Hands-on Lab: Backup and Restore using PostgreSQL

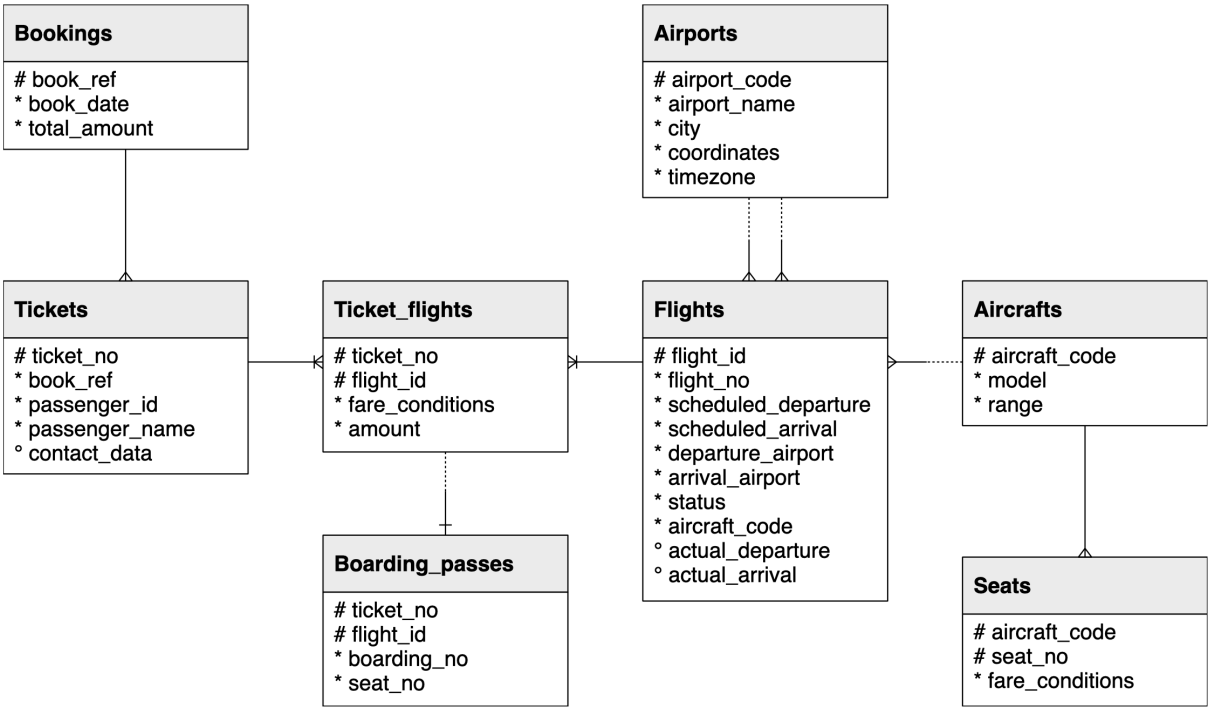
- In this lab, you will learn how to use the PostgreSQL Command Line Interface (CLI) to restore a full database from a backup. Then using a combination of the CLI and pgAdmin, which is a Graphical User Interface (GUI) for postgreSQL, you will make some changes to this database and perform a full backup. Finally, you will then delete this database to practice a full restoration in the scenario of an accidental deletion.

Software used in this Lab

In this lab, you will be using PostgreSQL. It is a popular open-source object Relational Database Management System (RDBMS) capable of performing a wealth of database administration tasks, such as storing, manipulating, retrieving, and archiving data.

Database used in this Lab

In this lab, you will use a database from https://postgrespro.com/education/demodb distributed under the PostgreSQL licence. It stores a month of data about airline flights in Russia and is organized according to the following schema:



Objectives

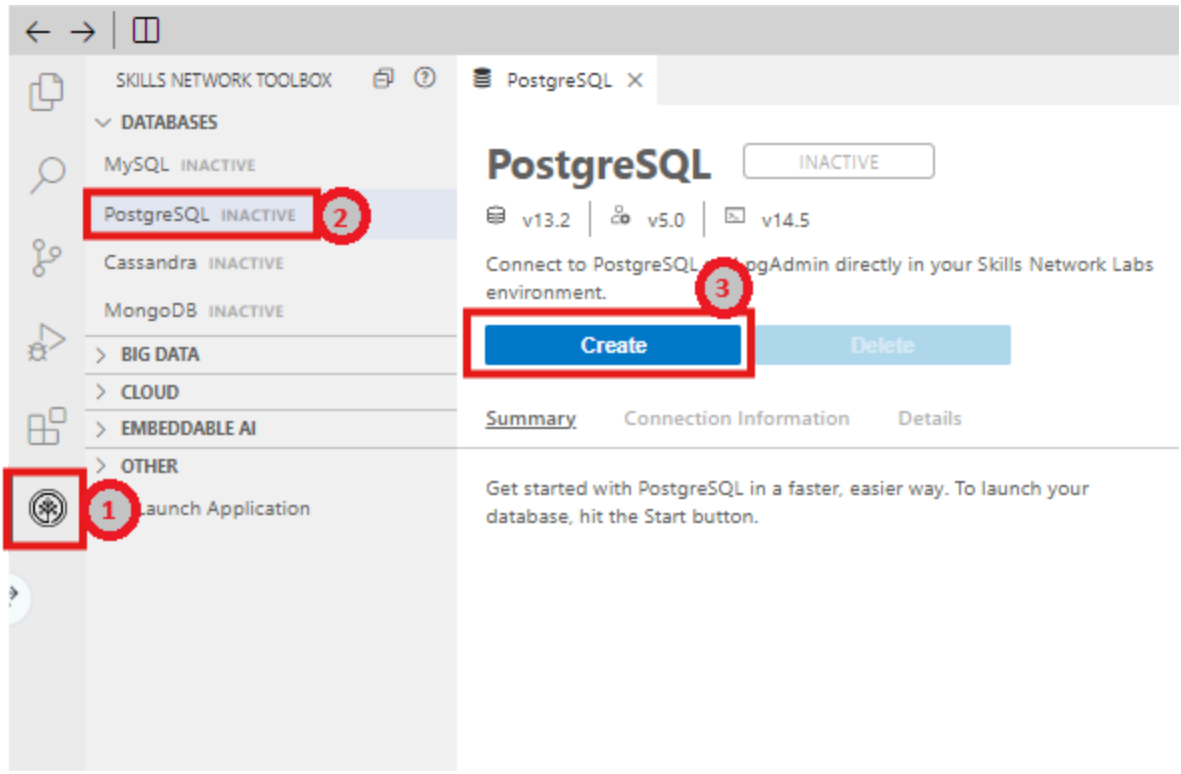
After completing this lab, you will be able to use the PostgreSQL CLI and pgAdmin to:

- Restore a full database from a backup
- Update a database and perform a full backup
- Drop a database and then restore it

Launching PostgreSQL in Cloud IDE

To get started with this lab, launch PostgreSQL using the Cloud IDE. You can do this by following these steps:

1. Click on the Skills Network extension button on the left side of the window.
2. Open the “DATABASES” drop down menu and click on “PostgreSQL”.
3. Click on the “Create” button. PostgreSQL may take a few moments to start.

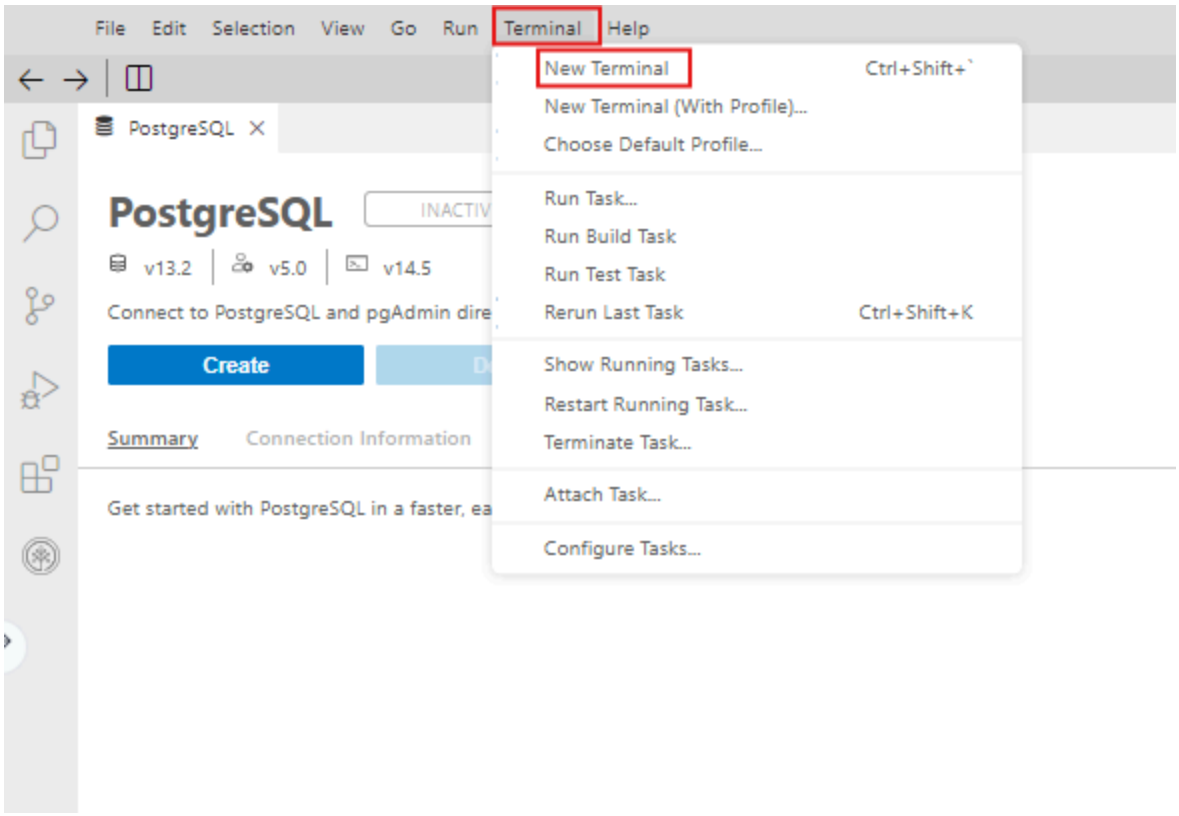


1.

