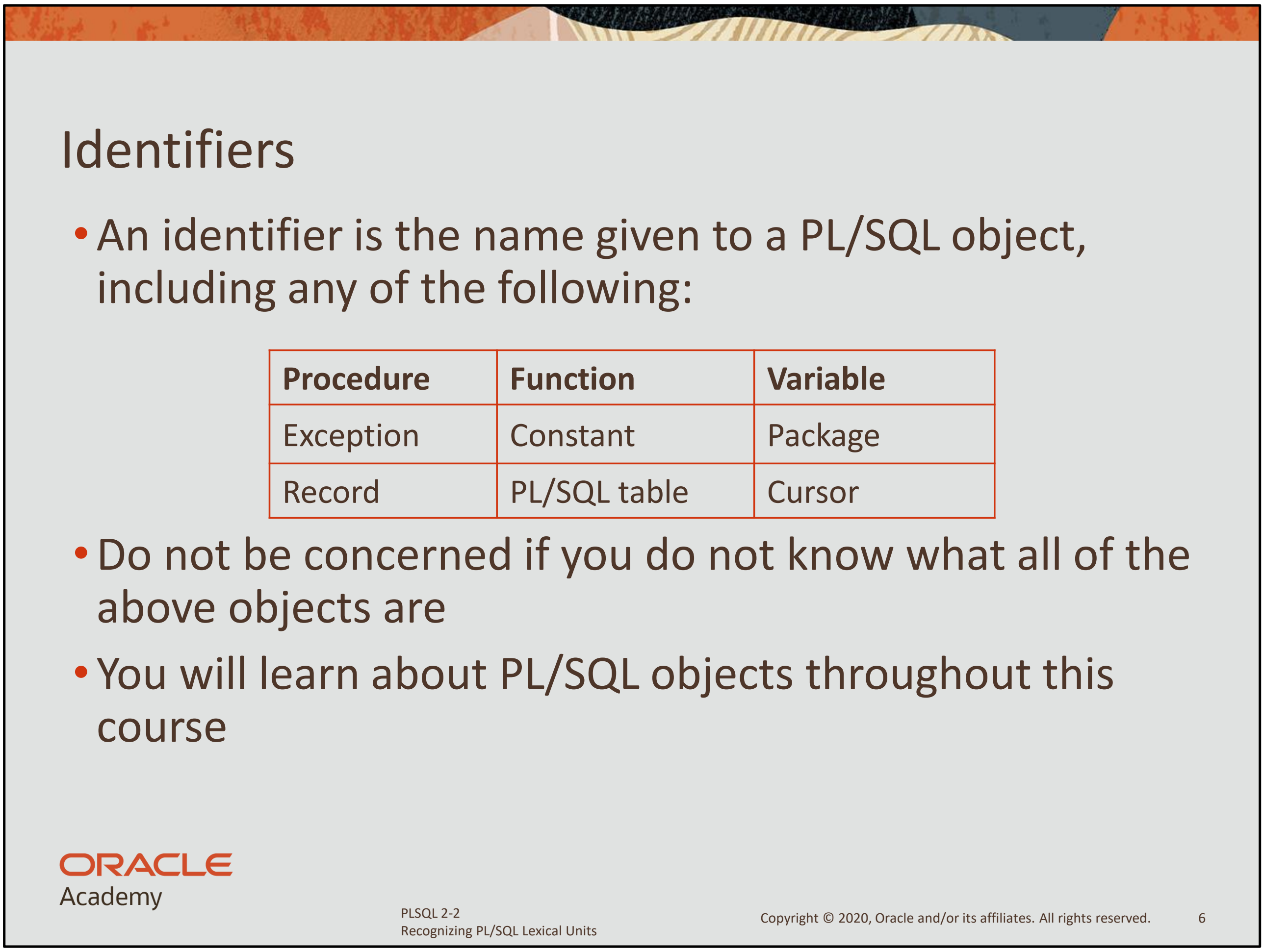
- Identifiers are names for objects such as variables, functions, and procedures.

- Reserved words are words already used by PL/SQL, such as BEGIN, END, and DECLARE, and words already used by SQL, such as SELECT, INTO, FROM, etc.

- Delimiters are symbols that have special meaning (+, ;, :=, ", etc.)

- A literal is an explicit numeric, character string, date, or Boolean value (ex. a person's first name could be a literal that is stored in a variable).

- Comments explain what a piece of code is trying to achieve and are ignored when the code is processed.



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

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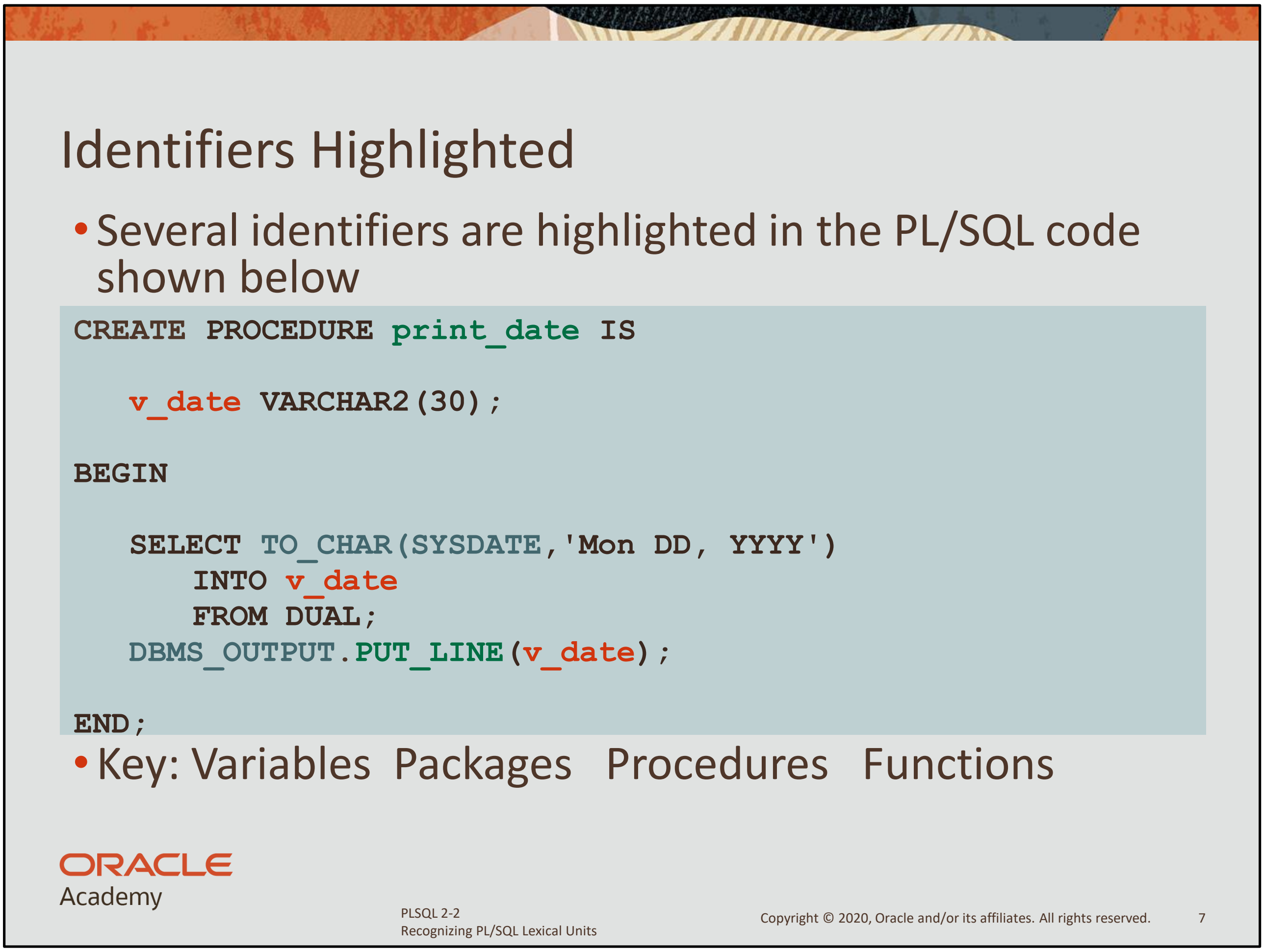

Identifiers Highlighted

- Several identifiers are highlighted in the PL/SQL code shown below

```
CREATE 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: Variables Packages   Procedures   Functions

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PLSQL 2-2
