

# Oracle®

## SQL Developer for VS Code



Release 24.2

G11259-01

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The Oracle logo, consisting of a solid red square with the word "ORACLE" in white, uppercase, sans-serif font centered within it.

ORACLE®

Oracle SQL Developer for VS Code, Release 24.2

G11259-01

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# Preface

This guide provides usage information about Oracle SQL Developer for VS Code.

## Audience

This guide is intended for those using the Oracle SQL Developer extension in Visual Studio Code.

## Conventions

The following text conventions are used in this document:

Convention	Meaning
<b>boldface</b>	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	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.

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# 1

## Changes in Release 24.2 for *SQL Developer* for *VS Code*

The new features in this release are:

- Support for JSON-Relational Duality Views  
See [Working with JSON-Relational Duality Views](#)

# 2

## Getting Started

Oracle SQL Developer for VS code is a new, more powerful version of Oracle SQL Developer desktop that is now freely available as an extension in Visual Studio Code. In the first release, you can browse, edit, and delete objects, run SQL statements and scripts, edit and run PL/SQL code, and manipulate and export data.

You can connect to any target Oracle Database schema using standard Oracle Database authentication. Once connected, you can perform operations on objects in the database.

### Topics:

- [Installing Oracle SQL Developer for VS Code](#)
- [Connecting to Your Database](#)

## 2.1 Installing Oracle SQL Developer for VS Code

Oracle SQL Developer for VS code is available for all major platforms.

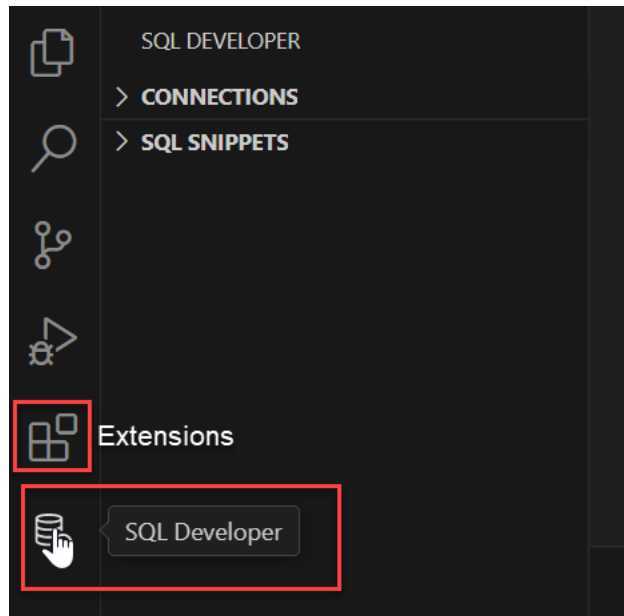
Perform the following steps to install Oracle SQL Developer for VS Code:

### Note:

After installing it the first time, the SQL Developer extension for VS Code is automatically updated as new versions become available.

1. Click the **Extensions** icon in the Activity Bar on the left side or use the **View: Extensions** command (Ctrl+Shift+X).
2. In the Extensions pane, in the Search field, enter **SQL Developer**.  
SQL Developer appears as one of the search results.
3. In the result entry, click **Install**.  
SQL Developer appears in the left pane under INSTALLED along with a SQL Developer icon in the left side bar.
4. Click the icon to open SQL Developer. In the left pane, Connections and SQL Snippets appear.





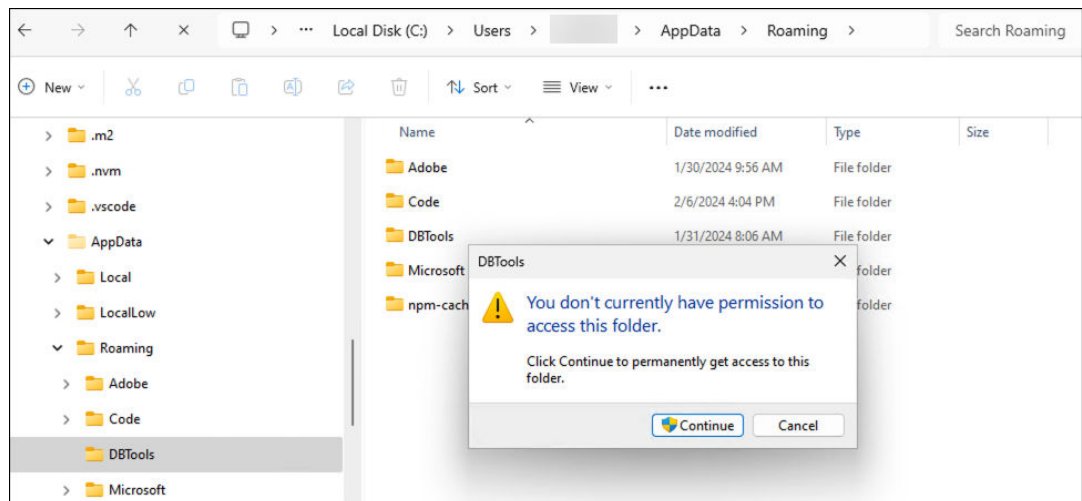
## 2.1.1 File Permissions for User Accounts in Windows Domain

If there are both local and domain accounts for a user in Windows, the directory is assigned to the local account, creating inaccessible secure storage for the domain account. That is, a DBTools directory owned by the local user is created in the domain user's AppData\Roaming location.

To resolve this issue:

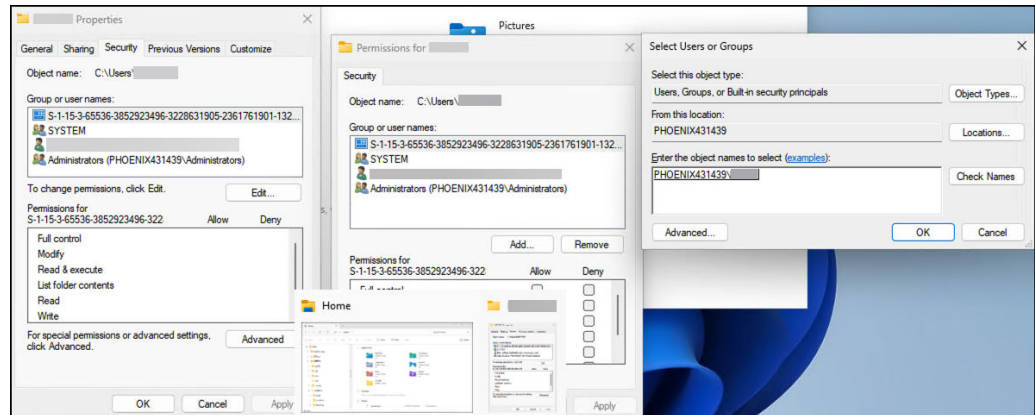
1. Uninstall SQL Developer for VS Code release 23.4.0.
2. Remove the DBTools directory.

As the domain user, if you try to open `<domain-user>/AppData/Roaming/DBTools`, you will get an error message.

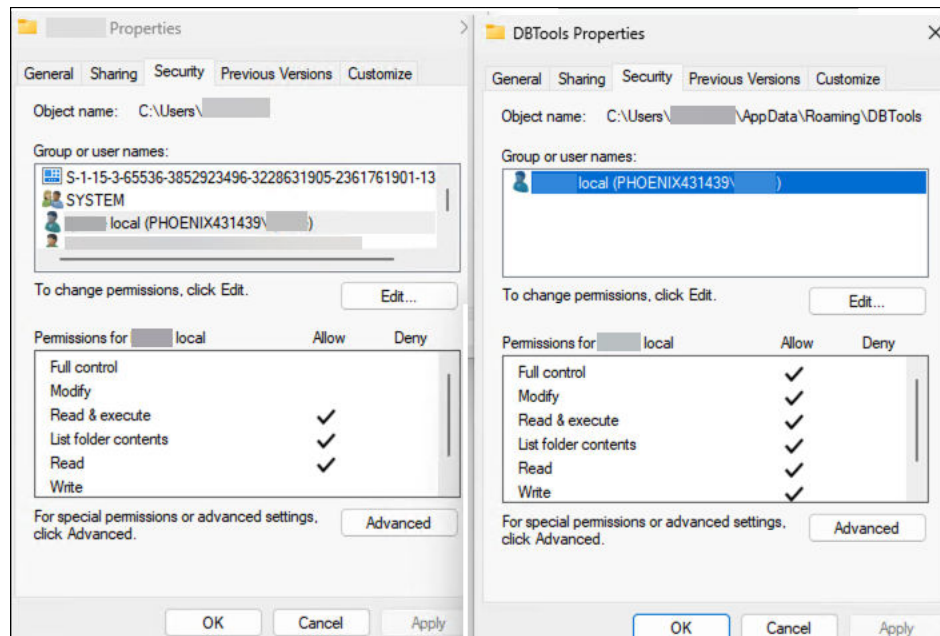


To resolve this, do one of the following:

- If you are also an administrator, you are prompted for access, then you can delete the directory before installing a new version.
- If you are not an administrator, contact an administrator who can help to delete the directory.
- If you know both local and domain passwords, provide local account access to your domain user directory.

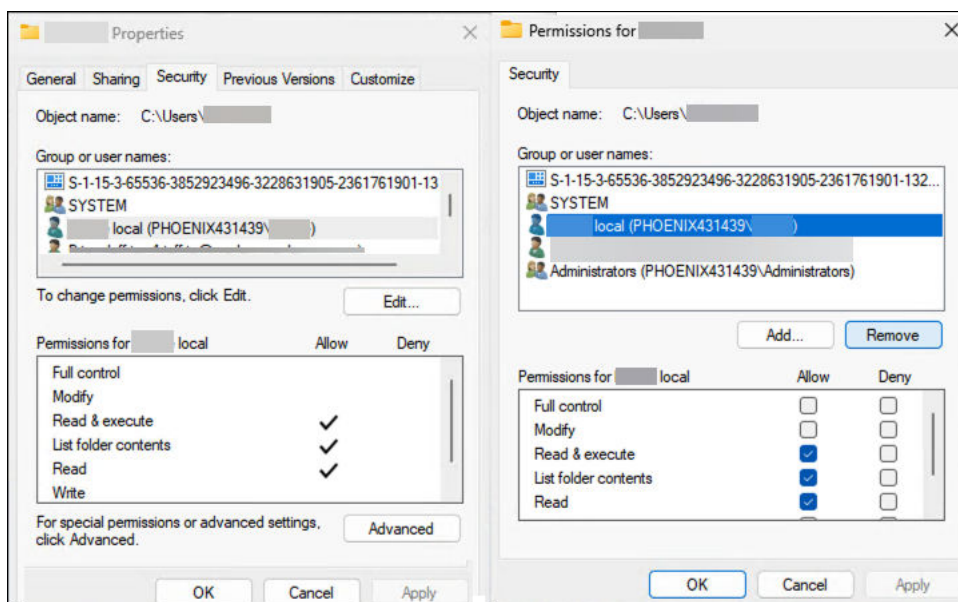


Ignore any errors as the focus is on the path to `AppData\Roaming\DBTools`.  
Permissions are as shown in the following figure:



Log in as local user and navigate to `<domain user>\AppData\Roaming`, and then delete `DBTools`.

