

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.



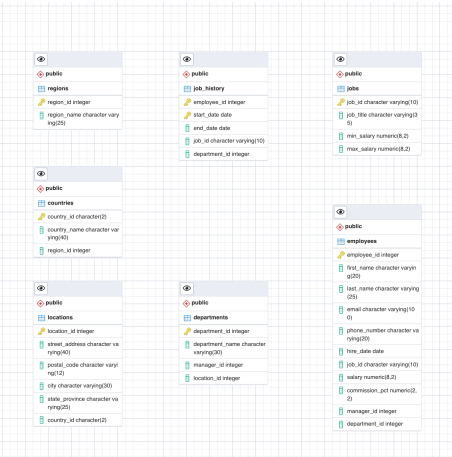
To complete this lab you will utilize the PostgreSQL relational database service available as part of IBM Skills Network Labs (SN Labs) Cloud IDE. SN Labs is a virtual lab environment used in this course.

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, so 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 through different tasks, first you will 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 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.

1. Go to **Terminal** > **New Terminal** to open a terminal from the side-by-side launched Cloud IDE.


Skills Network Labs

Instructions

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Helvetica N...

◀Step 6 of 7▶



Lab

IBMCloud

Launch Application

FileEditSelectionViewGoRun

TerminalHelp

New Terminal^ ^ `

Split Terminal

Run Task...

Run Build Task...

Run Test Task...

Run Last Task⬆ ⌘ K

Show Running Tasks...

Restart Running Task...

Terminate Task...

Attach Task...

Configure Tasks...

2. Start a PostgreSQL service session in the Cloud IDE using the command below in the terminal. Find your PostgreSQL service session password from the highlighted location of the terminal shown in the image below. Note down your PostgreSQL service session password because you may need to use it later in the lab.

```
1. 1
1. start_postgres
Copied!

theia@theiadocker-sandipsahajo:/home/project$ start_postgres
Starting your Postgres database....
This process can take up to a minute.

Postgres database started, waiting for all services to be ready....
[/]
Your Postgres database is now ready to use and available with username: postgres password: MTQ5NTItc2FuZGJw

You can access your Postgres database via:
• The Browser with pgadmin
  • URL: https://sandipsahajo-5050.theiadocker-27.proxy.cognitiveclass.ai/browser/
  • Database Password: MTQ5NTItc2FuZGJw
• CommandLine: psql --username=postgres --host=localhost
theia@theiadocker-sandipsahajo:/home/project$
```

3. Copy your pgAdmin weblink from the highlighted location of the terminal shown in the image below and paste it to a new tab of your web browser.

```
theia@theiadocker-sandipsahajo:/home/project$ start_postgres
Starting your Postgres database....
This process can take up to a minute.

Postgres database started, waiting for all services to be ready....
[/]
Your Postgres database is now ready to use and available with username: postgres password: MTQ5NTItc2FuZGJw

You can access your Postgres database via:
• The Browser with pgadmin
  • URL: https://sandipsahajo-5050.theiadocker-27.proxy.cognitiveclass.ai/browser/
  • Database Password: MTQ5NTItc2FuZGJw
• CommandLine: psql --username=postgres --host=localhost
theia@theiadocker-sandipsahajo:/home/project$
```

4. You will see the pgAdmin GUI tool.


pgAdmin

File ▾Object ▾Tools ▾Help ▾

Browserservers

DashboardPropertiesSQLStatisticsDependenciesDependents

Welcome




pgAdmin

Management Tools for PostgreSQL


Feature rich | Maximises PostgreSQL | Open Source

pgAdmin is an Open Source administration and management tool for the PostgreSQL database. It includes a graphical 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




Add New Server




Configure pgAdmin


Getting Started




PostgreSQL Documentation



pgAdmin Website



Planet PostgreSQL



Community Support

5. 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 name of the database and click **Save**.

pgAdmin File Object Tools Help

Browser 1

2

3

Servers (1)

postgres

Databases (1)

postgres

Create

Database...

Refresh...