Exercise 1: Restore a Full Database from a Backup

First, we will need to download the database.

1. Open a new terminal by clicking on the “New Terminal” button near the bottom of the interface.

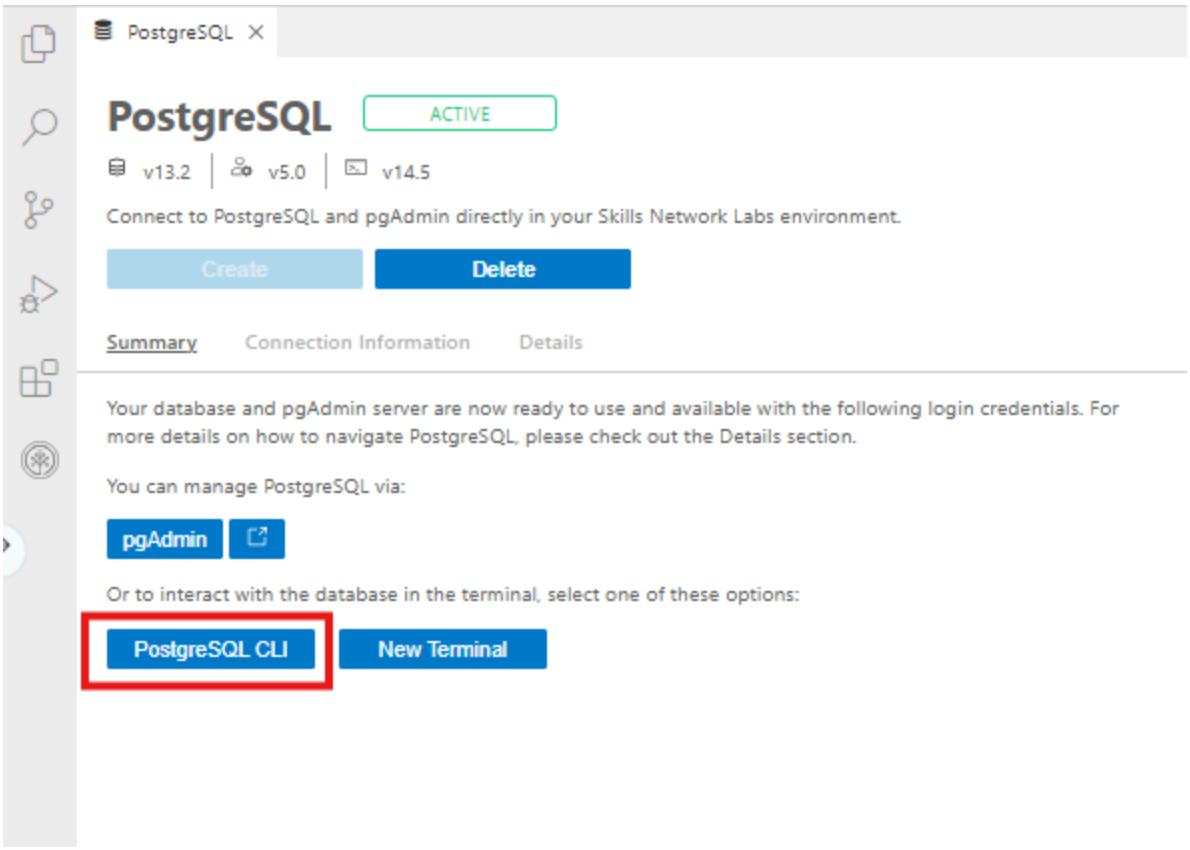


1. Run the following command in the terminal.
    a. `wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/example-guided-project/flights_RUSSIA_small.sql`

The file which you downloaded is a full database backup of a month of flight data in Russia.

Now, you can perform a full restoration of the dataset by first opening **the PostgreSQL CLI.**

1. Near the bottom of the window, click on the “PostgreSQL CLI” button to launch the Command Line Interface.



2. In the PostgreSQL CLI, type in the command `\i <file_name>.` In your case, the filename will be the name of the file you downloaded, `flights_RUSSIA_small.sql`. **This will restore the data** into a new database called `demo`.

run the command in postgres CLI

1. `\i flights_RUSSIA_small.sql`

The restorations may take a few moments to complete.

1. After the restoration completes, **one way you can check that the database has been restored** is with the following command, which lists all the tables in the current database schema.

run the command in postgres CLI

1. `\dt`

You should see the following output:

```
theia@theiadocker-davidpastern: /home/project      theia@theiadocker-davidpastern: /home/project ×

demo=# \dt
              List of relations
  Schema   |      Name       | Type  |  Owner
-----------+-----------------+-------+----------
 bookings | aircrafts_data  | table | postgres
 bookings | airports_data   | table | postgres
 bookings | boarding_passes | table | postgres
 bookings | bookings        | table | postgres
 bookings | flights         | table | postgres
 bookings | seats           | table | postgres
 bookings | ticket_flights  | table | postgres
 bookings | tickets         | table | postgres
(8 rows)

demo=#
```

Exercise 2: Modify the Database and Perform a Full Backup

Task A: Modify the Database with the CLI

1. One of the tables in the database schema is `aircrafts_data`. You can take a look at the contents of that table by executing the following command in the PostgreSQL **CLI**:

```
1  SELECT * FROM aircrafts_data;
```

This will show you the aircraft models in the database, their code, and their range in kilometers.

```
demo=# SELECT * FROM aircrafts_data;
 aircraft_code |              model               | range
---------------+----------------------------------+-------
 773           | {"en": "Boeing 777-300"}         | 11100
 763           | {"en": "Boeing 767-300"}         |  7900
 SU9           | {"en": "Sukhoi Superjet-100"}    |  3000
 320           | {"en": "Airbus A320-200"}        |  5700
 321           | {"en": "Airbus A321-200"}        |  5600
 319           | {"en": "Airbus A319-100"}        |  6700
 733           | {"en": "Boeing 737-300"}         |  4200
 CN1           | {"en": "Cessna 208 Caravan"}     |  1200
 CR2           | {"en": "Bombardier CRJ-200"}     |  2700
(9 rows)
```

2. Suppose a new model of aircraft is being added to the fleet, and you, as the database administrator, are responsible for updating the database to reflect this addition. The aircraft they wish to add is the Airbus A380, which has a range of 15,700 km and aircraft code "380". You can do this by executing the following command in the PostgreSQL CLI:

```
1  INSERT INTO aircrafts_data(aircraft_code, model, range) VALUES (380, '{"en": "Airbus A380-800"}' ,57 ;
```

3. To confirm that the information was entered into the database correctly, you can read out the `aircrafts_data` table again using:

```
SELECT * FROM aircrafts_data;
```

The output will look like this:

```
---------------+--------------------------------+--------
 773           | {"en": "Boeing 777-300"}       | 11100
 763           | {"en": "Boeing 767-300"}       |  7900
 SU9           | {"en": "Sukhoi Superjet-100"}  |  3000
 320           | {"en": "Airbus A320-200"}      |  5700
 321           | {"en": "Airbus A321-200"}      |  5600
 319           | {"en": "Airbus A319-100"}      |  6700
 733           | {"en": "Boeing 737-300"}       |  4200
 CN1           | {"en": "Cessna 208 Caravan"}   |  1200
 CR2           | {"en": "Bombardier CRJ-200"}   |  2700
 380           | {"en": "Airbus A380-800"}      | 15700
(10 rows)

demo=#
```

As you can see, there is a new entry in the table corresponding to the new aircraft added to the fleet.

