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2 Day + Java Developer's Guide

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Preface

This preface discusses the intended audience and conventions of the *Oracle Database 2 Day + Java Developer's Guide*.. It also includes a list of related Oracle documents that you can refer to for more information.

Audience

This guide is intended for application developers using Java to access and modify data in Oracle Database. This guide illustrates how to perform these tasks using a simple Java Database Connectivity (JDBC) application. This guide uses the Oracle JDeveloper integrated development environment (IDE) to create the application. This guide can be read by anyone with an interest in Java programming, but it assumes at least some prior knowledge of the following:

- Java
- Oracle PL/SQL
- Oracle databases

Related Documents

For more information, see the following documents in the Oracle Database documentation set:

- *Oracle Database JDBC Developer's Guide*
- *Oracle Database Java Developer's Guide*
- *Oracle Universal Connection Pool Developer's Guide*

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

1

Aims and Objectives of This Book

Java is a popular language among developers that is used to build various enterprise solutions.

This guide will help you understand all Java products used to build a Java application. You will learn how to model a Java Web application using MVC design pattern, Oracle JDBC Thin driver, Universal Connection Pool (UCP), and Java in the Database (using embedded OJVM).

In the next few chapters, you will create a Java web application — 'HR Web application'. This application will help the HR team of AnyCo Corporation to lookup or modify details of a specific employee, or all employees, delete an employee, or apply a salary raise to all employees.

The application will have two users

hrstaff

hradmin

Each user will have a different set of roles and privileges.

This Chapter contains the following topics:

Architecture of the Web Application

Components of the Application

Tasks for Day 1

Tasks for Day 2

Architecture of the Application

Architecture of the Web Application

The HR Web application uses the MVC (Model, View, Controller) architecture and the latest tools and technologies. A Model View Controllder (MVC) is a design pattern that is easy-to-use. It separates the web application into three simple parts (Model-View-Controller).

The **Model** stores the data or the information that the web application is meant to operate on. It does not include any information about the user-interface.

The **View** contains all elements of the user interface (UI). This includes buttons, display box, links, input box etc.

The **Controller** connects **Model** and **View**.

As a user, you will see the interface (View) that could be a JSP page ot an HTML page after you log into the application. The Controller (a Java Servlet) renders the correct

View to the user during logging in, or any other flow. When you request for data or an update to the data, the Controller invokes the Model that represents the data in terms of tables or views, and renders the data. The Model represents the user data usually stored in an Oracle Database or any other database.

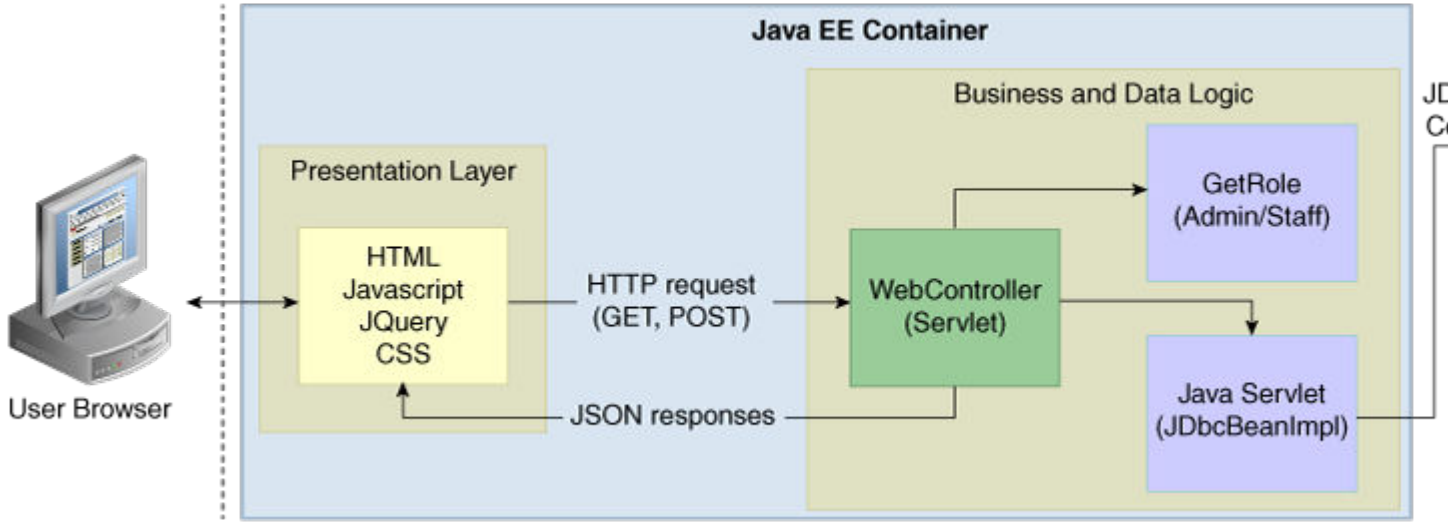
The Controller then passes on this data to the **View** to show it to the user in a presentable format.

Table 1-1 Architecture of the Web Application

Name	Technologies Used	Description
Model	Oracle Database, Java Beans	Represents the information or the data on which the application operates.
View	HTML, JavaScript, JQuery, CSS	User interface that renders the model to the end user. It includes all elements visible to the user such as buttons, links, input, etc.
Controller	Java Servlet	The controller processes and responds to user actions. It orchestrates the flow based on user input. It also connects Model and View and renders an output to the user.

Following is a link to the Web application:
You will use HR schema and the Employees to understand the flows in the Web application.

Figure 1-1



Components and Repositories

The following table lists and describes all the components required for the application.

Table 1-2 Components Required for the Application

Package Name	Description
src	Contains source files
target	Contains class files
src/main/java/com/oracle/jdbc/samples	-
/bean/JdbcBean.java	Defines the employee details as attributes
/bean/JdbcBeanImpl.java	Implementation class of the EmployeeBean
src/main/java/com/oracle/jdbc/samples	-
entity/Employee.java	Consists of all employee attributes and their defined datatypes
/web/WebController.java	Servlet that controls the application flow
/web/GetRole.java	Creates HRStaff and HRAdmin roles for the application
src/main/resources	-
SalaryHikeSP.java	Java class to be invoked from Java in the database to process an increment in salary
SalaryHikeSP.sql	SQL file with a procedure to increase the salary of the employees based on their salary range
src/main/webapp	-
about.html	Contains the details about the HR Web application
login.html	Contains the login page for the HR Web application
login-failed.html	Page to show when the login is unsuccessful
index.html	Landing page of the HR Web application
listAll.html	HTML page to display all employee records
listByName.html	HTML page to display the result when employees are searched by name
listById.html	HTML page to display the result when employees are searched by employee id
incrementSalary.html	HTML page to display the result after an increment is made to the salary
src/main/webapp	-
css/app.cs	Contains all style and font details used in the HR Web application
src/main/webapp	-
WEB-INF/web.xml	Controller for the HR Web application

Objectives and Tasks for Day 1

At the end of the first day, you will be able to:

a. Understand the JDBC, UCP, Java in the database and run a simple Java program to get familiar with these products.

b. Implement the functionality “listAll” to list the details of all the employees.

1 **Introduction to JDBC, UCP and Java in the Database:** You will familiarize yourself with the products, associated binaries and packages through a sample code.

2 **Overview of the HR Web Application:** This chapter will discuss the HR Web application in depth and familiarize you with the flows of the Web application, packages and files that you will create as a part of the Application.

3 **Getting Started with the Application:** You will understand the pre-requisites for building the application and how to get the environment ready. It starts with subscribing to the Oracle Database Service in the cloud or installing the Oracle Database 12c Release 2 on premises. Later, you will install JDeveloper, an IDE to build the application. You will use either web Logic Server that is integrated in the JDeveloper or Tomcat Java EE container to deploy and run the application.

The chapter will also help you download any other tools, such as Maven, that will help you build the application.

4 **List All Employees:** This chapter will help you how to put all components together and build an initial functionality to connect to the Oracle Database, and retrieve employee details from the database.

Objectives and Tasks for Day 2

Part II covers all tasks you will complete in Day 2. You will learn how to use Universal Connection Pool (UCP) and Java in the Database (OJVM). You will also learn how to:

1 Search By Employee ID: This chapter provides details on how to implement the ‘Search by Employee ID’ functionality.

2 Update an Employee Record: In this chapter, you will learn how to update employee records. This is two step process. You will first search the employee’s records, based on first name. Once you retrieve the required results, you can update the salary, job ID, firstname, lastname and other details.

3 **Delete an Employee Record:** In this Chapter, you will learn how to delete an employee record, in a two-step process.

4 **Increase Salary to All Employees:** You will understand how to provide increment to the salary of the employees listed in the table, using ‘Java in the database’.

5 **Creating Application Users:** This chapter shows how to create ‘hradmin’ and ‘hrstaff’ users in Tomcat and JDeveloper.

6 **Summary:** This chapter will summarize all that you have learnt over the two days. It will also provide appropriate references and links for enhancing your use of the Application.

2

Brief Introduction to JDBC, UCP, and Java in the Database

Oracle Database is a relational database that you can use to store, modify and use data.

The Java Database Connectivity (JDBC) standard is used by Java applications to access and manipulate data in relational databases.

JDBC is an industry-standard application programming interface (API) that lets you access a RDBMS using SQL from Java. JDBC complies with the Entry Level of the JDBC escape standard. Each vendor implements the JDBC Specification with its own extensions.

Universal Connection Pool (UCP) is a connection pool used to cache the database connection objects to reuse the connections, thus improving the performance.

Java in the Database (OJVM) helps group SQL operations with Java data logic and load them into the database for in-place processing.