Cast

Catalog

Event Triggers

Extensions

Foreign Data Wrappers

Languages

Publications

Schemas

Subscriptions

Login/Group Roles

Tablespaces

Dashboard Properties SQL Statistics

Server sessions

7

4

3

2

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Inse

1

Create - Database

General Definition Security Parameters Advanced SQL

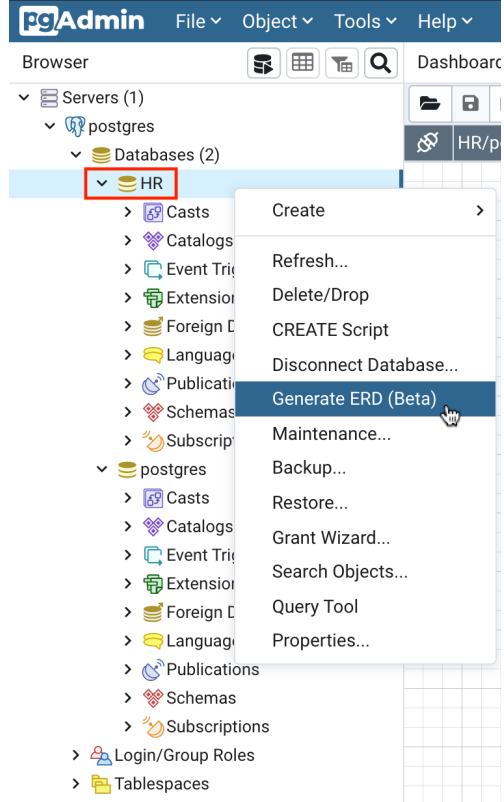
Database HR

Owner postgres

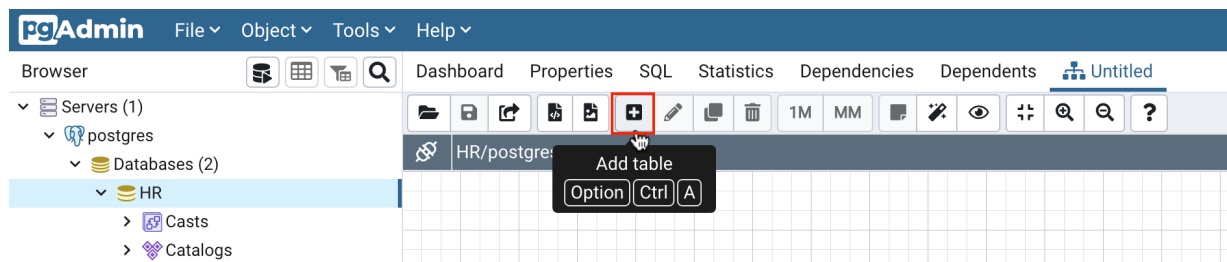
Comment

Cancel Reset Save

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



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



New table

General

Columns

Name

employees

Schema

public

Comment

✕ Cancel

OK

8. Switch to the **Columns** tab and click the **Add new row** button 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**.

General

Columns

Columns



	Name	Data type	Length/Precision	Scale	Not NULL?	Primary key?
--	------	-----------	------------------	-------	-----------	--------------

