Phase 4
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Group 8

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

Relation 1 (County): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Relation 2 (Means of Transportation): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Relation 3 (Financial Status of Citizens): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Relation 4 (Housing Architecture): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Relation 5 (EV Station): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Relation 6 (Median Household Income): The primary key is cName, and all other attributes are directly dependent on the primary key. Therefore, it satisfies BCNF.

Since every functional dependency X -> A in every relation schema R of the given relational schema satisfies X being a superkey of R, the relational schema is in BCNF.

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.

Gas Prices View
Data: cName, average_gas_price
Transaction requirements: Read access to the County table
Example query: "List the name and average gas price of all counties where the average gas price is above $3.00 per gallon."

```
CREATE VIEW Gas_Prices_View AS
SELECT cName, average_gas_price
FROM County;
```

Transportation View
Data: cName, %cars/trucks/vans, %public-transport, %taxi, %motorbike, %bicycle, %walk, %other_means, %work_from_home
Transaction requirements: Read access to the Means of Transportation table
Example query: "List the percentage of commuters in each county who use public transportation as their primary means of commuting."

```
CREATE VIEW Transportation_View AS
SELECT cName, %cars/trucks/vans, %public-transport, %taxi, %motorbike, %bicycle,
%walk, %other_means, %work_from_home
FROM Means_of_Transportation;
```

Poverty View
Data: cName, %population_in_poverty
Transaction requirements: Read access to the Financial Status of Citizens table
Example query: "Which counties have the highest percentage of their population living below the poverty line?"

```
CREATE VIEW Poverty_View AS
SELECT cName, %population_in_poverty
FROM Financial_Status_of_Citizens;
```

Housing Density View
Data: cName, units_by_structure, total_housing_units

Transaction requirements: Read access to the Housing Architecture table
Example query: "What is the average number of housing units per structure type in each county?"

```
CREATE VIEW Housing_Density_View AS
SELECT cName, units_by_structure, total_housing_units
FROM Housing_Architecture;
```

EV Station Density View
Data: cName, zipcode, charging_station_density
Transaction requirements: Read access to the EV Station table
Example query: "What is the EV charging station density (number of charging stations per square mile) in each county?"

```
CREATE VIEW EV_Station_Density_View AS
SELECT cName, zipcode, charging_station_density
FROM EV_Station;
```

Population Density View
Data: cName, population_density
Transaction requirements: Read access to the County table
Example query: "List the name and population density of all counties where the population density is above 500 people per square mile."

```
CREATE VIEW Population_Density_View AS
SELECT cName, population_density
FROM County;
```

Commuting View
Data: cName, total_workers, %cars/trucks/vans, %public-transport, %taxi, %motorbike, %bicycle, %walk, %other_means, %work_from_home

Transaction requirements: Read access to both the County and Means of Transportation tables
Example query: "What percentage of workers in each county commute by walking or biking?"

```
CREATE VIEW Commuting_View AS
SELECT cName, total_workers, %cars/trucks/vans, %public-transport, %taxi,
%motorbike, %bicycle, %walk, %other_means, %work_from_home
FROM County
JOIN Means_of_Transportation ON County.cName = Means_of_Transportation.cName;
```

Income View
Data: cName, median_household_income, %population_in_poverty
Transaction requirements: Read access to the Financial Status of Citizens table
Example query: "What is the median household income and percentage of population in poverty for each county?"

```
CREATE VIEW Income_View AS
SELECT cName, median_household_income, %population_in_poverty
FROM Financial_Status_of_Citizens;
```

EV Station Availability View
Data: zipcode, num_of_stations
Transaction requirements: Read access to the EV Station table
Example query: "List the zip codes where the number of EV charging stations is less than 5."

```
CREATE VIEW EV_Station_Availability_View AS
SELECT zipcode, num_of_stations
FROM EV_Station;
```

Transportation and Housing View

Data: cName, %cars/trucks/vans, %public-transport, %taxi, %motorbike, %bicycle, %walk, %other_means, %work_from_home, units_by_structure, total_housing_units
Transaction requirements: Read access to both the Means of Transportation and Housing Architecture tables
Example query: "What is the average number of housing units per structure type and the percentage of commuters using public transportation in each county?"

```
CREATE VIEW Transportation_Housing_View AS
SELECT County.cName, %cars/trucks/vans, %public-transport, %taxi, %motorbike, %bicycle, %walk, %other_means, %work_from_home, units_by_structure, total_housing_units
FROM County
JOIN Means_of_Transportation ON County.cName = Means_of_Transportation.cName
JOIN Housing_Architecture ON County.cName = Housing_Architecture.cName;
```

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.

Get the average gas price for a particular county:

```
SELECT average_gas_price
FROM Gas_Prices_View
WHERE cName = 'Atlantic';
```

Get percentage of workers who use public transportation in a particular county:

```
SELECT %public-transport
FROM Transportation_View
WHERE cName = 'Morris';
```

Get the percentage of population in poverty for a particular county:

```
SELECT %population_in_poverty
FROM Poverty_View
```

```
WHERE cName = 'Ocean';
```

Get the total number of housing units for a particular county:

```
SELECT total_housing_units
FROM Housing_Density_View
WHERE cName = 'Camden';
```

Get the EV charging station density for a particular county and zipcode:

```
SELECT charging_station_density
FROM EV_Station_Density_View
WHERE cName = 'Essex' AND zipcode = '08701';
```

Get the population density for a particular county:

```
SELECT population_density
FROM Population_Density_View
WHERE cName = 'Bergen';
```

Get the percentage of workers who walk or bike to work in a particular county:

```
SELECT %bicycle, %walk
FROM Commuting_View
WHERE cName = 'Mercer';
```

Get the median household income for a particular county:

```
SELECT median_household_income
FROM Income_View
WHERE cName = 'Hunterdon';
```

Get the number of EV charging stations available in a particular zipcode:

```
SELECT num_of_stations
FROM EV_Station_Availability_View
WHERE zipcode = '08701';
```

Get the percentage of workers who use public transportation and the total number of housing units for a particular county:

```
SELECT %public-transport, total_housing_units
FROM Transportation_Housing_View
WHERE cName = 'Salem';
```