

# Hands-on Lab: Database Design using ERDs



**Estimated time needed:** 45 minutes

In this lab, you will learn how to design a database by creating an entity relationship diagram (ERD) in the PostgreSQL database service using the pgAdmin graphical user interface (GUI) tool. First, you will create an ERD of a database. Next, you will generate and execute an SQL script to create the database schema from its ERD. Finally, you will load the created database schema with data.

## Software used in this lab

In this lab, you will use [PostgreSQL Database](#). PostgreSQL is a Relational Database Management System (RDBMS) designed to efficiently store, manipulate, and retrieve data.



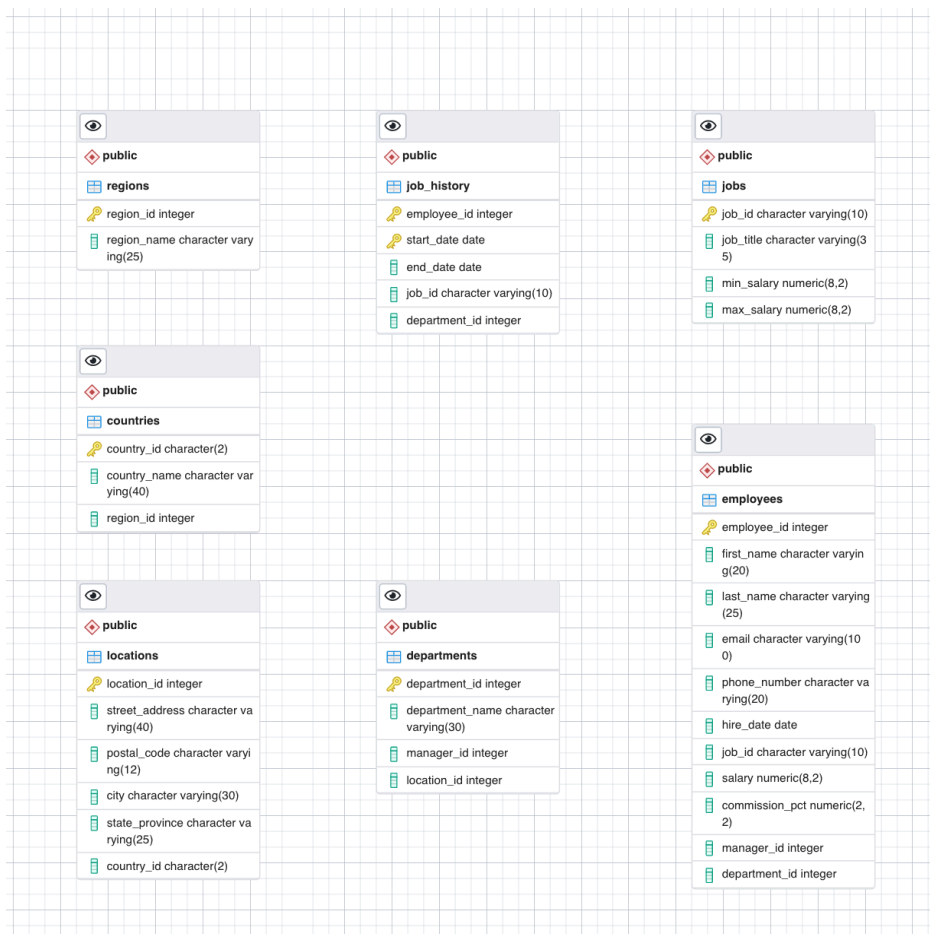
To complete this lab, you will utilize the PostgreSQL relational database service available as part of IBM Skills Network Labs (SN Labs) Cloud IDE. SN Labs is a virtual lab environment used in this course.

## Database used in this lab

The HR database used in this lab comes from the following source: [HR Sample Database](#) [Copyright 2021 - Oracle Corporation].

You will use a modified version of the database for the lab. To follow the lab instructions successfully, please use the database provided with the lab, rather than the database from the original source.

The following ERD shows the tables of the HR database:



## Objectives

After completing this lab, you will be able to use pgAdmin with PostgreSQL to:

- Create an ERD of a database.
- Generate and execute an SQL script from an ERD to create a schema.
- Load the database schema with data.

This lab is divided into two exercises, *Example Exercise* and *Practice Exercise*.

