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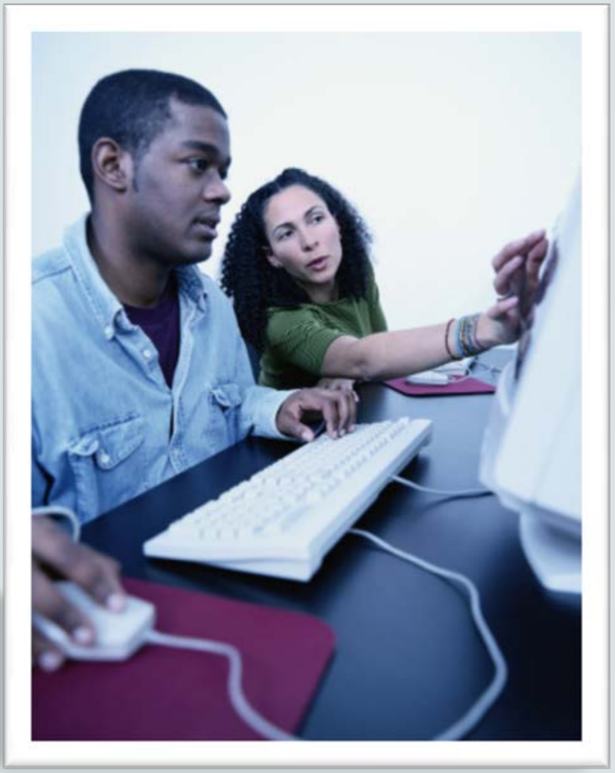
Database Programming with PL/SQL

2-3
Recognizing Data Types



Objectives

This lesson covers the following objectives:

- Define data type and explain why it is needed
- List and describe categories of data types
- Give examples of scalar and composite data types

Purpose

- As a result of the *Database Programming with SQL* course, you should be familiar with several data types that were used when defining the type of data stored in the different columns of a table (NUMBER, VARCHAR2, DATE, etc.).
- PL/SQL includes a variety of data types for use when defining variables, constants, and parameters.
- As with table columns, these data types specify what type and size of data can be stored in a particular location.

PL/SQL Data Types

- PL/SQL supports five categories of data type.
- A data type specifies a storage format, constraints, and a valid range of values.

Data Type	Description
Scalar	Holds a single value with no internal elements.
Composite	Contains multiple internal elements that can be manipulated individually.
Large Object (LOB)	Holds values called locators that specify the location of large objects (such as graphic images) that are stored out of line.
Reference	Holds values called pointers that point to a storage location.
Object	Is a schema object with a name, attributes, and methods. An object data type is similar to the class mechanism supported by C++ and Java.

Scalar Data Types

Scalar data types:

- Hold a single value
- Have no internal components
- Can be classified into four categories:
  - Character
  - Number
  - Date
  - Boolean

Scalar Data Types: Character (or String)

Character data types also are known as strings and allow storage of alphanumeric data (letters, numbers, and symbols).

Data Type	Description
`CHAR [(`*`maximum_length`*`)]`	**Base type for fixed-length character data up to 32,767 characters. 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 characters. VARCHAR2 is optimized for performance or efficiency, depending on the size.**
`LONG`	**Character data of variable length up to 2 gigabytes size.**

(ex.
```
v_first_name   VARCHAR2(20) := 'Neena';
```
)

Scalar Data Types: Number

Number data types allow storage of integers, decimals, and a positive or negative indicator.

Data Type	Description
`NUMBER`	**Floating-point number from 1E-130 to 10E125.**
`NUMBER`(*p*,*s*)	**Fixed-point number with precision *p*. Precision includes scale *s* and can range from 1 to 38. Scale can range from –84 to 127 and determines where rounding occurs as well as the fixed number of decimal places to store.**
`NUMBER`(*p*)	**Integers with maximum number of digits *p* (range 1-38).**
`PLS_INTEGER`	**Requires less storage and is faster than `NUMBER`.**

(ex. `v_salary   NUMBER(8,2) := 9999.99;`)

Scalar Data Types: Date

Date data types provide storage of dates and times.

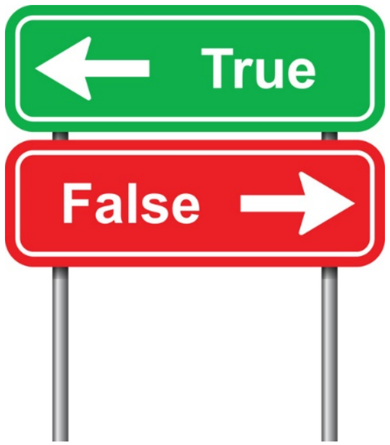
Data Type	Description
`DATE`	Base type for dates and times. DATE values include the time of day in seconds since midnight. The range for dates is between 1-Jan-4712 BCE and 31-Dec-9999 CE.
`TIMESTAMP`	`TIMESTAMP` extends the `DATE` data type to store the year, month, day, hour, minute, second, and fraction of seconds.
`TIMESTAMP WITH TIME ZONE`	`TIMESTAMP WITH TIME ZONE` extends the `TIMESTAMP` data type to include a time-zone displacement—that is, the difference (in hours and minutes) between local time and Coordinated Universal Time (UTC).

(ex. `v_hire_date   DATE := '15-Apr-2015';`)

Scalar Data Types: Boolean

- Use the BOOLEAN data type to store the logical values TRUE, FALSE, and NULL.
- Only logic operations are allowed on BOOLEAN variables.
- Column values cannot be fetched into a BOOLEAN variable and a table column cannot be defined with a BOOLEAN data type.

