PUBLIC

Administer and Operate SAP HANA in the Cloud
DAT261

Exercises / Solutions

José Ramos / SAP Labs Canada
Shabana Samsudheen / SAP Labs Canada
Daniel van Leeuwen / SAP Labs Canada
Iqra Mahmood / SAP Labs Canada
Hai Zhang / SAP Labs Korea

THE BEST RUN SAP®

TABLE OF CONTENTS

BEFORE YOU START **3**
Before You Get Started **3**
CHAPTER 1 - SAP HANA COCKPIT **4**
Overview **4**
Exercise 1: The Database Overview Page **4**
Exercise 2: Configuring Database Properties **9**
Exercise 3: Managing Services **12**
Exercise 4: Managing Alerts **18**
Exercise 5: Monitoring Resources **23**
Exercise 6: Security Basics **29**
Exercise 7: Performance Management **38**
Exercise 8: Database Backup **46**
Exercise 9: Recent Activities and Frequently Used Apps **50**
Exercise 10: Managing Workload Classes **52**
Summary **55**
CHAPTER 2 - DATABASE EXPLORER **56**
Overview **56**
Exercise 1: Getting Started with Database Explorer **56**
Exercise 2: Browsing the Catalog **59**
Exercise 3: Create, Import and Export with SAP HANA Database Explorer **66**
Exercise 4: Using the SQL Console **70**
Exercise 5: Browsing across Schemas and Editing Tables **78**
Summary **82**
CHAPTER 3 - PERFORMANCE MANAGEMENT TOOLS **83**
Overview **83**
Exercise 1: Extra features in Monitor Statements application **83**
Exercise 2: Importing and Exporting SQL Plans in the SQL Analyzer **84**
Exercise 3: Data Cache Monitoring Application **86**
Exercise 4: Importing NameServer Trace files in the Performance Monitor **89**
Summary **91**

BEFORE YOU START

Welcome to the Hands-On Workshop session DAT261 – Administer and Operate SAP HANA in the Cloud!

In this session, we'll introduce you to the different administration and monitoring tools for SAP HANA Cloud and show you how you can get common operational tasks done efficiently using the web-based tool SAP HANA cockpit.

Before You Get Started

This session assumes that you already have an SAP HANA Cloud Trial account. If that's the case, proceed to Chapter 1.

If you do not have an SAP HANA Cloud Trial account, you can register for free at https://www.sap.com/cmp/td/sap-hana-cloud-trial.html. Once you have successfully registered and your account is set up, perform the following steps:

1. Enter the "trial" subaccount
2. Enter the "dev" space
3. Click "SAP HANA Cloud" from the left navigation bar
4. Click the button "Create Instance" in the top right to invoke the Create Instance wizard
5. Enter "TechEd" for the instance name
6. Enter and confirm your administrator password - please remember it!
7. Click the button "Create Instance" at the bottom

A new SAP HANA Cloud instance will be created - this process will take approx. 25 minutes. You may need to refresh the page to see the instance as "Running" (as opposed to "Creating"). Once that's done, proceed to Chapter 1.

CHAPTER 1 - SAP HANA COCKPIT

Overview

Estimated time: 60 minutes

Objective

In the following exercises you will learn the fundamentals of operating SAP HANA cockpit to perform database administration tasks.

Exercise Description

The SAP HANA cockpit features database management capabilities for a SAP HANA Cloud instance. This chapter offers learning opportunities for:

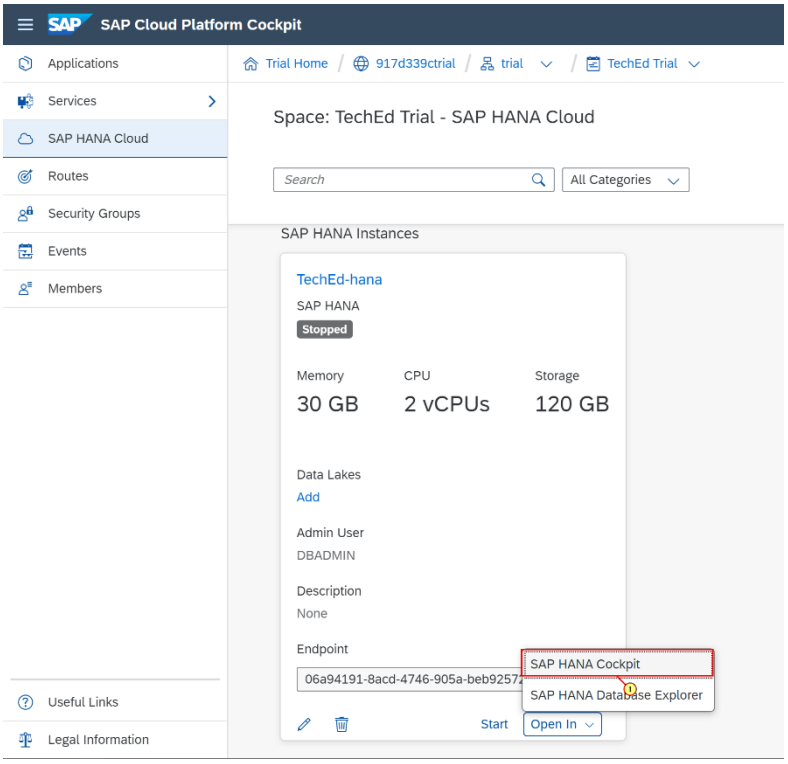
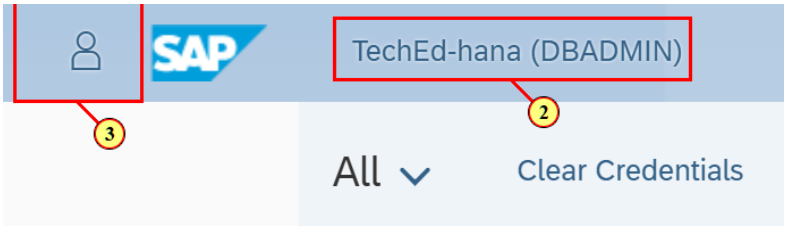
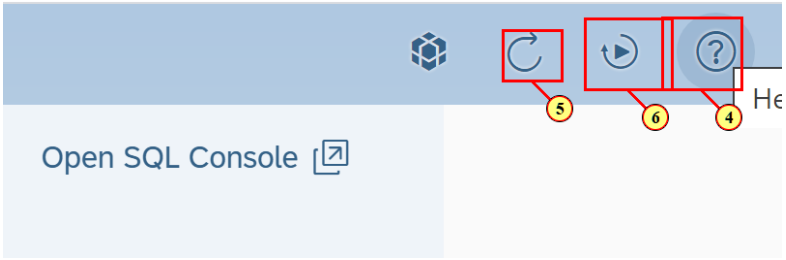
- Monitoring all your SAP HANA databases
- Comparing database configurations
- Configuring and managing individual databases
- Executing performance management tasks
- And much more!

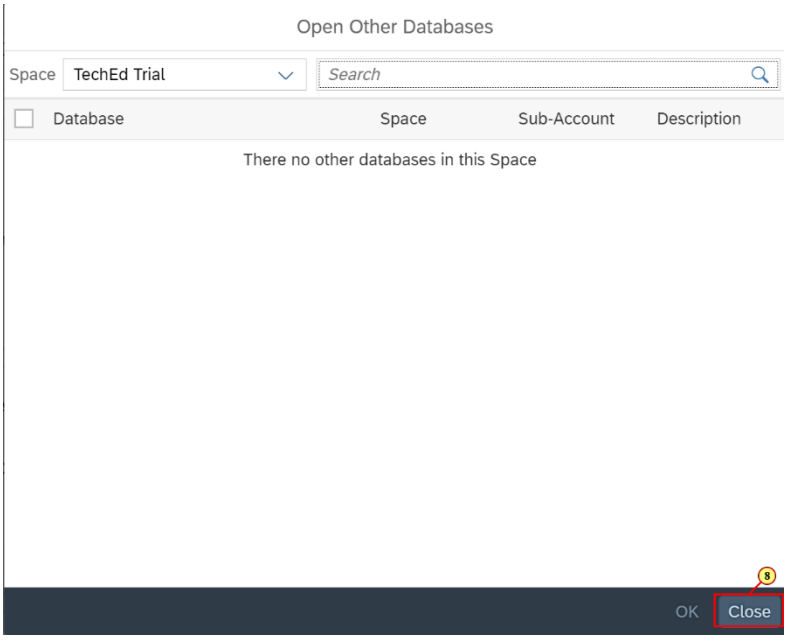
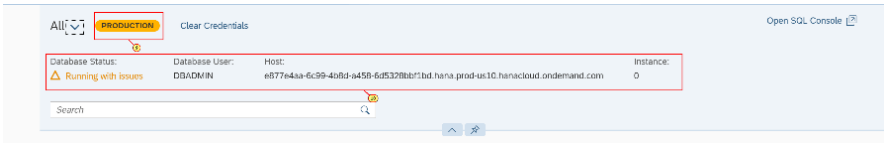
Exercise 1: The Database Overview Page

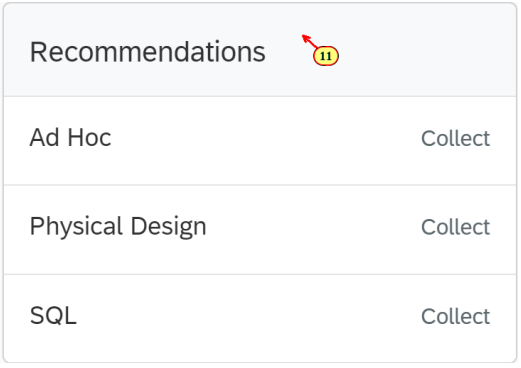
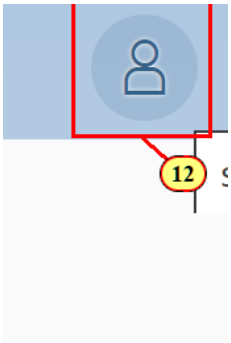
The Database Overview page displays health metrics for an individual SAP HANA Cloud database.

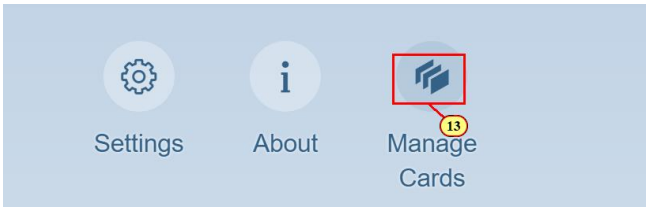
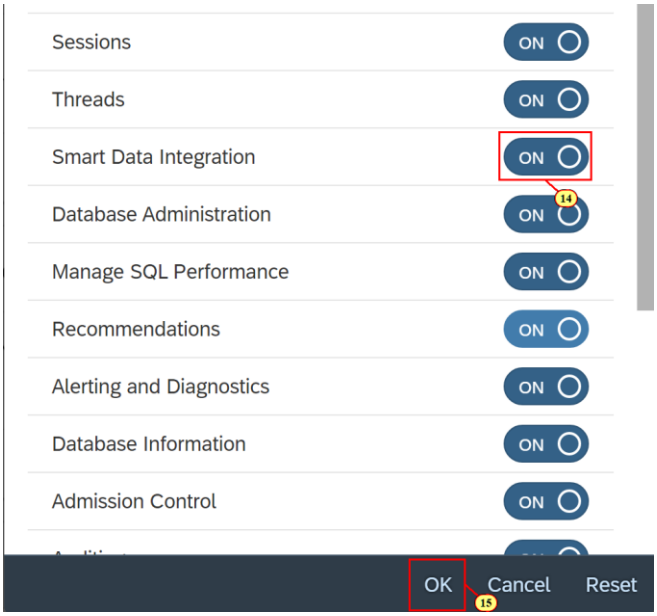
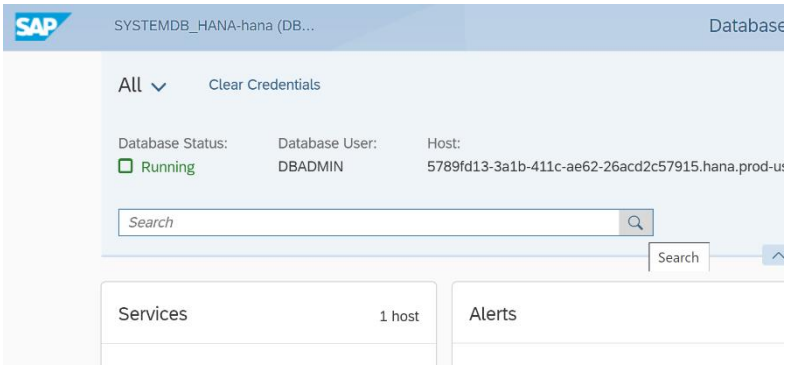
Through the Database Overview page, you can view key health indicators for this specific database, such as database status, alerts, and resource utilization. You also have access to tools that allow you to perform database administrations tasks, such as performance analysis, and executing SQL statements. Different parts of a single card can link to different views or applications. This way, you can see various components in a single view and make the decision whether to further examine issues by drilling down.

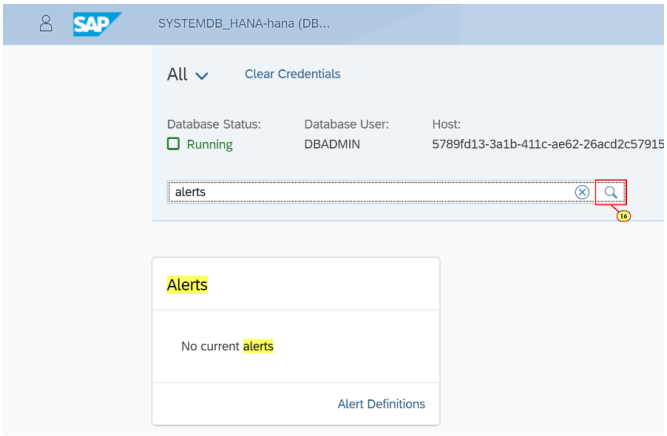
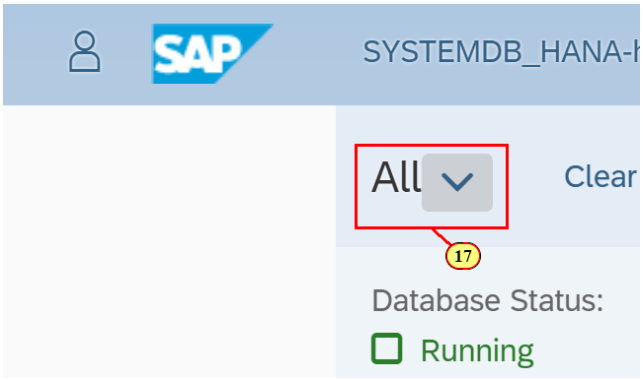
This exercise will teach you the basics of navigating the Database Overview page and how to find the information you need as a database administrator.

Explanation	Screenshot
1. Navigate to your SAP HANA Cloud Trial instance from the SAP Cloud Platform Cockpit ("trial" subaccount and "dev" space). Choose to open the **SAP HANA Cockpit.** If this is the first time you launch the SAP HANA cockpit or SAP HANA Database Explorer, you will be asked to enter your credentials. The default username is DBADMIN and the password is what you entered when creating the instance.	
2. At the top of the Overview page, you'll find the toolbar, displaying the name of the currently managed database TechEd-hana and the database username (DBADMIN) you're connecting as to that database. 3. The user icon in the top left opens a side bar menu with user specific settings.	
4. The Help button in the top right opens SAP Documents and displays the appropriate topic based on what you're doing. 5. You can manually **refresh** this page here.	

Explanation	Screenshot
6. You can set an auto-refresh for every 10 seconds, 20 seconds, 30 seconds, 1 minute, 5 minutes or 10 minutes.	
7. You can switch between multiple databases or navigate to multiple databases by clicking on this icon. Click on it to see a pop up, where you can select one or multiple databases that you want to navigate to.	
You can select one or multiple databases from this pop up. Once the databases that we need to be opened is selected from this pop up, if we click on **OK**, all the selected databases are opened simultaneously on new browser tabs. 8. Click on **Close** to close the pop up.	
9. You can see the usage type **"Production"** displayed as a label alongside the database for easier classification. 10. The General information about databases like Database Status, Database Username, Host Name, Instance details are available now in the header bar.	

Explanation	Screenshot
By default, when you first access the Database Overview page you see a quick synopsis of the database status and its alerts, as well as the utilization of memory, CPU and disk. As you scroll down, you see high-level performance metrics in the form of the number of threads, sessions and long-running statements. You also see general information about your SAP HANA database. Down further, you see security settings, such as data volume encryption, auditing status, authentication status, as well as security-related hyperlinks. There are also a number of hyperlinks to launch additional administration and Smart Data Integration applications.	
11. The organization of the cards in your Database Overview page is completely customizable. Click and hold any card and drag it across the screen to change its location.	
Another personalization feature is the ability to hide cards that you do not wish to see on your Database Overview page. 12. Click the **User Icon** in the top left.	

Explanation	Screenshot
13. Click **Manage Cards.**	
14. Click the on/off switches to turn some cards off. 15. Click **OK.**	
We will cover the search and highlight feature last in this exercise.	

Explanation	Screenshot
16. At the top right of the **Database Overview** page, you can search any keyword in the search bar by typing the keyword and then clicking the search icon.	
17. On the top left corner is a filtering option where the user can filter cards based on the area of interest.	

Exercise 2: Configuring Database Properties

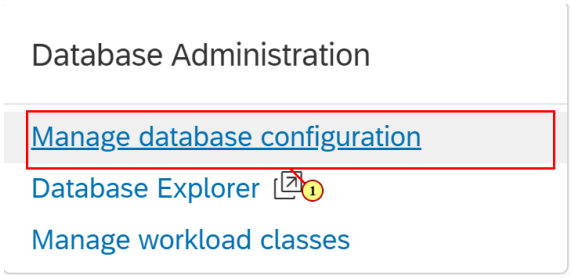
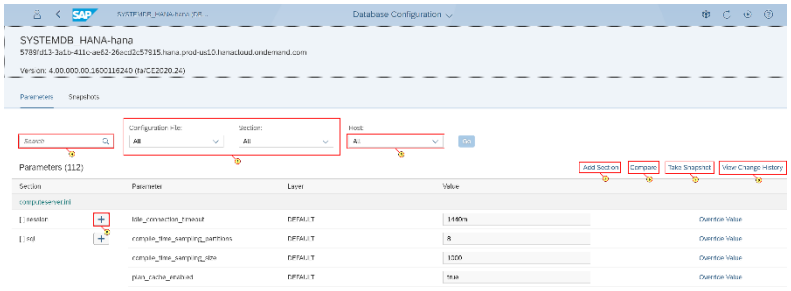
An SAP HANA database has several configuration (*.ini) files that contain properties for configuring the database.

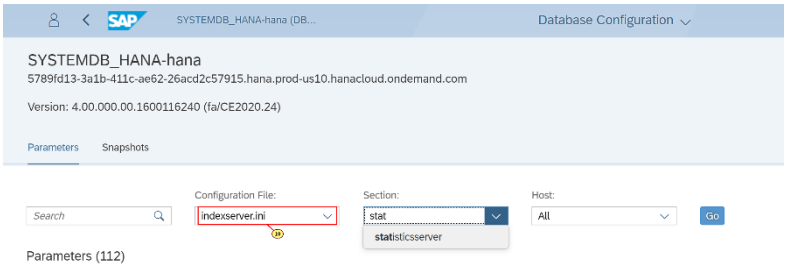
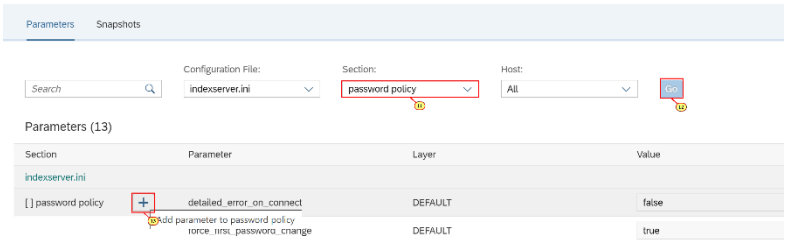
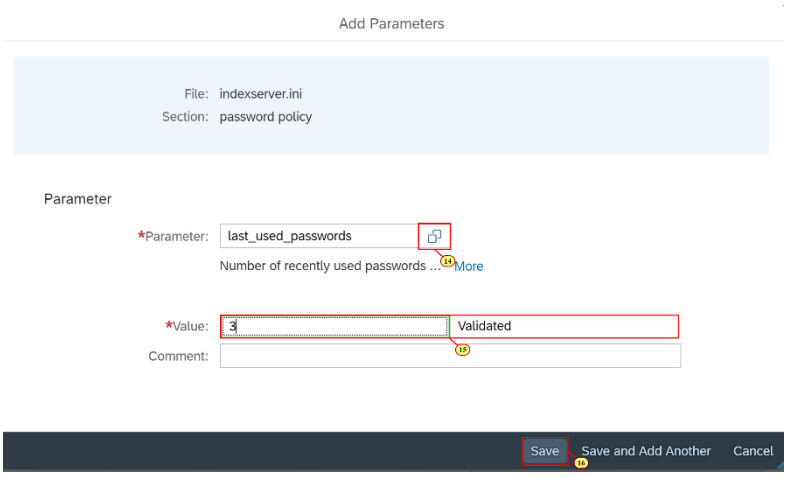
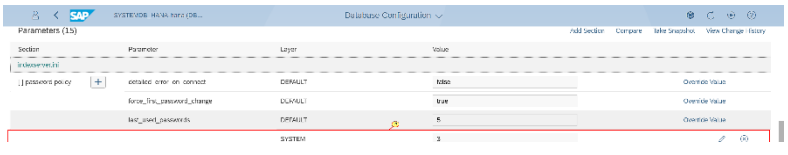
SAP HANA's configuration files contain parameters for global database configuration (global.ini), as well as the configuration of each service in the system (for example, indexserver.ini).

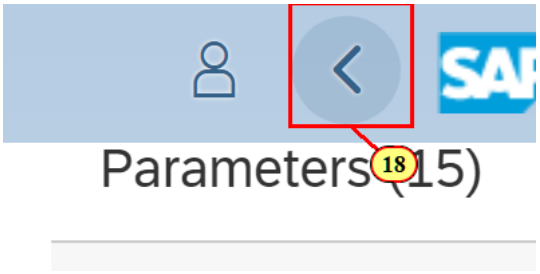
Properties can be configured at different layers, depending on the configuration file:

- DEFAULT: The default value for the property
- DATABASE: The database-specific value for the property

In this exercise, you will change a few properties using the "Configuration of System Properties" GUI application.

Explanation	Screenshot
1. Select **Manage Database Configuration** at the top of the Database Administration card.	
2. This application provides a visual way to edit properties by selecting a configuration file and its section. The Database Configuration page allows for the user to manage and edit many different properties of their system databases. 3. Properties can also be changed at the HOST layer, if the HANA system is configured as multi-host. 4. You can perform a global search for a configuration file, section, specific value or layer type. 5. You can add a section to a configuration file. 6. You can compare parameters. 7. You can take a snapshot with optional notes. 8. You can view your change history to keep track of your configuration edits. 9. You can add a parameter to a section by clicking the + button.	

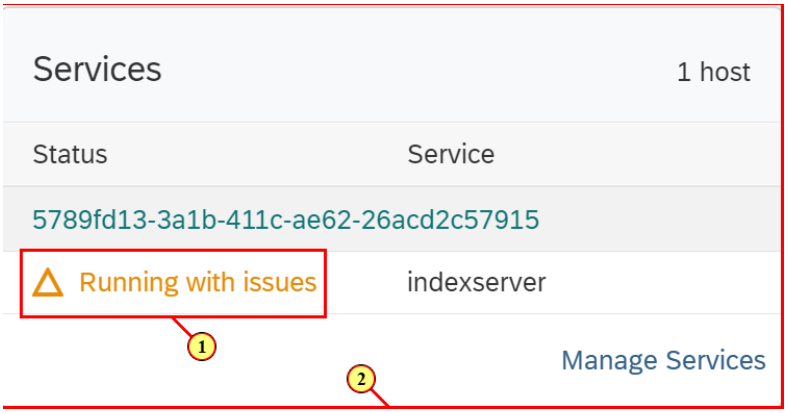
Explanation	Screenshot
10. Enter **indexserver.ini** in the **Configuration File** text field. You can use the drop-down list box to select the configuration file, or you can begin typing its name and the text box will auto fill.	
11. Let's change a parameter. Enter **password policy** in the **Section** field. 12. Click **Go.** 13. Click the **+** button to add a new parameter.	
14. Click on the Search button, and a pop up comes up with all possible Parameters that can be added for this section. 15. Enter **3** in the **Value** text field. 16. Click on **Save**.	
17. We've edited this password policy parameter so that the user cannot change their password to be one of the last 3 passwords used (instead of the default last 5 passwords used).	

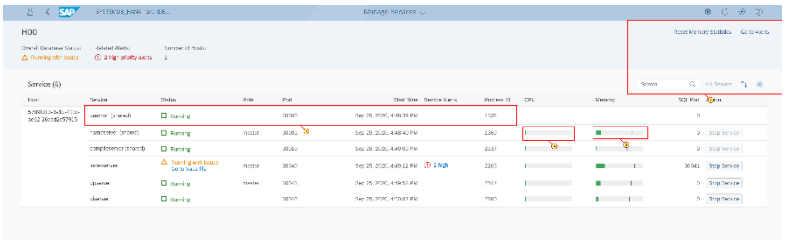
Explanation	Screenshot
18. Click **Back** in the top right to return to the Database Overview page.	

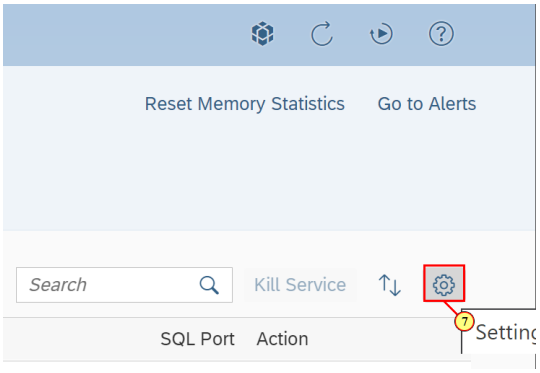
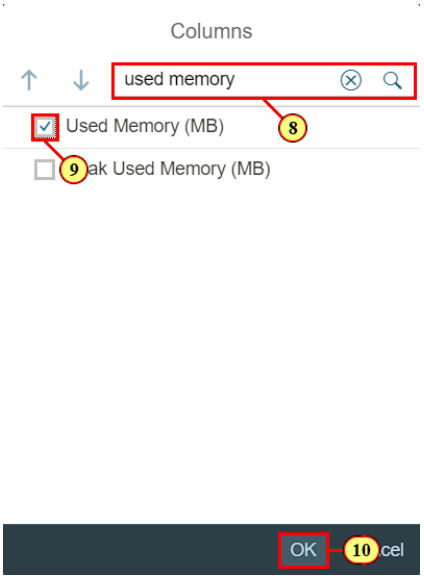
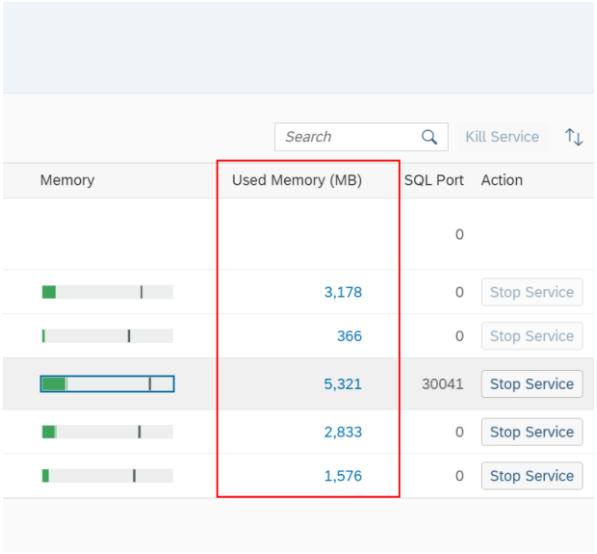
Exercise 3: Managing Services

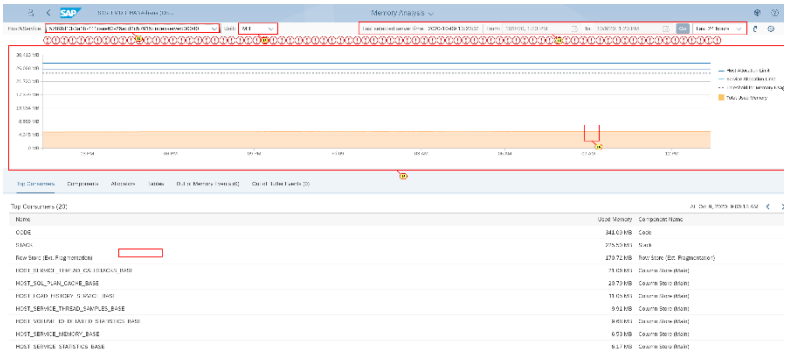
To monitor the health of your SAP HANA database in more detail, for example to troubleshoot performance bottlenecks, you can analyze the status and memory usage of individual database services. The Memory Analysis application is helpful here as it provides a more detailed breakdown of memory usage. It enables you to visualize and explore the memory allocation of every service of a selected host during a specified time range. If you notice an increase in overall memory usage, you can investigate whether it's due to a particular component, subcomponent, or table.

