

D80182GC10
Edition 1.0
August 2013
D83267



Oracle Database 12c: PL/SQL Fundamentals

Activity Guide

Copyright © 2013, Oracle and/or its affiliates. All rights reserved.

Disclaimer

This document contains proprietary information and is protected by copyright and other intellectual property laws. You may copy and print this document solely for your own use in an Oracle training course. The document may not be modified or altered in any way. Except where your use constitutes "fair use" under copyright law, you may not use, share, download, upload, copy, print, display, perform, reproduce, publish, license, post, transmit, or distribute this document in whole or in part without the express authorization of Oracle.

The information contained in this document is subject to change without notice. If you find any problems in the document, please report them in writing to: Oracle University, 500 Oracle Parkway, Redwood Shores, California 94065 USA. This document is not warranted to be error-free.

Restricted Rights Notice

If this documentation is delivered to the United States Government or anyone using the documentation on behalf of the United States Government, the following notice is applicable:

U.S. GOVERNMENT RIGHTS

The U.S. Government's rights to use, modify, reproduce, release, perform, display, or disclose these training materials are restricted by the terms of the applicable Oracle license agreement and/or the applicable U.S. Government contract.

Trademark Notice

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Author

Supriya Ananth

Technical Contributors and Reviewers

Nancy Greenberg, Swarnapriya Shridhar, KimSeong Loh, Miyuki Osato, Laszlo Czinkoczki, Diganta Choudhury, Jim Spiller, Christopher Wensley, Tom Best, Christoph Burandt, Yanti Chang, Chaitanya Kortamaddi, Bryan Roberts, Manish Pawar

This book was published using: Oracle Tutor

Table of Contents

| | |
|---|-------------|
| Practices for Lesson 1: Introduction | 1-1 |
| Practices for Lesson 1..... | 1-2 |
| Practice 1-1: Accessing SQL Developer Resources | 1-3 |
| Solution 1-1: Accessing SQL Developer Resources | 1-4 |
| Practice 1-2: Getting Started | 1-5 |
| Solution 1-2: Getting Started | 1-7 |
| Practices for Lesson 2: Introduction to PL/SQL | 2-1 |
| Practices for Lesson 2: Introduction to PL/SQL | 2-2 |
| Practice 2: Introduction to PL/SQL..... | 2-3 |
| Solution 2: Introduction to PL/SQL..... | 2-4 |
| Practices for Lesson 3: Declaring PL/SQL Variables | 3-1 |
| Practice 3: Declaring PL/SQL Variables | 3-2 |
| Solution 3: Declaring PL/SQL Variables..... | 3-5 |
| Practices for Lesson 4: Writing Executable Statements | 4-1 |
| Practice 4: Writing Executable Statements..... | 4-2 |
| Solution 4: Writing Executable Statements..... | 4-4 |
| Practices for Lesson 5: Using SQL Statements within a PL/SQL Block | 5-1 |
| Practice 5: Using SQL Statements within a PL/SQL | 5-2 |
| Solution 5: Using SQL Statements within a PL/SQL | 5-4 |
| Practices for Lesson 6: Writing Control Structures | 6-1 |
| Practice 6: Writing Control Structures | 6-2 |
| Solution 6: Writing Control Structures | 6-4 |
| Practices for Lesson 7: Working with Composite Data Types | 7-1 |
| Practice 7: Working with Composite Data Types | 7-2 |
| Solution 7: Working with Composite Data Types | 7-4 |
| Practices for Lesson 8: Using Explicit Cursors | 8-1 |
| Practice 8-1: Using Explicit Cursors | 8-2 |
| Solution 8-1: Using Explicit Cursors..... | 8-5 |
| Practice 8-2: Using Explicit Cursors: Optional | 8-10 |
| Solution 8-2: Using Explicit Cursors: Optional | 8-11 |
| Practices for Lesson 9: Handling Exceptions | 9-1 |
| Practice 9-1: Handling Predefined Exceptions..... | 9-2 |
| Solution 9-1: Handling Predefined Exceptions..... | 9-3 |
| Practice 9-2: Handling Standard Oracle Server Exceptions..... | 9-5 |
| Solution 9-2: Handling Standard Oracle Server Exceptions..... | 9-6 |
| Practices for Lesson 10: Introducing Stored Procedures and Functions | 10-1 |
| Practice 10: Creating and Using Stored Procedures | 10-2 |
| Solution 10: Creating and Using Stored Procedures | 10-4 |
| Additional Practices and Solutions for Lesson 1 | 11-1 |
| Practices for Lesson 1..... | 11-2 |
| Additional Practices and Solutions for Lesson 2 | 12-1 |
| Additional Practices for Lesson 2..... | 12-2 |
| Practice 2: Evaluating Declarations..... | 12-3 |
| Solution 2: Evaluating Declarations..... | 12-4 |

| | |
|--|-------------|
| Additional Practices and Solutions for Lesson 3..... | 13-1 |
| Practice 3: Evaluating Expressions | 13-2 |
| Solution 3: Evaluating Expressions | 13-3 |
| Additional Practices and Solutions for Lesson 4..... | 14-1 |
| Practice 4: Evaluating Executable Statements | 14-2 |
| Solution 4: Evaluating Executable Statements | 14-3 |
| Additional Practices and Solutions for Lesson 5..... | 15-1 |
| Practice 5-1: Using SQL Statements within a PL/SQL | 15-2 |
| Solution 5-1: Using SQL Statements within a PL/SQL | 15-3 |
| Practice 5-2: Using SQL Statements within a PL/SQL | 15-4 |
| Solution 5-2: Using SQL Statements within a PL/SQL | 15-5 |
| Additional Practices and Solutions for Lesson 6..... | 16-1 |
| Practice 6-1: Writing Control Structures | 16-2 |
| Solution 6-1: Writing Control Structures | 16-3 |
| Practice 6-2: Writing Control Structures | 16-4 |
| Solution 6-2: Writing Control Structures | 16-5 |
| Additional Practices and Solutions for Lesson 7: Working with Composite Data Types..... | 17-1 |
| Additional Practices for Lessons Titled "Working with Composite Data Types" and "Using Explicit Cursors\ | 17-2 |
| Practice 7/8-1: Fetching Data with an Explicit Cursor..... | 17-3 |
| Solution 7/8-1: Fetching Data with an Explicit Cursor..... | 17-4 |
| Practice 7/8-2: Using Associative Arrays and Explicit Cursors..... | 17-5 |
| Solution 7/8-2: Using Associative Arrays and Explicit Cursors..... | 17-6 |
| Additional Practices and Solutions for Lesson 8: Using Explicit Cursors | 18-1 |
| Practices for Lesson 8..... | 18-2 |
| Additional Practices and Solutions for Lesson 9: Handling Exceptions | 19-1 |
| Practice 9-1: Handling Exceptions | 19-2 |
| Solution 9-1: Handling Exceptions | 19-3 |

Practices for Lesson 1: Introduction

Chapter 1

Practices for Lesson 1

Lesson Overview

In these practices, you identify information resources for SQL Developer, execute SQL statements using SQL Developer, and examine data in the class schema. Specifically, you:

- Start SQL Developer
- Create a new database connection
- Browse the schema tables
- Set a SQL Developer preference

Note: All written practices use SQL Developer as the development environment. Although it is recommended that you use SQL Developer, you can also use the SQL*Plus environment that is available in this course.

Practice 1-1: Accessing SQL Developer Resources

In this practice, you view a demonstration on introduction to SQL Developer interface. Also, you navigate to the SQL Developer home page and browse helpful information on the tool.

1. Access the SQL Developer home page.
 - a. Access the online SQL Developer Home Page, which is available at:
http://www.oracle.com/technology/products/database/sql_developer/index.html
 - b. Bookmark the page for easier access in future.
2. Access the SQL Developer tutorial, which is available online at
<http://st-curriculum.oracle.com/tutorial/SQLDeveloper/index.htm>
Review the following sections and associated demonstrations:
 - a. What to Do First
 - b. Working with Database Objects
 - c. Accessing Data

Solution 1-1: Accessing SQL Developer Resources

1. Access the SQL Developer home page.
 - a. Access the online SQL Developer Home Page, which is available at:
http://www.oracle.com/technology/products/database/sql_developer/index.html

Note: The screenshots in this course reflect the 3.2 version of SQL Developer. However, the online SQL Developer Home Page points to the latest version of SQL Developer available for download.
 - b. Bookmark the page for easier access in future.
2. Access the SQL Developer tutorial, which is available online at
<http://st-curriculum.oracle.com/tutorial/SQLDeveloper/index.htm>
Then review the following sections and associated demos:
 - a. What to Do First
 - b. Working with Database Objects
 - c. Accessing Data

Practice 1-2: Getting Started

1. Start SQL Developer.
2. Create a database connection by using the following information (**Hint:** Select the Save Password check box):
 - a. Connection Name: MyConnection
 - b. Username: ora41
 - c. Password: ora41
 - d. Hostname: localhost
 - e. Port: 1521
 - f. SID: orcl
3. Test the new connection. If the Status is Success, connect to the database using this new connection.
 - a. In the Database Connection window, click the Test button.
Note: The connection status appears in the lower-left corner of the window.
 - b. If the status is Success, click the Connect button.
4. Browse the structure of the `EMPLOYEES` table and display its data.
 - a. Expand the MyConnection connection by clicking the plus symbol next to it.
 - b. Expand the Tables icon by clicking the plus symbol next to it.
 - c. Display the structure of the `EMPLOYEES` table.
5. Use the Data tab to view data in the `EMPLOYEES` table.
6. Use the SQL Worksheet to select the last names and salaries of all employees whose annual salary is greater than \$10,000. Use both the Execute Statement (F9) and the Run Script (F5) icons to execute the `SELECT` statement. Review the results of both methods of executing the `SELECT` statements on the appropriate tabs.
Note: Take a few minutes to familiarize yourself with the data, or consult Appendix A, which provides the description and data for all the tables in the HR schema that you will use in this course.
7. From the SQL Developer menu, select Tools > Preferences. The Preferences window appears.
8. Select Database > Worksheet Parameters. In the “Select default path to look for scripts” text box, use the Browse button to select the `/home/oracle/labs/plsf` directory. This directory contains the code example scripts, lab scripts, and practice solution scripts that are used in this course. Then, in the Preferences window, click OK to save the Worksheet Parameter setting.

9. Familiarize yourself with the structure of the `/home/oracle/labs/plsf` directory.
 - a. Select File > Open. The Open window automatically selects the `.../plsf` directory as your starting location. This directory contains three subdirectories:
 - The `/code_ex` directory contains the code examples found in the course materials. Each `.sql` script is associated with a particular page in the lesson.
 - The `/labs` directory contains the code that is used in certain lesson practices. You are instructed to run the required script in the appropriate practice.
 - The `/soln` directory contains the solutions for each practice. Each `.sql` script is numbered with the associated `practice_exercise` reference.
 - b. You can also use the Files tab to navigate through directories to open the script files.
 - c. Using the Open window, and the Files tab, navigate through the directories and open a script file without executing the code.
 - d. Close the SQL Worksheet.

Solution 1-2: Getting Started

1. Start SQL Developer.
Click the SQL Developer icon on your desktop.

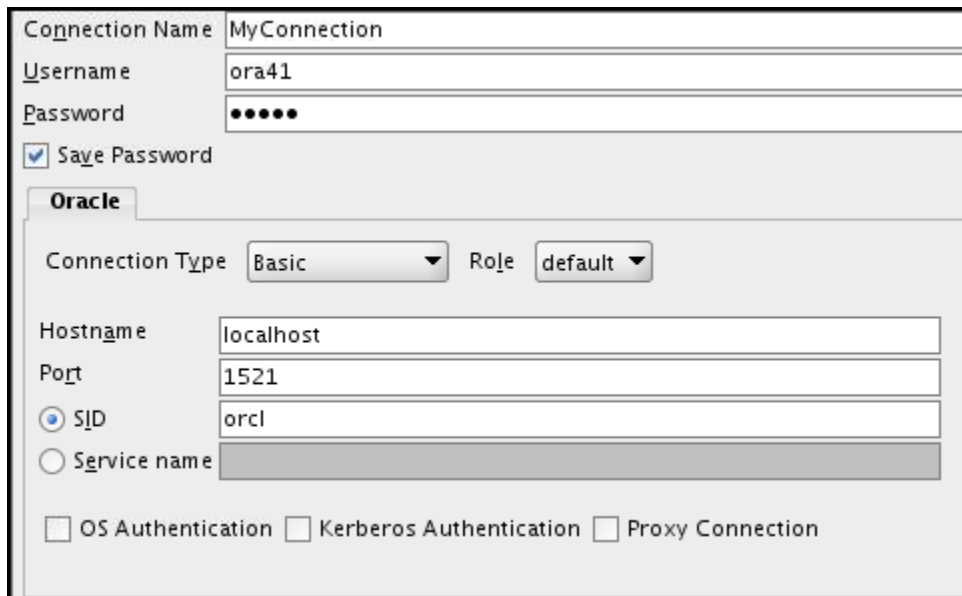


2. Create a database connection by using the following information (**Hint:** Select the Save Password check box):
 - a. Connection Name: MyConnection
 - b. Username: ora41
 - c. Password: ora41
 - d. Hostname: localhost
 - e. Port: 1521
 - f. SID: orcl

Right-click the Connections node on the Connections tabbed page and select **New Connection...**

Result: The New/Select Database Connection window appears.

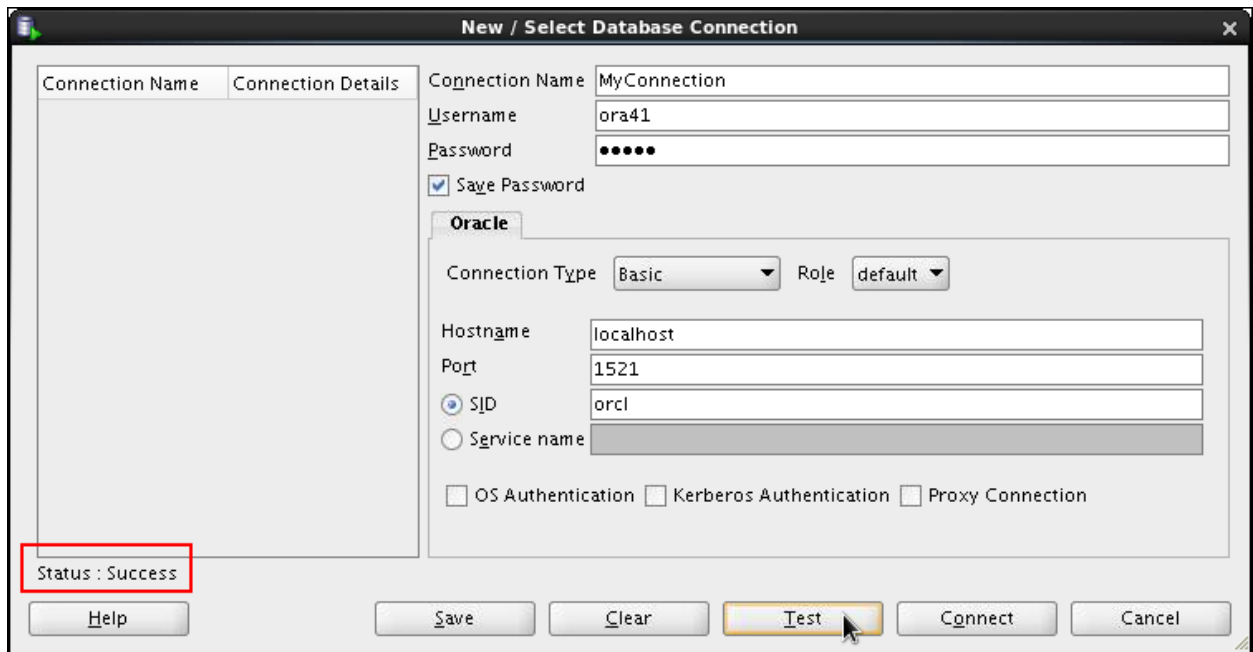
Use the preceding information to create the new database connection. In addition, select the Save Password check box. For example:



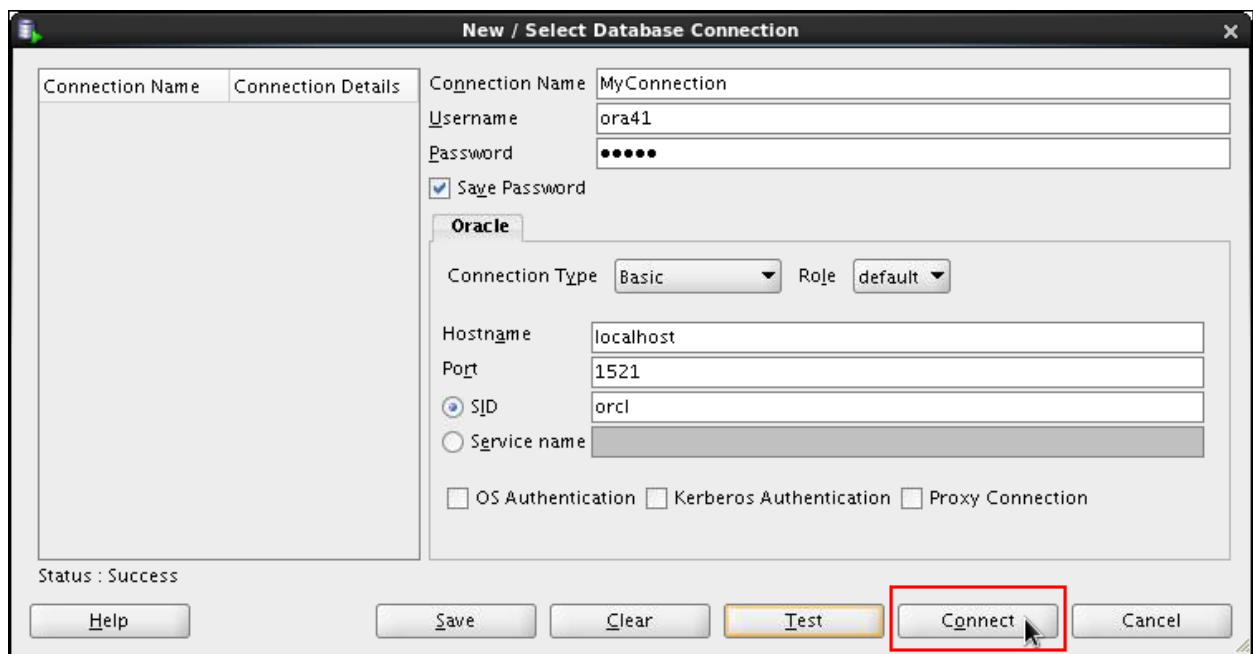
3. Test the new connection. If the Status is Success, connect to the database using this new connection.