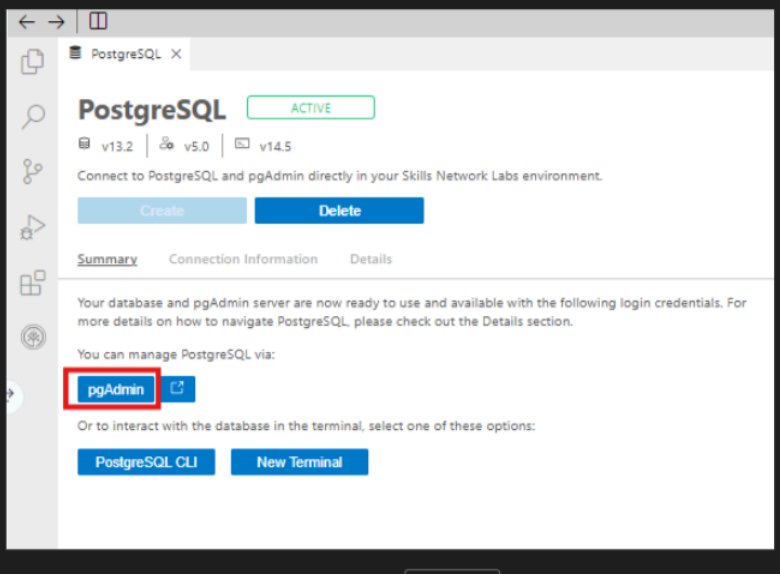
Task B: Backup your Database using pgAdmin

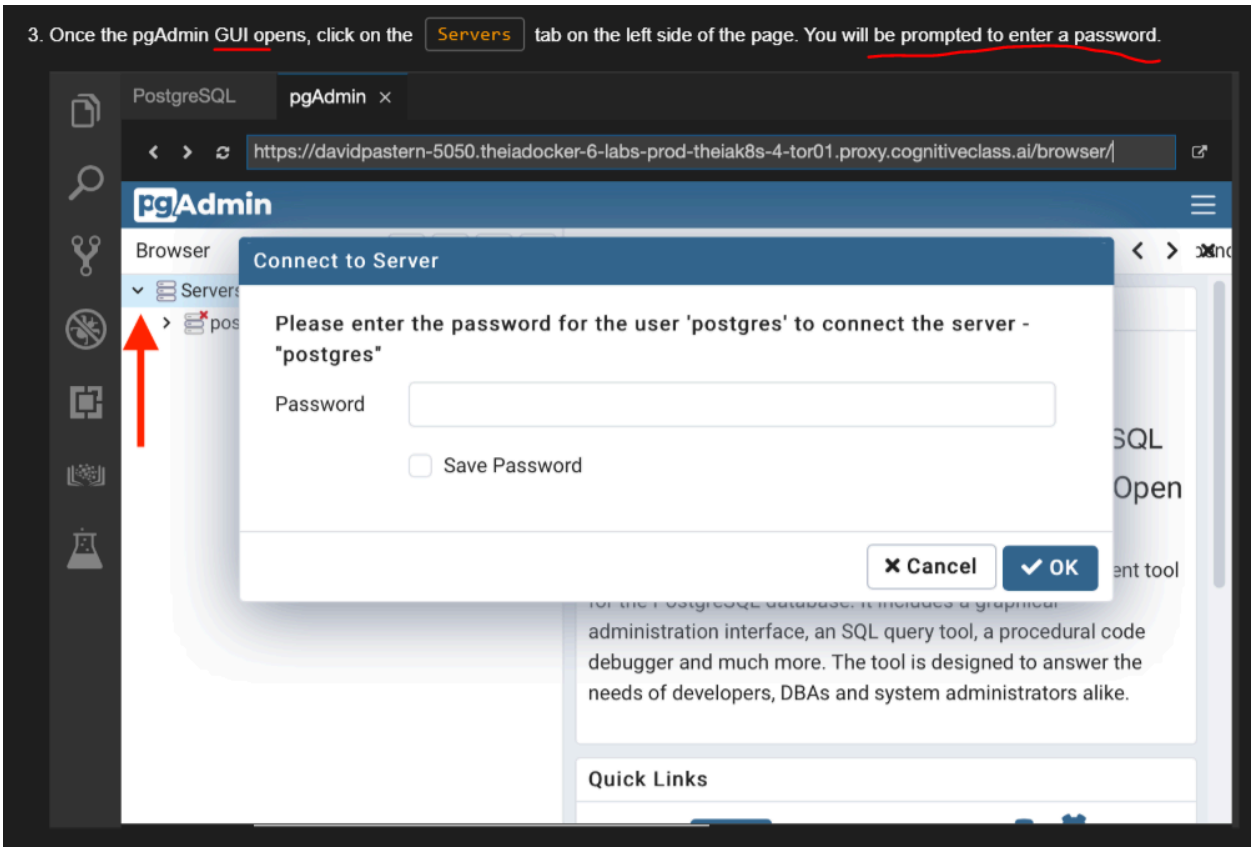
Now that you modified the database (minor modification for demonstration - in reality there would likely be far more additions) it is good practice to backup your database in case of accidental deletion.

1. To back up the `demo` database, first exit the PostgreSQL CLI by either entering:

```
\q
```

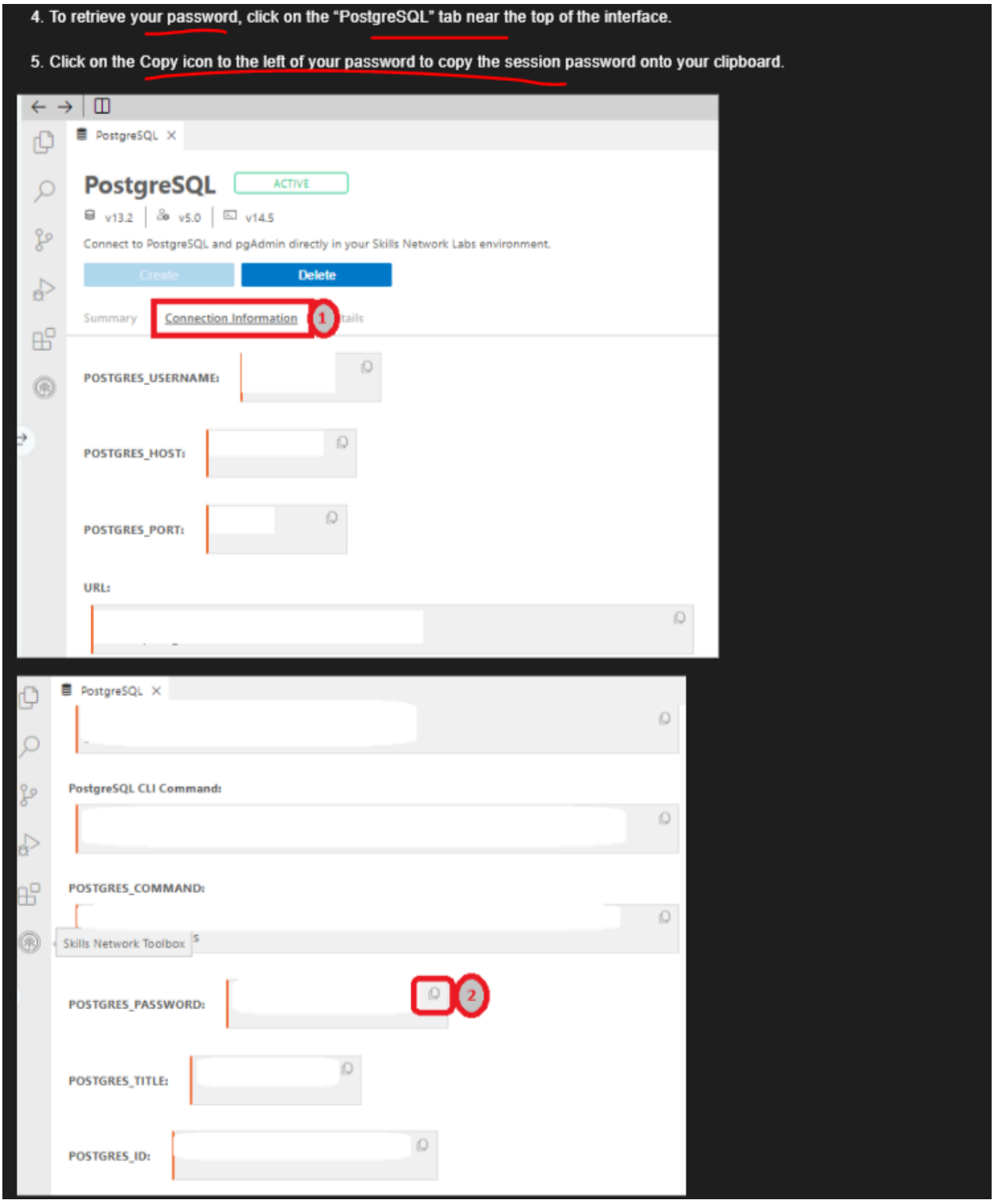
2. Next, open the pgAdmin Graphical User Interface by clicking the "pgAdmin" button in the Cloud IDE interface.