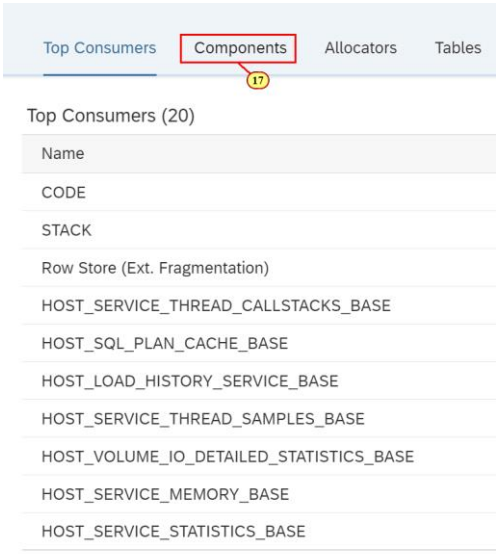
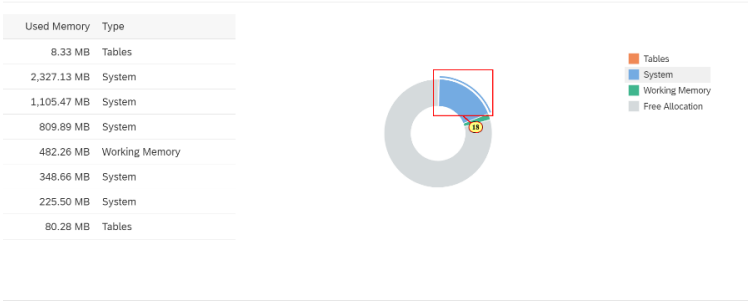
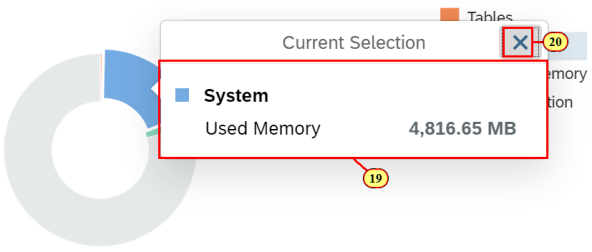
In this exercise, you review the information displayed in the Services card, examine the different database service management operations you have access to, and perform a basic analysis of memory usage.

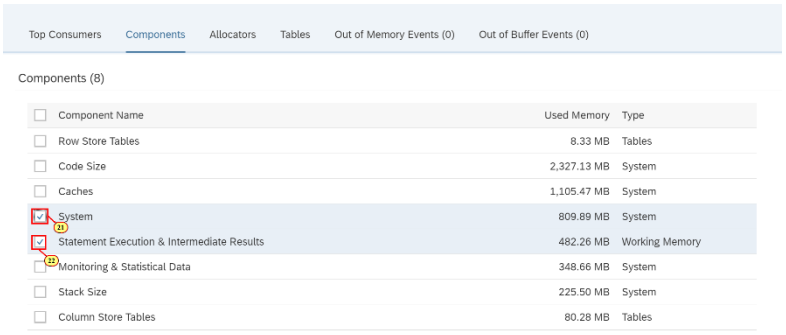
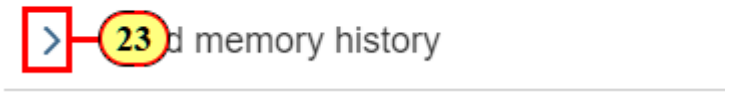
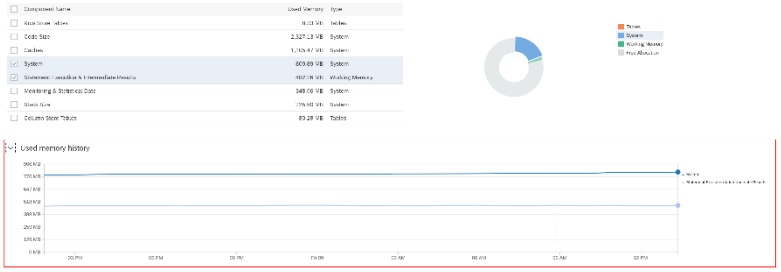
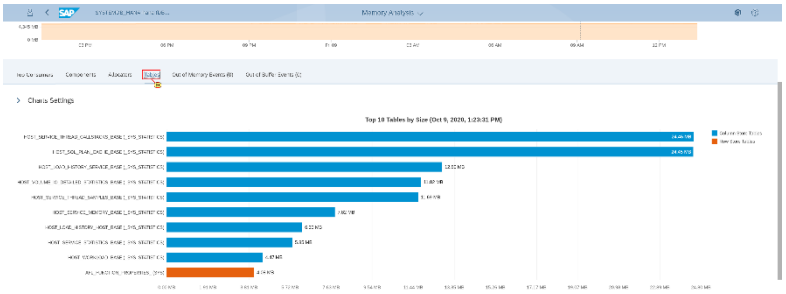
Explanation	Screenshot
The "Services" card displays metrics regarding the operational status of the SAP HANA database. 1. Here you see the status of the database, "Running with issues" in this case. Other possible values include "Running", "Stopped", "Error", "No SQL Access". 2. Click anywhere in the middle of the tile to open the Manage Services application.	

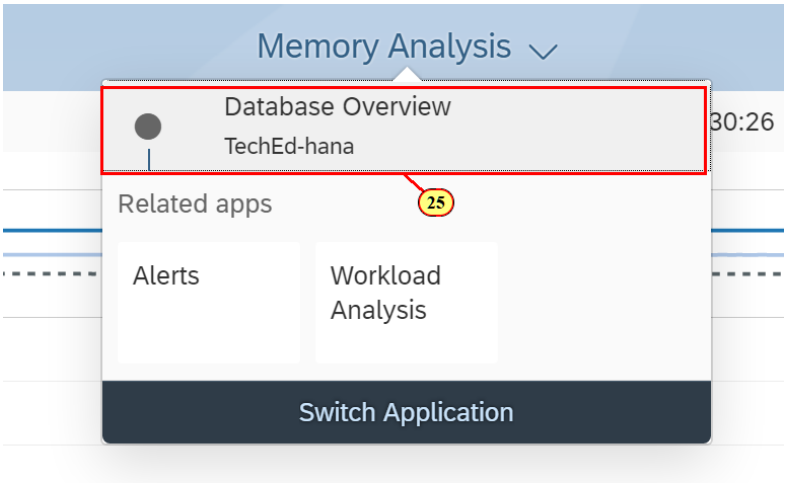
Explanation	Screenshot
The Manage Services app enables you to monitor the health of your SAP HANA database in more detail, for example, to troubleshoot performance bottlenecks, you can analyze the status and resource usage of individual database services. If necessary, you can perform follow-up operations, such as stopping a service, or killing a service. You can also reset memory statistics and navigate to Alerts application. 3. Detailed service information. 4. CPU usage of the service. Clicking on the mini bar chart redirects you to the Performance Monitor to see more details. 5. Memory usage of the service, showing used memory (dark green), peak memory (light green), effective allocation limit (grey bar) and physical memory (light grey background). 6. You can sort the table and add/remove other metrics (e.g. used memory, CPU process %, etc.) and search for specific services. You can also perform additional operations, such as start/stop/kill/add/remove services and reset memory statistics.	

Explanation	Screenshot
7. Let's add a column to the table. Click **Settings** (above the table on the right)..	
8. Enter **used memory** in the search bar. 9. Click **Used Memory (MB)**. 10. Click **OK**.	
The column "Used Memory (MB)" is added to the table. As you can see, the indexserver service consumes the most memory. Since we are looking at a tenant database, the main service is indexserver. For a system database the main server would be nameserver.	

Explanation	Screenshot
11. Let's examine the memory usage for the indexserver service. Locate it and click **memory mini bar chart** to launch the Memory Analysis tool.	
The Memory Analysis app enables you to visualize and explore the memory allocation of every service of a selected host during a specified time range. If you notice an increase in overall memory usage, you can investigate whether it's due to a particular component, subcomponent, or table. 12. You can choose which host and service to examine. 13. You can change the units for the displayed values (MB, GB, or TB). 14. You can select a time range to investigate, from the last 24 days to the last 6 weeks, or a custom range. 15. The upper time chart visualizes the memory statistics. In addition to the total used memory by SAP HANA, you also see the allocation limits for the service and the host. When analyzing memory, you typically select the appropriate time range to examine, then click on a specific time in the upper chart. The lower chart is then automatically populated based on that time, allowing you to deepen your analysis.	

Explanation	Screenshot
16. Click the upper chart on an area where the used memory is more than 0 MB (look for an orange colored section).	
17. Click the **Components** tab.	
The donut chart displays the memory details at that specific point in time. 18. Click the **blue section** in the donut chart to see more information about system memory.	
19. You see the amount of memory taken up by system memory. You can select more components to add their memory amount in this popup. 20. Click the **X** to close the popup.	

Explanation	Screenshot
21. Let's investigate a couple of components in more detail. Check **System**. 22. Click **Statement Execution & Intermediate Results**.	
23. Scroll down and click the **arrow** at the bottom of the page to expand the Used Memory history chart.	
The history chart shows the memory usage over time for the components you selected.	
24. You can deepen your analysis by looking at the statistics about the memory used by data tables. Click **Tables**. The top chart shows the breakdown of memory usage of the top 10 highest consuming tables for the specific time you're investigating. The bottom chart shows the memory usage of the top 10 tables with the largest change in consumption for the selected time period.	

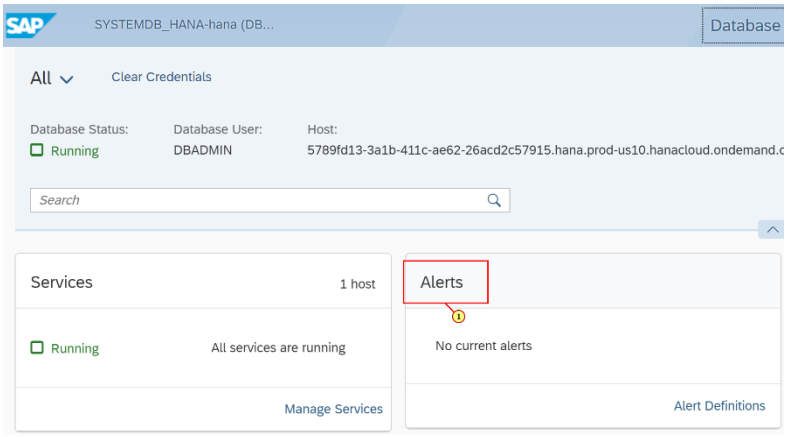
Explanation	Screenshot
25. Select the drop-down menu at the top named **Memory Analysis** and select **Database Overview** from the menu to return to the Database Overview page.	

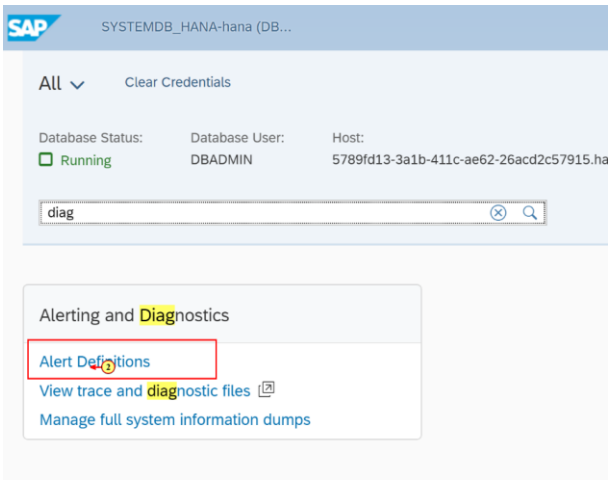
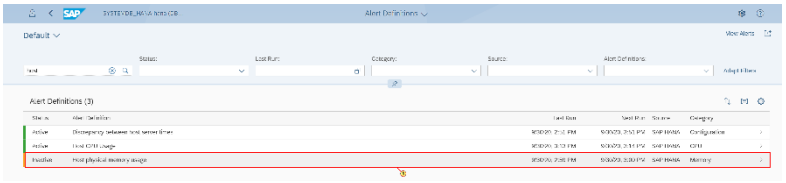
Exercise 4: Managing Alerts

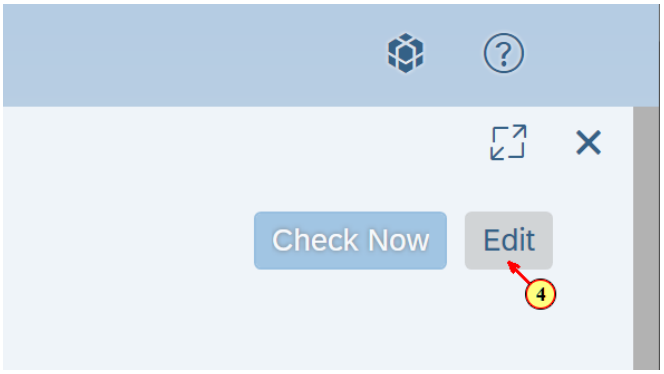
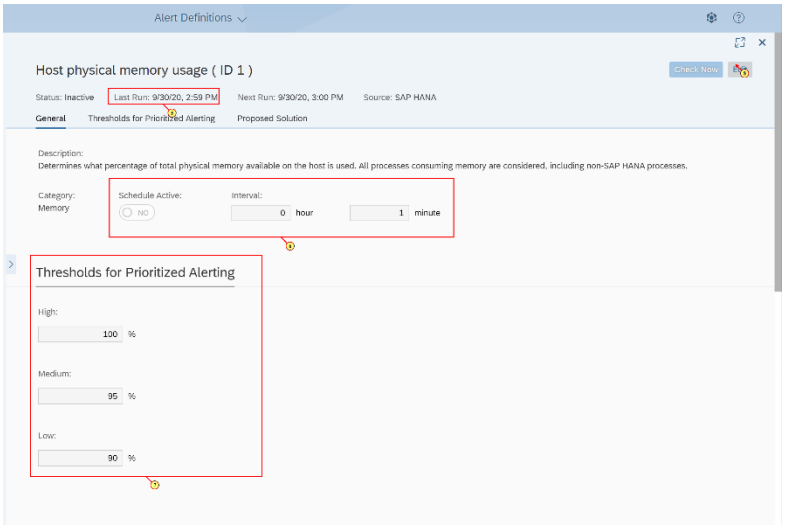
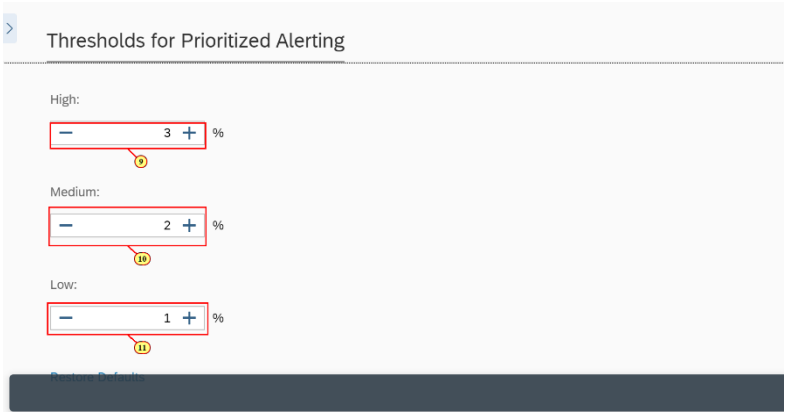
As an administrator, you actively monitor the status of the system, its services, and the consumption of system resources. However, you are also alerted of critical situations, for example: memory utilization is reaching a critical level, or a server has stopped.

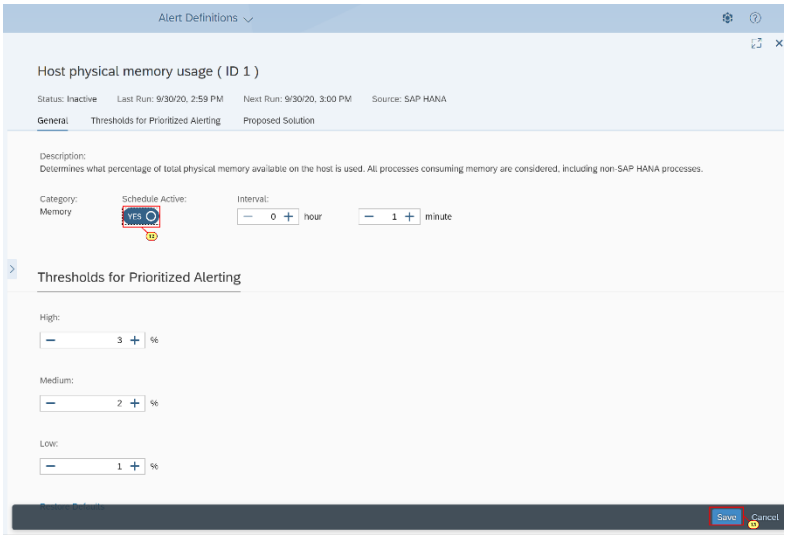
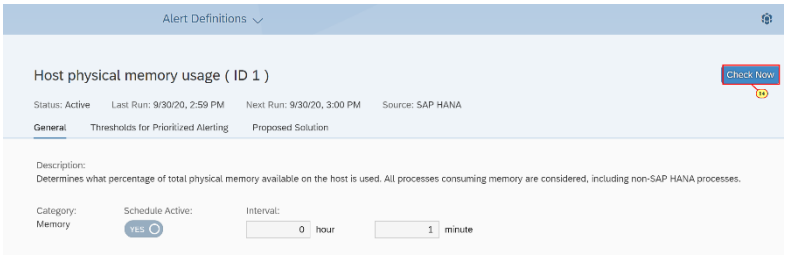
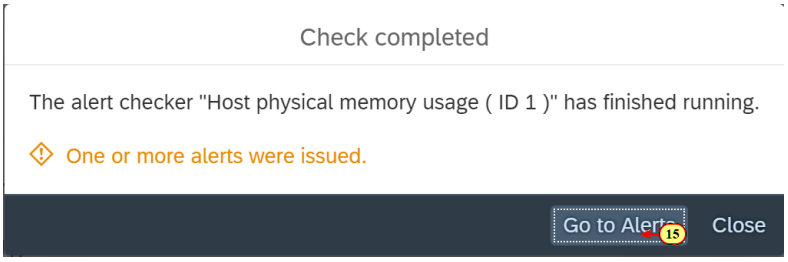
The internal monitoring infrastructure of the SAP HANA database is continuously collecting and evaluating information about status, performance, and resource usage from all components of the SAP HANA database. In addition, it performs regular checks on the data in system tables and views and when configurable threshold values are exceeded, issues alerts. In this way, you are warned of potential problems. The priority of the alert indicates the severity of the problem and depends on the nature of the check and configured threshold values.

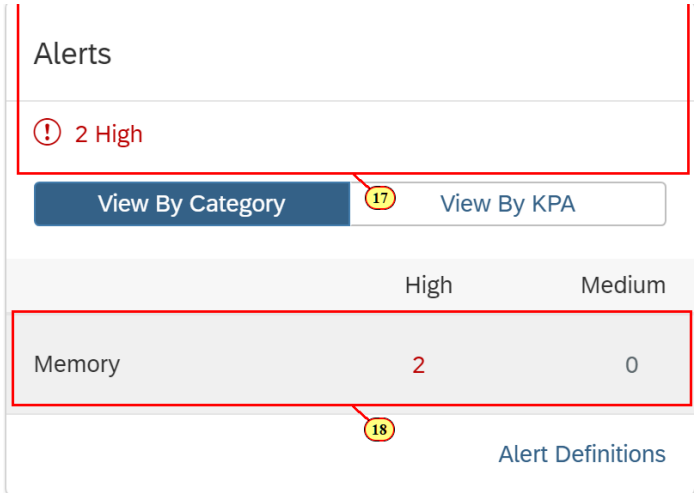
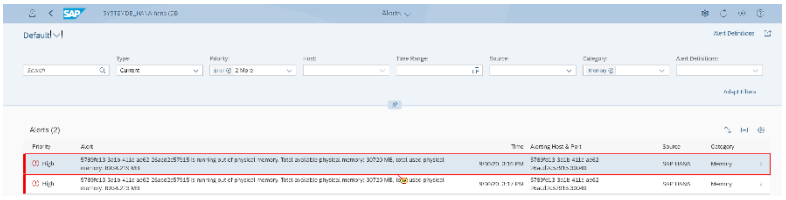
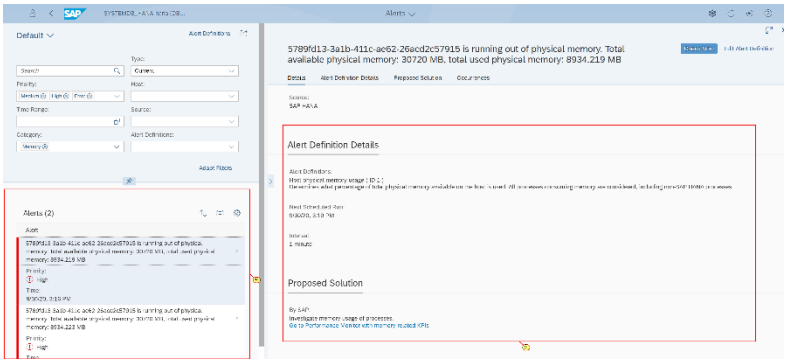
In this exercise, you'll examine the Alerts card, drill-down to obtain more information about raised alerts and configure alert thresholds.

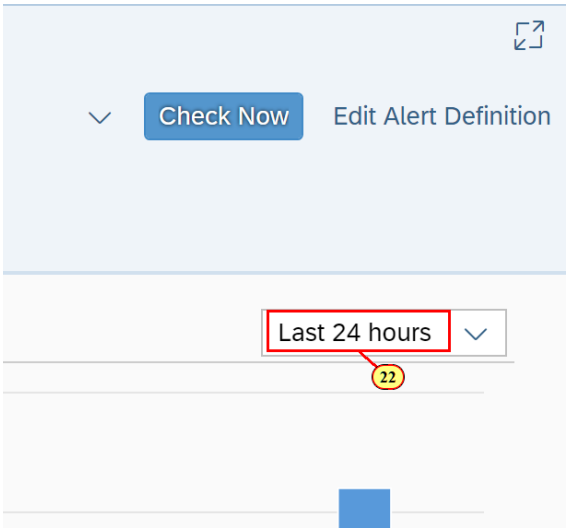
Explanation	Screenshot
1. Locate the **Alerts** card. This card displays the number of high (in red colored font) and medium (in orange colored font) priority alerts in the database, classified into one of the 10 alert categories in SAP HANA. It allows you to quickly identify issues in the database and drill-down to the Alert Details app to analyze	

Explanation	Screenshot
the situation. You can also choose to view alerts by the key performance areas of available, performance and capacity.	
2. Click on **Alert Definitions**.	
The Alert Definition screen allows you to choose from many existing alerts, search for them and manage how the different SAP HANA alerts are triggered. On clicking on a particular alert, it displays information about the alert, including its description, category, schedule, threshold values, proposed solution and notifications. 3. Locate (or Search) and click on **Host physical memory usage** alert	

Explanation	Screenshot
4. Click on **Edit** in the top right corner**.**	
5. Underneath the alert name, you see the last time SAP HANA checked for this alert. 6. SAP HANA uses a time interval to check for alerts. You can enable or disable the alert by toggling the schedule button. 7. The threshold values are critical to alert management, as they control the priority of the alert (high, medium or low). You can set these for most alerts, according to your needs. 8. Let's change the threshold values for the alert we are currently viewing, "Host physical memory usage". Click **Edit** on the top right corner.	
The threshold values determine the priority of the alert when it gets triggered. You can change them depending on your environment. For this workshop, we'll change the values to be unnecessarily low so that a high priority alert is triggered (when memory usage is more than 3% total), but under normal	

Explanation	Screenshot
circumstances the values would be more reasonable. 9. Replace the value in **High** text field to be **3** 10. Replace the value in **Medium** text field to be **2** 11. Replace the value in **Low** text field to be **1**	
12. Set the **Schedule Active** toggle button to **Yes** 13. Click on **Save** to accept the changes.	
14. Click **Check Now** to run the Alert.	
15. When the alert checker finishes running, you get a message with the result. In this case, one alert was issued. Click **Close.**	

Explanation	Screenshot
16. Click **Back** twice to return to Database Overview page.	
17. Locate the **Alerts** card. Notice the alert count for **Memory** increased to 2 because an alert was triggered due to low physical memory in the system. 18. Click on **Memory** bar to open the Alerts application.	
19. Click on one of the High priority Alerts to get into Alerts Details page.	
20. You can navigate to the Alert Details screen from different places and filtering is automatically done to see the relevant alerts. 21. You see detailed information about the alert, along with a proposed solution.	

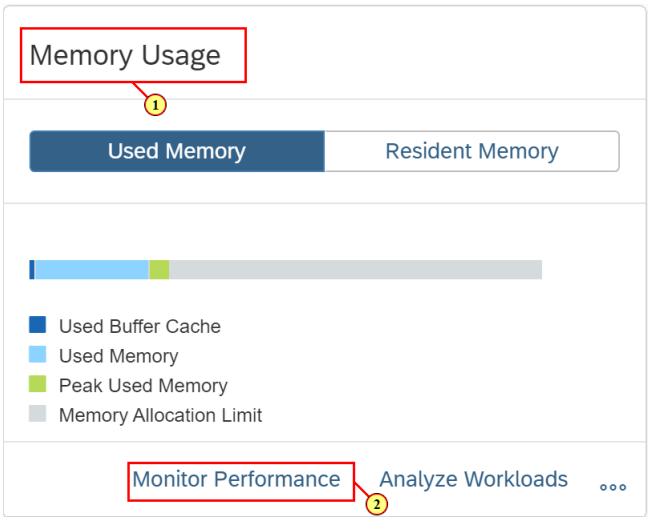
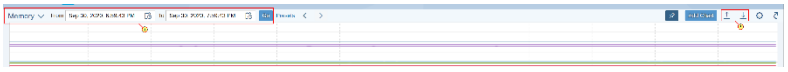
Explanation	Screenshot
22. You can see when this alert occurred, up to the last 30 days. This details are under the **Occurrences** tab.	
23. Click the **Back** button twice to return to Database Overview page.	

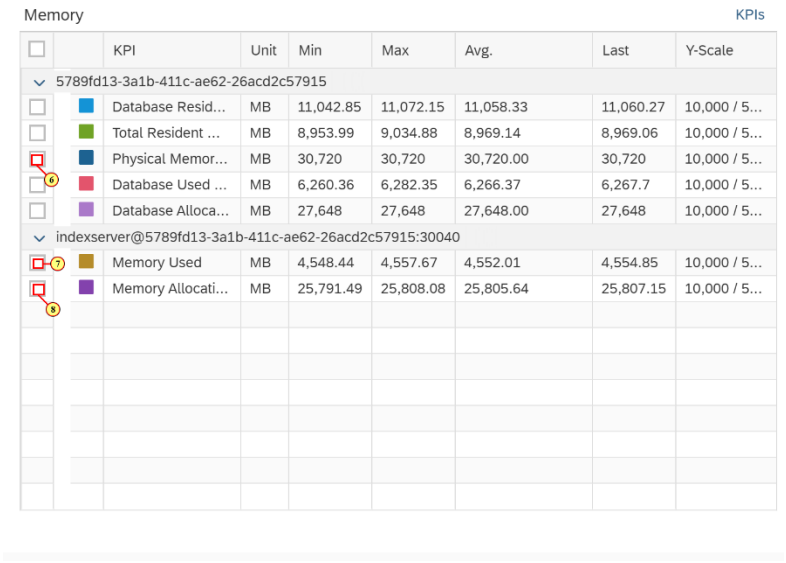
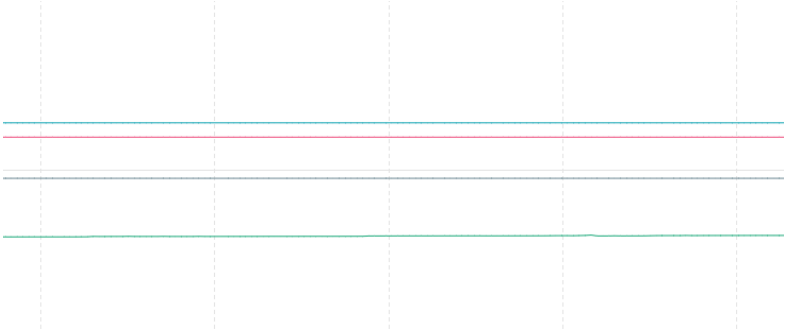
Exercise 5: Monitoring Resources

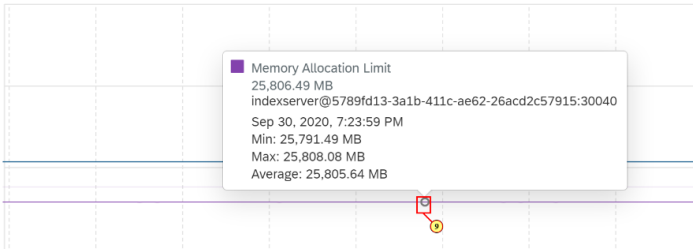
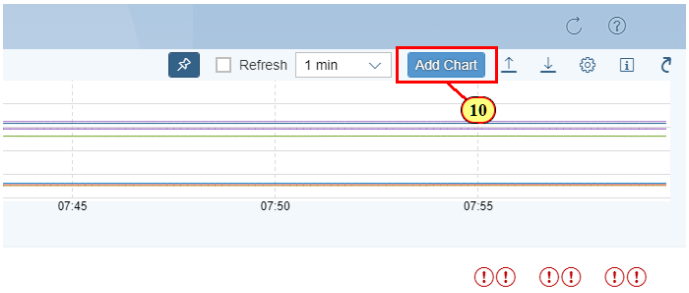
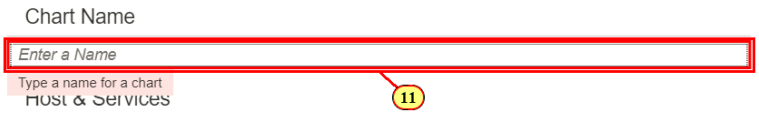
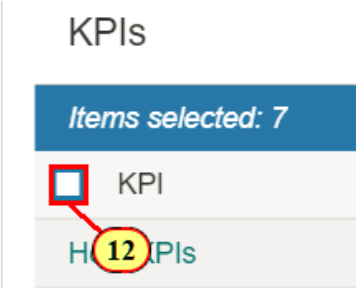
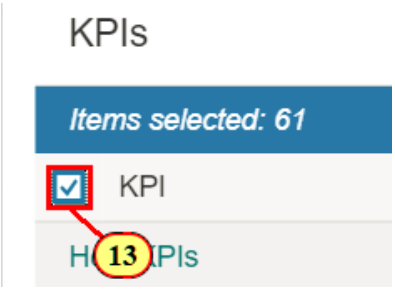
SAP HANA administrators must carefully monitor system computing resources to ensure optimal operation of the database. There are many metrics available to monitor in the SAP HANA cockpit, including memory, CPU and disk usage. You can view precise consumption details for those resources, as well as historical utilization information.