Log in as domain user and remove local account access to the domain account home directory.



3. Install SQL Developer for VS Code release 23.4.1.

## 2.2 Connecting to Your Database

A connection is a SQL Developer object that specifies the necessary information for connecting to a specific database as a specific user of that database. You must have at least one database connection (existing or created) to use SQL Developer for VS Code.

You can connect to any target Oracle database schema using standard Oracle database authentication. Once connected, you can perform operations on objects in the database.

The actions that you can perform for connections are:

- **Add:** To create a new connection. Click the **Add** icon next to Connections, enter the connection information and click **Connect**. For more information, see [Creating a Connection](#).
- **Edit:** To edit an existing connection. In the Connections panel, right-click the connection name and select **Edit**. Change any connection information except the connection name, and click **Save** or **Connect**.
- **Clone:** To create a new connection when one or more connections already exist. In the Connections panel, select an existing connection, right-click and click **Clone**. Change the Connection name to the desired name, edit other connection information as needed, and click **Save** or **Connect** to create the new connection.
- **Refresh:** To update the connection to include any changes that were made. Click the Refresh icon next to the connection name to refresh the connection.
- **Open SQL Worksheet:** To open a SQL Worksheet pane for the connection. Right-click the connection name, and select **Open SQL Worksheet**. See [Using the SQL Worksheet](#)
- **Open SQLcl:** To start the SQLcl command line in the Terminal tab for the opened database connection. Right-click the connection name, and select **Open SQLcl**.
- **Reconnect:** To reconnect to a connection where the session has been terminated. Right-click the name in the Connections panel, and select **Reconnect**.
- **Disconnect:** To disconnect from the current connection. Right-click the name in the Connections panel, and select **Disconnect**.

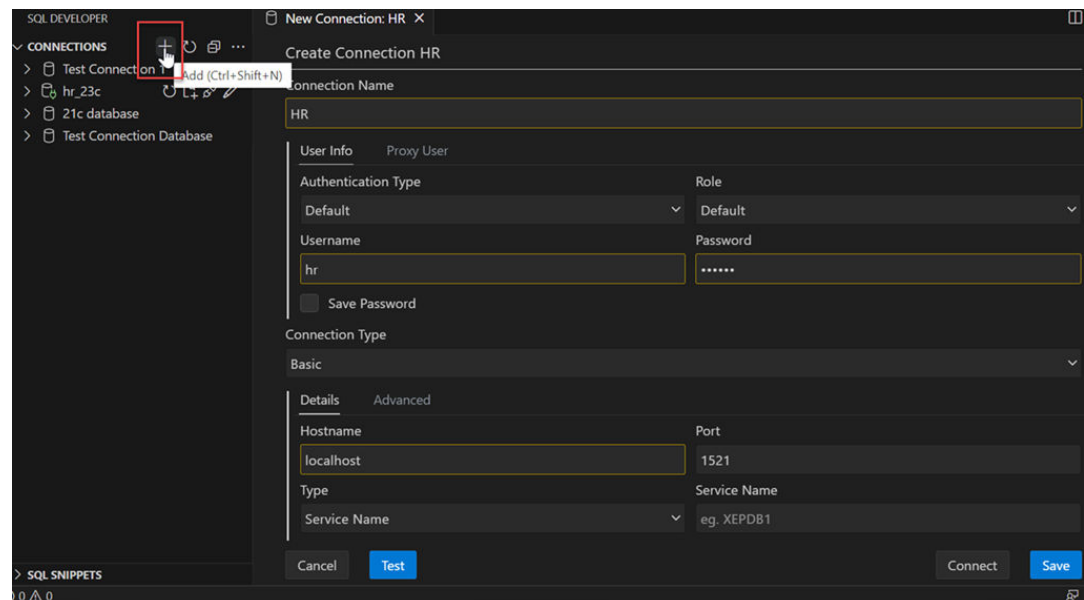
- **Delete:** To delete a connection (that is, delete it from SQL Developer, not merely disconnect from the current connection), right-click the connection name in the Connections panel display and select **Delete**. Deleting a connection does not delete the user associated with that connection.

## 2.2.1 Creating a Connection

Perform the following steps to create a new connection:

1. In the Connections panel, click the **Add** icon.

The Create Connection pane appears.



2. Enter the fields as follows:

**Connection Name:** An alias for a connection to the database using the information that you enter. (The connection name is not stored in the database, and the connection is not a database object.) Suggestion: Include the database name (SID) and user name in the connection name. Example: personnel\_joe for connecting to the personnel database as user Joe.

### User Info Tab

- **Role:** The set of privileges to be associated with the connection. For a user that has been granted the SYSDBA system privilege, you can specify a connection that includes the privilege.
- **Username:** Name of the database user for the connection. This user must have sufficient privileges to perform the tasks that you want to perform while connected to the database, such as creating, editing, and deleting tables, views, and other objects.
- **Password:** Password associated with the specified database user.
- **Save Password:** If this option is checked, the password is saved with the connection information, and you will not be prompted for the password on subsequent attempts to connect using this connection.
- **Connection Type:** Select Basic, TNS, Cloud Wallet, or Custom JDBC URL. The display of fields changes to reflect any change in connection type. For any Oracle

connection type, there is an **Advanced** tab that you can use to set custom JDBC properties.

– **Basic Connection Type**

- \* **Hostname:** Host system for the Oracle database.
- \* **Port:** Listener port.
- \* **Type:** Database name.
- \* **Service Name:** Network service name of the database (for a remote database connection over a secure connection).

– **TNS Connection Type**

- \* **Network Alias:** Oracle Net alias for the database.
- \* **TNS File Location:** Displays the directory where your TNSNAMES.ORA file is located. Click the **Edit in Settings** link to add or change the location.
- \* **Connect Identifier:** Oracle Net connect identifier.

– **Cloud Wallet Connection Type**

This connection type is relevant for Oracle Cloud connections that use Oracle Wallet.

- \* **Configuration File:** Client credentials zip file downloaded from the Cloud service console.
- \* **Service:** Service name in the client credentials file. This field is automatically prefilled after the client credential file is selected.
- \* **Proxy tab:** Cloud Wallet connections support a custom proxy.

– **Custom JDBC Connection Type**

- \* **Custom JDBC URL:** URL for connecting directly from Java to the database, it overrides any other connection type specification. If you are using TNS or a naming service with the OCI driver, you must specify this information:  
Example:

```
jdbc:oracle:thin:scott/@localhost:1521:orcl
```

Note that in this example, the "@" is required, and the user will be prompted to enter the password.

3. Click **Test** to test the database connection before opening it.
4. Click **Save** to save the connection details, or click **Connect** to open the connection.

# 3

## Using SQL Developer for VS Code

This chapter covers the following topics:

### Topics:

- Working with Database Objects
- Using Filters
- Entering and Modifying Data
- Using the SQL Worksheet
- Running Functions and Procedures
- Using Preferences

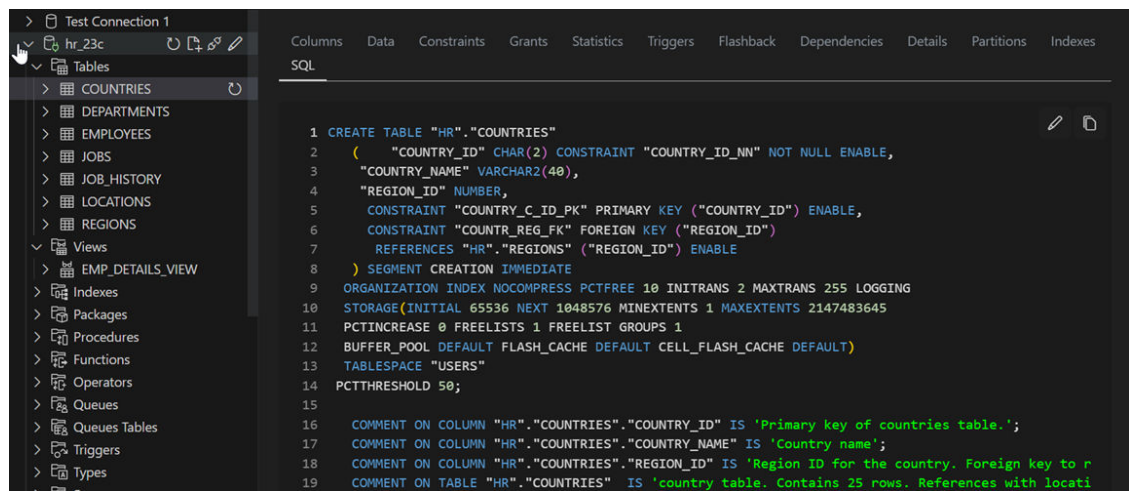
### 3.1 Working with Database Objects

The SQL Developer for VS code interface uses the left side for navigation to find and select objects, and the right side to display information about selected objects.

In the Connections panel, you can browse, edit and delete objects.

To search for an object within an object type, for example, a specific table, click **Tables** and type the name of the object. Even as you type, objects matching the letters entered are highlighted.

Click a database object to open it in the right panel. A tabular display of the object's properties are displayed. In the following figure, click the SQL tab to see the corresponding SQL source code for the COUNTRIES table.