Recognizing PL/SQL Lexical Units

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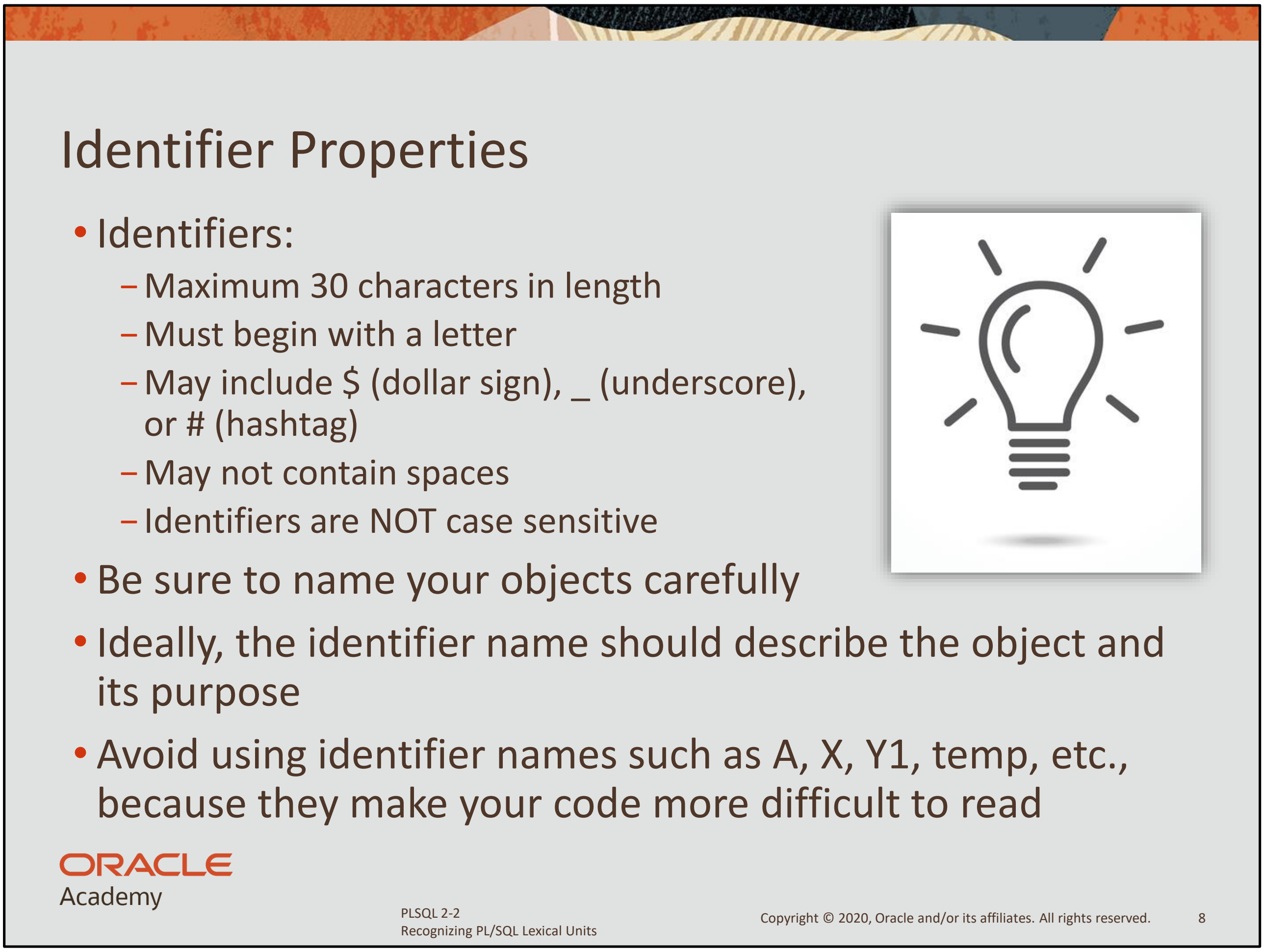
Identifiers are names for objects such as variables, functions, procedures, and packages.

The words PROCEDURE, IS, VARCHAR2, BEGIN, SELECT, INTO, FROM, DUAL, and END are reserved words.

As the course progresses, you will learn more about each of these elements.



Identifier Properties

- Identifiers:
  - Maximum 30 characters in length
  - Must begin with a letter
  - May include $ (dollar sign), _ (underscore), or # (hashtag)
  - May not contain spaces
  - Identifiers are NOT case sensitive
- Be sure to name your objects carefully
- Ideally, the identifier name should describe the object and its purpose
- Avoid using identifier names such as A, X, Y1, temp, etc., because they make your code more difficult to read

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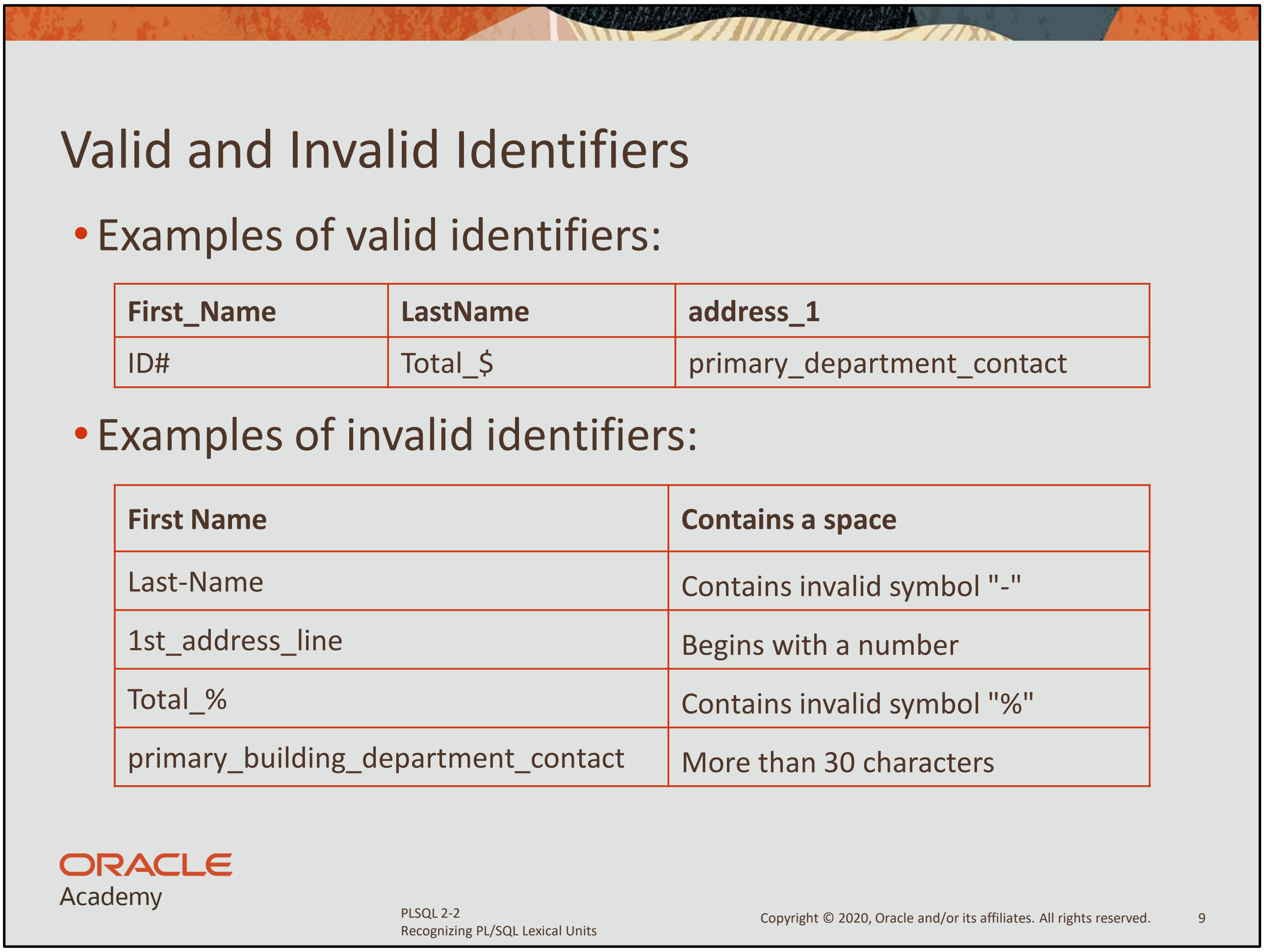
The convention is to begin variables with v_ and constants with c_.

