Project - Climate Action Sample

IT 120 - Databases

Kit Transue

Contents

Project

Overview

The project is to construct a database for a sample organization working on climate action. The process of developing the database will follow the model presented in class: you will suggest requirements on the basis of an initial interview; then you create a data model that will go on to become the structure of the database. You will write SQL to create, populate, update, and report on the database to address the customer's needs.

Artifacts

Here are the artifacts I will be looking for in the project.

Requirements Document

Write a brief (1-2 paragraph) statement of scope for the database and note at least three details about the data that may affect database design.

Design

For design: ultimately: an Entity-Relationship Diagram that reflects your plan for the physical layout of the database. This physical layout should include keys and should detail your plan for addressing any many-to-many relationships that might need to be expressed using a join table.

I suggest starting with a high-level design that captures only the entities and their relations, and then goes on to a mid-level design with the attributes identified. Seek my feedback at each level of iteration: this will save effort of filling in ("cementing," if you will) a design that might not work well. If you take the tiered approach, I suggest you identify each stage explicitly and make a copy of the design at that stage for your project history/portfolio/detail.

You may use Draw.io or another diagramming tool (including Lucid Charts or Visio) if that works better for you. The tool should be able to show attributes and identify keys, and to show relationships with the 1 (hash) or many (crowsfoot) endpoints.

SQL

The project will require several batches of SQL; each will have a different responsibility and will be needed at different stages of the database's lifetime. These should be kept separate from each other and all should be included with the project materials. There should be:

- SQL statements to create the table structure from an empty database
- SQL to populate the database with the initial data (COPY from CSV OK, or SQL INSERT)
- queries to answer questions the organization is interested in

Create Database

Create the database in PostgreSQL. Write the SQL script to create the tables for the entities in your Entity-Relationship Diagram. Your script should have all the tables, and the attributes with appropriate data types and the proper primary keys and foreign keys.

Some notes:

- use INTEGER for surrogate keys (no need to go all UUID here, and INTEGER is more efficient than the VARCHAR type)
- do not worry about expressing foreign key constraints (they complicate loading and experimentation at this stage, and it is easy to look up how to add them later)
- for surrogate keys, we will manage them explicitly (do not use SERIAL or other auto-assigned values: this is for ease in exchanging data if we need to, but a regular database would use SERIAL to provide DEFAULT values for surrogate keys)

To turn in:

- a modified "reset.bat" script to recreate your database
- the SQL script with the necessary CREATE TABLEs
- a screenshot of psql running on the database, with the output of the "\dt" meta-command showing the tables (ideally from the VSCode panel)

Populate database

Enter the sample data in Climate Action Database Sample Data into your database using psql statements. psql statements may be either COPY from CSV or INSERT INTO.

To turn in

- file containing SQL to populate tables
- accompanying CSV file, if used

SQL Query and Update

Provide an SQL file for each of the following that performs the desired action or creates the requested report.

1. Newsletter: Assuming a newsletter date of 2023-03-10, show upcoming events after that date.
2. INSERT a member event suggestion (not approved)
3. List all the members who were added in 2020 (Use the EXTRACT function to get the year), newest first
4. Compute the total value of the donations listed (SUM)
5. Compute the average value of a donation (AVG)
6. Report donors who have given more than $20 but are not members (SUM, GROUP)
7. Compute the total value of the sales (This involves a JOIN and multiplying the units sold * the price per unit for the merchandise.)
8. FIXME: question revised
9. Give membership to donors who have contributed (UPDATE)
10. Adjust inventory by sales (be concerned about idempotence) (UPDATE)

To turn in

SQL files that will query or update according to the above.

Use your automation to confirm the query runs the way you expect it to.

Some of these queries may uncover shortcomings in earlier steps: data that should be included but was left out, or data that is needed but that you don't know without further input from the customer.

When this happens, you are welcome to fix the issue in your design, create, or insert. If you change your tables but don't update the design, you might want

to docuemnt that in the create table sql. The text "FIXME" is conventional for this kind of note; many editors assist in navigating to FIXME comments.

If you don't fix it, you can do any or all of:

- explain with a FIXME
- write a working query as best a query as you can without the data
- write the query as you would like it to work, and that can serve as a demonstration that upstream things have been fixed once it starts to workpop

Extra:

Let's work on the comments section.

Comments section:

- write a query to show comments:

For events *after* 2023-03-21: Event date, Event name, commentor name, commentor date, comment

- change reset.bat so it runs q02 to insert a new event after building the database
- change reset.bat so it runs q12_review-comments.sql

In q12_review-comments.sql:

- Insert a new comment for "An Evening With Bill Nye. . . " (include this INSERT in your file so I can repeat it!)