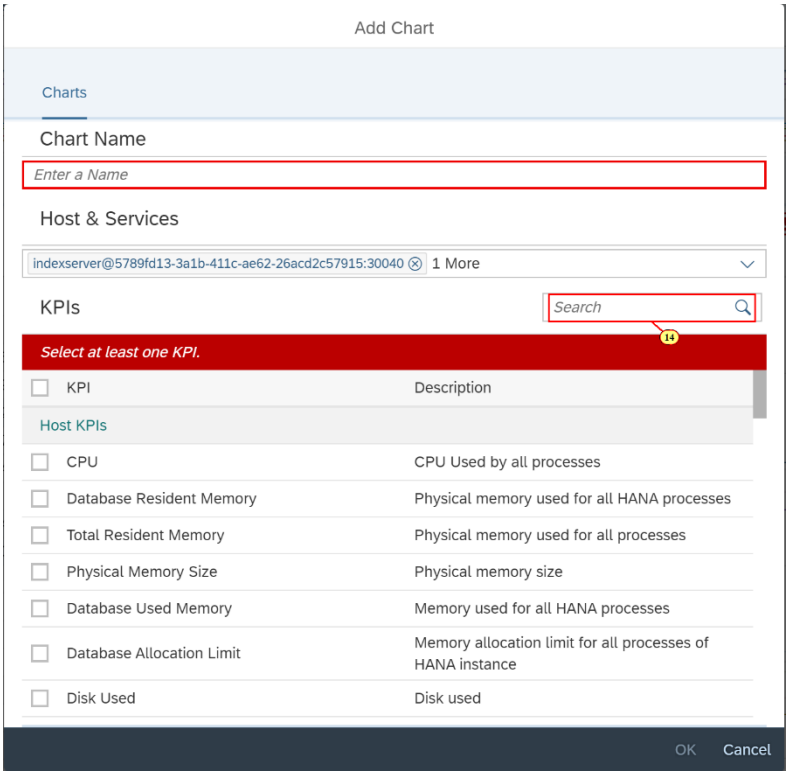
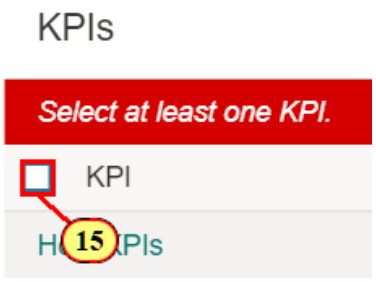
In this exercise, you'll examine the memory utilization of an SAP HANA database and observe the behavior of a few KPIs. You'll also learn to customize the utilization charts to display the information most relevant to your situation.

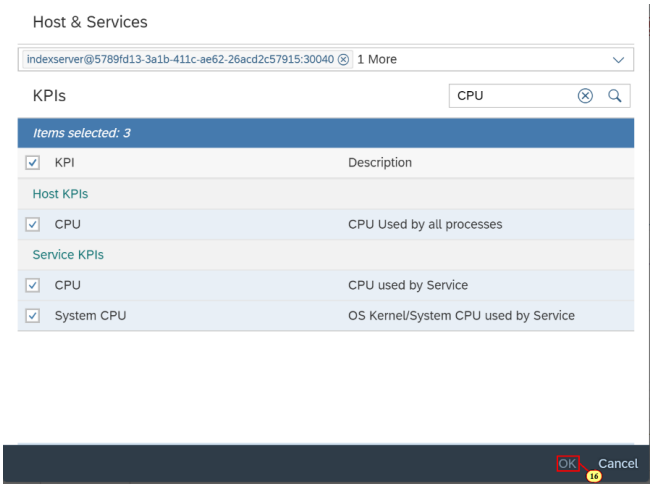
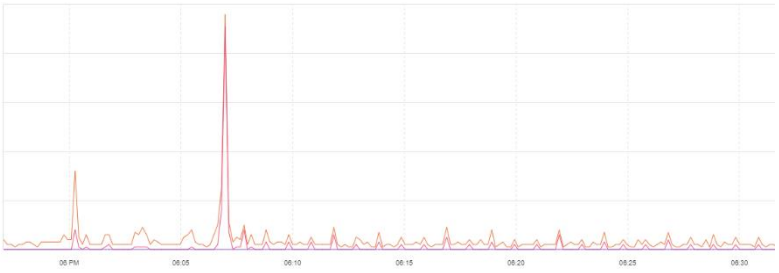
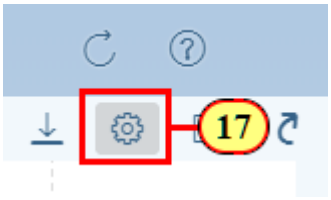
Explanation	Screenshot
1. Locate the Memory Usage card. It displays how much	

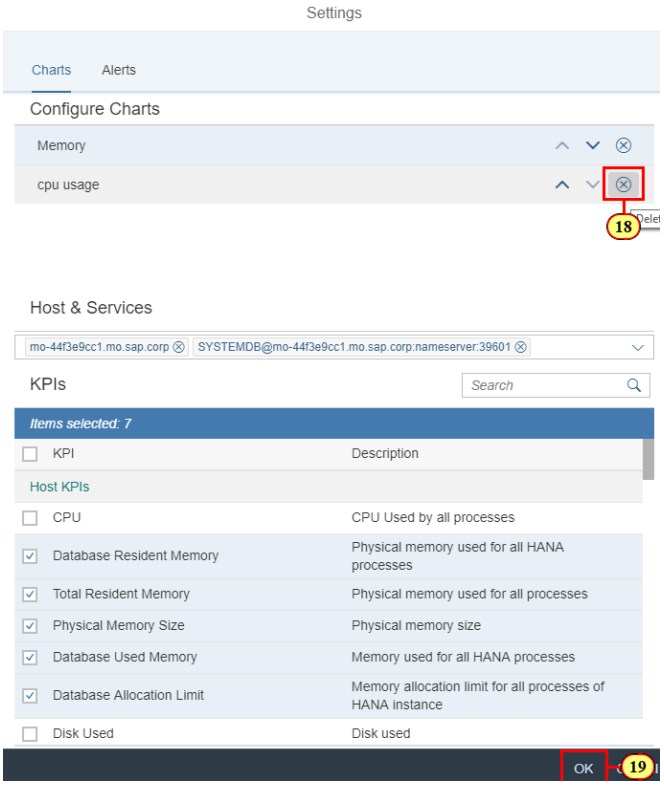
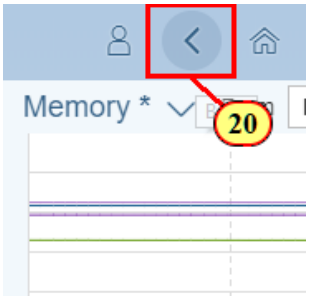
Explanation	Screenshot
memory the host has consumed for the past 2 hours. There are also CPU Usage and Disk Usage cards, showing those metrics for the same time period. 2. Let's investigate the memory utilization for this database. Click **Monitor Performance**.	
3. The Performance Monitor appears, allowing you to see KPIs for memory usage. 4. You can change the time range to display. 5. You can export a complete snapshot of the performance monitor data into a ZIP file that you can download and send to SAP Support to analyze and diagnose problems with the SAP HANA database. Similarly, you can import performance monitor data from a ZIP file into the SAP HANA cockpit.	

Explanation	Screenshot
6. Let's examine a few KPIs in more detail. Check **Physical Memory Size**. 7. Click **Memory Used**. 8. Click **Memory Allocation Limit**.	
The colored lines representing the selected KPIs are highlighted and you can now make a few observations: this host has 32 GB of RAM and the Memory Allocation Limit for this service (indexserver) is slightly below, so there's a bit of memory left in reserve for other processes. The Memory Used for this service is much lower so there's plenty of room to allocate more memory. What you're looking for are situations that may trigger out of memory events and negatively affect performance. For example, when the memory consumption stays constant near the limits for a prolonged period of time and sudden spike of memory usage happens.	

Explanation	Screenshot
9. You can obtain details for a specific point in time by simply hovering the mouse cursor over the line. Mouse over any point along the **Memory Allocation Limit** line (in Purple).	
10. Let's add a new chart to this screen. Click **Add Chart**.	
11. Enter **CPU Usage** in the Chart Name text field.	
12. We want a few CPU KPIs, but first we need to uncheck the 7 currently checked KPIs. A quick way to do this is to select them all, unselect them, then check the ones we want. Check **KPI** to select all KPIs.	
13. Now check KPI again to unselect all the items.	

Explanation	Screenshot
14. Enter **CPU** in the search bar.	
15. Check **KPI** to select the 3 CPU KPIs that appear.	

Explanation	Screenshot
16. Click **OK.**	
The new chart appears at the bottom of the screen. You can perform the same type of analysis by selecting the KPIs you want to examine and mousing over the lines to see more details.	
17. Let's remove this chart. Click the **Manage Configurations** button at the top right.	

Explanation	Screenshot
18. In this dialog, you can change the KPIs for the chart, change its ordering, or remove it from the Performance Monitor. Click **Delete Chart**. 19. Click **OK**.	
20. We are back at the original Performance Monitor screen. Click the **Back** button to return to the Database Overview page.	

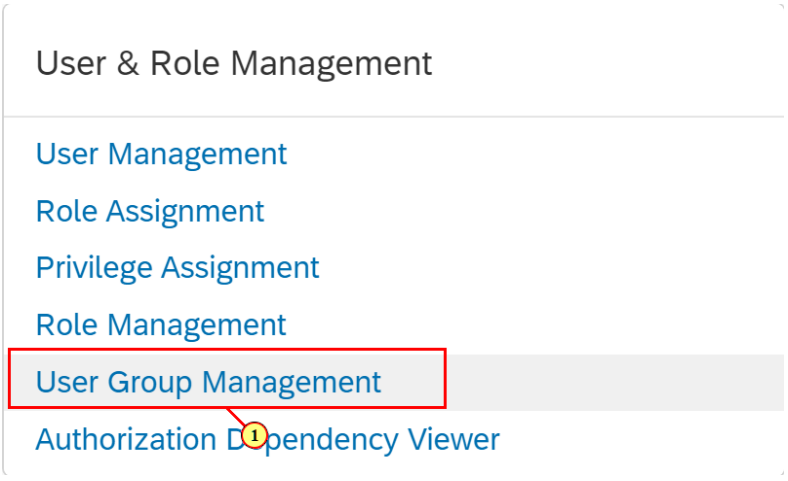
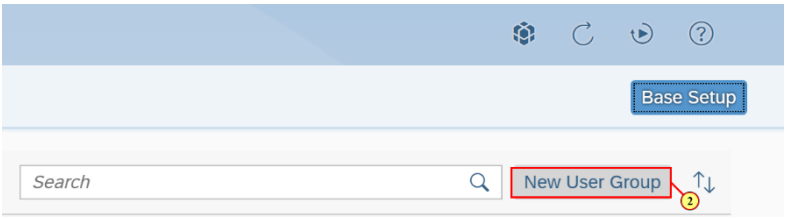
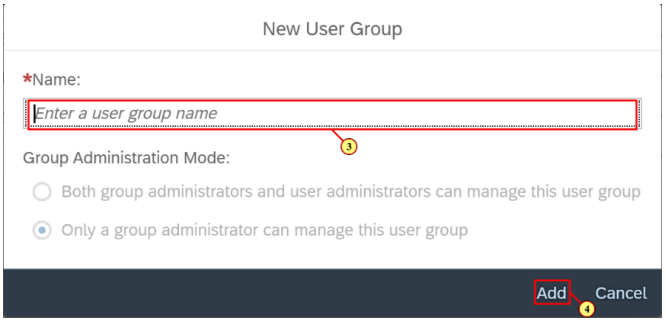
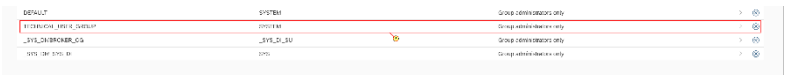
Exercise 6: Security Basics

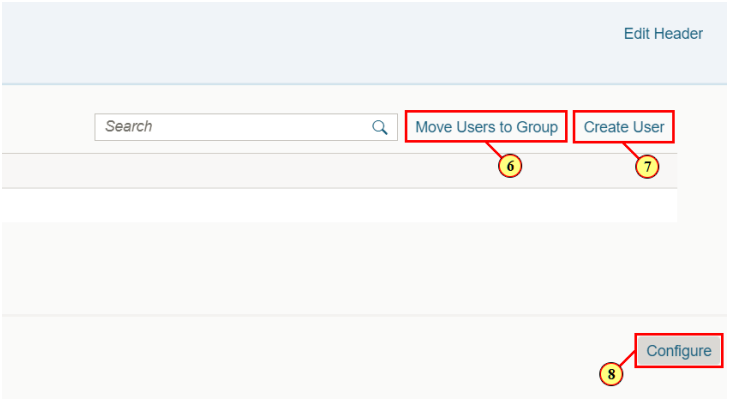
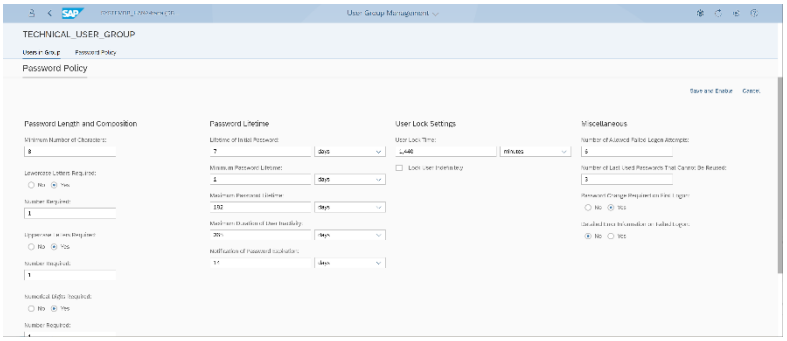
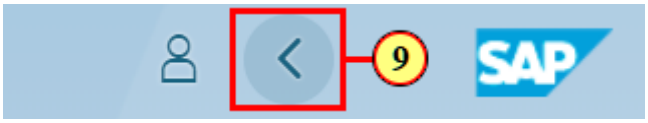
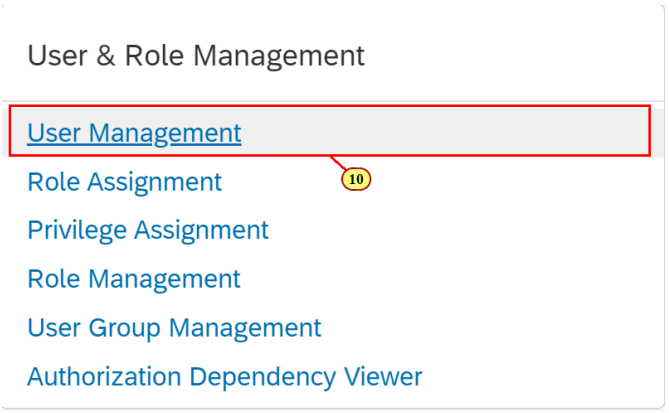
Security administration encompasses a wide range of topics, from monitoring critical security settings, to auditing activity in the SAP HANA database, to managing SAP HANA users and roles.

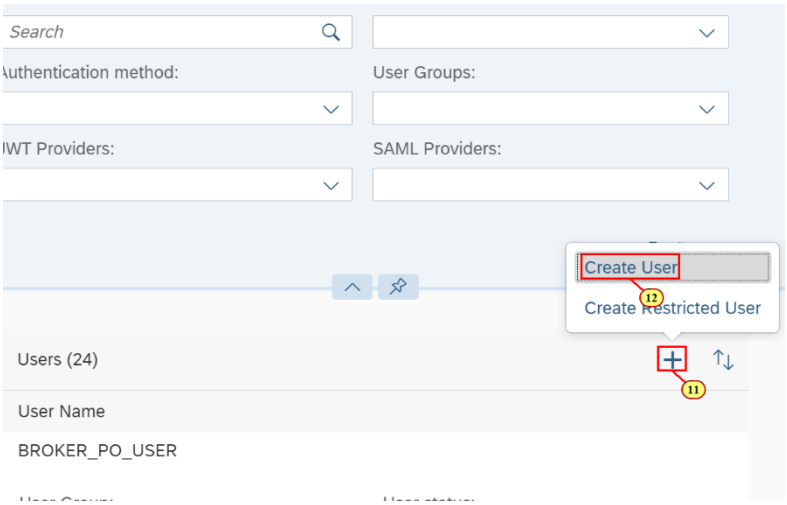
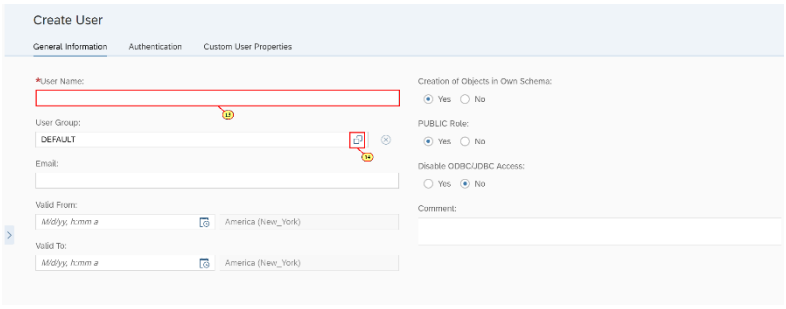
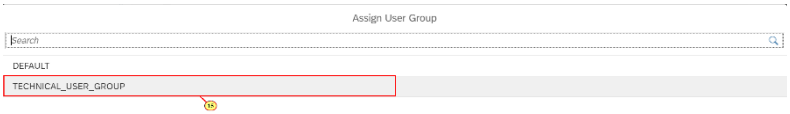
This exercise concentrates on user, role and user group management to provide you with a basic understanding of this important task of database administration.

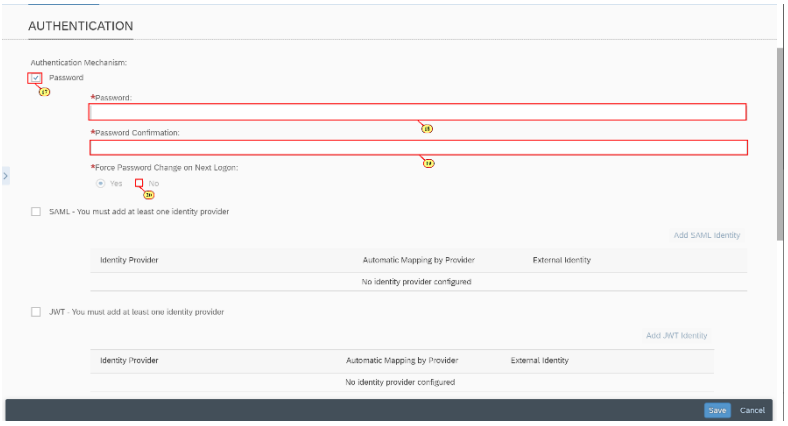
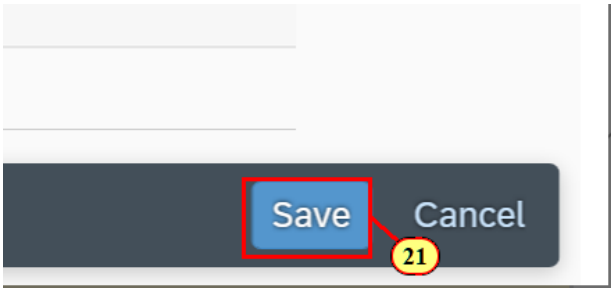
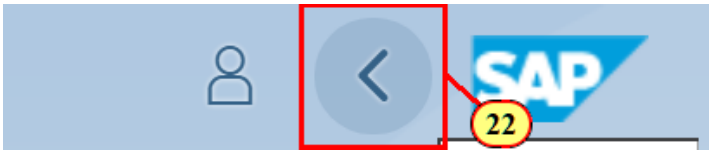
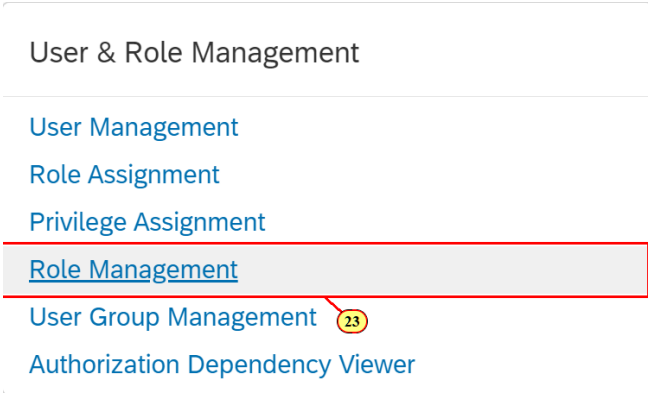
Every user who wants to work with the SAP HANA database must have a database user. As the database administrator, you create and provision the required users, as well as perform other tasks related to user administration. Roles are the standard mechanism of granting privileges to SAP HANA database users. It is recommended that you assign roles to users instead of granting privileges individually. User groups are a mechanism to organize users with similar roles or purposes.

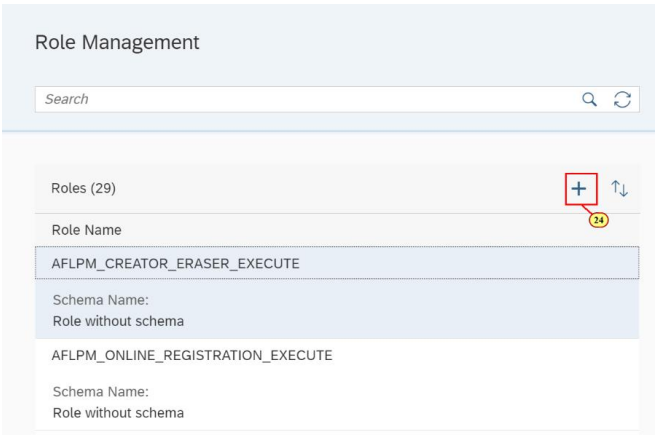
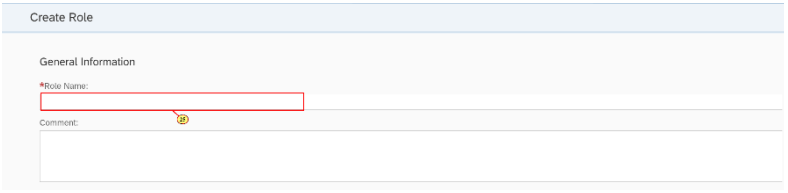
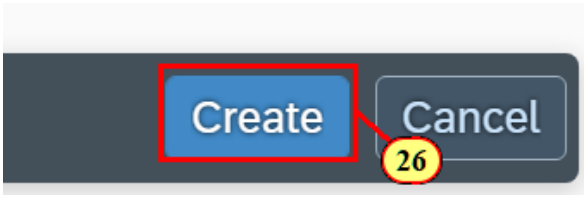
In this exercise, you'll create a new user, a new role and a new user group.

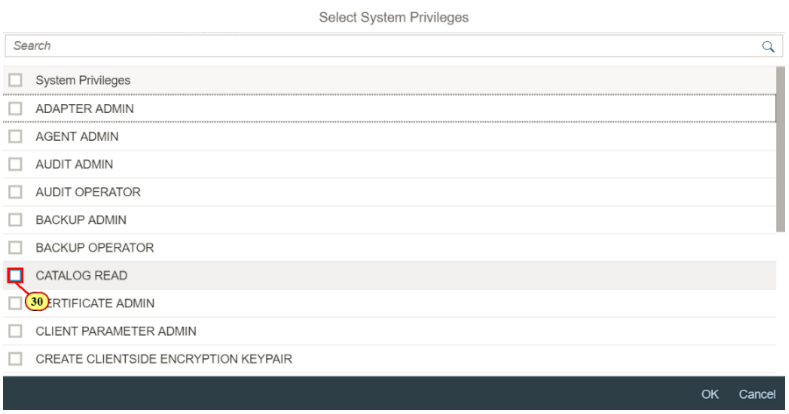
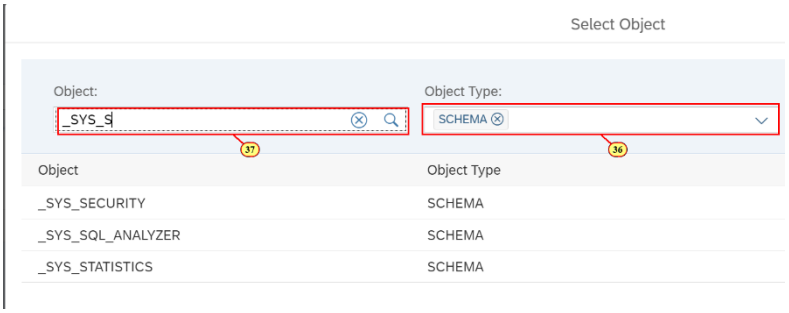
Explanation	Screenshot
1. From the Database Overview page, locate the **User & Role Management** card. Let's first create a new user group. Click **User Group Management**.	
You can use user groups to group together users with similar roles and to enforce a specific password policy on the group. 2. Click **New User Group**.	
3. Enter **TECHNICAL_USER_GROUP** in the **Name** text field. 4. Leave the rest of the options in their default settings. Click **Add**.	
5. Let's explore what we can do with our newly created user group. Click anywhere on the **TECHNICAL_USER_GROUP** row.	

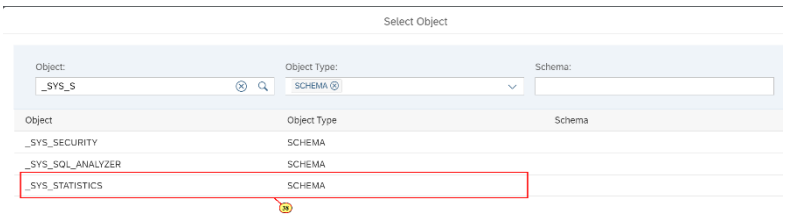
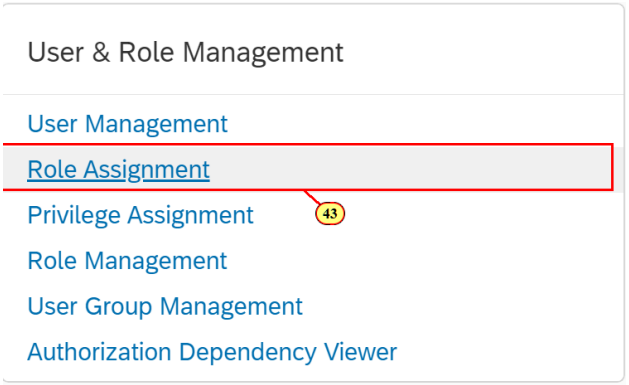
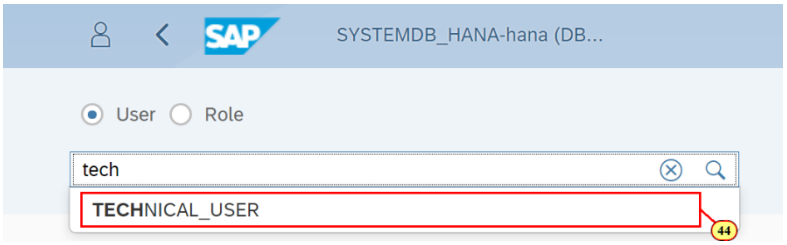
Explanation	Screenshot
6. From here you can move existing users to this user group. We haven't created our technical user yet so we won't do this from this page. 7. We can also create a new user to assign to this user group. 8. To expand the **Password Policy** configuration, click **Configure**.	
The password policy can be configured to be different from the database's password policy and will be applied to any users belonging to this user group. From here you can change password policies, such as length requirements, character requirements, password lifetime, user Lock Settings and expiry, etc.	
9. Click the **Back** button twice to return to the Database Overview page.	
10. Let's now create a new user. Go back to the **User & Role Management** card and click **on User Management**.	

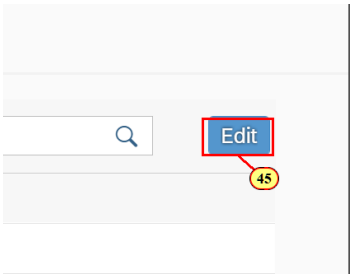
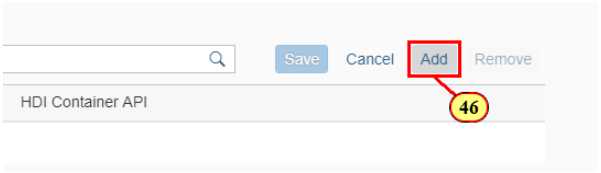
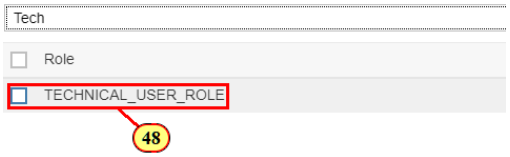
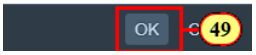
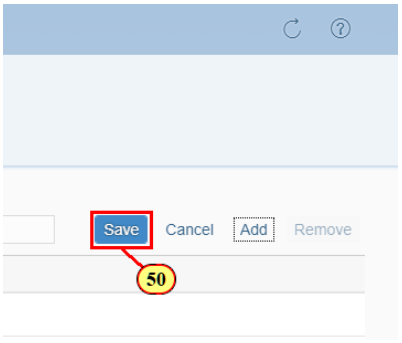
Explanation	Screenshot
11. Click the **plus sign (+)** button. 12. Click **Create User.** By default, standard users can create objects in their own schema and read data in system views. Read access to system views is granted by the PUBLIC role, which is granted to every standard user. Restricted users initially have no privileges. They are intended for provisioning users who access SAP HANA through client applications and who are not intended to have full SQL access via an SQL console.	
13. Enter **TECHNICAL_USER** in the **User Name** text field. . 14. Click the **User Group** pop-up icon.	
15. Click **TECHNICAL_USER_GROUP**.	