(ex.
```
v_control   BOOLEAN := TRUE;
```
)



Composite Data Types

- Composite data types have internal components, sometimes called elements, that can be manipulated individually.
- Composite data types include the following:
  - RECORD
  - TABLE
  - VARRAY
- RECORD and TABLE data types are covered later in this course.

Record Composite Data Type

- A composite variable that contains internal components that match the data structure of the EMPLOYEES table can be created using:

```
v_emp_record     employees%ROWTYPE;
```

- The internal elements can be referenced by prefixing the column-name with the record-name:

```
v_emp_record.first_name
```

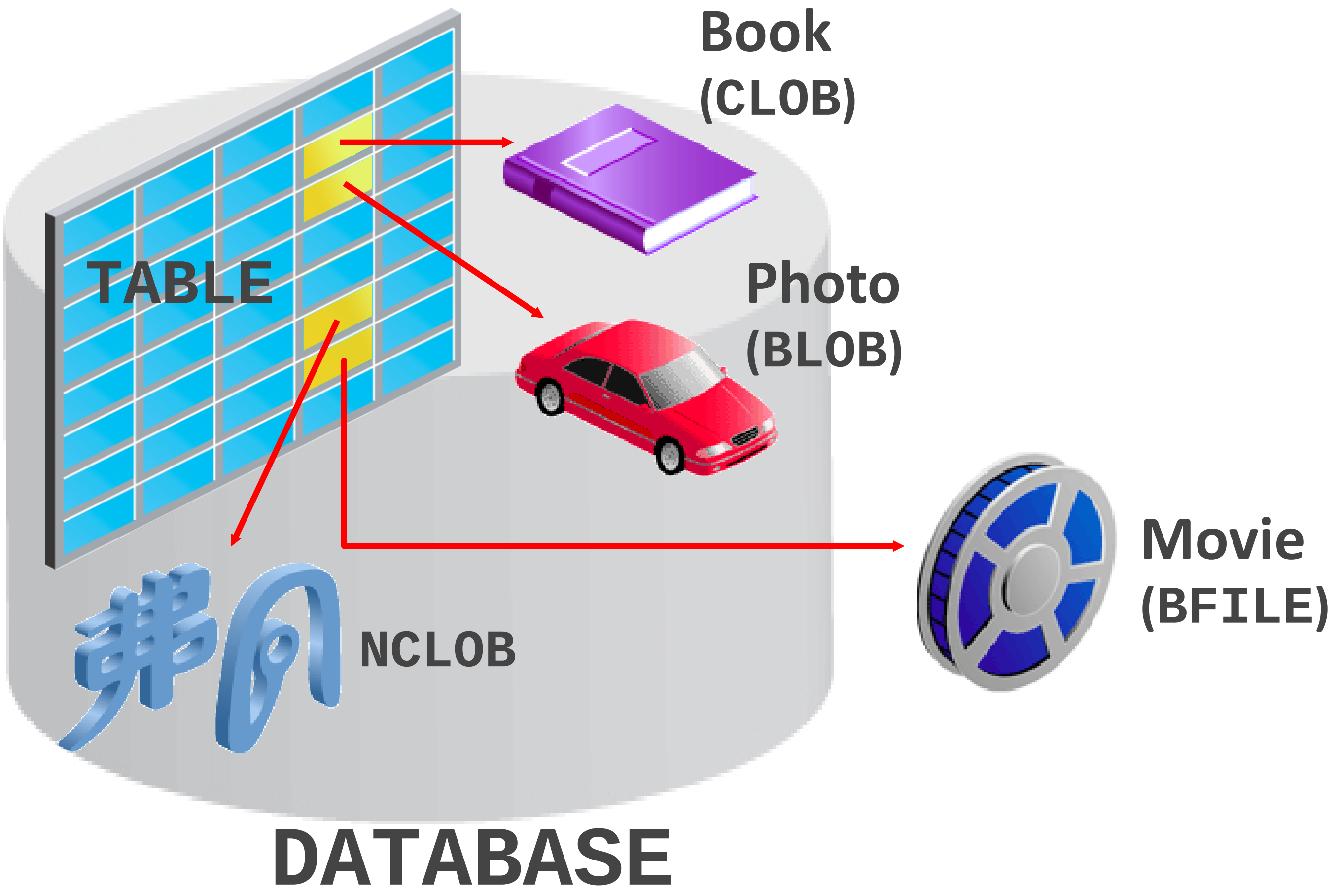
LOB (Large Object) Data Type

- LOB data types allow you to store blocks of unstructured data (such as text, graphic images, video, or audio) up to 4 gigabytes in size.
- A database column can be a LOB data type.
- There are four LOB data types:
  - Character large object (CLOB)
  - Binary large object (BLOB)
  - Binary file (BFILE)
  - National language character large object (NCLOB)

LOB Data Type

- `LOB` data types store locators, which point to large objects stored in an external file.
- `LOB` data types allow efficient, random, piece-wise access to the data.
- `CLOB`, `BLOB`, and `NCLOB` data is stored in the database, either inside or outside of the row.
- `BFILE` data is stored in operating system files outside the database.

LOB Data Type



Terminology

Key terms used in this lesson included:

- BFILE
- BLOB
- CLOB
- Composite
- LOB

Terminology

Key terms used in this lesson included:

- NCLOB
- Object
- Reference
- Scalar

Summary

In this lesson, you should have learned how to:

- Define data type and explain why it is needed
- List and describe categories of data types
- Give examples of scalar and composite data types

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