- a. In the Database Connection window, click the Test button.

Note: The connection status appears in the lower-left corner of the window.



- b. If the status is Success, click the Connect button.



Note: To display the properties of an existing connection, right-click the connection name on the Connections tab and select Properties from the shortcut menu.

4. Browse the structure of the EMPLOYEES table and display its data.
 - a. Expand the MyConnection connection by clicking the plus symbol next to it.

- b. Expand Tables by clicking the plus symbol next to it.
- c. Display the structure of the EMPLOYEES table.

Drill down on the EMPLOYEES table by clicking the plus symbol next to it.

Click the EMPLOYEES table.

Result: The Columns tab displays the columns in the EMPLOYEES table as follows:

| | COLUMN_NAME | DATA_TYPE | NULLABLE | DATA_DEFAULT | COLUMN_ID | COMMENTS |
|----|----------------|-------------------|----------|--------------|-----------|--------------------------------|
| 1 | EMPLOYEE_ID | NUMBER(6,0) | No | (null) | | 1 Primary key of employees ta |
| 2 | FIRST_NAME | VARCHAR2(20 BYTE) | Yes | (null) | | 2 First name of the employee. |
| 3 | LAST_NAME | VARCHAR2(25 BYTE) | No | (null) | | 3 Last name of the employee. |
| 4 | EMAIL | VARCHAR2(25 BYTE) | No | (null) | | 4 Email id of the employee |
| 5 | PHONE_NUMBER | VARCHAR2(20 BYTE) | Yes | (null) | | 5 Phone number of the employe |
| 6 | HIRE_DATE | DATE | No | (null) | | 6 Date when the employee star |
| 7 | JOB_ID | VARCHAR2(10 BYTE) | No | (null) | | 7 Current job of the employee |
| 8 | SALARY | NUMBER(8,2) | Yes | (null) | | 8 Monthly salary of the emplo |
| 9 | COMMISSION_PCT | NUMBER(2,2) | Yes | (null) | | 9 Commission percentage of th |
| 10 | MANAGER_ID | NUMBER(6,0) | Yes | (null) | | 10 Manager id of the employee; |
| 11 | DEPARTMENT_ID | NUMBER(4,0) | Yes | (null) | | 11 Department id where employe |

5. Use the Data tab to view the data in the EMPLOYEES table.

Result: The EMPLOYEES table data is displayed as follows:

| | EMPLOYEE_ID | FIRST_NAME | LAST_NAME | EMAIL | PHONE_NUMBER | HIRE_DATE |
|----|-------------|-------------|-----------|----------|--------------|-----------|
| 1 | 100 | Steven | King | SKING | 515.123.4567 | 17-JUN-03 |
| 2 | 101 | Neena | Kochhar | NKOCHHAR | 515.123.4568 | 21-SEP-05 |
| 3 | 102 | Lex | De Haan | LDEHAAN | 515.123.4569 | 13-JAN-01 |
| 4 | 103 | Alexander | Hunold | AHUNOLD | 590.423.4567 | 03-JAN-06 |
| 5 | 104 | Bruce | Ernst | BERNST | 590.423.4568 | 21-MAY-07 |
| 6 | 105 | David | Austin | DAUSTIN | 590.423.4569 | 25-JUN-05 |
| 7 | 106 | Valli | Pataballa | VPATABAL | 590.423.4560 | 05-FEB-06 |
| 8 | 107 | Diana | Lorentz | DLORENTZ | 590.423.5567 | 07-FEB-07 |
| 9 | 108 | Nancy | Greenberg | NGREENBE | 515.124.4569 | 17-AUG-02 |
| 10 | 109 | Daniel | Faviet | DFAVIET | 515.124.4169 | 16-AUG-02 |
| 11 | 110 | John | Chen | JCHEN | 515.124.4269 | 28-SEP-05 |
| 12 | 111 | Ismael | Sciarra | ISCIARRA | 515.124.4369 | 30-SEP-05 |
| 13 | 112 | Jose Manuel | Urman | JMURMAN | 515.124.4469 | 07-MAR-06 |
| 14 | 113 | Luis | Popp | LPOPP | 515.124.4567 | 07-DEC-07 |
| 15 | 114 | Den | Raphaely | DRAPHEAL | 515.127.4561 | 07-DEC-02 |

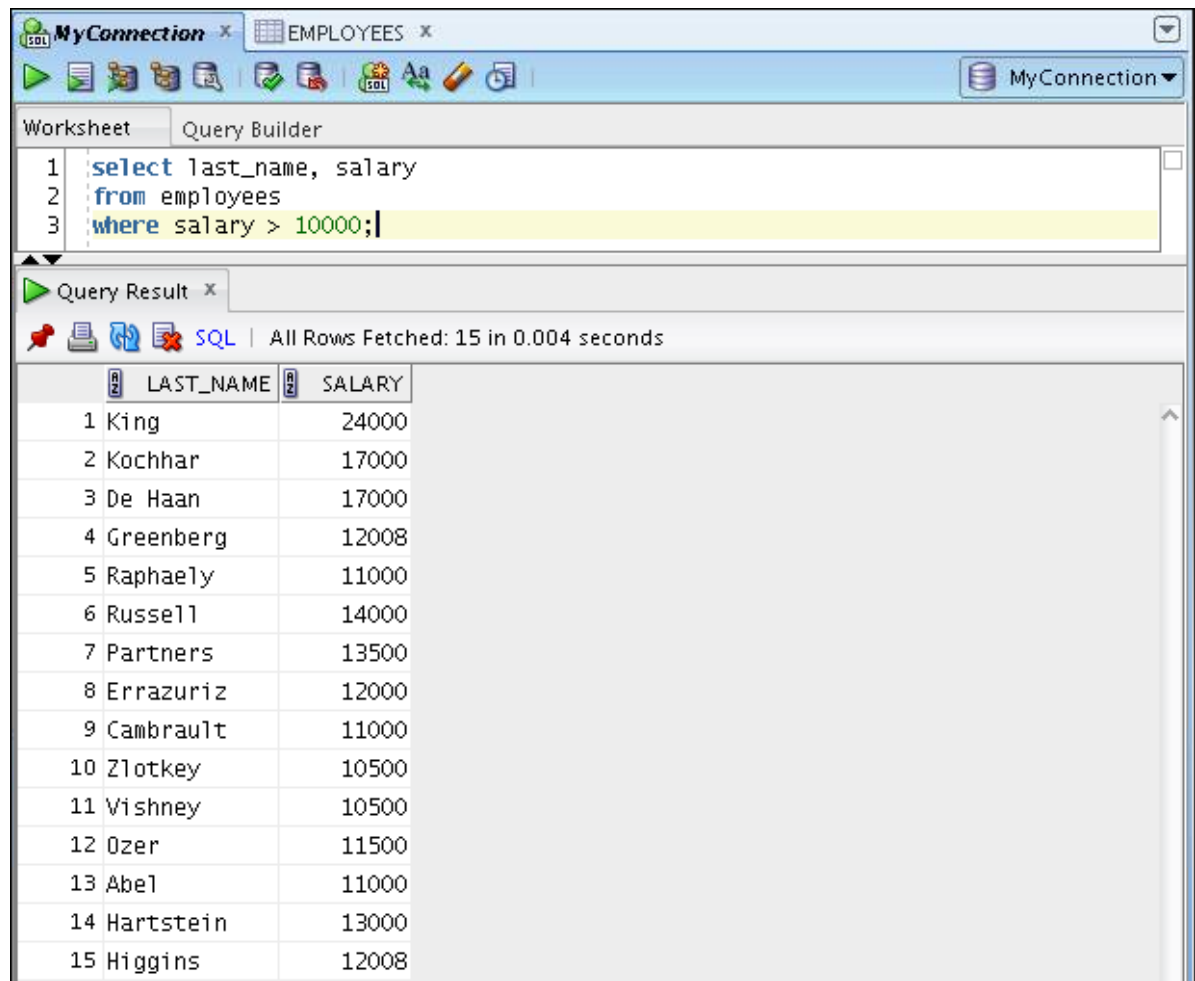
- Use the SQL Worksheet to select the last names and salaries of all employees whose annual salary is greater than \$10,000. Use both the Execute Statement (F9) and Run Script (F5) icons to execute the `SELECT` statement. Review the results of both methods of executing the `SELECT` statements on the appropriate tabs.

Note: Take a few minutes to familiarize yourself with the data, or consult Appendix A, which provides the description and data for all the tables in the HR schema that you will use in this course.

To display the SQL Worksheet, click the MyConnection tab.

Note: This tab was opened previously when you drilled down on your database connection. Enter the appropriate `SELECT` statement. Press F9 to execute the query and F5 to execute the query using the Run Script method.

For example, when you press F9, the results appear similar to the following:



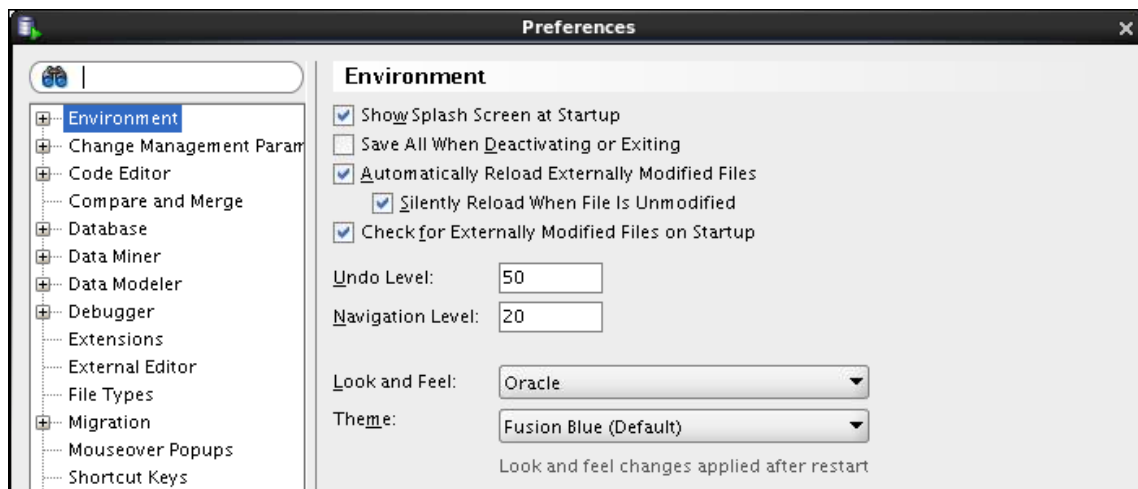
The screenshot shows the 'MyConnection' application window with the 'EMPLOYEES' tab selected. The 'Worksheet' tab is active, displaying the following SQL query:

```
1 select last_name, salary
2 from employees
3 where salary > 10000;
```

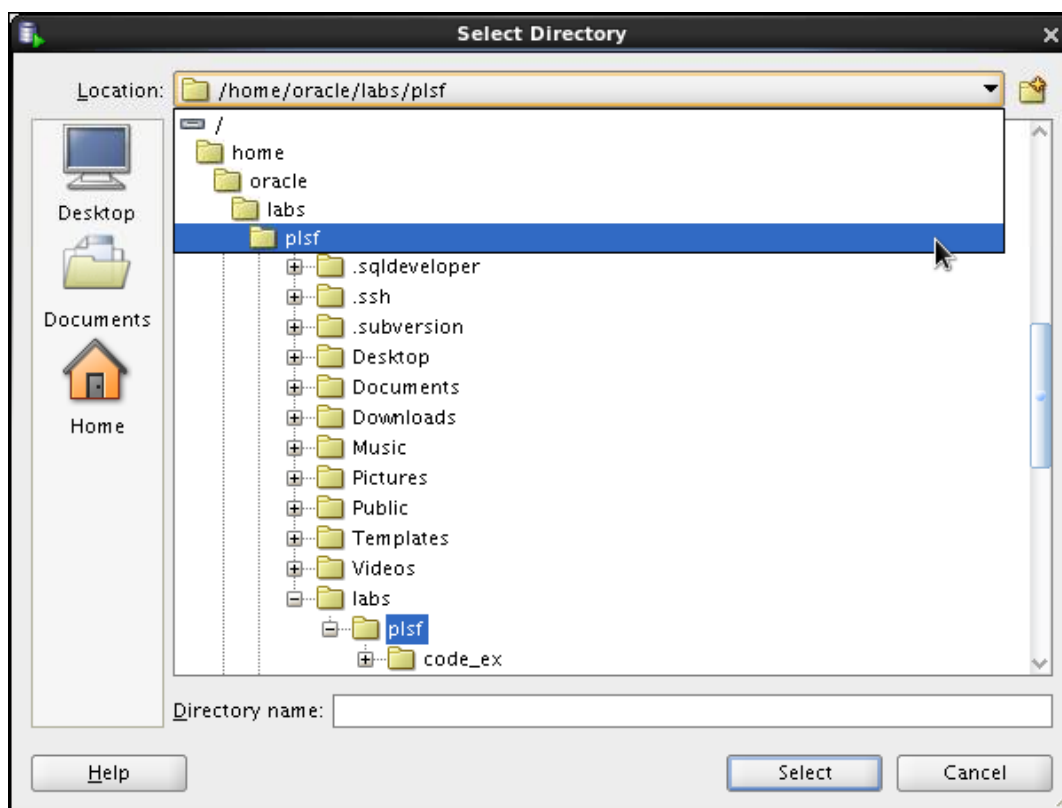
Below the query, the 'Query Result' tab is active, showing the results of the query. The status bar indicates 'All Rows Fetched: 15 in 0.004 seconds'. The results are displayed in a table with two columns: 'LAST_NAME' and 'SALARY'.

| | LAST_NAME | SALARY |
|----|-----------|--------|
| 1 | King | 24000 |
| 2 | Kochhar | 17000 |
| 3 | De Haan | 17000 |
| 4 | Greenberg | 12008 |
| 5 | Raphaely | 11000 |
| 6 | Russell | 14000 |
| 7 | Partners | 13500 |
| 8 | Errazuriz | 12000 |
| 9 | Cambrault | 11000 |
| 10 | Zlotkey | 10500 |
| 11 | Vishney | 10500 |
| 12 | Ozer | 11500 |
| 13 | Abel | 11000 |
| 14 | Hartstein | 13000 |
| 15 | Higgins | 12008 |

- From the SQL Developer menu, select Tools > Preferences. The Preferences window appears.



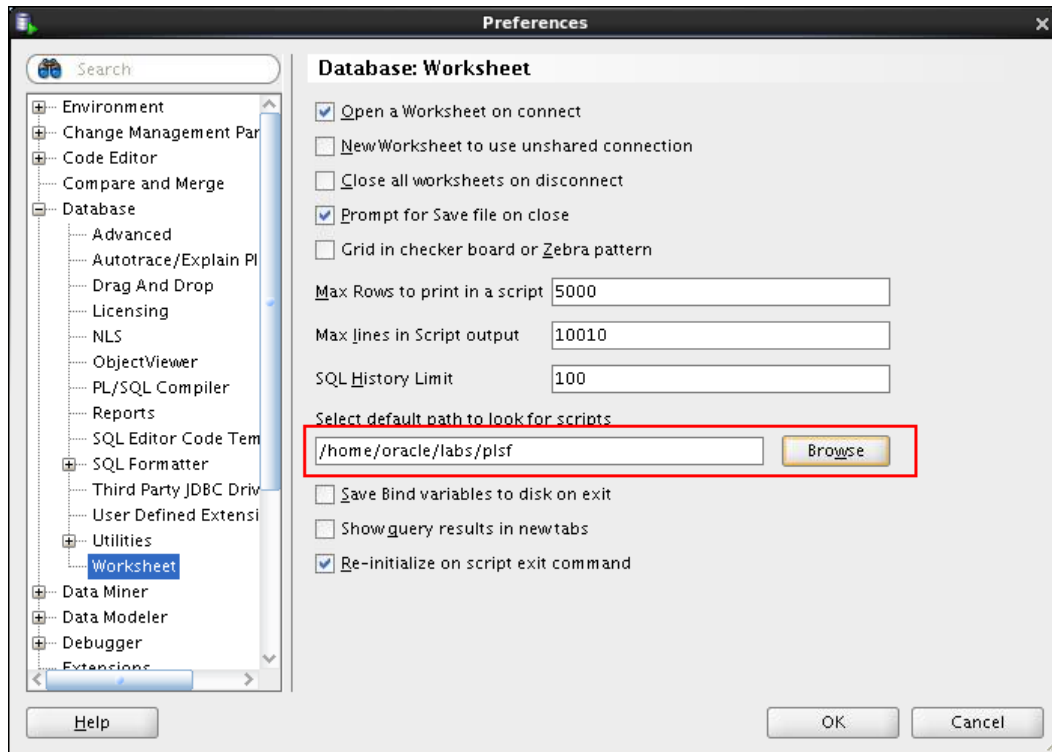
- Select Database > Worksheet Parameters. In the “Select default path to look for scripts” text box, use the Browse button to select the /home/oracle/labs/plsf directory.



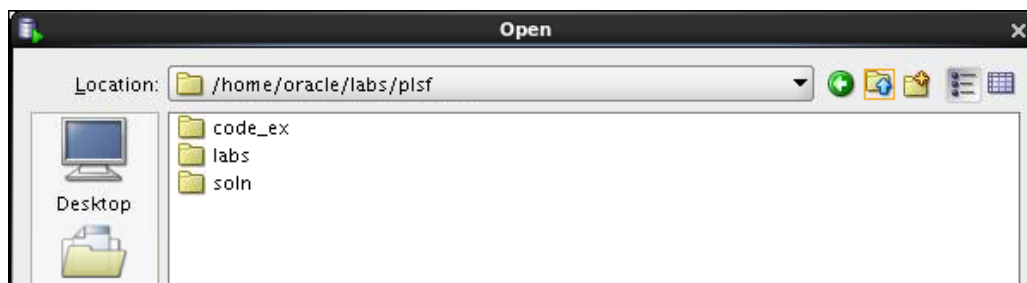
This directory contains the code example scripts, lab scripts, and practice solution scripts that are used in this course.

Click Select to choose the directory.