✕ Cancel

OK

New table

General

Columns

Columns

employee_id

integer

Yes

Yes

first_name

character varying

20

No

No

last_name

character varying

25

Yes

No

email

character varying

100

Yes

No

phone_number

character varying

20

No

No

hire_date

date

Yes

No

job_id

character varying

10

Yes

No

salary

numeric

8

2

Yes

No

commission_pct

numeric

2

2

No

No

manager_id

integer

No

No

department_id

integer

No

No

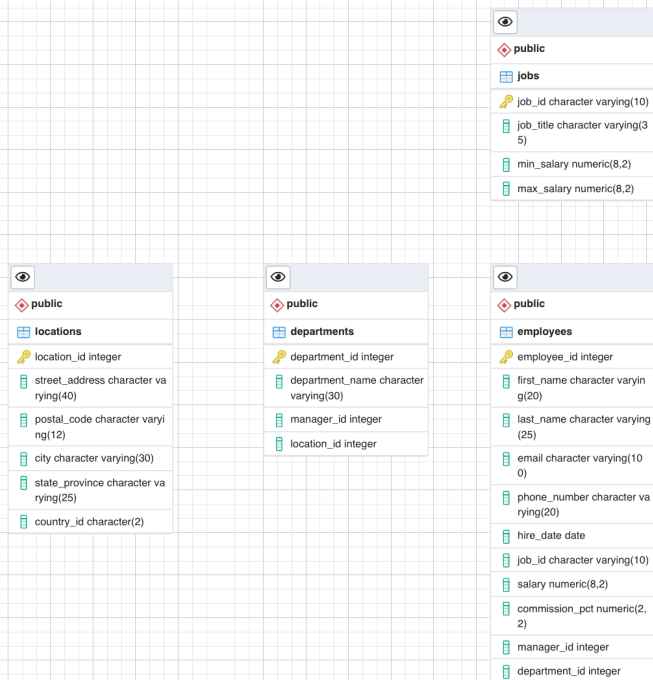
✖ Cancel

OK

9. Similarly, create entity diagrams for the other three tables following steps 7 and 8:

- ▶ [\[Click here\]](#) 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

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



Next you will create relationships between the entities by adding foreign keys to the tables. Select the entity diagram **employees** and click the **One-to-Many link** button. 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 link

Option Ctrl O

👁
🔹 public
📄 employees
🔑 employee_id integer
📄 first_name character varying(20)
📄 last_name character varying(25)
📄 email character varying(100)
📄 phone_number character varying(20)
📄 hire_date date
📄 job_id character varying(10)
📄 salary numeric(8,2)
📄 commission_pct numeric(2,2)
📄 manager_id integer
📄 department_id integer

👁
🔹 public
📄 departments
🔑 department_id integer
📄 department_name character varying(30)
📄 manager_id integer
📄 location_id integer

👁
🔹 public
📄 jobs
🔑 job_id character varying(10)
📄 job_title character varying(35)
📄 min_salary numeric(8,2)
📄 max_salary numeric(8,2)

👁
🔹 public
📄 locations
🔑 location_id integer
📄 street_address character varying(40)
📄 postal_code character varying(12)
📄 city character varying(30)
📄 state_province character varying(25)
📄 country_id character(2)