Identifiers are NOT case sensitive, so v_num, V_NUM, and V_Num are all the same identifier.



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 symbol "-"
1st_address_line	Begins with a number
Total_%	Contains invalid symbol "%"
primary_building_department_contact	More than 30 characters

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Reserved Words

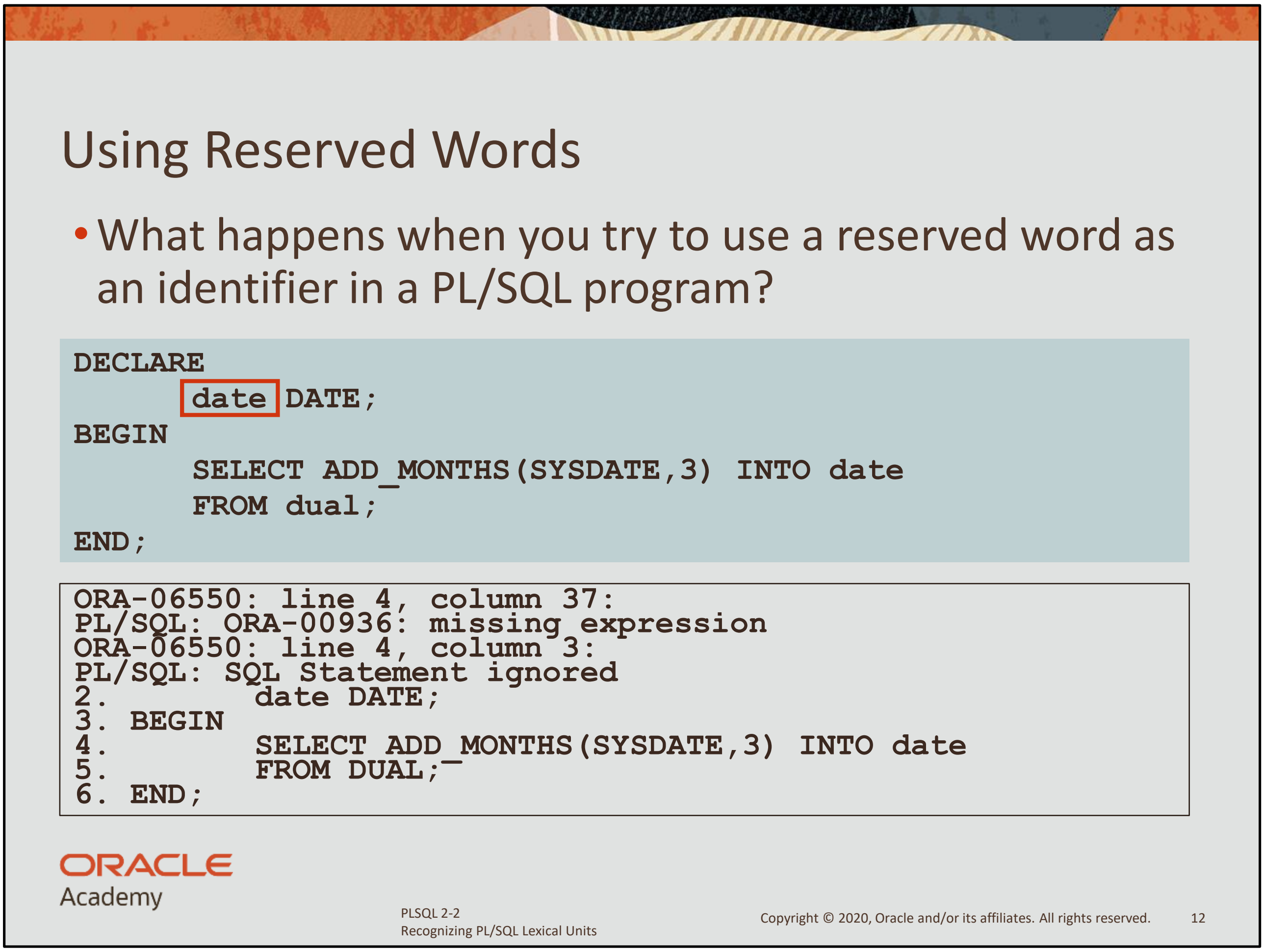
- Reserved words are words that have special meaning to the Oracle database
- Reserved words cannot be used as identifiers in a PL/SQL program

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”



Using Reserved Words

- What happens when you try to use a reserved word as an identifier in a PL/SQL program?