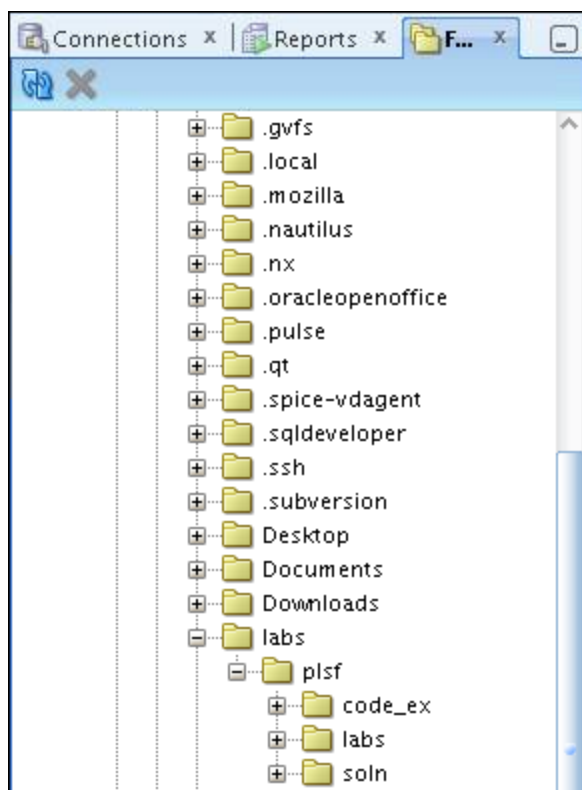
Then, in the Preferences window, click OK to save the Worksheet Parameter setting.



9. Familiarize yourself with the structure of the `/home/oracle/labs/plsf` directory.
 - a. Select File > Open. Navigate to the `/home/oracle/labs/plsf` directory. This directory contains three subdirectories:

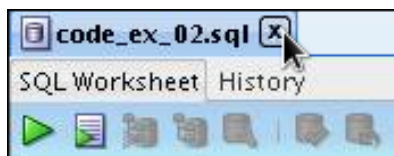


- The `/code_ex` directory contains the code examples found in the course materials. Each `.sql` script is associated with a particular page in the lesson.
 - The `/labs` directory contains the code that is used in certain lesson practices. You are instructed to run the required script in the appropriate practice.
 - The `/soln` directory contains the solutions for each practice. Each `.sql` script is numbered with the associated practice_exercise reference.
- b. You can also use the Files tab to navigate through directories to open script files.



- c. Using the Open window, and the Files tab, navigate through the directories and open a script file without executing the code.
- d. Close the SQL Worksheet.

To close any SQL Worksheet tab, click X on the tab, as shown here:



Practices for Lesson 2: Introduction to PL/SQL

Chapter 2

Practices for Lesson 2: Introduction to PL/SQL

Lesson Overview

The `/home/oracle/labs/plsf/labs` folder is the working directory where you save the scripts that you create.

The solutions for all the practices are in the `/home/oracle/labs/plsf/soln` folder.

Practice 2: Introduction to PL/SQL

1. Which of the following PL/SQL blocks execute successfully?
 - a.

```
BEGIN  
END;
```
 - b.

```
DECLARE  
v_amount INTEGER(10);  
END;
```
 - c.

```
DECLARE  
BEGIN  
END;
```
 - d.

```
DECLARE  
v_amount INTEGER(10);  
BEGIN  
DBMS_OUTPUT.PUT_LINE(v_amount);  
END;
```
2. Create and execute a simple anonymous block that outputs "Hello World." Execute and save this script as lab_02_02_soln.sql.

Solution 2: Introduction to PL/SQL

1. Which of the following PL/SQL blocks execute successfully?

- a. BEGIN
END;
- b. DECLARE
v_amount INTEGER(10);
END;
- c. DECLARE
BEGIN
END;
- d. DECLARE
v_amount INTEGER(10);
BEGIN
DBMS_OUTPUT.PUT_LINE(v_amount);
END;

The block in a does not execute. It has no executable statements.

The block in b does not have the mandatory executable section that starts with the `BEGIN` keyword.

The block in c has all the necessary parts, but no executable statements.

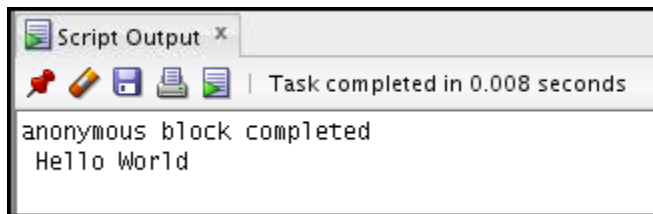
The block in d executes successfully.

2. Create and execute a simple anonymous block that outputs “Hello World.” Execute and save this script as `lab_02_02_soln.sql`.

Enter the following code in the workspace, and then press F5.

```
SET SERVEROUTPUT ON
BEGIN
DBMS_OUTPUT.PUT_LINE(' Hello World ');
END;
```

You should see the following output on the Script Output tab:



Click the Save button. Select the folder in which you want to save the file. Enter `lab_02_02_soln.sql` as the file name and click Save.

Practices for Lesson 3: Declaring PL/SQL Variables

Chapter 3

Practice 3: Declaring PL/SQL Variables

In this practice, you declare PL/SQL variables.

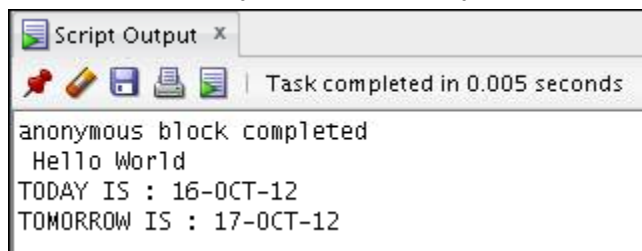
1. Identify valid and invalid identifiers:
 - a. today
 - b. last_name
 - c. today's_date
 - d. Number_of_days_in_February_this_year
 - e. Isleap\$year
 - f. #number
 - g. NUMBER#
 - h. number1to7
2. Identify valid and invalid variable declaration and initialization:
 - a. number_of_copies PLS_INTEGER;
 - b. PRINTER_NAME constant VARCHAR2(10);
 - c. deliver_to VARCHAR2(10):=Johnson;
 - d. by_when DATE:= CURRENT_DATE+1;
3. Examine the following anonymous block, and then select a statement from the following that is true.

```
DECLARE
  v_fname VARCHAR2(20);
  v_lname VARCHAR2(15) DEFAULT 'fernandez';
BEGIN
  DBMS_OUTPUT.PUT_LINE(v_fname || ' ' || v_lname);
END;
```

- a. The block executes successfully and prints "fernandez."
- b. The block produces an error because the `fname` variable is used without initializing.
- c. The block executes successfully and prints "null fernandez."
- d. The block produces an error because you cannot use the `DEFAULT` keyword to initialize a variable of type `VARCHAR2`.
- e. The block produces an error because the `v_fname` variable is not declared.

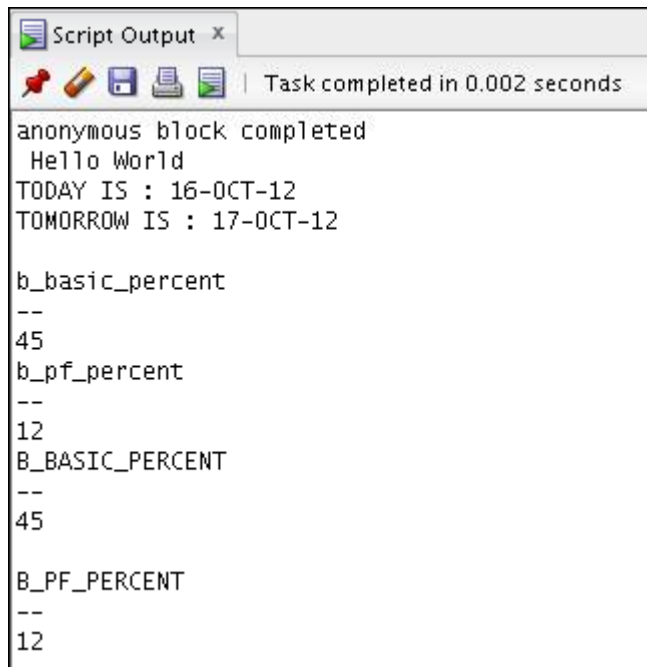
4. Modify an existing anonymous block and save it as a new script.
 - a. Open the `lab_02_02_soln.sql` script, which you created in Practice 2.
 - b. In this PL/SQL block, declare the following variables:
 - 1) `v_today` of type `DATE`. Initialize `today` with `SYSDATE`.
 - 2) `v_tomorrow` of type `today`. Use the `%TYPE` attribute to declare this variable.
 - c. In the executable section:
 - 1) Initialize the `v_tomorrow` variable with an expression, which calculates tomorrow's date (add one to the value in `today`)
 - 2) Print the value of `v_today` and `tomorrow` after printing "Hello World"
 - d. Save your script as `lab_03_04_soln.sql`, and then execute.

The sample output is as follows (the values of `v_today` and `v_tomorrow` will be different to reflect your current today's and tomorrow's date):



5. Edit the `lab_03_04_soln.sql` script.
 - a. Add code to create two bind variables, named `b_basic_percent` and `b_pf_percent`. Both bind variables are of type `NUMBER`.
 - b. In the executable section of the PL/SQL block, assign the values 45 and 12 to `b_basic_percent` and `b_pf_percent` respectively.

- c. Terminate the PL/SQL block with “/” and display the value of the bind variables by using the PRINT command.
- d. Execute and save your script as lab_03_05_soln.sql. The sample output is as follows:



```
Script Output x
Task completed in 0.002 seconds

anonymous block completed
Hello World
TODAY IS : 16-OCT-12
TOMORROW IS : 17-OCT-12

b_basic_percent
--
45
b_pf_percent
--
12
B_BASIC_PERCENT
--
45
B_PF_PERCENT
--
12
```

Solution 3: Declaring PL/SQL Variables

1. Identify valid and invalid identifiers:

| | |
|---|--|
| a. today | Valid |
| b. last_name | Valid |
| c. today's_date | Invalid – character “'” not allowed |
| d. Number_of_days_in_February_this_year | Invalid – Too long |
| e. Isleap\$year | Valid |
| f. #number | Invalid – Cannot start with “#” |
| g. NUMBER# | Valid |
| h. number1to7 | Valid |
2. Identify valid and invalid variable declaration and initialization:

| | | |
|---------------------|--------------------------|----------------|
| a. number_of_copies | PLS_INTEGER; | Valid |
| b. PRINTER_NAME | constant VARCHAR2(10); | Invalid |
| c. deliver_to | VARCHAR2(10) := Johnson; | Invalid |
| d. by_when | DATE := CURRENT_DATE+1; | Valid |

*The declaration in **b** is invalid because constant variables must be initialized during declaration. The declaration in **c** is invalid because string literals should be enclosed within single quotation marks.*

3. Examine the following anonymous block, and then select a statement from the following that is true.

```
DECLARE
  v_fname VARCHAR2(20);
  v_lname VARCHAR2(15) DEFAULT 'fernandez';
BEGIN
  DBMS_OUTPUT.PUT_LINE(v_fname || ' ' || v_lname);
END;
```

- a. The block executes successfully and prints “fernandez.”
 - b. The block produces an error because the `fname` variable is used without initializing.
 - c. The block executes successfully and prints “null fernandez.”
 - d. The block produces an error because you cannot use the `DEFAULT` keyword to initialize a variable of type `VARCHAR2`.
 - e. The block produces an error because the `v_fname` variable is not declared.
- a. The block will execute successfully and print “fernandez.”**

4. Modify an existing anonymous block and save it as a new script.
 - a. Open the lab_02_02_soln.sql script, which you created in Practice 2.
 - b. In the PL/SQL block, declare the following variables:
 - 1) Variable v_today of type DATE. Initialize today with SYSDATE.

```
DECLARE
  v_today DATE:=SYSDATE;
```

- 2) Variable v_tomorrow of type today. Use the %TYPE attribute to declare this variable.

```
v_tomorrow v_today%TYPE;
```

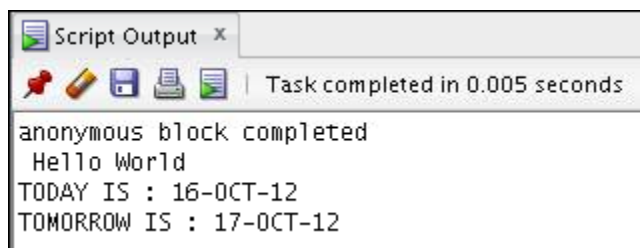
In the executable section:

- 1) Initialize the v_tomorrow variable with an expression, which calculates tomorrow's date (add one to the value in v_today).
- 2) Print the value of v_today and v_tomorrow after printing "Hello World".

```
BEGIN
  v_tomorrow:=v_today +1;
  DBMS_OUTPUT.PUT_LINE(' Hello World ');
  DBMS_OUTPUT.PUT_LINE('TODAY IS : ' || v_today);
  DBMS_OUTPUT.PUT_LINE('TOMORROW IS : ' || v_tomorrow);
END;
```

- c. Save your script as lab_03_04_soln.sql, and then execute.

The sample output is as follows (the values of v_today and v_tomorrow will be different to reflect your current today's and tomorrow's date):



5. Edit the `lab_03_04_soln.sql` script.
- Add the code to create two bind variables, named `b_basic_percent` and `b_pf_percent`. Both bind variables are of type `NUMBER`.

```
VARIABLE b_basic_percent NUMBER
VARIABLE b_pf_percent NUMBER
```

- In the executable section of the PL/SQL block, assign the values 45 and 12 to `b_basic_percent` and `b_pf_percent` respectively.

```
:b_basic_percent:=45;
:b_pf_percent:=12;
```

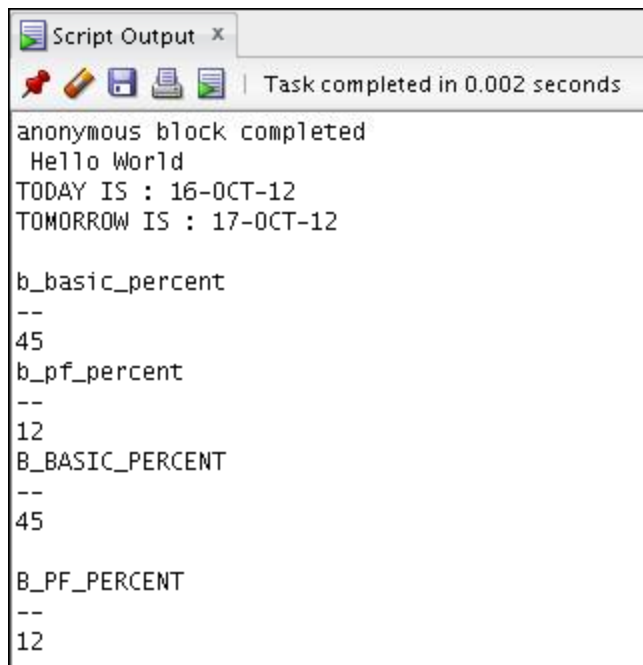
- Terminate the PL/SQL block with `/` and display the value of the bind variables by using the `PRINT` command.

```
/
PRINT b_basic_percent
PRINT b_pf_percent
```

OR

```
PRINT
```

- Execute and save your script as `lab_03_05_soln.sql`. The sample output is as follows:



```
Script Output x
Task completed in 0.002 seconds

anonymous block completed
Hello World
TODAY IS : 16-OCT-12
TOMORROW IS : 17-OCT-12

b_basic_percent
--
45
b_pf_percent
--
12
B_BASIC_PERCENT
--
45
B_PF_PERCENT
--
12
```


Practices for Lesson 4: Writing Executable Statements

Chapter 4

Practice 4: Writing Executable Statements

Note: If you have executed the code examples for this lesson, make sure you execute the following code before starting this practice:

```
DROP sequence my_seq;
```

In this practice, you examine and write executable statements.

```
DECLARE
  v_weight      NUMBER(3) := 600;
  v_message     VARCHAR2(255) := 'Product 10012';
BEGIN
  DECLARE
    v_weight      NUMBER(3) := 1;
    v_message     VARCHAR2(255) := 'Product 11001';
    v_new_locn    VARCHAR2(50) := 'Europe';
  BEGIN
    v_weight := v_weight + 1;
    v_new_locn := 'Western ' || v_new_locn;
1 →
  END;
  v_weight := v_weight + 1;
  v_message := v_message || ' is in stock';
  v_new_locn := 'Western ' || v_new_locn;
2 →
END;
/
```

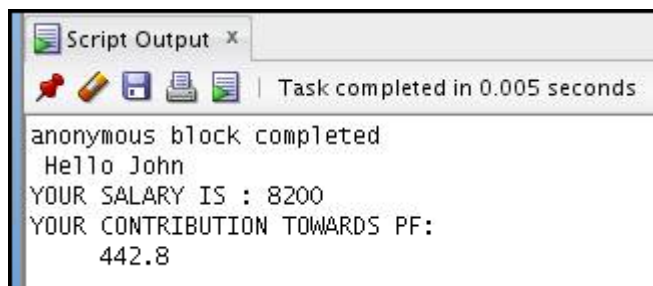
1. Evaluate the preceding PL/SQL block and determine the data type and value of each of the following variables, according to the rules of scoping.
 - a. The value of `v_weight` at position 1 is:
 - b. The value of `v_new_locn` at position 1 is:
 - c. The value of `v_weight` at position 2 is:
 - d. The value of `v_message` at position 2 is:
 - e. The value of `v_new_locn` at position 2 is:

```
DECLARE
  v_customer     VARCHAR2(50) := 'Womansport';
  v_credit_rating VARCHAR2(50) := 'EXCELLENT';
BEGIN
  DECLARE
    v_customer     NUMBER(7) := 201;
    v_name          VARCHAR2(25) := 'Unisports';
  BEGIN
    v_credit_rating := 'GOOD';
    ...
  END;
  ...
END;
```


2. In the preceding PL/SQL block, determine the values and data types for each of the following cases:
 - a. The value of `v_customer` in the nested block is:
 - b. The value of `v_name` in the nested block is:
 - c. The value of `v_credit_rating` in the nested block is:
 - d. The value of `v_customer` in the main block is:
 - e. The value of `v_name` in the main block is:
 - f. The value of `v_credit_rating` in the main block is:
3. Use the same session that you used to execute the practices in the lesson titled “Declaring PL/SQL Variables.” If you have opened a new session, execute `lab_03_05_soln.sql`. Then, edit `lab_03_05_soln.sql` as follows:
 - a. Use single-line comment syntax to comment the lines that create the bind variables, and turn on `SERVEROUTPUT`.
 - b. Use multiple-line comments in the executable section to comment the lines that assign values to the bind variables.
 - c. In the declaration section:
 - 1) Declare and initialize two temporary variables to replace the commented out bind variables
 - 2) Declare two additional variables: `v_fname` of type `VARCHAR2` and size 15, and `v_emp_sal` of type `NUMBER` and size 10
 - d. Include the following SQL statement in the executable section:

```
SELECT first_name, salary INTO v_fname, v_emp_sal
FROM employees WHERE employee_id=110;
```