> **See Also:**
>
> `http://www.oracle.com/technetwork/java/overview-141217.html`

This chapter introduces you to the JDBC driver, Universal Connection Pool (UCP) and Java in the Database (OJVM) with Oracle Database 12*c* Release 2 (12.2)

- Java Database Connectivity Driver (JDBC)
- Universal Connection Pool (UCP)
- Java in the Database (OJVM)

Java Database Connectivity Driver (JDBC)

JDBC is a database access protocol that enables you to connect to a database and run SQL statement and queries on the database. JDBC drivers implement and comply with the latest JDBC specifications. Java application need to have `ojdbc8.jar` compatible with JDK8 in their classpath.

The core Java class libraries provide the JDBC APIs, `java.sql` and `javax.sql`

The following sections describe Oracle support for the JDBC standard:

- Oracle JDBC Thin Driver
- Oracle JDBC Packages

Oracle JDBC Thin Driver

Oracle recommends using the JDBC Thin Driver for most requirements. The JDBC Thin Driver will work on any system with a suitable Java Virtual Machine. (JVM). Some other client drivers that Oracle provides are JDBC thin driver, Oracle Call Interface (OCI) driver, Server side thin driver, and server side internal driver.

The JDBC Thin Driver is a pure Java, Type IV driver. The JDBC driver version)ojdbc8.jar) inludes support for JDK 8.

JDBC Thin Driver communicates with the server using SQL*Net to access the database.

> **See Also:**
>
> *Oracle Database JDBC Developer's Guide*

Action Item 1: Change the DB_URL to point to your database. If you need help, refer to the DataSourceSample.java on Github.

```
import java.sql.Connection;
import java.sql.SQLException;
import java.sql.DatabaseMetaData;

import oracle.jdbc.pool.OracleDataSource;
import oracle.jdbc.OracleConnection;

public class DataSourceSample {
  // The recommended format of a connection URL is the long format with the
  // connection descriptor.
  // final static String DB_URL=
"jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS=(HOST=myhost)(PORT=1521)
(PROTOCOL=tcp))(CONNECT_DATA=(SERVICE_NAME=myorcldbservicename)))";

  final static String DB_URL=
"jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS=(HOST=localhost)(PORT=5521)
(PROTOCOL=tcp))(CONNECT_DATA=(SERVICE_NAME=service name)))";
  final static String DB_USER = "username";
  final static String DB_PASSWORD = password;

  public static void main (String args[]) throws SQLException {

    OracleDataSource ods = new OracleDataSource();
    ods.setURL(DB_URL);
    ods.setUser(DB_USER);
    ods.setPassword(DB_PASSWORD);

    // With AutoCloseable, the connection is closed automatically.
    try (OracleConnection connection = (OracleConnection)
      ods.getConnection()) {
      // Get the JDBC driver name and version
      DatabaseMetaData dbmd = connection.getMetaData();
      System.out.println("Driver Name: " + dbmd.getDriverName());
```

```
      System.out.println("Driver Version: " +
        dbmd.getDriverVersion());
      System.out.println("Database Username is: " +
        connection.getUserName());
    }
  }
}
```

Universal Connection Pool

Connection pools help improve performance by reusing connection objects and reducing the number of times that connection objects are created.

Oracle Universal Connection Pool (UCP) is a feature rich Java connection pool that provides connection pool functionalities, along with high availability, scalability and load balancing with the help of tighter integration with Oracle Database configurations.

A Java application or container must have `ucp.jar` in their classpath, along with the `ojdbc8.jar` (JDK8), to be able to use UCP.

> **See Also:**
>
> *Oracle Universal Connection Pool Developer's Guide*

Action Item 2: Change the DB_URL to point to your database.

```
Import java.sql.Connection;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;

import oracle.ucp.jdbc.PoolDataSourceFactory;
import oracle.ucp.jdbc.PoolDataSource;

public class UCPSample {
  // final static String DB_URL=
"jdbc:oracle:thin:@(DESCRIPTION=(ADDRESS=(HOST=myhost)(PORT=1521)
(PROTOCOL=tcp))(CONNECT_DATA=(SERVICE_NAME=myorcldbservicename)))";

  final static String DB_USER = "username";
  final static String DB_PASSWORD = "pwd";
  final static String CONN_FACTORY_CLASS_NAME =
"oracle.jdbc.pool.OracleDataSource";

  /*
   * The sample demonstrates UCP as client side connection pool.
   */
  public static void main(String args[]) throws Exception {
    // Get the PoolDataSource for UCP
    PoolDataSource pds = PoolDataSourceFactory.getPoolDataSource();

    // Set the connection factory first before all other properties
```

```
    pds.setConnectionFactoryClassName(CONN_FACTORY_CLASS_NAME);
    pds.setURL(DB_URL);
    pds.setUser(DB_USER);
    pds.setPassword(DB_PASSWORD);
    pds.setConnectionPoolName("JDBC_UCP_POOL");

    // Default is 0. Set the initial number of connections to be
    // created when UCP is started.
    pds.setInitialPoolSize(5);

    // Default is 0. Set the minimum number of connections
    // that is maintained by UCP at runtime.
    pds.setMinPoolSize(5);

    // Default is Integer.MAX_VALUE (2147483647). Set the maximum
    // number of connections allowed on the connection pool.
    pds.setMaxPoolSize(20);

    // Default is 30secs. Set the frequency in seconds to enforce
    // the timeout properties. Applies to
    // inactiveConnectionTimeout(int secs),
    // AbandonedConnectionTimeout(secs)&
    //TimeToLiveConnectionTimeout(int secs).
    // Range of valid values is 0 to Integer.MAX_VALUE.
    pds.setTimeoutCheckInterval(5);

    // Default is 0. Set the maximum time, in seconds, that a
    // connection remains available in the connection pool.
    pds.setInactiveConnectionTimeout(10);

    System.out.println("Available connections before checkout: "
        + pds.getAvailableConnectionsCount());
    System.out.println("Borrowed connections before checkout: "
        + pds.getBorrowedConnectionsCount());
    // Get the database connection from UCP.
    try (Connection conn = pds.getConnection()) {
      System.out.println("Available connections after checkout: "
          + pds.getAvailableConnectionsCount());
      System.out.println("Borrowed connections after checkout: "
          + pds.getBorrowedConnectionsCount());
      // Perform a database operation
      printEmployees(conn);
    } catch (SQLException e) {
      System.out.println("UCPSample - " + "SQLException occurred : "
          + e.getMessage());
    }
    System.out.println("Available connections after checkin: "
        + pds.getAvailableConnectionsCount());
    System.out.println("Borrowed connections after checkin: "
        + pds.getBorrowedConnectionsCount());
  }
 /*
  * Displays first_name and last_name from the employees table.
  */
  public static void printEmployees(Connection connection)
```

```
     throws SQLException {
    // Statement and ResultSet are AutoCloseable and closed
    // automatically.
    try (Statement statement = connection.createStatement()) {
      try (ResultSet resultSet = statement
          .executeQuery("select first_name, last_name from
            employees")) {
        System.out.println("FIRST_NAME" + "  " + "LAST_NAME");
        System.out.println("---------------------");
        while (resultSet.next())
          System.out.println(resultSet.getString(1) + " "
              + resultSet.getString(2) + " ");
      }
    }
  }
}
```

Java in the Database (OJVM)

Oracle Database has a Java Virtual Machine (JVM) that resides in the server. It helps Java applications running in the Oracle JVM on the server to access data present on the same system and same process.

Java in the Database is recommended for applications that are data-intensive. JVM has the ability to use the underlying Oracle RDBMS libraries directly, without the use of a network connection between the Java code and SQL data. This helps improve performance and execution. For data access, Oracle Database uses server-side internal driver when Java code runs on the server.

Action Item 3: Connect to the database through SQLPlus and run ServersideConnect.sql before invoking ServersideConnect.java. For more information, refer to the samples of Github.

ServersideConnect.sql

```
Rem NAME
Rem ServersideConnect.sql
Rem
Rem DESCRIPTION
Rem SQL for invoking the method which gets a server side connection to
rem Reads the content of the Java source from ServersideConnect.java
rem then compiles it
connect username/pwd
CREATE OR REPLACE AND COMPILE JAVA SOURCE NAMED ServersideConnect_src AS
@ ServersideConnect.java
/
show error
rem A wrapper (a.k.a. Call Spec), to invoke Java
rem function in the database from SQL, PL/SQL, and client applications
CREATE OR REPLACE PROCEDURE ServersideConnect_proc AS
LANGUAGE JAVA NAME 'ServersideConnect.jrun ()';
/
rem running the sample
connect username/pwd
```

```
SET SERVEROUTPUT ON SIZE 10000
CALL dbms_java.set_output (10000);

execute ServersideConnect_proc;


InternalT2Server.java
import java.sql.Connection;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;

import oracle.jdbc.driver.OracleDriver;
import oracle.jdbc.pool.OracleDataSource;

public class ServersideConnect {

  static public void jrun() throws SQLException {
    // For testing ServersideConnect
    // test("jdbc:oracle:kprb:@");
    method1("jdbc:default:connection");
    method2();
  }
 /*
  * Shows using the server side Type 2 driver a.k.a KPRB driver
  */
 static public void method1 (String url) throws SQLException {
    Connection connection = null;
    try {
     // Method 1: Using OracleDataSource
      OracleDataSource ods = new OracleDataSource();
      ods.setURL(url);
      connection = ods.getConnection();
      System.out.println("Method 1: Getting Default Connection "
          + "using OracleDataSource");
      // Perform database operation
      printEmployees(connection);
    }
}

static public void method2 () throws SQLException {
   Connection connection = null;
   try {
        OracleDriver ora = new OracleDriver();
        connection = ora.defaultConnection();
        System.out.println("Method 2: Getting Default Connection "
          + "using OracleDriver");
        // Perform database operation
        printEmployees(connection);
   }
}

 /*
  * Displays employee_id and first_name from the employees table.
  */
```

```
  static public void printEmployees(Connection connection)
     throws SQLException {
    ResultSet resultSet = null;
    Statement statement = null;
    try {
      statement = connection.createStatement();
      resultSet = statement.executeQuery("SELECT employee_id, first_name"
         +    " FROM employees order by employee_id");
      while (resultSet.next()) {
        System.out.println("Emp no: " + resultSet.getInt(1) + " Emp name: "
            + resultSet.getString(2));
      }
    }
    catch (SQLException ea) {
      System.out.println("Error during execution: " + ea);
      ea.printStackTrace();
    }
    finally {
      if (resultSet != null) resultSet.close();
      if (statement != null) statement.close();
    }
  }
}
```

3

Overview of the HR Web Application

The HR Web Application is intended to give you access to information related to all employees of AnyCo Corporation.

