PL/SQL - DATA TYPES

In this chapter, we will discuss the Data Types in PL/SQL. The PL/SQL variables, constants and parameters must have a valid data type, which specifies a storage format, constraints, and a valid range of values. We will focus on the **SCALAR** and the **LOB** data types in this chapter. The other two data types will be covered in other chapters.

S.No	Category & Description
1	**Scalar** Single values with no internal components, such as a **NUMBER, DATE,** or **BOOLEAN**.
2	**Large Object** *LOB* Pointers to large objects that are stored separately from other data items, such as text, graphic images, video clips, and sound waveforms.
3	**Composite** Data items that have internal components that can be accessed individually. For example, collections and records.
4	**Reference** Pointers to other data items.

PL/SQL Scalar Data Types and Subtypes

PL/SQL Scalar Data Types and Subtypes come under the following categories –

S.No	Date Type & Description
1	**Numeric** Numeric values on which arithmetic operations are performed.
2	**Character** Alphanumeric values that represent single characters or strings of characters.
3	**Boolean**

	Logical values on which logical operations are performed.
4	**Datetime** Dates and times.

PL/SQL provides subtypes of data types. For example, the data type NUMBER has a subtype called INTEGER. You can use the subtypes in your PL/SQL program to make the data types compatible with data types in other programs while embedding the PL/SQL code in another program, such as a Java program.

PL/SQL Numeric Data Types and Subtypes

Following table lists out the PL/SQL pre-defined numeric data types and their sub-types –

S.No	Data Type & Description
1	**PLS_INTEGER** Signed integer in range -2,147,483,648 through 2,147,483,647, represented in 32 bits
2	**BINARY_INTEGER** Signed integer in range -2,147,483,648 through 2,147,483,647, represented in 32 bits
3	**BINARY_FLOAT** Single-precision IEEE 754-format floating-point number
4	**BINARY_DOUBLE** Double-precision IEEE 754-format floating-point number
5	**NUMBER***prec*, *scale* Fixed-point or floating-point number with absolute value in range 1E-130 to *butnotincluding* 1.0E126. A NUMBER variable can also represent 0
6	**DEC***prec*, *scale* ANSI specific fixed-point type with maximum precision of 38 decimal digits
7	**DECIMAL***prec*, *scale*

	IBM specific fixed-point type with maximum precision of 38 decimal digits
8	**NUMERIC***pre*, *secale* Floating type with maximum precision of 38 decimal digits
9	**DOUBLE PRECISION** ANSI specific floating-point type with maximum precision of 126 binary digits *approximately*38*decimaldigits*
10	**FLOAT** ANSI and IBM specific floating-point type with maximum precision of 126 binary digits *approximately*38*decimaldigits*
11	**INT** ANSI specific integer type with maximum precision of 38 decimal digits
12	**INTEGER** ANSI and IBM specific integer type with maximum precision of 38 decimal digits
13	**SMALLINT** ANSI and IBM specific integer type with maximum precision of 38 decimal digits
14	**REAL** Floating-point type with maximum precision of 63 binary digits *approximately*18*decimaldigits*

Following is a valid declaration –

```
DECLARE
   num1 INTEGER;
   num2 REAL;
   num3 DOUBLE PRECISION;
BEGIN
   null;
END;
/
```

When the above code is compiled and executed, it produces the following result –

```
PL/SQL procedure successfully completed
```

PL/SQL Character Data Types and Subtypes

Following is the detail of PL/SQL pre-defined character data types and their sub-types –

S.No	Data Type & Description
1	**CHAR** Fixed-length character string with maximum size of 32,767 bytes
2	**VARCHAR2** Variable-length character string with maximum size of 32,767 bytes
3	**RAW** Variable-length binary or byte string with maximum size of 32,767 bytes, not interpreted by PL/SQL
4	**NCHAR** Fixed-length national character string with maximum size of 32,767 bytes
5	**NVARCHAR2** Variable-length national character string with maximum size of 32,767 bytes
6	**LONG** Variable-length character string with maximum size of 32,760 bytes
7	**LONG RAW** Variable-length binary or byte string with maximum size of 32,760 bytes, not interpreted by PL/SQL
8	**ROWID** Physical row identifier, the address of a row in an ordinary table
9	**UROWID** Universal row identifier $physical, logical, or foreign row identifier$

PL/SQL Boolean Data Types

The **BOOLEAN** data type stores logical values that are used in logical operations. The logical values are the Boolean values **TRUE** and **FALSE** and the value **NULL**.