- e. Change the line that prints “Hello World” to print “Hello” and the first name. Then, comment the lines that display the dates and print the bind variables.
- f. Calculate the contribution of the employee towards provident fund (PF). PF is 12% of the basic salary, and the basic salary is 45% of the salary. Use local variables for the calculation. Try to use only one expression to calculate the PF. Print the employee’s salary and his or her contribution toward PF.
- g. Execute and save your script as `lab_04_03_soln.sql`. The sample output is as follows:



```
Script Output x
Task completed in 0.005 seconds
anonymous block completed
Hello John
YOUR SALARY IS : 8200
YOUR CONTRIBUTION TOWARDS PF:
442.8
```

Solution 4: Writing Executable Statements

In this practice, you examine and write executable statements.

```

DECLARE
  v_weight      NUMBER(3) := 600;
  v_message     VARCHAR2(255) := 'Product 10012';
BEGIN
  DECLARE
    v_weight      NUMBER(3) := 1;
    v_message     VARCHAR2(255) := 'Product 11001';
    v_new_locn    VARCHAR2(50) := 'Europe';
  BEGIN
    v_weight := v_weight + 1;
    v_new_locn := 'Western ' || v_new_locn;
1 →
  END;
  v_weight := v_weight + 1;
  v_message := v_message || ' is in stock';
  v_new_locn := 'Western ' || v_new_locn;
2 →
END;
/

```

1. Evaluate the preceding PL/SQL block and determine the data type and value of each of the following variables, according to the rules of scoping.
 - a. The value of `v_weight` at position 1 is:
2
The data type is NUMBER.
 - b. The value of `v_new_locn` at position 1 is:
Western Europe
The data type is VARCHAR2.
 - c. The value of `v_weight` at position 2 is:
601
The data type is NUMBER.
 - d. The value of `v_message` at position 2 is:
Product 10012 is in stock
The data type is VARCHAR2.
 - e. The value of `v_new_locn` at position 2 is:
Illegal because v_new_locn is not visible outside the subblock

```

DECLARE
    v_customer    VARCHAR2(50) := 'Womansport';
    v_credit_rating VARCHAR2(50) := 'EXCELLENT';
BEGIN
    DECLARE
        v_customer    NUMBER(7) := 201;
        v_name VARCHAR2(25) := 'Unisports';
    BEGIN
        v_credit_rating := 'GOOD';
        ...
    END;
    ...
END;

```

2. In the preceding PL/SQL block, determine the values and data types for each of the following cases:
 - a. The value of `v_customer` in the nested block is:
201
The data type is NUMBER.
 - b. The value of `v_name` in the nested block is:
Unisports
The data type is VARCHAR2.
 - c. The value of `v_credit_rating` in the nested block is:
GOOD
The data type is VARCHAR2.
 - d. The value of `v_customer` in the main block is:
Womansport
The data type is VARCHAR2.
 - e. The value of `v_name` in the main block is:
 Null. **name is not visible in the main block and you would see an error.**
 - f. The value of `v_credit_rating` in the main block is:
EXCELLENT
The data type is VARCHAR2.
3. Use the same session that you used to execute the practices in the lesson titled “Declaring PL/SQL Variables.” If you have opened a new session, execute `lab_03_05_soln.sql`. Then, edit `lab_03_05_soln.sql` as follows:
 - a. Use single-line comment syntax to comment the lines that create the bind variables, and turn on `SERVEROUTPUT`.

```

-- VARIABLE b_basic_percent NUMBER
-- VARIABLE b_pf_percent NUMBER
SET SERVEROUTPUT ON

```

- b. Use multiple-line comments in the executable section to comment the lines that assign values to the bind variables.

```
/*:b_basic_percent:=45;
:b_pf_percent:=12;*/
```

- c. In the declaration section:

- 1) Declare and initialize two temporary variables to replace the commented out bind variables
- 2) Declare two additional variables: v_fname of type VARCHAR2 and size 15, and v_emp_sal of type NUMBER and size 10

```
DECLARE
  v_basic_percent NUMBER:=45;
  v_pf_percent NUMBER:=12;
  v_fname VARCHAR2(15);
  v_emp_sal NUMBER(10);
```

- d. Include the following SQL statement in the executable section:

```
SELECT first_name, salary INTO v_fname, v_emp_sal
FROM employees WHERE employee_id=110;
```

- e. Change the line that prints “Hello World” to print “Hello” and the first name. Then, comment the lines that display the dates and print the bind variables.

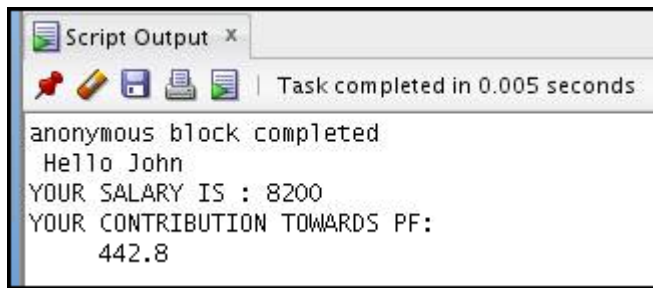
```
DBMS_OUTPUT.PUT_LINE(' Hello '|| v_fname);
/*  DBMS_OUTPUT.PUT_LINE('TODAY IS : '|| v_today);
DBMS_OUTPUT.PUT_LINE('TOMORROW IS : ' || v_tomorrow);*/
...
...

/
--PRINT b_basic_percent
--PRINT b_basic_percent
```

- f. Calculate the contribution of the employee towards provident fund (PF). PF is 12% of the basic salary, and the basic salary is 45% of the salary. Use local variables for the calculation. Try to use only one expression to calculate the PF. Print the employee’s salary and his or her contribution toward PF.

```
DBMS_OUTPUT.PUT_LINE('YOUR SALARY IS : '||v_emp_sal);
DBMS_OUTPUT.PUT_LINE('YOUR CONTRIBUTION TOWARDS PF:
  '||v_emp_sal*v_basic_percent/100*v_pf_percent/100);
END;
```

- g. Execute and save your script as `lab_04_03_soln.sql`. The sample output is as follows:



The screenshot shows a window titled "Script Output" with a close button (X). Below the title bar is a toolbar with icons for a pin, a pencil, a save icon, a print icon, and a refresh icon. To the right of the toolbar, it says "Task completed in 0.005 seconds". The main area of the window contains the following text:

```
anonymous block completed
Hello John
YOUR SALARY IS : 8200
YOUR CONTRIBUTION TOWARDS PF:
    442.8
```


Practices for Lesson 5: Using SQL Statements within a PL/SQL Block

Chapter 5

Practice 5: Using SQL Statements within a PL/SQL

Note: If you have executed the code examples for this lesson, make sure you execute the following code before starting this practice:

```
DROP table employees2;
DROP table copy_emp;
```

In this practice, you use PL/SQL code to interact with the Oracle Server.

1. Create a PL/SQL block that selects the maximum department ID in the `departments` table and stores it in the `v_max_deptno` variable. Display the maximum department ID.
 - a. Declare a variable `v_max_deptno` of type `NUMBER` in the declarative section.
 - b. Start the executable section with the `BEGIN` keyword and include a `SELECT` statement to retrieve the maximum `department_id` from the `departments` table.
 - c. Display `v_max_deptno` and end the executable block.
 - d. Execute and save your script as `lab_05_01_soln.sql`. The sample output is as follows:

```
anonymous block completed
The maximum department_id is : 270
```

2. Modify the PL/SQL block that you created in step 1 to insert a new department into the `departments` table.
 - a. Load the `lab_05_01_soln.sql` script. Declare two variables:
`v_dept_name` of type `departments.department_name` and
`v_dept_id` of type `NUMBER`
 Assign 'Education' to `v_dept_name` in the declarative section.
 - b. You have already retrieved the current maximum department number from the `departments` table. Add 10 to it and assign the result to `v_dept_id`.
 - c. Include an `INSERT` statement to insert data into the `department_name`, `department_id`, and `location_id` columns of the `departments` table. Use values in `dept_name` and `dept_id` for `department_name` and `department_id`, respectively, and use `NULL` for `location_id`.
 - d. Use the SQL attribute `SQL%ROWCOUNT` to display the number of rows that are affected.
 - e. Execute a `SELECT` statement to check whether the new department is inserted. You can terminate the PL/SQL block with `"/` and include the `SELECT` statement in your script.
 - f. Execute and save your script as `lab_05_02_soln.sql`. The sample output is as follows:

```
anonymous block completed
The maximum department_id is : 270
SQL%ROWCOUNT gives 1

DEPARTMENT_ID DEPARTMENT_NAME          MANAGER_ID LOCATION_ID
-----
          280 Education
```


3. In step 2, you set `location_id` to `NULL`. Create a PL/SQL block that updates the `location_id` to 3000 for the new department.

Note: If you successfully completed step 2, continue with step 3a. If not, first execute the solution script `/soln/sol_05_02.sql`.

- Start the executable block with the `BEGIN` keyword. Include the `UPDATE` statement to set the `location_id` to 3000 for the new department (`dept_id =280`).
- End the executable block with the `END` keyword. Terminate the PL/SQL block with `/` and include a `SELECT` statement to display the department that you updated.
- Include a `DELETE` statement to delete the department that you added.
- Execute and save your script as `lab_05_03_soln.sql`. The sample output is as follows:

```
anonymous block completed
DEPARTMENT_ID DEPARTMENT_NAME          MANAGER_ID LOCATION_ID
-----
           280 Education                      3000

1 rows deleted.
```

Solution 5: Using SQL Statements within a PL/SQL

In this practice, you use PL/SQL code to interact with the Oracle Server.

1. Create a PL/SQL block that selects the maximum department ID in the `departments` table and stores it in the `v_max_deptno` variable. Display the maximum department ID.
 - a. Declare a variable `v_max_deptno` of type `NUMBER` in the declarative section.

```
DECLARE
  v_max_deptno NUMBER;
```

- b. Start the executable section with the `BEGIN` keyword and include a `SELECT` statement to retrieve the maximum `department_id` from the `departments` table.

```
BEGIN
  SELECT MAX(department_id) INTO v_max_deptno FROM
    departments;
```

- c. Display `v_max_deptno` and end the executable block.

```
DBMS_OUTPUT.PUT_LINE('The maximum department_id is : ' ||
  v_max_deptno);
END;
```

- d. Execute and save your script as `lab_05_01_soln.sql`. The sample output is as follows:

```
anonymous block completed
The maximum department_id is : 270
```

2. Modify the PL/SQL block that you created in step 1 to insert a new department into the `departments` table.
 - a. Load the `lab_05_01_soln.sql` script. Declare two variables:
 - `v_dept_name` of type `departments.department_name` and
 - `v_dept_id` of type `NUMBER`
 Assign 'Education' to `v_dept_name` in the declarative section.

```
v_dept_name departments.department_name%TYPE:= 'Education';
v_dept_id NUMBER;
```

- b. You have already retrieved the current maximum department number from the `departments` table. Add 10 to it and assign the result to `v_dept_id`.

```
v_dept_id := 10 + v_max_deptno;
```

- c. Include an `INSERT` statement to insert data into the `department_name`, `department_id`, and `location_id` columns of the `departments` table. Use values in `dept_name` and `dept_id` for `department_name` and `department_id`, respectively, and use `NULL` for `location_id`.

```
...
INSERT INTO departments (department_id, department_name,
location_id)
VALUES (v_dept_id, v_dept_name, NULL);
```

- d. Use the SQL attribute `SQL%ROWCOUNT` to display the number of rows that are affected.

```
DBMS_OUTPUT.PUT_LINE (' SQL%ROWCOUNT gives ' || SQL%ROWCOUNT);
...
```

- e. Execute a `SELECT` statement to check whether the new department is inserted. You can terminate the PL/SQL block with `/` and include the `SELECT` statement in your script.

```
...
/
SELECT * FROM departments WHERE department_id= 280;
```

- f. Execute and save your script as `lab_05_02_soln.sql`. The sample output is as follows:

```
anonymous block completed
The maximum department_id is : 270
SQL%ROWCOUNT gives 1

DEPARTMENT_ID DEPARTMENT_NAME          MANAGER_ID LOCATION_ID
-----
          280 Education
```

3. In step 2, you set `location_id` to `NULL`. Create a PL/SQL block that updates the `location_id` to 3000 for the new department.
- Note:** If you successfully completed step 2, continue with step 3a. If not, first execute the solution script `/soln/sol_05_02.sql`.
- a. Start the executable block with the `BEGIN` keyword. Include the `UPDATE` statement to set `location_id` to 3000 for the new department (`dept_id=280`).

```
BEGIN
UPDATE departments SET location_id=3000 WHERE
department_id=280;
```

- b. End the executable block with the END keyword. Terminate the PL/SQL block with “/” and include a SELECT statement to display the department that you updated.

```
END;  
/  
SELECT * FROM departments WHERE department_id=280;
```

- c. Include a DELETE statement to delete the department that you added.

```
DELETE FROM departments WHERE department_id=280;
```

- d. Execute and save your script as lab_05_03_soln.sql. The sample output is as follows:

```
anonymous block completed  
DEPARTMENT_ID DEPARTMENT_NAME          MANAGER_ID LOCATION_ID  
-----  
              280 Education                3000  
  
1 rows deleted.
```

Practices for Lesson 6: Writing Control Structures

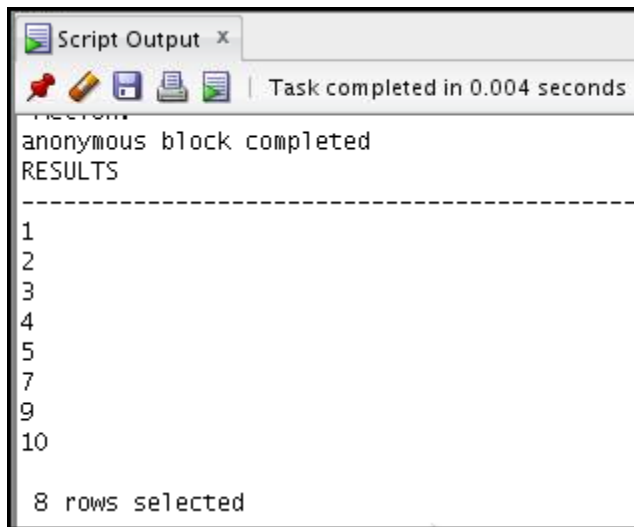
Chapter 6

Practice 6: Writing Control Structures

In this practice, you create PL/SQL blocks that incorporate loops and conditional control structures. This practice tests your understanding of various `IF` statements and `LOOP` constructs.

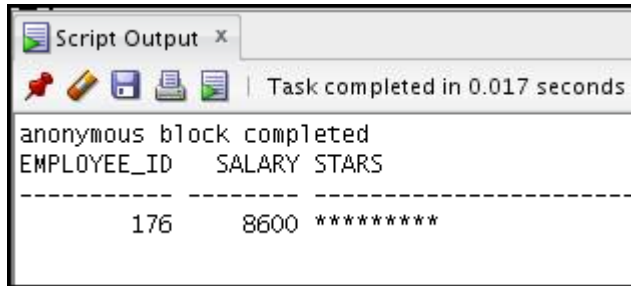
1. Execute the command in the `lab_06_01.sql` file to create the `messages` table. Write a PL/SQL block to insert numbers into the `messages` table.
 - a. Insert the numbers 1 through 10, excluding 6 and 8.
 - b. Commit before the end of the block.
 - c. Execute a `SELECT` statement to verify that your PL/SQL block worked.

Result: You should see the following output:



2. Execute the `lab_06_02.sql` script. This script creates an `emp` table that is a replica of the `employees` table. It alters the `emp` table to add a new column, `stars`, of `VARCHAR2` data type and size 50. Create a PL/SQL block that inserts an asterisk in the `stars` column for every \$1000 of an employee's salary. Save your script as `lab_06_02_soln.sql`.
 - a. In the declarative section of the block, declare a variable `v_empno` of type `emp.employee_id` and initialize it to 176. Declare a variable `v_asterisk` of type `emp.stars` and initialize it to `NULL`. Create a variable `v_sal` of type `emp.salary`.
 - b. In the executable section, write logic to append an asterisk (*) to the string for every \$1,000 of the salary. For example, if the employee earns \$8,000, the string of asterisks should contain eight asterisks. If the employee earns \$12,500, the string of asterisks should contain 13 asterisks.
 - c. Update the `stars` column for the employee with the string of asterisks. Commit before the end of the block.
 - d. Display the row from the `emp` table to verify whether your PL/SQL block has executed successfully.

- e. Execute and save your script as `lab_06_02_soln.sql`. The output is as follows:



```
Script Output x
Task completed in 0.017 seconds
anonymous block completed
EMPLOYEE_ID  SALARY STARS
-----
          176      8600 *****
```

Solution 6: Writing Control Structures

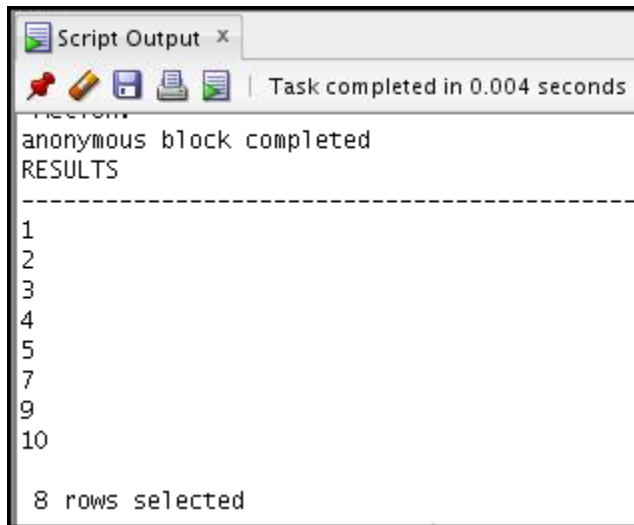
1. Execute the command in the `lab_06_01.sql` file to create the `messages` table. Write a PL/SQL block to insert numbers into the `messages` table.
 - a. Insert the numbers 1 through 10, excluding 6 and 8.
 - b. Commit before the end of the block.

```
BEGIN
FOR i in 1..10 LOOP
  IF i = 6 or i = 8 THEN
    null;
  ELSE
    INSERT INTO messages(results)
      VALUES (i);
  END IF;
END LOOP;
COMMIT;
END;
```

- c. Execute a `SELECT` statement to verify that your PL/SQL block worked.

```
SELECT * FROM messages;
```

Result: You should see the following output:



2. Execute the `lab_06_02.sql` script. This script creates an `emp` table that is a replica of the `employees` table. It alters the `emp` table to add a new column, `stars`, of `VARCHAR2` data type and size 50. Create a PL/SQL block that inserts an asterisk in the `stars` column for every \$1000 of the employee's salary. Save your script as `lab_06_02_soln.sql`.