The two types of users that will be able to access this application are:

- HRStaff
- HRAdmin

The HRStaff and HRAdmin accounts have different privileges.

HRStaff has read only access to the application and does not have privileges to update/delete an employee record. HRStaff can only List the employees and Search by Employee ID.

The HRAdmin, has complete control on the application and has read and write privileges. HRAdmin is the only user who has access to all functionalities of the application such as *update/delete an employee record*, or *provide salary increment for all employees*.

This Chapter has the following sections:

- Functionalities of he HR Web Application
- Packages

Functionalities of the HR Web Application

Following is a list of functionalities to access information related to AnyCo Corporation:

Through the **hrstaff**, you can perform the following functions:

- **List All Employees**

  Use the `List All Employees` option to retrieve employee information. This function lists information such as `Employee_ID`, `First_Name`, `Last_Name`, `Email`, `Phone_Number`, `Job_Id`, and `Salary`.

- **Search By Employee ID**

  Use the`primary key` (which is the Employee ID) to search for a particular employee.

  Through the **hradmin** user, you can perform the following functions:

  The **hradmin** user has full control of the application and has both read and update privileges.

- **Update Employee Record**

  You can update employee records, using the `Update Employee Record` function. First, search for employees, based on the name of the employee. You can then

update employee details in the record, such as `first_name`, `last_name`, `email`, `phone_number`, `job_id` and `salary` using the `UPDATE` function.

Use the `DELETE` function to the delete the entire employee record from the database.

- **Increment Salary**

  Through the increment salary tab, you can alter (increase or decrease) the percentage of salary for hike.

- **About**

  This page provides an overview of the HR Application and explains the various functionalities it offers.

4
Getting Started with the Application

To develop a Java application that connects to Oracle Database 12*c* Release 2 (12.2), you must ensure that certain components are installed as required. This chapter covers the following topics:

- What You Need to Install
- Verifying the Oracle Database 12c Release 2 (12.2) Installation
- Installing Oracle JDeveloper or any Java IDE (Eclipse, NetBeans, Intellij)

What You Need to Install

To be able to develop the sample application, you need to install the following products and components:

- Oracle Database 12c Release 2 (12.2)
- J2SE or JDK
- Apache Maven
- JDeveloper IDE
- Web Server (Tomcat)
- Oracle Database 12*c* Release 2 (12.2)

  To develop the Java web application, you need a working installation of Oracle Database 12c Release 2 (12.2) server with the HR schema, which usually comes with the database. There are two ways you can install the Oracle Database 12c Release 2 (12.2).

  Oracle Database Services on Cloud

  The Oracle Database Services on Cloud offer access to a single Oracle Database with Oracle providing the computing power, physical storage, and tools for maintenance and management operations. You can get access to a working database in just a few minutes. After creating an instance of the database on the Oracle cloud, you will have full access to the features and the operations available with the Oracle Database excluding the EECS option.

  Oracle Cloud gives you the flexibility to start at a cost and level suitable to your needs. Later, you can adapt with your changing requirements.

  You can login to Database Cloud Services page to review various options available and to sign-up. Some of the options are listed here for easy reference:

  Oracle Database Cloud Service (DBCS)

  Oracle Database Cloud Service on Oracle Cloud Infrastructure (CS)

  Oracle Database Exadata Express Cloud Service (EECS) - Fully Managed

  Oracle Database Exadata Cloud Service (ExaCS)

Oracle Database Exadata Cloud Machine (ExaCM)

Create an account in the Oracle Database Cloud Service (DBCS). This will give you access to HR schema as well.

> **Note:**
>
> Using Java Applications and IDEs with Oracle Database Cloud Service(DBCS) OTN page provides instructions to create a database instance and also try to connect to it using JDBC and UCP code samples provided in the beginning of the guide

Step 1:

Oracle Database Installation Available on OTN

As an alternative option, Oracle Database 12c Release 2 can also be installed on premise. Follow the links to install Oracle Database and check out the release notes.

- Oracle Database 12c Release 2 for Linux
- Oracle Database 12c Release 2 for Windows

> **Note:**
>
> Download JDK 8 — a Java Development Kit (JDK 8) to create and compile Java applications. Refer http://www.oracle.com/technetwork/java/javase/downloads/index.html for more information about installing Java.

Refer http://www.oracle.com/technetwork/java/overview-141217.html for information about the JDBC API.

Oracle Database 12*c* Release 2 (12.2)

To develop the Java application, you need a working installation of Oracle Database 12*c* Release 2 (12.2) Server with the `HR` schema, which comes with the database. The installation creates an instance of Oracle Database 12*c* Release 2 (12.2) and provides additional tools for managing this database.

Oracle Database Services on Cloud

The Oracle Database Services on Cloud offer access to a single Oracle Database with Oracle providing the computing power, physical storage, and tools for maintenance and management operations. You can get access to a working database in just a few minutes. After creating an instance of the database on the Oracle cloud, you will have full access to the features and the operations available with the Oracle Database excluding the EECS option.

Oracle Cloud gives you the flexibility to start at a cost and level suitable to your needs. Later, you can adapt with your changing requirements.

You can login to Database Cloud Services page to review various options available and to sign-up. Some of the options are listed here for easy reference:

Oracle Database Cloud Service (DBCS)

Oracle Database Cloud Service on Oracle Cloud Infrastructure (CS)

Oracle Database Exadata Express Cloud Service (EECS) - Fully Managed

Oracle Database Exadata Cloud Service (ExaCS)

Oracle Database Exadata Cloud Machine(ExaCM)

Create an account in the Oracle Database Cloud Service (DBCS). This will give you access to HR schema as well.

Follow the step-by-step instructions provided on Using Java Applications and IDEs with Oracle Database Cloud Service(DBCS) OTN page to create a database instance and also try to connect to it using JDBC and UCP code samples provided in the beginning of the guide.

Step 1:

Oracle Database Installation Available on OTN

As an alternative option, Oracle Database 12c Release 2 can also be installed on premise. Follow the links to install Oracle Database and check out the release notes.

For more information, refer to the following Oracle Database 12*c* Release 2 (12.2) installation guides and release notes:

- *Oracle Database Installation Guide for Linux*
- *Oracle Database Installation Guide for Microsoft Windows*

Unlocking the HR Schema for the JDBC Application

The `HR` user account, which owns the sample HR schema used for the Java application in this guide, is initially locked. You must log in as a user with administrative privileges (`SYS`) and unlock the account before you can log in as `HR`.

If the database is locally installed, use the **Run SQL Command Line** to unlock the account as follows:

1. To access the **Run SQL Command Line**, from the **Start** menu, select **Programs** (or All Programs), then **Oracle Database 12c Release 2 (12.2)**, and then click **Run SQL Command Line**. Log in as a user with DBA privileges, for example:

   ```
   > CONNECT SYS AS SYSDBA;
   Enter password: password
   ```

2. Run the following command:

   ```
   > ALTER USER HR ACCOUNT UNLOCK;
   ```

   or,

   ```
   > ALTER USER HR IDENTIFIED BY HR;
   ```

3. Test the connection as follows:

   ```
   > CONNECT HR
   Enter password: password
   ```

You should see a message indicating that you have connected to the database.

> **Note:**
>
> For information about creating and using secure passwords with Oracle Database 12*c* Release 2 (12.2), refer to *Oracle Database Security Guide*.

In addition, some of the constraints and triggers present in the `HR` schema are not in line with the scope of the Java application created in this guide. You must remove these constraints and triggers as follows using the following SQL statements:

```
DROP TRIGGER HR.UPDATE_JOB_HISTORY;
DROP TRIGGER HR.SECURE_EMPLOYEES;
DELETE FROM JOB_HISTORY;
```

JDK 8

You will need JDK8 — a Java Development Kit to create and compile Java applications.

> **Note:**
>
> Oracle Database 12c Release 2 (12.2) JDBC driver supports JDK8. Refer http://www.oracle.com/technetwork/java/javase/downloads/index.html for information about installing Java.

JDeveloper IDE

In this guide, Oracle JDeveloper Release 12c is the integrated development environment (IDE) used to create the sample Java web application. JDeveloper is used to edit the source code, compile the application, create a war file, and deploy the war file onto the integrated weblogic server (WLS).

J2SE or JDK

To create and compile Java applications, you need the full Java 2 Platform, Standard Edition, Software Development Kit (J2SE SDK), formerly known as the Java Development Kit (JDK).

> **Note:**
>
> Oracle Database 12*c* Release 2 (12.2) supports JDK 8.

> **See Also:**
>
> - `http://www.oracle.com/technetwork/java/javase/downloads/index.html` for information about installing Java
> - `http://www.oracle.com/technetwork/java/overview-141217.html` for information about the JDBC API

Integrated Development Environment

For ease in developing the application, you can choose to develop your application in an integrated development environment (IDE). This guide uses Oracle JDeveloper to create the files for this application.

Web Server

The sample application developed in this guide uses JavaServer Pages (JSP) technology to display information and accept input from users. To deploy these pages, you need a Web server with a servlet and JSP container, such as the Apache Tomcat application server.