The object types available are:

- Tables
- Views
- Duality Views
- Indexes
- Functions
- Procedures
- Packages
- Triggers
- Types
- Sequences
- Synonyms (Public and Private)
- Other Users

### 3.1.1 Tables

You can perform the following operations on a table by right-clicking the table name in the Connections navigator and selecting an item from the menu:

- **Open:** Opens the table in the right panel.
- **Table:** Table actions include Rename, Copy (create a copy using a different name), Drop (delete the table), Truncate (delete existing data without affecting the table definition), Lock (set the table lock mode: row share, exclusive, and so on), Comment (descriptive comment explaining the use or purpose of the table), Parallel (change the default degree of parallelism for queries and DML on the table), No Parallel (specify serial execution), Count Rows (return the number of rows), and Generate Table API (generate statements for a PL/SQL procedure to perform operations on the table).
- **Column:** Column actions include Comment (descriptive comment about a column), Add, Drop, Rename and Normalize.
- **Index:** Options include Create (create an index on specified columns), Create Text (create an Oracle Text index on a column), Create Text (create a function-based index on a column), and Drop.
- **Constraint:** Options include Enable or Disable Single, Drop (delete a constraint), Add Check (add a check constraint), Add Foreign Key, and Add Unique.
- **Statistics:** Options include Gather Statistics (compute exact table and column statistics and store them in the data dictionary) and Validate Structure (verifies the integrity of each data block and row, and for an index-organized table also generates the optimal prefix compression count for the primary key index on the table). Statistics are used by the Oracle Database optimizer to choose the execution plan for SQL statements that access analyzed objects.
- **Storage:** Options include Shrink Table (shrink space in a table, for segments in tablespaces with automatic segment management) and Move Table (to another tablespace). The Shrink Table options include Compact (only defragments the segment space and compacts the table rows for subsequent release, but does not readjust the high water mark and does not release the space immediately) and Cascade (performs the same operations on all dependent objects of the table, including secondary indexes on index-organized tables).

- **Trigger:** Options include Create, Create PK from Sequence (create a before-insert trigger to populate the primary key using values from a specified sequence), Enable or Disable All, Enable or Disable Single, and Drop (delete the trigger).

You can perform the following operations on a column in a table by right-clicking the column name in the Connections navigator and selecting an item from the menu:

- **Rename:** Renames the column.
- **Drop:** Deletes the column (including all data in that column) from the table.
- **Comment:** Adds a descriptive comment about the column.
- **Encrypt** (for Oracle Database Release 10.2 and higher, and only if the Transparent Data Encryption feature is enabled for the database): Displays a dialog box in which you specify a supported encryption algorithm to be used for encrypting all data in the column. Current data and subsequently inserted data are encrypted.
- **Decrypt** (for Oracle Database Release 10.2 and higher, and only if the Transparent Data Encryption feature is enabled for the database): Decrypts data in the column that had been encrypted, and causes data that is subsequently inserted not to be encrypted.
- **Normalize:** Creates a new table using the distinct values in the specified column. You must specify names for the new table and its primary key column, as well as a sequence name and trigger name.

## 3.1.2 Views

You can perform the following operations on a view by right-clicking the view name in the Connections panel and selecting an item from the menu:

- **Open:** Opens the view in the right pane.
- **Rename:** Renames the view.
- **Drop:** Deletes the view.
- **Compile:** Recompiles the view, to enable you to locate possible errors before runtime. You may want to recompile a view after altering one of its base tables to ensure that the change does not affect the view or other objects that depend on it.

To create a view:

1. Right-click the **Views** node and select **Create (simple)**.
2. Enter **View Name** and **SQL Query**.
3. Click **Apply**.

## 3.1.3 Duality Views

See [Working with JSON-Relational Duality Views](#)

## 3.1.4 Indexes

You can perform the following operations on an index by right-clicking the index name in the Connections navigator and selecting an item from the menu:

- **Open:** Opens the index in the right pane.
- **Drop:** Deletes the index.



- **Rebuild:** Recreates the index or one of its partitions or subpartitions. If the index is unusable, a successful rebuild operation makes the index usable. For a function-based index, rebuilding also enables the index; however, if the function on which the index is based does not exist, the rebuild operation fails.
- **Rename:** Changes the name of the index.
- **Make Unusable:** Prevents the index from being used by Oracle in executing queries. An unusable index must be rebuilt, or dropped and re-created, before it can be used again.
- **Coalesce:** Merges the contents of index blocks, where possible, to free blocks for reuse.
- **Compute Statistics:** For a function-based index, collects statistics on both the index and its base table using the DBMS\_STATS package. Such statistics will enable Oracle Database to correctly decide when to use the index.
- **Rebuild Index Partition:** Rebuilds a specified index partition.
- **Drop Index Partition:** Drops (deletes) a specified index partition.

### 3.1.5 Functions

You can perform the following operations on a function by right-clicking the function name in the Connections navigator and selecting an item from the menu:

- **Open:** Opens the function in the right pane.
- **Drop:** Deletes the function.
- **Grant:** Enables you to grant available privileges on the function to selected users.
- **Revoke:** Enables you to revoke available privileges on the function from selected users.

### 3.1.6 Packages

You can perform the following operations on a package by right-clicking the package name in the Connections navigator and selecting an item from the menu:

- **Open:** Opens the package in the right pane.
- **Run:** Lets you select a member in the package and run it.
- **Drop Package:** Deletes the package.

### 3.1.7 Procedures

You can perform the following operations on a procedure by right-clicking the procedure name in the Connections navigator and selecting an item from the menu:

- **Open:** Displays the procedure text so that you can view and edit it.
- **Run:** Displays the PL/SQL dialog box, and then executes the procedure.
- **Drop:** Deletes the procedure.

### 3.1.8 Triggers

Triggers are stored PL/SQL blocks associated with a table, a schema, or the database, or anonymous PL/SQL blocks or calls to a procedure implemented in PL/SQL or Java. Oracle Database automatically executes a trigger when specified conditions occur.

See [Oracle Database 2 Day Developer's Guide](#)

## 3.1.9 Types

A data type associates a fixed set of properties with the values that can be used in a column of a table or in an argument of a function or procedure. These properties cause Oracle Database to treat values of one data type differently from values of another data type. Most data types are supplied by Oracle, although users can create data types.

See [Oracle Database Concepts](#)

## 3.1.10 Sequences

Sequences are used to generate unique integers. You can use sequences to automatically generate primary key values.

See [Oracle Database 2 Day Developer's Guide](#)

## 3.1.11 Synonyms (Public and Private)

Synonyms provide alternative names for tables, views, sequences, procedures, stored functions, packages, materialized views, Java class database objects, user-defined object types, or other synonyms. The Connections navigator has a Synonyms node for all synonyms (public and private) owned by the user associated with the specified connection, and a Public Synonyms node for all public synonyms on the database associated with the connection.

See [Oracle Database 2 Day Developer's Guide](#)

## 3.1.12 Other Users

Database users are accounts through which you can log in to the database. In the Connections navigator, you can see the Other Users in the database associated with a connection, but the objects that you are allowed to see for each user are determined by the privileges of the database user associated with the current database connection.

# 3.2 Working with JSON-Relational Duality Views

A JSON-relational duality view exposes data stored in relational database tables as JSON documents. These documents are generated on demand. Duality views organize your data both relationally and hierarchically. This means that applications can access (create, query, modify) the same data as a set of JSON documents or as a set of related tables and columns, and both approaches can be employed at the same time.

For more information about JSON- Relational Duality Views, see [Oracle® Database JSON-Relational Duality Developer's Guide](#).

In the SQL Developer extension for VS Code, Duality View is treated as an object type and is available as a separate node in the Connections panel. The tasks that you can perform are:

- **Create** a duality view using the Duality View Builder.
- **Edit** a duality view.
- **Insert** a data record in a duality view.
- **Edit** a data record in a duality view.
- **Display** the JSON Data Guide Diagram for a duality view.

## 3.2.1 Create a Duality View

You can use the Duality View Builder to create a duality view.

### Note:

The tables used to define a duality view must satisfy certain [requirements](#). If these requirements are not met, an error is raised when you try to create the view.

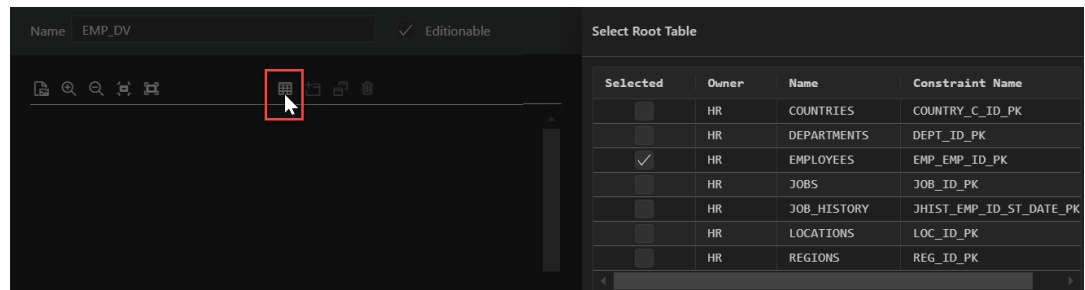
Also, see [Restrictions for JSON-Relational Duality Views](#).

1. In the Connections panel, right-click the **Duality Views** node and select **Duality View Builder**.

The Duality View Builder interface appears. It consists of three parts: the diagram panel, the preview panel, and the definition panel. Enter a name for the duality view in the **Name** field on top, and click **Save to File** to save and continue working at a later time.