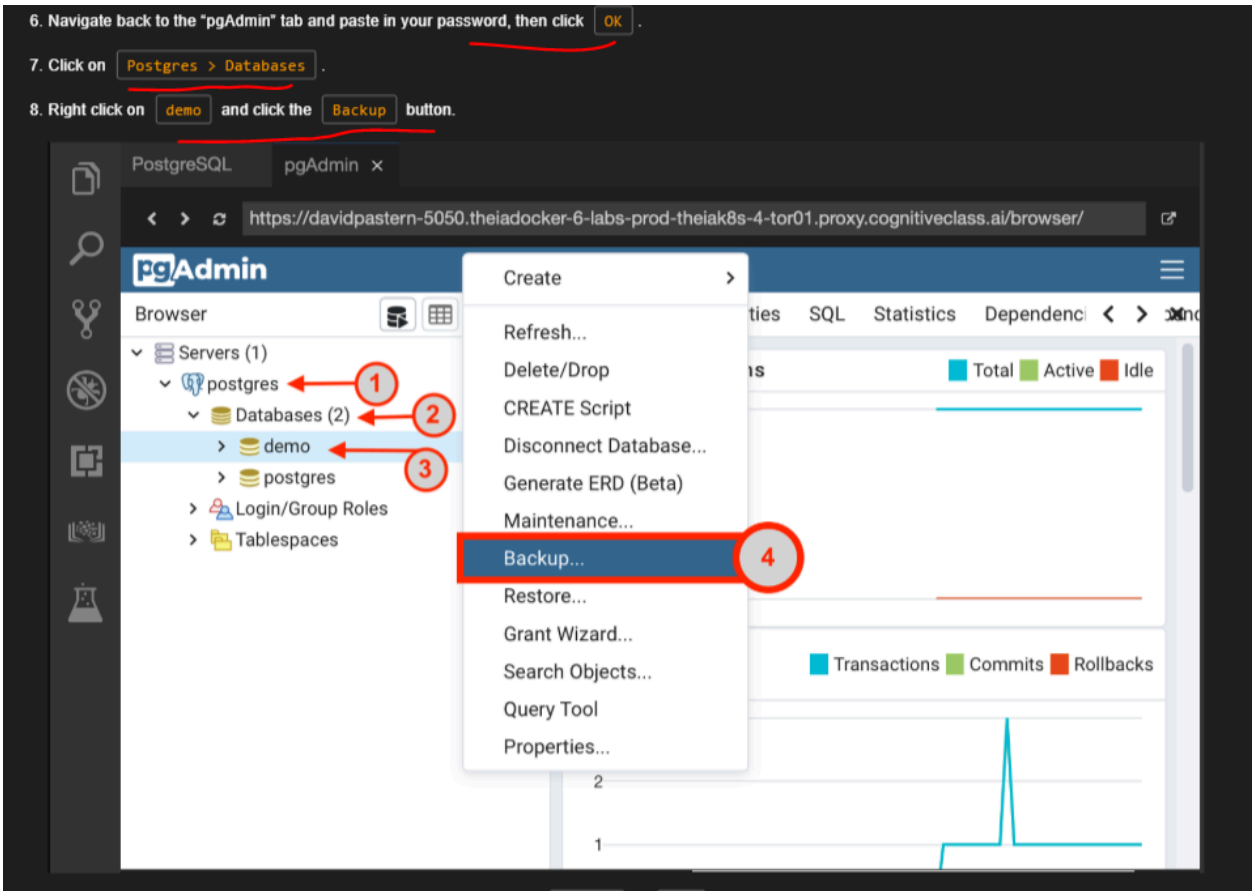


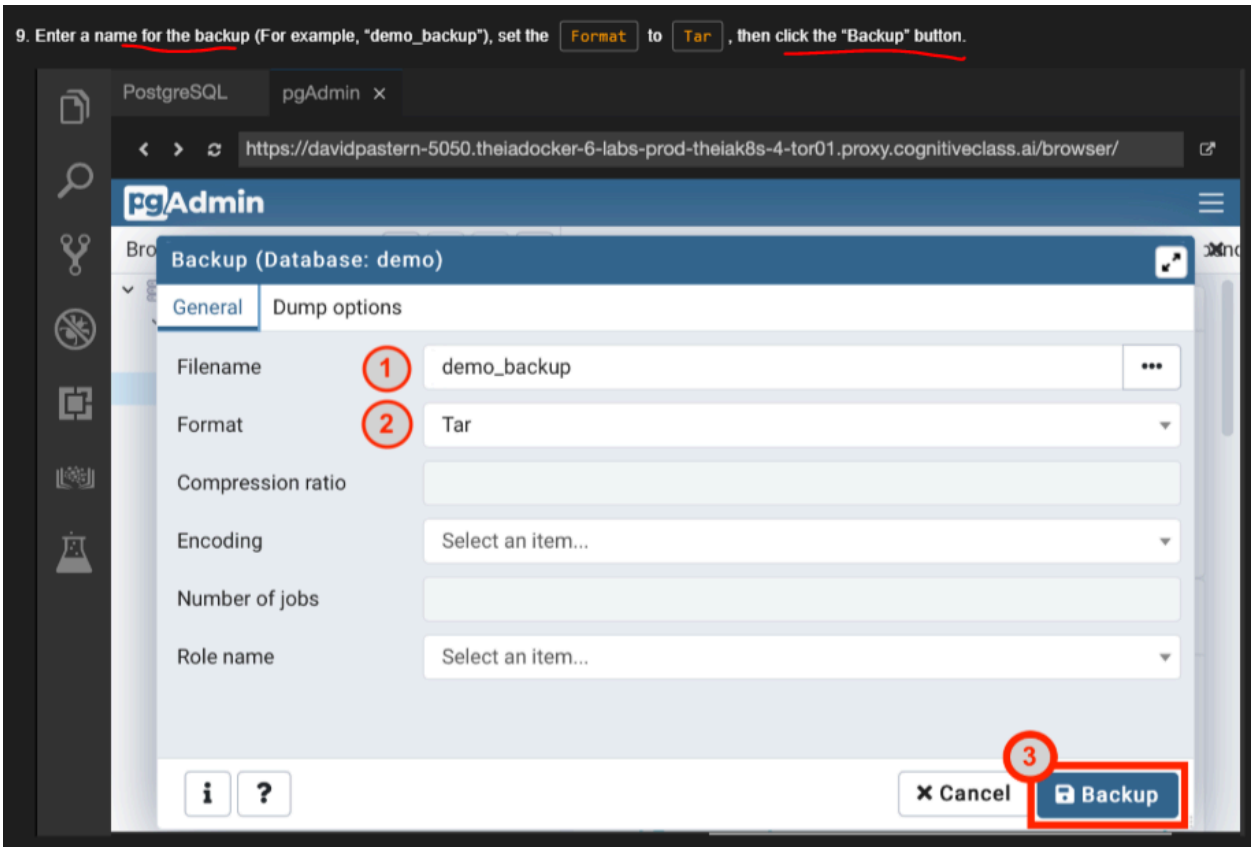

3. Once the pgAdmin GUI opens, click on the Servers tab on the left side of the page. You will be prompted to enter a password.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Browser
Connect to Server
Please enter the password for the user 'postgres' to connect the server - "postgres"
Password
Save Password
Cancel
OK
administration interface, an SQL query tool, a procedural code debugger and much more. The tool is designed to answer the needs of developers, DBAs and system administrators alike.
Quick Links

4. To retrieve your password, click on the "PostgreSQL" tab near the top of the interface.

5. Click on the Copy icon to the left of your password to copy the session password onto your clipboard.




6. Navigate back to the "pgAdmin" tab and paste in your password, then click OK .
7. Click on Postgres > Databases .
8. Right click on demo and click the Backup button.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Browser
Servers (1)
postgres
Databases (2)
demo
postgres
Login/Group Roles
Tablespaces
1
2
3
4
Create
Refresh...
Delete/Drop
CREATE Script
Disconnect Database...
Generate ERD (Beta)
Maintenance...
Backup...
Restore...
Grant Wizard...
Search Objects...
Query Tool
Properties...
SQL
Statistics
Total
Active
Idle
Transactions
Commits
Rollbacks
2
1