One to many relation

General

Local Table

(public) employees

Local Column

department_id

x

Referenced Table

(public) departments

x

Referenced Column

department_id

x

x

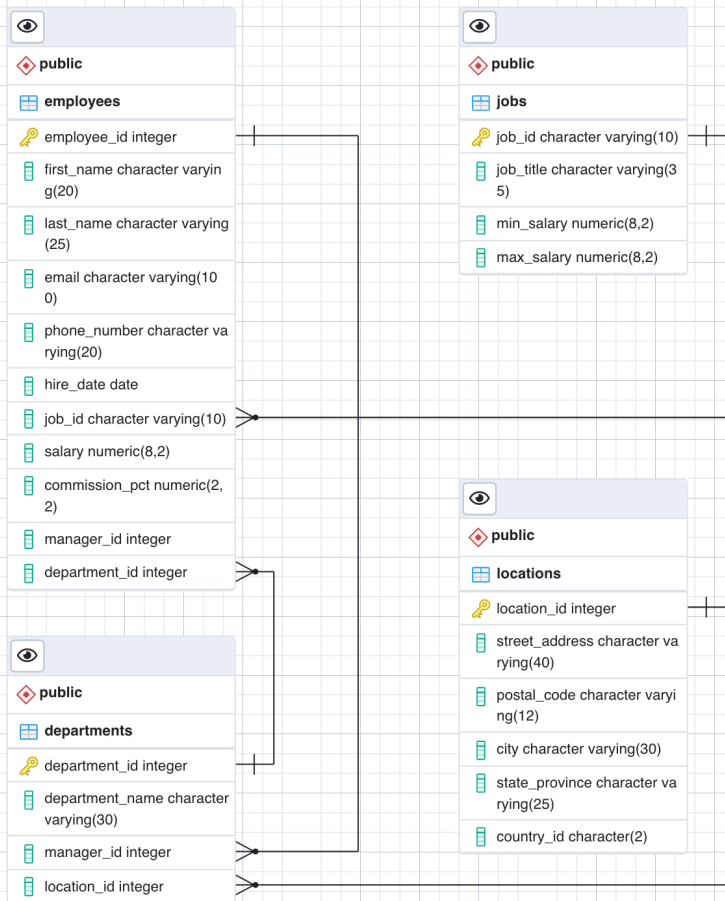
Cancel

OK

12. Similarly, create the other relationships between the tables following the instructions in step 11:

- [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

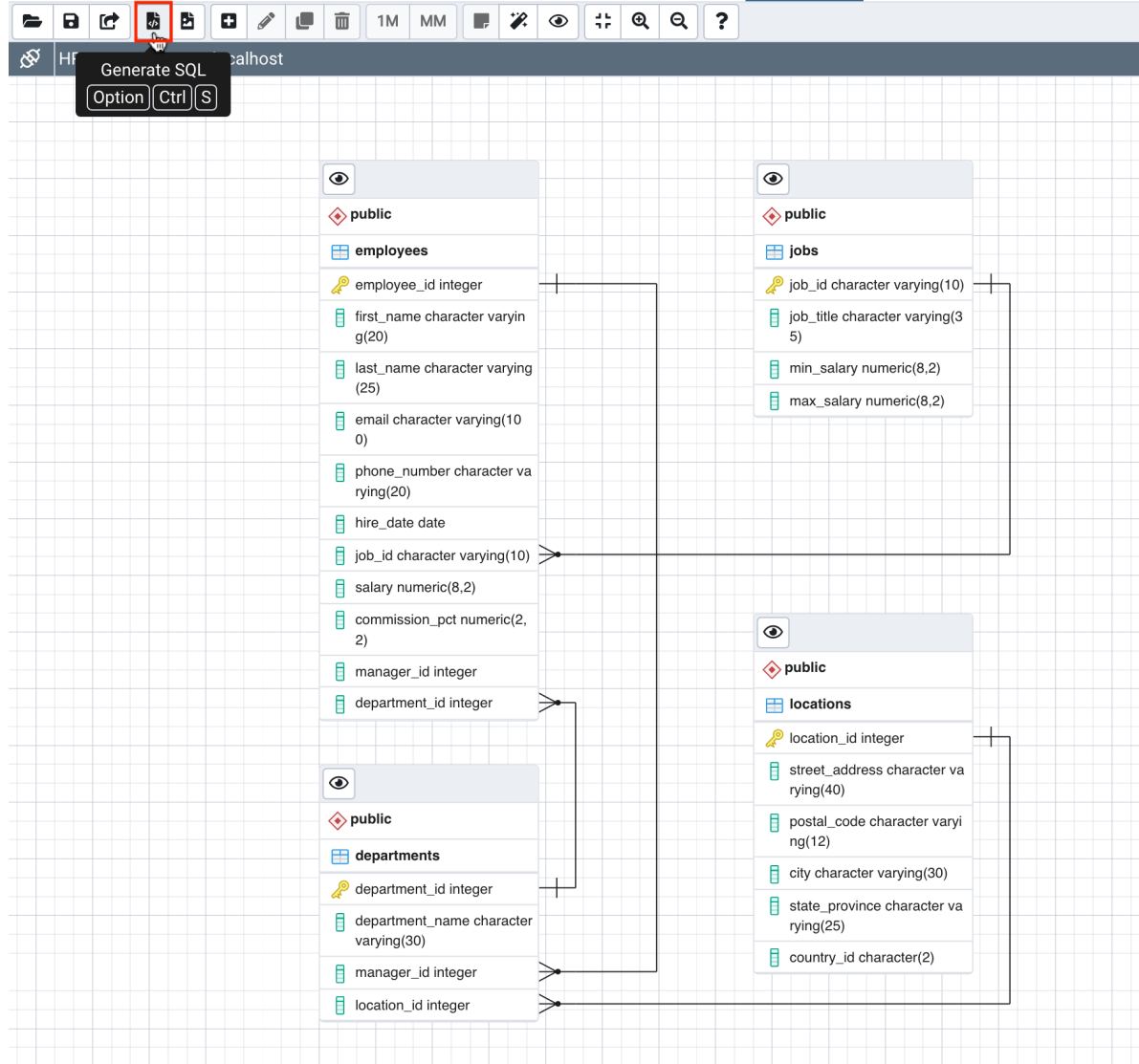
13. After creating all four relationships, you have completed the ERD for this exercise. Proceed to Task B.