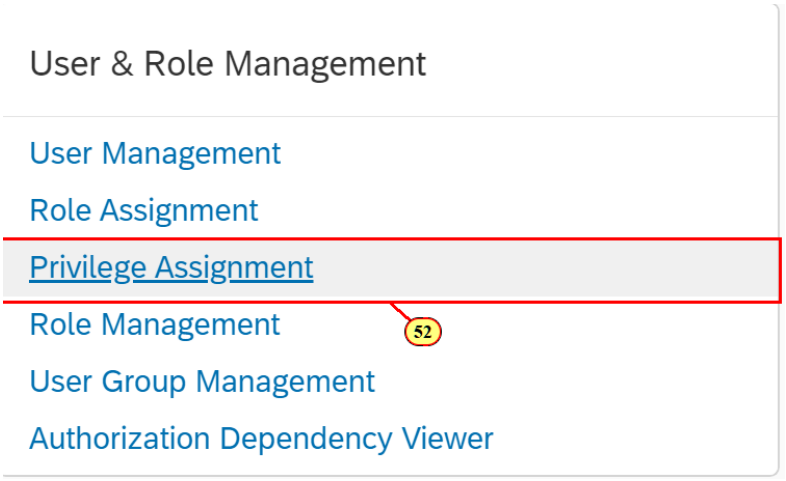
Explanation	Screenshot
16. Scroll down to the **AUTHENTICATION** section. 17. Click **Password**. 18. Enter **Abcd1234** in the **Password** text field. 19. Enter **Abcd1234** in the **Password Confirmation** text field. 20. Select the **No** radio button on the "Force password change on logon" option.	
21. Click Save in the bottom right corner.	
22. Click the **Back** button twice to return to the Database Overview page.	
23. Let's create a new role. Go back to the **User & Role Management** card and click **Role Management.**	

Explanation	Screenshot
24. Click the **plus sign (+).**	
25. Enter **TECHNICAL_USER_ROLE** in the **Role Name** text field.	
26. Click on **Create**.	
27. Click **System Privileges**. The parentheses beside the privilege type shows the number of this type of privilege granted to this role.	
28. Click **Edit**.	
29. Click **Add**.	

Explanation	Screenshot
30. Click **CATALOG READ**.	
31. Click **OK**.	
32. Click **Save**. Notice the number in the parentheses besides "System Privileges" is now one.	
33. Click **Object Privileges**.	
34. Click **Edit**.	
35. Click **Add Object**.	
36. You can filter based on Object Type. On clicking the dropdown, you can see all Object Types based on which you can filter the Objects. Choose **SCHEMA** in the **Object Type** dropdown field. 37. You can also filter based on Object Name, Enter _SYS_S in the **Object** Text field.	

Explanation	Screenshot
38. Choose _SYS_STATISTICS from the filtered results.	
39. Scroll down until you see the SELECT privilege. Check **SELECT**.	
40. Click the **SELECT** toggle to change it to **YES**.	
41. Click **OK**.	
42. Click **Back**.	
43. Let's now assign the newly created TECHNICAL_USER_ROLE to our user TECHNICAL_USER. Click on **Role Assignment**.	
On the **Role Assignment** page, we can search based on either Users or Roles 44. Search with keyword 'tech' and all existing User with that keyword show up in the dropdown. Click **TECHNICAL_USER** from the dropdown.	

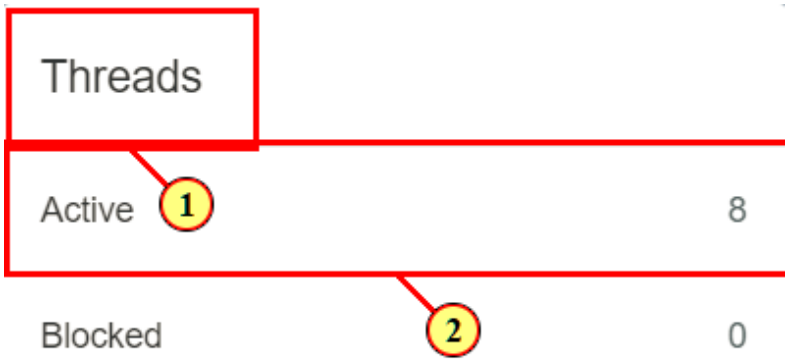
Explanation	Screenshot
45. Click **Edit**.	
46. Click **Add**.	
47. Enter **TECHNICAL_USER_ROLE** in the **Search** text field.	
48. Click **TECHNICAL_USER_ROLE.**	
49. Click **OK**.	
50. Click **Save**.	
51. Click **Back** to return to the Database Overview Page.	

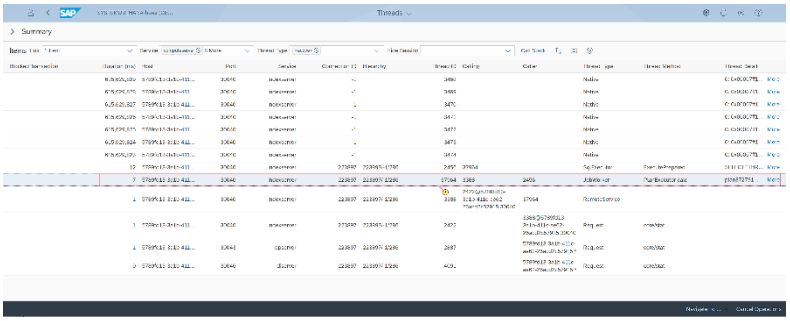
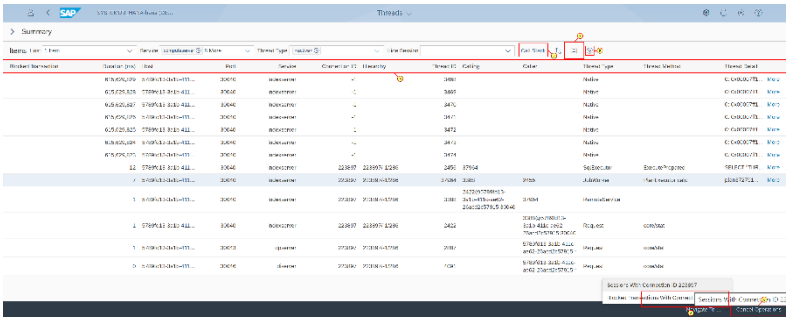
Explanation	Screenshot
52. There is one more link in the **User & Role Management** card, and that is **Privilege Assignment**. This application allows you to assign the same privileges that you saw in the **Role Assignment** application, but this time without having to create a role for the user. This is useful for unique users that require a different combination of privileges than the main reusable roles. We won't cover this because it will mostly be a repeat of what we just saw with the roles portion of this exercise.	

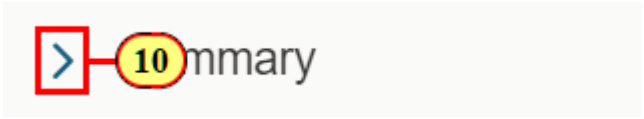
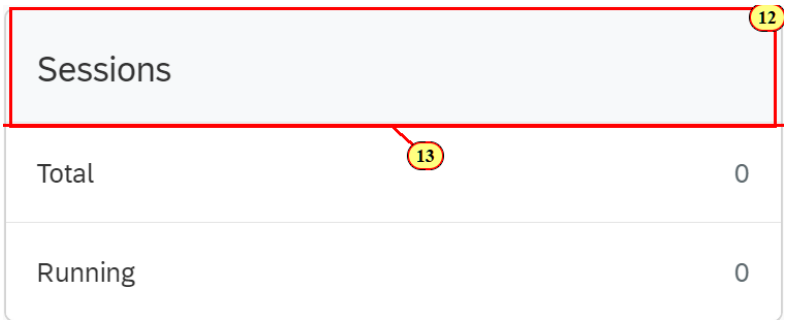
Exercise 7: Performance Management

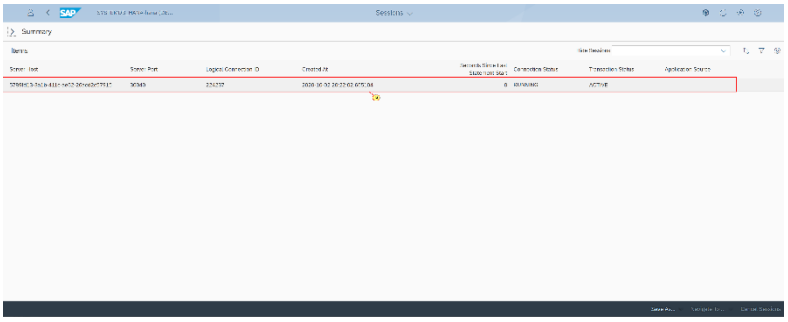
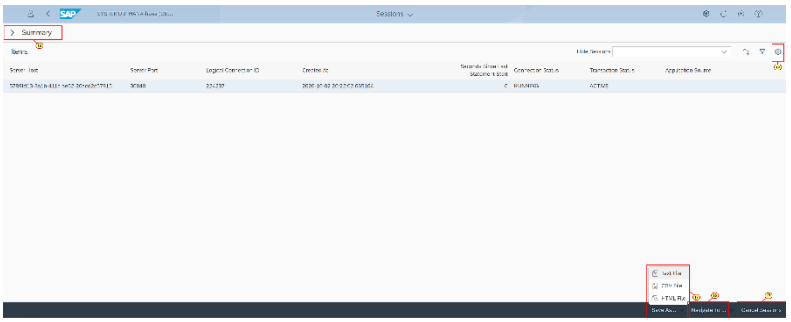
Managing and monitoring past and current information about the performance of the SAP HANA database is important for root-cause analysis and the prevention of future performance issues. We already learned about the Performance Monitor and Memory Analysis applications to visualize and analyze current and historical performance data.

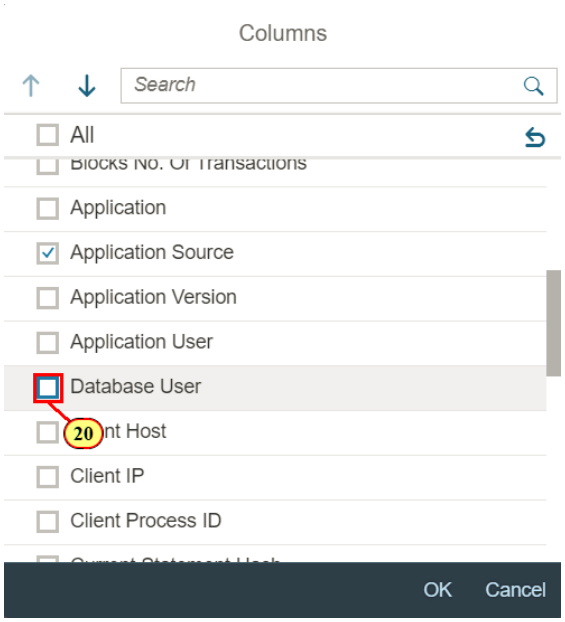
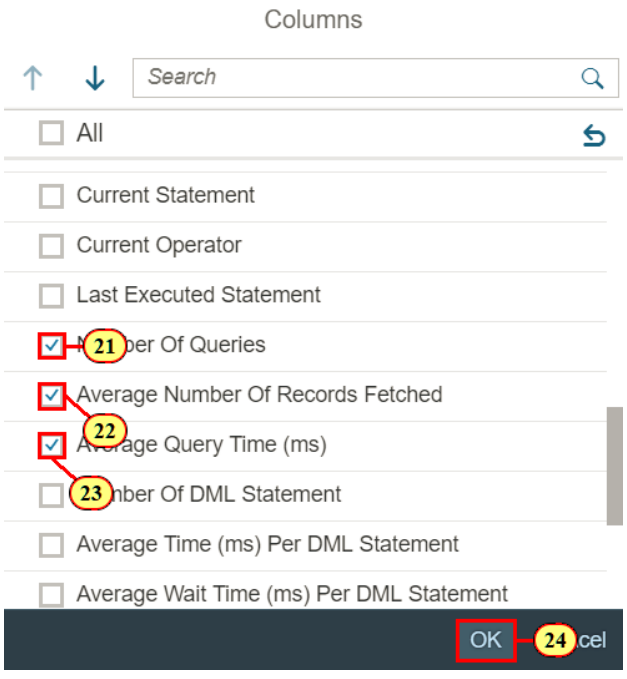
In this exercise, you'll explore the additional performance management tools available in the SAP HANA cockpit.

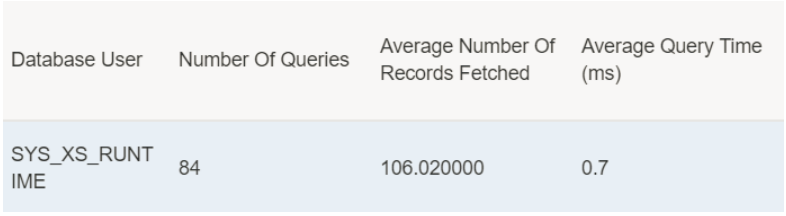
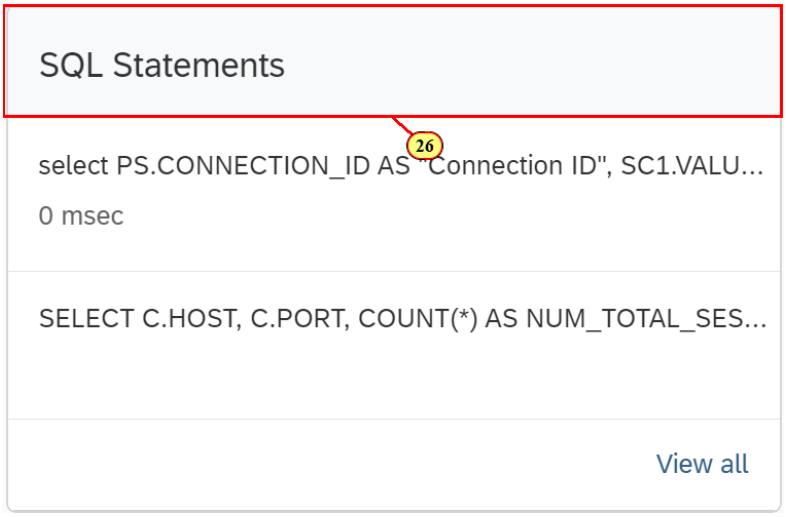
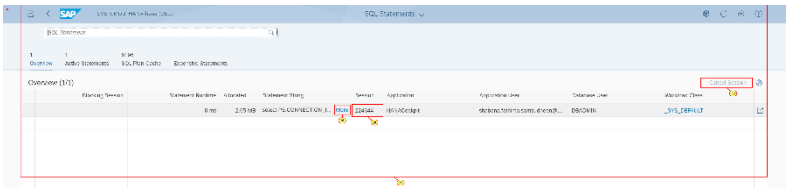
Explanation	Screenshot
1. From the Database Overview page, scroll down until you locate the **Threads** card. This card shows the number of active and blocked threads in the database. Clicking on it takes you to the Threads app, which is used to monitor the longest-running threads active in your system. It may be useful to see, for example, how long a thread is running, or if a thread is blocked for an inexplicable length of time. 2. Click on the **Active** threads to launch the Threads application.	

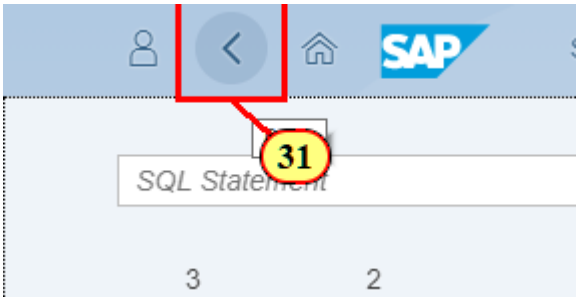
Explanation	Screenshot
3. Click any row to activate the options in the bottom right corner.	
When you launch the Threads app, you'll see detailed information for approximately the 1,000 longest-running threads currently active in the database. 4. For each statement, you can see the duration, as well as the name of the service that is executing the thread. You can identify the host, the port, and the thread type, whether the statement is related to a blocking transaction, and much more. 5. Clicking on a thread offers you the option to navigate to the sessions or blocked transactions associated with that connection ID. 6. If a thread is involved in a blocked transaction or using an excessive amount of memory, you can cancel the operation executing the thread. 7. You can view the call stack for this thread, although that is typically only useful to SAP Support when analyzing incidents.	

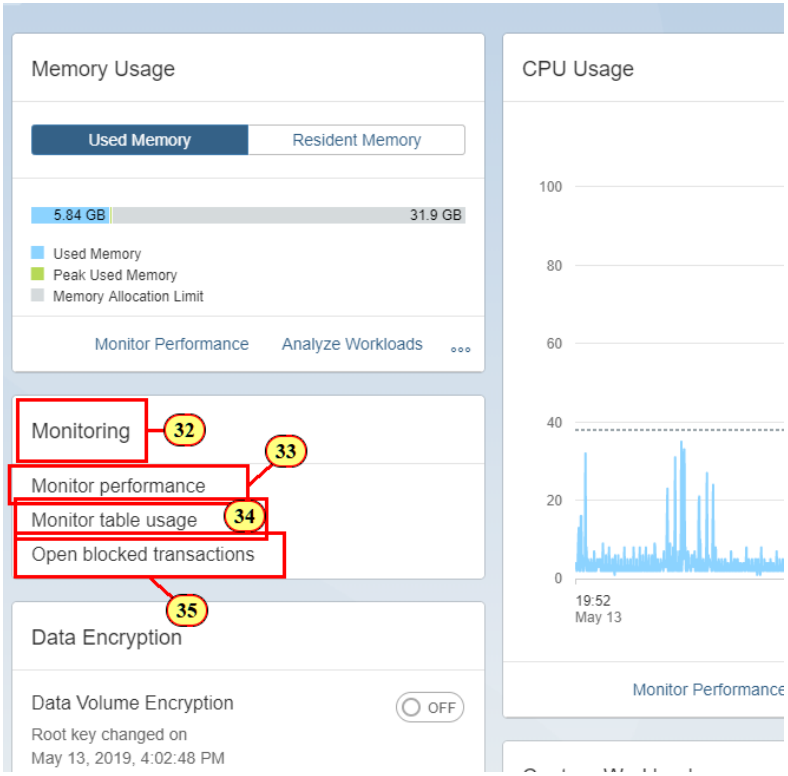
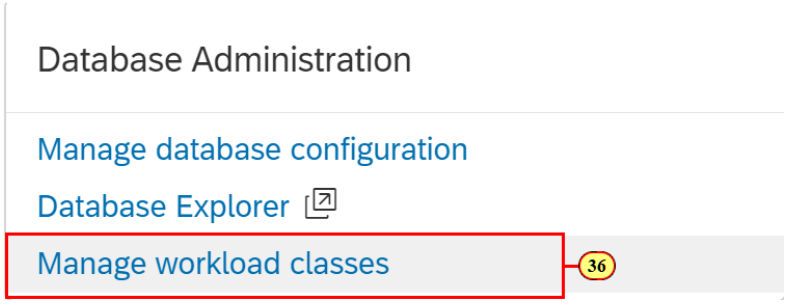
Explanation	Screenshot
8. The threads can be grouped or sorted using the Group and Sort icon. 9. You can view much more details on the threads by adding columns to the table via the Settings button.	
10. Click the **Summary** arrow above the table.	
In addition to the thread details, you can see a summary of the top 5 application and database users, and information about the total number of threads by status and type. 11. Click **Back** to return to the Database Overview page.	
12. Locate the **Sessions** card. The Sessions card shows the currently running and total number of sessions in the database. Analyzing the sessions connected to your SAP HANA database can help you identify which applications or which users are currently connected to your system, as well as what they are doing in terms of SQL execution. 13. Click on anywhere on the sessions card to launch the Sessions application.	

Explanation	Screenshot
14. Click any row to activate the options in the bottom right corner.	
The Sessions app allows you to monitor all sessions in the database. It can be used to see whether a session is blocked and, if so, which session is blocking it. 15. Similar to the Threads app, you can see a summary of the top users, applications and sessions. 16. You can navigate to threads and blocked transactions with a specific connection ID. 17. You can cancel a session. 18. You can save the data sets as a text, CSV or HTML file. 19. Click **Settings**.	

Explanation	Screenshot
20. Scroll down until you see **Database User** and check it.	
21. Scroll down further to **Number Of Queries** and check it. 22. Click **Average Number Of Records Fetched**. 23. Click **Average Query Time (ms)**. 24. Click **OK**.	

Explanation	Screenshot
You added columns to see the database user, the number of queries in this session, along with its average number of records fetched and query time. By examining these metrics, you can determine whether the queries in this session are returning the expected number of rows and are executing in the expected amount of time.	
25. Click **Back** to return to the Database Overview page.	
The SQL Statements tile displays the number of long-running statements and the long-running blocking situations currently active in the database. They are ranked based on a combination of the following criteria: (1) Runtime of the current statement execution, (2) Lock wait time of the current statement execution, and (3) Cursor duration of the current statement execution. 26. Locate the **SQL Statements** card and click on the top section.	
27. You are now redirected to SQL Statements page, where you can have a look at the Overview, Active Statements, SQL Plan Cache and Expensive statements. These options in details will be discussed in Chapter 3.	

Explanation	Screenshot
The Monitor Statements app shows the 100 most critical statements currently active in the database. For each statement, you can see the full statement string, as well as the ID of the session in which the statement is running. You can identify the application, the application user and the database user running the statement, and whether the statement is related to a blocking transaction. 28. You can see the entire SQL statement by clicking the "More" link. 29. You can view the session the statement is running in. 30. If a statement is involved in a blocked transaction or using an excessive amount of memory, you can cancel the session the statement is running in (or the blocking session).	
31. Click **Back** to return to the Database Overview page.	

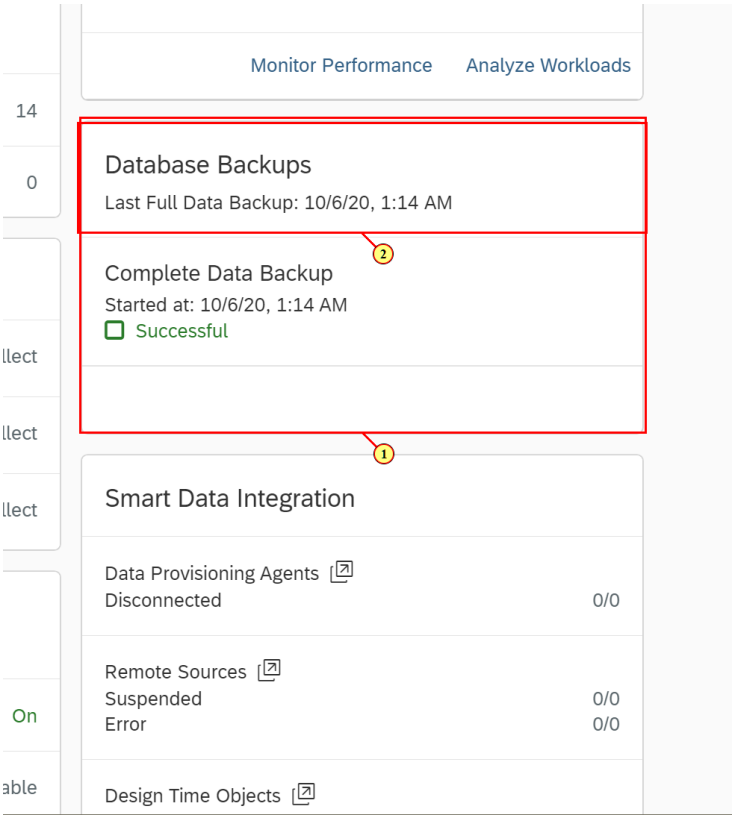
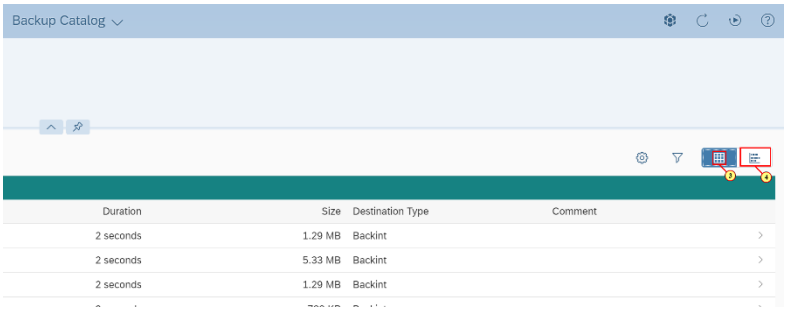
Explanation	Screenshot
32. Scroll to the **Monitoring** card. We'll briefly explain the other performance management tools available in SAP HANA cockpit. 33. We already examined the Performance Monitor in a previous exercise. It allows you to visually analyze historical performance in the database across a range of related performance indicators. 34. Monitoring table usage can help you optimize resource utilization and improve query performance. This link takes you to the Table Usage application, where you can visualize tables by size, explore the usage history of tables, and move tables to warm storage. 35. The "Open blocked transactions" link opens the Blocked Transactions application. In this application you can see important details about the currently blocked transactions such as host, service, connection ID, duration, thread details, and more.	
36. A bit further down in the **Database Administration** card, you'll see the link to launch the Manage workload classes application. Use it to create workload classes and workload class mappings. Workload classes allow SAP HANA to influence dynamic resource consumption on the session or statement level. Workload management allows you to determine how much concurrent work takes place	

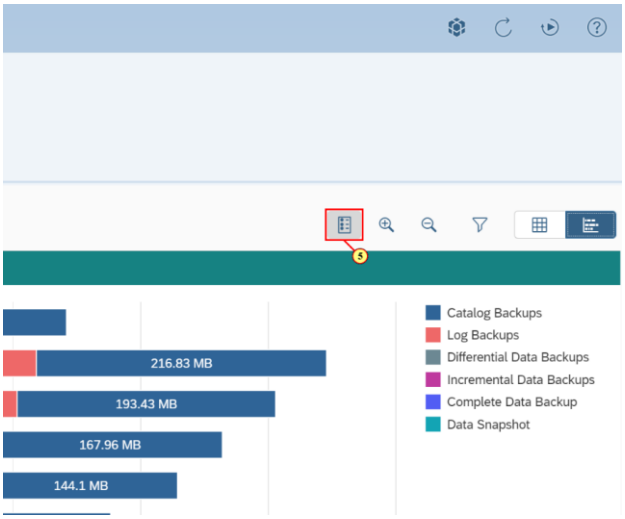
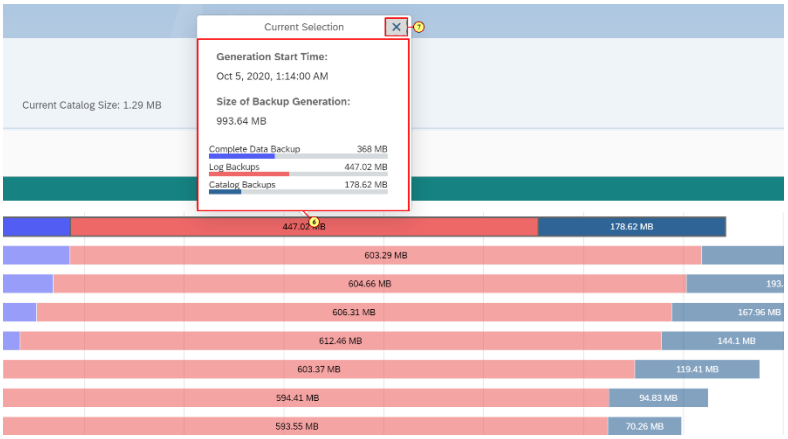
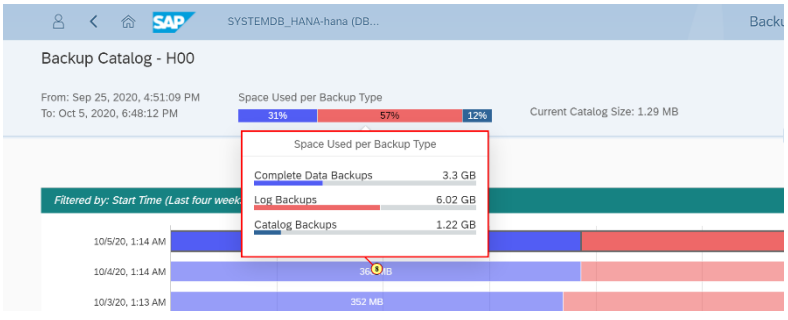
Explanation	Screenshot
on an SAP HANA system and how that work is prioritized. The goal is to maximize the overall system performance by balancing the demand for resources between the various workloads.  Use this application to create workload classes and workload class mappings. Workload classes allow SAP HANA to influence dynamic resource consumption on the session or statement level. Workload management allows you to determine how much concurrent work takes place on an SAP HANA system and how that work is prioritized. The goal is to maximize the overall system performance by balancing the demand for resources between the various workloads.	

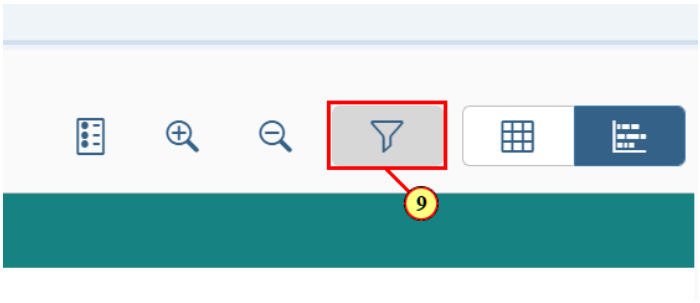
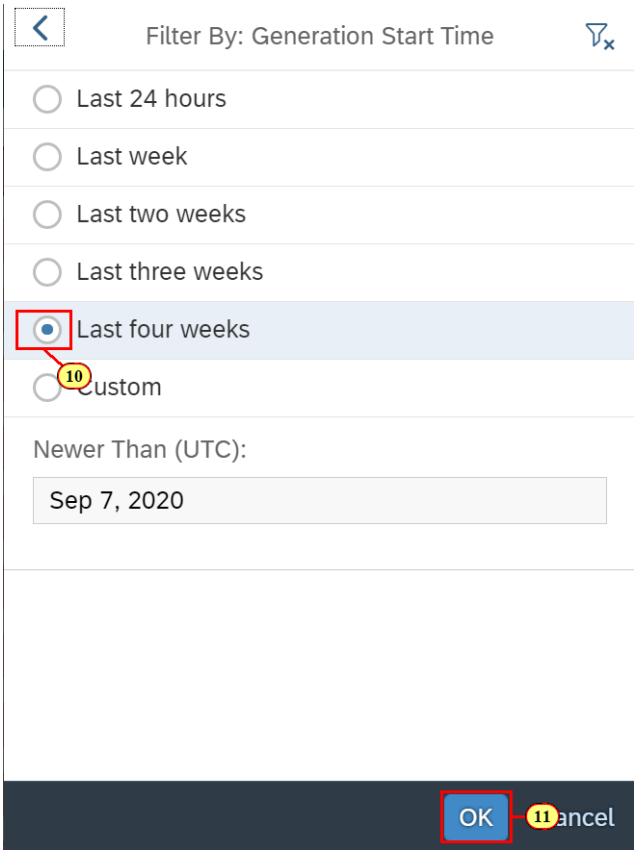
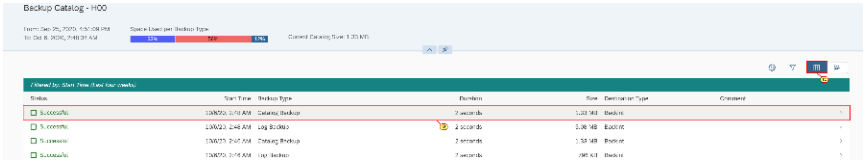
Exercise 8: Database Backup

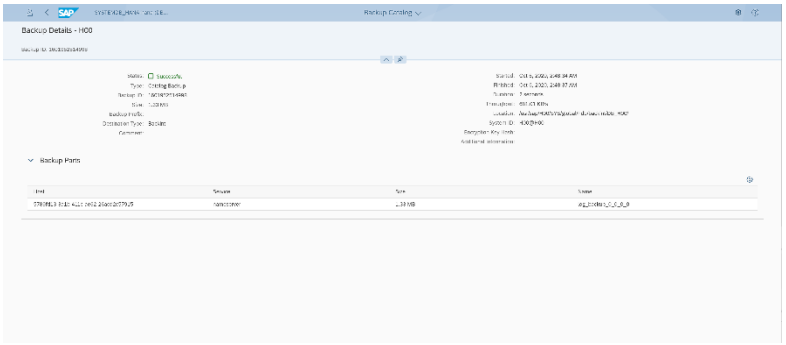
Database backups are crucial to ensuring data stays safe. In the SAP HANA Cloud service, all backups are created for you, but you can view the backup catalog in the SAP HANA cockpit.