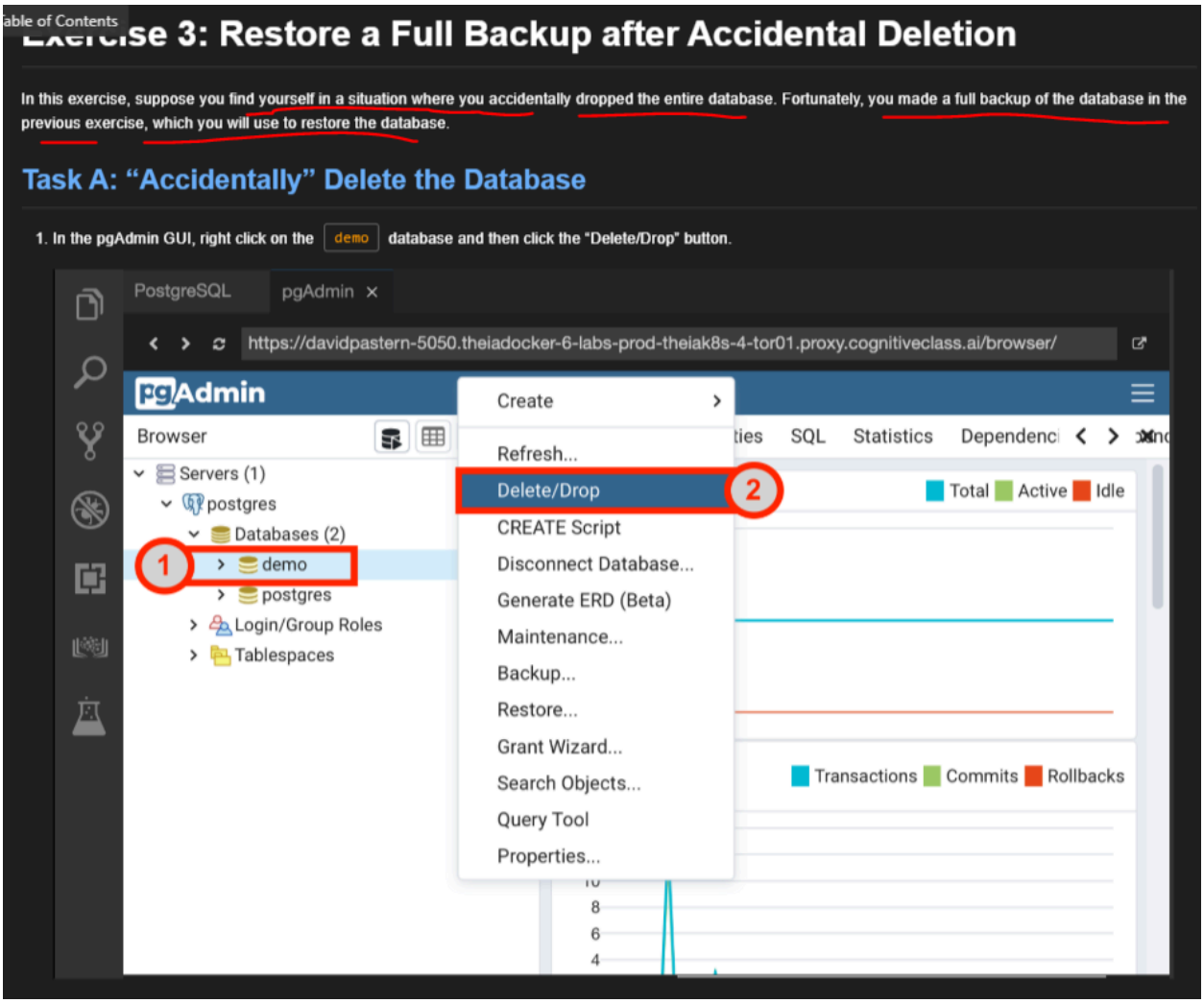

9. Enter a name for the backup (For example, "demo_backup"), set the Format to Tar, then click the "Backup" button.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Backup (Database: demo)
General
Dump options
Filename
1
demo_backup
Format
2
Tar
Compression ratio
Encoding
Select an item...
Number of jobs
Role name
Select an item...
3
Cancel
Backup

Exercise 3: Restore a Full Backup after Accidental Deletion

In this exercise, suppose you find yourself in a situation where you accidentally dropped the entire database. Fortunately, you made a full backup of the database in the previous exercise, which you will use to restore the database.

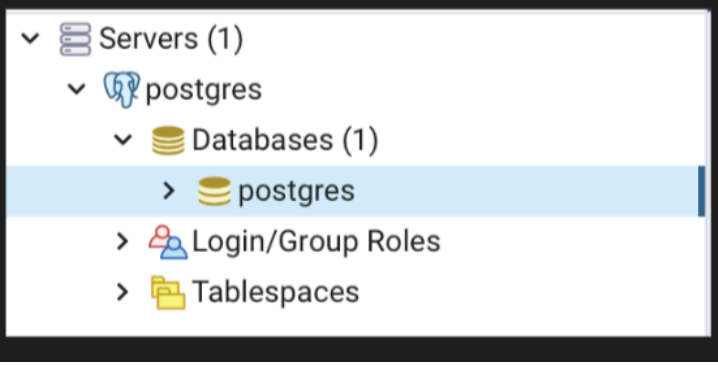
Task A: "Accidentally" Delete the Database

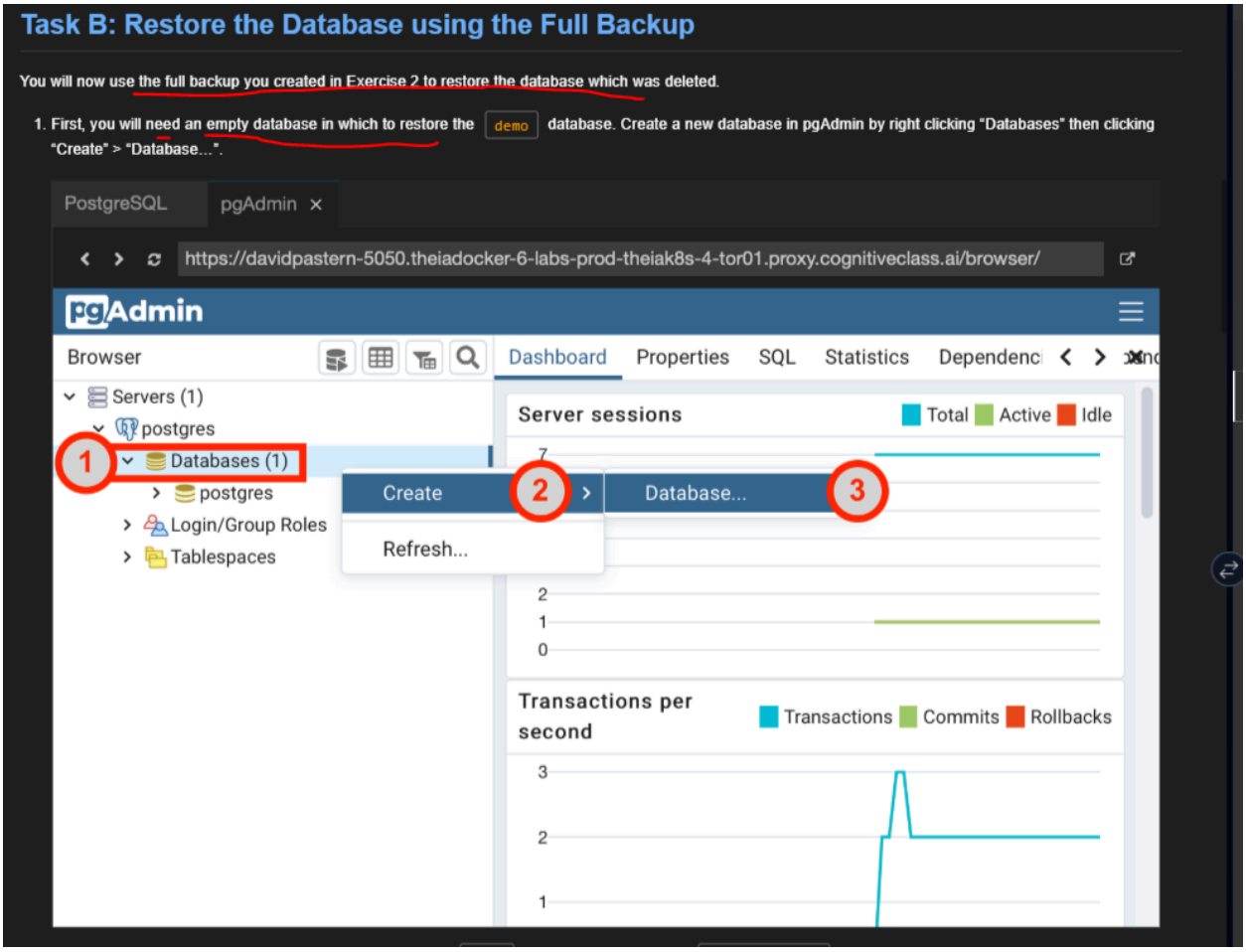
1. In the pgAdmin GUI, right click on the `demo` database and then click the "Delete/Drop" button.