## Example Exercise

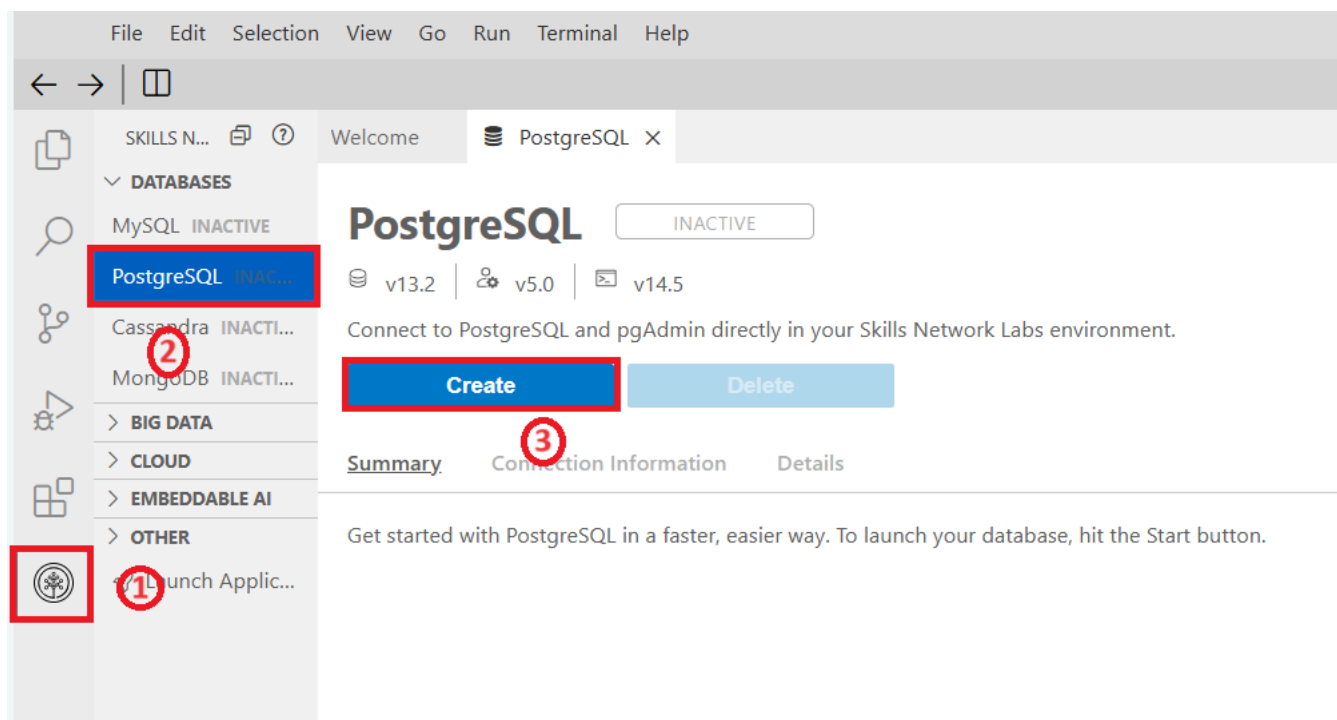
In this example exercise, you will first create a partial ERD of the HR database. Next, you will generate and execute an SQL script to create the partial schema of the HR database from its ERD. Finally, you will load the created database schema with data by using the Restore feature.

## Task A: Create an Entity Relationship Diagram (ERD) of a database

In this task of the Example Exercise, you will create a partial ERD of the HR database.

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

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



4. Note down your PostgreSQL service session password because you may need to use it later in the lab.
5. Click the pgAdmin button in the same window where you started PostgreSQL.
6. You will see the pgAdmin GUI tool.



## Welcome



pgAdmin  
Management

Feature rich | Maximizing

pgAdmin is an Open Source administration tool designed to answer the needs of PostgreSQL users.

## Quick Links

## Getting Started



PostgreSQL Documentation

7. In the tree-view, expand **Servers > postgres > Databases**. Enter your PostgreSQL service session password if prompted during the process. Right-click on **Databases** and go to **Create > Database**. Type **HR** as the name of the database and click **Save**.

The screenshot shows the pgAdmin 4 web interface. The top navigation bar includes the pgAdmin logo and menus for File, Object, Tools, and Help. Below the navigation bar, there are tabs for Dashboard, Properties, and SQL. The main area is divided into a left sidebar (tree view) and a right pane (content area).

In the tree view, the following items are highlighted with red boxes and numbered:

- 1**: The **Browsers** tab.
- 2**: The **Servers (1)** folder.
- 3**: The **postgres** server folder.
- 4**: The **Databases (1)** folder.

A right-click context menu is open over the **Databases (1)** folder. The menu options are:

- Create** (highlighted with a blue bar)
- Refresh...**

The **Create** option has a submenu arrow, and the **Database...** option is highlighted with a mouse cursor.

The right pane displays the **Server sessions** table with 7 rows and the **Tuples in** table with 1 row.