This guide uses the embedded server called the Oracle WebLogic Server in JDeveloper for deploying the JSP pages. If you choose not to install Oracle JDeveloper, then any Web server that enables you to deploy JSP pages should suffice.

For more information about these servers, please refer to vendor-specific documentation.

Verifying the Oracle Database 12*c* Release 2 (12.2) Installation

Oracle Database 12*c* Release 2 (12.2) installation is platform-specific. You must verify that the installation was successful before you proceed to create the sample application. This section describes the steps for verifying an Oracle Database 12*c* Release 2 (12.2) installation.

Verifying a installation involves the following tasks:

Github Repository Details

Table 4-1 Github Repository Details

Name and Location	Details
2DaysJavaGuide-Workspace	This zip contains outlines of Java classes, for building the HR web application. Download the zip, unzip to a location, and follow the instructions.

Table 4-1 (Cont.) Github Repository Details

Name and Location	Details
HRWebApp	This repository contains the complete code samples of the application. Refer to this when you face issues or exceptions.

Import the Application in JDeveloper

Use the following steps to import the application in JDeveloper:

1. Navigate to the location where the HRWebApp_Workspace is extracted.

2. Choose a name for the application.

3. It creates a project with all files required to build HR web application. Now, you can start editing.

Compile Applications in JDeveloper

You can compile or create a .war file using maven commands through JDeveloper.

1. Right click on the project.

2. Run Maven

3. Navigate to compile/package/clean

Compile Using Maven and Run the Application in any Java EE Container

a. Compile Using Maven:

HR web application can also be easily compiled using the Maven commands. If you are using Oracle maven repository, then make sure to have the settings.xml file with all the required details available for easy access. After you download the HRWebApp_workspace and add the required code, use the commands below to clean, compile and package the source code.

Execute the following commands:

```
mvn –s settings.xml clean
```

```
mvn –s settings.xml compile
```

```
mvn –s settings.xml package
```

b. Deploy the .war file on any Java EE container

Once the source code is packaged using the maven command “mvn –s settings.xml package”, the war file will be placed under the folder “target/JdbcWebSamples.war”. Place this war file under TOMCAT_HOME/webapps/ and start the tomcat server. Once

the tomcat is started, access the HR web application using the URL http://localhost:8080/JdbcWebSamples/.

If the login/logout modules are added, then login with either **hradmin** or **hrstaff** user.

Run the the Application in JDeveloper

JDeveloper uses the integrade WebLogic Server to run the web application.

List All Employees

HR web Application has several functionalities. “List All” is the functionality where the details of employees such as Employee_id, First_name, Last_Name, Email, Phone_number, Job_id, Salary etc., are retrieved from the “Employees” table and shown on a web page. See the screenshot below that shows “List All” functionality.

5

List All Employees

HR web Application has several functionalities. “List All” is the functionality where the details of employees such as Employee_id, First_name, Last_Name, Email, Phone_number, Job_id, Salary etc., are retrieved from the “Employees” table and shown on a web page. See the screenshot below that shows “List All” functionality.

Creating a Java Bean Entity for an Employee

Class Name: src/main/java/com/oracle/jdbc/samples/entity/Employee.java

Github Location: Employee.java

Description: This is a class that contains the getter and setter methods for all the attributes of an employee. Example: First_name, Last_Name, Employee_Id etc., will have a getter and setter methods.

Steps to be Performed:

1. Create a constructor *Employee()* as shown in the sample.

2. Create a getter and setter method for all the attributes of an employee to show it on the web application.

Creating Employee.java:

1. Declare the package for the class Employee.java.

```
package com.oracle.jdbc.samples.entity;
```

2. Import the following packages required for the Employee class

```
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Timestamp;
```

3. Declare an Employee class. Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis:

```
public class Employee {
```

4. Declare the following variables for each one of the attributes of an employee.

```
private int Employee_Id;
private String First_Name;
private String Last_Name;
private String Email;
private String Phone_Number;
private String Job_Id;
private int Salary;
```

5. Create a constructor for Employee that takes ResultSet as the input and throws SQLExceptio. In this constructor, set all the values for the attributes of the Employee.

```
public Employee(ResultSet resultSet) throws SQLException {
  this.Employee_Id = resultSet.getInt(1);
  this.First_Name = resultSet.getString(2);
  this.Last_Name = resultSet.getString(3);
  this.Email = resultSet.getString(4);
  this.Phone_Number = resultSet.getString(5);
  this.Job_Id = resultSet.getString(6);
  this.Salary = resultSet.getInt(7);
}
```

Instructions for Creating Getter and Setter Methods:

Getter and Setter methods are used to get and set the value of X which is the way to achieve encapsulation. Create the getX and setX methods for all the attributes of the Employee such as employee_id, first_name, last_name, salary, etc.

1. Create the getter and setter methods for the Employee_Id as shown below

```
public int getEmployee_Id() {
   return Employee_Id;
}
  public void setEmployee_Id(int Employee_Id) {
     this.Employee_Id = Employee_Id;
  }
```

2. Create the getter and setter methods for the First_Name of an employee

```
public String getFirst_Name() {
  return First_Name;
}
public void setFirst_Name(String First_Name) {
  this.First_Name = First_Name;
}
```

3. Create the getter and setter methods for the Last_Name of an employee

```
public String getLast_Name() {
  return Last_Name;
}
public void setLast_Name(String Last_Name) {
  this.Last_Name = Last_Name;
}
```

4. Create the getter and setter methods for Email of an employee

```
public String getEmail() { return Email; } public void setEmail(String
Email) { this.Email = Email; }
```

5. Create the getter and setter methods for Phone Number of an employee

```
public String getPhone_Number() {
```

```
return Phone_Number; }

public void setPhone_Number(String Phone_Number) {

this.Phone_Number = Phone_Number;

}
```

6. Create the getter and setter methods for JobId of an employee

```
public String getJob_Id() { return Job_Id;}public void setJob_Id(String
Job_Id) { this.Job_Id = Job_Id;}
```

7. Create the getter and setter methods for Salary of an employee

```
public int getSalary() {
  return Salary;
}
public void setSalary(int Salary) {
  this.Salary = Salary;
}
```

Creating a Java Bean Interface for a JDBC Connection

1. Declare the package for the class EmployeeBean.java

```
package com.oracle.jdbc.samples.bean;
```

2. Import Employee entity class as it contains the employee details

```
import com.oracle.jdbc.samples.entity.Employee;
```

3. Declare an interface EmployeeBean class. Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis

```
public interface EmployeeBean {
```

4. On the new line, declare a method getEmployees()that returns a List of Employee objects.

```
public List<Employee> getEmployees();
```

Creating a Java Bean Implementation for a JDBC Connection

Class Name: src/main/java/com/oracle/jdbc/samples/bean/EmployeeBeanImpl.java

Github Location: EmployeeBeanImpl.java

Description: This is an implementation class. All the methods declared in EmployeeBean.java are implemented in this class. New methods related to each one of the features will be added in the next chapters. To begin with, we will be adding the implementation of the method required for “ListAll” functionality.

Steps to be performed:

Step 4: Create a method *getConnection()* – to establish a connection to the database. Ensure you update connection URL, DB username and DB password to point to your database.

Step 5: Create a method getEmployees() – To retrieve a list of employees from employees table. Update the SELECT query to be used by choosing the columns that you want from the Employees table.

Step 4: Instructions for creating getConnection() method:

1. Declare the package for the EmployeeBean.java.

```
package com.oracle.jdbc.samples.bean;
```

2. Import Employee class as it contains the employee details.

```
Import com.oracle.jdbc.samples.entity.Employee;
```

3. Import other dependent classes as shown below. If the particular class is not imported, JDeveloper will display a message reminding you to import the required package. Press the Alt+Enter keys to import the class:

```
import java.sql.*;
import java.util.ArrayList;
import java.util.List;
import java.util.logging.Level;
import java.util.logging.Logger;

import java.sql.PreparedStatement;
import oracle.jdbc.OracleStatement;
import oracle.jdbc.OracleConnection;
import oracle.jdbc.driver.OracleDriver;
import oracle.jdbc.OracleTypes;
import java.sql.PreparedStatement;
import oracle.jdbc.OracleStatement;
import oracle.jdbc.OracleConnection;

import oracle.ucp.jdbc.PoolDataSourceFactory;
import oracle.ucp.jdbc.PoolDataSource;
```

4. Add the following class declaration EmployeeBeanImpl that implements EmployeeBean. Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis.

```
public class EmployeeBeanImpln implements EmployeeBean {
```

5. Declare a static method getConnection() to establish the connection. Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis.

```
public static Connection getConnection() throws SQLException {
```

6. Register a driver as shown below.

```
DriverManager.registerDriver(new oracle.jdbc.OracleDriver());
```

7. Get a connection by passing the database URL and database username and password.

```
Connection connection = DriverManager.getConnection("jdbc:oracle:thin:@//
myorclhost:5521/myorcldbservice", "hr", "hr");
```

8. Return the database connection.

```
return connection;
```

Instructions to Create getEmployees() method:

1. Declare the method getEmployees(). Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis.

```
Public List<Employee> getEmployees()throws SQLException {
```

2. Declare a variable for the return value of type List<Employee>

```
List<Employee> returnValue = new ArrayList<>();
```

3. Start a try block. The source code is compiled with JDK8 and we use auto-closeable statements which means that there is no need to explicitly specify `catch` and `finally` blocks. The first try block is for getting a database connection by invoking the method `getConnection()`. Declare a variable connection to establish a database connection.

```
try (Connection connection = getConnection()) {
```

4. Start another try block for creating a `Statement`.

```
try (Statement statement = connection.createStatement()) {
```

5. Start another try block for ResultSet. Include the query that needs to be executed. Make sure to retrieve all the required fields of the employee in the query.

```
try (ResultSet resultSet = statement.executeQuery("SELECT Employee_Id,
First_Name, Last_Name, Email, Phone_Number, Job_Id, Salary FROM
EMPLOYEES")) {
```

6. Start a while loop to capture the list of employees retrieved from the ResultSet.

```
while(resultSet.next()) {
  returnValue.add(new Employee(resultSet));
}
```

7. Ensure you close the parenthesis for all the try blocks.

8. Catch the SQLException and log the message in logger as shown below.

```
catch (SQLException ex) {
  logger.log(Level.SEVERE, null, ex);
  ex.printStackTrace();
}
```

9. Return the List of employees from the method `getEmployees()`

```
return returnValue;
```

Creating a Servlet to Process the Request

The following code describes the steps required to create a Servlet to process a request.