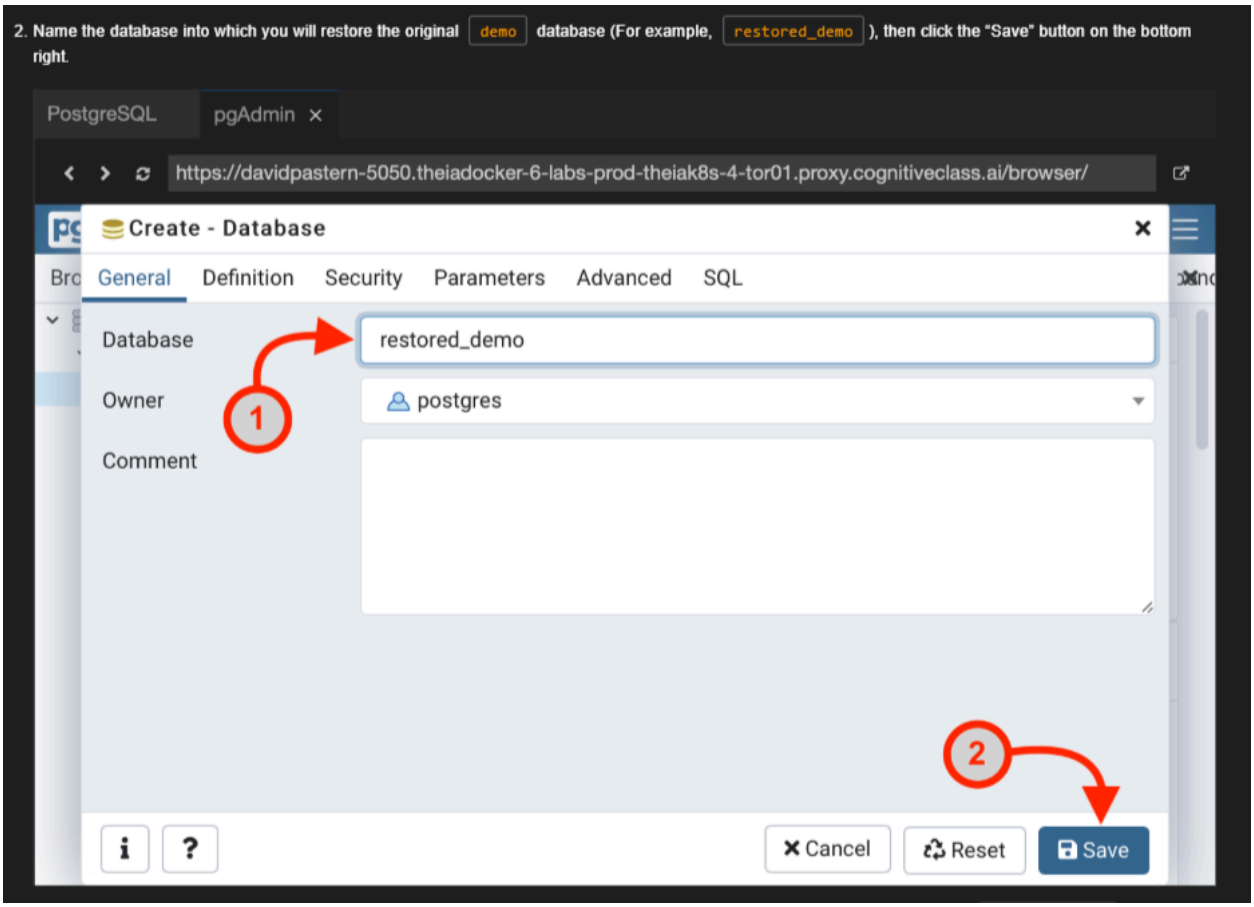


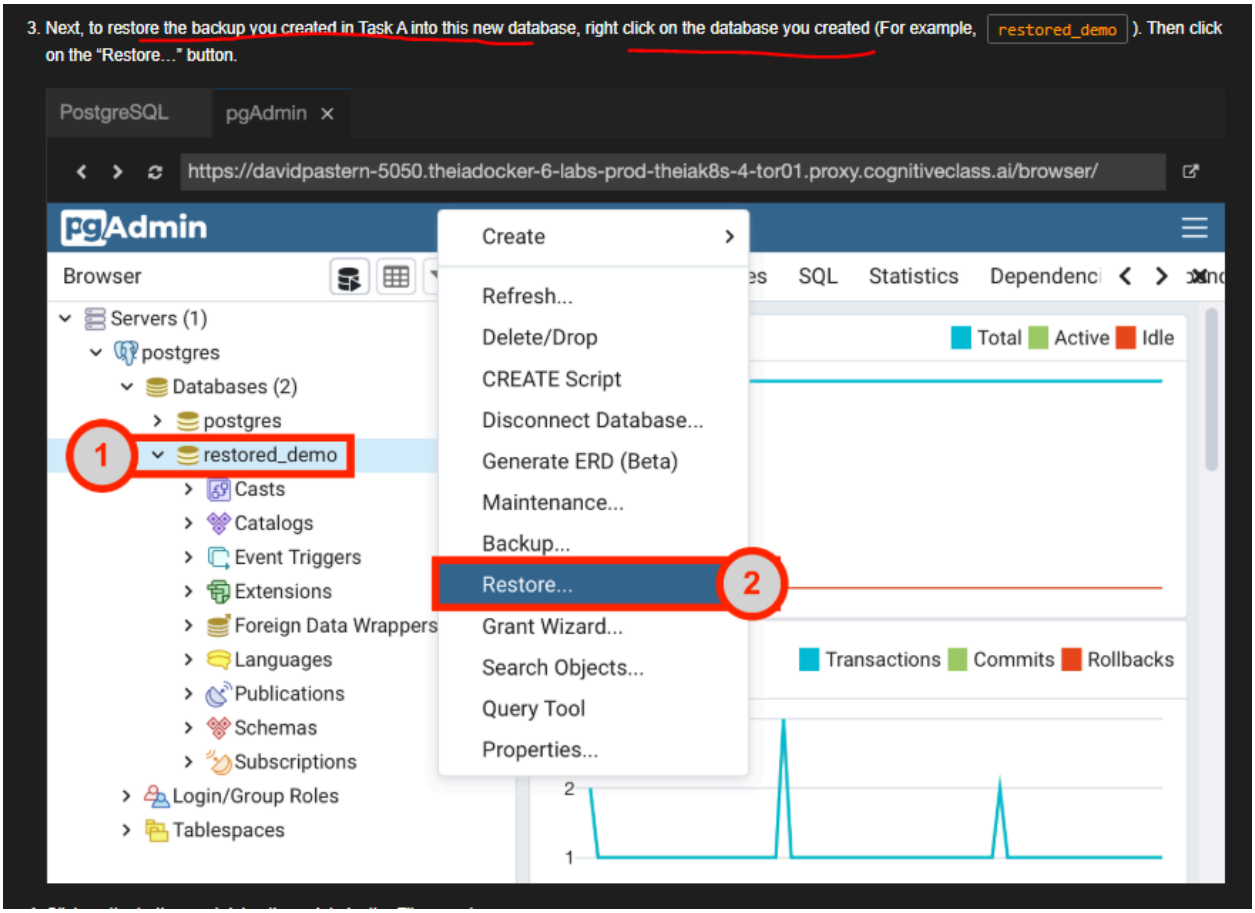
2. When prompted, click "Yes" to confirm the deletion of the database.

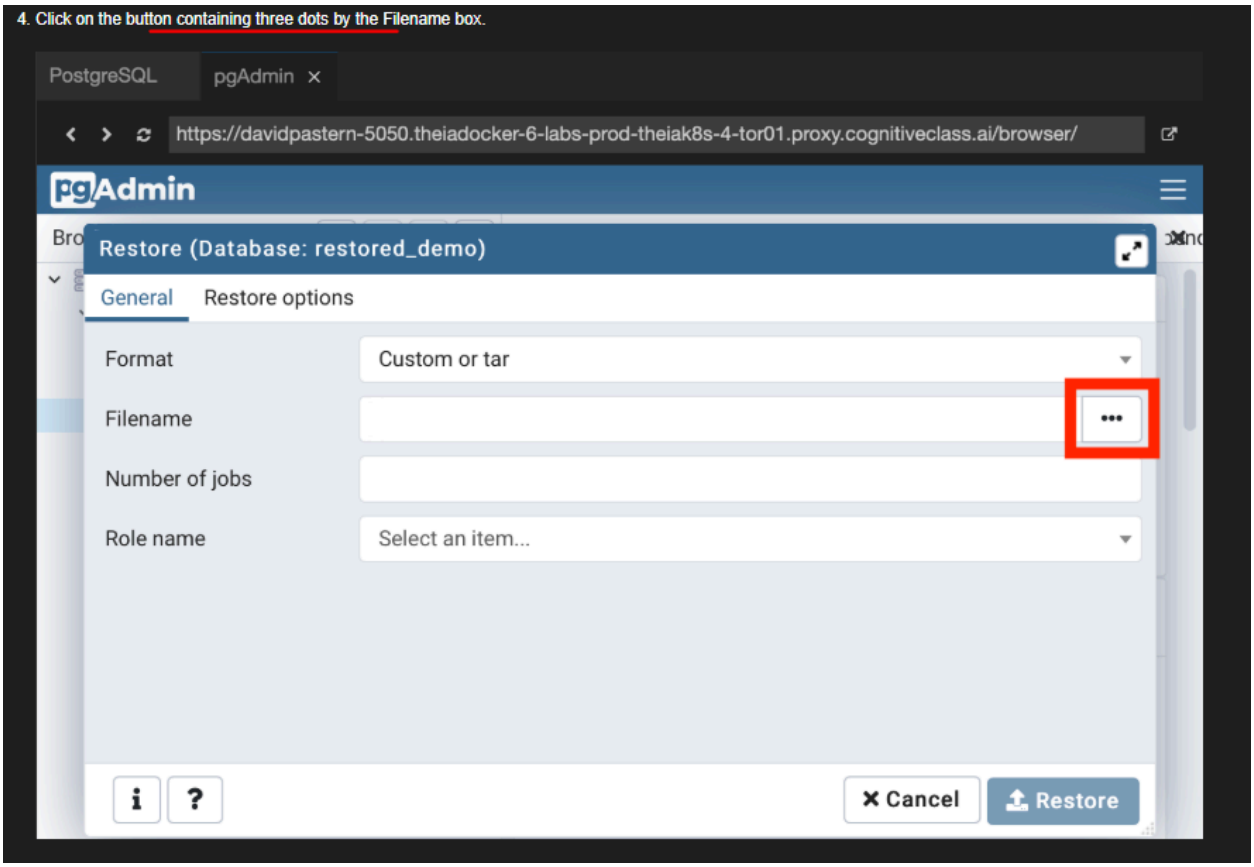
3. You will see that the `demo` database is no longer listed, which verifies that you have dropped it.