## Create - Database

General

Definition

Security

Parameters


Advanced

SQL

Database

HR

Owner

 postgres

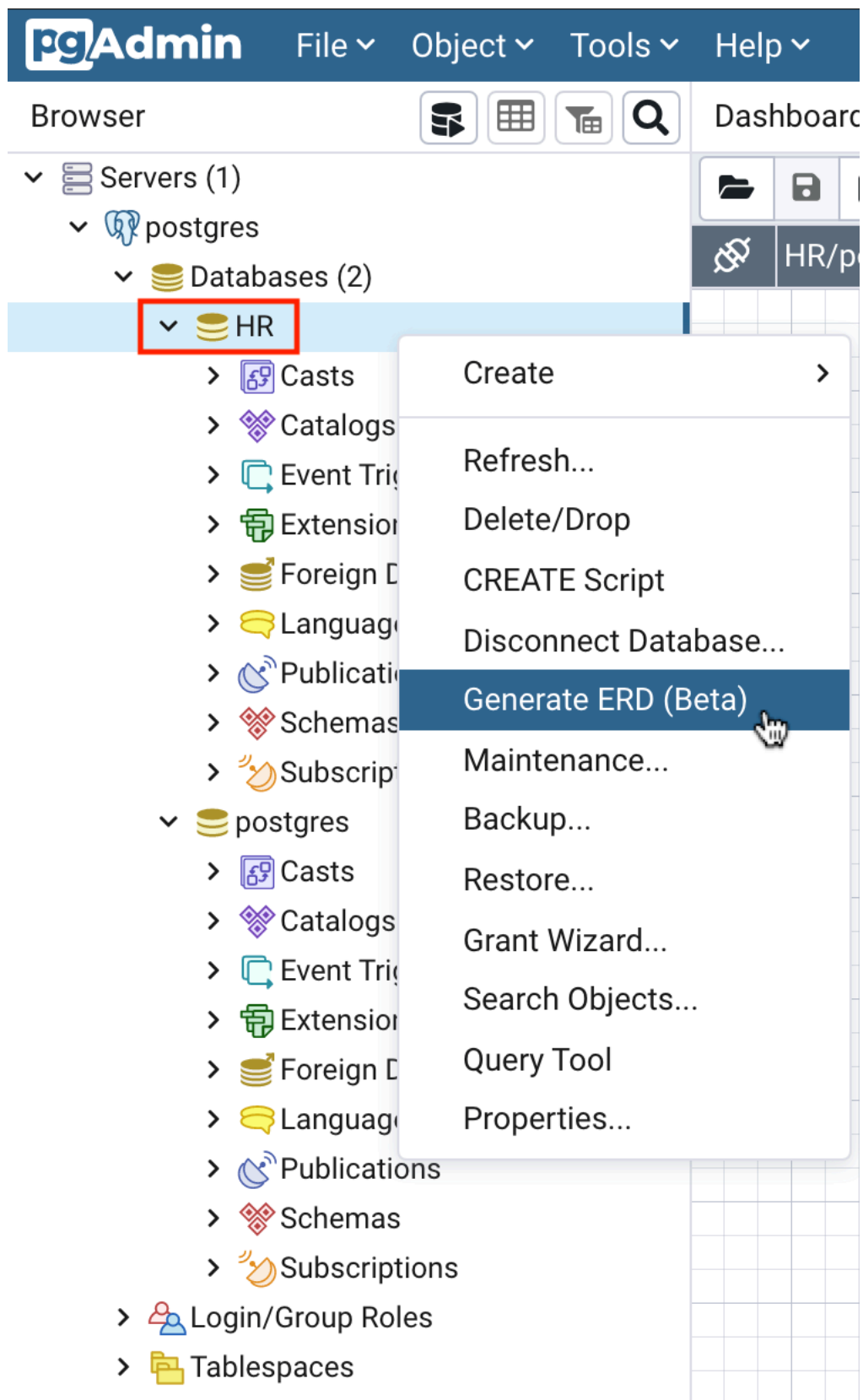
Comment

**i**

**?**

**✕** Cancel

8. In the tree-view, expand **HR**. Right-click on **HR** and select **Generate ERD (Beta)**.



9. Click **Add table**. On the **General** tab, in the **Name** box, type **employees** as the name of the table. Don't click **OK**, proceed to the next step.

Browser



Dashboard

Properties

SQL

▾ Servers (1)

▾ postgres

▾ Databases (2)

▾ HR

&gt; Casts

&gt; Catalogs



HR/postgres

Add table

Option

Ctrl

New table


General

Columns

Name

employees

Schema

 public

Comment

10. Switch to the **Columns** tab and click **Add new row** to add the necessary column placeholders. Now enter the **employees** table definition information as shown in the image below to create its entity diagram. Then click **OK**.



New table

General

Columns

Columns























	Name	Data type	Length/Prec
--	------	-----------	-------------

## New table

General

Columns

### Columns

		Name	Data type
		employee_id	integer
		first_name	character varying
		last_name	character varying
		email	character varying
		phone_number	character varying
		hire_date	date
		job_id	character varying
		salary	numeric
		commission_pct	numeric
		manager_id	integer
		department_id	integer

11. Similarly, create entity diagrams for the other three tables following steps 9 and 10:

- ▶ [\[Click here\]](#) Create an entity diagram for the jobs table
- ▶ [\[Click here\]](#) Create an entity diagram for the departments table
- ▶ [\[Click here\]](#) Create an entity diagram for the locations table

12. After creating all four entity diagrams, the entities of the ERD are complete.

13. Next, you will create relationships between the entities by adding foreign keys to the tables. Select the entity diagram **employees** and click **One-to-Many link**. Now enter the definition information for a foreign key on the **employees** table as shown in the image below to create the relationship. Then click **OK**.

## One to many relation

### General

Local Table	(public) employees
Local Column	department_id
Referenced Table	(public) departments
Referenced Column	department_id

✕ Cancel

12. Similarly, create the other relationships between the tables following the instructions in step 13:

- ▶ [\[Click here\]](#) Create a relationship between employees and jobs
- ▶ [\[Click here\]](#) Create a relationship between departments and locations
- ▶ [\[Click here\]](#) Create a relationship between departments and employees

13. After creating all four relationships, you have completed the ERD for this exercise. Proceed to Task B.

## Task B: Generate and execute SQL script from ERD to create the schema

In this task of the Example Exercise, you will generate and execute a SQL script from the ERD you created in Task A of the Example Exercise.

1. In the **Generate ERD (Beta)** window, click **Generate SQL**.

2. A new Query Editor window will open containing a SQL script generated from the ERD. Click **Execute/Refresh** to run the script. Proceed to Task C.