Class Name: src/main/java/com/oracle/jdbc/samples/web/WebController.java

Github Location: WebController.java

Description: This is the main servlet that controls all the flows of the application. For every new functionality of the application, we will be adding the code to handle the new requests and responses in `doPost()` and `processResponse()` respectively.

Steps to be Performed:

6. Create a servlet *WebController.java* and *reportError()* method

7. Create a method *processRequest()* – This method processes both GET and POST HTTP requests.

8. Create a method *doGet()* – Add details to get the employee details from the database and show the results in JSON. JSON will be the output format of the results that is shown on the HTML.

9. Create a method getServletInfo() – To display some generic information about the servlet.

10. Create a logger to log exceptions and other error messages.

Step 6: Instructions for creating a WebController.java and reportError() method

1. Declare the package for the WebController.java.

```
package com.oracle.jdbc.samples.web;
```

2. Import `Employee` class as it contains the employee details and also, the `EmployeeBeanImpl`.

```
import com.oracle.jdbc.samples.entity.Employee;
   import com.oracle.jdbc.samples.bean.EmployeeBean;
   import com.oracle.jdbc.samples.bean.EmployeeBeanImpl;
```

3. Import the GSON (Google GSON) for displaying the Employee results.

```
import com.google.gson.Gson; import com.google.gson.reflect.TypeToken;
```

4. Import other dependent classes as shown below. If the particular class is not imported, then JDeveloper will display a message reminding you to import the required package. Press the Alt+Enter keys to import it.

```
import javax.servlet.ServletException;
    import javax.servlet.annotation.WebServlet;
    import javax.servlet.http.*;
    import java.io.IOException;
    import java.io.PrintWriter;
    import java.io.BufferedReader;
    import java.util.ArrayList;
```

```
import java.util.List;
import java.util.Map;

import java.util.logging.Logger;
```

5. Add the annotation to the servlet.

```
@WebServlet(name = "WebController", urlPatterns = {"/WebController"})
```

6. Add the following class declaration WebController that extends HttpServlet. Add an open parenthesis ({) and closing parenthesis (}). Place the cursor in between the parenthesis.

```
public class WebController extends HttpServlet {
```

7. Declare an object “employeeBean” of the type `EmployeeBeanImpl`. This will be a global variable and available for all the methods such as `reportError()`, `processRequest()`, and `doGet()` to use.

8. Declare an object “gson” of the type Gson. This will be a global variable and available for all the methods such as `reportError()`, `processRequest()`, and `doGet()` to use.

```
Gson gson = new Gson();
```

9. Declare a method reportError as shown below. This is to capture the error and show it on the page.

```
private void reportError(HttpServletResponse response, String message)
throws ServletException, IOException {
```

10. Set the response content type to be “text/html” and charset=UTF-8 as shown below.

```
response.setContentType("text/html;charset=UTF-8");
```

11. Create a PrintWriter object and print the error message as shown.

try (PrintWriter out = response.getWriter()) {

```
try (PrintWriter out = response.getWriter()) {
out.println("<!DOCTYPE html>");
out.println("<html>");
out.println("<head>");
out.println("<title>Servlet WebController</title>");
out.println("</head>");
out.println("<body>");
out.println("<h1>" + message + "</h1>");
out.println("</body>");
out.println("</html>");
}
```

Step 7: Instructions for Creating Process Request:

1. Add the following method declaration for processRequest(req, res). Add open and close parentheses ({, }) and position the cursor in between the parenthesis.

```
protected void processRequest(HttpServletRequest request,
HttpServletResponse response) throws ServletException, IOException {
```

2. Declare a variable *employeeList* of the *List* type that contains Employee objects. Declare the variable gson to process Gson object.

```
List<Employee> employeeList = null;
```

3. Instantiate the employeeList object by invoking getEmployees method of EmployeeBean.

```
employeeList = employeeBean.getEmployees();
```

4. Check if the employeeList is not NULL

```
if (employeeList != null) {
```

5. Set the content type to “application/json”

```
response.setContentType("application/json");
```

6. Invoke the method toJson(…) and convert the employeeList to JSON.

```
gson.toJson(employeeList,
            new TypeToken<ArrayList<Employee>>() {}.getType(),
response.getWriter());
```

7. End of if condition. Close the parenthesis (})

8. Add an else condition to cover the error scenario when the employeeList is empty.

```
else {
  response.setStatus(HttpServletResponse.SC_NOT_FOUND);
}
```

Step 8: Instructions for Creating `doGet()`:

1. Add the following method declaration for doGet().Add open and close parentheses ({, }) and position the cursor in between the parenthesis.

```
protected void doGet(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
```

2. Invoke the method `processRequest(request, response)` by passing the `HTTPServletRequest` and `HTTPServletResponse` response objects.

```
processRequest(request, response);
```

Step 9: Instructions for Creating `getServletInfo()`:

1. Add the following method declaration for getServletInfo().Add open and close parentheses ({, }) and position the cursor in between the parenthesis.

```
public String getServletInfo() {
```

2. In the return statement, set a message about the servlet.

```
return "JdbcWebServlet: Reading Employees table using JDBC and
transforming it as a JSON. ";
```

Step 10: Instructions for Creating Logger ():

1. Create a variable logger of the type Logger at the end of the class, before closing the parenthesis for the class WebController.java.

```
private static final Logger logger =
Logger.getLogger(WebController.class.getName());
```

Create an HTML Page to Display Results

Class Name:

`src/main/webapp/listAll.html`

Github Location: listAll.html

Description: This is the HTML page to show the results retrieved from the database.

Steps to be Performed:

Step 11: Create the title, stylesheet, and body of the HTML page

Step 12: Start the <script> tags and handle GET request

Step 13: Create a method processResponse() – To process the JSON response and show the results on the HTML page.

Step 11: Instructions to create title, stylesheet, and body of the HTML Page:

1. Create the title, stylesheet, and body for the HTML page.

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>List all Employees</title>

<link rel="stylesheet" type="text/css" href="css/app.css" > </head> <body>
```

Step 12: Instructions for Handling GET requests:

1. Start the <script> tags and declare few variables for the URL and HTTPRequest.

```
<script>

var xmlhttp = new XMLHttpRequest();

var url = "WebController";
```

2. Define the action when the requests are sent i.e., when the links for each one of the functionalities is selected.

```
xmlhttp.onreadystatechange=function() {
     if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
       processResponse(xmlhttp.responseText);
     }
   }
xmlhttp.open("GET", url, true);
xmlhttp.send();
```

Step 13: Instructions for handling `processResponse()` requests:

1. Create the function `processResponse()` to display JSON results on HTML page.

```
function processResponse(response) {
// Process the JSON response into an array.
var arr = JSON.parse(response);
var i;
var out - "<table>";
keys = Object.keys(arr[0]);
//Print headers
out += "<tr>"
for(i = 0; i < keys.length; ++i) {
out += "<th>"+keys [i]+"</th>"
}
out += "</tr>";
// Print values
for(j = 0; j < arr.length; j++) {
out += "<tr>"
for(i = 0; i < keys.length; ++i) {
out += "<td>"+arr[j][keys[i]]+"</td>"
}
out += "</tr>"
}
out += "</table>";


document.getElementById("id-emp").innerHTML = out;

}


}
```

Create a CSS File

The following code creates a method processResponse() inside the Java script that processes the JSON to show it on the HTML.

Class Name: src/main/webapp/css/app.css

Github Location : app.css

Description: The stylesheet has the color, font, and style for all the UI elements such as buttons, side navigation, main page, links, etc., on the page.

Steps to be Performed:

Step 14: Download the app.css and use it in your application.

6
Search by Employee ID

"Search by Employee Id" is the functionality where we can search for a particular employee based on their employee Id which is the primary key. The user needs to input the employee Id and submit the request.

Employee Java Bean

Class Name: `src/main/java/com/oracle/jdbc/samples/bean/EmployeeBean.java`

Github Location: EmployeeBean.java

Description: New method getEmployee(int) for searching employee by ID.

Steps to be performed:

Step 1: Declare a method `getEmployee(int)`

Step 1:Instructions for Declaring `getEmployee(int)` method:

1. The file EmployeeBean is already created on Day 1 for "ListAll" functionality. We can use the same class and add new methods for each one of the functionalities.

2. On the new line, declare a method getEmployee(int) that takes EmployeeId as a parameter.

```
public List<Employee> getEmployee(int empId);
```

Implement a new method `getEmployee(int)` in `EmployeeBeanImpl.java`.

Github Location: EmployeeBeanImpl.java

Description: Implement a new method getEmployee(int) to search employee by id. This method takes the employee Id as input parameter and returns an object of type Employee.

Steps to be Performed:

Step 2: Implement a new method `getEmployee(int)`:

Step 2: Instructions to create `getEmployee(int)` Method:

1. Declare the method *getEmployee(int)* that returns a List of the objects of type Employee.

```
public List<Employee> getEmployee(int empId) {
```

2. Declare a variable for the return value of type List<Employee>

```
List<Employee> returnValue = new ArrayList<>();
```

3. The first try block is for the getting a database connection by invoking the method getConnection(). Declare a variable connection to establish a database connection.