- a. In the declarative section of the block, declare a variable `v_empno` of type `emp.employee_id` and initialize it to 176. Declare a variable `v_asterisk` of type `emp.stars` and initialize it to `NULL`. Create a variable `v_sal` of type `emp.salary`.

```
DECLARE
    v_empno      emp.employee_id%TYPE := 176;
    v_asterisk   emp.stars%TYPE := NULL;
    v_sal        emp.salary%TYPE;
```

- b. In the executable section, write logic to append an asterisk (*) to the string for every \$1,000 of the salary. For example, if the employee earns \$8,000, the string of asterisks should contain eight asterisks. If the employee earns \$12,500, the string of asterisks should contain 13 asterisks.

```
BEGIN
    SELECT NVL(ROUND(salary/1000), 0) INTO v_sal
    FROM emp WHERE employee_id = v_empno;

    FOR i IN 1..v_sal
    LOOP
        v_asterisk := v_asterisk || '*';
    END LOOP;
```

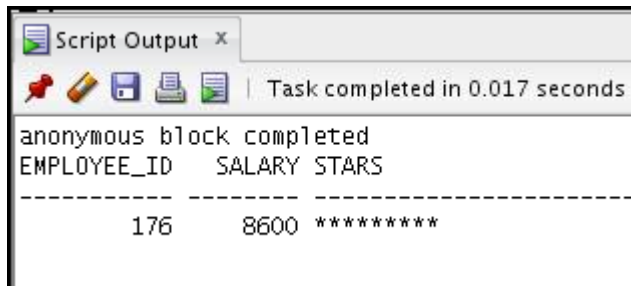
- c. Update the `stars` column for the employee with the string of asterisks. Commit before the end of the block.

```
UPDATE emp SET stars = v_asterisk
WHERE employee_id = v_empno;
COMMIT;
END;
/
```

- d. Display the row from the `emp` table to verify whether your PL/SQL block has executed successfully.

```
SELECT employee_id,salary, stars
FROM emp WHERE employee_id =176;
```

- e. Execute and save your script as `lab_06_02_soln.sql`. The output is as follows:



```
Script Output x
Task completed in 0.017 seconds

anonymous block completed
EMPLOYEE_ID  SALARY STARS
-----
          176      8600 *****
```

Practices for Lesson 7: Working with Composite Data Types

Chapter 7

Practice 7: Working with Composite Data Types

Note: If you have executed the code examples for this lesson, make sure you execute the following code before starting this practice:

```
DROP table retired_emps;
DROP table empl;
```

1. Write a PL/SQL block to print information about a given country.
 - a. Declare a PL/SQL record based on the structure of the `COUNTRIES` table.
 - b. Declare a variable `v_countryid`. Assign CA to `v_countryid`.
 - c. In the declarative section, use the `%ROWTYPE` attribute and declare the `v_country_record` variable of type `countries`.
 - d. In the executable section, get all the information from the `COUNTRIES` table by using `v_countryid`. Display selected information about the country. The sample output is as follows:

```
anonymous block completed
Country Id: CA Country Name: Canada Region: 2
```

- e. You may want to execute and test the PL/SQL block for countries with the IDs DE, UK, and US.
2. Create a PL/SQL block to retrieve the names of some departments from the `DEPARTMENTS` table and print each department name on the screen, incorporating an associative array. Save the script as `lab_07_02_soln.sql`.
 - a. Declare an `INDEX BY` table `dept_table_type` of type `departments.department_name`. Declare a variable `my_dept_table` of type `dept_table_type` to temporarily store the names of the departments.
 - b. Declare two variables: `f_loop_count` and `v_deptno` of type `NUMBER`. Assign 10 to `f_loop_count` and 0 to `v_deptno`.
 - c. Using a loop, retrieve the names of 10 departments and store the names in the associative array. Start with `department_id` 10. Increase `v_deptno` by 10 for every loop iteration. The following table shows the `department_id` for which you should retrieve the `department_name`.

| DEPARTMENT_ID | DEPARTMENT_NAME |
|---------------|------------------|
| 10 | Administration |
| 20 | Marketing |
| 30 | Purchasing |
| 40 | Human Resources |
| 50 | Shipping |
| 60 | IT |
| 70 | Public Relations |
| 80 | Sales |

| | |
|------------|------------------|
| 90 | Executive |
| 100 | Finance |

- d. Using another loop, retrieve the department names from the associative array and display them.
- e. Execute and save your script as `lab_07_02_soln.sql`. The output is as follows:

```
anonymous block completed
Administration
Marketing
Purchasing
Human Resources
Shipping
IT
Public Relations
Sales
Executive
Finance
```

3. Modify the block that you created in Practice 2 to retrieve all information about each department from the `DEPARTMENTS` table and display the information. Use an associative array with the `INDEX BY` table of records method.
 - a. Load the `lab_07_02_soln.sql` script.
 - b. You have declared the associative array to be of type `departments.department_name`. Modify the declaration of the associative array to temporarily store the number, name, and location of all the departments. Use the `%ROWTYPE` attribute.
 - c. Modify the `SELECT` statement to retrieve all department information currently in the `DEPARTMENTS` table and store it in the associative array.
 - d. Using another loop, retrieve the department information from the associative array and display the information.

The sample output is as follows:

```
anonymous block completed
Department Number: 10 Department Name: Administration Manager Id: 200 Location Id: 1700
Department Number: 20 Department Name: Marketing Manager Id: 201 Location Id: 1800
Department Number: 30 Department Name: Purchasing Manager Id: 114 Location Id: 1700
Department Number: 40 Department Name: Human Resources Manager Id: 203 Location Id: 2400
Department Number: 50 Department Name: Shipping Manager Id: 121 Location Id: 1500
Department Number: 60 Department Name: IT Manager Id: 103 Location Id: 1400
Department Number: 70 Department Name: Public Relations Manager Id: 204 Location Id: 2700
Department Number: 80 Department Name: Sales Manager Id: 145 Location Id: 2500
Department Number: 90 Department Name: Executive Manager Id: 100 Location Id: 1700
Department Number: 100 Department Name: Finance Manager Id: 108 Location Id: 1700
```

Solution 7: Working with Composite Data Types

1. Write a PL/SQL block to print information about a given country.
 - a. Declare a PL/SQL record based on the structure of the COUNTRIES table.
 - b. Declare a variable v_countryid. Assign CA to v_countryid.

```
SET SERVEROUTPUT ON

SET VERIFY OFF
DECLARE
  v_countryid varchar2(20) := 'CA';
```

- c. In the declarative section, use the %ROWTYPE attribute and declare the v_country_record variable of type countries.

```
v_country_record countries%ROWTYPE;
```

- d. In the executable section, get all the information from the COUNTRIES table by using v_countryid. Display selected information about the country.

```
BEGIN
  SELECT *
  INTO   v_country_record
  FROM   countries
  WHERE  country_id = UPPER(v_countryid);

  DBMS_OUTPUT.PUT_LINE ('Country Id: ' ||
    v_country_record.country_id ||
    ' Country Name: ' || v_country_record.country_name
    || ' Region: ' || v_country_record.region_id);

END;
```

The sample output after performing all the above steps is as follows:

```
anonymous block completed
Country Id: CA Country Name: Canada Region: 2
```

- e. You may want to execute and test the PL/SQL block for countries with the IDs DE, UK, and US.

2. Create a PL/SQL block to retrieve the names of some departments from the `DEPARTMENTS` table and print each department name on the screen, incorporating an associative array. Save the script as `lab_07_02_soln.sql`.

- a. Declare an `INDEX BY table` `dept_table_type` of type `departments.department_name`. Declare a variable `my_dept_table` of type `dept_table_type` to temporarily store the names of the departments.

```
SET SERVEROUTPUT ON

DECLARE
    TYPE dept_table_type is table of
        departments.department_name%TYPE
    INDEX BY PLS_INTEGER;
    my_dept_table    dept_table_type;
```

- b. Declare two variables: `f_loop_count` and `v_deptno` of type `NUMBER`. Assign 10 to `f_loop_count` and 0 to `v_deptno`.

```
f_loop_count    NUMBER (2) :=10;
v_deptno        NUMBER (4) :=0;
```

- c. Using a loop, retrieve the names of 10 departments and store the names in the associative array. Start with `department_id` 10. Increase `v_deptno` by 10 for every iteration of the loop. The following table shows the `department_id` for which you should retrieve the `department_name` and store in the associative array.

| DEPARTMENT_ID | DEPARTMENT_NAME |
|---------------|------------------|
| 10 | Administration |
| 20 | Marketing |
| 30 | Purchasing |
| 40 | Human Resources |
| 50 | Shipping |
| 60 | IT |
| 70 | Public Relations |
| 80 | Sales |
| 90 | Executive |
| 100 | Finance |

```

BEGIN
  FOR i IN 1..f_loop_count
  LOOP
    v_deptno:=v_deptno+10;
    SELECT department_name
    INTO my_dept_table(i)
    FROM departments
    WHERE department_id = v_deptno;
  END LOOP;

```

- d. Using another loop, retrieve the department names from the associative array and display them.

```

FOR i IN 1..f_loop_count
  LOOP
    DBMS_OUTPUT.PUT_LINE (my_dept_table(i));
  END LOOP;
END;

```

- e. Execute and save your script as lab_07_02_soln.sql. The output is as follows:

```

anonymous block completed
Administration
Marketing
Purchasing
Human Resources
Shipping
IT
Public Relations
Sales
Executive
Finance

```

3. Modify the block that you created in Practice 2 to retrieve all information about each department from the DEPARTMENTS table and display the information. Use an associative array with the INDEX BY table of records method.
- Load the lab_07_02_soln.sql script.
 - You have declared the associative array to be of the departments.department_name type. Modify the declaration of the associative array to temporarily store the number, name, and location of all the departments. Use the %ROWTYPE attribute.

```

SET SERVEROUTPUT ON

DECLARE
  TYPE dept_table_type is table of departments%ROWTYPE
  INDEX BY PLS_INTEGER;
  my_dept_table      dept_table_type;
  f_loop_count       NUMBER (2) :=10;
  v_deptno           NUMBER (4) :=0;

```


- c. Modify the `SELECT` statement to retrieve all department information currently in the `DEPARTMENTS` table and store it in the associative array.

```
BEGIN
  FOR i IN 1..f_loop_count
  LOOP
    v_deptno := v_deptno + 10;
    SELECT *
    INTO my_dept_table(i)
    FROM departments
    WHERE department_id = v_deptno;
  END LOOP;
```

- d. Using another loop, retrieve the department information from the associative array and display the information.

```
FOR i IN 1..f_loop_count
LOOP
  DBMS_OUTPUT.PUT_LINE ('Department Number: ' ||
my_dept_table(i).department_id
  || ' Department Name: ' || my_dept_table(i).department_name
  || ' Manager Id: ' || my_dept_table(i).manager_id
  || ' Location Id: ' || my_dept_table(i).location_id);
END LOOP;
END;
```

The sample output is as follows:

```
anonymous block completed
Department Number: 10 Department Name: Administration Manager Id: 200 Location Id: 1700
Department Number: 20 Department Name: Marketing Manager Id: 201 Location Id: 1800
Department Number: 30 Department Name: Purchasing Manager Id: 114 Location Id: 1700
Department Number: 40 Department Name: Human Resources Manager Id: 203 Location Id: 2400
Department Number: 50 Department Name: Shipping Manager Id: 121 Location Id: 1500
Department Number: 60 Department Name: IT Manager Id: 103 Location Id: 1400
Department Number: 70 Department Name: Public Relations Manager Id: 204 Location Id: 2700
Department Number: 80 Department Name: Sales Manager Id: 145 Location Id: 2500
Department Number: 90 Department Name: Executive Manager Id: 100 Location Id: 1700
Department Number: 100 Department Name: Finance Manager Id: 108 Location Id: 1700
```


Practices for Lesson 8: Using Explicit Cursors

Chapter 8

Practice 8-1: Using Explicit Cursors

In this practice, you perform two exercises:

- First, you use an explicit cursor to process a number of rows from a table and populate another table with the results using a cursor `FOR` loop.
 - Second, you write a PL/SQL block that processes information with two cursors, including one that uses a parameter.
1. Create a PL/SQL block to perform the following:
 - a. In the declarative section, declare and initialize a variable named `v_deptno` of type `NUMBER`. Assign a valid department ID value (see table in step d for values).
 - b. Declare a cursor named `c_emp_cursor`, which retrieves the `last_name`, `salary`, and `manager_id` of employees working in the department specified in `v_deptno`.
 - c. In the executable section, use the cursor `FOR` loop to operate on the data retrieved. If the salary of the employee is less than 5,000 and if the manager ID is either 101 or 124, display the message “<<`last_name`>> Due for a raise.” Otherwise, display the message “<<`last_name`>> Not Due for a raise.”
 - d. Test the PL/SQL block for the following cases:

| Department ID | Message |
|---------------|---|
| 10 | Whalen Due for a raise |
| 20 | Hartstein Not Due for a raise Fay Not Due for a raise |
| 50 | Weiss Not Due for a raise Fripp Not Due for a raise Kaufling Not Due for a raise Vollman Not Due for a raise. OConnell Due for a raise Grant Due for a raise |
| 80 | Russell Not Due for a raise Partners Not Due for a raise Errazuriz Not Due for a raise Cambrault Not Due for a raise Livingston Not Due for a raise Johnson Not Due for a raise |

2. Next, write a PL/SQL block that declares and uses two cursors—one without a parameter and one with a parameter. The first cursor retrieves the department number and the department name from the `DEPARTMENTS` table for all departments whose ID number is less than 100. The second cursor receives the department number as a parameter, and retrieves employee details for those who work in that department and whose `employee_id` is less than 120.
 - a. Declare a cursor `c_dept_cursor` to retrieve `department_id` and `department_name` for those departments with `department_id` less than 100. Order by `department_id`.
 - b. Declare another cursor `c_emp_cursor` that takes the department number as parameter and retrieves the following data from the `EMPLOYEES` table: `last_name`, `job_id`, `hire_date`, and `salary` of those employees who work in that department, with `employee_id` less than 120.
 - c. Declare variables to hold the values retrieved from each cursor. Use the `%TYPE` attribute while declaring variables.
 - d. Open `c_dept_cursor` and use a simple loop to fetch values into the variables declared. Display the department number and department name. Use the appropriate cursor attribute to exit the loop.
 - e. Open `c_emp_cursor` by passing the current department number as a parameter. Start another loop and fetch the values of `emp_cursor` into variables, and print all the details retrieved from the `EMPLOYEES` table.
- Note**
- Check whether `c_emp_cursor` is already open before opening the cursor.
 - Use the appropriate cursor attribute for the exit condition.
 - When the loop completes, print a line after you have displayed the details of each department, and close `c_emp_cursor`.
- f. End the first loop and close `c_dept_cursor`. Then end the executable section.

- g. Execute the script. The sample output is as follows:

```

anonymous block completed
Department Number : 10  Department Name : Administration
-----
Department Number : 20  Department Name : Marketing
-----
Department Number : 30  Department Name : Purchasing
Raphaely    PU_MAN    07-DEC-02    11000
Khoo        PU_CLERK   18-MAY-03    3100
Baida       PU_CLERK   24-DEC-05    2900
Tobias      PU_CLERK   24-JUL-05    2800
Himuro      PU_CLERK   15-NOV-06    2600
Colmenares  PU_CLERK   10-AUG-07    2500
-----
Department Number : 40  Department Name : Human Resources
-----
Department Number : 50  Department Name : Shipping
-----
Department Number : 60  Department Name : IT
Hunold      IT_PROG    03-JAN-06    9000
Ernst       IT_PROG    21-MAY-07    6000
Austin      IT_PROG    25-JUN-05    4800
Pataballa   IT_PROG    05-FEB-06    4800
Lorentz     IT_PROG    07-FEB-07    4200
-----
Department Number : 70  Department Name : Public Relations
-----
Department Number : 80  Department Name : Sales
-----
Department Number : 90  Department Name : Executive
King        AD_PRES    17-JUN-03    24000
Kochhar     AD_VP      21-SEP-05    17000
De Haan     AD_VP      13-JAN-01    17000

```

Solution 8-1: Using Explicit Cursors

In this practice, you perform two exercises:

- First, you use an explicit cursor to process a number of rows from a table and populate another table with the results using a cursor `FOR` loop.
 - Second, you write a PL/SQL block that processes information with two cursors, including one that uses a parameter.
1. Create a PL/SQL block to perform the following:
 - a. In the declarative section, declare and initialize a variable named `v_deptno` of the `NUMBER` type. Assign a valid department ID value (see table in step d for values).

```
DECLARE
v_deptno NUMBER := 10;
```

- b. Declare a cursor named `c_emp_cursor`, which retrieves the `last_name`, `salary`, and `manager_id` of employees working in the department specified in `v_deptno`.

```
CURSOR c_emp_cursor IS
  SELECT      last_name, salary, manager_id
  FROM        employees
  WHERE       department_id = v_deptno;
```

- c. In the executable section, use the cursor `FOR` loop to operate on the data retrieved. If the salary of the employee is less than 5,000 and if the manager ID is either 101 or 124, display the message “<<*last_name*>> Due for a raise.” Otherwise, display the message “<<*last_name*>> Not Due for a raise.”

```
BEGIN
  FOR emp_record IN c_emp_cursor
  LOOP
    IF emp_record.salary < 5000 AND (emp_record.manager_id=101 OR
    emp_record.manager_id=124) THEN
      DBMS_OUTPUT.PUT_LINE (emp_record.last_name || ' Due for a
    raise');
    ELSE
      DBMS_OUTPUT.PUT_LINE (emp_record.last_name || ' Not Due for a
    raise');
    END IF;
  END LOOP;
END;
```

- d. Test the PL/SQL block for the following cases:

| Department ID | Message |
|---------------|---|
| 10 | Whalen Due for a raise |
| 20 | Hartstein Not Due for a raise Fay Not Due for a raise |
| 50 | Weiss Not Due for a raise Fripp Not Due for a raise Kaufling Not Due for a raise Vollman Not Due for a raise. OConnell Due for a raise Grant Due for a raise |
| 80 | Russell Not Due for a raise Partners Not Due for a raise Errazuriz Not Due for a raise Cambrault Not Due for a raise Livingston Not Due for a raise Johnson Not Due for a raise |

2. Next, write a PL/SQL block that declares and uses two cursors—one without a parameter and one with a parameter. The first cursor retrieves the department number and the department name from the `DEPARTMENTS` table for all departments whose ID number is less than 100. The second cursor receives the department number as a parameter, and retrieves employee details for those who work in that department and whose `employee_id` is less than 120.
- a. Declare a cursor `c_dept_cursor` to retrieve `department_id` and `department_name` for those departments with `department_id` less than 100. Order by `department_id`.

```
DECLARE
  CURSOR c_dept_cursor IS
    SELECT department_id, department_name
    FROM departments
    WHERE department_id < 100
    ORDER BY department_id;
```


- b. Declare another cursor `c_emp_cursor` that takes the department number as parameter and retrieves the following data from the `EMPLOYEES` table: `last_name`, `job_id`, `hire_date`, and `salary` of those employees who work in that department, with `employee_id` less than 120.

```
CURSOR c_emp_cursor(v_deptno NUMBER) IS
    SELECT last_name, job_id, hire_date, salary
    FROM employees
    WHERE department_id = v_deptno
    AND employee_id < 120;
```

- c. Declare variables to hold the values retrieved from each cursor. Use the `%TYPE` attribute while declaring variables.

```
v_current_deptno departments.department_id%TYPE;
v_current_dname departments.department_name%TYPE;
v_ename employees.last_name%TYPE;
v_job employees.job_id%TYPE;
v_hiredate employees.hire_date%TYPE;
v_sal employees.salary%TYPE;
```

- d. Open `c_dept_cursor` and use a simple loop to fetch values into the variables declared. Display the department number and department name. Use the appropriate cursor attribute to exit the loop.

```
BEGIN
    OPEN c_dept_cursor;
    LOOP
        FETCH c_dept_cursor INTO v_current_deptno,
            v_current_dname;
        EXIT WHEN c_dept_cursor%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE ('Department Number : ' ||
            v_current_deptno || ' Department Name : ' ||
            v_current_dname);
```

- e. Open `c_emp_cursor` by passing the current department number as a parameter. Start another loop and fetch the values of `emp_cursor` into variables, and print all the details retrieved from the `EMPLOYEES` table.