```
DECLARE
      date DATE;
BEGIN
      SELECT ADD_MONTHS(SYSDATE,3) INTO date
      FROM dual;
END;
```

```
ORA-06550: line 4, column 37:
PL/SQL: ORA-00936: missing expression
ORA-06550: line 4, column 3:
PL/SQL: SQL Statement ignored
2.         date DATE;
3.  BEGIN
4.         SELECT ADD_MONTHS(SYSDATE,3) INTO date
5.         FROM DUAL;‾
6.  END;
```

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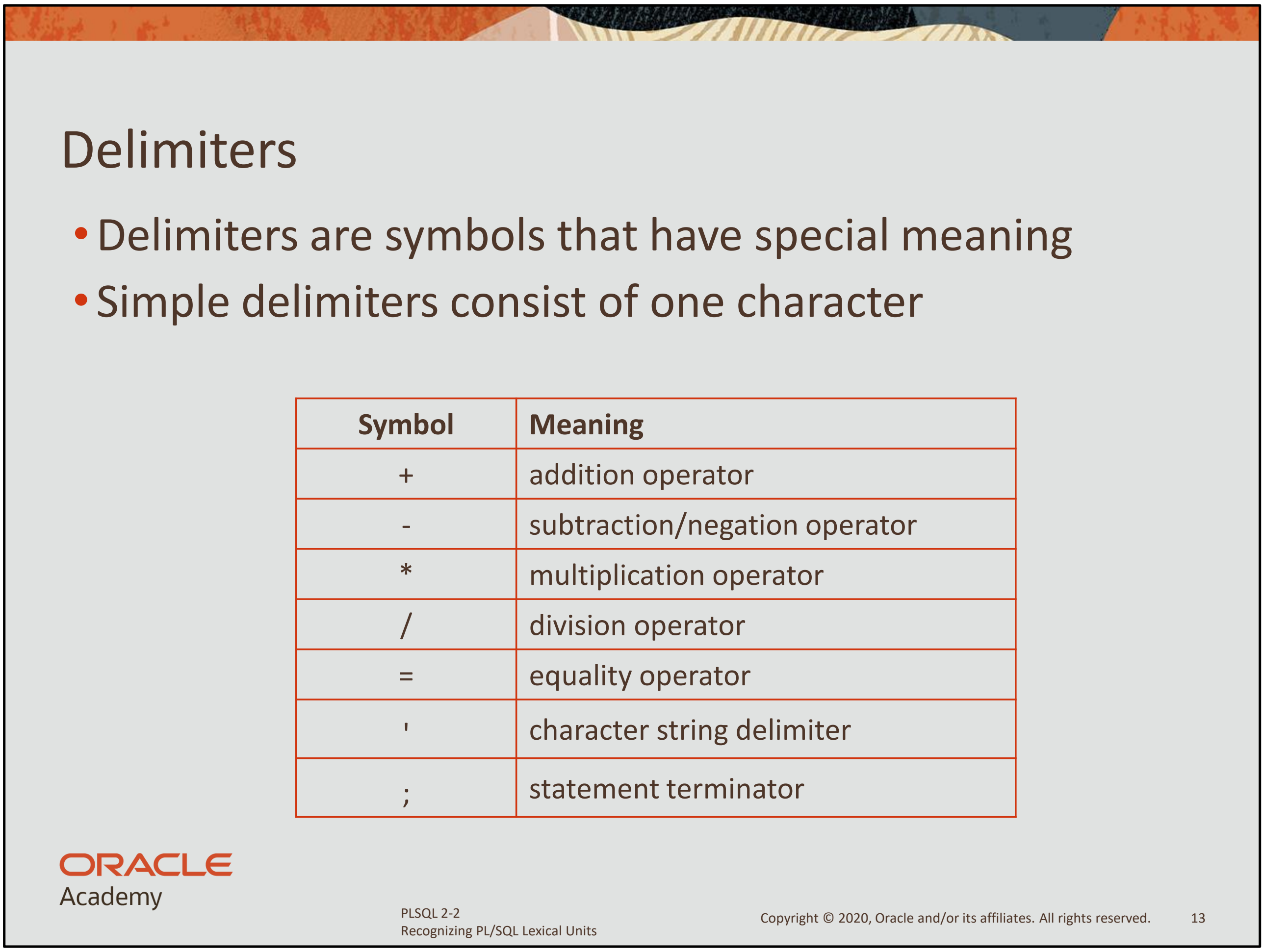

Delimiters

- Delimiters are symbols that have special meaning
- Simple delimiters consist of one character

Symbol	Meaning
+	addition operator
-	subtraction/negation operator
*	multiplication operator
/	division operator
=	equality operator
'	character string delimiter
;	statement terminator

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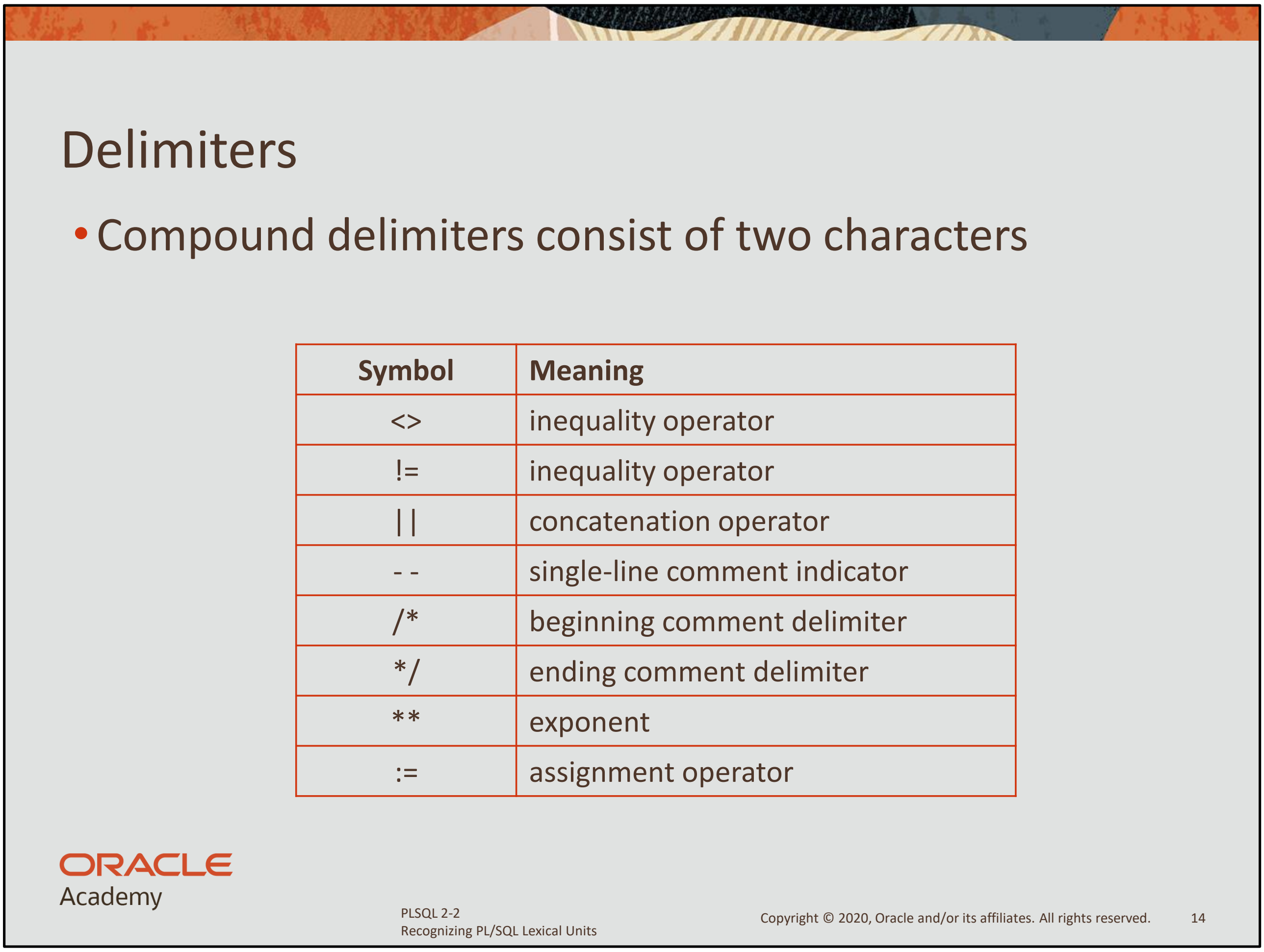
You have already learned that the symbol ";" is used to terminate a SQL or PL/SQL statement. It tells the compiler that it is the end of the statement. Lines of code are not terminated at the physical end of the line. They are terminated by the semi-colon. Often a single statement is spread over several lines to make the code more readable.



Delimiters

- Compound delimiters consist of two characters

<table>
<tr><th>Symbol</th><th>Meaning</th></tr>
<tr><td>&lt;&gt;</td><td>inequality operator</td></tr>
<tr><td>!=</td><td>inequality operator</td></tr>
<tr><td>| |</td><td>concatenation operator</td></tr>
<tr><td>- -</td><td>single-line comment indicator</td></tr>
<tr><td>/*</td><td>beginning comment delimiter</td></tr>
<tr><td>*/</td><td>ending comment delimiter</td></tr>
<tr><td>* *</td><td>exponent</td></tr>
<tr><td>:=</td><td>assignment operator</td></tr>
</table>

The single-line comment indicator is shown with a space between the dashes for visual clarity. When used, there should not be a space between any of the characters in a compound delimiter.