```
try (Connection connection = getConnection()) {
```

4. Start another try block for creating a PreparedStatement. PreparedStatement includes the query that needs to be executed to select an employee based on the employee id.

```
try (PreparedStatement preparedStatement =
connection.prepareStatement("SELECT Employee_Id, First_Name, Last_Name,
Email, Phone_Number, Job_Id, Salary FROM EMPLOYEES WHERE Employee_Id
= ?")) {
```

5. Set the input parameter which is the employee id for the query.

```
preparedStatement.setInt(1, empId);
```

6. Start another try block for ResultSet.

```
try (ResultSet resultSet = preparedStatement.executeQuery()) {
```

7. Check if there is anything returned. If yes, then add it to returnValue; otherwise, throw an exception.

```
if(resultSet.next()) {
    returnValue.add(new Employee(resultSet));
  } else {
    throw new SQLException("No recrods found");
  }
```

8. Make sure to close the parenthesis for all the try blocks. There are a total of 3 try blocks which need to be closed.

9. Catch the SQLException and log the message in logger as shown below.

```
catch (SQLException ex) {
  logger.log(Level.SEVERE, null, ex);
  throw ex;
}
```

10. Return the List of Employees from the method getEmployee(int)

```
return returnValue;
```

Add the code to a Servlet to process the request

Class Name: src/main/java/com/oracle/jdbc/samples/web/WebController.java

Github Location: WebController.java

Description: This servlet has already been created in Day 1. We will be adding the relevant code to search by employee id.

Steps to be performed:

Step 3: Add the code to search by employee id to the method `processRequest()`.

Step 3: Instruction for adding code to `processRequest()`:

1. Declare a varianle ID_KEY to capture the employee id. This is a global variable, hence, needs to be declared outside the method `processRequest()` but within the `WebController` class.

```
private static final String ID_KEY = “id”;
```

2. The method processRequest() is already created in the “ListAll” feature. Now, we will add the code to implement “Search by employee id” functionality.

3. Declare a variable value of the String type to capture the input from the user.

```
String value = null;
```

4. In addition to what was added for “ListAll” feature, we will add an if condition to handle the new functionality. Get the employee id entered by the user and invoke the method getEmployee(int) to verify if the employee record exists.

```
if ((value = request.getParameter(ID_KEY)) != null) {
      int empId = Integer.valueOf(value).intValue();
      employeeList = employeeBean.getEmployee(empId);
   } else {
      // Previously used getEmployees() method for Listall feature
      employeeList = employeeBean.getEmployees();
   }
```

Create a New HTML for Search by Employee Id

Class Name:

`src/main/webapp/listById.html`

Github Location: listById.html

Description: This is the HTML that shows an input box for user to enter the employee id. If the employee record is found, then the details of the employee will be shown on the page, otherwise, an error message will be displayed.

Steps to be performed:

Step 4: Create the title, head, and stylesheet for the HTML page.

Step 5: Create a function to submit the input field i.e, employee id

Step 6: Create a method processResponse() – To process the JSON response and show the results on the HTML page.

1. Create the title, stylesheet, and body for the HTML page.

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>List Employee by Id</title>
<!-- Specify the stylesheet here -->
<link rel="stylesheet" type="text/css" href="css/app.css" >
<!-- Bootstrap JS for the UI -->
```

```
<link rel="stylesheet"
href="http://maxcdn.bootstrapcdn.com/bootstrap/3.3.6/css/
bootstrap.min.css">
</head>
```

Step 5: Instructions for handling the input field:

1. Start the <body> tag and a <input> tag for capturing the employee id.

```
<body>
<div><label>Employee Id: </label>
<input id="empId" type="textfield"
onkeypress="return waitForEnter(event)"\>
</div>
<br/>
<br/>
<script>
function waitForEnter(e) {
  if (e.keyCode == 13) {
    var tb = document.getElementById("empId");
    fetchElementById(tb.value)
    return false;
  }
}
<script>
var xmlhttp = new XMLHttpRequest();
var url = "WebController";
```

3. Define the action when the requests are sent i.e., when the links for each one of the functionalities is selected.

```
xmlhttp.onreadystatechange=function() {
     if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
       processResponse(xmlhttp.responseText);
     }
   }
xmlhttp.open("GET", url, true);
xmlhttp.send();
```

Step 6: Instructions for Creating `processResponse()` method:

1. Create the function `processResponse()` to display JSON results on HTML page.

```
function processResponse(response) {
//Process the JSON respnse into an array.
var arr = JSON.parse(response);
     var i;
var out = "<table>";
keys = Object.keys(arr[0]);

// Print Headers
out += "<tr>"
for(i = 0; i < keys.length; ++i) {
out += "<th>"+keys[i]+"</th>"
```

```
}
out += "</tr>";
// Print values
for(j = 0; j < arr.length; j++) {
out += "<tr>"
for(i = 0; i < keys.length; ++i) {
out += "<td>"+arr[j][keys[i]]+"</td>"

}
out += "</tr>"
}
out += "</table>";
document.getElementById("id-emp").innerHTML = out;
}
```

7

Update an Employee Record

The **hradmin** has the privilege to update an employee record. The **hrstaff** user does not have this privilege.

First, you must search for an employee in the records. Once you retrieve the information related to the employee, you will find the ‘Edit’ and ‘Delete’options to modify details related to the employee.

This Chapter shows you the classes that need to be created and code that needs to be added to build ‘Search by Employee ID’ functionality.

In this Chapter, you will learn how to:

1. Declare a new new method *getEmployeeByFn(String)* in *EmployeeBean.java*
2. Declare a new method *updateEmployee(int)* in *EmployeeBean.java*
3. Implement a new method *getEmployeeByFn(String)* in *EmployeeBeanImpl.java*
4. Implement a new method *updateEmployee(int)* in *EmployeeBeanImpl.java*
5. Add the code to a *WebController.java* to process the request and response
6. Create a HTML page (*listByName.html*) to display the results

Class Name:

`src/main/java/com/oracle/jdbc/samples/entity/Employee.java`

Use the `Employee.java` file that you created, earlier in the example.

Declare a new method *getEmployeeByFn(String)* in EmployeeBean.java

Class Name: src/main/java/com/oracle/jdbc/samples/bean/EmployeeBean.java

Github Location: EmployeeBean.java

Description: The method `getEmployeeByFn(String)` helps you search employees based on their first name.

To modify details of the employee, the **hradmin** must first search for the employee based on his/her first name.

Steps to be performed:

Step 1: Declare a method `getEmployeeByFn(String)`

Step 1: Instructions for declaring getEmployeeByFn(String) method:

1. Use the class EmployeeBean that you created on Day 1 of the exercise. You can add new methods for each of the functionalities.

2. Declare a method `getEmployeeByFn(String)` that takes first name as a parameter.

```
public List<Employee> getEmployeeByFn(String fn)throws SQLException;
```

Declare a new method *updateEmployee(Employee)*

Class Name: `src/main/java/com/oracle/jdbc/samples/bean/EmployeeBean.java`.

Github Location: EmployeeBean.java

Description: This method allows you to update attributes of an employee such as first name, last name, salary, job_id etc

Steps to be Performed:

Step 2: Declare a method *updateEmployee(Employee)*

Instructions for declaring `updateEmployee(Employee)` method

1. Use the `EmployeeBean` file that you created in the exercise from Day 1 for '`ListAll`' functionality. You can use the same class and add new methods for the new functionalities.

2. Declare a method `updateEmployee(Employee)` that takes Employee object as a parameter.

```
public String updateEmployee(Employee employee) throws SQLException;
```

Implement a New Method `getEmployeebyFn()` for Search by Employee name

Class Name:

`src/main/java/com/oracle/jdbc/samples/bean/JdbcBeanImpl.java`

Github Location: EmployeeBeanImpl.java

Description: Implement a new method `getEmployeeByFn(String)` to search by employee id. This method uses the employee id as an input parameter and returns an object of type Employee.

Steps to be Performed: Implement a method `getEmployeeByFn(String)`

Instructions for implementing `getEmployeeByFn(String)` method:

1. Declare `getEmployeeByFn(String)` that returns a an Employee object.

```
public List<Employee> getEmployeeByFn(String fn) throws SQLException {
```

2. Declare a variable for the return value of type `List<Employee>`

```
List<Employee> returnValue = new ArrayList<>();
```

3. Create a `try` block. The `try` block will help you create a database connection by invoking the `getConnection` method.

```
try (Connection connection = getConnection()) {
```

4. Create another `try` block to create a `PreparedStatement`. Add the query that will be executed to select an employee based on the employee id.

```
try (PreparedStatement preparedStatement =
connection.prepareStatement("SELECT Employee_Id, First_Name, Last_Name,
Email, Phone_Number, Job_Id, Salary FROM EMPLOYEES WHERE First_Name
LIKE ?")) {
```

5. Set an input parameter — first name of the employee. The input parameter of the method is set as the IN parameter for the `preparedStatement`.

```
preparedStatement.setString(1, fn + '%');
```

6. Create another `try` block for `ResultSet`. Include the query that needs to be executed.

```
try (ResultSet resultSet = preparedStatement.executeQuery()) {
```

7. Include while statement to loop through the results. If any record is found, add it to the `returnValue`.

```
while(resultSet.next()) {
    returnValue.add(new Employee(resultSet));
  }
```

8. Ensure you close parenthesis for all `try` blocks.

9. Catch the `SQLException` and log the message in the logger.

```
catch (SQLException ex) {
  logger.log(Level.SEVERE, null, ex);
  throw ex;
}
```

10. Return the List of employees from the method `getEmployee(int)`

```
return returnValue;
```

Implement a new method *updateEmployee(Employee)*

Class Name: src/main/java/com/oracle/jdbc/samples/bean/EmployeeBeanImpl.java.