Note

- Check whether `c_emp_cursor` is already open before opening the cursor.
- Use the appropriate cursor attribute for the exit condition.
- When the loop completes, print a line after you have displayed the details of each department, and close `c_emp_cursor`.

```
IF c_emp_cursor%ISOPEN THEN
    CLOSE c_emp_cursor;
END IF;
OPEN c_emp_cursor (v_current_deptno);
LOOP
    FETCH c_emp_cursor INTO v_ename,v_job,v_hiredate,v_sal;
    EXIT WHEN c_emp_cursor%NOTFOUND;
    DBMS_OUTPUT.PUT_LINE (v_ename || ' ' || v_job
                          || ' ' || v_hiredate || ' ' || v_sal);
END LOOP;
DBMS_OUTPUT.PUT_LINE('-----');
                        ');
                        CLOSE c_emp_cursor;
```

- f. End the first loop and close `c_dept_cursor`. Then end the executable section.

```
END LOOP;
CLOSE c_dept_cursor;
END;
```

- g. Execute the script. The sample output is as follows:

```

anonymous block completed
Department Number : 10  Department Name : Administration
-----
Department Number : 20  Department Name : Marketing
-----
Department Number : 30  Department Name : Purchasing
Raphaely  PU_MAN  07-DEC-02  11000
Khoo      PU_CLERK 18-MAY-03  3100
Baida     PU_CLERK 24-DEC-05  2900
Tobias    PU_CLERK 24-JUL-05  2800
Himuro    PU_CLERK 15-NOV-06  2600
Colmenares PU_CLERK 10-AUG-07  2500
-----
Department Number : 40  Department Name : Human Resources
-----
Department Number : 50  Department Name : Shipping
-----
Department Number : 60  Department Name : IT
Hunold    IT_PROG  03-JAN-06  9000
Ernst     IT_PROG  21-MAY-07  6000
Austin    IT_PROG  25-JUN-05  4800
Pataballa IT_PROG  05-FEB-06  4800
Lorentz   IT_PROG  07-FEB-07  4200
-----
Department Number : 70  Department Name : Public Relations
-----
Department Number : 80  Department Name : Sales
-----
Department Number : 90  Department Name : Executive
King       AD_PRES  17-JUN-03  24000
Kochhar    AD_VP    21-SEP-05  17000
De Haan    AD_VP    13-JAN-01  17000

```

Practice 8-2: Using Explicit Cursors: Optional

If you have time, complete the following optional practice. Here, create a PL/SQL block that uses an explicit cursor to determine the top *n* salaries of employees.

1. Run the `lab_08-02.sql` script to create the `TOP_SALARIES` table for storing the salaries of the employees.
2. In the declarative section, declare the `v_num` variable of the `NUMBER` type that holds a number *n*, representing the number of top *n* earners from the `employees` table. For example, to view the top five salaries, enter 5. Declare another variable `sal` of type `employees.salary`. Declare a cursor, `c_emp_cursor`, which retrieves the salaries of employees in descending order. Remember that the salaries should not be duplicated.
3. In the executable section, open the loop and fetch the top *n* salaries, and then insert them into the `TOP_SALARIES` table. You can use a simple loop to operate on the data. Also, try and use the `%ROWCOUNT` and `%FOUND` attributes for the exit condition.
Note: Make sure that you add an exit condition to avoid having an infinite loop.
4. After inserting data into the `TOP_SALARIES` table, display the rows with a `SELECT` statement. The output shown represents the five highest salaries in the `EMPLOYEES` table.

| SALARY |
|--------|
| ----- |
| 24000 |
| 17000 |
| 17000 |
| 14000 |
| 13500 |

5. Test a variety of special cases such as `v_num = 0` or where `v_num` is greater than the number of employees in the `EMPLOYEES` table. Empty the `TOP_SALARIES` table after each test.

Solution 8-2: Using Explicit Cursors: Optional

If you have time, complete the following optional exercise. Here, create a PL/SQL block that uses an explicit cursor to determine the top n salaries of employees.

1. Execute the `lab_08-02.sql` script to create a new table, `TOP_SALARIES`, for storing the salaries of the employees.
2. In the declarative section, declare a variable `v_num` of type `NUMBER` that holds a number n , representing the number of top n earners from the `EMPLOYEES` table. For example, to view the top five salaries, enter 5. Declare another variable `sal` of type `employees.salary`. Declare a cursor, `c_emp_cursor`, which retrieves the salaries of employees in descending order. Remember that the salaries should not be duplicated.

```
DECLARE
  v_num          NUMBER(3) := 5;
  v_sal          employees.salary%TYPE;
  CURSOR c_emp_cursor IS
    SELECT salary
    FROM employees
    ORDER BY salary DESC;
```

3. In the executable section, open the loop and fetch the top n salaries, and then insert them into the `TOP_SALARIES` table. You can use a simple loop to operate on the data. Also, try and use the `%ROWCOUNT` and `%FOUND` attributes for the exit condition.

Note: Make sure that you add an exit condition to avoid having an infinite loop.

```
BEGIN
  OPEN c_emp_cursor;
  FETCH c_emp_cursor INTO v_sal;
  WHILE c_emp_cursor%ROWCOUNT <= v_num AND c_emp_cursor%FOUND LOOP
    INSERT INTO top_salaries (salary)
      VALUES (v_sal);
    FETCH c_emp_cursor INTO v_sal;
  END LOOP;
  CLOSE c_emp_cursor;
END;
```

4. After inserting data into the `TOP_SALARIES` table, display the rows with a `SELECT` statement. The output shown represents the five highest salaries in the `EMPLOYEES` table.

```
/
SELECT * FROM top_salaries;
```

The sample output is as follows:

| SALARY |
|--------|
| ----- |
| 24000 |
| 17000 |
| 17000 |
| 14000 |
| 13500 |

5. Test a variety of special cases such as `v_num = 0` or where `v_num` is greater than the number of employees in the `EMPLOYEES` table. Empty the `TOP_SALARIES` table after each test.

Practices for Lesson 9: Handling Exceptions

Chapter 9

Practice 9-1: Handling Predefined Exceptions

In this practice, you write a PL/SQL block that applies a predefined exception to process only one record at a time. The PL/SQL block selects the name of the employee with a given salary value.

1. Execute the command in the `lab_06_01.sql` file to re-create the `messages` table.
2. In the declarative section, declare two variables: `v_ename` of type `employees.last_name` and `v_emp_sal` of type `employees.salary`. Initialize the latter to 6000.
3. In the executable section, retrieve the last names of employees whose salaries are equal to the value in `v_emp_sal`. If the salary entered returns only one row, insert into the `MESSAGES` table the employee's name and the salary amount.
Note: Do not use explicit cursors.
4. If the salary entered does not return any rows, handle the exception with an appropriate exception handler and insert into the `MESSAGES` table the message "No employee with a salary of <salary>."
5. If the salary entered returns multiple rows, handle the exception with an appropriate exception handler and insert into the `MESSAGES` table the message "More than one employee with a salary of <salary>."
6. Handle any other exception with an appropriate exception handler and insert into the `MESSAGES` table the message "Some other error occurred."
7. Display the rows from the `MESSAGES` table to check whether the PL/SQL block has executed successfully. The output is as follows:

| |
|--|
| <pre>RESULTS ----- More than one employee with a salary of 6000 1 rows selected</pre> |
|--|

8. Change the initialized value of `v_emp_sal` to 2000 and re-execute. Output is as follows:

| |
|---|
| <pre>RESULTS ----- More than one employee with a salary of 6000 No employee with a salary of 2000</pre> |
|---|

Solution 9-1: Handling Predefined Exceptions

In this practice, you write a PL/SQL block that applies a predefined exception to process only one record at a time. The PL/SQL block selects the name of the employee with a given salary value.

1. Execute the command in the `lab_06_01.sql` file to re-create the `MESSAGES` table.
2. In the declarative section, declare two variables: `v_ename` of type `employees.last_name` and `v_emp_sal` of type `employees.salary`. Initialize the latter to 6000.

```
DECLARE
    v_ename      employees.last_name%TYPE;
    v_emp_sal    employees.salary%TYPE := 6000;
```

3. In the executable section, retrieve the last names of employees whose salaries are equal to the value in `v_emp_sal`. If the salary entered returns only one row, insert into the `MESSAGES` table the employee's name and the salary amount.
Note: Do not use explicit cursors.

```
BEGIN
    SELECT last_name
    INTO    v_ename
    FROM    employees
    WHERE   salary = v_emp_sal;
    INSERT INTO messages (results)
    VALUES (v_ename || ' - ' || v_emp_sal);
```

4. If the salary entered does not return any rows, handle the exception with an appropriate exception handler and insert into the `MESSAGES` table the message "No employee with a salary of <salary>."

```
EXCEPTION
    WHEN no_data_found THEN
        INSERT INTO messages (results)
        VALUES ('No employee with a salary of ' ||
                TO_CHAR(v_emp_sal));
```

5. If the salary entered returns multiple rows, handle the exception with an appropriate exception handler and insert into the `MESSAGES` table the message "More than one employee with a salary of <salary>."

```
WHEN too_many_rows THEN
    INSERT INTO messages (results)
    VALUES ('More than one employee with a salary of ' ||
            TO_CHAR(v_emp_sal));
```

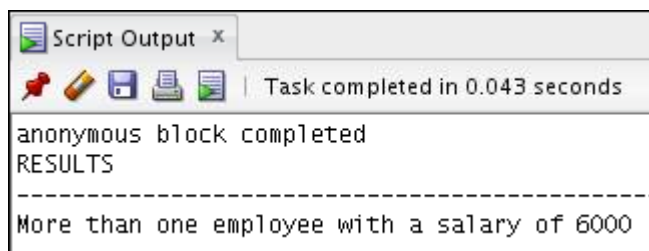
6. Handle any other exception with an appropriate exception handler and insert into the `MESSAGES` table the message "Some other error occurred."

```
WHEN others THEN
    INSERT INTO messages (results)
    VALUES ('Some other error occurred. ');
END;
```

7. Display the rows from the `MESSAGES` table to check whether the PL/SQL block has executed successfully.

```
/
SELECT * FROM messages;
```

The output is as follows:



8. Change the initialized value of `v_emp_sal` to 2000 and re-execute. The output is as follows:

```
RESULTS
-----
More than one employee with a salary of 6000
No employee with a salary of 2000
```

Practice 9-2: Handling Standard Oracle Server Exceptions

In this practice, you write a PL/SQL block that declares an exception for the Oracle Server error ORA-02292 (integrity constraint violated - child record found). The block tests for the exception and outputs the error message.

1. In the declarative section, declare an exception `e_childrecord_exists`. Associate the declared exception with the standard Oracle Server error `-02292`.
2. In the executable section, display "Deleting department 40...." Include a `DELETE` statement to delete the department with the `department_id` 40.
3. Include an exception section to handle the `e_childrecord_exists` exception and display the appropriate message.

The sample output is as follows:

| | |
|---|--|
| <pre>anonymous block completed Deleting department 40..... Cannot delete this department. There are employees in this department (child records exist.)</pre> | |
|---|--|

Solution 9-2: Handling Standard Oracle Server Exceptions

In this practice, you write a PL/SQL block that declares an exception for the Oracle Server error ORA-02292 (integrity constraint violated - child record found). The block tests for the exception and outputs the error message.

1. In the declarative section, declare an exception `e_childrecord_exists`. Associate the declared exception with the standard Oracle Server error `-02292`.

```
SET SERVEROUTPUT ON
DECLARE
    e_childrecord_exists EXCEPTION;
    PRAGMA EXCEPTION_INIT(e_childrecord_exists, -02292);
```

2. In the executable section, display "Deleting department 40...." Include a `DELETE` statement to delete the department with `department_id` 40.

```
BEGIN
    DBMS_OUTPUT.PUT_LINE(' Deleting department 40.....');
    delete from departments where department_id=40;
```

3. Include an exception section to handle the `e_childrecord_exists` exception and display the appropriate message.

```
EXCEPTION
    WHEN e_childrecord_exists THEN
        DBMS_OUTPUT.PUT_LINE(' Cannot delete this department. There are
employees in this department (child records exist.) ');
END;
```

The sample output is as follows:

| | |
|--|--|
| anonymous block completed | |
| Deleting department 40..... | |
| Cannot delete this department. There are employees in this department (child records exist.) | |

Practices for Lesson 10: Introducing Stored Procedures and Functions

Chapter 10

Practice 10: Creating and Using Stored Procedures

Note: If you have executed the code examples for this lesson, make sure you execute the following code before starting this practice:

```
DROP table dept;
DROP procedure add_dept;
DROP function check_sal;
```

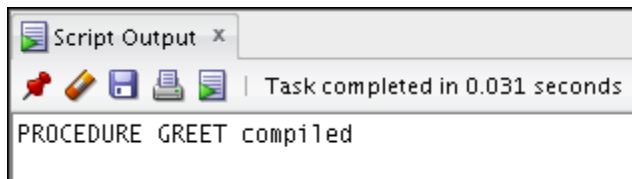
In this practice, you modify existing scripts to create and use stored procedures.

1. Open `sol_03.sql` script from the `/home/oracle/labs/plsf/soln/` folder. Copy the code under task 4 into a new worksheet.

```
SET SERVEROUTPUT ON

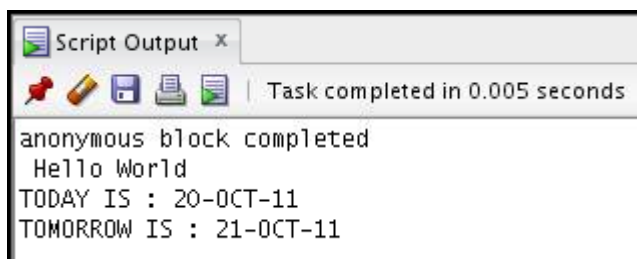
DECLARE
    v_today DATE:=SYSDATE;
    v_tomorrow v_today%TYPE;
BEGIN
    v_tomorrow:=v_today +1;
    DBMS_OUTPUT.PUT_LINE(' Hello World ');
    DBMS_OUTPUT.PUT_LINE('TODAY IS : ' || v_today);
    DBMS_OUTPUT.PUT_LINE('TOMORROW IS : ' || v_tomorrow);
END;
```

- a. Modify the script to convert the anonymous block to a procedure called `greet`.
(Hint: Also remove the `SET SERVEROUTPUT ON` command.)
- b. Execute the script to create the procedure. The output results should be as follows:



- c. Save this script as `lab_10_01_soln.sql`.
- d. Click the Clear button to clear the workspace.
- e. Create and execute an anonymous block to invoke the `greet` procedure.
(Hint: Ensure that you enable `SERVEROUTPUT` at the beginning of the block.)

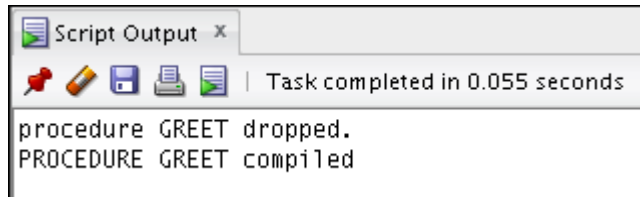
The output should be similar to the following:



2. Modify the `lab_10_01_soln.sql` script as follows:
 - a. Drop the `greet` procedure by issuing the following command:

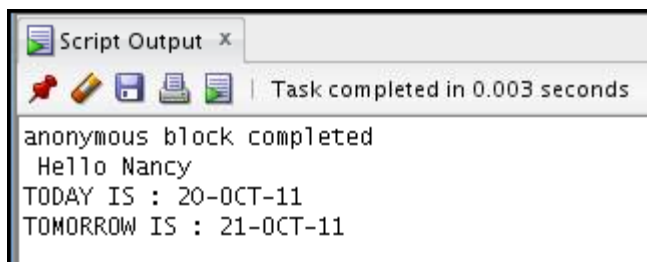
```
DROP PROCEDURE greet;
```

- b. Modify the procedure to accept an argument of type `VARCHAR2`. Call the argument `p_name`.
 - c. Print `Hello <name>` (that is, the contents of the argument) instead of printing `Hello World`.
 - d. Save your script as `lab_10_02_soln.sql`.
 - e. Execute the script to create the procedure. The output results should be as follows:



- f. Create and execute an anonymous block to invoke the `greet` procedure with a parameter value. The block should also produce the output.

The sample output should be similar to the following:



Solution 10: Creating and Using Stored Procedures

In this practice, you modify existing scripts to create and use stored procedures.

1. Open `sol_03.sql` script from the `/home/oracle/labs/plsf/soln/` folder. Copy the code under task 4 into a new worksheet.