Notepad

HR/postgres@localhost

Query Editor

Query History

1

-- This script was generated by a beta version of the ER

2

-- Please log an issue at <https://redmine.postgresql.org>

3

▼ BEGIN;

4

5

6

CREATE TABLE public.departments

7

(

8

department\_id integer NOT NULL,

9

department\_name character varying(30) NOT NULL,

10

manager\_id integer,

11

location\_id integer,

12

PRIMARY KEY (department\_id)

13

);

14

15

CREATE TABLE public.employees

16

(

17

employee\_id integer NOT NULL,

18

first\_name character varying(20),

19

last\_name character varying(25) NOT NULL,

20

email character varying(100) NOT NULL,

21

phone\_number character varying(20),

22

hire\_date date NOT NULL,

23

job\_id character varying(10) NOT NULL,

24

salary numeric(8, 2) NOT NULL,

25

commission\_pct numeric(2, 2).

Data Output

Explain

Messages

Notifications

COMMIT

Query returned successfully in 99 msec.

## Task C: Load the database schema with data

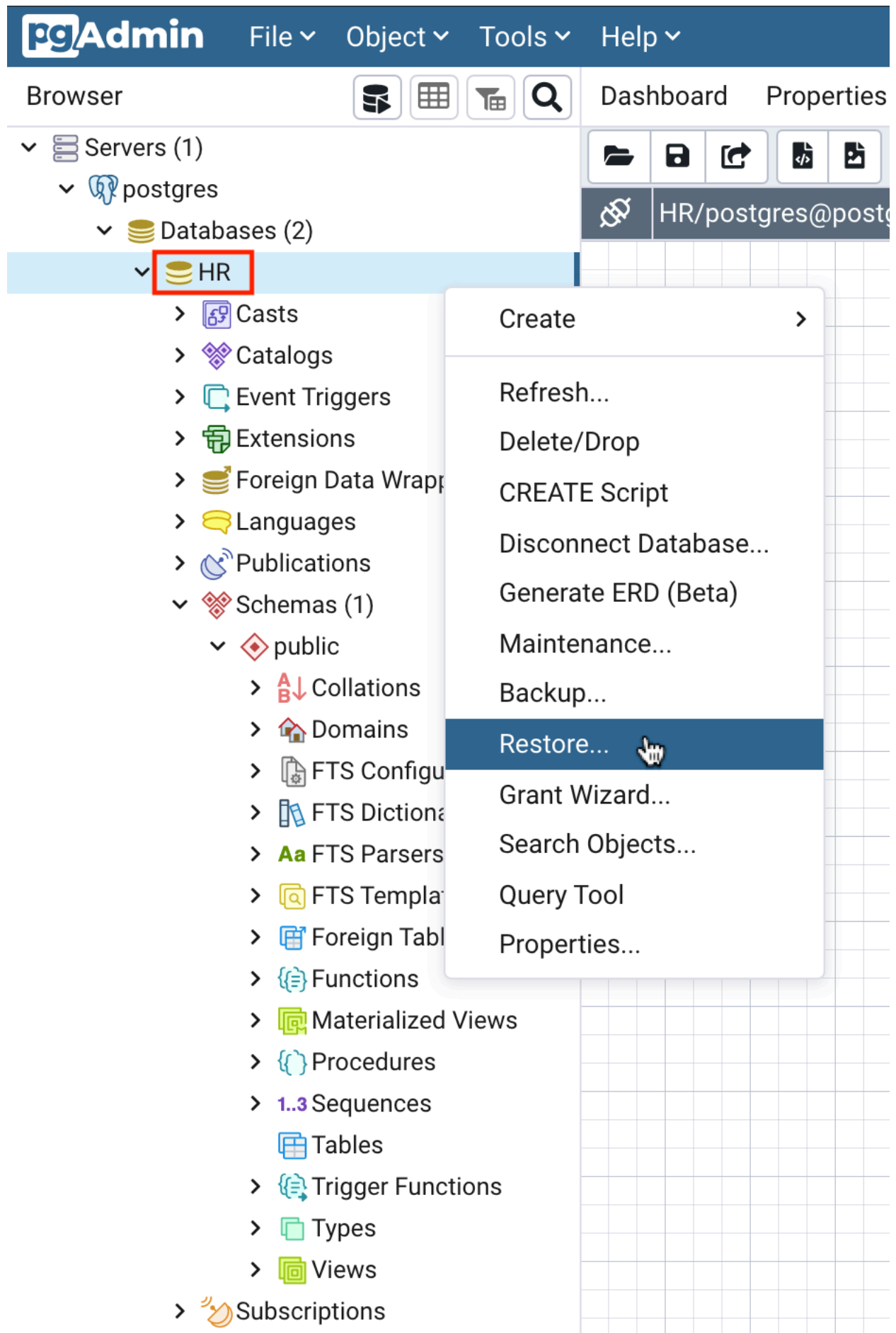
In this task of the Example Exercise, you will load the database schema you created in Task B of the Example Exercise with data using the pgAdmin Restore feature.

1. Download the **HR\_pgsql\_dump\_data\_for\_example-exercise.tar** PostgreSQL dump file (containing the partial HR database data) using the link below to your local computer.

- [HR\\_pgsql\\_dump\\_data\\_for\\_example-exercise.tar](#)

2. Follow the instructions below to import/restore the data:

- In the tree-view, expand **HR**. Right-click **HR** and click **Restore**.



- On the **General** tab, click **Select file** by the Filename box.

Restore (Database: HR)

General

Restore options

Format

Custom or tar

Filename

Number of jobs

Role name

Select an item...

i

?

- Initially make sure the folder details empty and select the var option from the list as shown in the screenshot below. Select var folder.

Select file

Home

Up

Search

...