Literals

- A literal is an explicit numeric, character string, date, or Boolean value that might be stored in a variable
- Literals are classified as:
  - Character (also known as string literals)
  - Numeric
  - Boolean

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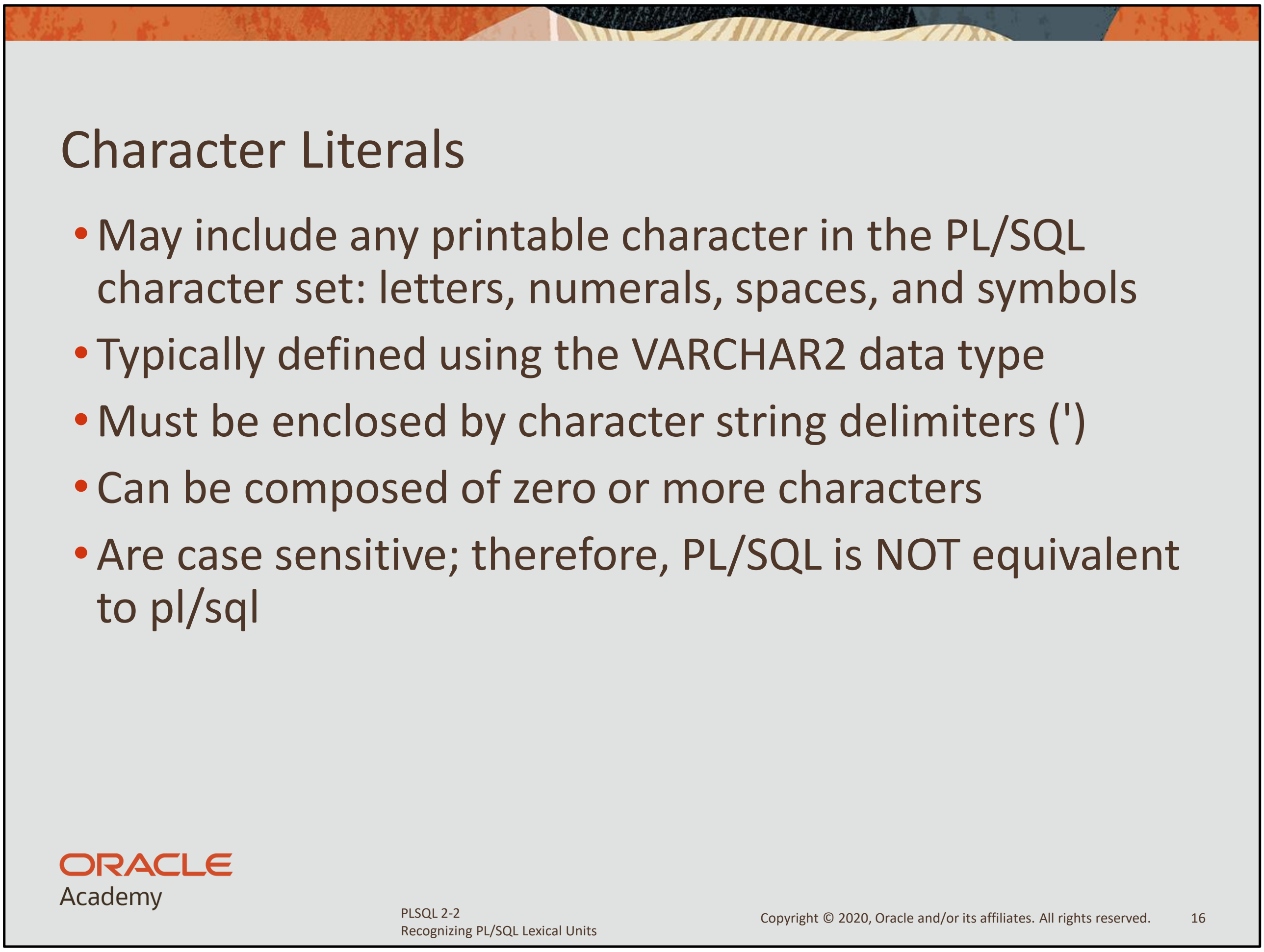
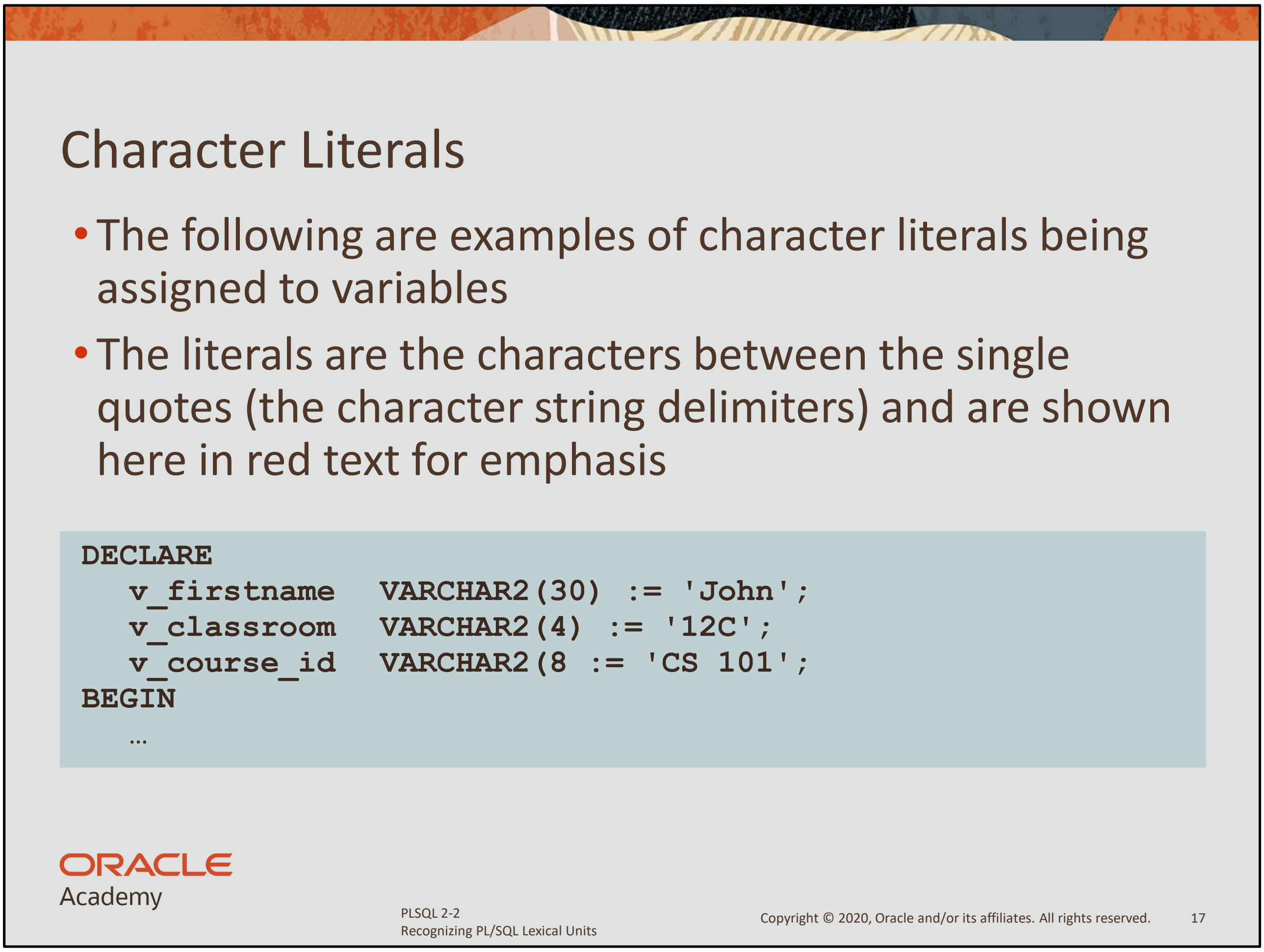


Character Literals

- May include any printable character in the PL/SQL character set: letters, numerals, spaces, and symbols
- Typically defined using the VARCHAR2 data type
- Must be enclosed by character string delimiters (')
- Can be composed of zero or more characters
- Are case sensitive; therefore, PL/SQL is NOT equivalent to pl/sql

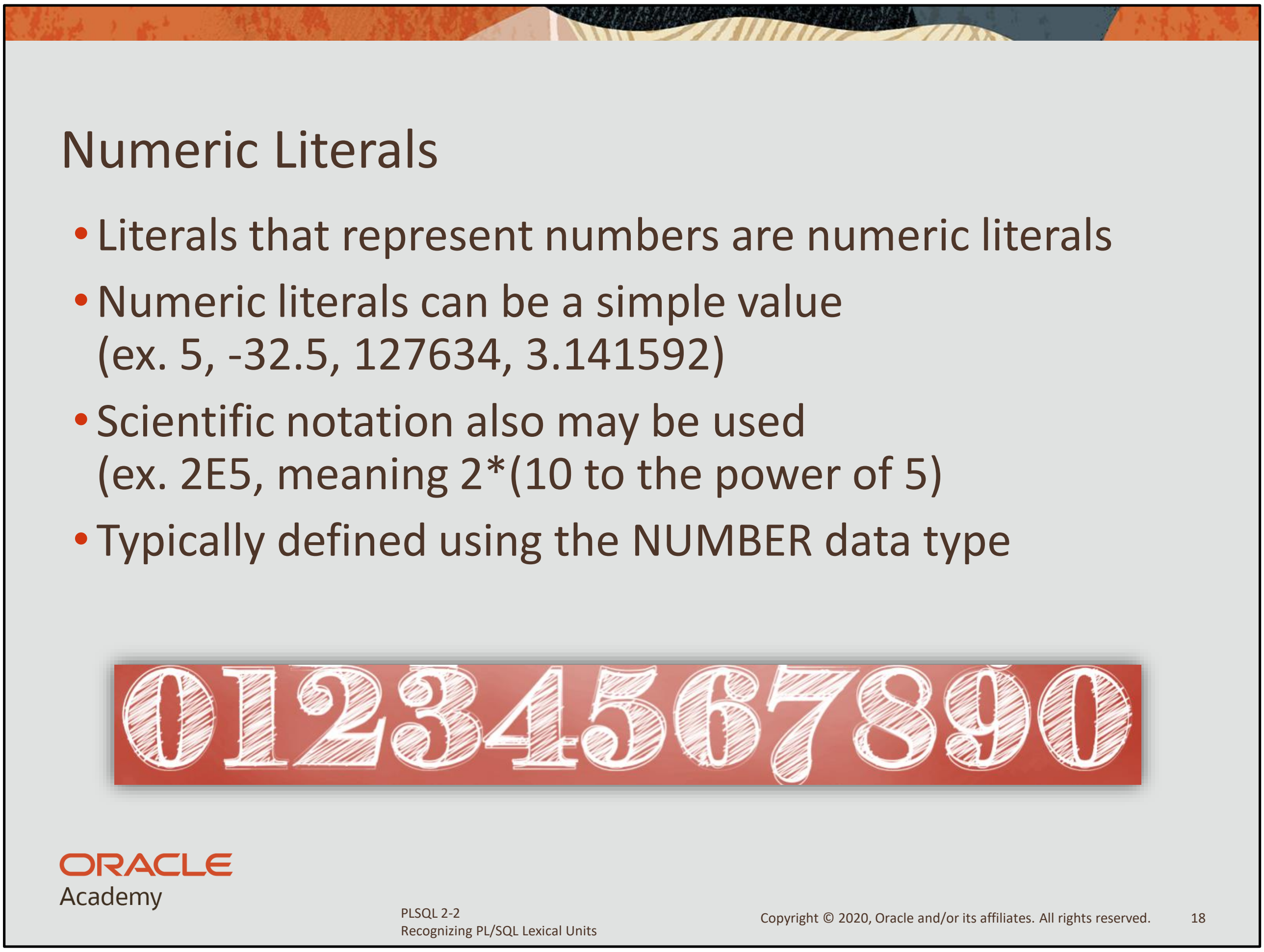
Be careful when copying code into the APEX SQL Commands window. Some word processors may default to displaying "smart quotes." Smart quotes are curly or sloped. PL/SQL code requires the use of "straight quotes."



Character Literals

