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CS-UY 3083 Sec A, Introduction to Databases.

Homework No.: 05, due date: 11/16/2025 11:59 PM EST

Problem 1:
A database for maintaining information about the cities in the United States has the following relation schema

Info(city_name, state, governor, mayor)

The city_name attribute is the name of a city, state is the abbreviation for state the city is in, governor is the name of the governor of the state the city is in, and mayor is the name of the mayor of the city. For example, the tuple ('New York', 'NY', 'Andrew Cuomo', 'Bill de Blasio') gives information about New York City. Two cities may have the same name (for example there are at least two cities named Portland in the US), but two cities in the same state cannot have the same name. Two states cannot have the same abbreviation. Each city has exactly one mayo and each state has exactly one governor.

1. Which of the following are super keys? Which are candidate keys? (There may be more than one):

- {city_name}
- {state}
- {city_name, state}
- {city_name, state, mayor}

2. If there are 1000 cities from NY state in a relation of this schema, how many rows will need to be updated when NY gets a new governor?

3. Give an example of a trivial functional dependency in this schema.

4. Give an example of a non-trivial functional dependency in this schema for which the left-hand side is a superkey.

5. Give an example of a non-trivial functional dependency in this schema for which the left-hand side is not a superkey.

6. Decompose the schema into two schemas that are in Boyce-Codd Normal Form (BCNF).

7. If there are 1000 cities from NY state in relations of the BCNF schemas, how many rows will need to be updated when NY gets a new governor?