Github Location: EmployeeBeanImpl.java

Description: The method `updateEmployee(Employee)` enables you to update the employee details such as first_name, last_name etc, in the employee record.

Steps to be performed: Implement a method `updateEmployee(Employee)`

Instructions for Implementing `UpdateEmployee(Employee)` method:

1. Declare method `updateEmployee(Employee)`.

```
public String updateEmployee(Employee employee) throws SQLException {
```

2. Declare and initialize a variable for capturing the number of records updated.

```
int updateCount = 0;
```

3. Create a `try` block to establish a database connection by invoking the method `getConnection()`.

```
try (Connection connection = getConnection()) {
```

4. Create another try block to make a `PreparedStatement`. Include the query you will need to execute to select an employee based on the employee id.

```
try (PreparedStatement preparedStatement =
connection.prepareStatement("UPDATE employees SET FIRST_NAME = ?,
LAST_NAME = ?, EMAIL = ?, PHONE_NUMBER = ?, SALARY = ? WHERE EMPLOYEE_ID
= ?")) {
```

5. Set the new values entered by the user for each attribute and execute the prepapredStatement.

```
preparedStatement.setString(1, employee.getFirst_Name());
preparedStatement.setString(2, employee.getLast_Name());
preparedStatement.setString(3, employee.getEmail());
preparedStatement.setString(4, employee.getPhone_Number());
preparedStatement.setInt(5, employee.getSalary());
   preparedStatement.setInt(6, employee.getEmployee_Id());
updateCount = preparedStatement.executeUpdate();
```

6. Close parenthesis for all `try` blocks.

7. Catch the SQLException and log the message in the logger as shown below:

```
catch (SQLException ex) {
  logger.log(Level.SEVERE, "Unable to update record", ex);
  throw new SQLException("Alert! Record could not be updated, "
    +ex.getMessage(), ex);}
```

8. Log the message with the number of records updated to the logger.

```
logger.fine("Update count: " +updateCount);
```

9. If none of the records were updated, enter a message as follows:

```
if (updateCount != 1) {
  logger.severe("Unable to update record");
  throw new SQLException("Alert! Record could not be updated");
}
```

10. Return the success message if the record was updated.

```
return "Success: Record updated";
```

Add the Code to a Servlet (*WebController.java*)

This is the start of your topic.

Class Name: src/main/java/com/oracle/jdbc/samples/web/WebController.java

Github Location: WebController.java

Description: You have created the servlet in the Day 1 exercise. In this section, you will add the relevant code to give a salary raise to all employees.

Step 6: Add code to calculate salary budget, after the user enters the input percentage. This is handled in the `doPost()` method.

Instructions to add code to doPost(req, res):

1. You have already created this method in the 'Update an Employee' record section.

2. Create another `if` block to check the functionality to be invoked based on the input.

```
if ("incrementSalary".equals(value)) {
  if ((value = request.getParameter(INCREMENT_PCT)) != null)   {
       try {
   System.out.println("increment% = " +value);
   response.setContentType("application/json");
List<Employee> employeeList =
employeeBean.incrementSalary(Integer.valueOf(value));
   System.out.println("incrementSalary, employeeList: "
+employeeList.toString());
   gson.toJson(employeeList,
new TypeToken<ArrayList<Employee>>(){}.getType(),
response.getWriter());
  }catch (Exception ea)
{         response.setStatus(HttpServletResponse.SC_NOT_MODIFIED);
   }
} else {
response.setStatus(HttpServletResponse.SC_NOT_MODIFIED);
      }
}
```

3. Ensure all the parenthesis are closed properly.

Create a new HTML(*incrementSalary.html*)

Class Name: `src/main/webapp/incrementSalary.html.`

Github Location: incrementSalary.html

Description: This HTML displays an input box to enter the percentage for calculating the salary budget.

Step 7: Create the title, head, and stylesheet for the HTML page

Step 8: Create a function to submit the input field i.e, employee first name

Step 9: Create a method processResponse() – To process the JSON response and show the results on the HTML page

Step 7: Instructions to create the title, stylesheet, and body of the HTML page:

1. Create the title, stylesheet, and body of the HTML page.

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>Increment Salary</title>
<link rel="stylesheet" type="text/css" href="css/app.css" >
<link rel="stylesheet" href="http://maxcdn.bootstrapcdn.com/bootstrap/
3.3.6/css/bootstrap.min.css">
<script    src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.2/
jquery.min.js">script    src="https://ajax.googleapis.com/ajax/libs/jquery/
1.12.2/jquery.min.js"></script>
</head>
```

Step 8: Instructions for Handling the Input Field

1. Start the <body> tag and a <input> tag for capturing the percentage for salary raise.

```
<body>
<div> Enter the percentage increase in salary<inputid='incrementField'
type="number" max="100" min="3">%
</div>
<div id="UpdateButton"> <button type="button" class="btn btn-info btn-lg"
onclick='javascipt:confirmUpdate()'> Increment Salaries</button> <button
type="button" class="btn btn-default btn-lg"
onclick='javascipt:cancelUpdate()'>Cancel</button></div>
<div id="status" class="none"></div>
<div id="id-emp"></div>
<script>
function showStatus(c, message) {
     $('#status').text(message);
     $('#status').attr('class', c);
       }

function confirmUpdate() {
  var increment = $('#incrementField').val();
  var res = confirm("Do you really want to Increment Salary by "
+increment +"%?");
  if(res == true) {
    console.log("Salary record");
    $('#UpdateButton').hide();
    showStatus("alert alert-info", "Updating records, processing request");
    var xmlhttp = new XMLHttpRequest();
    var url = "WebController?op=incrementSalary&incrementPct=" +increment;
    xmlhttp.onreadystatechange = function() {
      if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
        processResponse(xmlhttp.responseText);
        showStatus("alert alert-success", "Updating records, successfully
updated");
```

```
      }
      else {
        showStatus("alert alert-danger", "Updating records, failure, could
not update records");
      }
    }
    xmlhttp.open("POST", url, true);
    xmlhttp.send();
    showStatus("alert alert-info", "Updating records, request sent");

  }
  else {
    console.log("Salary not updated");
    showStatus("alert alert-warning", "Updating records, attempt
cancelled");

  }
}

</script>
```

Step 9: Instructions to Create `processResponse()` method:

1. Create the function `processRequest()` to display the JSON results on HTML page.

```
unction processResponse(response) {
  var arr = JSON.parse(response);
  var i;
  var out = "<table>";
keys = Object.keys(arr[0]);

  // Print headers
  out += "<tr>"
for(i = 0; i < keys.length; ++i) {
    out += "<th>"+keys[i]+"</th>"
}
out += "</tr>";

// Print values
for(j = 0; j < arr.length; j++) {
out += "<tr>"
for(i = 0; i < keys.length; ++i) {
out += "<td>"+arr[j][keys[i]]+"</td>"
}
out += "</tr>"
}
out += "</table>";
document.getElementById("id-emp").innerHTML = out;
}
```

Creating Login Users in Tomcat

The HR Web Application will have two users — `hradmin` and `hrstaff`.

After you login on the home scree using your credentials, you will be able to see the landing page, with details of the web application. The hradmin and hrstaff have different privileges and access to different features.

This Chapter will show you the required classes that you need to create and how to build the 'Login' functionality in Tomcat.

- Create a XML file (*tomcat-users.xml)* for login functionality
- Create a HTML page (*login.html*) to login the user
- Create a HTML page (*login-failed.html*) to display the error message
- Create a *web.xml* to authenticate the users during login
- Create a HTML page (about.html) to show more details about the application
- Create a landing page (index.html) and define the html pages for redirection
- Add code to the servlet (*WebController.java*) to process logout

Create an XML file (*tomcat-users.xml)* for login functionality

Class Name: `/java/HRWebApp/tomcat-users.java`

Github Location: tomcat-users.xml

Description: Create an XML file tomcat-users.xml and list down the login users you want to allow access to. Specify both username and password for each one of the users.

Step 1: Create a new file tomcat-user.xml

Instructions for creating tomcat-users.xml:

1. Create the file `tomcat-users.xml`. Place this file under `TOMCAT_HOME/conf /tomcat-users.xml`

```
<?xml version='1.0' encoding='utf-8'?> z
<tomcat-users xmlns="http://tomcat.apache.org/xml"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://tomcat.apache.org/xml tomcat-users.xsd"
version="1.0">
<role rolename="manager"/>
<role rolename="staff"/>
<user username="hradmin" password="welcome" roles="manager,staff"/>
<user username="hrstaff" password="welcome" roles="staff"/>
</tomcat-users>
```

Create a new HTML (*login.html*)

Class Name: src/main/webapp/login.html

Github Location: login.html

Description: The login page is displayed when you invoke the main page of the web application. The login page shows up fields to capture username and password.

Step 2: Create the title, head, and stylesheet for *login.html*

Step 3: Create the <body> to capture input fields and submit the form

Step 2: Instructions to create title, head and stylesheet for `login.html`:

1. Create the file `tomcat-users.xml`. Place this file `TOMCAT_HOME/conf/tomcat-users.xml`.

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>Login to Jdbc Web Sample application</title>
<link rel="stylesheet" href="http://maxcdn.bootstrapcdn.com/bootstrap/
3.3.6/css/bootstrap.min.css">
<style>
#cent {
    position:absolute;
    top:50%;
    left:50%;
    margin-top:-50px; /* this is half the height of your div*/
    margin-left:-100px; /*this is half of width of your div*/
  }
   td {
     height: 30px;
   }

</style>
</head>
```

Step 3: Instructions to Create the <body> and submit the form:

1. Create the <body> and <form> to submit the login credentials entered by the user.

```
<body>
<div id="cent">
<form method="POST" action="j_security_check">
<table>
<tr>
<td colspan="2">Login to the Jdbc Web Sample application:</td>
</tr>
<td>Name:</td>
<td><input type="text" name="j_username" /></td>
</tr>
<tr>
<td>Password:</td>
<td><input type="password" name="j_password"/></td>
</tr>
<tr>
<td colspan="2"><input type="submit" value="Go" /></td>
</tr>
</table>
</form>
</div>
</body>
```

Create a new HTML (*login-failed.html*)

Class Name: src/main/webapp/login-failed.html

Github Location: login-failed.html

Description: This the html page that will be displayed if the login is unsuccessful.