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

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

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



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

pgAdmin File Object Tools Help

Browser Servers (1) postgres Databases (2) HR

Cast Catalog Event Trigger Extension Foreign Data Wrapper Language Publication Schemas (1) public Collation Domain FTS Configuration FTS Dictionary FTS Parser FTS Template Foreign Table Function Materialized View Procedure Sequence Table Trigger Function Type View Subscription


Create Refresh... Delete/Drop CREATE Script Disconnect Database... Generate ERD (Beta) Maintenance... Backup... Restore... Grant Wizard... Search Objects... Query Tool Properties...

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

Restore (Database: HR)

General Restore options

Format Custom or tar

Filename 

Number of jobs

Role name Select an item...

Cancel Restore

Click the Upload File button.

Select file

/var/lib/pgadmin/

Name

Size

Modified

sessions

4.0 kB

Mon Mar 29 10:20:20 2021

storage

4.0 kB

Mon Mar 29 10:04:10 2021

Show hidden files and folders?☐

Format

backup

Cancel

Select

Double-click on the drop files area and load the **HR_pgsql_dump_data_for_example-exercise.tar** you downloaded earlier from your local computer storage.

Select file

/var/lib/pgadmin/

Double click on this space

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

Show hidden files and folders?☐

Format

backup

Cancel

Select

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

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 50 mb.

Show hidden files and folders?☐

Format backup

Cancel

Select

Make sure Format is set to **All Files**, select the uploaded **HR_pgsql_dump_data_for_example-exercise.tar** file from the list, and then click the **Select** button.

Select file

/var/lib/pgadmin/HR_pgsql_dump_data_for_example-ex...

Name	Size	Modified
HR_pgsql_dump_data_for_example-exercise.tar	20.5 kB	Thu Apr 1 13:46:45 2021
pgadmin4.db	156.0 kB	Thu Apr 1 13:45:14 2021
sessions	4.0 kB	Thu Apr 1 09:25:08 2021
storage	4.0 kB	Thu Apr 1 09:24:08 2021

Show hidden files and folders?☐

Format All Files

Cancel

Select

Now switch to **Restore options** tab.

Restore (Database: HR)

General

Restore options

Format

Custom or tar

Filename

/var/lib/pgadmin/HR_pgsql_dump_data_for_example-exercise.tar

Number of jobs

Role name

Select an item...

i

?

Cancel

Restore

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

General

Restore options

Queries

Include CREATE DATABASE statement

No

Clean before restore

No

Single transaction

No

Disable

Trigger

Yes

No data for Failed Tables

No

i

?

Cancel

Restore

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 restore feature.

- Download the **HR_pgsql_ERD_for_practice-exercise.pgerrd** ERD file (containing a partial HR database ERD based on the one that you created in Task A of Example Exercise) below to your local computer storage.