(you should have three comments in the comment table and three events in the event table)

- describe what you expect to see
- Print one line for each comment
- if an event has no comments, show the event but with comment fields empty

Inventory planning

in q13_inventory-planning.sql:

Write a report that shows any items that have been over-sold. Over-sold means the quantity of un-shipped sales is bigger than the quantity on hand.

Your report should show the item name and the number of additional units that should be purchased to fulfill the orders.

To test this:

You should be starting with 30 of the books "Call to Action".

Add two orders for "Call to Action". One should be for 15 copies; the other should be for 20 copies. Before adding the orders, your report should be empty. After adding both orders, your report should show the organization needs to get at least 5 copies of "Call to Action" from their supplier to fulfill their orders.

Hints: there are a lot of similarities betwen this and the nested SELECTs in q10_adjust-inventory.sql.

reset.bat has been updated to run this query before and after..

Climate Change Database Sample Interview

In this imagined interview, Hannah is in the role of the database designer tasked with deploying a database to help a grassroots organization interested in climate change.

Hannah: Thanks for meeting with me. The goal for today is to get an overview of the database. We don't need to go into all the detail, just get a good general picture of what you need. What do you see as the main purpose of the database?

Megan: Our goal is to create a climate action site and we need the database to drive it.

Hannah: Ok, can you describe some of what you want to happen on that site?

Megan: Sure. We want to provide resources—links to sites and documents with useful information. We will generate some materials of our own. We also want to provide a calendar of events, some of which we will offer and some offered by other organizations and institutions. We want to suggest things people can do to make a difference.

Hannah: Are you anticipating any fundraising.

Megan: Yes, we are hoping to see items such as T-shirts, cups, books, posters, etc. to raise enough money to support the site. We will also take donations. Anyone that donates over 20 dollars becomes a member automatically, though you do not have to donate to become a member.

Hannah: How do you anticipate the site operations? Can anyone contribute articles, or can only certain people? How do you think it will work?

Megan: We will want people to register in order to contribute articles or links to events. There will be a small staff that validates the links to make sure they are legitimate, and to oversee donations and such. People who register can agree to receive newsletters that will update them about new information on the side.

Hannah: Will only members be allowed to view the data?

Megan: No. Anyone should be able to view the resources and events and be able to buy merchandise or donate. Only members can contribute events or resources and only members can add comments.

Hannah: Oh, what will they be able to comment on?

Megan: Events and resources, mainly.

Hannah: OK. Is there anything else you want to add?

Megan: I can't think of anything else at the moment.

Hannah: Well, if anything occurs to you: let me know,

Sample Documents

Existing documents provide insight into both requirements and existing processes. Below is an example of the documents that might have been collected during interviews with an imagined grassroots organization interested in climate change.

Members

Member Name	Email	Phone	Date added
Jill Keller	JillKileer@gmail.com	206-555-1245	3/29/2019
Mark Lowen	lowen@msn.com		4/19/2020
Wendy Nelson	wnelson@yahoo.com	456-555-1265	5/1/2020
Krystal Brown	krystalball@hotmail.com	904-555-2211	5/20/2021
Bob Danielson	bd2035@gmail.com	360-555-2030	6/10/2020
Ta Nguyen	tnguyen304@gmail.com		7/12/2020
Nichole Bradley	nicholeb@harvest.org	222-555-2323	7/15/2020

Merchandise

Name	Description	Units	Price per unit	Quanti
Earth Rise T-Shirt	T-shirt with earth rising over moon	1 T-Shirt	15.50	20
Earth Rise Puzzle	1000 piece jigsaw puzzle of earth rising over moon	1 box	9.35	15
Endangered Habitats	Tabletop book	1 book	35.30	25
Last Views	4k UHD documentary on endangered species	1 disc	23.90	10
Call to Action	Book on climate change action	1 book	6.45	30

Sales

FIXME: add sales totals, even though those should not be in the ultimate tables

Customer	Lindsey Peterson

Email	lp@msn.com		
Billing Address	161 Brown Street, Chicago, IL, 80092		
Date Ordered	10/2/2020		
Shipping Address	same		
Date Shipped	10/4/2020		
Item1	Earth Rise puzzle	Qty	2
Item2	Earth Rise T-shirt	Qty	1
	———-		
Customer	Krystal Brown		
Email	Krystalball@hotmail.com		
Billing Address	303 South Market, Seattle, WA, 98112		
Date Ordered	10/09/2020		
Shipping Address	120 Pine Street, Seattle, WA 98122		
Date Shipped	10/12/2019		
Item1	Earth rise T-shirt	Qty	3
Item2	-	Qty	-
	———-		
Customer	Marcus Tellerman		
Email	mtellerman@yahoo.com		
Billing Address	2020 North Street, San Francisco, CA. 99122		
Date Ordered	10/30/2020		
Shipping Address			
Date Shipped			
Item1	last views	Qty	1
Item2	-	Qty	-