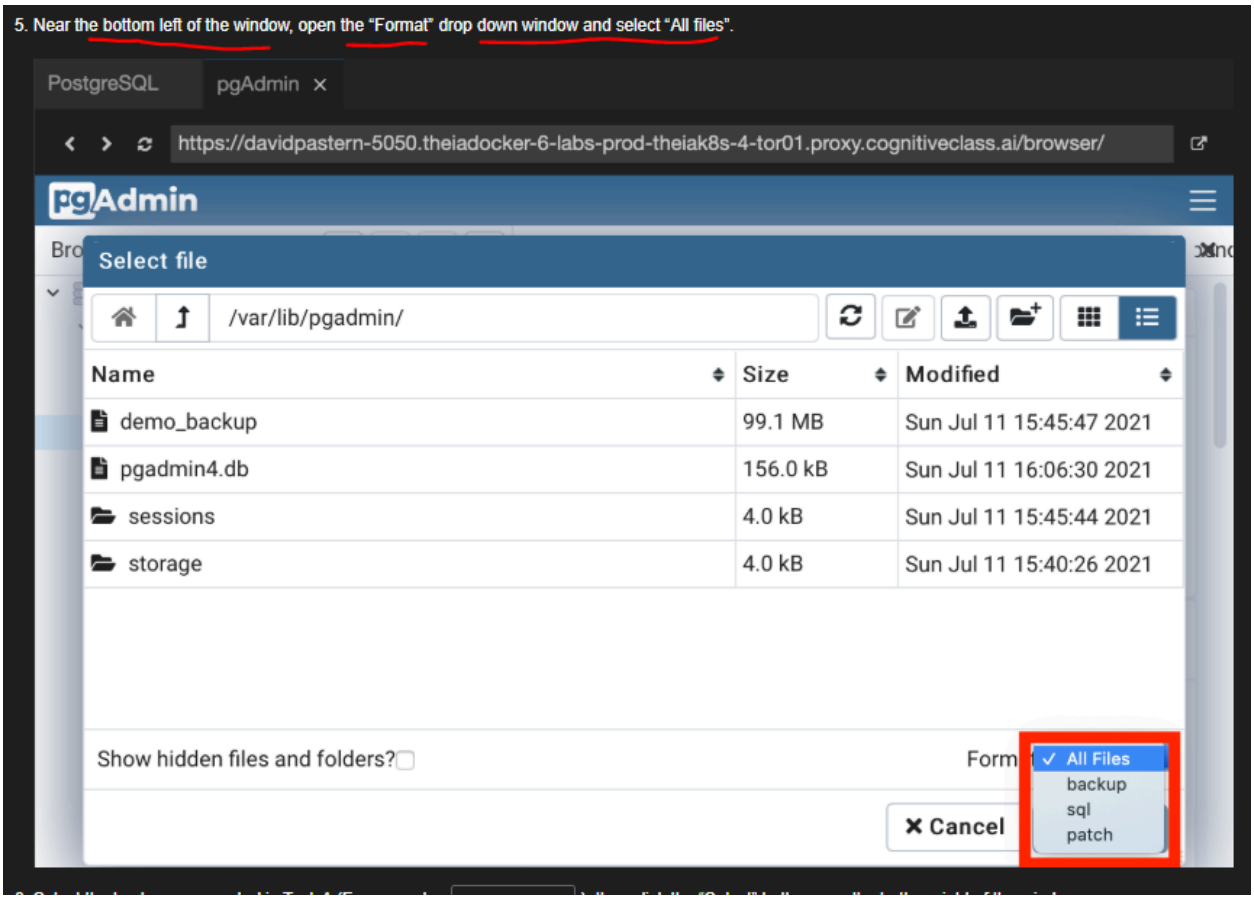


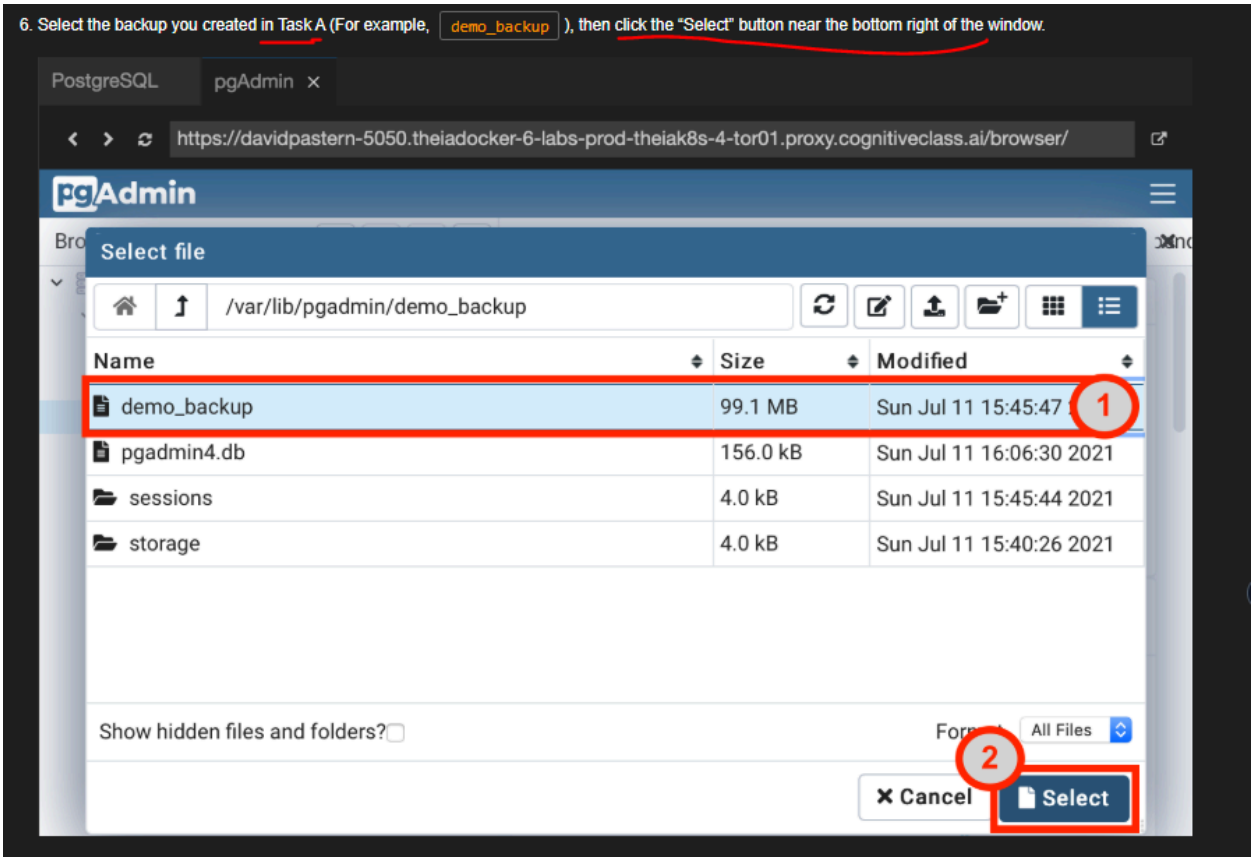

Task B: Restore the Database using the Full Backup
You will now use the full backup you created in Exercise 2 to restore the database which was deleted.
1. First, you will need an empty database in which to restore the demo database. Create a new database in pgAdmin by right clicking "Databases" then clicking "Create" > "Database...".
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Browser
Dashboard
Properties
SQL
Statistics
Dependenc
Servers (1)
postgres
Databases (1)
postgres
Login/Group Roles
Tablespaces
1
Create
2
Database...
3
Refresh...
Server sessions
Total
Active
Idle
Transactions per second
Transactions
Commits
Rollbacks


2. Name the database into which you will restore the original demo database (For example, restored_demo), then click the "Save" button on the bottom right.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
Create - Database
General
Definition
Security
Parameters
Advanced
SQL
Database
restored_demo
Owner
postgres
Comment
1
2
Cancel
Reset
Save