↳ [HR_pgsql_ERD_for_practice-exercise.pgerrd](#)

- In pgAdmin, create a new database named **HR_Complete**.
- Open the ERD Tool and use the **Load from file** button to load the **HR_pgsql_ERD_for_practice-exercise.pgerrd** file.

pgAdmin

File ▾Object ▾Tools ▾Help ▾

Browser

Servers (1)

postgres

Databases (2)

HR_Complete

postgres

Casts

Catalogs

Event Triggers

Extensions

Foreign Data Wrappers

Languages

Publications

Schemas

Subscriptions

Login/Group Roles

Tablespaces

Dashboard

Properties

SQL

Statistics

Dependencies

Dependents

Untitled

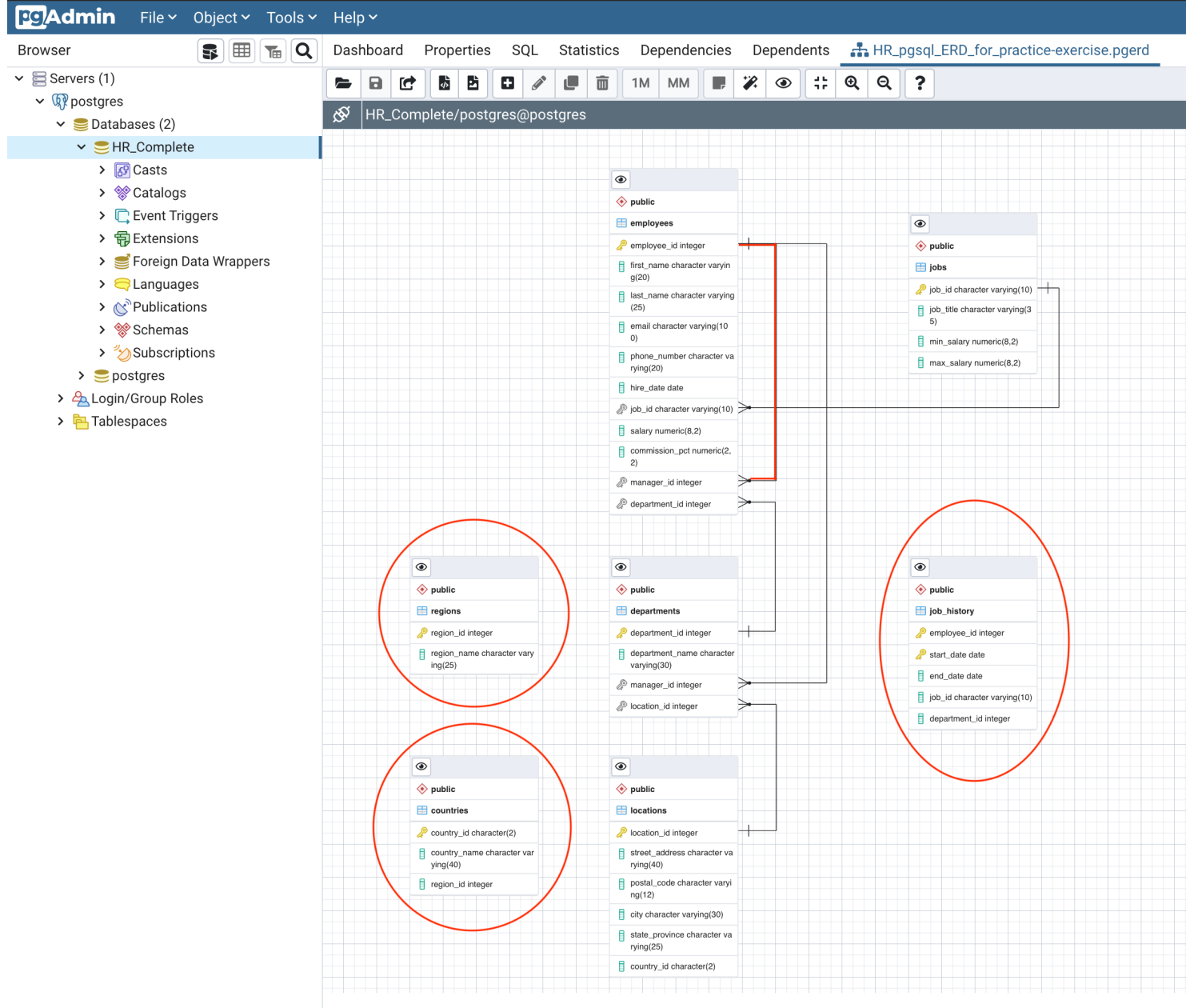
Load from file

Ctrl O

ete/postgres@postgres

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 as well as one new relationship within the entity diagram of the **employees** table between *manager_id* as local column and *employee_id* as referenced column.