Donations

Name	**Email**	**Date**	**Amount**
Hamid Brown	hamidb@outlook.com	8/14/2020	10.00
Ha Li	hali@gmail.com	10/15/2020	200.00
Ken Jackson	kj202@yahoo.com	10/15/2020	15.00
Wendy Nelson	windynelson@morningstar.org	10/16/2020	135.00
Ken Jackson	kj202@yahoo.com	3/2/2022	15.00

Events

Convention on Climate Policy
Room 313

Convention Center
200 Pike Street
Seattle, WA, 98122
December 3rd 2022

Price 250.00 per attendee

UN Report on Climate Progress
UN Convention House 2
UN Plaza
New York, NY, 00231
April 13,2023

Price Free, but limited seats

Resources

Partnership for Energy progress

https://www.pepnw.org/about-us/

The Partnership for Energy Progress is a collaboration of utilities, farmers, workers, small and large businesses, and community advocates across the Northwest. Our goal is to communicate the work we do to provide reliable, affordable energy to homes and businesses, and highlight the progress we're making to address climate change.

Date added: 9/12/2020

Member who added: Jill Keller

Siemens Company

https://new.siemens.com/us/en/company/sustainability/environmental-action.html

Siemens is supporting the Decade of Action to accelerate the adoption of sustainable technologies so our customers, our communities and our employees can lead the U.S. towards a low-carbon future.

Date Added: 10/09/2022

Member added: Jill Keller

UN Environment Program

https://www.unep-wcmc.org/

UN Environment Programme World Conservation Monitoring Centre is a world leader in biodiversity knowledge. It works with scientists and policy makers worldwide to place biodiversity at the heart of environment and development decision-making to enable enlightened choices for people and the planet.

Date Added: 10/18/2020

Member added: Bob Danielson

NASA on Climate Change

https://climate.nasa.gov/

Explore a real-time data visualization of NASA's Earth-orbiting satellites and the data they collect about climate change.

Date Added: 10/25/2020

Member added: Ta Nguyen

Comments

10/20/2022

Nichole Bradey

Climate.nasa.gov

This site is gorgeous and useful. Well worth the time to visit and explore its features.

10/22/2022

Wendy Nelson

I attended the Convention on Climate policy last year and it was quite enlightening. They had discussions from several high ranking scientists and politicians. Worth the price.

Recap of the Database Development Lifecycle

We are covering the last few sections of Database Design, where we go from the "physical model" stage of the ERD (with all relations fully expressed using foreign keys) to the SQL and running databases.

Installation refresher

We need to:

- make sure the database server is running
- create an empty database to work with
- add tables to the database
- populate those tables with data

Is database server running?

These tools can help confirm the database server is running:

```
pgAdmin4
```

```
brew services start postgresql
```

```
pg_ctl start
```

Listing databases

```
psql -l
```

Dropping/creating a database

commandline

This is the preferred way to automate operations

```
dropdb databasename
createdb databasename
```

pgAdmin

Right-click on the Server and select "new database." Choose "template-0" if asked for a template.

SQL

Datatypes

These are the datatypes that should be sufficient for the project:

- INTEGER (for surrogate keys)
- DATE – for dates
- NUMERIC(14,2) – allows trillion dollar donations
- VARCHAR – for text

Syntax

Keywords and table/column names are case-insensitive (mostly; you can quote if you need to).

Every SQL statement must be terminated with a semicolon.

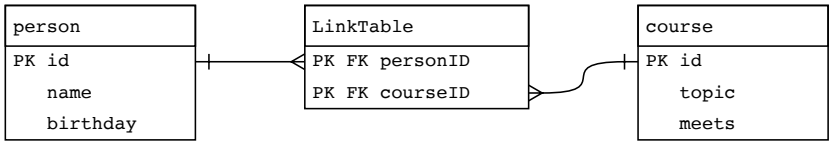
New: Comments begin with – (two hyphens)

CREATE TABLE

```
CREATE TABLE table-name (
  first-column-name INTEGER,
  second-column-name VARCHAR
);
```

Design-to-SQL

Since the designs all have attributes down to the physical model (all foreign key attributes to support relations are shown in the design), writing the SQL is a pretty direct mapping:



becomes:

```
CREATE TABLE person (
   id INTEGER PRIMARY KEY,
   name VARCHAR,
   birthday DATE
);

CREATE TABLE course (
  id INTEGER PRIMARY KEY,
  topic VARCHAR,
  meets VARCHAR
);

CREATE TABLE LinkTable (
  personID INTEGER,
  courseID INTEGER,
  PRIMARY KEY (personID, courseID)
);
```