### Diagram Panel

2. From the toolbar, select **Add Root Table**. In the following figure, the table `EMPLOYEES` is selected.

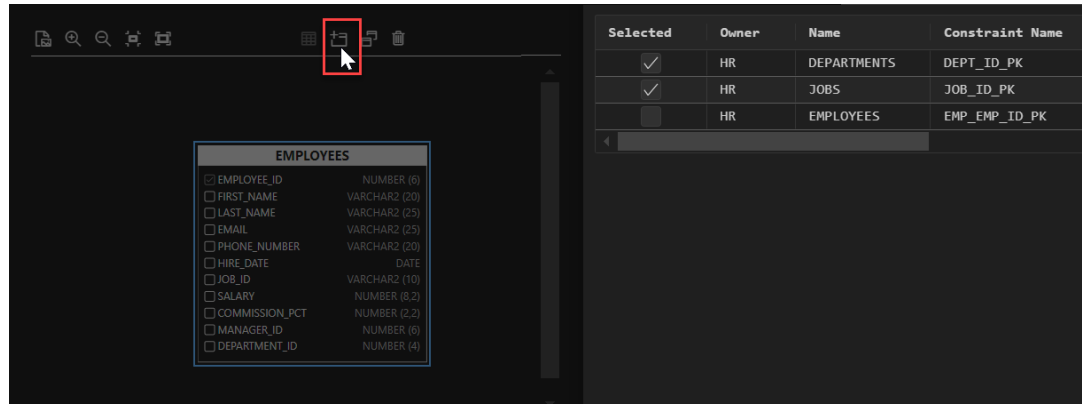


3. In the Select Root Table pane, select the checkbox for the root table that you want, and click **Apply**.

The selected table appears in the diagram pane. You can zoom in and zoom out and export to SVG format using the icons in the toolbar.

4. You can now select Parent and Child Tables. Select the table in the diagram (when selected, a blue border appears around the table) and from the toolbar, and select **Add Parent Table(s)**. Following this, if you want to add child tables, select the parent table and select **Add Child Table(s)** from the toolbar.

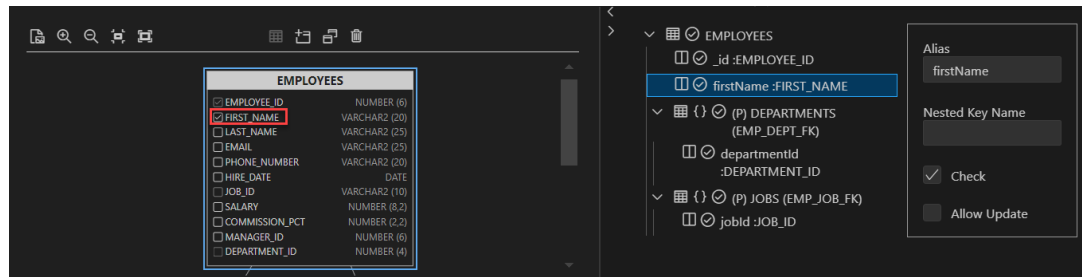
In the following figure, `Departments` and `Jobs` are selected as parent tables.



### Preview Panel

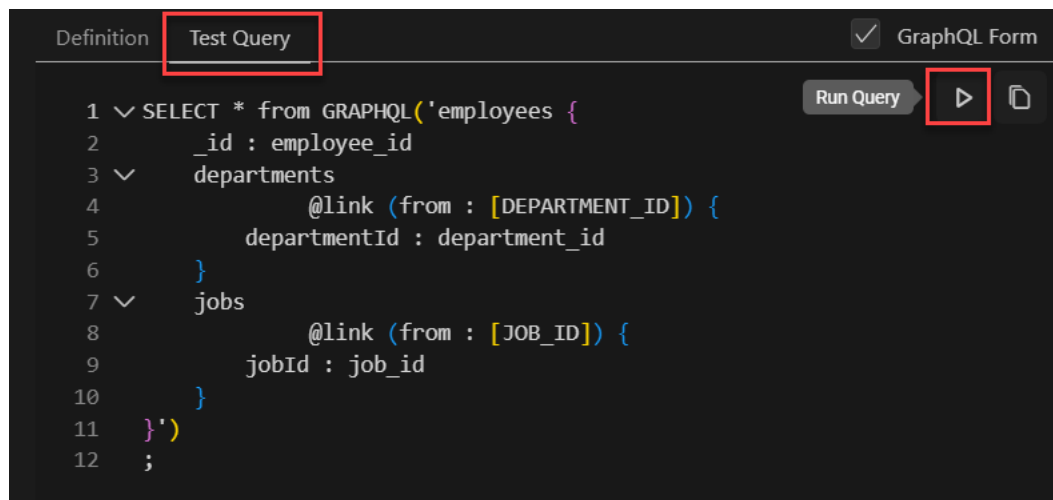
- You can select additional columns for the table by selecting the appropriate checkbox in the diagram panel. As you select, these changes instantly appear in the preview panel. Select an object in the preview panel to set additional properties such as Alias, Nested Key Name, Allow Update, Allow Insert, Allow Delete, Check, and Filter.

In the following figure, the `First_Name` column is selected in the diagram panel and it immediately appears in the preview panel. Select `First_Name` in the preview panel to set additional properties such as Nested Key Name, Check and Allow Update.



### Definition Panel

- In the Definition tab, the duality view definition is automatically generated in GraphQL format. If GraphQL is not selected, then the definition is displayed in SQL statement format.
- To test the SELECT statement, select the **Test Query** tab and click the **Run Query** icon.



The output is displayed below the definition panel.

### Create Duality View

- After confirming the output, you can create the duality view. In the top right corner, click **Create Duality View**.

To view the newly created duality view, refresh the Connections panel and expand the Duality View node. Click the duality view name to open it in the right panel.

## 3.2.2 Edit a Duality View

You can use the Duality View Builder to edit a duality view.

- In the Connections panel, expand the **Duality Views** node, right-click the name of the duality view to edit, and select **Edit**.

The duality view appears in the Duality View Builder interface.

- Some of the changes that you can make to the duality view are add or delete tables in the diagram panel, and add columns or set additional properties for objects in the preview panel.

For more information about how to make these changes, see [Create a Duality View](#).

## 3.2.3 Insert a Data Record in a Duality View

This section covers the steps to insert a data record in a duality view.

- In the Connections panel, expand the **Duality Views** node, and then click the duality view name to open it in the right panel.
- Select the **Data** tab.
- Click **Insert**.
- In the Insert panel, enter the value for the first property. Press the Enter key to move to the next line. When you enter quotation marks, the available properties that you can choose from are displayed in a list.

The screenshot shows the Oracle Duality View Builder interface. The 'Data' tab is selected, and the 'Insert' button is highlighted. The 'DATA' panel displays a list of records for the 'STUDENTSUBJECT\_OV' view. The 'Insert' panel shows the 'id' property being edited with the value '112'. A list of available properties is shown on the right, including 'Designation', 'Email', 'StudentName', 'SubjectDetails', and 'Teacher'.

id	StudentName	Email	Designation
100	Sally Kelly	sally.kelly@college.com	
101	John Byrne	john.byrne@college.com	
102	Kevin Doyle	kevin.doyle@college.com	
103	Leanne Murphy	leanne.murphy@college.com	
105	Jane Knowles	jane.knowles@college.com	
106	David Barnes	david.barnes@college.com	
107	Louise Caulfield	louise.caulfield@college.com	
108	Kate Jones	kate.jones@college.com	
109	Carl Hynes	carl.hynes@college.com	
110	Rachel Duggan	rachel.duggan@college.com	
111	Peter Sweeney	peter.sweeney@college.com	

If you add any new property that is not part of the schema, an error notification is displayed.

After you complete entering all the details, click **Save**.

- Click **Commit** to commit the changes to the database.

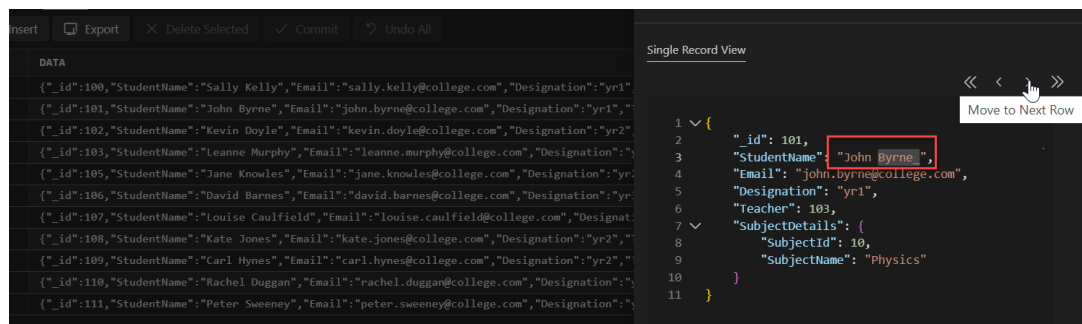
### 3.2.4 Edit a Data Record in a Duality View

This section covers the steps to edit a data record in a duality view.

- In the Connections panel, expand the **Duality Views** node, and then click the duality view name to open it in the right panel.
- Select the **Data** tab.
- Position the cursor on the row that you want to edit, right-click and select **Single Record View**.

Alternatively, click the **Edit** icon at the end of the row that you want to edit.

- In the Single Record View panel, click and type to complete the required changes.



To move to another record, you can use the **move to next row** or **move to previous row** icons.

#### Note:

When using the Single Record View option for a table with a column of JSON data type, note the following:

- In a duality view, the metadata-related fields (such as etag, asof) are not available for editing.
- For a regular table that has a column of JSON data type, this restriction does not hold and all the fields can be edited.
- If the result of a SELECT statement in the worksheet is a duality view table or a table with a JSON data type column, then the table remains read-only and cannot be edited.

- After you have completed all your changes, click **Save**.

A star symbol (\*) appears next to the row number. This indicates that the changes to the row have not yet been committed to the database.