Explanation	Screenshot
1. Let's now look into the backup of our database.	

Explanation	Screenshot
Locate the **Database Backups** card. 2. Click **Manage database backups**.	
3. Clicking on this option would display all the backups stored in a table format. 4. Clicking on Horizontal stacked chart button would display all the backups stored in a statistical or pictorial format i.e. in form of graphical representation that is easy to interpret.	

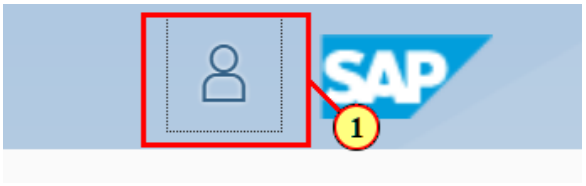
Explanation	Screenshot
5. Clicking on the **Legend** button would either display the different types of backups that has been captured. We can either choose to display these types or hide them by click on this button.	
6. On clicking anywhere on the horizontal bar chart, you get details on memory consumed by complete data backup and other backup types. In this screenshot you can notice the amount of memory occupied by Log and Catalog Backups. 7. Click **Close** button to close the pop up.	
8. On clicking the topmost horizontal bar, gives you details on Space Used per Backup Type.	

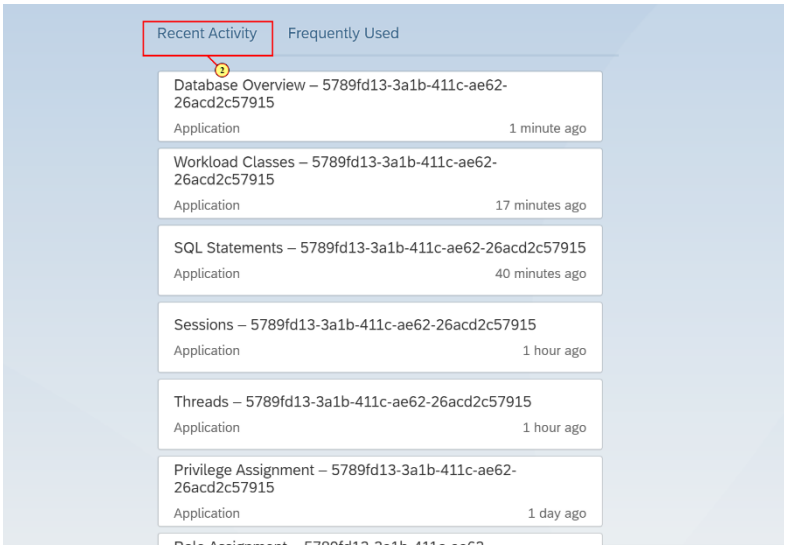
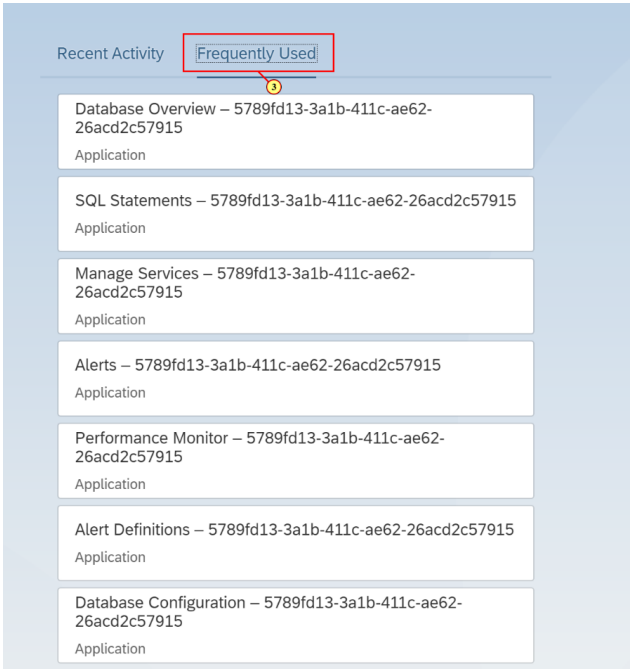
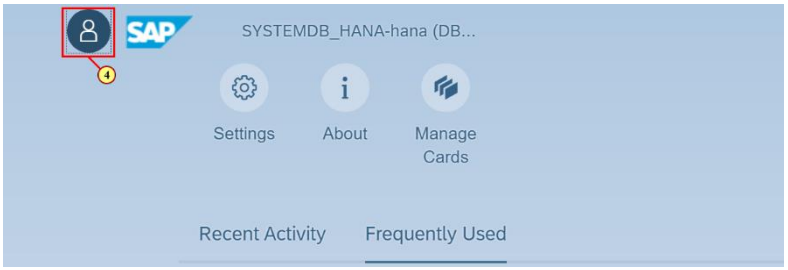
Explanation	Screenshot
9. The filtering button can be used to filter based on the what time frames we would like to see the backups.	
10. Select 'Last Four Weeks' to view the backups taken in last four-week time frame. 11. Click on **OK** to apply the chosen time frame**.**	
12. Click **on Table View** button to get back to the Backup details page. 13. On clicking on any of the backup record, you will be redirected to Backup details page, that has in detail view of the backup.	

Explanation	Screenshot
	
14. Click Back twice to return to the Database Overview page.	

Exercise 9: Recent Activities and Frequently Used Apps

As the tenant database administrator, you have the option to view your recent activities and most frequently used applications in the Database Overview page of your selected database in order to trace back your activities or view your favorite applications faster.

Explanation	Screenshot
1. Click the **User Icon** at the top left of the database overview page.	

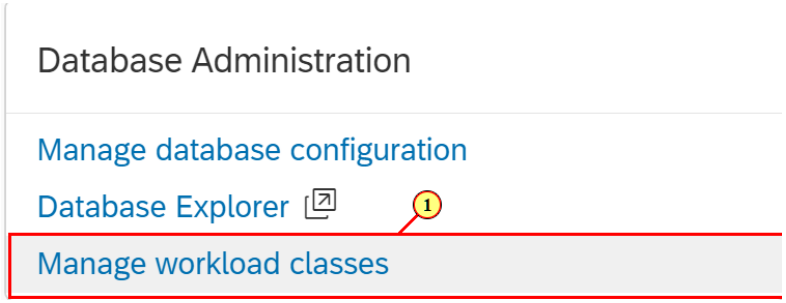
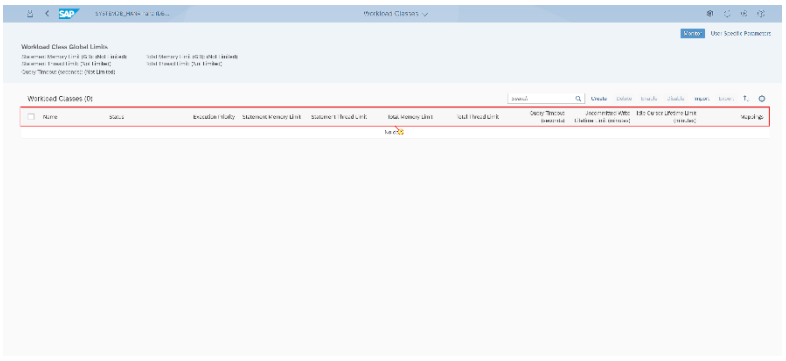
Explanation	Screenshot
Under the **Recent Activity** tab in the side bar are a list of the applications the user had used. The history can stretch back to several days. 2. When you click the user icon, the side bar menu is displayed and shows both the **Recent Activity** list and a tab for the **Frequently Used** list.	
3. Click the **Frequently Used** tab to view the list of frequently used applications.	
The **Frequently Used** tab in the side bar allows the user to view their most frequently used applications in a list, with the most used application at the top and least used application near the bottom	

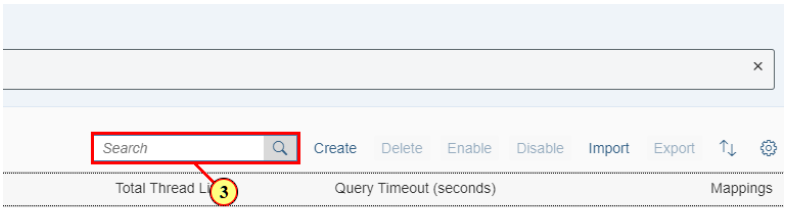
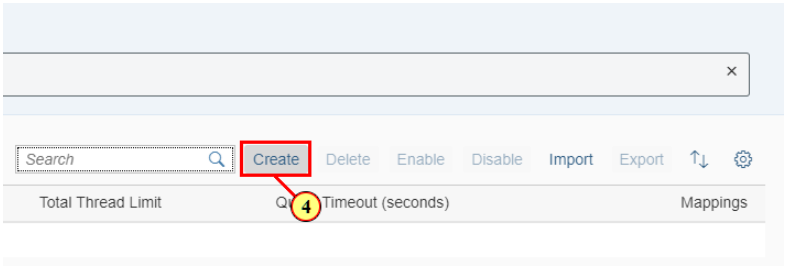
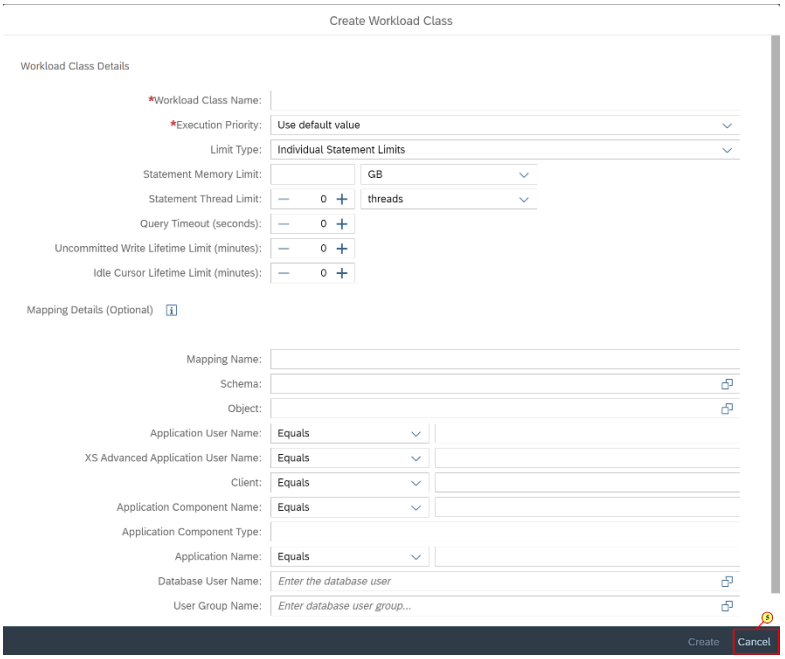
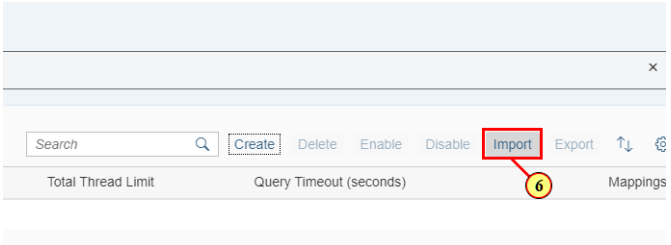
Explanation	Screenshot
4. Select the **User Icon** at the top left again to close the side bar and to go back to the Database Overview page.	

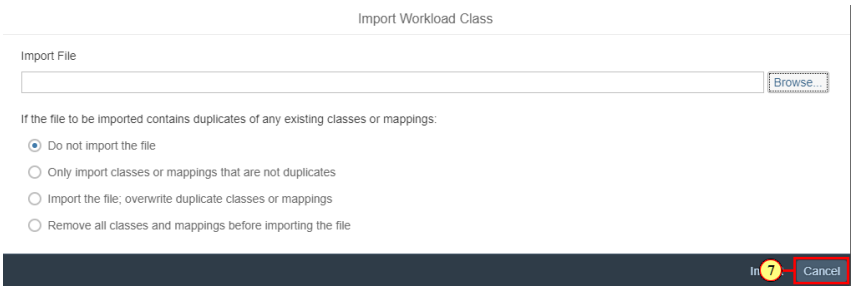
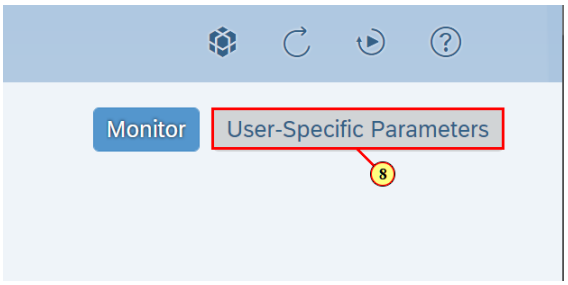
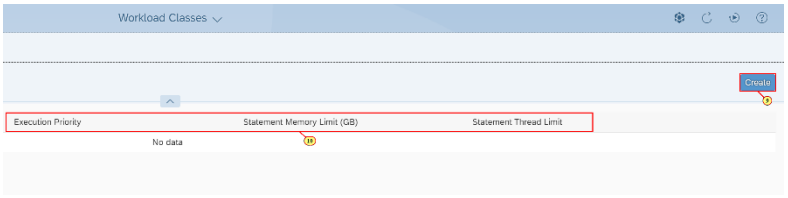
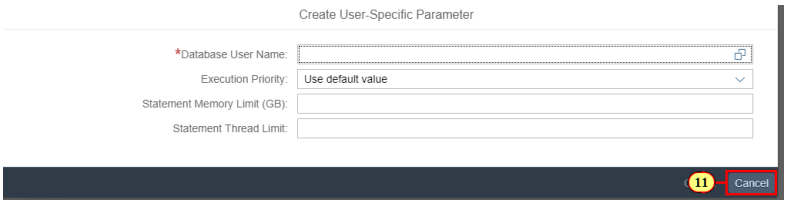
Exercise 10: Managing Workload Classes

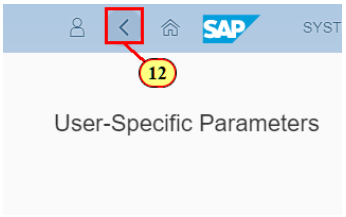
We manage workload in SAP HANA by creating workload classes and workload class mappings. Appropriate workload parameters are then dynamically applied to each client session. You can classify workloads based on user and application context information and apply configured resource limitations (for example, a statement memory limit). Workload classes allow SAP HANA to influence dynamic resource consumption on the session or statement level.

In this exercise you will learn on how to create Workload classes and how to monitor them.

Explanation	Screenshot
1. Locate the Data Administration card on the Database Overview page and click **Manage workload classes**.	
2. The workload classes application displays the parameters for every workload class in the system.	

Explanation	Screenshot
3. You can search for workload classes using the **Search bar**.	
4. You can create a new workload class. Click the **Create** button to view the pop-up page.	
You can create a workload class by entering a class name, execution priority, limit type, statement memory limit, and statement thread limit. You also have the option to map workload classes to user groups in the **Mapping Details** section of the pop-up. 5. Click **Cancel** to return to the workload classes application.	
6. Click **Import** to import new workload classes into the application.	

Explanation	Screenshot
You can browse a Workload Class file that you want to be imported using the Browse option. Then, select from one of the four radio options that we have, according to how you want the classes and mappings to be imported and then click on **Import.** Since we will not be importing any class files for now, let us continue as is. 7. Click **Cancel** to return to the workload classes application.	
8. Click **User-Specific Parameters** to view the user-only values for the workload classes.	
9. Click **Create**. 10. The user-specific parameters for the workload classes include execution priority, statement memory limit, and statement thread limit.	
11. Click **Cancel** as we will not be creating a new user-specific parameter. Creating a new user-specific parameter will require a database user name. You can optionally add execution priority, statement memory limit, and statement thread limit.	

Explanation	Screenshot
12. Click **Back** twice to return to the Database Overview page.	

Summary

You have completed the exercise!

You are now able to:
Monitor and manage individual SAP HANA databases

CHAPTER 2 - DATABASE EXPLORER

Overview

Estimated time: 30 minutes

Objective
The SAP HANA database explorer is a web-based tool for browsing and working with database objects such as tables, views, functions, stored procedures, debugging SQL Script, viewing trace files and executing SQL statements. In the following exercises, you will become familiar with use of the Database Explorer.

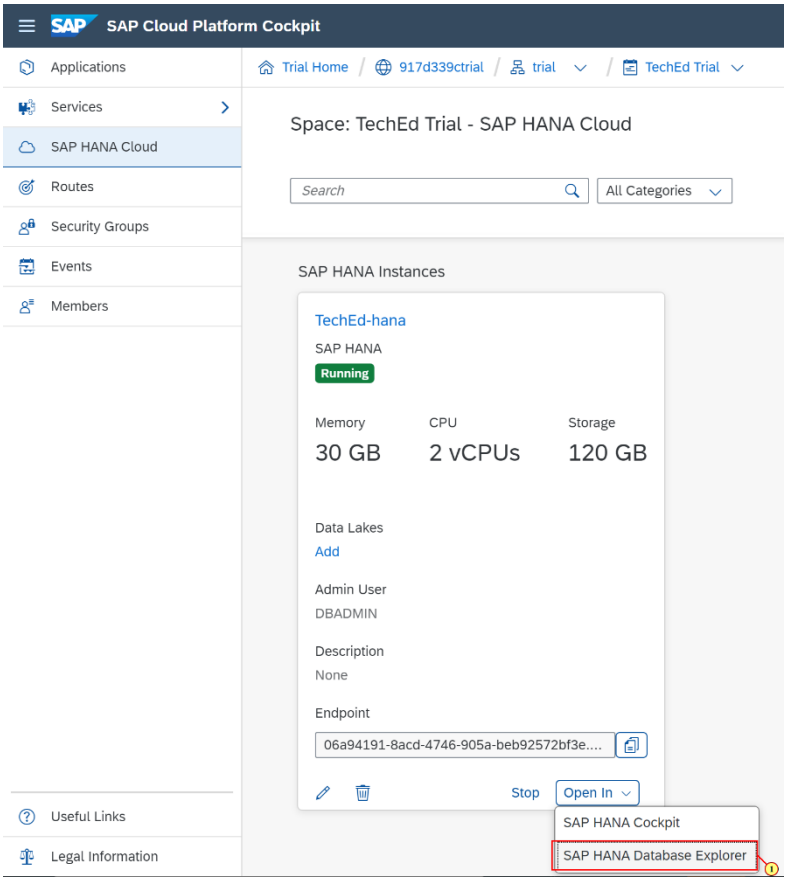
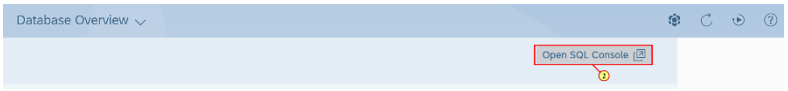
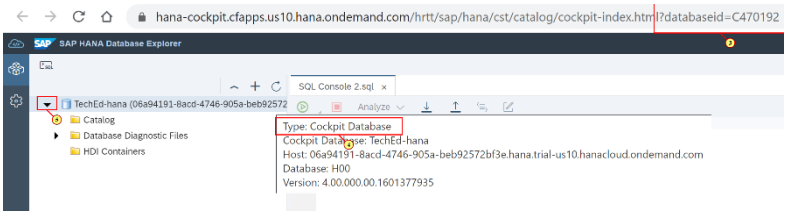
Exercise Description
This chapter offers learning opportunities for:

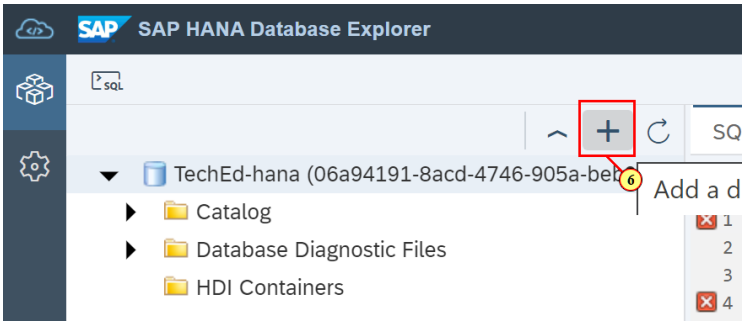
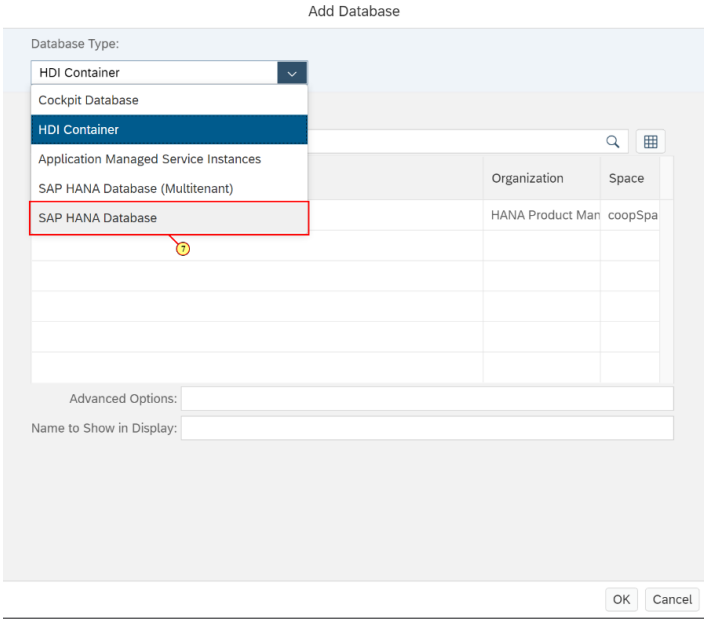
- Starting the Database Explorer and connecting to databases
- Exploring database objects using the Database Explorer
- Using the SQL Console
- Creating, Importing, Exporting and Editing database objects

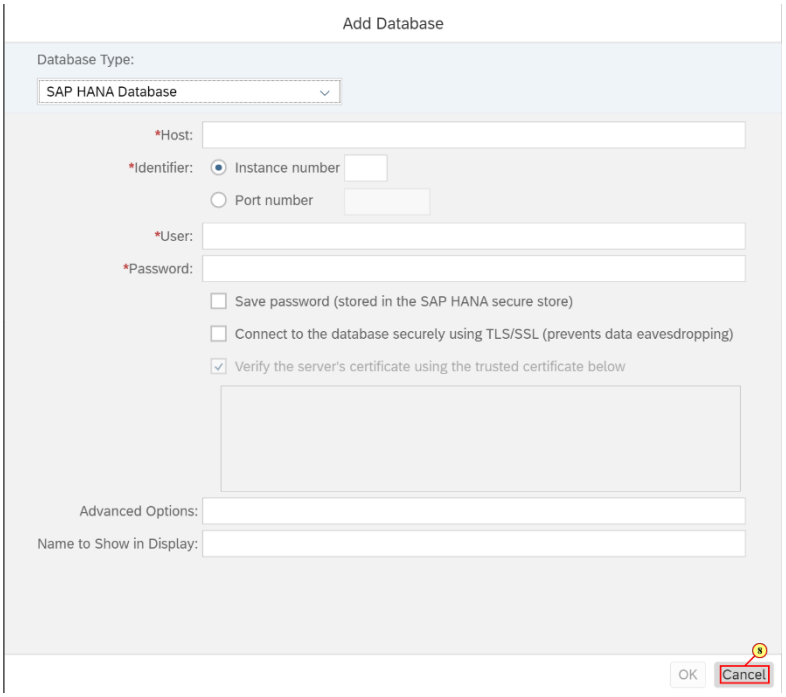
Exercise 1: Getting Started with Database Explorer

In this exercise, you will launch the Database Explorer from the SAP HANA Cloud instance, and then connect to a database.

Explanation	Screenshot
1. From the SAP Cloud Platform, you can choose to	

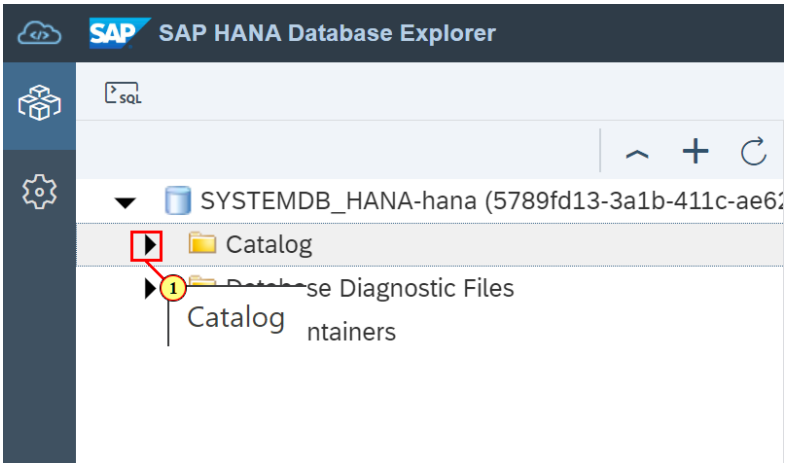
Explanation	Screenshot
open the **SAP HANA Database Explorer.**	
2. Or you can also launch the Database Explorer from the HANA Cloud Cockpit by clicking on 'Open SQL Console' option on the top right corner.	
You may be prompted to enter database login credentials at this point. Enter the DBADMIN user credentials which were set during the SAP HANA instance setup process. 3. Notice that the SAP HANA database explorer opens and the selected database is the one from the administered database. Also note that the	

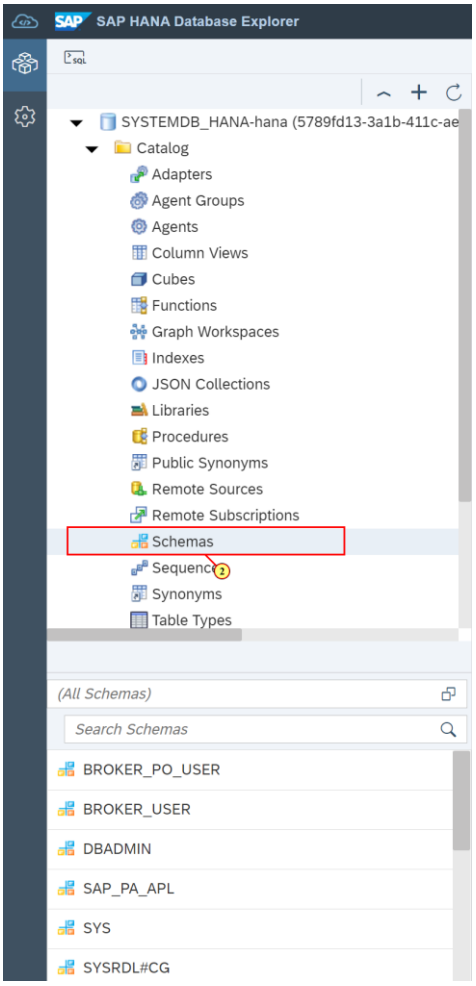
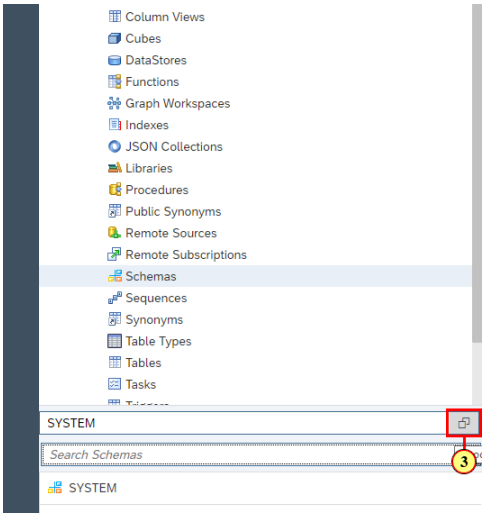
Explanation	Screenshot
URL contains a "?databaseid=" 4. Hover over the database to see a summary and note that the type is Cockpit Database 5. At the top of the left pane, click the arrow next to the TechEd-hana database icon, to expand the object hierarchy for the database. You will see that it holds catalog objects and database diagnostic files (trace files, or log files)	
6. Click the + button at the top of the left pane to connect to a database that is not already in the treeview on the left pane. You can connect to other resources managed by SAP HANA cockpit, or you can connect to other SAP HANA databases, which are not managed by this SAP HANA cockpit instance.	
7. Choose SAP HANA Database from the dropdown.	