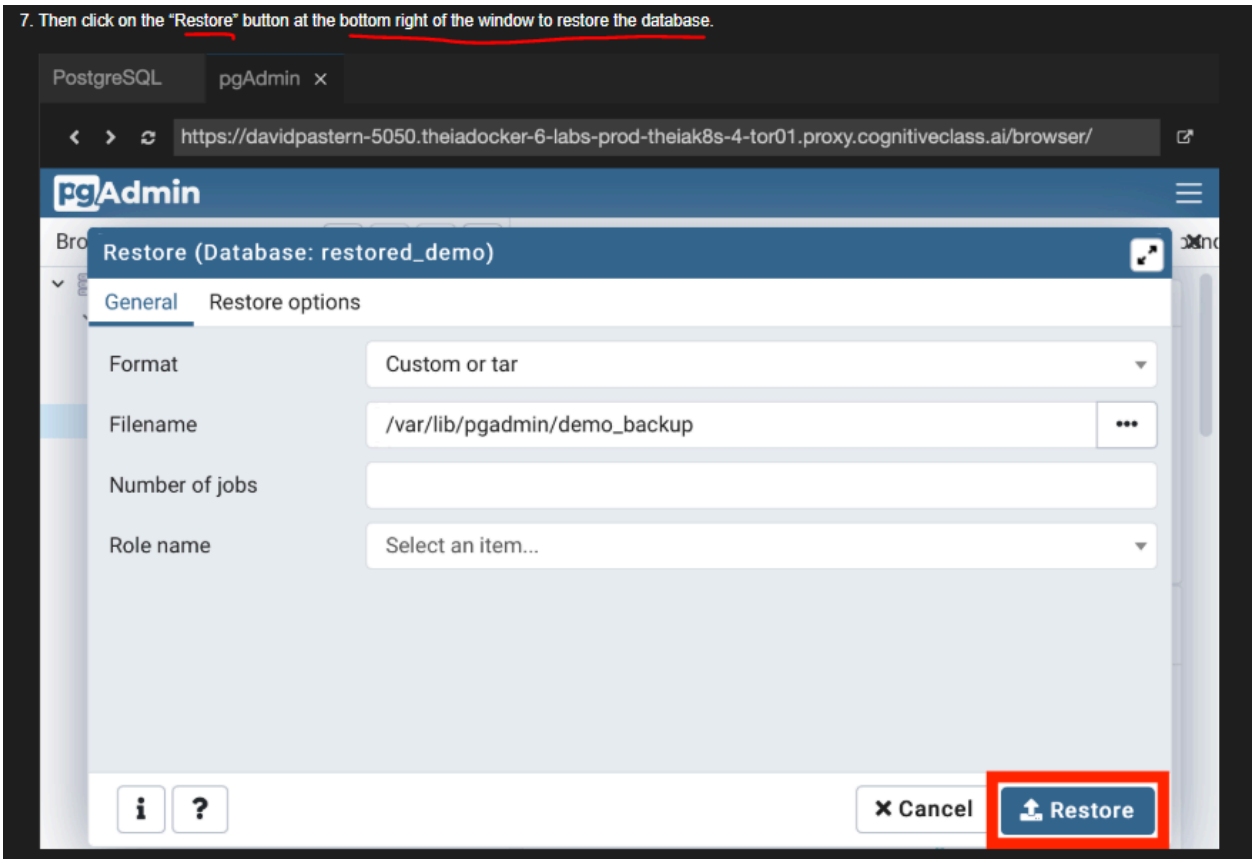

3. Next, to restore the backup you created in Task A into this new database, right click on the database you created (For example, restored_demo). Then click on the "Restore..." button.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Browser
Servers (1)
postgres
Databases (2)
postgres
restored_demo
Casts
Catalogs
Event Triggers
Extensions
Foreign Data Wrappers
Languages
Publications
Schemas
Subscriptions
Login/Group Roles
Tablespaces
1
Create
Refresh...
Delete/Drop
CREATE Script
Disconnect Database...
Generate ERD (Beta)
Maintenance...
Backup...
Restore...
Grant Wizard...
Search Objects...
Query Tool
Properties...
2
SQL
Statistics
Dependenc
Total
Active
Idle
Transactions
Commits
Rollbacks
2
1


4. Click on the button containing three dots by the Filename box.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Restore (Database: restored_demo)
General
Restore options
Format
Custom or tar
Filename
Number of jobs
Role name
Select an item...
Cancel
Restore

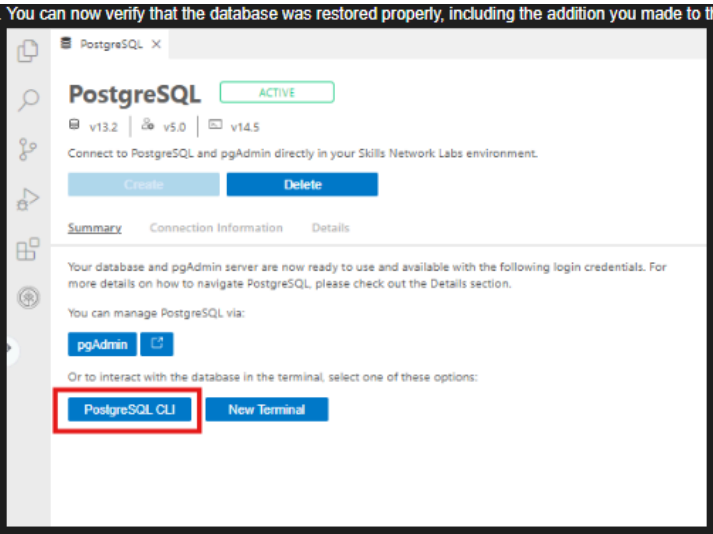

5. Near the bottom left of the window, open the "Format" drop down window and select "All files".
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Select file
/var/lib/pgadmin/
Name
Size
Modified
demo_backup
99.1 MB
Sun Jul 11 15:45:47 2021
pgadmin4.db
156.0 kB
Sun Jul 11 16:06:30 2021
sessions
4.0 kB
Sun Jul 11 15:45:44 2021
storage
4.0 kB
Sun Jul 11 15:40:26 2021
Show hidden files and folders?
Form
All Files
backup
sql
patch
Cancel


6. Select the backup you created in Task A (For example, demo_backup), then click the "Select" button near the bottom right of the window.
PostgreSQL
pgAdmin
https://davidpastern-5050.theiadocker-6-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/browser/
pgAdmin
Select file
/var/lib/pgadmin/demo_backup
Name
Size
Modified
demo_backup
99.1 MB
Sun Jul 11 15:45:47
1
pgadmin4.db
156.0 kB
Sun Jul 11 16:06:30 2021
sessions
4.0 kB
Sun Jul 11 15:45:44 2021
storage
4.0 kB
Sun Jul 11 15:40:26 2021
Show hidden files and folders?
All Files
2
Cancel
Select

7. Then click on the "Restore" button at the bottom right of the window to restore the database.



8. You can now verify that the database was restored properly, including the addition you made to the `aircrafts_data` table. Open up the PostgreSQL CLI:

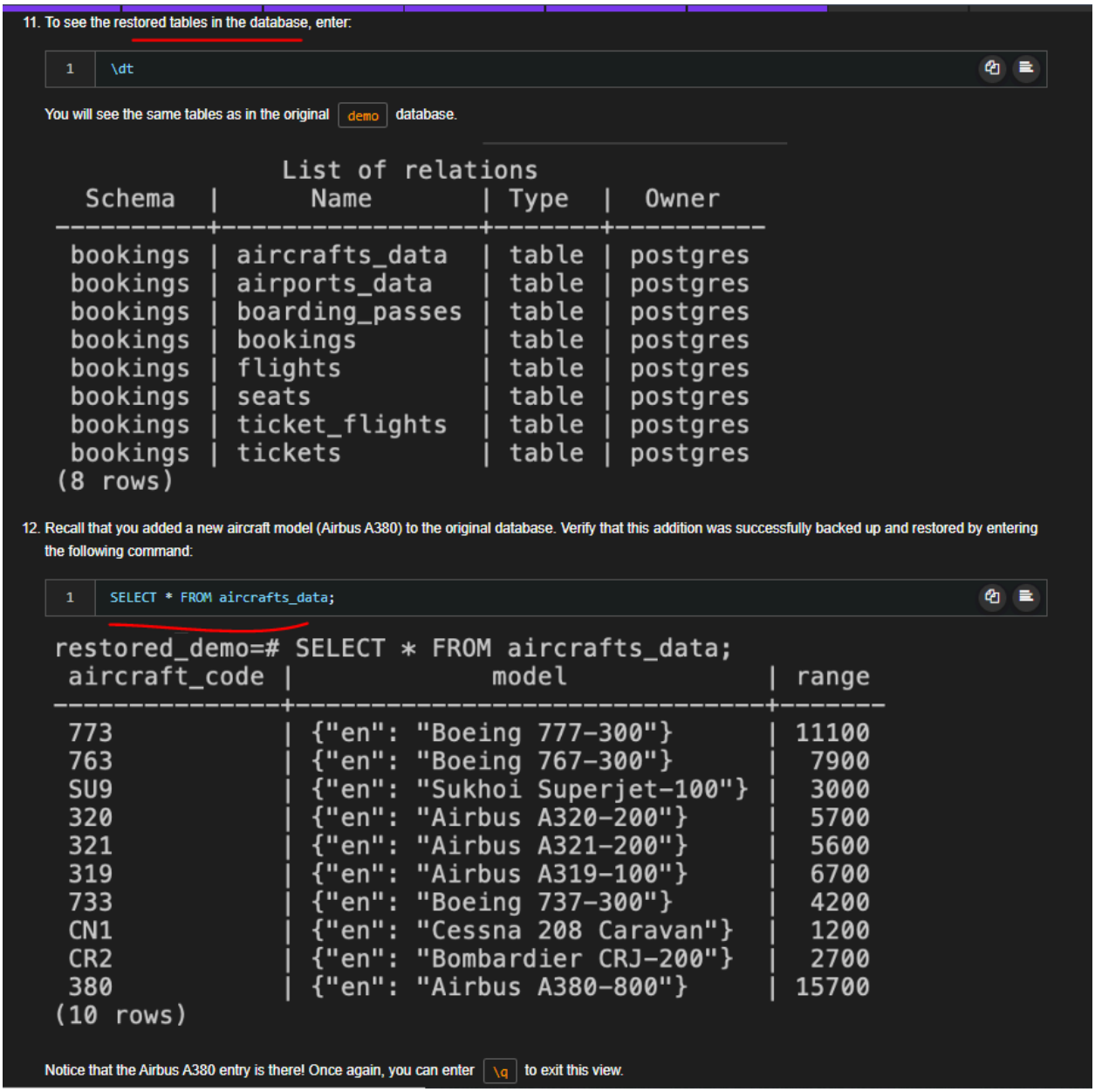


9. In the CLI, enter the command:

```
\connect restored_demo
```

10. To set the proper search path for your database, enter the following into the CLI:

```
SELECT pg_catalog.set_config('search_path', 'bookings', false);
```



Conclusion

Congratulations! You have successfully completed the lab and have gained some familiarity on how to perform a full backup and restoration of a database using PostgreSQL.

To summarize, recall that you covered the following objectives:

- Restore a full database from a backup

- Update a database and perform a full backup
- Drop a database and then restore it