

1.

Here are the functional dependencies for our relational schema:

MUNICIPALITY: {MNo} \rightarrow {Name, County}

POPULATION: {MNo, Year} \rightarrow {EVs, CO2, Pop, PersonalVehicles}

ON_ROAD_VEHICLE: {MNo, Year, Type} \rightarrow {CO2, Miles}

MEANS_OF_TRANSPORTATION: {MNo, PYear, Type} \rightarrow {Percentage}

Our relational schema is already normalized to 1NF because each attribute is atomic.

There are no nested relations or tuples where an attribute can have multiple values.

Our relational schema is already normalized to 2NF because each functional dependency involving non-prime attributes is uniquely determined by the whole primary key.

Our relational schema is already normalized to 3NF because there are no transitive functional dependencies.

Our relational schema is in BCNF because each functional dependency already depends on the primary key of the relation.

2.

a. Compare Means of Transportation by Municipality or State

- i. For municipality, we can just use the means of transportation table directly
 - it has all of the information and nothing extra
- ii. For statewide data, the view would hide the MNo field and sum all elements in means of transportation, grouping by year

b. Compare Vehicle Miles Traveled by Municipality

- i. This could select everything from ON_ROAD_VEHICLE except for CO2
- though we may want to access CO2 to show the correlation between VMT and greenhouse gasses, in which case we'd just use the whole table
 - c. Compare EV Ownership by Municipality
 - i. Select from POPULATION MNo, year, EVs
 - d. Compare Population by Municipality
 - i. Select from POPULATION MNo, year, Population
 - e. Compare Greenhouse Gases by Municipality or State
 - i. Select from POPULATION MNo, year, CO2
- 3. ***The “?” parameters will be filled in by the user***
 - a. Comparing Means of Transportation
 - i. By Municipality


```
SELECT Percentage FROM MEANS_OF_TRANSPORTATION WHERE  
MNo = ? AND PYear = ? AND Type = ?
```
 - ii. By State


```
SELECT (Type, SUM(Percenage)) FROM  
MEANS_OF_TRANSPORTATION WHERE PYear = ? GROUP BY Type
```
 - b. Compare Vehicle Miles Traveled by Municipality
 - i.

```
SELECT (CO2, Miles) FROM ON_ROAD_VEHICLE WHERE MNo = ?  
AND Year = ? AND Type = ?
```
 - c. Compare EV Ownership by Municipality

i. SELECT (EVs, PersonalVehicles) FROM POPULATION WHERE MNO
= ? AND YEAR = ?

d. Compare Population by Municipality

i. SELECT (Pop) FROM POPULATION WHERE MNO = ? AND YEAR =
?

e. Compare Greenhouse Gases by Municipality or State

i. By Municipality

SELECT (CO2) FROM POPULATION WHERE MNO = ? AND YEAR
= ?

ii. By State

SELECT (SUM(CO2)) FROM POPULATION WHERE YEAR = ?