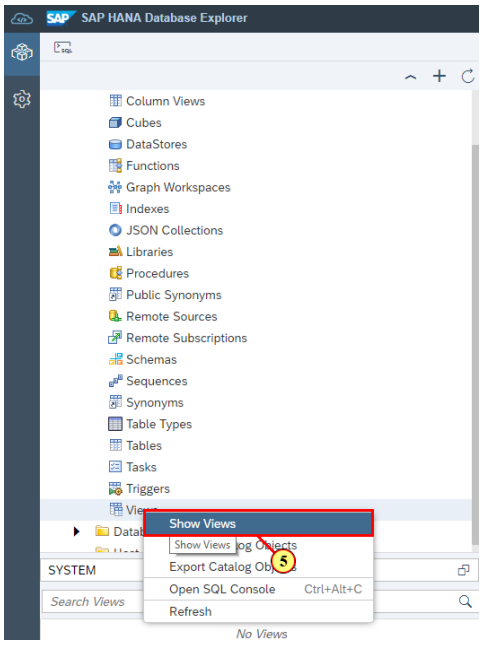
Explanation	Screenshot
Provide the host, port, user name, password and name to show in display. The host and port values can be copied from the SAP HANA Cloud Platform Cockpit. 8. As we are not going to add another database for now in our exercise, continue by clicking on **Cancel** to close the pop up.	

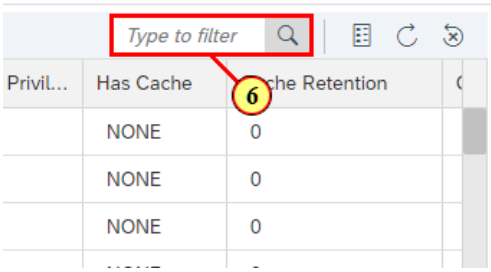
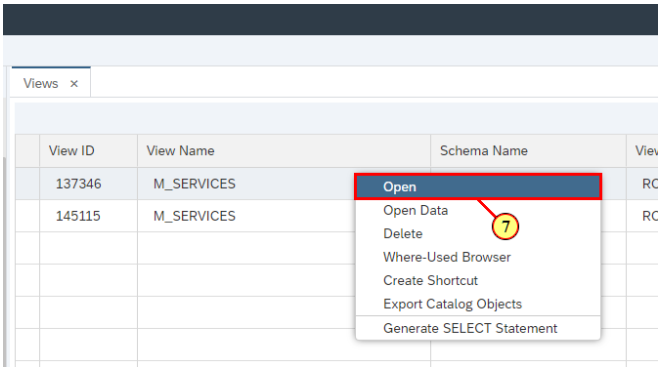
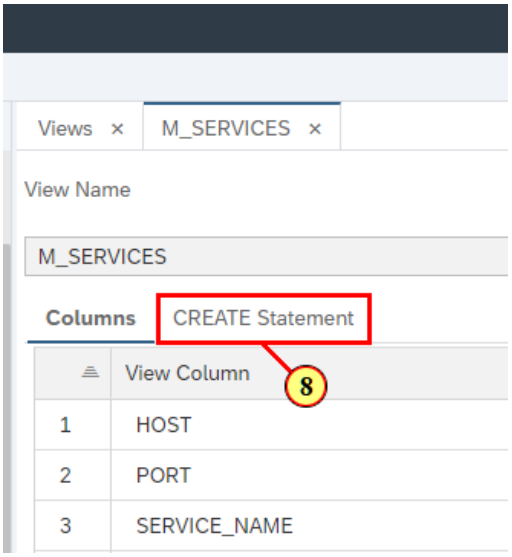
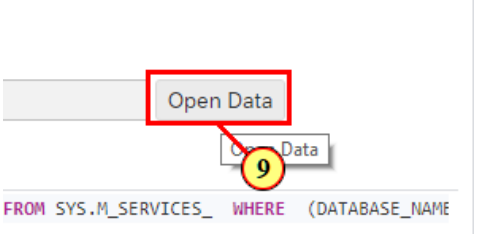
Exercise 2: Browsing the Catalog

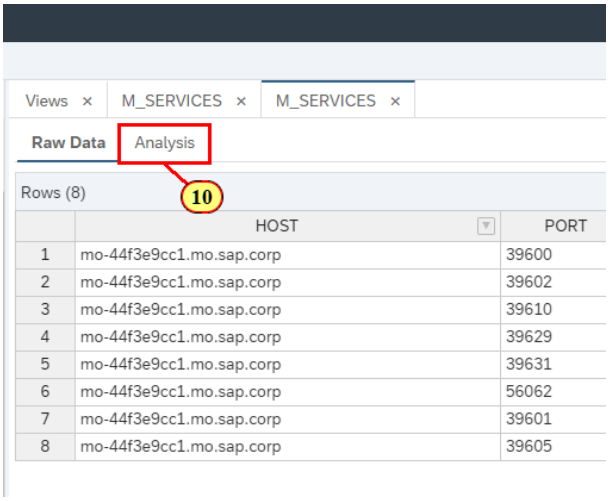
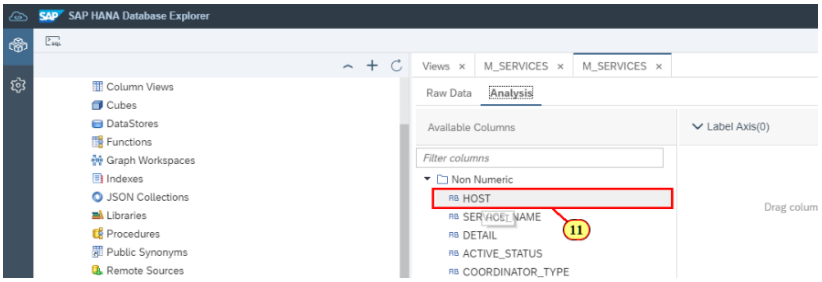
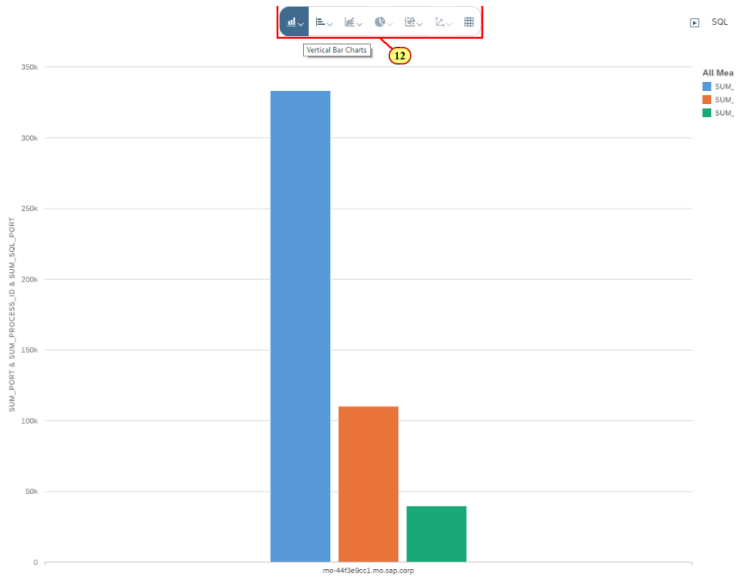
In this exercise we will browse the catalog objects in the database, and explore their properties and data using the Database Explorer. We will use the SYSTEM schema, which exists in every SAP HANA database, as a source of examples.

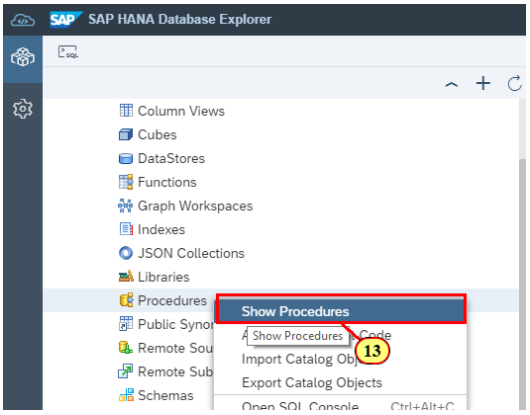
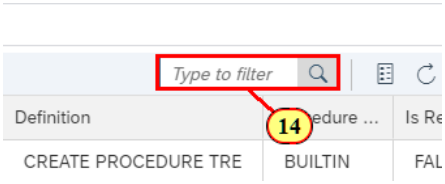
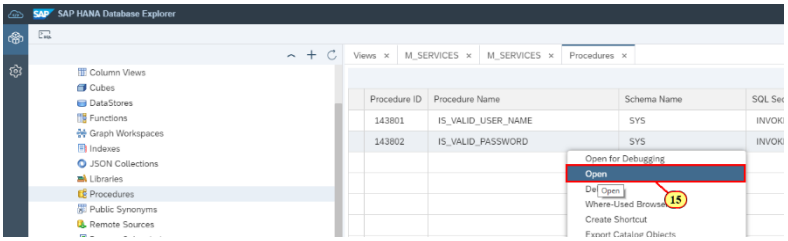
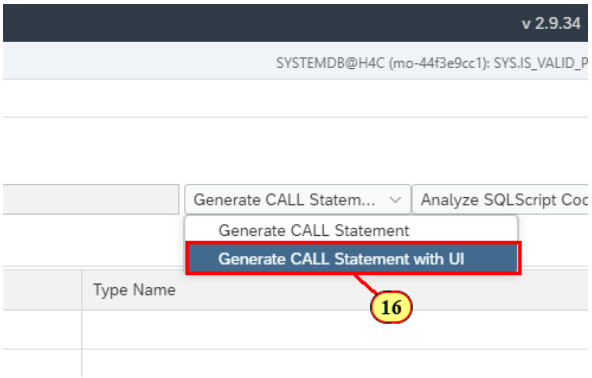
Explanation	Screenshot
1. Click the arrow next to the **Catalog** folder to expand the catalog hierarchy. It shows a separate container for each schema in the database to which you have access to.	

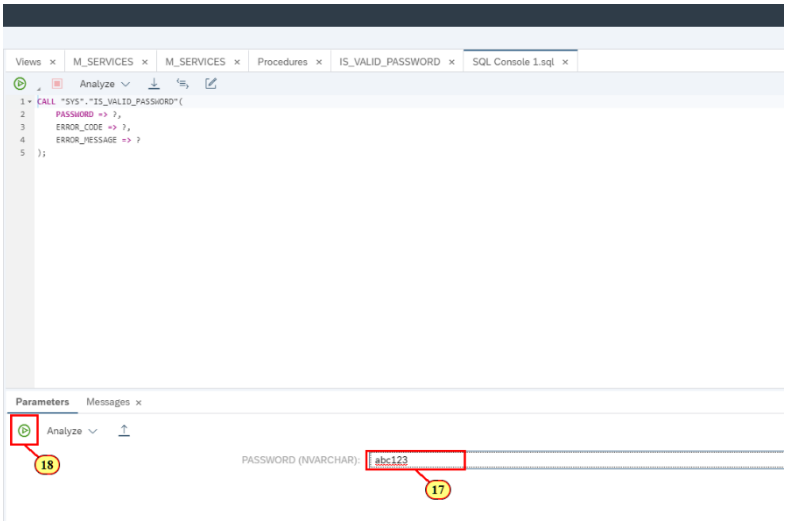
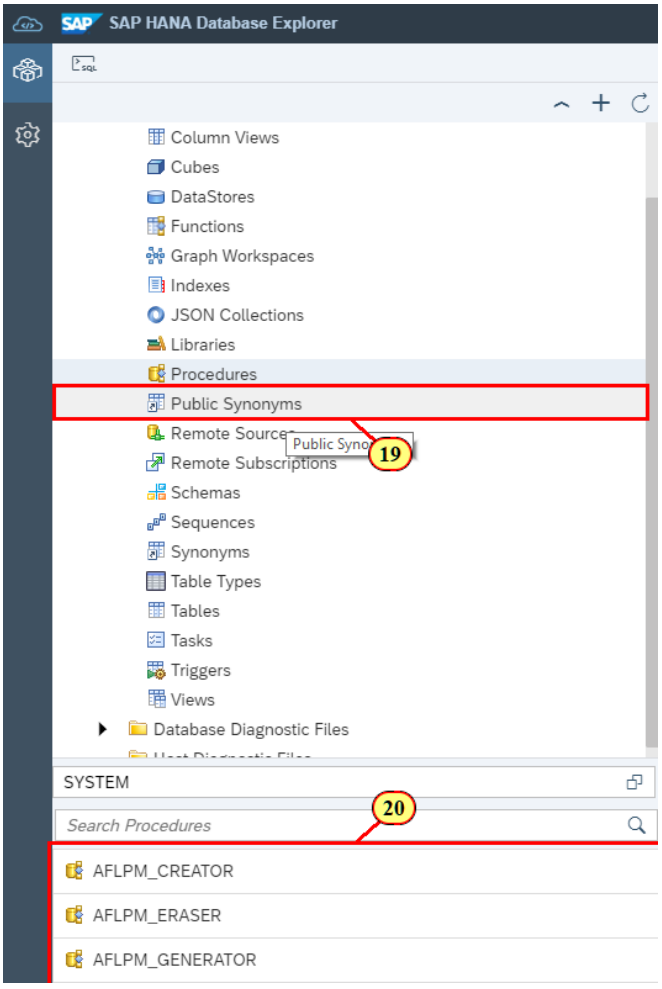
Explanation	Screenshot
2. Click the **Schemas** button.	
3. Click on the **Choose Schema** icon on the right to open a pop-up with a list of schemas. At the bottom left, you will see SYSTEM schema. As you may know, this schema contains the system catalog as well as a set of other objects for monitoring and providing information about the database, its state and behavior.	

Explanation	Screenshot
You can now search for objects across multiple schemas. 4. Here in the pop-up, many schemas can be chosen from the list. Click **OK** to close the pop-up.	
5. Right click **Views** and choose **Show Views** from the context menu. The right pane displays the views that are in the SYSTEM schema. This is the same list as below the hierarchy, but with more detail about each view. Other objects, such as tables and sequences, can be viewed in the same way and have similar grid displays.	

Explanation	Screenshot
6. Enter **M_SERVICES** in the search field to the top right of the grid and press Enter. We will use this view as an example of a simple view.	
7. Right-click in the M_SERVICES row and choose **Open** from the context menu. The columns and datatypes in the M_SERVICES view are shown in a separate tab.	
8. Click **CREATE Statement** above the grid, to display the SQL statement associated with the view.	
9. Click **Open Data** at the top right of the window to display the view contents. The contents are shown in a separate tab.	

Explanation	Screenshot
10. Click **Analysis** at the top of the grid, to explore the data graphically. The data for this view is not very suitable for graphical analysis, but for other tables and views this is a useful capability.	
11. Although this is not a useful table to display graphically, you can learn how the dialog works. Drag the **HOST** column into the Label Axis area. You can drag numeric columns into the Value Axis area.	
This is an example of what the graph might look like with HOST on the label axis, and PORT, PROCESS_ID and SQL_PORT on the value axis. 12. Click the icons here to change the type of graph that is being displayed. At this stage you may wish to take a few minutes to explore other views in the SYSTEM schema.	

Explanation	Screenshot
13. Now we will explore stored procedures. Right-click on **Procedures** with the right mouse button and choose **Show Procedures** from the context menu. A grid of procedures and their properties is displayed in the right pane.	
14. Enter **IS_VALID** in the search field above the grid.	
15. We are going to use the IS_VALID_PASSWORD procedure as an example. Find the IS_VALID_PASSWORD row, click on the **IS_VALID_PASSWORD** row with the right mouse button and choose **Open** from the context menu. A grid is displayed showing the procedure arguments: you can also view the SQL statement for this procedure by selecting the 'CREATE Statement' tab.	
16. We are going to run this procedure, which requires a single argument (the password candidate). Click **Generate CALL Statement** at the top right of the window and click **Generate CALL Statement with UI** from the drop-down menu.	

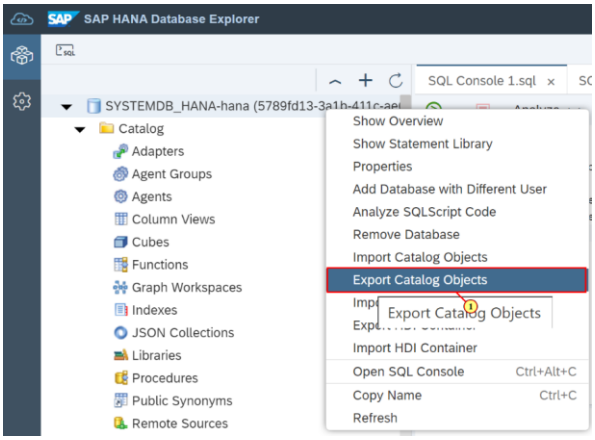
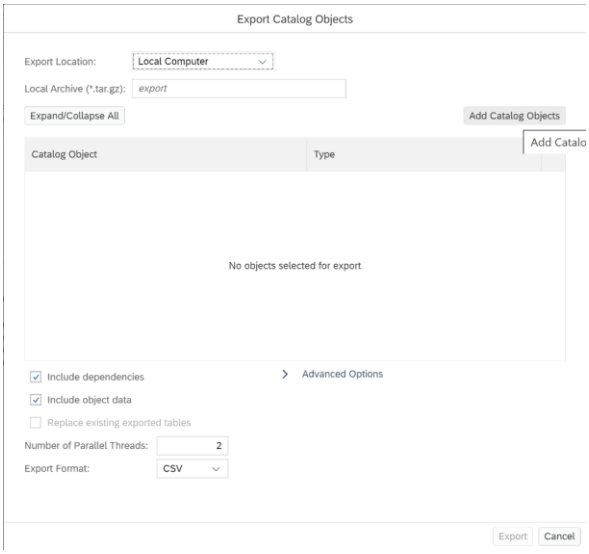
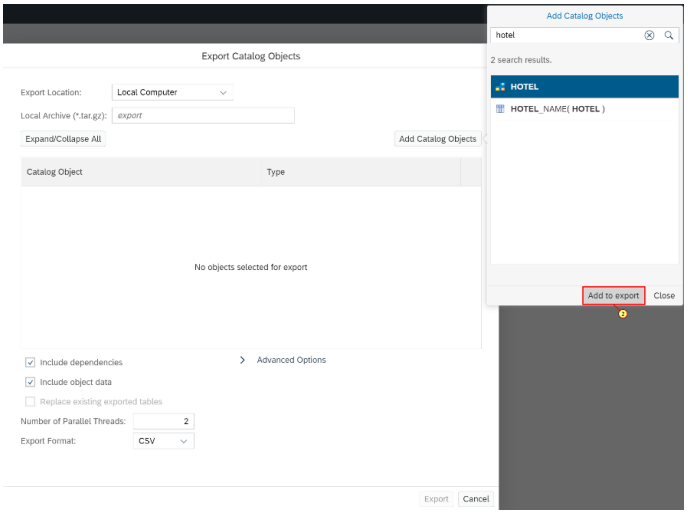
Explanation	Screenshot
17. Enter **abc123** in the text field. 18. Click the **Run** button under the Parameters tab to run the procedure. The procedure should display a result with an error code and a statement that the password is too short. Try a more complex password until you get an error code of 0. Password rules are customizable in SAP HANA, but here we are using the default rules.	
19. As the final example in this exercise, click on **Public Synonyms** at the top of the catalog hierarchy. The list of public synonyms appears below the catalog hierarchy. 20. Search through the synonyms in the list. Click on a synonym to display its metadata in the right pane, including the object to which it refers. This completes the exercise. Take a few minutes to review what you have been doing so that you are comfortable navigating the catalog hierarchy.	

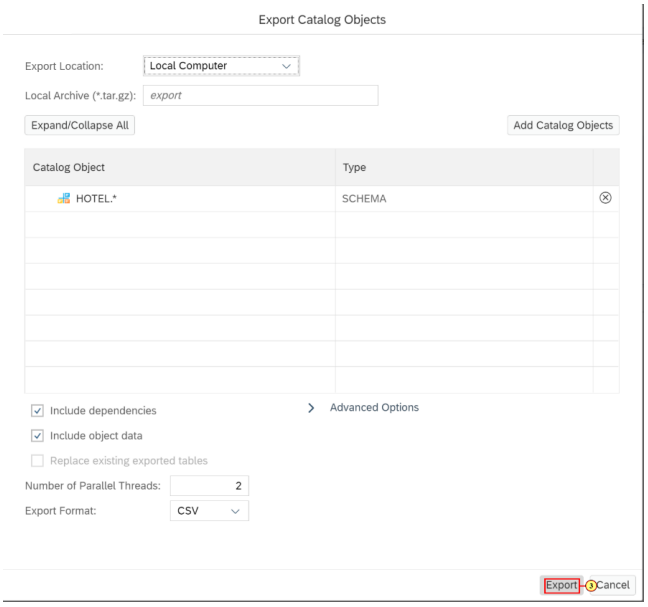
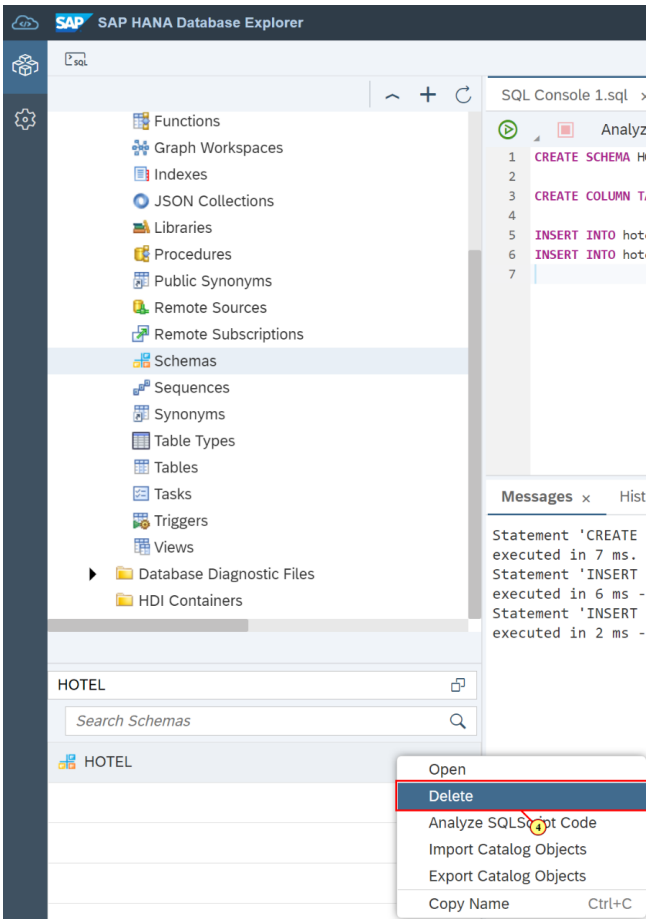
Exercise 3: Create, Import and Export with SAP HANA Database Explorer

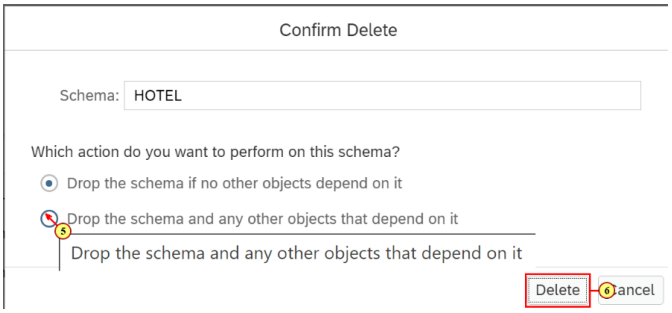
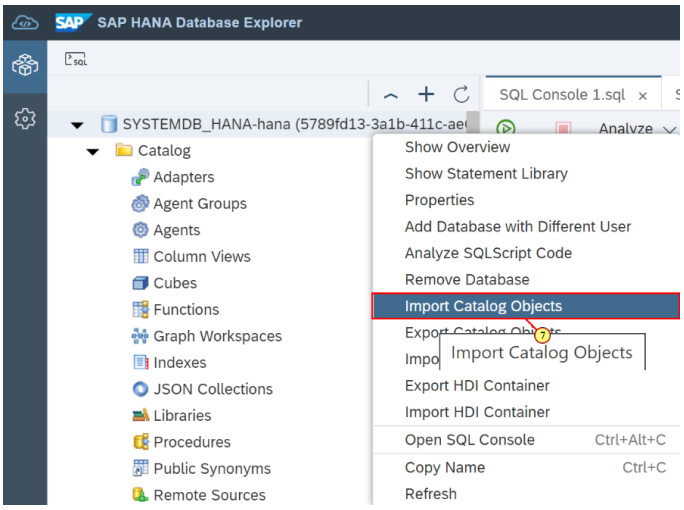
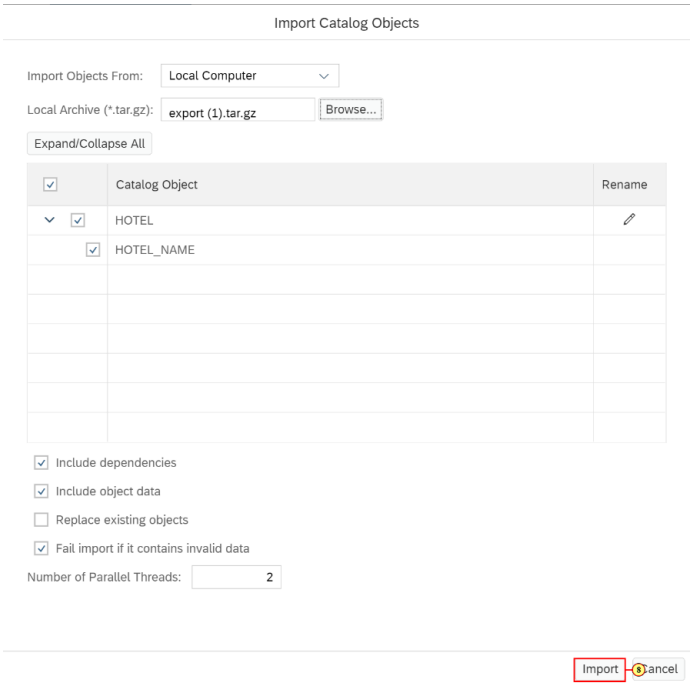
In this exercise, we will explore creating schemas, tables and also how to import and export the catalog objects.

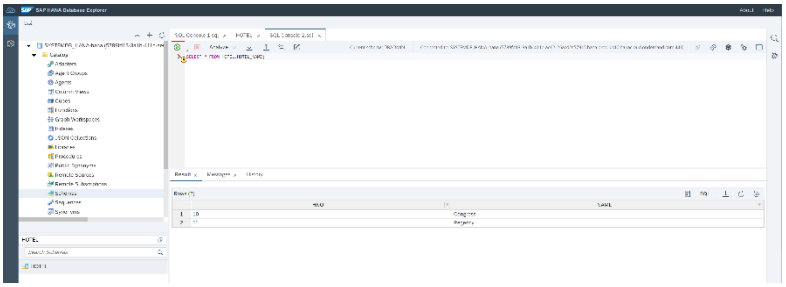
Explanation	Screenshot

To begin with this exercise, we will have to create a SCHEMA and TABLE as prerequisites. Below SQL statements can be used to create schema HOTEL and a table HOTEL_NAME.
 	
SQL to create a schema:
 	
`CREATE SCHEMA HOTEL;`
 	
SQL to create a table:
 	
`CREATE COLUMN TABLE hotel.hotel_name( hno INTEGER PRIMARY KEY, name VARCHAR(50) NOT NULL);`
 	
SQL to insert records into table HOTEL_NAME:
 	
`INSERT INTO hotel.hotel_name VALUES('10', 'Congress');`
`INSERT INTO hotel.hotel_name VALUES('11', 'Regency');`
 	
On successfully executing the above SQL statements, we have a schema named HOTEL and a table under it HOTEL_NAME with 2 records inserted into it.
 	
Now let us explore the Import and Export Catalog Objects functionalities.
	

Explanation	Screenshot
Let us start by exporting the newly created schema HOTEL to our local disk. 1. Right-click on a database connected and select **Export Catalog Objects Wizard**.	
The Export Catalog Objects wizard will open as a new window.	
2. The **Add Catalog Objects** button opens up a search panel that shows all objects that are available to export. Select the **HOTEL** schema and choose **Add to export**.	

Explanation	Screenshot
3. The objects selected for export display. Press the **Export** button to export the selected objects.	
The inverse operation is to import objects. In this exercise we will explore import operation by first deleting the existing objects in the schema HOTEL and then run the import catalog wizard. 4. To do so, right-click on the schema named HOTEL, and select **Delete**.	

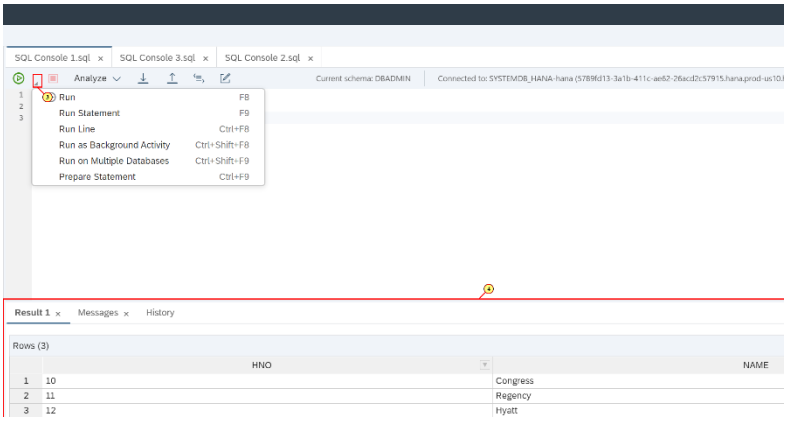
Explanation	Screenshot
5. Then select **Drop the schema and any other objects that depend on it**. 6. Click on **Delete**.	
7. To import the previously exported objects, right-click on the database connection and select **Import Catalog Objects**.	
Select **Local Computer** from the **Import Objects From** dropdown. **Browse** to the file that was created during the export steps. All catalog objects and any dependencies are displayed. 8. Click **on Import** When complete, a success message will appear. And, the objects in schema HOTEL will again be viewable.	