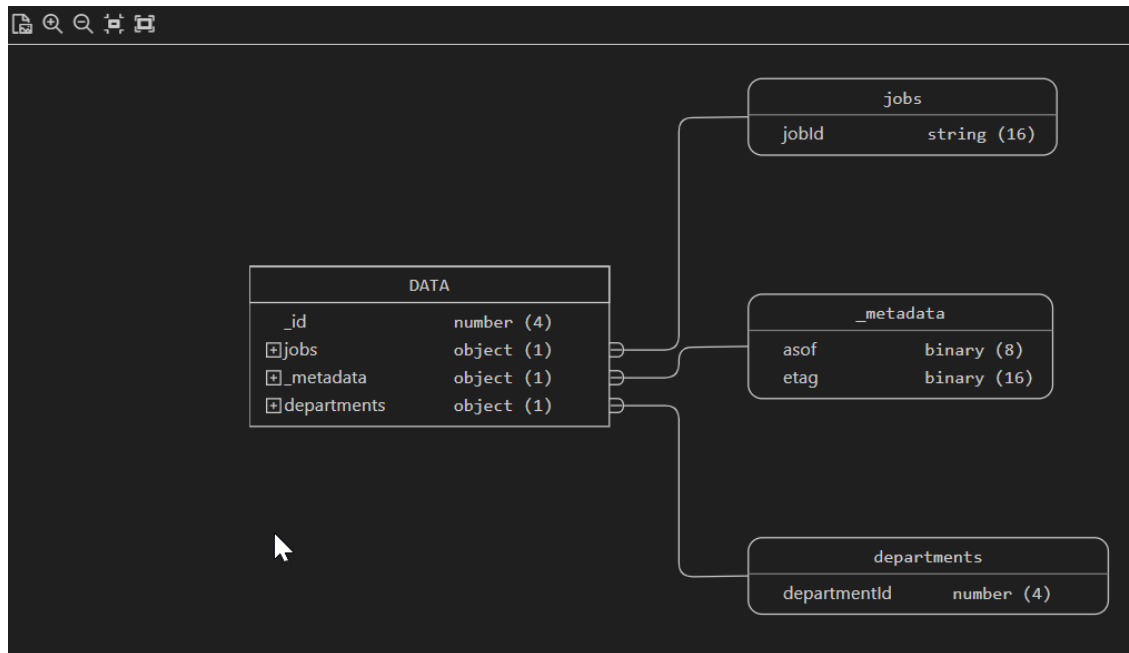
- Click **Commit** to commit the changes to the database.

### 3.2.5 Display the JSON Data Guide Diagram for a Duality View

The JSON data guide diagram represents the JSON schema for a duality view.

In the Connections panel, expand the **Duality Views** node, right-click the name of the duality view to edit, and select **Show JSON Data Guide** to display the diagram.

The following figure displays the JSON data guide diagram for the `EMP_DV` duality view that was created in [Create a Duality View](#).



## 3.3 Using Filters

Filters enable you to control the objects that appear in the Connections navigator display. The filter can be applied on the following:

- Schema (Connection Tree Node or User Tree Node )
- Object Type (Table,View, Procedure and so on)

To access the Filter pane, right-click a connection node or an object type node (such as Tables) in the Connections navigator and select **Apply Filter**. Use the pane to limit the number of objects of that type that are displayed, according to one or more filter criteria that you specify. For each criterion, specify the following:

- Name (list always includes NAME, other criteria depend on the object type)
- Operator (for example, LIKE)
- Value for comparison (for example EM%)
- Case-sensitive option for character data comparison

For example, to display only tables with names that start with `EM`, specify `NAME`, `LIKE`, and `EM%` (with the percent sign as a wildcard character).

The following attributes are applicable for object type filters.

**Ignore Schema Filter** (object type node filters): If this option is checked, any filter criterion specified at the connection level is ignored. Only the object type node filter criteria are applied.

**Include Synonym** (object type node filters): If this option is checked, synonyms for objects of this object type are included.

To add another filter criterion, click the Add (+) icon. To delete a criterion, select it and click the Delete (X) icon. To move a criterion up or down in the list, select it and use the arrow icons.

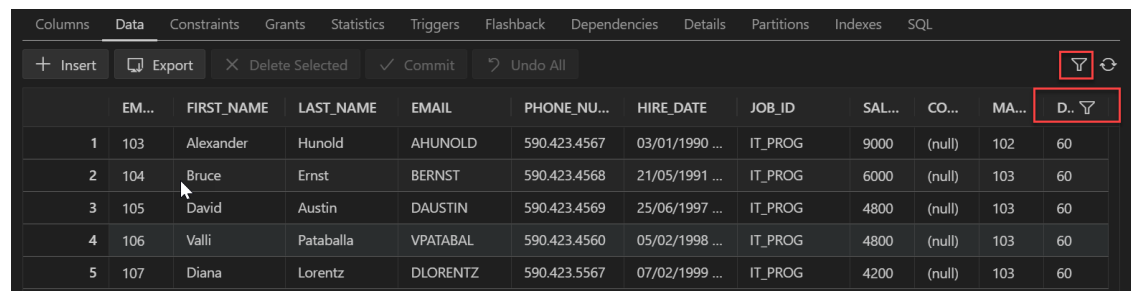
To apply the filter criteria to the Connections navigator display, click **OK**.

To remove the effects of applying a filter, right-click the object type node in the Connections navigator display and select **Clear Filter**.

## 3.4 Entering and Modifying Data

You can enter data into tables and views and also edit and delete existing data. To do any of these operations, select the object in the Connections panel, and then click the Data tab in the table detail display. If you click one of the other tabs, Columns, Constraints, Grants, Statistics, Triggers, and so on, you can view the information and perform relevant context menu (right-click) operations.

The following figure shows the Data pane for a table named EMPLOYEES, with a filter applied to show only those employees whose department\_id is 60. A filter icon appears next to the department\_id column name in the table.



	EM...	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NU...	HIRE_DATE	JOB_ID	SAL...	CO...	MA...	D..
1	103	Alexander	Hunold	AHUNOLD	590.423.4567	03/01/1990 ...	IT_PROG	9000	(null)	102	60
2	104	Bruce	Ernst	BERNST	590.423.4568	21/05/1991 ...	IT_PROG	6000	(null)	103	60
3	105	David	Austin	DAUSTIN	590.423.4569	25/06/1997 ...	IT_PROG	4800	(null)	103	60
4	106	Valli	Pataballa	VPATABAL	590.423.4560	05/02/1998 ...	IT_PROG	4800	(null)	103	60
5	107	Diana	Lorentz	DLORENTZ	590.423.5567	07/02/1999 ...	IT_PROG	4200	(null)	103	60

The Data tab provides the following options:

- **Insert** adds an empty row at the beginning of the table, for you to enter new data.
- **Export** enables you to export some or all of the table data to a file or to the system clipboard, in any of the following formats: XML (XML tags and data), CSV (comma-separated values including a header row for column identifiers), SQL Insert (INSERT statements), or SQL Loader (SQL\*Loader control file). After you select a format, the Database Export (Unload Database Objects and Data) wizard is displayed.
- **Delete Selected** marks the selected rows for deletion. The actual deletion does not occur until you commit changes.
- **Commit** ends the current transaction and makes permanent all changes performed in the transaction.
- **Undo All** reverts back to the previous state before any changes were made in the current transaction.



- **Filter** icon enables you to add a filter to limit the display of data. Enter the column name, operator and value, and click **Add**. The filter is added below. Add more filters if needed. Click **Apply** to apply the filters.

- **Refresh** icon queries the database to update the data display. If a filter is specified, the refresh operation uses the filter.

In the data grid, the context menu (right-click) includes the following commands:

- **Single Record View** displays the Single Record View dialog box, which enables you to edit data for a table or view, one record at a time.
- **Count Rows** displays the number of rows in the table.
- **Export** enables you to export some or all of the table data to a file or to the system clipboard, in any of the following formats: XML (XML tags and data), CSV (comma-separated values including a header row for column identifiers), SQL Insert (INSERT statements), or SQL Loader (SQL\*Loader control file). After you select a format, the Database Export (Unload Database Objects and Data) wizard is displayed.

When you right-click a column name, the context menu commands are:

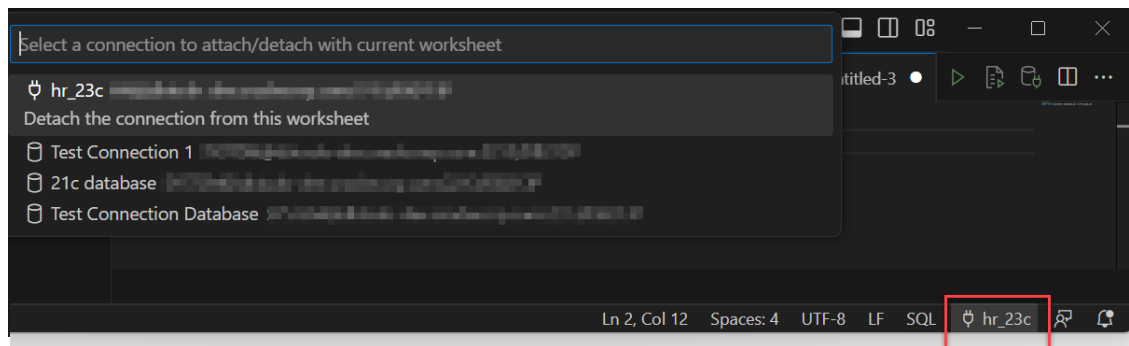
- **Auto-fit All Columns** adjusts the width of all columns according to your specification (by column header, by column data, or best fit).
- **Auto-fit Selected Columns** adjusts the width of the selected columns according to your specification (by column header, by column data, or best fit).
- **Columns** enables you to reorder, hide or show columns.
- **Sort** enables you to sort columns in ascending or descending order.

## 3.5 Using the SQL Worksheet

You can use the SQL Worksheet to enter and execute SQL, PL/SQL, and SQLcl statements. You can specify any action that can be processed by the database connection associated with the worksheet, such as creating a table, inserting data, creating and editing a trigger, selecting data from a table, and saving that data to a file.

You can display a SQL Worksheet by right-clicking a connection name in the Connections panel and selecting **Open SQL Worksheet**.