- The following are examples of character literals being assigned to variables
- The literals are the characters between the single quotes (the character string delimiters) and are shown here in red text for emphasis

```
DECLARE
   v_firstname   VARCHAR2(30)  := 'John';
   v_classroom   VARCHAR2(4)  := '12C';
   v_course_id   VARCHAR2(8  := 'CS 101';
BEGIN
   …
```



Numeric Literals

- Literals that represent numbers are numeric literals
- Numeric literals can be a simple value (ex. 5, -32.5, 127634, 3.141592)
- Scientific notation also may be used (ex. 2E5, meaning 2*(10 to the power of 5)
- Typically defined using the NUMBER data type

0123456789 0

Numeric Literals

- The following are examples of numeric literals being assigned to variables (and one constant)
- The literals are shown here in red text for emphasis

```
DECLARE
   v_classroom   NUMBER(3)  := 327;
   v_grade       NUMBER(3)  := 95;
   v_price       NUMBER(5)  := 150;
   v_salary      NUMBER(8)  := 2E5;
   c_pi          CONSTANT NUMBER(7,6)  := 3.141592;
BEGIN
   …
```

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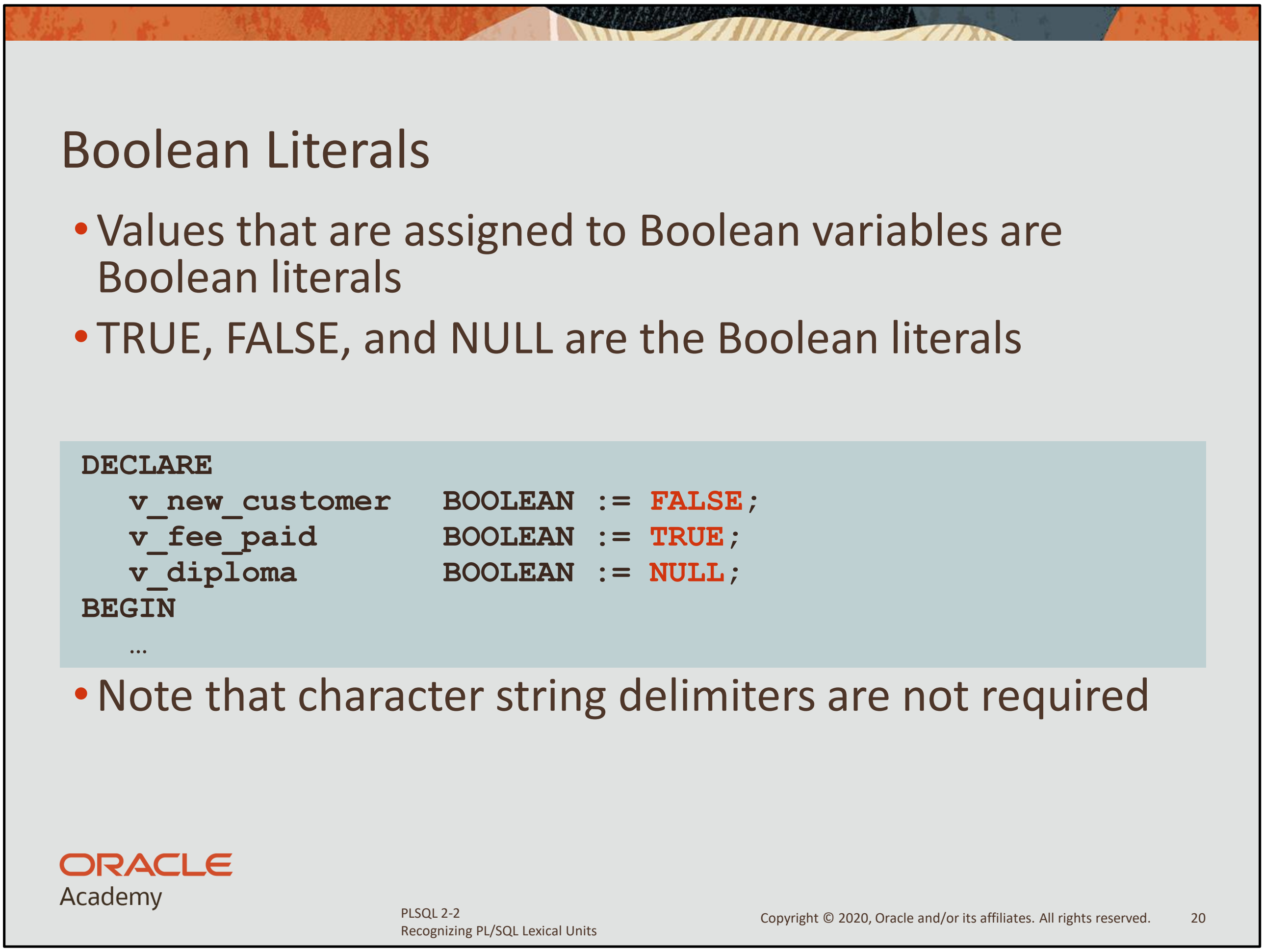

Boolean Literals

- Values that are assigned to Boolean variables are Boolean literals
- TRUE, FALSE, and NULL are the Boolean literals

```
DECLARE
   v_new_customer   BOOLEAN := FALSE;
   v_fee_paid       BOOLEAN := TRUE;
   v_diploma        BOOLEAN := NULL;
BEGIN
   …
```

- Note that character string delimiters are not required

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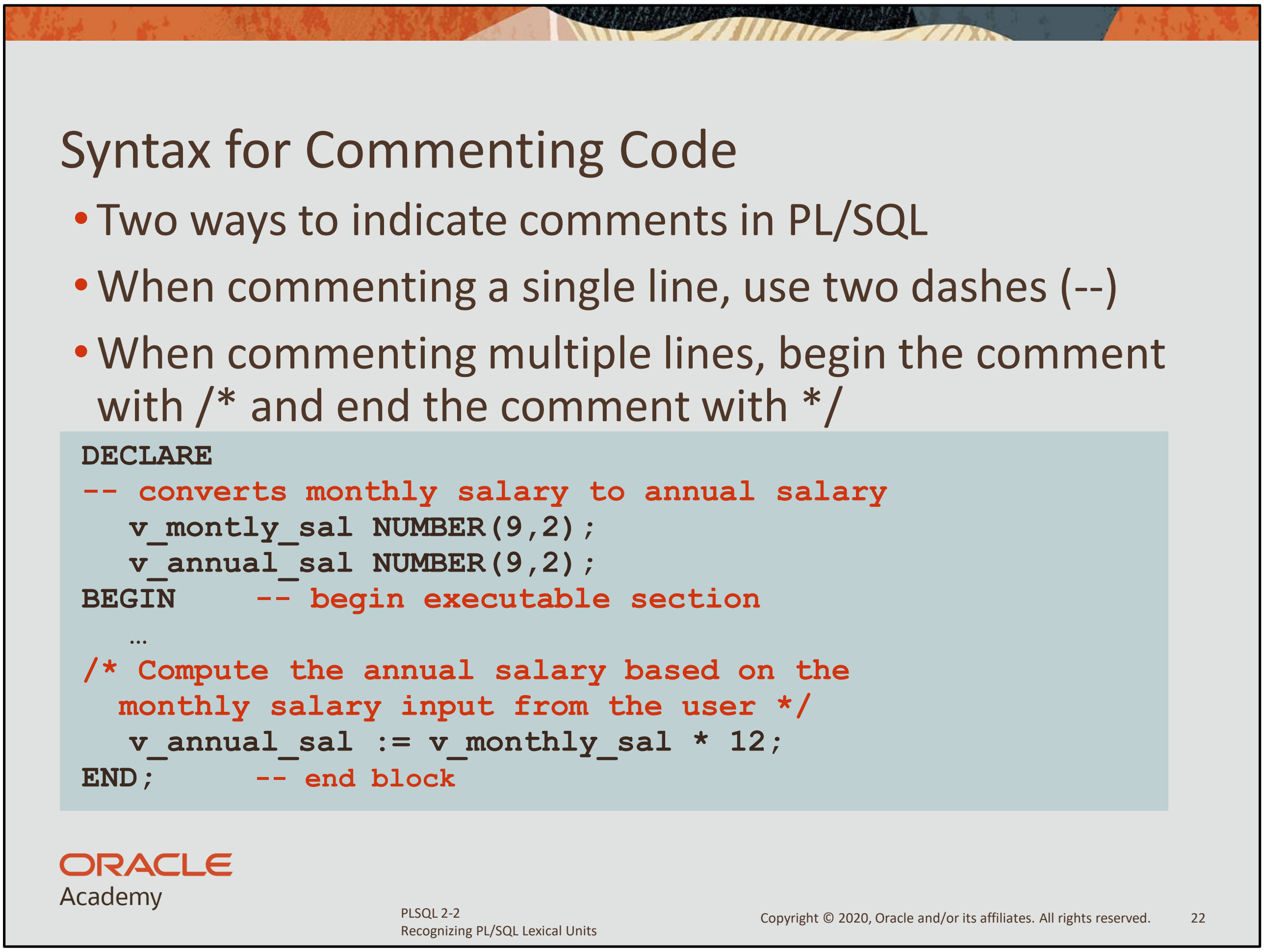
The idea of Boolean variables and literals may be new to students because an Oracle database table cannot contain columns with a Boolean data type. More information regarding the use of Boolean variables will be covered later in the course.

Boolean literals are NOT case sensitive, so FALSE is the same as false, TRUE is the same as true, and NULL is the same as null.