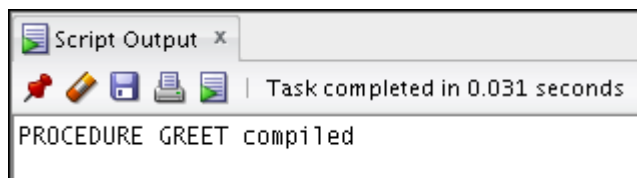
```
SET SERVEROUTPUT ON

DECLARE
    v_today DATE:=SYSDATE;
    v_tomorrow v_today%TYPE;
BEGIN
    v_tomorrow:=v_today +1;
    DBMS_OUTPUT.PUT_LINE(' Hello World ');
    DBMS_OUTPUT.PUT_LINE('TODAY IS : ' || v_today);
    DBMS_OUTPUT.PUT_LINE('TOMORROW IS : ' || v_tomorrow);
END;
```

- a. Modify the script to convert the anonymous block to a procedure called `greet`. (Hint: Also remove the `SET SERVEROUTPUT ON` command.)

```
CREATE PROCEDURE greet IS
    V_today DATE:=SYSDATE;
    V_tomorrow today%TYPE;
...
```

- b. Execute the script to create the procedure. The output results should be as follows:

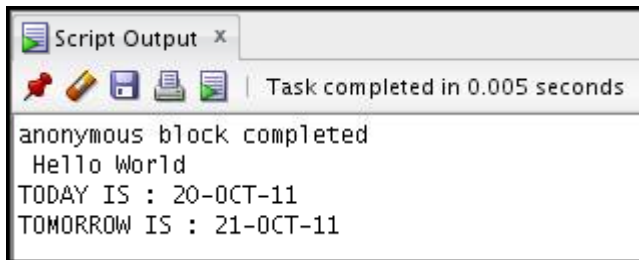


- c. Save this script as `lab_10_01_soln.sql`.
- d. Click the Clear button to clear the workspace.
- e. Create and execute an anonymous block to invoke the `greet` procedure. (Hint: Ensure that you enable `SERVEROUTPUT` at the beginning of the block.)

```
SET SERVEROUTPUT ON

BEGIN
    greet;
END;
```


The output should be similar to the following:



2. Modify the `lab_10_01_soln.sql` script as follows:
 - a. Drop the `greet` procedure by issuing the following command:

```
DROP PROCEDURE greet;
```

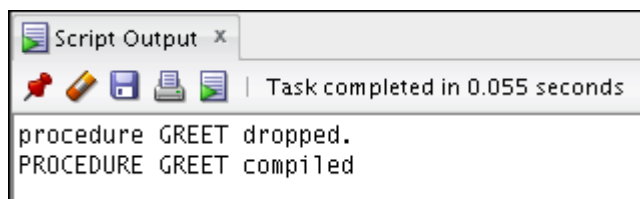
- b. Modify the procedure to accept an argument of type `VARCHAR2`. Call the argument `p_name`.

```
CREATE PROCEDURE greet(p_name VARCHAR2) IS
  V_today DATE:=SYSDATE;
  V_tomorrow today%TYPE;
```

- c. Print `Hello <name>` instead of printing `Hello World`.

```
BEGIN
  V_tomorrow:=v_today +1;
  DBMS_OUTPUT.PUT_LINE(' Hello ' || p_name);
  ...
```

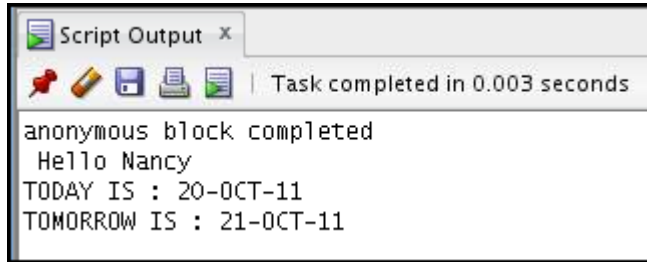
- d. Save your script as `lab_10_02_soln.sql`.
 - e. Execute the script to create the procedure. The output results should be as follows:



- f. Create and execute an anonymous block to invoke the `greet` procedure with a parameter value. The block should also produce the output.

```
SET SERVEROUTPUT ON;
BEGIN
  greet('Nancy');
END;
```

The sample output should be similar to the following:



Additional Practices and Solutions for Lesson 1

Chapter 11

Practices for Lesson 1

There are no practices for this lesson.

Additional Practices and Solutions for Lesson 2

Chapter 12

Additional Practices for Lesson 2

Overview

These additional practices are provided as a supplement to the *Oracle Database: PL/SQL Fundamentals* course. In these practices, you apply the concepts that you learned in the course.

These additional practices provide supplemental practice in declaring variables, writing executable statements, interacting with the Oracle Server, writing control structures, and working with composite data types, cursors, and handle exceptions. The tables used in this portion of the additional practices include `employees`, `jobs`, `job_history`, and `departments`.

Practice 2: Evaluating Declarations

Overview

These paper-based exercises are used for extra practice in declaring variables and writing executable statements.

Evaluate each of the following declarations. Determine which of them are not legal and explain why.

1. DECLARE
 name,dept VARCHAR2 (14) ;
2. DECLARE
 test NUMBER (5) ;
3. DECLARE
 MAXSALARY NUMBER (7,2) = 5000 ;
4. DECLARE
 JOINDATE BOOLEAN := SYSDATE ;

Solution 2: Evaluating Declarations

Evaluate each of the following declarations. Determine which of them are not legal and explain why.

1. DECLARE
name,dept VARCHAR2(14);

This is illegal because only one identifier per declaration is allowed.

2. DECLARE
test NUMBER(5);

This is legal.

3. DECLARE
MAXSALARY NUMBER(7,2) = 5000;

This is illegal because the assignment operator is wrong. It should be :=.

4. DECLARE
JOINDATE BOOLEAN := SYSDATE;

This is illegal because there is a mismatch in the data types. A Boolean data type cannot be assigned a date value. The data type should be date.

Additional Practices and Solutions for Lesson 3

Chapter 13

Practice 3: Evaluating Expressions

In each of the following assignments, determine the data type of the resulting expression.

1. `email := firstname || to_char(empno);`
2. `confirm := to_date('20-JAN-1999', 'DD-MON-YYYY');`
3. `sal := (1000*12) + 500`
4. `test := FALSE;`
5. `temp := temp1 < (temp2/ 3);`
6. `var := sysdate;`

Solution 3: Evaluating Expressions

In each of the following assignments, determine the data type of the resulting expression.

1. `email := firstname || to_char(empno);`

Character string

2. `confirm := to_date('20-JAN-1999', 'DD-MON-YYYY');`

Date

3. `sal := (1000*12) + 500`

Number

4. `test := FALSE;`

Boolean

5. `temp := temp1 < (temp2/ 3);`

Boolean

6. `var := sysdate;`

Date

Additional Practices and Solutions for Lesson 4

Chapter 14

Practice 4: Evaluating Executable Statements

In this paper-based exercise, you evaluate the PL/SQL block, and then answer the questions that follow by determining the data type and value of each variable, according to the rules of scoping.

```

DECLARE
    v_custid      NUMBER(4) := 1600;
    v_custname    VARCHAR2(300) := 'Women Sports Club';
    v_new_custid  NUMBER(3) := 500;
BEGIN
    DECLARE
        v_custid      NUMBER(4) := 0;
        v_custname    VARCHAR2(300) := 'Shape up Sports Club';
        v_new_custid  NUMBER(3) := 300;
        v_new_custname VARCHAR2(300) := 'Jansports Club';
    BEGIN
        v_custid := v_new_custid;
        v_custname := v_custname || ' ' || v_new_custname;
1  →
        END;
        v_custid := (v_custid *12) / 10;
2  →
        END;

```

Evaluate the preceding PL/SQL block and determine the *value* and *data type* of each of the following variables, according to the rules of scoping:

1. v_custid at position 1:
2. v_custname at position 1:
3. v_new_custid at position 1:
4. v_new_custname at position 1:
5. v_custid at position 2:
6. v_custname at position 2:

Solution 4: Evaluating Executable Statements

Evaluate the following PL/SQL block. Then, answer the questions that follow by determining the data type and value of each of the following variables, according to the rules of scoping.

```

DECLARE
    v_custid      NUMBER(4) := 1600;
    v_custname    VARCHAR2(300) := 'Women Sports Club';
    v_new_custid  NUMBER(3) := 500;
BEGIN
    DECLARE
        v_custid      NUMBER(4) := 0;
        v_custname    VARCHAR2(300) := 'Shape up Sports Club';
        v_new_custid  NUMBER(3) := 300;
        v_new_custname VARCHAR2(300) := 'Jansports Club';
    BEGIN
        v_custid := v_new_custid;
        v_custname := v_custname || ' ' || v_new_custname;
1  →
        END;
        v_custid := (v_custid *12) / 10;
2  →
        END;

```

Evaluate the preceding PL/SQL block and determine the *value* and *data type* of each of the following variables, according to the rules of scoping:

1. v_custid at position 1:
500, and the data type is NUMBER.
2. v_custname at position 1:
Shape up Sports Club Jansports Club, and the data type is VARCHAR2.
3. v_new_custid at position 1:
300, and the data type is NUMBER (or INTEGER).
4. v_new_custname at position 1:
Jansports Club, and the data type is VARCHAR2.
5. v_custid at position 2:
1920, and the data type is NUMBER.
6. v_custname at position 2:
Women Sports Club, and the data type is VARCHAR2.

Additional Practices and Solutions for Lesson 5

Chapter 15

Practice 5-1: Using SQL Statements within a PL/SQL

For this exercise, a temporary table is required to store the results.

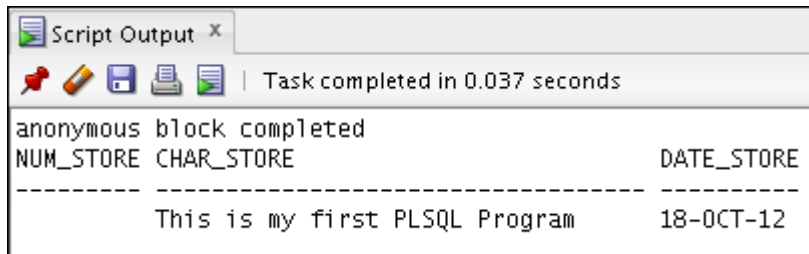
1. Run the `lab_ap_05.sql` script that creates the table described here:

| Column Name | NUM_STORE | CHAR_STORE | DATE_STORE |
|--------------|-----------|------------|------------|
| Key Type | | | |
| Nulls/Unique | | | |
| FK Table | | | |
| FK Column | | | |
| Data Type | Number | VARCHAR2 | Date |
| Length | 7,2 | 35 | |

2. Write a PL/SQL block that performs the following:
 - a. Declares two variables and assigns the following values to these variables:

| Variable | Data type | Contents |
|----------------|---------------|---------------------------------|
| V_MESSAGE | VARCHAR2 (35) | This is my first PL/SQL program |
| V_DATE_WRITTEN | DATE | Current date |

- b. Stores the values from these variables in the appropriate TEMP table columns
3. Verify your results by querying the TEMP table. The output results should appear as follows:



| | | |
|-----------|--------------------------------|------------|
| NUM_STORE | CHAR_STORE | DATE_STORE |
| ----- | ----- | ----- |
| | This is my first PLSQL Program | 18-OCT-12 |

Solution 5-1: Using SQL Statements within a PL/SQL

For this exercise, a temporary table is required to store the results.

1. Run the `lab_ap_05.sql` script that creates the table described here:

| Column Name | NUM_STORE | CHAR_STORE | DATE_STORE |
|--------------|-----------|------------|------------|
| Key Type | | | |
| Nulls/Unique | | | |
| FK Table | | | |
| FK Column | | | |
| Data Type | Number | VARCHAR2 | Date |
| Length | 7,2 | 35 | |

2. Write a PL/SQL block that performs the following:

- a. Declares two variables and assigns the following values to these variables:

| Variable | Data type | Contents |
|----------------|---------------|---------------------------------|
| V_MESSAGE | VARCHAR2 (35) | This is my first PL/SQL program |
| V_DATE_WRITTEN | DATE | Current date |

- b. Stores the values from these variables in the appropriate TEMP table columns

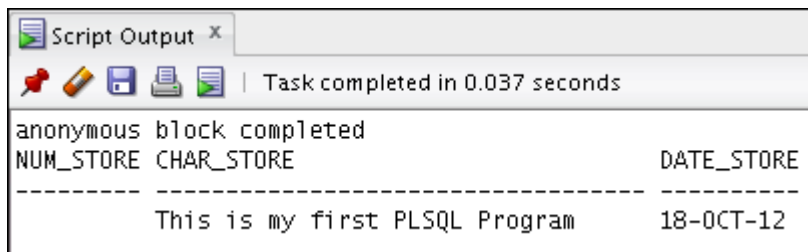
```

DECLARE
    V_MESSAGE VARCHAR2 (35);
    V_DATE_WRITTEN DATE;
BEGIN
    V_MESSAGE := 'This is my first PLSQL Program';
    V_DATE_WRITTEN := SYSDATE;
    INSERT INTO temp (CHAR_STORE, DATE_STORE)
        VALUES (V_MESSAGE, V_DATE_WRITTEN);
END;
/

```

3. Verify your results by querying the TEMP table. The output results should look similar to the following:

```
SELECT * FROM TEMP;
```



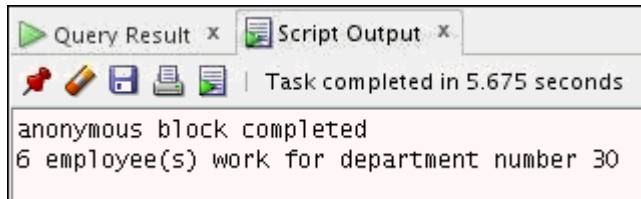
The screenshot shows a 'Script Output' window with a title bar and a close button. Below the title bar, there are icons for a red pin, a pencil, a folder, a printer, and a document, followed by the text 'Task completed in 0.037 seconds'. The main content area displays the text 'anonymous block completed' followed by a table with three columns: NUM_STORE, CHAR_STORE, and DATE_STORE. The table has one data row with the values 'This is my first PLSQL Program' and '18-OCT-12'.

| NUM_STORE | CHAR_STORE | DATE_STORE |
|-----------|--------------------------------|------------|
| | This is my first PLSQL Program | 18-OCT-12 |

Practice 5-2: Using SQL Statements within a PL/SQL

In this exercise, you use data from the `employees` table.

1. Write a PL/SQL block to determine how many employees work for a specified department. The PL/SQL block should:
 - Use a substitution variable to store a department number
 - Print the number of people working in the specified department
2. When the block is run, a substitution variable window appears. Enter a valid department number and click OK. The output results should look similar to the following:



Solution 5-2: Using SQL Statements within a PL/SQL

In this exercise, you use data from the `employees` table.

1. Write a PL/SQL block to determine how many employees work for a specified department. The PL/SQL block should:

- Use a substitution variable to store a department number
- Print the number of people working in the specified department

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    V_HOWMANY NUMBER(3);
```

```
    V_DEPTNO DEPARTMENTS.department_id%TYPE := &P_DEPTNO;
```

```
BEGIN
```

```
    SELECT COUNT(*) INTO V_HOWMANY FROM employees
```

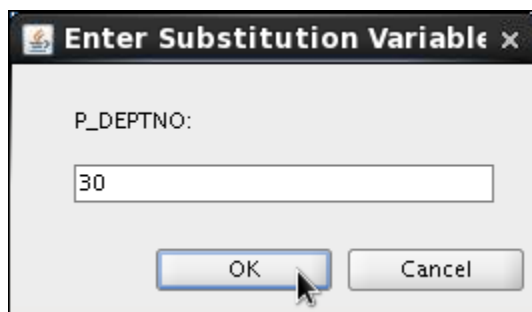
```
    WHERE department_id = V_DEPTNO;
```

```
    DBMS_OUTPUT.PUT_LINE (V_HOWMANY || ' employee(s)  
    work for department number ' || V_DEPTNO);
```

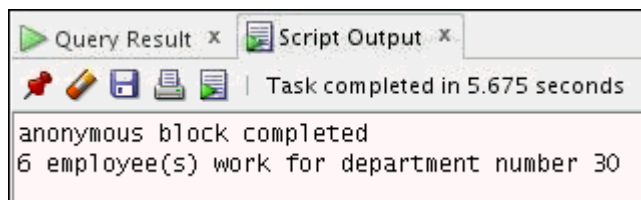
```
END;
```

```
/
```

2. When the block is run, a substitution variable window appears. Enter a valid department number and click OK.



The output results should look similar to the following:



Additional Practices and Solutions for Lesson 6

Chapter 16

Practice 6-1: Writing Control Structures

In these practices, you use control structures to direct the logic of program flow.

1. Write a PL/SQL block to accept a year input and check whether it is a leap year.
Hint: The year should be exactly divisible by 4 but not divisible by 100, or it should be divisible by 400.
2. Test your solution by using the following table. For example, if the year entered is 1990, the output should be "1990 is not a leap year."

| | |
|------|-----------------|
| 1990 | Not a leap year |
| 2000 | Leap year |
| 1996 | Leap year |
| 1886 | Not a leap year |
| 1992 | Leap year |
| 1824 | Leap year |

Solution 6-1: Writing Control Structures

- Write a PL/SQL block to accept a year input and check whether it is a leap year.
Hint: The year should be exactly divisible by 4 but not divisible by 100, or it should be divisible by 400.