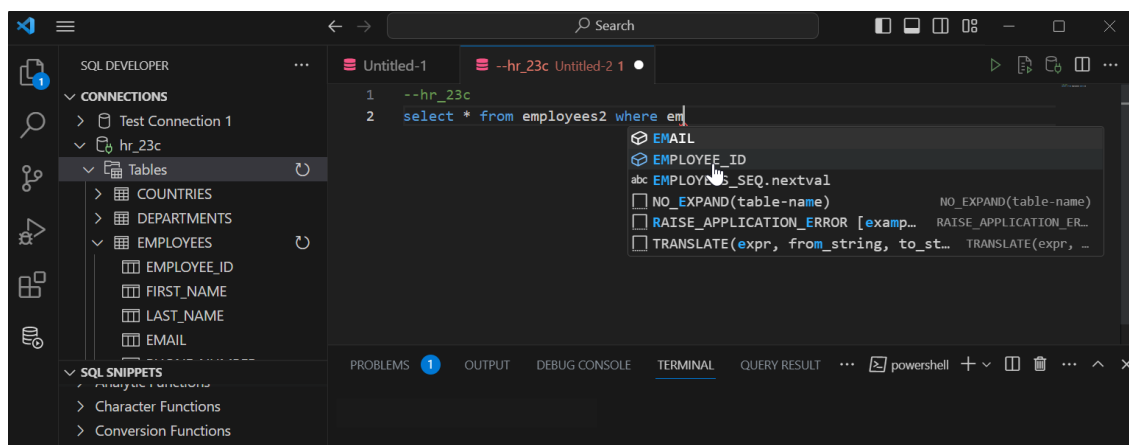
When SQL Worksheet is open and if you also have existing SQL files open, you can attach a connection by clicking the connection icon in the lower right corner. Once a connection is associated with your editor or file, you see the name of your connection displayed in the lower right corner.



In the editor, you can enter one or more SQL or statements that you intend to execute. For multiple statements, each non-PL/SQL statement must be terminated with either a semicolon or (on a new line) a slash (/), and each PL/SQL statement must be terminated with a slash (/) on a new line. SQL keywords are automatically highlighted.

You can drag some kinds of objects such as tables or views from the Connections navigator and drop them into the editor pane. When you do this, the following options appear: Object Name, Select, Insert, Delete, Update. If you select SELECT, a SELECT statement is constructed with all columns in the table or view. You can then edit the statement, for example, modifying the column list or adding a WHERE clause.

When you press **Ctrl+Space**, a context-sensitive popup window appears. This provides you with a list of possible completions at the insertion point that you can use to autocomplete code that you are editing. This list is based on the code context at the insertion point. To exit at any time, press **Esc** or continue typing.



SQL Worksheet has the following icons at the top right corner:

- **Run Statement (Ctrl+Enter)** executes the statement at the mouse pointer in the SQL Worksheet. The SQL statements can include bind variables and substitution variables of type VARCHAR2. A pop-up box is displayed for entering variable values. The output is displayed under the Query Result tab in the lower pane.
- **Run Script (F5)** executes all statements in the SQL Worksheet using the Script Runner. The SQL statements can include substitution variables (but not bind variables) of type VARCHAR2. A pop-up box is displayed for entering substitution variable values. The output is displayed under the Script Output tab in the lower pane.
- **Run in SQLcl (Ctrl+Shift+Enter)** executes the statement or script by opening a SQLcl command line session and displaying the output.
- **Explain Plan (F10)** generates the execution plan for the statement (internally executing the EXPLAIN PLAN statement). The results appear under the Explain tab in the lower pane.

### 3.5.1 SQLcl Commands Supported in the SQL Worksheet

The SQL Worksheet supports SQLcl commands. SQLcl commands must be interpreted by the SQL Worksheet before being passed to the database. Any commands that are not supported by the SQL Worksheet are ignored and not passed to the database.

For information about SQLcl commands, you can enter the help command. For information about a specific command or topic, include it as the parameter (for example, help @, help exit, or help reserved words). If the command is not supported, or if there are restrictions or usage notes, the help display includes this information.

### 3.5.2 Script Runner

With Script Runner, you have access to commands such as @, @@, CONNECT, EXIT, QUIT, UNDEFINE, WHENEVER, and substitution variables. For example, to run a script named c:\myscripts\mytest.sql, type @c:\myscripts\mytest in the editor, and select the Run Script icon.

The following considerations apply to using the script runner:


- You cannot use bind variables. (However, you can use bind variables of type VARCHAR2, NUMBER, and DATE.)
- For substitution variables, the syntax &&variable assigns a permanent variable value, and the syntax &variable assigns a temporary (not stored) variable value.
- For EXIT and QUIT, commit is the default behavior, but you can specify rollback. In either case, the context is reset, for example, WHENEVER command information and substitution variable values are cleared.
- DESCRIBE works for most, but not all object types.

### 3.5.3 Explain Plan

The Execute Explain Plan icon generates the execution plan, which you can see by clicking the Explain Plan tab. The execution plan is the sequence of operations that will be performed to execute the statement.

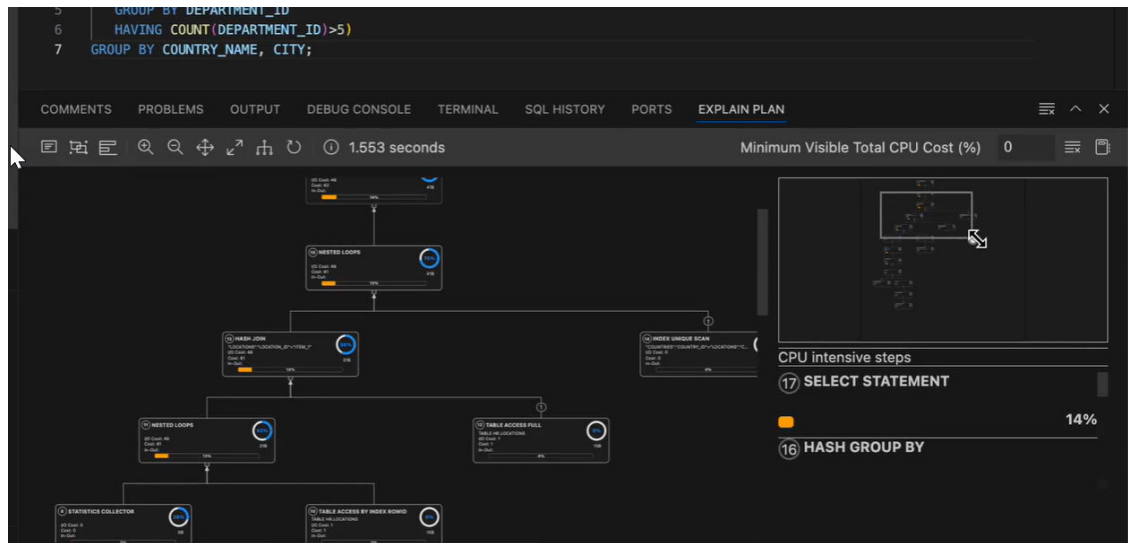
The Explain Plain diagram view is a graphical representation of the contents of `PLAN_TABLE`, which is the default table for the results of the `EXPLAIN PLAN` statement.

By default, three levels of steps are visible in the diagram. You can use the **+/-** signs at the bottom of each step (available when the step has children) to expand or collapse. To view all

steps in the diagram, use  **Expand All** in the toolbar.

The diagram also provides the following details:

- Cardinality (number on the arrow to the parent step), which is the number of rows processed
- Operation and options applied in that step
- Execution order, which is the sequential number in the order of execution
- Access predicates CPU cost in percentage (orange bar)
- Total CPU cost for the step in percentage (blue circle)
- Estimated I/O Cost, Bytes processed and Cost metrics



You see a brief description pop-up when you hover over any of the statistics in a step.

The icons in the toolbar are:

- **Text View:** Displays the execution steps in a plain text format.  
For the Text View, you can select the level of detail displayed in explain plan by selecting the appropriate option in [Using Preferences](#).
- **Diagram View:** Displays the steps in a flowchart format.
- **Zoom In, Zoom Out:** If a step is selected in the diagram, clicking the Zoom In icon ensures that it remains at the center of the screen.
- **Fit Screen:** Fits the entire diagram in the visible area.
- **Actual Size:** Sets the zoom factor to 1.
- **Expand All:** Displays all steps in the diagram.

- **Reset Diagram:** Resets the diagram to the initial status, that is, only three levels of steps are displayed.
- **Show Info:** Shows the `SELECT` statement used by the Explain Plan functionality.
- **Min Visible Total CPU Cost(%):** Defines the threshold to filter steps with total CPU cost equal or more than the provided value.  
Enter a value between 0 and 100. There is no filtering for 0.
- **Plan Notes:** Displays the Explain Plan notes.

### Properties


Double-click or press **Enter** on a selected step to open the Properties slider, which provides more information about that step. See `PLAN_TABLE` in *Oracle Database Reference* for a description of each property.

The Properties slider shows:

- All information for that step extracted from `PLAN_TABLE` in a tabular format. Nulls are excluded.  
You can select **JSON** to view the properties in JSON format.
- Information from `OTHER_XML` column of `PLAN_TABLE`.  
The information is displayed in JSON format.

### Navigation

- Press the **Tab** key to move through the steps in the execution order. The selected step has a blue border around it.  
To move in the reverse direction, press the **Shift + Tab** keys.  
If no step is selected, pressing the **Tab** key selects the step with execution number 1.
- Depending on the zoom level, use horizontal and vertical scrollbars to view different parts of diagram.  
Click the left mouse button and hold it to pan the diagram around up and down.

Use the  icon at the bottom right to scroll to the top of the diagram.

### Diagram Navigator

The Diagram Navigator is at the top right corner and represents a smaller copy of the diagram. The rectangle border allows zoom-in and zoom-out operations and moves to show different parts of the diagram.

The diagram navigator shows a list with steps having more than 1% CPU cost in descending order. Click a step in the list to navigate to the same step in the diagram, enabling you to see it in the context of the other steps.

## 3.5.4 SQL History

You can click the SQL History tab in the lower right pane to view a list of SQL statements and scripts that you have executed, and optionally double-click one or more statements to have them either replace the statements currently on the SQL Worksheet or be added to the statements currently on the SQL Worksheet. The list is at first organized by date, and then by connection name.

