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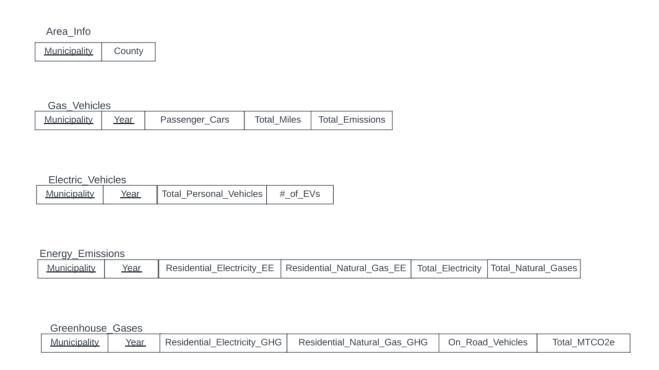
CSC 315 - 01

April 10, 2023

Phase IV Elaboration: Database Design

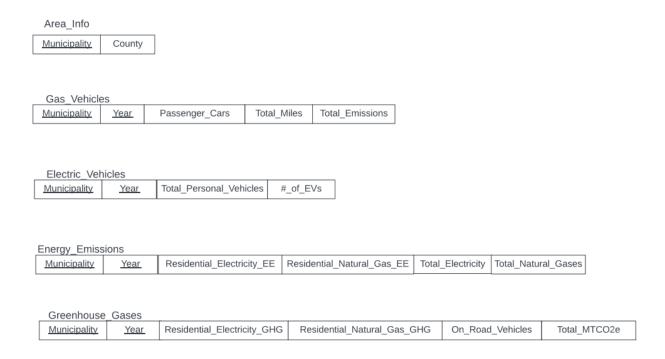
 Demonstrate that all the relations in the relational schema are normalized to Boyce-Codd normal form (BCNF).

1 NF



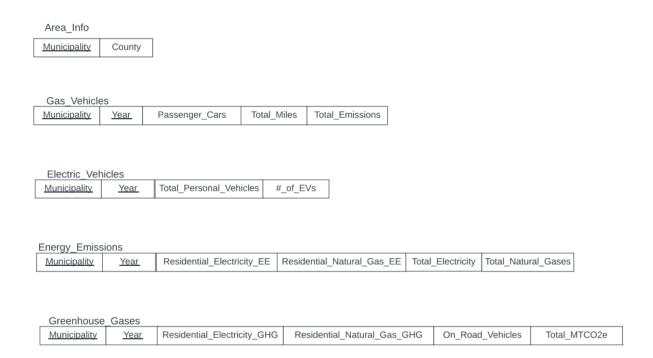
This is already in 1NF because all the attributes have singular values.

2 NF



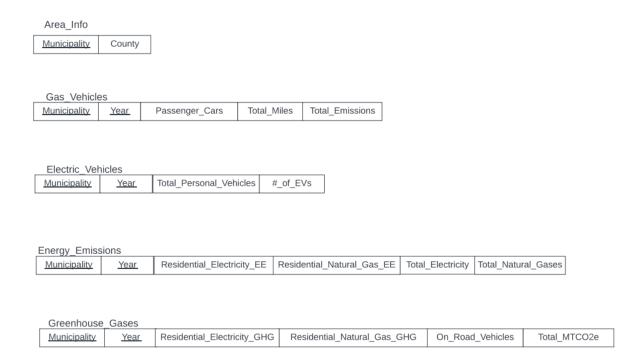
Since no attributes are unique if the composite keys are separated, this is already in 2NF.

3 NF



Since no attributes are uniquely defined by other attributes, this is in 3NF.

BCNF



Since there are no colliding candidate keys and it is already in 3NF, this is also in BCNF.

2. Define the different views (virtual tables) required. For each view, list the data and transaction requirements. Give a few examples of queries, in English, to illustrate.

CREATE VIEW Area AS

SELECT Municipality, County

FROM Area Info;

Example: SELECT * FROM Area: retrieves all municipalities and counties from Area_Info

<u>Transaction Requirements:</u>

Atomicity: this command is atomic because it cannot be done partially.

Consistency: the command is only selecting from the view and is not changing the data itself, making it consistent

Isolation: this command is done alone and is not affected by other transactions

Durability: the command SELECT does not apply changes to the database

CREATE VIEW GVs AS

SELECT Municipality, Year, Passenger_Cars, Total_Miles, Total_Emissions FROM Gas_Vehicles;

Example: SELECT Total_Miles

FROM GVs

WHERE Municipality = 'Trenton City' AND Year = '2019';

- This selects the total vehicle miles traveled in Trenton City in 2019

Transaction Requirements:

Atomicity: this transaction is atomic because it is completed in full

Consistency: this transaction does not change the data in the database, therefore the data is in a consistent state before and after the transaction

Isolation: this transaction does not interfere with the other transactions that may occur at the same time

Durability: the SELECT command does not make permanent modifications to the database

CREATE VIEW EVs AS

SELECT Municipality, Year, Total_Passenger_Vehicles, #_of_EVs

FROM Electric_Vehicles;

CREATE VIEW Energy AS

SELECT Municipality, Year, Residential_Electricity_EE, Residential_Natural_Gas_EE,

Total_Electricity, Total_Natural_Gases

FROM Energy_Emissions;

CREATE VIEW Gas AS

SELECT Municipality, Year, Residential Electricity GHG, Residential Natural Gas GHG,

On_Road_Vehicles, Total_MTCO2e

FROM Greenhouse_Gases;

- 3. Design a complete set of SQL queries to satisfy the transaction requirements identified in the previous stages, using the relational schema and views defined in tasks 2 and 3 above.
- 1.) Retrieve the total number of personal vehicles in the year 2020 in Egg Harbor township.

SELECT Total Personal Vehicles

FROM EVs

WHERE Municipality = 'Egg Harbor township' AND Year = '2020';

2.) For each municipality, list the total electricity and metric tons of carbon dioxide in 2015.

SELECT Municipality, Total_Electricity, Total_MTCO2e

FROM Energy NATURAL JOIN Gas

WHERE Year = '2015';

3.) Retrieve the total miles traveled in Mercer county.

SELECT SUM(Total_Miles)

FROM Area NATURAL JOIN GVs

WHERE County = 'Mercer';

Because these queries used each relation once, this is a complete set.