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
- Comments should describe the purpose and use of each block of code
- 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



Syntax for Commenting Code

- Two ways to indicate comments in PL/SQL
- When commenting a single line, use two dashes (--)
- When commenting multiple lines, begin the comment with /* and end the comment with */

```
DECLARE
-- converts monthly salary to annual salary
   v_montly_sal NUMBER(9,2);
   v_annual_sal NUMBER(9,2);
BEGIN    -- begin executable section
   …
/* Compute the annual salary based on the
  monthly salary input from the user */
   v_annual_sal := v_monthly_sal * 12;
END;     -- end block
```

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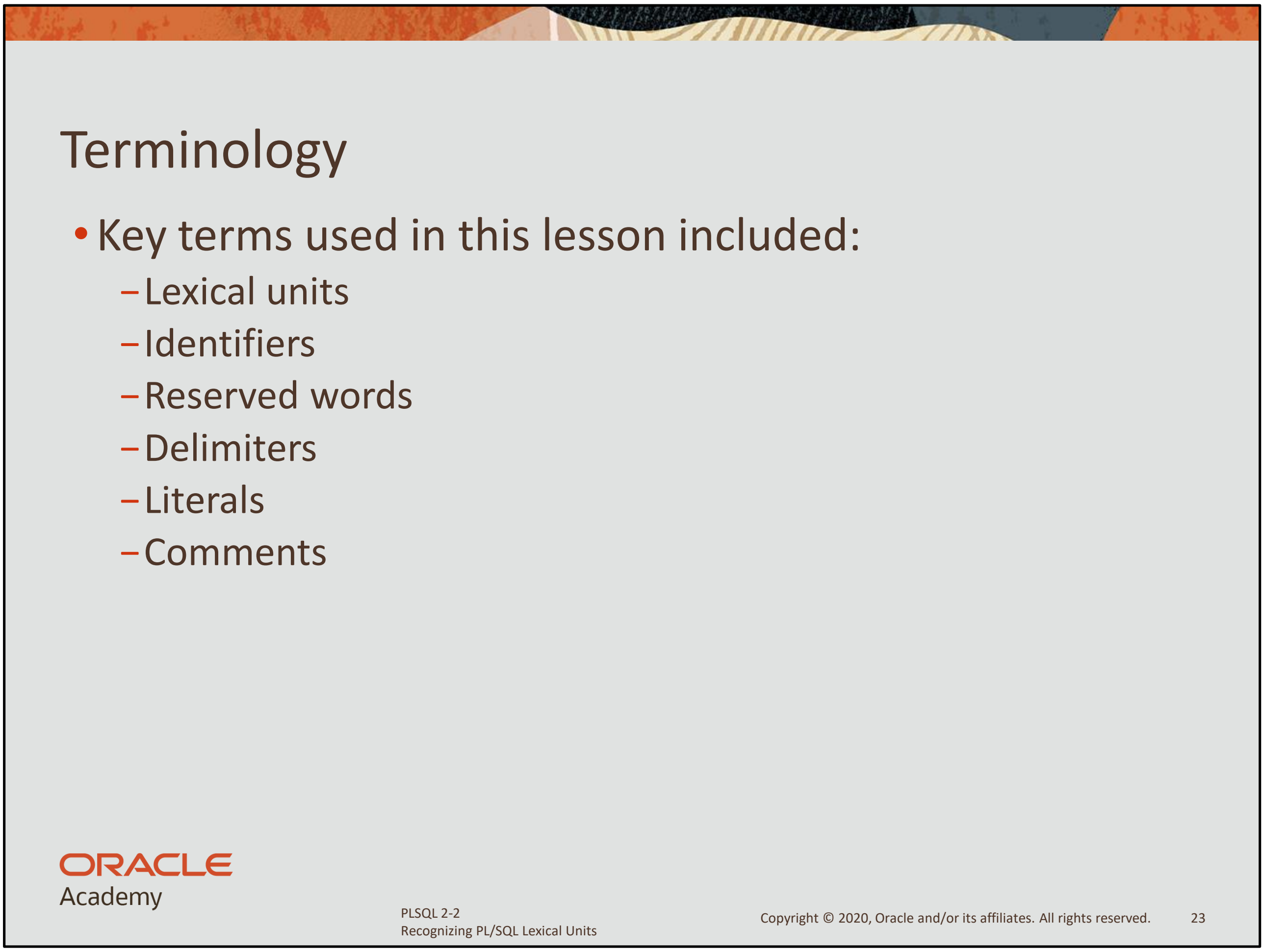
This example includes thorough commenting, especially for such a simple block of code, but is shown to demonstrate various ways to add comments to your code.



Terminology

- Key terms used in this lesson included:
  - Lexical units
  - Identifiers
  - Reserved words
  - Delimiters
  - Literals
  - Comments

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- Lexical Units – Building blocks of any PL/SQL block and are sequences of characters including letters, digits, tabs, returns, and symbols.

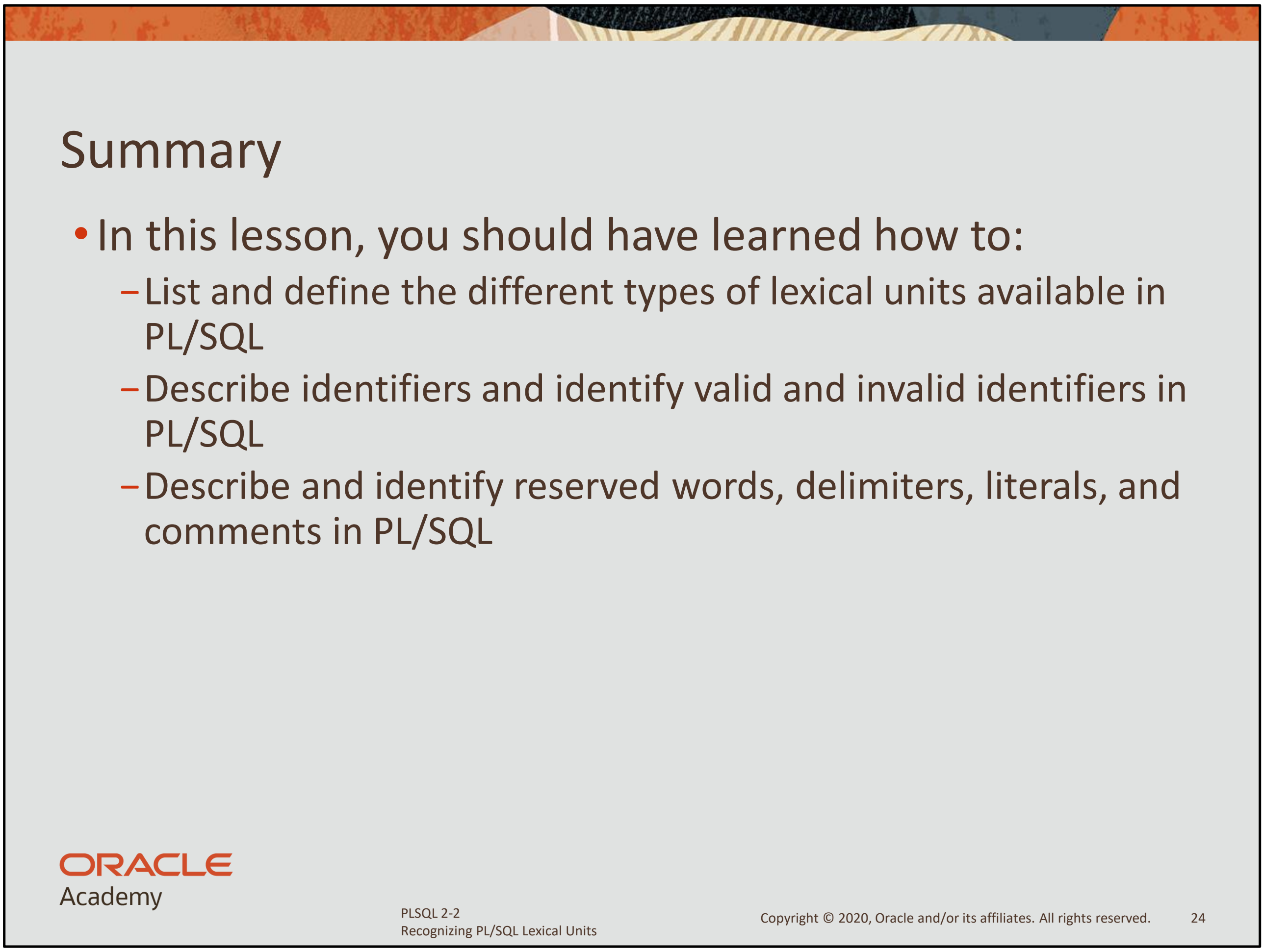
- Identifiers – A name, up to 30 characters in length, given to a PL/SQL object.

- Reserved words – Words that have special meaning to an Oracle database and cannot be used as identifiers.

- Delimiters – Symbols that have special meaning to an Oracle database.

- Literals – An explicit numeric, character string, date, or Boolean value that is not represented by an identifier.

- Comments – Describe the purpose and use of each code segment and are ignored by PL/SQL.



Summary

- In this lesson, you should have learned how to:
  - List and define the different types of lexical units available in PL/SQL
  - Describe identifiers and identify valid and invalid identifiers in PL/SQL
  - Describe and identify reserved words, delimiters, literals, and comments in PL/SQL

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