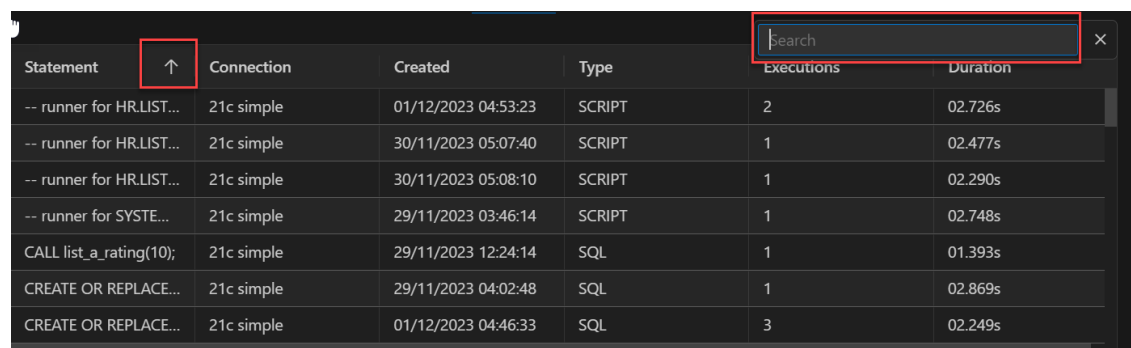
The SQL history list will not contain any statement that can include a password. Such statements include (but are not necessarily limited to) CONNECT, ALTER USER, and CREATE DATABASE LINK.

You can control the maximum number of statements in the history by setting the SQL History Limit in Preferences.

When a SQL statement in the SQL History list is selected, it automatically opens the PL/SQL subprogram in the SQL Worksheet pane.

To **sort** the statements in the list, double-click the column header that you want to sort on and the statements are sorted in ascending order. Double-click the header again to sort in descending order. To remove sorting applied to the column, double-click the column header again.

To display the **Search** functionality, in the SQL History pane, press **Ctrl+F** (**Cmd+F** for MacOS).

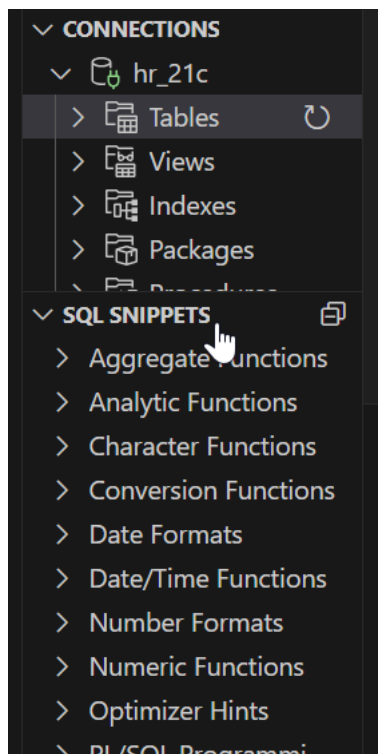


Statement	Connection	Created	Type	Executions	Duration
-- runner for HR.LIST...	21c simple	01/12/2023 04:53:23	SCRIPT	2	02.726s
-- runner for HR.LIST...	21c simple	30/11/2023 05:07:40	SCRIPT	1	02.477s
-- runner for HR.LIST...	21c simple	30/11/2023 05:08:10	SCRIPT	1	02.290s
-- runner for SYSTE...	21c simple	29/11/2023 03:46:14	SCRIPT	1	02.748s
CALL list_a_rating(10);	21c simple	29/11/2023 12:24:14	SQL	1	01.393s
CREATE OR REPLACE...	21c simple	29/11/2023 04:02:48	SQL	1	02.869s
CREATE OR REPLACE...	21c simple	01/12/2023 04:46:33	SQL	3	02.249s

## 3.5.5 Using Snippets to Insert Code Fragments

Snippets are code fragments, such as SQL functions, Optimizer hints, and miscellaneous PL/SQL programming techniques. Some snippets are just syntax, and others are examples. You can insert and edit snippets when you are using the SQL Worksheet or creating or editing a PL/SQL function or procedure.

Snippets are displayed in the lower part of the Connections panel. Click the Expand icon to view all the available snippets in each group (such as Aggregate Functions or Character Functions). In most cases, the fragments in each group do not represent all available objects in that logical grouping, or all formats and options of each fragment shown. For complete and detailed information, see the Oracle Database documentation.



To insert a snippet into your code in a SQL Worksheet or in a PL/SQL function or procedure, drag the snippet from the left bottom pane and drop it into the desired place in your code. Edit the syntax so that the SQL function is valid in the current context.

For example, you could type `SELECT` and then drag `CONCAT(char1, char2)` from the Character Functions group. Then, edit the `CONCAT` function syntax and type the rest of the statement, such as in the following:

```
SELECT CONCAT(title, ' is a book in the library.') FROM books;
```

## 3.5.6 Connection Management

Starting with release 24.1.1, opening a new SQL Worksheet creates a new, dedicated connection to the database. This means that long-running queries in your SQL Worksheet do not block other database requests.

You can control this behaviour using the `Session per attached worksheet` setting in Preferences.

1. From the **File** menu, go to **Preferences** and then select **Settings** from the sub-menu.
2. Under **User**, expand **Extensions** and then expand **Oracle SQL Developer Extension for VS Code**.
3. In the right panel, under **Database Connections**, in the **Session per attached worksheet** field, select **off** from the drop-down list to remove this setting.

The default setting is `on`.

## 3.6 Running Functions and Procedures

You can open and run PL/SQL subprograms (functions and procedures).

- To open a subprogram, click the name in the Connections panel to open, or right-click and select **Open**.
- To compile a subprogram, open it in the SQL Worksheet, and then select the **Compile** icon in the top right corner.

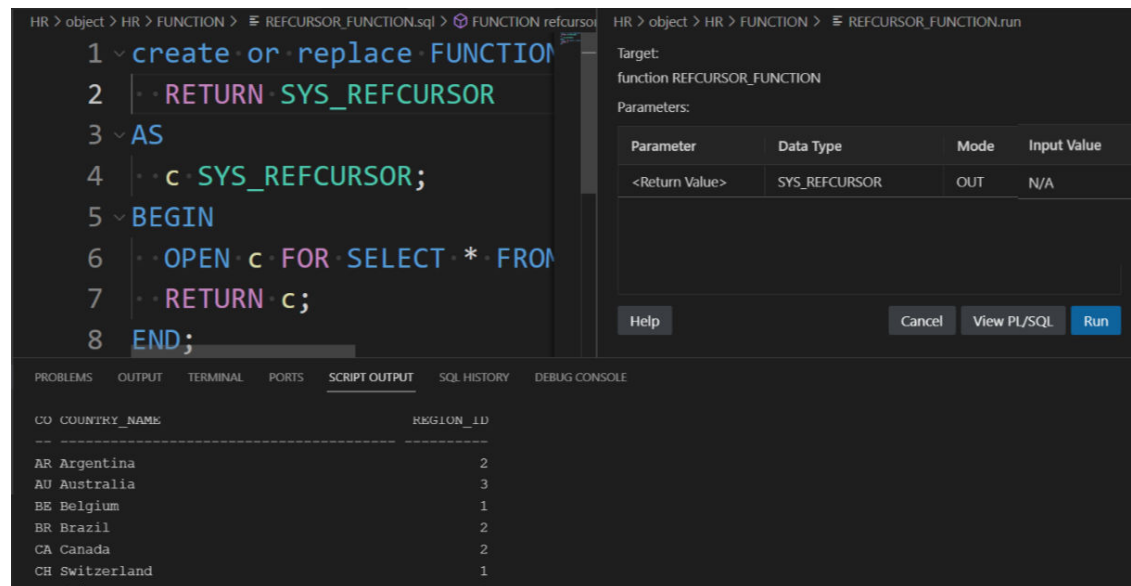
To debug a subprogram, open it in the SQL Worksheet, and then select the **Compile for Debug** icon.

If there are any issues during compilation, these are shown under the Script Output tab in the lower pane.

- To run a subprogram, open it in the SQL Worksheet and then select the **Run** icon. You can then view the PL/SQL code and edit if needed, and then click **Run**. The results are displayed in the Script Output pane below.

The Run, Compile and Compile for Debug icons are also available when opening PL/SQL files with any of the following extensions, KLR, PKB, PKH, PKS, PLB and PLS, from your local device.

In the following figure, the REFCURSOR\_FUNCTION is run and the output is displayed below.



## 3.7 Using Preferences

To modify SQL Developer preferences, from the **File** menu, select **Preferences** and then **Settings**. Under **User**, expand **Extensions** and select **Oracle SQL Developer Extension for VS Code**.

The preferences available are:

### Database Connections



- **Tns Configuration Path:** Enter the location of the tnsnames.ora file.
- **Startup Script Path:** Specify the location for the startup script to run when an Oracle database connection is opened. The default location is the default path for scripts.
- **Connections Tree**  
Folders Fetch Size: Specifies the maximum number of rows to be fetched at a time into the data grid display for nodes such as Tables, Views, Materialized Views,

### Database NLS

The NLS settings specify values for globalization support parameters, such as the language, territory, sort preference, and date format. These parameter values are used for SQL Developer session operations, such as for statements executed using the SQL Worksheet and for the National Language Support Parameters report. Specifying values in this preferences pane does not apply those values to the underlying database itself. To change the database settings, you must change the appropriate initialization parameters and restart the database.

Note that SQL Developer does not use default values from the current system for globalization support parameters; instead, SQL Developer, when initially installed, by default uses parameter values that include the following:

```
NLS_LANG, "ENGLISH"  
NLS_TERR, "AMERICA"  
NLS_CHAR, "AL32UTF8"  
NLS_SORT, "BINARY"  
NLS_CAL, "GREGORIAN"  
NLS_DATE_LANG, "ENGLISH"  
NLS_DATE_FORM, "DD-MM-RR"
```

### SQL History

- **History Limit:** Maximum number of statements that can be stored in SQL History.

### Telemetry

- **Allow automated usage reporting to Oracle:** Determines whether you consent to usage reporting. If you consent, automated reports can occasionally be sent to Oracle describing the product features in use. No personally identifiable information will be sent and the report will not affect performance.

### SQL Worksheet

- **Explain Plan:** Determines the level of details displayed in the Explain Plan.

# 4

## Tutorial: Creating Objects for a Small Database

Create objects for a simplified library database, which will include tables for books, patrons (people who have library cards), and transactions (checking a book out, returning a book, and so on).

The tables are deliberately oversimplified for this tutorial. They would not be adequate for any actual public or organizational library.

This tutorial assumes that you have a database connection to a database user that will own the tables and other objects that you create.