```
SET SERVEROUTPUT ON;
DECLARE
    v_YEAR NUMBER(4) := &P_YEAR;
    v_REMAINDER1 NUMBER(5,2);
    v_REMAINDER2 NUMBER(5,2);
    v_REMAINDER3 NUMBER(5,2);
BEGIN
    v_REMAINDER1 := MOD(v_YEAR,4);
    v_REMAINDER2 := MOD(v_YEAR,100);
    v_REMAINDER3 := MOD(v_YEAR,400);
    IF ((v_REMAINDER1 = 0 AND v_REMAINDER2 <> 0 ) OR
        v_REMAINDER3 = 0) THEN
        DBMS_OUTPUT.PUT_LINE(v_YEAR || ' is a leap year');
    ELSE
        DBMS_OUTPUT.PUT_LINE(v_YEAR || ' is not a leap
        year');
    END IF;
END;
/
```

- Test your solution by using the following table. For example, if the year entered is 1990, the output should be "1990 is not a leap year."

| | |
|------|-----------------|
| 1990 | Not a leap year |
| 2000 | Leap year |
| 1996 | Leap year |
| 1886 | Not a leap year |
| 1992 | Leap year |
| 1824 | Leap year |

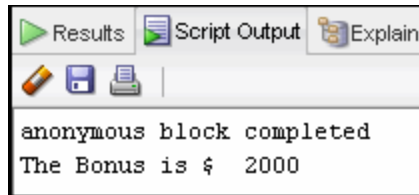
Practice 6-2: Writing Control Structures

- Write a PL/SQL block to store the monthly salary of an employee in a substitution variable. The PL/SQL block should:

- Calculate the annual salary as salary * 12
- Calculate the bonus as indicated in the following table:

| Annual Salary | Bonus |
|---------------|-------|
| >= 20,000 | 2,000 |
| 19,999–10,000 | 1,000 |
| <= 9,999 | 500 |

- Display the amount of the bonus in the Script Output window in the following format:



- Test the PL/SQL for the following test cases:

| Monthly Salary | Bonus |
|----------------|-------|
| 3000 | 2000 |
| 1200 | 1000 |
| 800 | 500 |

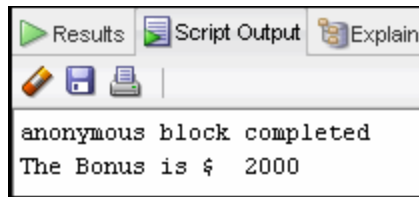
Solution 6-2: Writing Control Structures

- Write a PL/SQL block to store the monthly salary of an employee in a substitution variable. The PL/SQL block should:

- Calculate the annual salary as salary * 12
- Calculate the bonus as indicated in the following table:

| Annual Salary | Bonus |
|---------------|-------|
| >= 20,000 | 2,000 |
| 19,999–10,000 | 1,000 |
| <= 9,999 | 500 |

- Display the amount of the bonus in the Script Output window in the following format:



```

SET SERVEROUTPUT ON;
DECLARE
    V_SAL          NUMBER(7,2) := &B_SALARY;
    V_BONUS        NUMBER(7,2);
    V_ANN_SALARY   NUMBER(15,2);
BEGIN
    V_ANN_SALARY := V_SAL * 12;
    IF V_ANN_SALARY >= 20000 THEN
        V_BONUS := 2000;
    ELSIF V_ANN_SALARY <= 19999 AND V_ANN_SALARY >=10000 THEN
        V_BONUS := 1000;
    ELSE
        V_BONUS := 500;
    END IF;
    DBMS_OUTPUT.PUT_LINE ('The Bonus is $ ' ||
        TO_CHAR(V_BONUS));
END;
/

```

- Test the PL/SQL for the following test cases:

| Monthly Salary | Bonus |
|----------------|-------|
| 3000 | 2000 |
| 1200 | 1000 |
| 800 | 500 |

Additional Practices and Solutions for Lesson 7: Working with Composite Data Types

Chapter 17

Additional Practices for Lessons Titled “Working with Composite Data Types” and “Using Explicit Cursors”

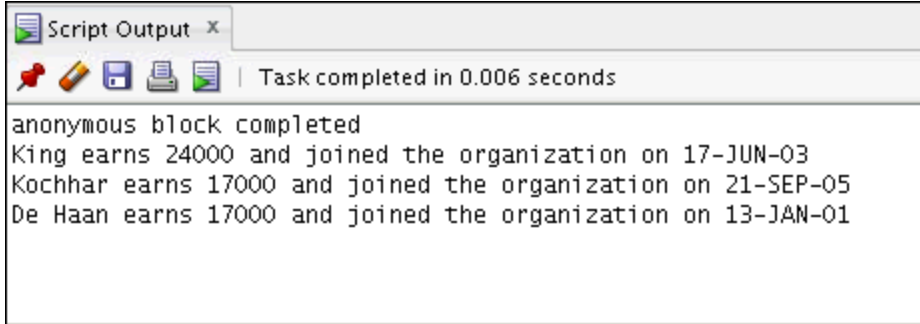
Overview

In the following exercises, you practice using associative arrays (this topic is covered in the lesson titled “Working with Composite Data Types”) and explicit cursors (this topic is covered in the lesson titled “Using Explicit Cursors”). In the first exercise, you define and use an explicit cursor to fetch data. In the second exercise, you combine the use of associative arrays with an explicit cursor to output data that meets a certain criteria.

Practice 7/8-1: Fetching Data with an Explicit Cursor

In this practice, you create a PL/SQL block to perform the following:

1. Declare a cursor named `EMP_CUR` to select the employee's last name, salary, and hire date from the `EMPLOYEES` table.
2. Process each row from the cursor, and if the salary is greater than 15,000 and the hire date is later than 01-FEB-1988, display the employee name, salary, and hire date in the format shown in the following sample output:



```
Script Output x
Task completed in 0.006 seconds

anonymous block completed
King earns 24000 and joined the organization on 17-JUN-03
Kochhar earns 17000 and joined the organization on 21-SEP-05
De Haan earns 17000 and joined the organization on 13-JAN-01
```

Solution 7/8-1: Fetching Data with an Explicit Cursor

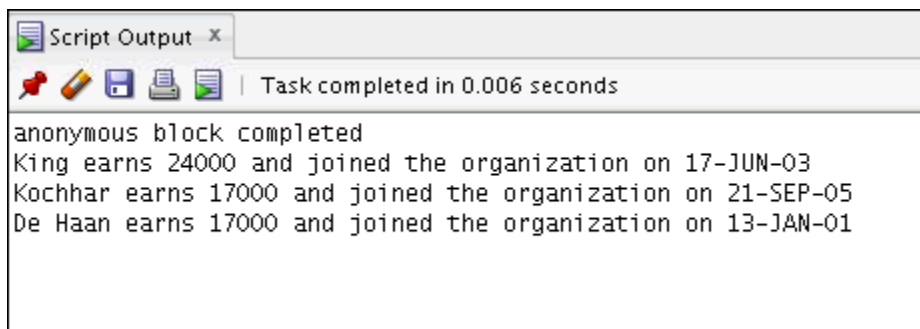
In this practice, you create a PL/SQL block to perform the following:

1. Declare a cursor named EMP_CUR to select the employee's last name, salary, and hire date from the EMPLOYEES table.

```
SET SERVEROUTPUT ON;
DECLARE
  CURSOR C_EMP_CUR IS
    SELECT last_name,salary,hire_date FROM EMPLOYEES;
  V_ENAME VARCHAR2(25);
  v_SAL    NUMBER(7,2);
  V_HIREDATE DATE;
```

2. Process each row from the cursor, and if the salary is greater than 15,000 and the hire date is later than 01-FEB-1988, display the employee name, salary, and hire date in the format shown in the following sample output:

```
BEGIN
  OPEN C_EMP_CUR;
  FETCH C_EMP_CUR INTO V_ENAME,V_SAL,V_HIREDATE;
  WHILE C_EMP_CUR%FOUND
  LOOP
    IF V_SAL > 15000 AND V_HIREDATE >=
      TO_DATE('01-FEB-1988','DD-MON-YYYY') THEN
      DBMS_OUTPUT.PUT_LINE (V_ENAME || ' earns '
        || TO_CHAR(V_SAL) || ' and joined the organization on '
        || TO_DATE(V_HIREDATE,'DD-Mon-YYYY'));
    END IF;
    FETCH C_EMP_CUR INTO V_ENAME,V_SAL,V_HIREDATE;
  END LOOP;
  CLOSE C_EMP_CUR;
END;
/
```

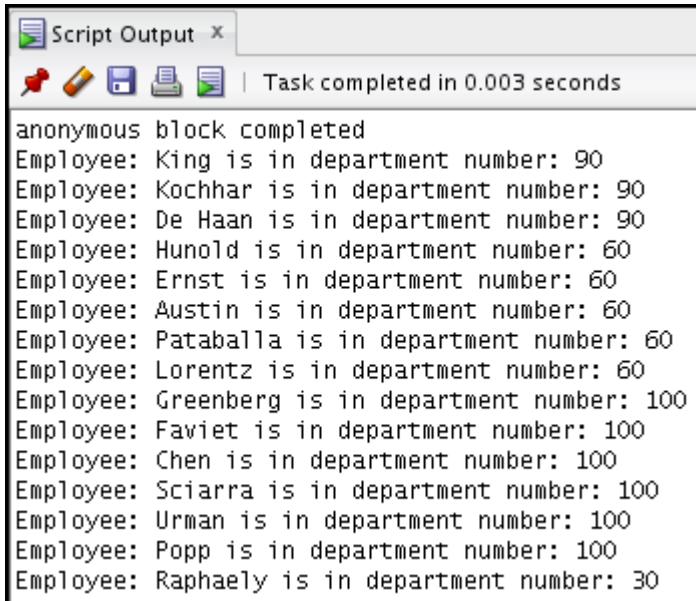


Practice 7/8-2: Using Associative Arrays and Explicit Cursors

In this practice, you create a PL/SQL block to retrieve and output the last name and department ID of each employee from the `EMPLOYEES` table for those employees whose `EMPLOYEE_ID` is less than 115.

In the PL/SQL block, use a cursor `FOR` loop strategy instead of the `OPEN / FETCH / CLOSE` cursor methods used in the previous practice.

1. In the declarative section:
 - Create two associative arrays. The unique key column for both arrays should be of the `BINARY_INTEGER` data type. One array holds the employee's last name and the other holds the department ID.
 - Declare a cursor that selects the last name and department ID for employees whose ID is less than 115
 - Declare the appropriate counter variable to be used in the executable section
2. In the executable section, use a cursor `FOR` loop (covered in the lesson titled "Using Explicit Cursors") to access the cursor values, assign them to the appropriate associative arrays, and output those values from the arrays. The correct output should return 15 rows, in the following format:



```
Script Output x
Task completed in 0.003 seconds

anonymous block completed
Employee: King is in department number: 90
Employee: Kochhar is in department number: 90
Employee: De Haan is in department number: 90
Employee: Hunold is in department number: 60
Employee: Ernst is in department number: 60
Employee: Austin is in department number: 60
Employee: Pataballa is in department number: 60
Employee: Lorentz is in department number: 60
Employee: Greenberg is in department number: 100
Employee: Faviet is in department number: 100
Employee: Chen is in department number: 100
Employee: Sciarra is in department number: 100
Employee: Urman is in department number: 100
Employee: Popp is in department number: 100
Employee: Raphaely is in department number: 30
```

Solution 7/8-2: Using Associative Arrays and Explicit Cursors

In this practice, you create a PL/SQL block to retrieve and output the last name and department ID of each employee from the `EMPLOYEES` table for those employees whose `EMPLOYEE_ID` is less than 115.

In the PL/SQL block, use a cursor `FOR` loop strategy instead of the `OPEN / FETCH / CLOSE` cursor methods used in the previous practice.

1. In the declarative section:

- Create two associative arrays. The unique key column for both arrays should be of the `BINARY_INTEGER` data type. One array holds the employee's last name and the other holds the department ID.
- Declare a counter variable to be used in the executable section
- Declare a cursor that selects the last name and department ID for employees whose ID is less than 115

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    TYPE Table_Ename IS table of employees.last_name%TYPE
    INDEX BY BINARY_INTEGER;
```

```
    TYPE Table_dept IS table of employees.department_id%TYPE
    INDEX BY BINARY_INTEGER;
```

```
    Tename Table_Ename;
```

```
    Tdept Table_dept;
```

```
    i BINARY_INTEGER :=0;
```

```
    CURSOR Namedept IS SELECT last_name,department_id
```

```
    FROM employees WHERE employee_id < 115;
```

2. In the executable section, use a cursor `FOR` loop (covered in the lesson titled "Using Explicit Cursors") to access the cursor values, assign them to the appropriate associative arrays, and output those values from the arrays.

```
BEGIN
```

```
    FOR emprec in Namedept
```

```
    LOOP
```

```
        i := i +1;
```

```
        Tename(i) := emprec.last_name;
```

```
        Tdept(i) := emprec.department_id;
```

```
        DBMS_OUTPUT.PUT_LINE ('Employee: ' || Tename(i) ||
```

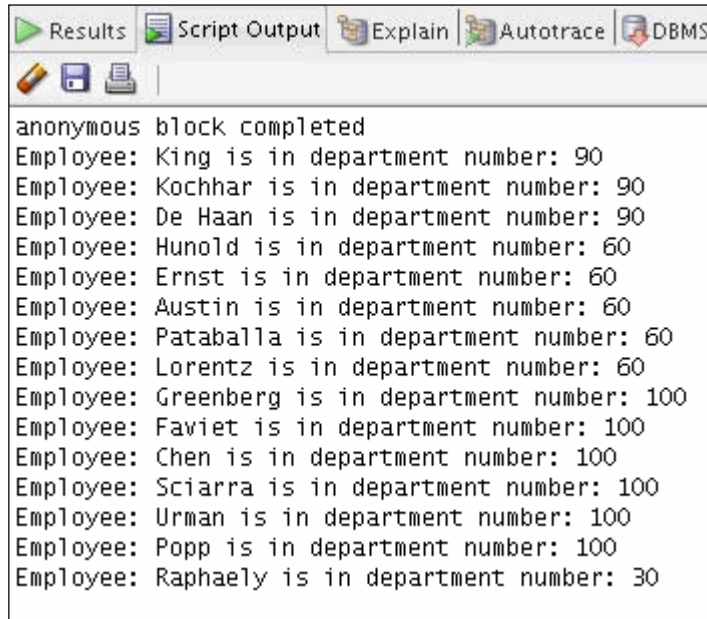
```
        ' is in department number: ' || Tdept(i));
```

```
    END LOOP;
```

```
END;
```

```
/
```

The correct output should return 15 rows, similar to the following:



The screenshot shows the 'Results' tab in SQL Developer. The output consists of 15 rows of text, each representing an employee and their department number. The first row is 'anonymous block completed'. The subsequent 14 rows list employees: King, Kochhar, De Haan, Hunold, Ernst, Austin, Pataballa, Lorentz, Greenberg, Faviet, Chen, Sciarra, Urman, Popp, and Raphaely, each followed by their department number. The window has tabs for 'Results', 'Script Output', 'Explain', 'Autotrace', and 'DBMS'.

```
anonymous block completed
Employee: King is in department number: 90
Employee: Kochhar is in department number: 90
Employee: De Haan is in department number: 90
Employee: Hunold is in department number: 60
Employee: Ernst is in department number: 60
Employee: Austin is in department number: 60
Employee: Pataballa is in department number: 60
Employee: Lorentz is in department number: 60
Employee: Greenberg is in department number: 100
Employee: Faviet is in department number: 100
Employee: Chen is in department number: 100
Employee: Sciarra is in department number: 100
Employee: Urman is in department number: 100
Employee: Popp is in department number: 100
Employee: Raphaely is in department number: 30
```


Additional Practices and Solutions for Lesson 8: Using Explicit Cursors

Chapter 18

Practices for Lesson 8

Practices Overview

Practices of this lesson are included in Practice 7.

Additional Practices and Solutions for Lesson 9: Handling Exceptions

Chapter 19

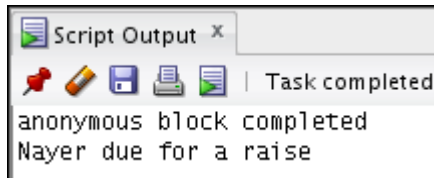
Practice 9-1: Handling Exceptions

For this exercise, you must first create a table to store some results. Run the `lab_ap_09.sql` script that creates the table for you. The script looks like the following:

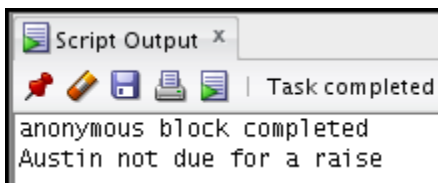
```
CREATE TABLE analysis
  (ename Varchar2(20), years Number(2), sal Number(8,2)
  );
```

In this practice, you write a PL/SQL block that handles an exception, as follows:

1. Declare variables for the employee last name, salary, and hire date. Use a substitution variable for the employee last name. Then, query the `EMPLOYEES` table for the `last_name`, `salary`, and `hire_date` of the specified employee.
2. If the employee has been with the organization for more than five years, and if that employee's salary is less than 3,500, raise an exception. In the exception handler, perform the following:
 - Output the following information: employee last name and the message "due for a raise," similar to the following:



- Insert the last name, years of service, and salary into the `ANALYSIS` table.
3. If there is no exception, output the employee last name and the message "not due for a raise," similar to the following:



4. Verify the results by querying the `ANALYSIS` table. Use the following test cases to test the PL/SQL block.

| LAST_NAME | MESSAGE |
|-----------|---------------------|
| Austin | Not due for a raise |
| Nayer | Due for a raise |
| Fripp | Not due for a raise |
| Khoo | Due for a raise |

Solution 9-1: Handling Exceptions

For this exercise, you must first create a table to store some results. Run the `lab_ap_09.sql` script that creates the table for you. The script looks similar to the following:

```
CREATE TABLE analysis
  (ename Varchar2(20), years Number(2), sal Number(8,2)
  );
```

In this practice, you write a PL/SQL block that handles an exception, as follows:

1. Declare variables for the employee last name, salary, and hire date. Use a substitution variable for the employee last name. Then, query the `EMPLOYEES` table for the `last_name`, `salary`, and `hire_date` of the specified employee.
2. If the employee has been with the organization for more than five years, and if that employee's salary is less than 3,500, raise an exception. In the exception handler, perform the following:
 - Output the following information: employee last name and the message "due for a raise."
 - Insert the employee name, years of service, and salary into the `ANALYSIS` table.
3. If there is no exception, output the employee last name and the message "not due for a raise."

```
SET SERVEROUTPUT ON;
DECLARE
  E_DUE_FOR_RAISE EXCEPTION;
  V_HIREDATE EMPLOYEES.HIRE_DATE%TYPE;
  V_ENAME EMPLOYEES.LAST_NAME%TYPE := INITCAP( '& B_ENAME' );
  V_SAL EMPLOYEES.SALARY%TYPE;
  V_YEARS NUMBER(2);
BEGIN
  SELECT SALARY, HIRE_DATE, MONTHS_BETWEEN(SYSDATE, hire_date) / 12
  YEARS
  INTO V_SAL, V_HIREDATE, V_YEARS
  FROM employees WHERE last_name = V_ENAME;
  IF V_SAL < 3500 AND V_YEARS > 5 THEN
    RAISE E_DUE_FOR_RAISE;
  ELSE
    DBMS_OUTPUT.PUT_LINE (V_ENAME || ' not due for a
raise');
  END IF;
EXCEPTION
  WHEN E_DUE_FOR_RAISE THEN
    BEGIN
      DBMS_OUTPUT.PUT_LINE (V_ENAME || ' due for a raise');
      INSERT INTO ANALYSIS (ENAME, YEARS, SAL)
      VALUES (V_ENAME, V_YEARS, V_SAL);
```

END;

END;

/

4. Verify the results by querying the `ANALYSIS` table. Use the following test cases to test the PL/SQL block.

| LAST_NAME | MESSAGE |
|-----------|---------------------|
| Austin | Not due for a raise |
| Nayer | Due for a raise |
| Fripp | Not due for a raise |
| Khoo | Due for a raise |

SELECT * FROM analysis;

| RZ | ENAME | RZ | YEARS | RZ | SAL |
|----|-------|----|-------|----|------|
| 1 | Nayer | | 14 | | 3200 |
| 2 | Khoo | | 16 | | 3100 |