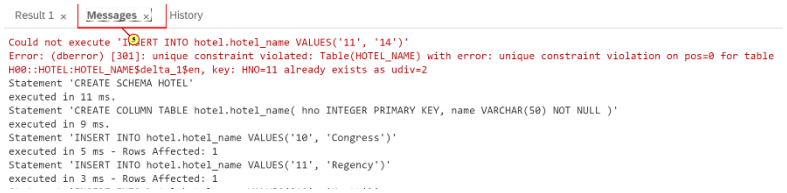
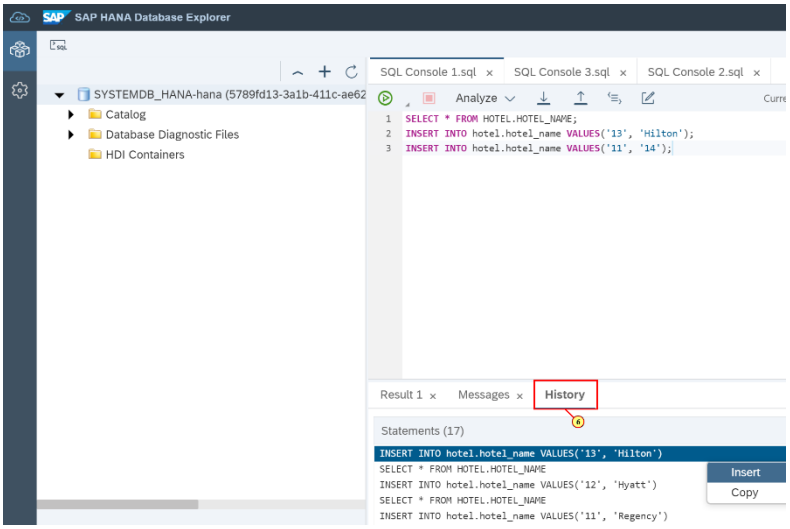
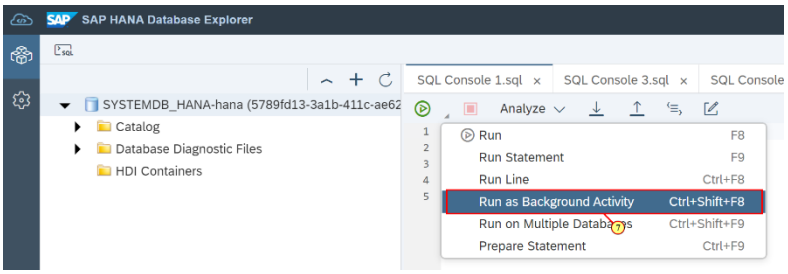
Explanation	Screenshot
9. Copy and run the SQL statement: `SELECT * FROM HOTEL.HOTEL_NAME;` to view the records under it.	

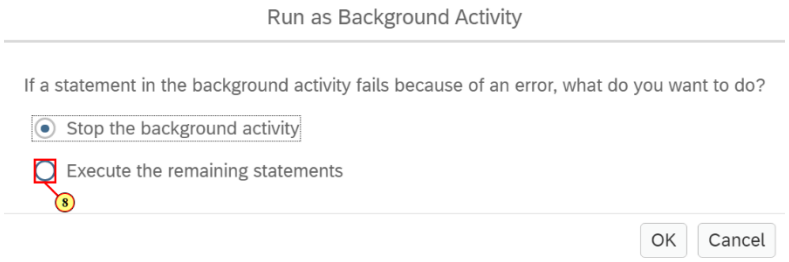
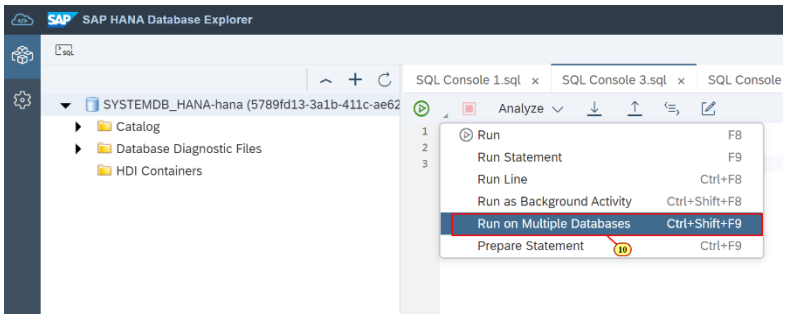
Exercise 4: Using the SQL Console

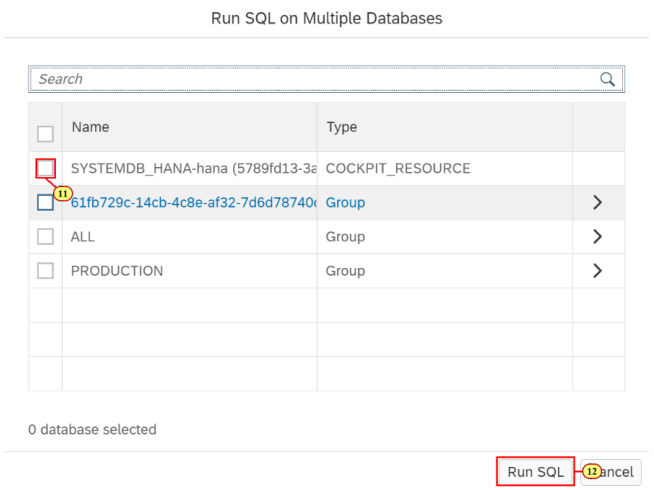
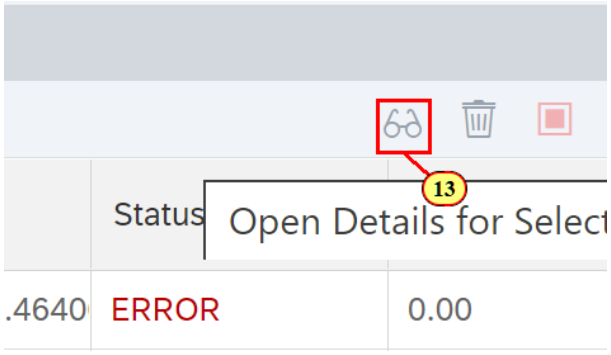
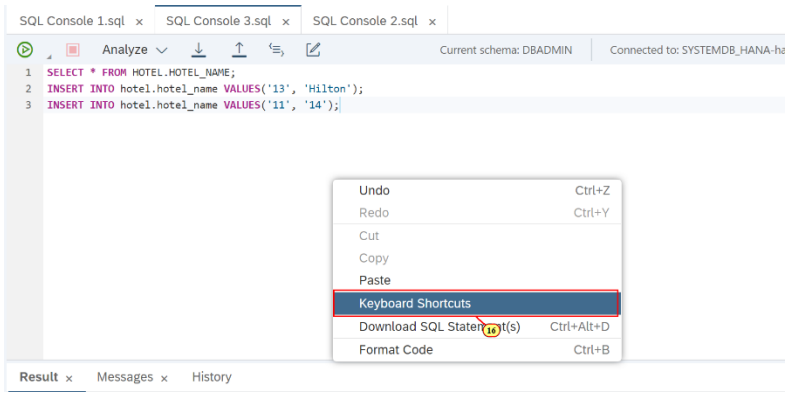
In this exercise, we explore the use of the SQL Console, where you edit and execute SQL statements.

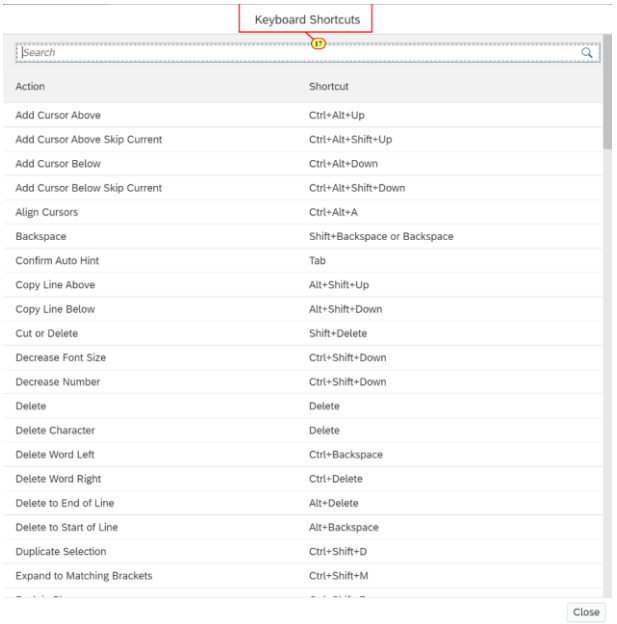
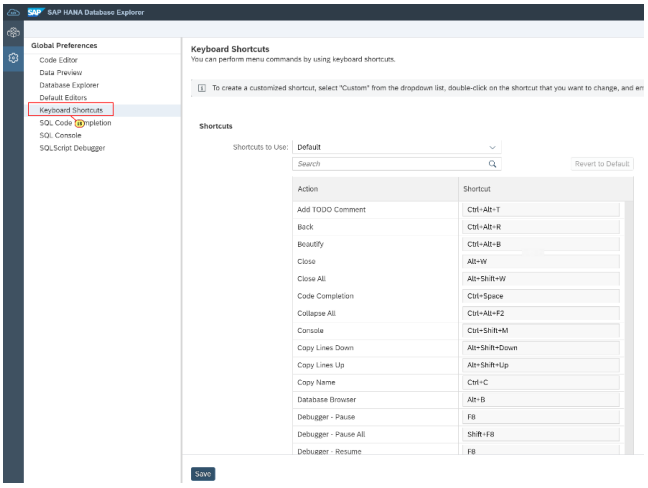
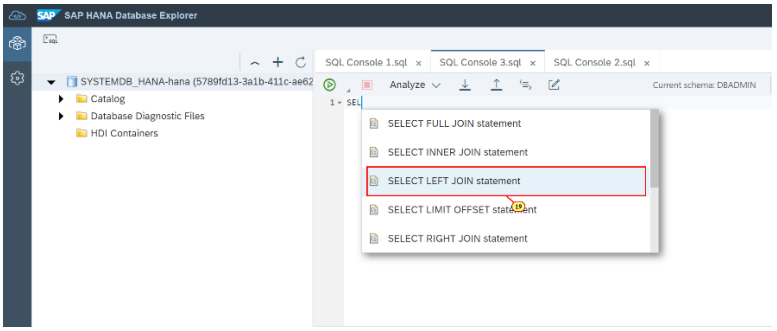
Explanation	Screenshot
1. Select a connection and open the SQL console. 2. You can notice that the database connection the SQL console is connected to is displayed and in the toolbar there are options to connect, disconnect, or change the connection.	

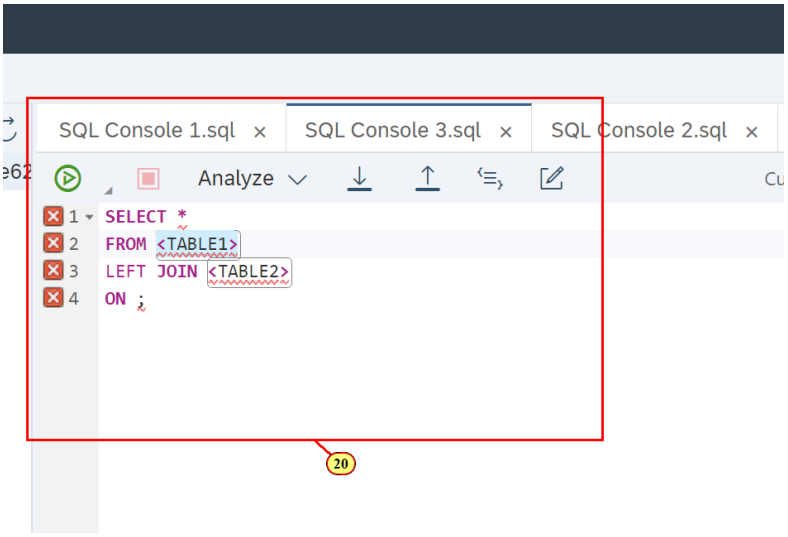
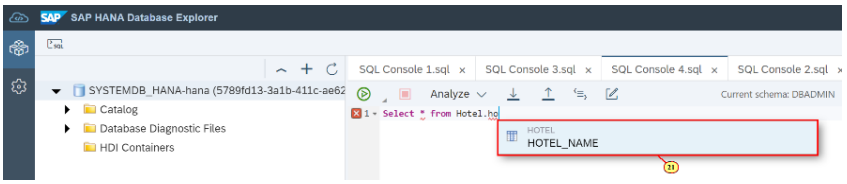
Enter the below SQL commands in the SQL console:
 	
`INSERT INTO hotel.hotel_name VALUES('13', 'Hilton');`
`INSERT INTO hotel.hotel_name VALUES('11', '14');`
`SELECT * FROM HOTEL.HOTEL_NAME;`
 	
3. On expanding the run drop down, you can notice that there are multiple options and their short cut keys. Choose
	

Explanation	Screenshot
Run to execute the SQL. Or, you can also run the SQL by just clicking on the **Run** button instead of going into the dropdown. 4. The records from the HOTEL table are shown in the results tab.	
5. The **Messages** tab displays information about the executed queries as well as any errors.	
6. The **History** tab displays the last 50 successfully executed queries. A previously executed query can be searched for and recalled.	
On reloading the web page, you can notice that when the database explorer re-loads, the SQL console tab and the statements it had last run are shown minus contents of the result, messages and history tab. 7. Sometimes you might need to execute a SQL statement that takes a long time to run. In that case, you can run it as a background activity. That	

Explanation	Screenshot
allows you to close your browser window, and come back later to see the results of the statement. For this click on **Run as Background Activity** under the Run option	
8. You will be displayed a pop up that asks you whether you want to **Stop the background activity** or **Execute the remaining statements** as a part of running the SQL as background activity. Choose the options as per your necessity.	
9. To view the results of a query that was run in the background, open the background activities monitor, select the query, and then choose the open details button. A new SQL console will be displayed with the SQL, the results, and any messages from the execution period.	
The SAP HANA database explorer provides the ability to run a query against multiple databases. 10. Click on **Run on Multiple Databases** option in the Run dropdown.	

Explanation	Screenshot
11. This dialog enables multiple databases to be selected. Here, choose the databases across which you want to execute the query. 12. Click on **Run SQL**.	
13. To view the results of a query run on multiple databases, open the background activities monitor, select the query to view the result from and then choose the open details button.	
14. The results of a query can be downloaded by clicking on this **Download** button. 15. Choose your preferences and click on **Download** option.	
16. Keyboard shortcuts are available to provide alternate methods of completing frequently performed tasks. Right-click in the SQL console and choose **Keyboard Shortcuts**.	

Explanation	Screenshot
17. This is the list of shortcuts displayed.	
18. Shortcuts can be configured in **Settings** under **Keyboard Shortcuts**.	
We will now discuss about the autocomplete functionality, which will ease the process of query writing. 19. Once a statement is started, press Ctrl+Space to see a list of possible statements based on what you have typed. Select the LEFT	

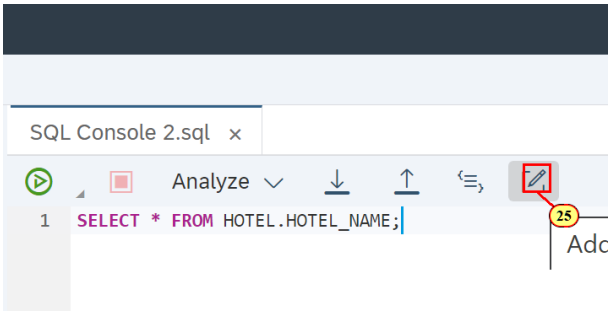
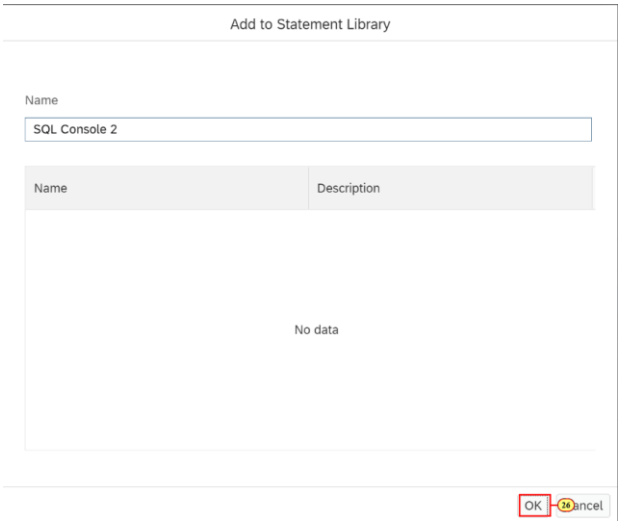
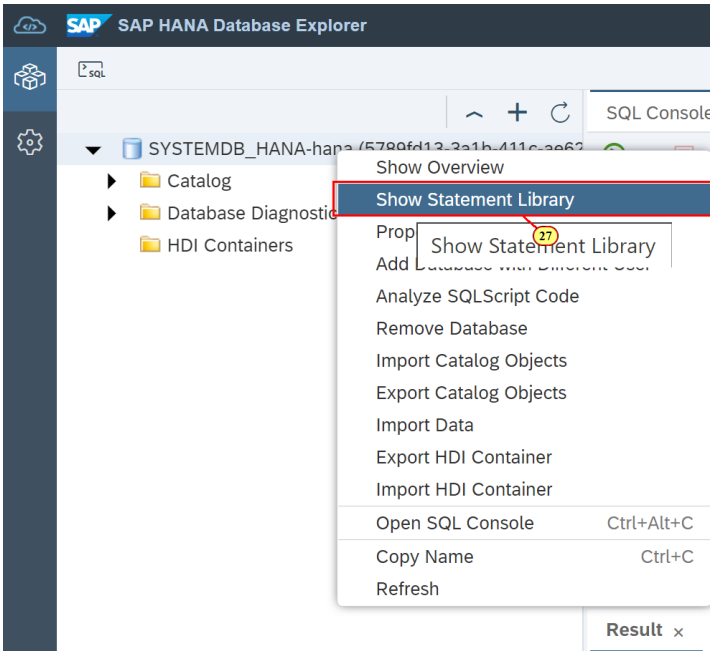
Explanation	Screenshot
JOIN statement from the displayed dropdown.	
20. By selecting the statement you wish to write from the provided options, the SQL statement will be written into the console. There will be some required information to fill into the generated statement. In the example in screenshot, table names will need to be replaced along with the columns to be used in the on clause.	
Copy the following SQL into the console and then use the autocomplete shortcut to see the available tables: SELECT * FROM HOTEL.HOTEL_NAME 21. In addition to completing SQL statements, this autocomplete shortcut (ctrl + space) can also be applied to database objects. In this example, autocomplete provides a dropdown of all the available tables matching the first couple of letters provided.	

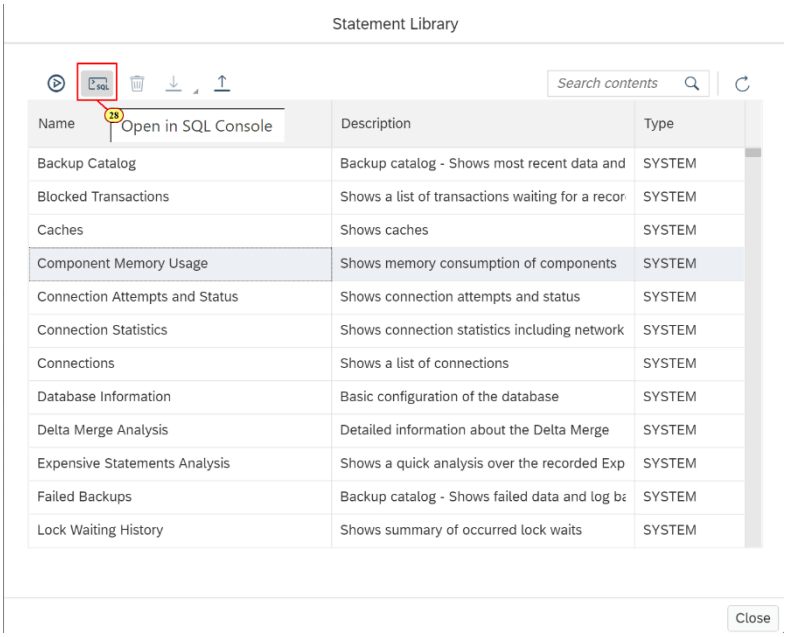
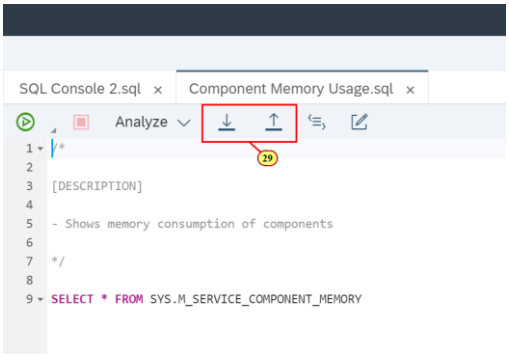
On the right hand side, there is a statement help panel providing more information about statement syntax, along with any tables, functions, stored procedures or SQL functions that have been referenced.

22. The first section in the help panel is Statement/Syntax. This section looks at the keywords in the current SQL statement and identifies what type of statement is written. It provides information on the proper syntax for that statement.

23. The second section shows tables or views referenced in the SQL statement, the schema it belongs to and the columns in that table/view.

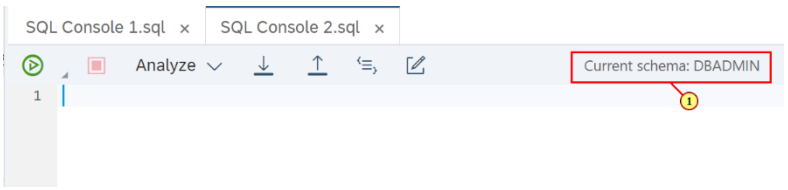
24. The third section shows stored procedures or functions that are referenced in the SQL statement as well any input and output parameters.
The final section in the help panel shows any SQL functions that have been included in the SQL. For each SQL function referenced, both input and return parameters are listed.

Explanation	Screenshot
25. Frequently used statements can be saved to the statement library for easy access. Enter the below statement into the SQL console and click on the **Add to Statement Library** button: `SELECT * FROM HOTEL.HOTEL_NAME;`	
26. You can name the query to be saved and click on **OK**.	
27. To view the statement library, right click on a database connection and select **Show Statement Library**.	

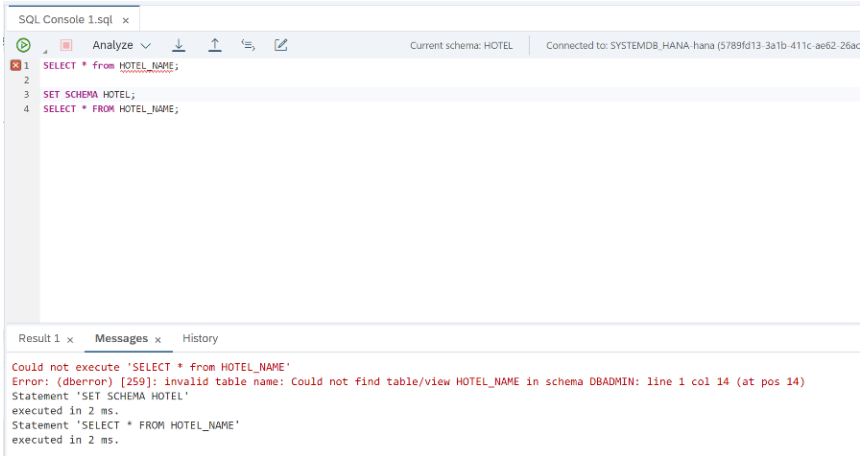
Explanation	Screenshot
In the statement library there are two types of statements: User defined and System. This is reflected in the type column. User defined statements are the ones that you have created and added, like future reservations, while System statements are already created and added to the library. System statements are often used for monitoring and diagnostic purposes. 28. To run a statement, select one from the statement library and left-click the **Open in SQL Console** button.	
29. It is also possible to export and import SQL statements directly to/from the file system.	

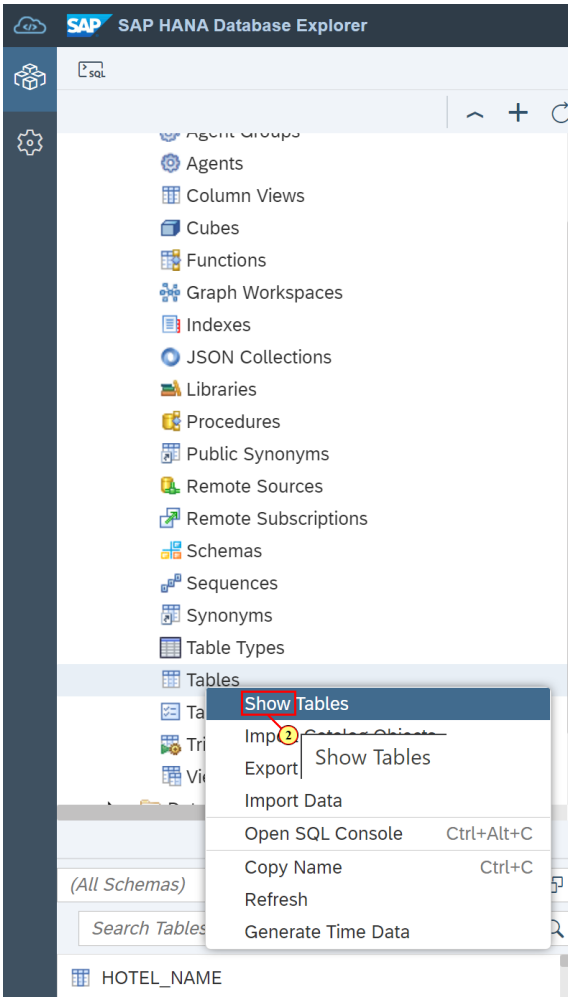
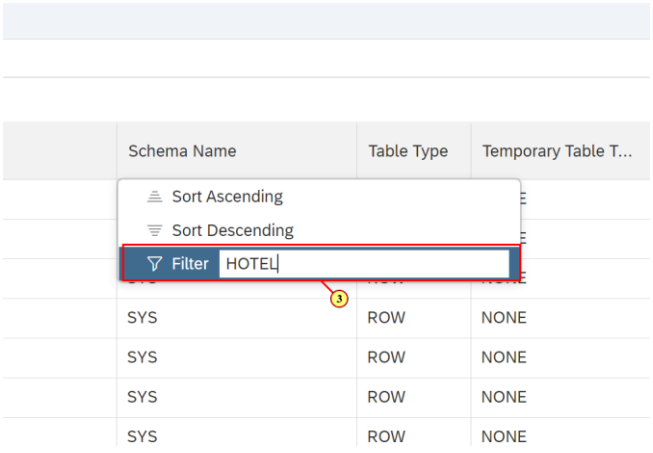
Exercise 5: Browsing across Schemas and Editing Tables

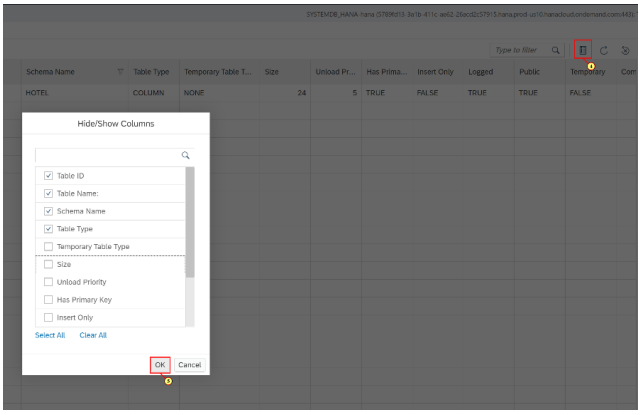
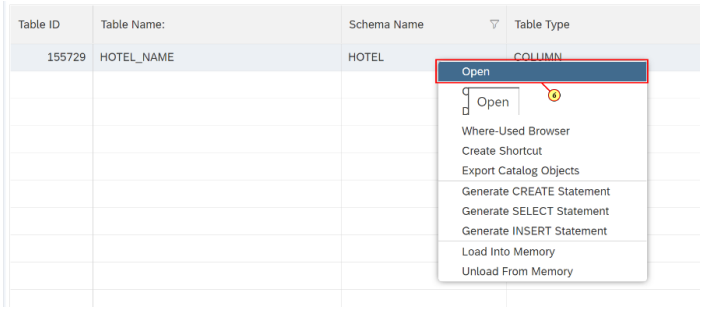
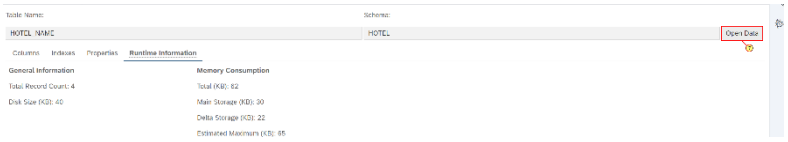
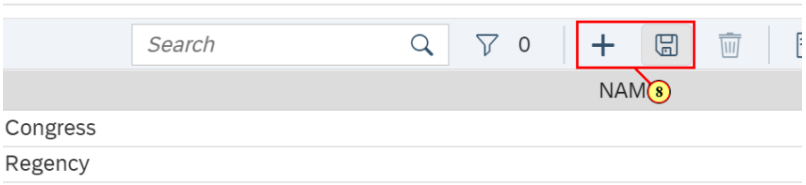
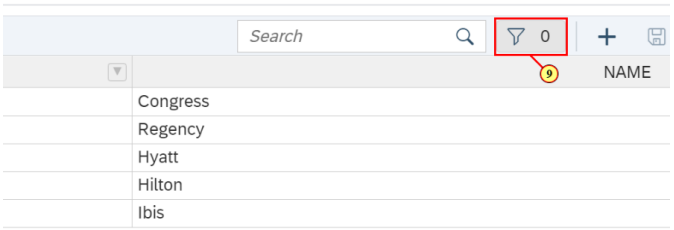
In this exercise, we will discuss on browsing and executing SQL scripts across different schemas and editing an existing table.

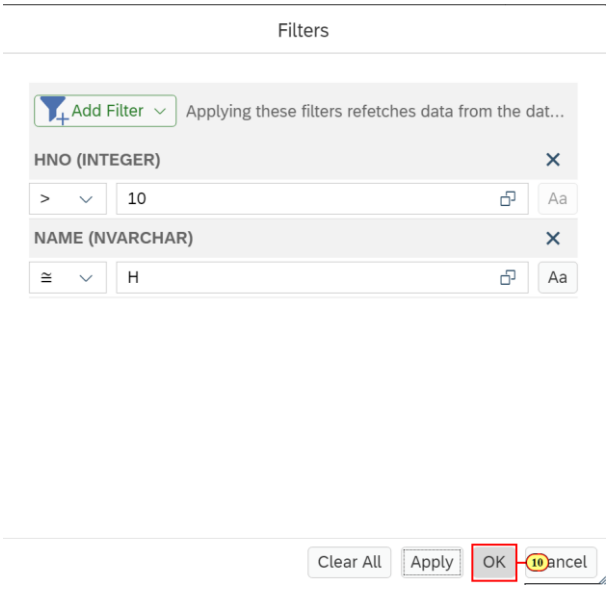
Explanation	Screenshot
1. The current schema in the SQL console is shown at the top of the SQL console.	