The major steps are:

- [Create a Table \(BOOKS\)](#)
- [Create a Table \(PATRONS\)](#)
- [Create a Table \(TRANSACTIONS\)](#)
- [Create Two Sequences](#)
- [Insert Data into the Tables](#)
- [Create a View](#)
- [Create a PL/SQL Procedure](#)
- [Use the SQL Worksheet for Queries](#)

### 4.1 Create a Table (BOOKS)

The BOOKS table contains a row for each book in the library. It includes columns of character and number types, a primary key, a unique constraint, and a check constraint.

1. Right-click the connection name, and select **Open SQL Worksheet**.
2. Enter the following statement:

```
CREATE TABLE books (  
  book_id VARCHAR2(20),  
  title VARCHAR2(50)  
  CONSTRAINT title_not_null NOT NULL,  
  author_last_name VARCHAR2(30)  
  CONSTRAINT last_name_not_null NOT NULL,  
  author_first_name VARCHAR2(30),  
  rating NUMBER,  
  CONSTRAINT books_pk PRIMARY KEY (book_id),  
  CONSTRAINT rating_1_to_10 CHECK (rating IS NULL OR  
    (rating >= 1 and rating <= 10)),  
  CONSTRAINT author_title_unique UNIQUE (author_last_name, title));
```

3. Click the **Run Statement** icon.

The following notification is displayed in the Script Output pane:

```
Table BOOKS created.
```

## 4.2 Create a Table (PATRONS)

The PATRONS table contains a row for each patron who can check books out of the library.

1. In the SQL Worksheet, enter the following statement:

```
CREATE TABLE patrons (  
    patron_id NUMBER,  
    last_name VARCHAR2(30)  
        CONSTRAINT patron_last_not_null NOT NULL,  
    first_name VARCHAR2(30),  
    street_address VARCHAR2(50),  
    city_state_zip VARCHAR2(50),  
    CONSTRAINT patrons_pk PRIMARY KEY (patron_id));
```

2. Click the **Run Statement** icon.

The following notification is displayed in the Script Output pane:

```
Table PATRONS created.
```

## 4.3 Create a Table (TRANSACTIONS)

The TRANSACTIONS table contains a row for each transaction involving a patron and a book (for example, someone checking a book out or returning a book). It includes two foreign key columns.

1. In the SQL Worksheet, enter the following statement:

```
CREATE TABLE transactions (  
    transaction_id NUMBER,  
    patron_id CONSTRAINT for_key_patron_id  
        REFERENCES patrons (patron_id),  
    book_id CONSTRAINT for_key_book_id  
        REFERENCES books (book_id),  
    transaction_date DATE  
        CONSTRAINT tran_date_not_null NOT NULL,  
    transaction_type NUMBER  
        CONSTRAINT tran_type_not_null NOT NULL,  
    CONSTRAINT transactions_pk PRIMARY KEY (transaction_id));
```

2. Click the **Run Statement** icon.

The following notification is displayed in the Script Output pane:

```
Table TRANSACTIONS created.
```

## 4.4 Create Two Sequences

Create two sequence objects, which will be used in INSERT statements to generate unique primary key values in the PATRONS and TRANSACTIONS tables.

1. In the SQL Worksheet, enter the following statements:

```
CREATE SEQUENCE patron_id_seq
START WITH 100
INCREMENT BY 1;
```

```
CREATE SEQUENCE transaction_id_seq
START WITH 100
INCREMENT BY 1;
```

## 4.5 Insert Data into the Tables

Add some sample data to the BOOKS, PATRONS, and TRANSACTIONS tables.

1. Copy and paste the following INSERT statements into the SQL Worksheet:

```
INSERT INTO books VALUES ('A1111', 'Moby Dick', 'Melville', 'Herman', 10);
INSERT INTO books VALUES ('A2222', 'Get Rich Really Fast', 'Scammer',
'Ima', 1);
INSERT INTO books VALUES ('A3333', 'Finding Inner Peace', 'Blissford',
'Serenity', null);
INSERT INTO books VALUES ('A4444', 'Great Mystery Stories', 'Whodunit',
'Rodney', 5);
INSERT INTO books VALUES ('A5555', 'Software Wizardry', 'Abugov', 'D.',
10);
```

```
INSERT INTO patrons VALUES (patron_id_seq.nextval,
'Smith', 'Jane', '123 Main Street', 'Mytown, MA 01234');
INSERT INTO patrons VALUES (patron_id_seq.nextval,
'Chen', 'William', '16 S. Maple Road', 'Mytown, MA 01234');
INSERT INTO patrons VALUES (patron_id_seq.nextval,
'Fernandez', 'Maria', '502 Harrison Blvd.', 'Sometown, NH 03078');
INSERT INTO patrons VALUES (patron_id_seq.nextval,
'Murphy', 'Sam', '57 Main Street', 'Mytown, MA 01234');
```

```
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 100, 'A1111', SYSDATE, 1);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 100, 'A2222', SYSDATE, 2);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 101, 'A3333', SYSDATE, 3);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 101, 'A2222', SYSDATE, 1);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 102, 'A3333', SYSDATE, 1);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 103, 'A4444', SYSDATE, 2);
```

```
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 100, 'A4444', SYSDATE, 1);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 102, 'A2222', SYSDATE, 2);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 102, 'A5555', SYSDATE, 1);
INSERT INTO transactions
VALUES (transaction_id_seq.nextval, 101, 'A2222', SYSDATE, 1);
```

2. Click **Run Script**.

## 4.6 Create a View

Create a view that returns information about patrons and their transactions. This view queries the PATRONS and TRANSACTIONS tables, and returns rows that contain a patron's ID, last name, and first name, along with a transaction and the transaction type. The rows are ordered by patron ID, and by transaction type within patron IDs.

1. Right-click the **Views** node in the schema hierarchy on the left side, and select **Create (simple)**.
2. Enter the following information:
  - **View Name:** Enter **patrons\_trans\_view**.
  - In **SQL Query**, enter the following statement:

```
SELECT p.patron_id,
       p.last_name,
       p.first_name,
       t.transaction_type,
       t.transaction_date
FROM patrons p, transactions t
WHERE p.patron_id = t.patron_id
ORDER BY p.patron_id, t.transaction_type
```

3. Click **Apply**.

## 4.7 Create a PL/SQL Procedure

Create a procedure that lists all books with a specified rating. You can then call this procedure with an input parameter (a number from 1 to 10), and the output will be all the titles of all books with that rating.

To create the procedure:

1. Enter the following procedure text:

```
CREATE OR REPLACE
PROCEDURE list_a_rating(in_rating IN NUMBER) AS
  matching_title VARCHAR2(50);
  TYPE my_cursor IS REF CURSOR;
  the_cursor my_cursor;
BEGIN
  OPEN the_cursor
  FOR 'SELECT title
      FROM books
```

```

        WHERE rating = :in_rating'
    USING in_rating;
    DBMS_OUTPUT.PUT_LINE('All books with a rating of ' || in_rating || ':');
    LOOP
        FETCH the_cursor INTO matching_title;
        EXIT WHEN the_cursor%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE(matching_title);
    END LOOP;
    CLOSE the_cursor;
END list_a_rating;

```

2. Click **Run Script**.

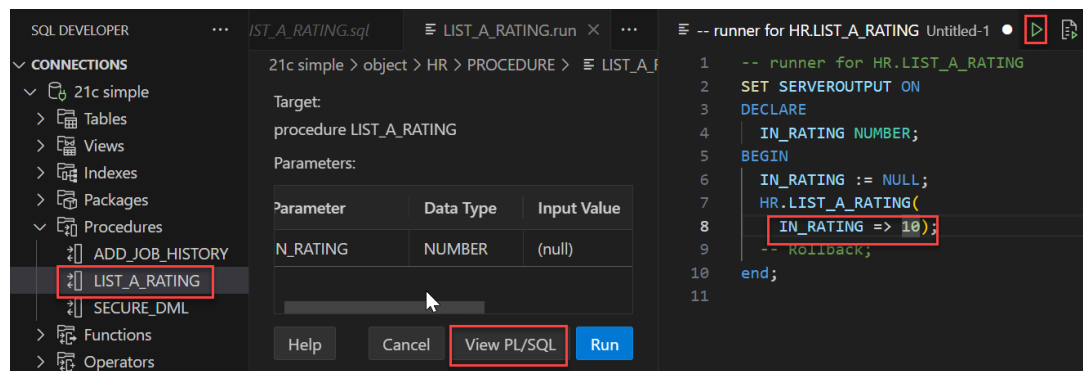
The following notification is displayed in the Script Output tab:

```
Procedure LIST_A_RATING compiled
```

3. To run this procedure, right-click LIST\_A\_RATING in the Connections navigator and select **Run**. The parameter and its properties are displayed.

4. Click **View PL/SQL**.

5. Change IN\_RATING => IN\_RATING to IN\_RATING => **10**, and click **Run Statement**.



The result is shown in the Script Output pane:

```

All books with a rating of
10:
Moby
Dick
Software Wizardry

```

## 4.8 Use the SQL Worksheet for Queries

You can use the SQL Worksheet to test SQL statements using a database connection.

1. In the right pane, enter the following statement (the semicolon is optional for the SQL Worksheet):

```
SELECT author_last_name, title FROM books;
```

Notice the automatic highlighting of SQL keywords (SELECT and FROM in this example).

2. Click the **Run Statement** icon in the SQL Worksheet toolbar. The results of the query are displayed in the Query Result tab under the area in which you entered the SQL statement.
3. Enter (or copy and paste) the following statement:

```
SELECT p.patron_id,  
       p.last_name,  
       p.first_name,  
       t.transaction_type,  
       t.transaction_date  
FROM patrons p, transactions t  
WHERE p.patron_id = t.patron_id  
ORDER BY p.patron_id, t.transaction_type;
```

4. Click the **Run Statement** icon in the SQL Worksheet toolbar, and view the results of the query.
5. Click the **Explain Plan** icon in the SQL Worksheet toolbar to see the execution plan (displayed on the Explain tab) that Oracle Database follows to execute the SQL statement. The information includes the optimizer strategy and the cost of executing the statement.

# 5

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lie

<https://github.com/calvinmetcalf/lie/releases/tag/v3.3.0>

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immediate

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setimmediate  
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inherits

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string\_decoder

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util-deprecate

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process-nexttick-args  
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memoize-one

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