Name	Date Modified	Size
bin	Thu Sep 5 20:00:48 2024	
sbin	Mon Jul 29 05:02:19 2024	
srv	Mon Jul 22 14:34:18 2024	
sys	Thu Sep 5 20:08:48 2024	
tmp	Thu Sep 5 20:09:17 2024	
usr	Mon Jul 29 05:02:18 2024	
var	Mon Jul 29 05:02:20 2024	
venv	Mon Jul 29 04:58:51 2024	

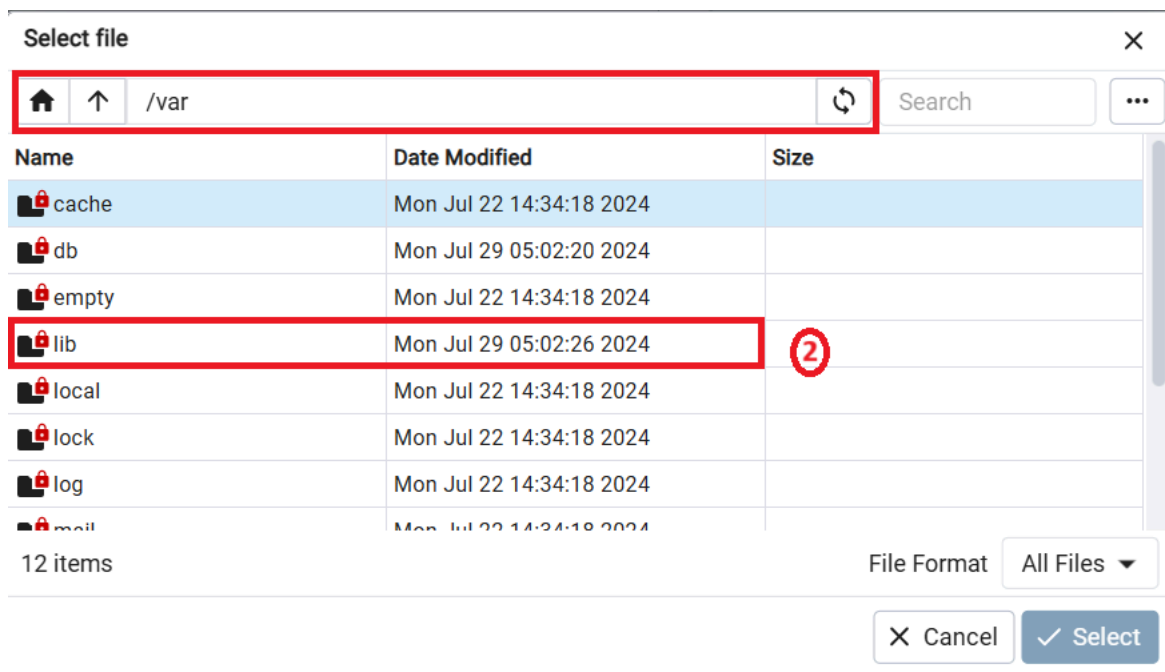
21 items

File Format All Files

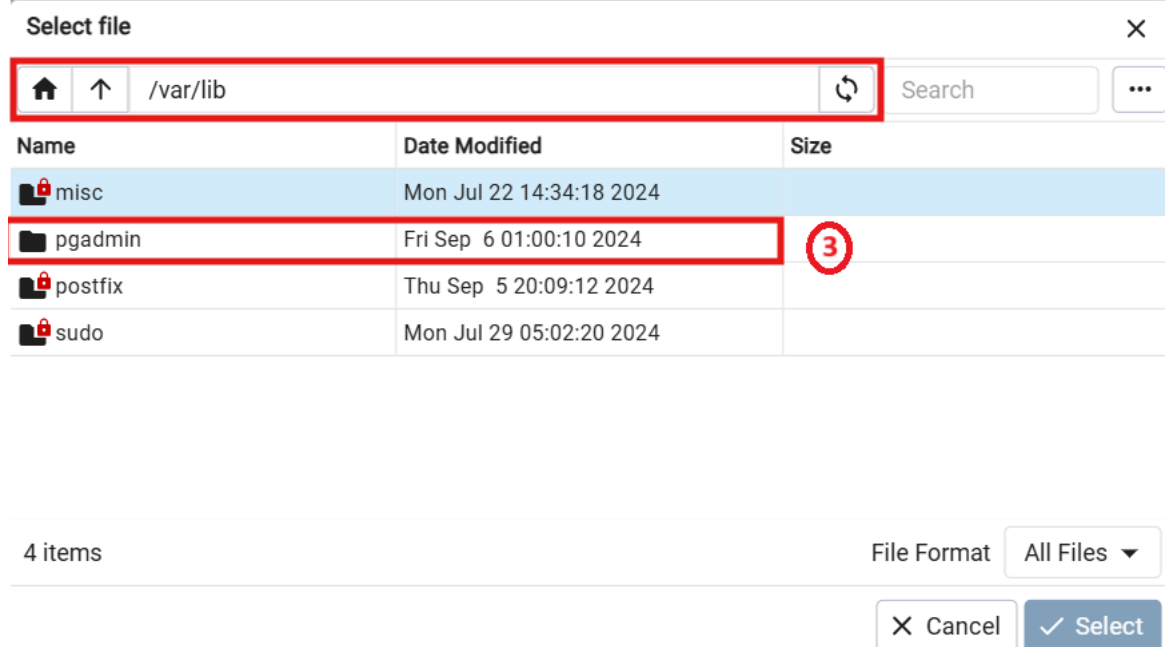
Cancel

Select

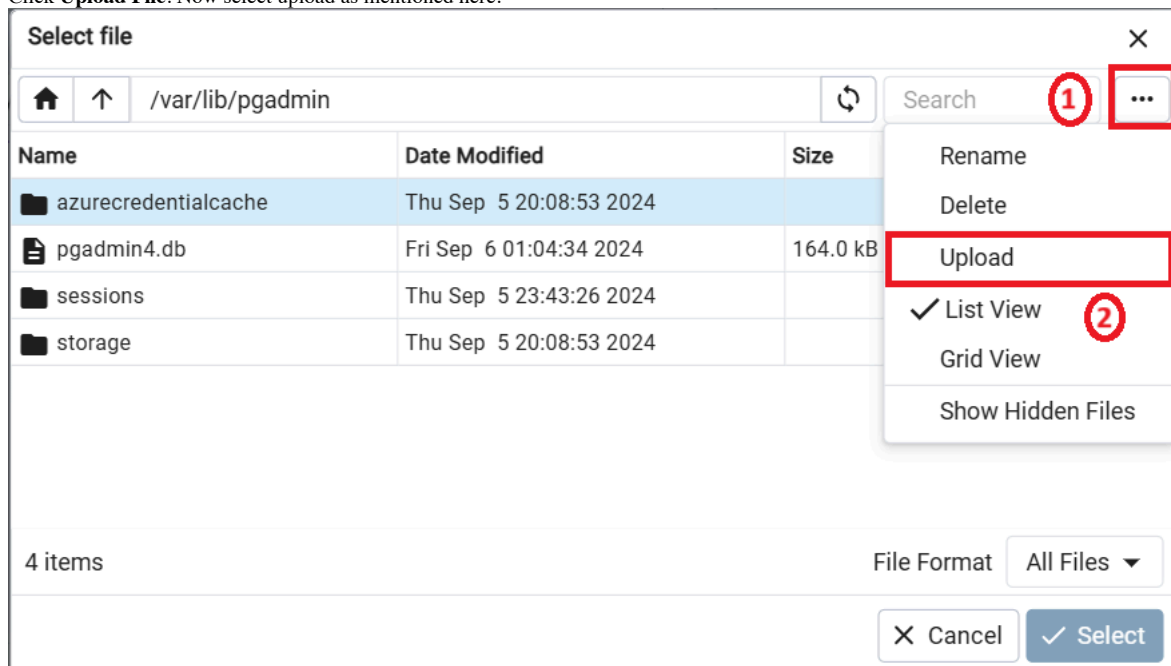
- Select lib folder.



- o Select pgadmin folder. Here you could notice the folders are locked except the pgadmin folder.



- o Click **Upload File**. Now select upload as mentioned here.








- Double-click on the drop files area and load the **HR\_pgsql\_dump\_data\_for\_example-exercise.tar** you downloaded earlier on your local computer.

Note: Ensure that you upload the files to this path: /var/lib/pgadmin/

Select file



/var/lib/pgadmin/



Double click on this space


Drop files here to upload. The file size limit (per file) is 50

Show hidden files and folders?☐


- When the upload is complete, close the drop files area by clicking **X**.


Select file





/var/lib/pgadmin/



21 KB

HR\_pgsql\_dump...  
exercise.tar

100%

Drop files here to upload. The file size limit (per file) is

Show hidden files and folders?☐





- Ensure **Format** is set to **All Files**, select the uploaded **HR\_pgsql\_dump\_data\_for\_example-exercise.tar** file from the list, and then click **Select**.

## Select file



/var/lib/pgadmin/HR\_pgsql\_dump\_data\_for\_example-ex...



Name	Size
 HR_pgsql_dump_data_for_example-exercise.tar	20.5 kB
 pgadmin4.db	156.0 kB
 sessions	4.0 kB
 storage	4.0 kB

Show hidden files and folders? ☐

- Now switch to the **Restore options** tab.

## Restore (Database: HR)

General

Restore options

Format

Custom or tar

Filename

/var/lib/pgadmin/HR\_pgsql\_dump\_data\_for\_exa

Number of jobs

Role name

Select an item...

i

?

- Under **Disable**, set the **Trigger** option to **Yes**. Then click **Restore**.