However, SQL has no data type equivalent to BOOLEAN. Therefore, Boolean values cannot be used in –

- SQL statements
- Built-in SQL functions (such as **TO_CHAR**)
- PL/SQL functions invoked from SQL statements

PL/SQL Datetime and Interval Types

The **DATE** datatype is used to store fixed-length datetimes, which include the time of day in seconds since midnight. Valid dates range from January 1, 4712 BC to December 31, 9999 AD.

The default date format is set by the Oracle initialization parameter NLS_DATE_FORMAT. For example, the default might be 'DD-MON-YY', which includes a two-digit number for the day of the month, an abbreviation of the month name, and the last two digits of the year. For example, 01-OCT-12.

Each DATE includes the century, year, month, day, hour, minute, and second. The following table shows the valid values for each field –

Field Name	Valid Datetime Values	Valid Interval Values
YEAR	-4712 to 9999 $excludingyear0$	Any nonzero integer
MONTH	01 to 12	0 to 11
DAY	01 to 31 $limitedbythevaluesofMONTHandYEAR, accordingtotherulesofthecalendarforthelocale$	Any nonzero integer
HOUR	00 to 23	0 to 23
MINUTE	00 to 59	0 to 59
SECOND	00 to 59.9n, where 9n is the precision of time fractional seconds	0 to 59.9 n, where 9n is the precision of interval fractional seconds
TIMEZONE_HOUR	-12 to 14 $rangeaccommodatesdaylightsavingstimechanges$	Not applicable
TIMEZONE_MINUTE	00 to 59	Not applicable

TIMEZONE_REGION	Found in the dynamic performance view V$TIMEZONE_NAMES	Not applicable
TIMEZONE_ABBR	Found in the dynamic performance view V$TIMEZONE_NAMES	Not applicable

PL/SQL Large Object *LOB* Data Types

Large Object *LOB* data types refer to large data items such as text, graphic images, video clips, and sound waveforms. LOB data types allow efficient, random, piecewise access to this data. Following are the predefined PL/SQL LOB data types –

Data Type	Description	Size
BFILE	Used to store large binary objects in operating system files outside the database.	System-dependent. Cannot exceed 4 gigabytes *GB*.
BLOB	Used to store large binary objects in the database.	8 to 128 terabytes *TB*
CLOB	Used to store large blocks of character data in the database.	8 to 128 TB
NCLOB	Used to store large blocks of NCHAR data in the database.	8 to 128 TB

PL/SQL User-Defined Subtypes

A subtype is a subset of another data type, which is called its base type. A subtype has the same valid operations as its base type, but only a subset of its valid values.

PL/SQL predefines several subtypes in package **STANDARD**. For example, PL/SQL predefines the subtypes **CHARACTER** and **INTEGER** as follows –

```
SUBTYPE CHARACTER IS CHAR;
SUBTYPE INTEGER IS NUMBER(38,0);
```

You can define and use your own subtypes. The following program illustrates defining and using a user-defined subtype –

```
DECLARE
   SUBTYPE name IS char(20);
   SUBTYPE message IS varchar2(100);
   salutation name;
   greetings message;
BEGIN
   salutation := 'Reader ';
   greetings := 'Welcome to the World of PL/SQL';
   dbms_output.put_line('Hello ' || salutation || greetings);
END;
/
```

When the above code is executed at the SQL prompt, it produces the following result –

```
Hello Reader Welcome to the World of PL/SQL

PL/SQL procedure successfully completed.
```

NULLs in PL/SQL

PL/SQL NULL values represent **missing** or **unknown data** and they are not an integer, a character, or any other specific data type. Note that **NULL** is not the same as an empty data string or the null character value **'\0'**. A null can be assigned but it cannot be equated with anything, including itself.