Explanation	Screenshot

Copy and paste the below SQL commands in the console and run them:
 	
`SELECT * FROM HOTEL_NAME; ------ ( should fail )`
`SET SCHEMA HOTEL; ---------- ( sets the schema to HOTEL )`
`SELECT * FROM HOTEL_NAME; ---------- ( should succeed )`
 	
We can notice from the result section that the first SQL query fails as the schema is still set to DBADMIN and HOTEL_NAME table does not exist in that schema. Whereas once the schema is set to HOTEL, the same query succeeds. This can be noticed in the messages section of DBX.
 	
The result for the successfully executed SQL query can be seen under the Results tab.
	

Explanation	Screenshot
Let us now explore the Table Editor feature. 2. Right-click on **Tables** in the catalog tree and choose **Show Tables**. A list of all of the tables with additional metadata appears.	
3. You can apply filters to the columns. Here let us filter based on schema name HOTEL.	

Explanation	Screenshot
4. The set of columns to be displayed can be set by clicking on this button. 5. Select the columns you want to be displayed, and click on **OK**.	
6. Right-click on the name of a table in the tree and select **Open**. The editor for the table opens in a new tab.	
7. To see and possibly edit the contents of the table, click on **Open Data.**	
8. Rows can be edited by selecting a cell and typing in the new value. New rows can be added by selecting the **+** button. Changes must be saved by pressing the save button in order to commit them to the table.	
9. Filters can also be applied to the table using a set of dropdowns that build up a WHERE clause which can select a subset of the data.	

Explanation	Screenshot
10. In this example in screenshot, the filter is set to find Hotel that starts with letter 'H' and its hotel number is greater than 10. Once the necessary filters are chosen, click on **OK**.	
11. Click on the **SQL** button to see the generated query.	

Summary

You have completed the exercise!

You are now able to:

- Navigate the user interface of the Database Explorer
- Use the SQL Console to execute SQL statements
- Navigate the Catalog Browser to find different objects
- Create, Import and Export Catalog Objects
- Browse across Schemas and Editing Tables

CHAPTER 3 - PERFORMANCE MANAGEMENT TOOLS

This chapter covers features related to performance management tasks.

Overview

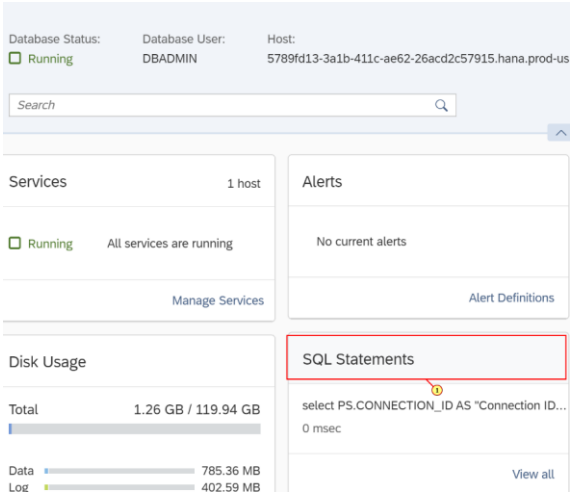
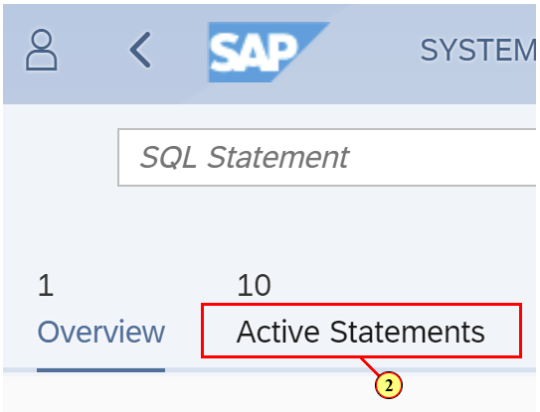
Estimated time: 15 minutes

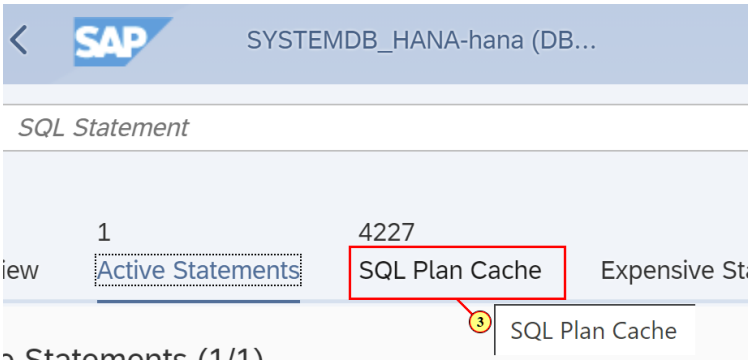
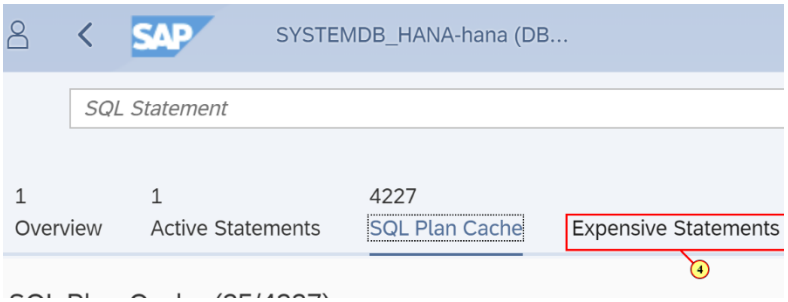
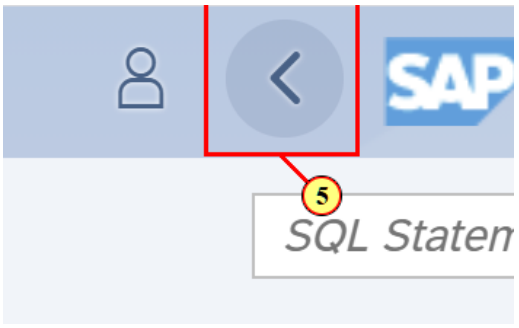
Objective

To explore on Performance Management tools, that allow us to perform various tasks related to the Top SQL commands, Active Statements, Expensive Statements and Data Cache. We will also have a hands-on on Performance Monitoring and Analyzing, Importing and Exporting SQL plans.

Exercise 1: Extra features in Monitor Statements application

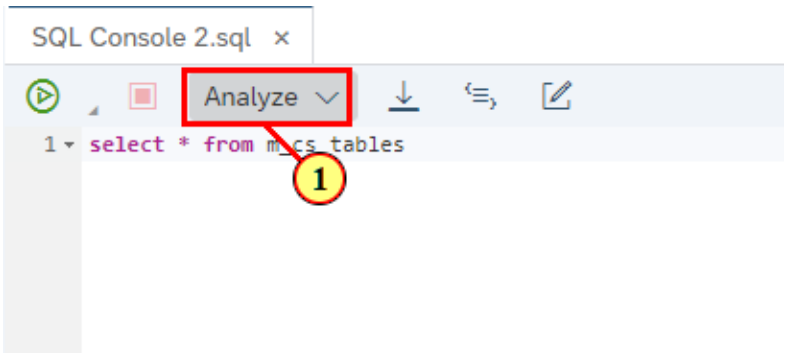
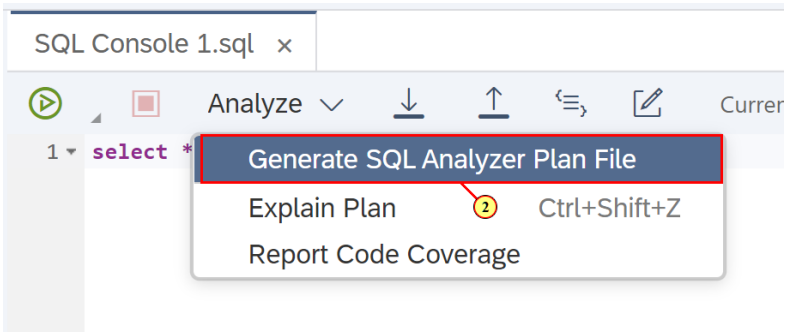
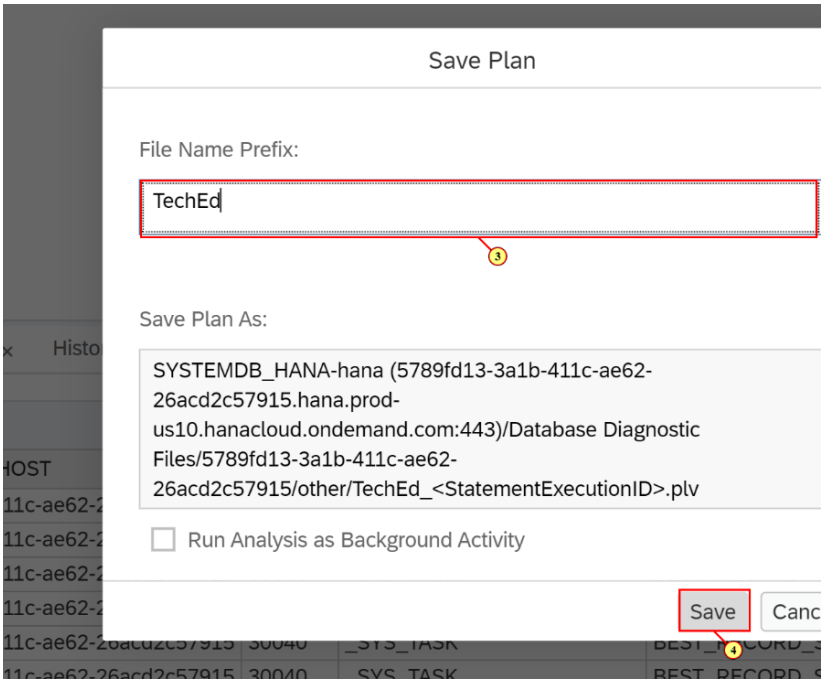
In this exercise, you will explore on the Top SQL Statements like Active Statements, SQL Plan Cache, Expensive Statements

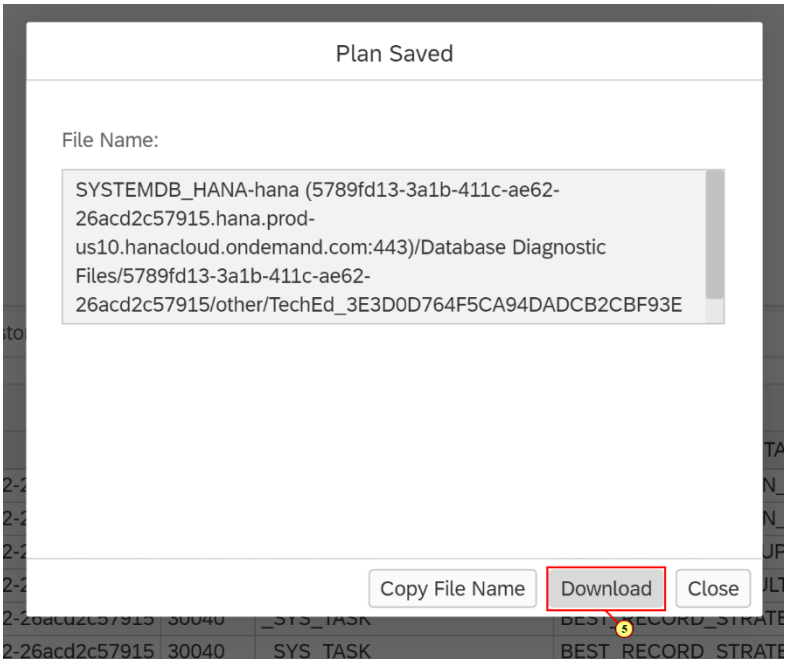
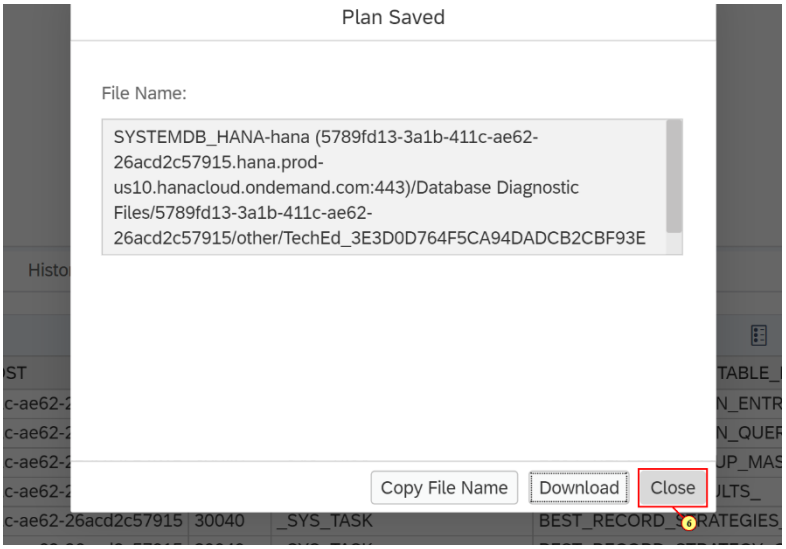
Explanation	Screenshot
1. At the **SQL Statements** card, click anywhere in the top section.	
The overview page displays an overview of the current active statements and its various parameters. You can even view the entire statement string by clicking **More** in the Statement String column. 2. Click **Active Statements** at the top left of the Monitor Statements page.	

Explanation	Screenshot
The active statements page displays each active SQL statement and its various parameters, such as its status, its statement string and its connection ID. 3. Click **SQL Plan Cache**.	
The SQL Plan Cache page displays the SQL plans that have been cached in the server. It displays its host and port number as well as the user name. 4. Click **Expensive Statements.**	
There are currently no expensive statements so there is nothing to display. 5. Click the **back** button at the top left to return to the Database Overview page.	

Exercise 2: Importing and Exporting SQL Plans in the SQL Analyzer

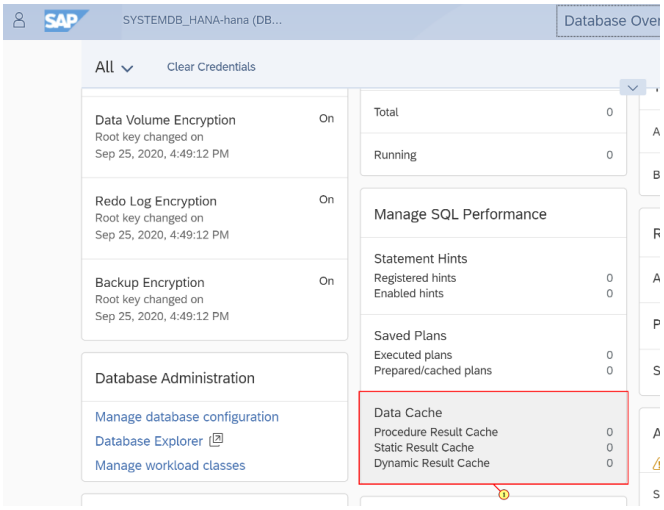
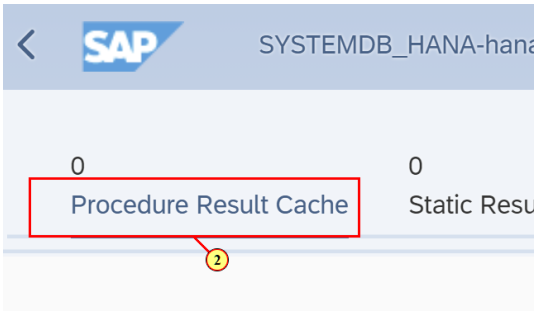
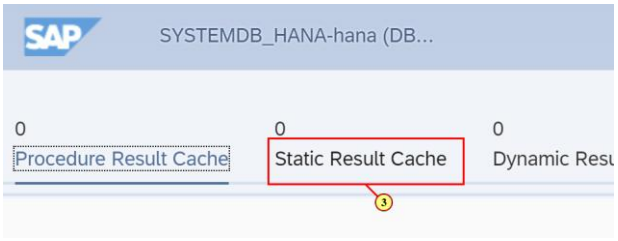
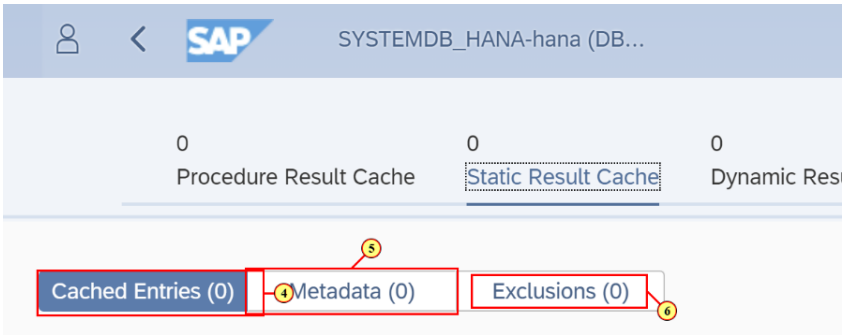
In this exercise, you will have hands-on on how to import, export and analyze the SQL Plans in the SQL Analyzer. For this you will be launching the Database Explorer.

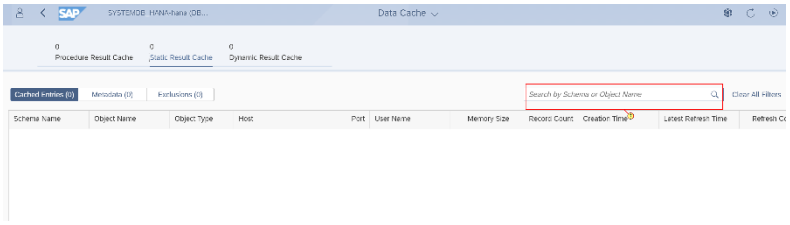
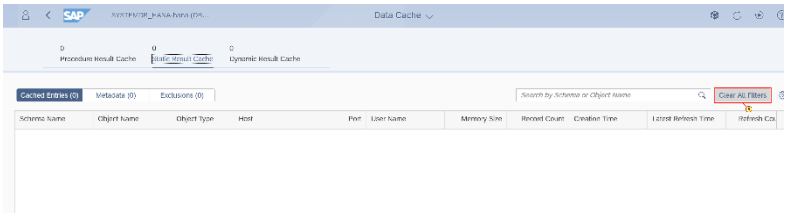
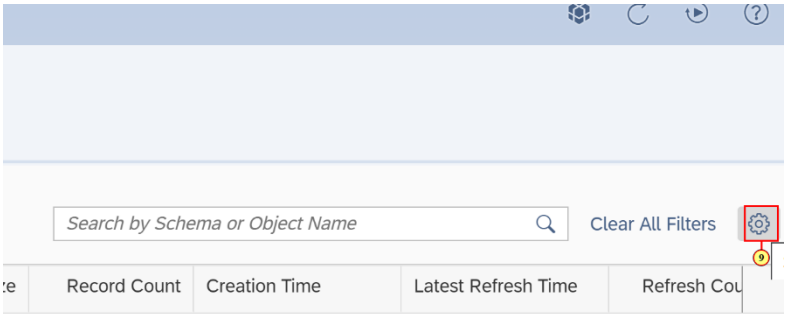
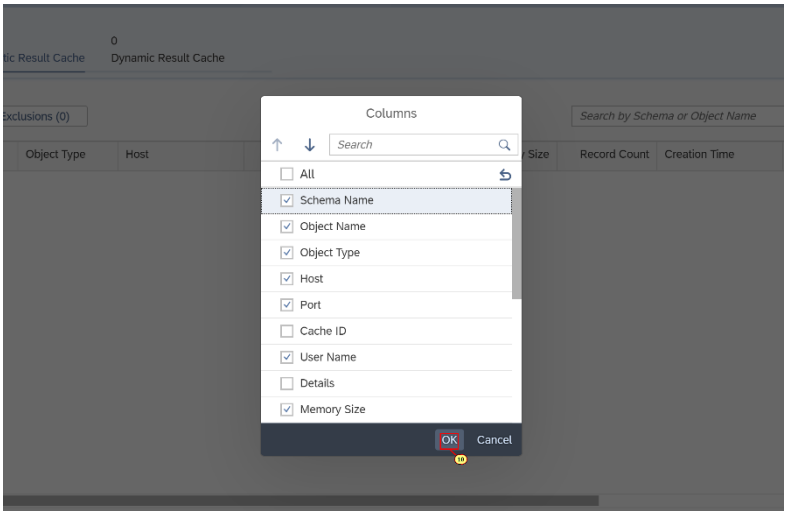
Explanation	Screenshot
1. Select the **Analyze** drop-down menu to view the analyzer options.	
2. Select **Generate SQL Analyzer Plan File** from the dropdown menu.	
This feature allows the user to both analyze the SQL query and export the SQL plan to their local directory. 3. Enter **TechEd** in the text box 4. Select **Save** to save the SQL plan.	

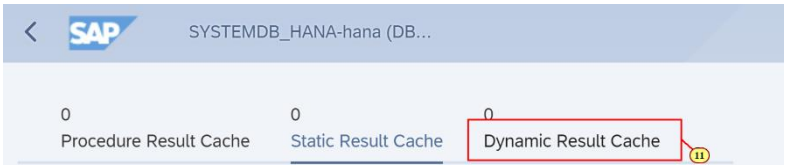
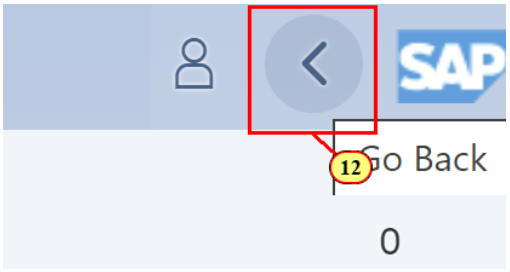
Explanation	Screenshot
5. Click Download to download the SQL plan to your local directory.	
6. Click **Close** to close the pop-up window and return to the Analyze SQL page in the Database Explorer. You have completed the exercise! You are now able to: • View the active statements and monitor the expensive statements • Import and export SQL plans • View cached data entries • Import trace files	

Exercise 3: Data Cache Monitoring Application

In this exercise, you will explore on Data Cache variants such as Procedure Result Cache, Static Result Cache and Dynamic Result Cache. You will also have hands-on on searching cache based on schemas and objects.

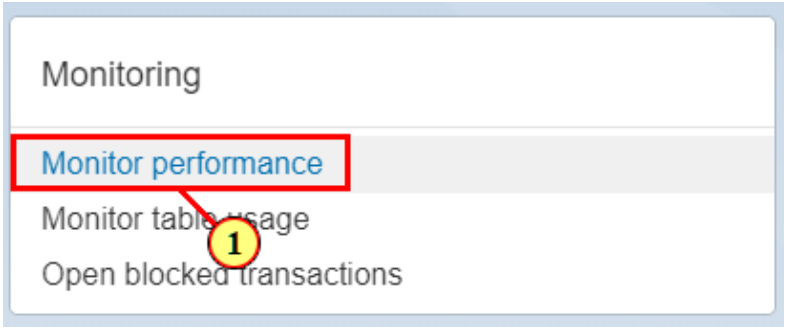
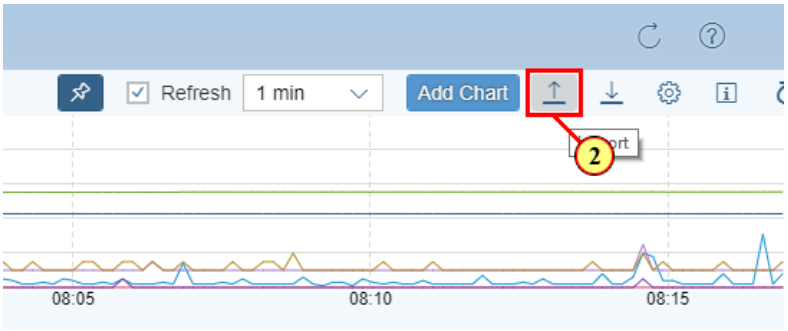
Explanation	Screenshot
1. In the Database Overview page of your selected resource, scroll down to the **Manage SQL Performance** card and select anywhere on the **Data Cache** box.	
2. You are currently viewing the Procedure Result Cache entries.	
3. You are currently viewing only the static cache data entries.	
4. You are currently in the **Cached Entries** tab. Here, you can view all the cached data entries in the table below. 5. Clicking the **Metadata** tab will display schemas and its various object parameters. 6. Clicking the **Exclusions** tab will display the excluded schemas.	

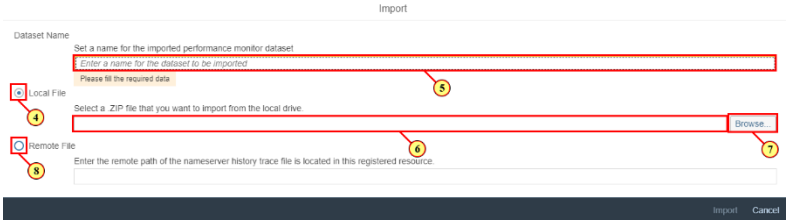
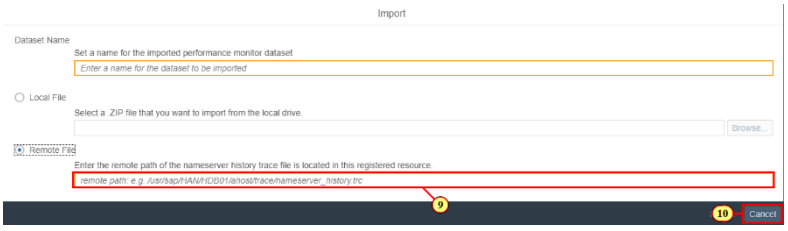
Explanation	Screenshot
7. You can search for the data entries either through schemas or object names.	
8. You can clear all existing filters for filtering data cache entries by clicking **Clear All Filters**.	
9. Click on the **gear icon**.	
The settings pop-up can filter various columns which represent schema and object parameters. 10. Click **OK**.	

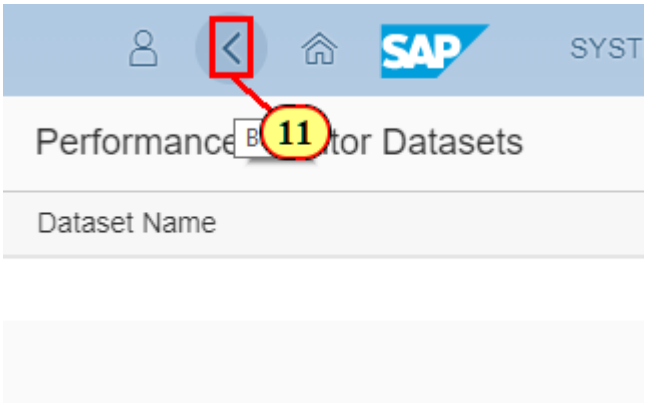
Explanation	Screenshot
11. Clicking **Dynamic Result Cache** will display all the dynamic data cache entries.	
12. Click the **back** button to return to the Database Overview page.	

Exercise 4: Importing NameServer Trace files in the Performance Monitor

In this exercise, you will have hands-on on how to import the NameServer Trace files in the Performanace Monitor application.

Explanation	Screenshot
1. Click **Monitor Performance** to enter the Performance Management application.	
2. Click the **Import** icon at the top right of the Performance Monitor page.	

Explanation	Screenshot
3. Click the **Import** button at the very bottom right of the Performance Monitor Datasets page.	
4. Ensure that the **Local File** option is selected first. 5. You can enter a name for the new dataset that you are about to import, either from your local directory or a remote directory. 6. You can enter the path of a .ZIP file that you would like to import. 7. You can click **Browse** to browse your local directory and select a local .ZIP file to import. 8. Select the **Remote File** option under the **Local File** option.	
9. The search bar for your remote file provides an example for the path of your directory that your remote file may be located in. Notice that for importing a remote file, the remote path for the nameserver history trace file is all you need. The above options can stay empty since they are meant for local file importing. 10. We will not be importing any nameserver trace files. Click **Cancel** to close the pop-up.	

Explanation	Screenshot
11. Click the **Back** button twice to return to the Database Overview page.	

Summary

You have completed the exercise!

You are now able to:

- Explore extra features in Monitor Statements Application.
- Import and Export SQL Plans.
- Use the Data Cache Monitoring Application.
- Import trace files in Performance Monitor Application.

CONGRATULATIONS! YOU COMPLETED THIS WORKSHOP!

www.sap.com/contactsap

© 2020 SAP SE or an SAP affiliate company. All rights reserved.
No part of this publication may be reproduced or transmitted in any form or for any purpose without the express permission of SAP SE or an SAP affiliate company.

The information contained herein may be changed without prior notice. Some software products marketed by SAP SE and its distributors contain proprietary software components of other software vendors. National product specifications may vary.

These materials are provided by SAP SE or an SAP affiliate company for informational purposes only, without representation or warranty of any kind, and SAP or its affiliated companies shall not be liable for errors or omissions with respect to the materials. The only warranties for SAP or SAP affiliate company products and services are those that are set forth in the express warranty statements accompanying such products and services, if any. Nothing herein should be construed as constituting an additional warranty.

In particular, SAP SE or its affiliated companies have no obligation to pursue any course of business outlined in this document or any related presentation, or to develop or release any functionality mentioned therein. This document, or any related presentation, and SAP SE's or its affiliated companies' strategy and possible future developments, products, and/or platform directions and functionality are all subject to change and may be changed by SAP SE or its affiliated companies at any time for any reason without notice. The information in this document is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. All forward-looking statements are subject to various risks and uncertainties that could cause actual results to differ materially from expectations. Readers are cautioned not to place undue reliance on these forward-looking statements, and they should not be relied upon in making purchasing decisions.

SAP and other SAP products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of SAP SE (or an SAP affiliate company) in Germany and other countries. All other product and service names mentioned are the trademarks of their respective companies. See www.sap.com/copyright for additional trademark information and notices.

THE BEST RUN SAP®