General

Restore options

### Queries

Include CREATE  
DATABASE  
statement

No

Clean before  
restore

Single  
transaction

No

### Disable

Trigger

Yes

No data for  
Failed Tables

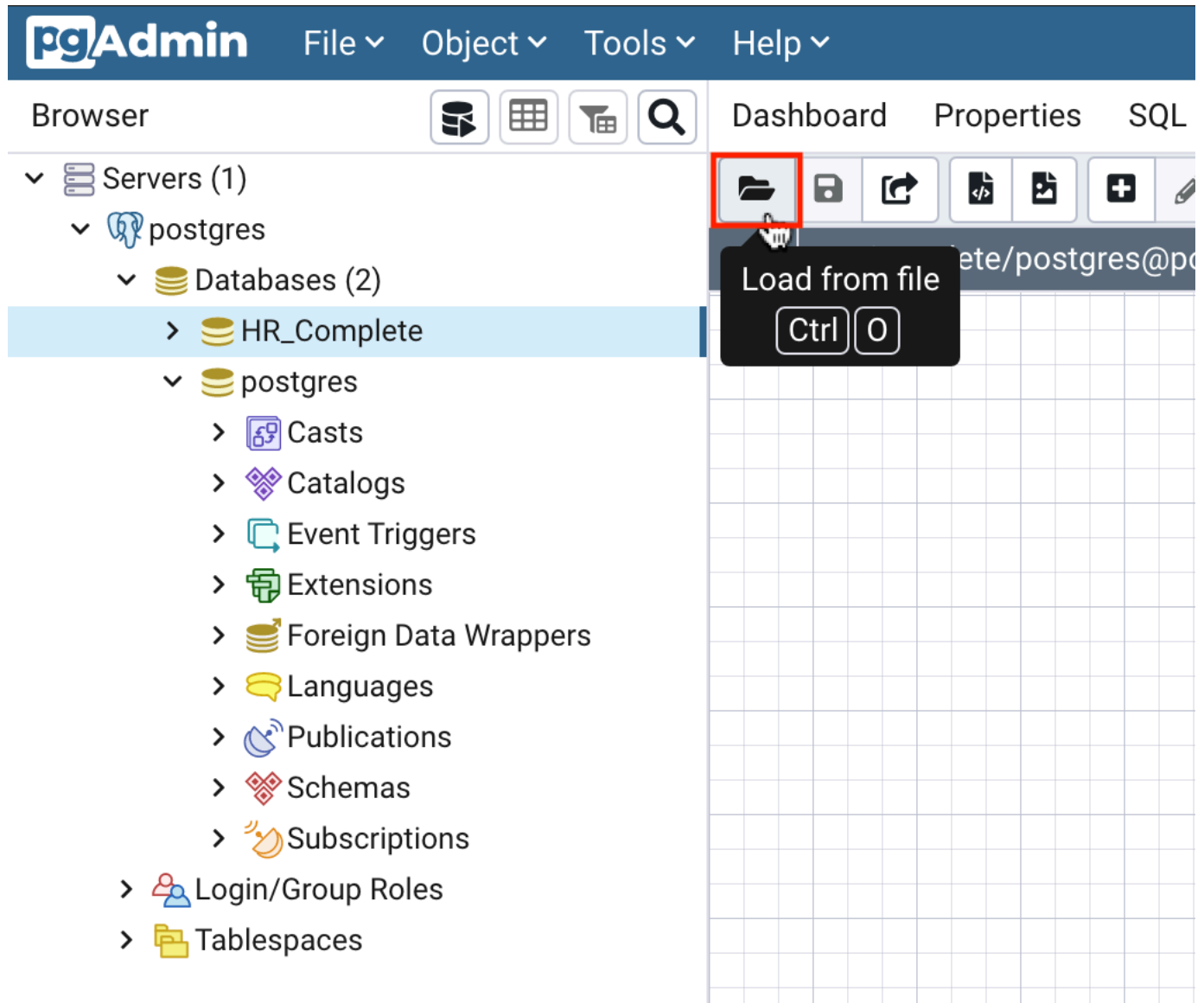
i

?

# Practice Exercise

In this practice exercise, first you will finish creating a partially complete ERD for the HR database. Next, you will generate and execute an SQL script to build the complete schema of the HR database from its ERD. Finally, you will load the complete database schema with data by using the Restore feature.

1. Download the **HR\_pgsql\_ERD\_for\_practice-exercise.pgerd** ERD file (containing a partial HR database ERD based on the one that you created in Task A of the Example Exercise) below to your local computer.
  - [HR\\_pgsql\\_ERD\\_for\\_practice-exercise.pgerd](#)
2. In pgAdmin, create a new database named **HR\_Complete**.
3. Open the ERD Tool and use **Load from file** to load the **HR\_pgsql\_ERD\_for\_practice-exercise.pgerd** file.



**Tip:** Follow Example Exercise Task C for how to load any file in pgAdmin.

4. You will see the previous four entity diagrams along with relationships that you created in the Example Exercise. You will also see three new entity diagrams for the **job\_history**, **regions**, and **countries** tables and one new relationship within the entity diagram of the **employees** table between *manager\_id* as local column and *employee\_id* as referenced column.

Browser



Dashboard

Properties

SQL

▾ Servers (1)

▾ postgres

▾ Databases (2)

▾ HR\_Complete

&gt; Casts

&gt; Catalogs

&gt; Event Triggers

&gt; Extensions

&gt; Foreign Data Wrappers

&gt; Languages

&gt; Publications

&gt; Schemas

&gt; Subscriptions

&gt; postgres

&gt; Login/Group Roles

&gt; Tablespaces



HR\_Complete/postgres@pg



public

regions

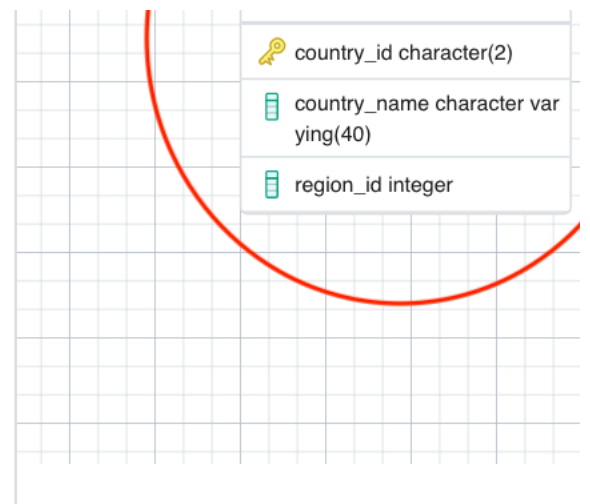
region\_id integer

region\_name character varying(25)