Step 4: Create the new page *login-failed.html* to show a message during unsuccessful login attempts

Instructions to Create a new HTML page `login-failed.html`.

1. Create the `login-failed.html` as shown below.

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>Login Failed</title>
</head>
<body>
<p>
Sorry, login failed!
</p>
</body>
</html>
```

Create a *web.xml* to authenticate the users during login

Class Name: `src/main/webapp/WEB-INF/web.xml`

Github Location: web.xml

Description: The web.xml file consists of descriptors to authenticate the users when the login page is shows to the user.

Steps: Create the file web.xml as shown below.

Instructions for creating `web.xml`

1. Use the following steps to create the web.xml file:

```
<!DOCTYPE web-app PUBLIC
 "-//Sun Microsystems, Inc.//DTD Web Application 2.3//EN"
 "http://java.sun.com/dtd/web-app_2_3.dtd">
<web-app>
<display-name>Jdbc Web Sample</display-name>
<security-role>
<role-name>manager</role-name>
</security-role>
<security-role>
<role-name>staff</role-name>
</security-role>
<security-constraint>
<web-resource-collection>
<web-resource-name>Wildcard means whole app requires
```

```
authentication</web-resource-name>
<url-pattern>/*</url-pattern>
<http-method>GET</http-method>
<http-method>POST</http-method>
</web-resource-collection>
<auth-constraint>
<role-name>manager</role-name>
</auth-constraint>
<user-data-constraint>
<transport-guarantee>NONE</transport-guarantee>
</user-data-constraint>
</security-constraint>
<security-constraint>
<web-resource-collection>
<web-resource-name>Wildcard means whole app requires
authentication</web-resource-name>
<url-pattern>/*</url-pattern>
<http-method>GET</http-method>
</web-resource-collection>
<auth-constraint>
<role-name>staff</role-name>
</auth-constraint>
<user-data-constraint>
<transport-guarantee>NONE</transport-guarantee>
</user-data-constraint>
  </security-constraint>
<login-config>
<auth-method>FORM</auth-method>
<form-login-config>
<form-login-page>/login.html</form-login-page>
<form-error-page>/login-failed.html</form-error-page>
</form-login-config>
</login-config>
</web-app>
```

Create a HTML page *(about.html)* to describe the web application

Class Name: `src/main/webapp/about.html`

Github Location: about.html

Description: The `about.html` file displays information about the HR Application, users and functionalities.

Step 6: Download the about.html and use it in your application.

Create a landing page (index.html) and define the pages for redirection

Class Name: `src/main/webapp/index.html`

Github Location: index.html

Description: The index.html file consists of all details about the HR Web Application. It describes in detail its users and functionalities.

Step 7: Create the title, head, and stylesheet for *index.html*

Step 8: Create the <body> to invoke the html pages for redirecting the requests

7. Instructions to Create title, head and stylesheet for index.html:

1. Create the index.html file.

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8">
<title>Employee table listing</title>
<link rel="stylesheet" type="text/css" href="css/app.css" >
<style>
iframe:focus {
outline: none;
}
iframe[seamless] {
display: block;
}
</style>
</head>
<body>
```

Step 8: Instructions to Create <body>, redirection, and actions for buttons:

1. Create <body> and actions for the features through navigation links and logout.

```
<body>
<div id="sideNav" class="sidenav">

<a href="javascript:void(0)" class="closebtn" onclick="closeNav()"
class="staff">x</a>
<a href="javascript:switchSrc('listAll.html')" class="staff">List All</a>
<a href="javascript:switchSrc('listById.html')" class="staff">Search By
Id</a>

<a href="javascript:switchSrc('listByName.html')" class="manager">Update
Employee Record</a>
<a href="javascript:switchSrc('incrementSalary.html')"
class="manager">Increment Salary</a>
<a href="javascript:switchSrc('about.html')">About</a>
</div>
<div id="main">
<div align="right">
<div
id="myrole"
        style="display:inline; color:#393318; display: block; background-
color:#eff0f1;position: absolute; top: 20px; right: 8%;"
    >myrole</div>
<a href="javascript:void(0)"
       onclick="logout()"
       class="staff"
       style="display: block; position: absolute; top: 20px; right:
1%">Logout</a>
```

```
</div>
<div>
<span style="font-size:30px;cursor:pointer" onclick="openNav()"> Java 2
Days HR Web Application        </span>
</div>
<div>
<iframe id="content"
src="about.html"
frameborder="0"
style="overflow:hidden; height:100%; width:100%"
height="100%"
width="100%"></iframe>
</div>
</div>
<script>
function openNav() {
  document.getElementById("sideNav").style.width = "256px";
  document.getElementById("main").style.marginLeft = "256px";
}

function closeNav() {
  document.getElementById("sideNav").style.width = "0";
  document.getElementById("main").style.marginLeft= "0";
}

function switchSrc(src) {
  document.getElementById('content').src = src;
}

function logout() {

  var xmllogout = new XMLHttpRequest();
  xmllogout.open("GET", "WebController?logout=true", true, "_", "_");
  xmllogout.withCredentials = true;
  // Invlalid credentials to fake logout
  xmllogout.setRequestHeader("Authorization", "Basic 00001");
  xmllogout.send();

  xmllogout.onreadystatechange = function() {
    window.location.replace("index.html");
  }

 return true;
}

var xmlhttp = new XMLHttpRequest();
var url = "getrole";

xmlhttp.onreadystatechange = function() {
  if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
    role = xmlhttp.responseText;
    console.log("role: " +role);
    if (role == "staff") {
      console.log ("disabling manager");
      var x = document.getElementsByClassName('manager');
```

```
      for(i = 0; i < x.length; ++i) {
        x[i].style.display = 'none';
      }
    }
    document.getElementById('myrole').innerHTML = ' '+role+' ';
  }
}
xmlhttp.open("GET", url, true);
xmlhttp.send();
</script>
</body>
```

Add code to the servlet (*WebController.java*) to process logout

Class Name: `src/main/java/com/oracle/jdbc/samples/web/WebController.java`

Github Location: WebController.java

Description: You have created this servlet in the Day 1 exercise. In this step, you will add relevant code to implement logout and login.

Step 9: Update the method `processRequest(req, res)` **for log out functionality**

Instructions to Update the Method `processRequest (req, res):`

1. You have created a method in the “ListAll” feature in the earlier steps. In this step, you will add code for the `logout` functionality.

2. Create an `if` block to verify the functionality you will invoke based on input. Check if the input valuie is ‘`LOGOUT`’. Then, invoke the relevant method to log out the user.

```
if ((value = request.getParameter(LOGOUT)) != null) {
/* Getting session and then invalidating it */

 HttpSession session = request.getSession(false);
if (request.isRequestedSessionIdValid() && session != null)   {
  session.invalidate();
}
handleLogOutResponse(request,response);
   response.setStatus(HttpServletResponse.SC_UNAUTHORIZED);
return;
}

private void handleLogOutResponse(HttpServletRequest request,
HttpServletResponse response) {
    Cookie[] cookies = request.getCookies();
    for (Cookie cookie : cookies) {
      cookie.setMaxAge(0);
      cookie.setValue(null);
      cookie.setPath("/");
      response.addCookie(cookie);

    }
  }
```

3. Verify that all parenthesis are closed properly.

8
Best Practices

1. Use Database Service on Cloud:

Use the Oracle Database Service on Cloud (DBCS) to create a database on cloud. DBCS comes with an in-built HR schema and tables that you can use when you build the HR web application.

> **Note:**
>
> Use Oracle Database Enterprise Edition 12.2.0.1 to use features and functionalities of the latest Oracle Database.

2. JDBC Driver, UCP:

It is recommend that you use the latest 12.2.0.1 versions of JDBC drivers and UCP.

> **Note:**
>
> Download the latest JDBC drivers and UCP from 12.2.0.1 JDBC driver and UCP

3. JDK 8

It is recommended that you use the latest version of Oracle JDBC driver 12.2.0.1, that is compliant with JDK 8.

4. Auto-closeable statements

Starting JDK7, 'Auto-closeable statements' has been introduced, that close by default without an explicit `catch` statement.

5. Use PreparedStatement instead of Statement objects:

Statement in JDBC must be localized to being used for `DDL` (`ALTER, CREATE, GRANT` etc) since these commands cannot accept bind variables.

Use `PreparedStatement` or `CallableStatement` for any other type of statement. These statements can accept bind variables.

9
Troubleshooting and Debugging

1. Tomcat log file:

Check `TOMCAT_HOME/logs/catalina.out` for any errors after deploying the application.

2. Additional Logging:

Enable logging in Tomcat to find logging messages in the code.

> **Note:**
>
> Refer https://tomcat.apache.org/tomcat-8.0-doc/logging.html for more information

Debugging UI Related Issues

1. Browser Version:

This application has been tested on Firefox (version 52) and Chrome (version 58) successfully.

2. Browser Console:

Look for errors in the browser console to find and debug issues.

3. Monitor Network Traffic:

Track network traffic to find out the requests being made, and the responses to the requests. A return status higher than 400 indicates errors. If you find errors in the range of 400 t 500 inspect the Tomcat log files for debugging.

Inspect the `JSON` responses from various calls to the backend server.

4. Additional Logging:

Edit the packaged HTML files, and add `console.log(...)` to add extra logging.

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