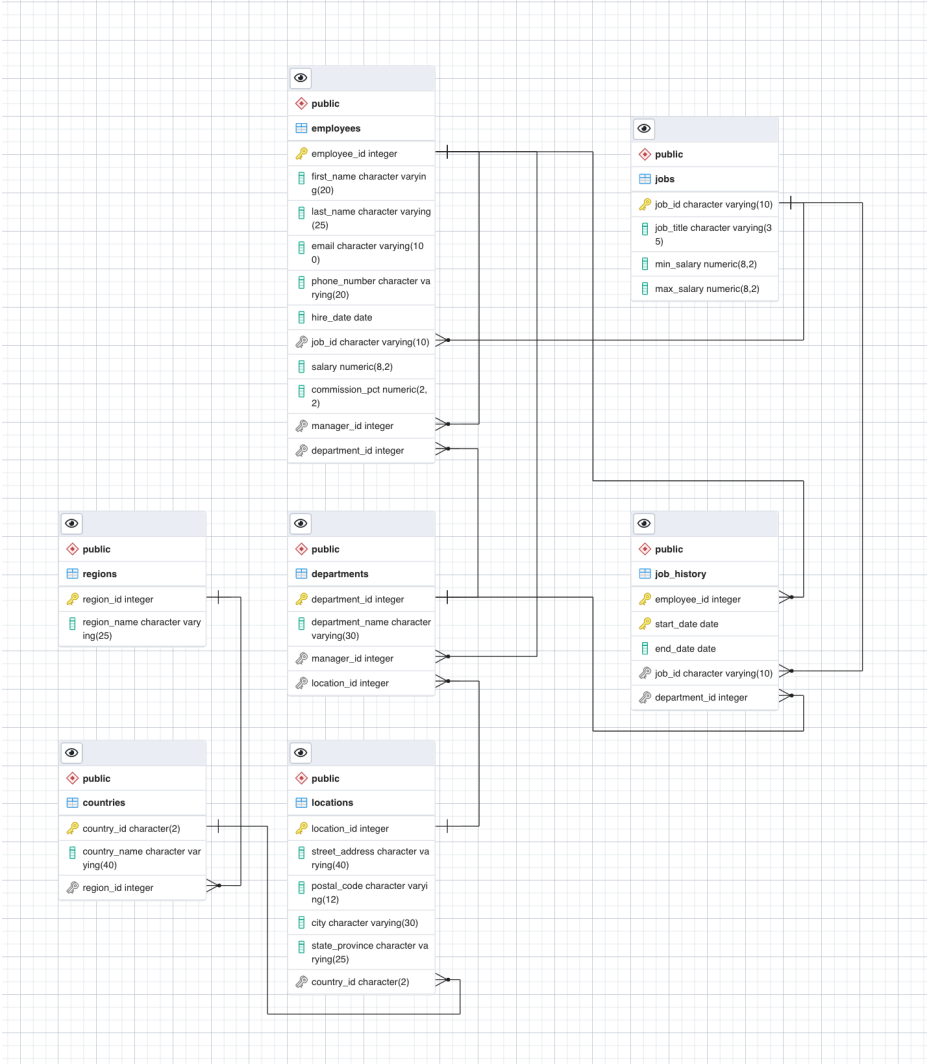


5. Create the remaining relationships between the tables:

- [\[Click here\]](#) 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 storage. 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.

Congratulations! You have completed this lab, and you are ready for the next topic.

Author(s)

- [Sandip Saha Joy](#)

Other Contributor(s)

-

Changelog

Date	Version	Changed by	Change Description
2021-03-31 1.0		Sandip Saha Joy	Created initial version