public

countries

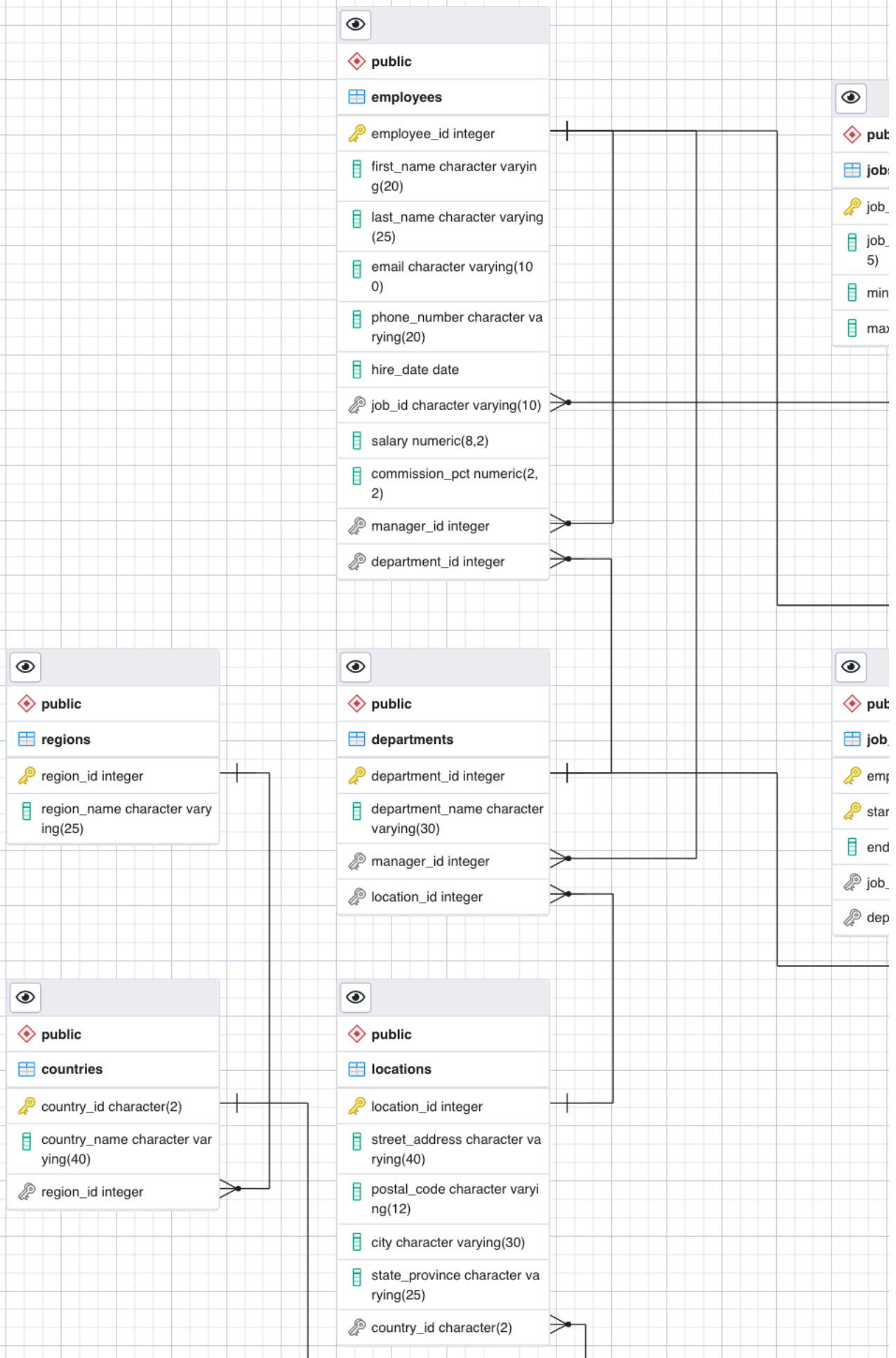


5. Create the remaining relationships between the tables:

- ▶ [Click here] Create a relationship between countries and regions
- ▶ [Click here] Create a relationship between job\_history and departments
- ▶ [Click here] Create a relationship between job\_history and employees
- ▶ [Click here] Create a relationship between job\_history and jobs
- ▶ [Click here] Create a relationship between locations and countries

**Tip:** Follow Example Exercise Task A for how to create relationships between the entities by adding foreign keys to the tables.

6. After creating the remaining relationships, the complete ERD of the HR database will look like the following image:







7. Generate and execute an SQL script from the ERD to create the schema of the **HR\_Complete** database.

**Tip:** Follow Example Exercise Task B.

8. Download the **HR\_pgsql\_dump\_data.tar** PostgreSQL dump file (containing the complete HR database data) below to your local computer. Use the dump file to restore/import the data to the **HR\_Complete** database.

- [HR\\_pgsql\\_dump\\_data.tar](#)

**Tip:** Follow Example Exercise Task C.

## Conclusion

Congratulations! You have completed this lab, and you have learned how to create an ERD of a database, generate and execute an SQL script from an ERD to create a schema, and load the database schema with data.

## Author(s)

- [Sandip Saha Joy](#)

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