Final Prep

Question 1

Given the following DB schema:

- *Students* (`sid`: int, `name`: string, `city`: string, `state`: string, `age`: int)
- *Rents* (`cid`: int, `sid`: int, `price`: int, `rentdate`: date)
- *Cars* (`cid`: int, `make`: string, `model`: string, `myear`: int)

1. Write the SQL statement that extracts how many students are in state MA.
2. Write the SQL statement that extracts how many students are in each state.
3. Write the SQL statement that finds the id and name of students who rented both a Honda Accord and a Toyota Prius.
4. Write the SQL statement that finds the id and name of students who only rented a Toyota Prius.
5. Write the SQL Statement that extracts the students who rented all cars.
6. Write the SQL statement to create a view called *Cars2020* that contains information about all cars manufactured in 2020.
7. Write the SQL to create a *Cars* table with the constraints that all cars must be newer than 2010 (including 2010).
8. Write the SQL to extract the average age of students by state, for those states that have at least 100 students.
9. Write the SQL statement to extract the number of cars each student whose name starts with the letter 'a' rented. Make the query case insensitive with regard to the name of the student.
10. Write the SQL statement to extract the id and name of students who only rented cars in 2018.
11. Write the relational algebra to extract all Honda Accord cars older than 2018.

$$\sigma_{(make='Honda')\wedge(model='Accord')\wedge(myear<2018)}Cars$$

12. Write the relational algebra to extract only the cid for all Honda Accord cars older than 2018.

$$\pi_{cid}(\sigma_{(make='Honda')\wedge(model='Accord')\wedge(myear<2018)}Cars)$$

13. Write the relational algebra to extract the name of students who rented cards Hondas only in 2018.

$$\rho(StudentsRent2018, \pi_{sid,name}(Students \bowtie (\sigma_{make='Honda'}Cars) \bowtie (\sigma_{rentdate=2018}Rents)))$$
$$\rho(StudentsRentOther, \pi_{sid,name}(Students \bowtie (\sigma_{make='Honda'}Cars) \bowtie (\sigma_{rentdate!=2018}Rents)))$$
$$\pi_{name}(StudentsRent2018 - StudentsRentOther)$$

Question 2

Explain whether this relation is in BCNF. If not, decompose it to BCNF.

- CSJDPQV
- Key is C
- Functional dependencies are: PQ $\rightarrow$ V, S $\rightarrow$ D

Check condition S $\rightarrow$ D

- D is not included or equal to S
- S is not part of a key

S $\rightarrow$ D violates BCNF so we must decompose it.

Check condition PQ $\rightarrow$ V

- V is not included or equal to PQ
- PQ is not included in a key

PQ $\rightarrow$ V violates BCNF so we must decompose it.

Decomposition of CSJDPQV

Decompose for PQ $\rightarrow$ V (PQV, CSJDPQ)

Decompose for S $\rightarrow$ D (PQV, SD, CSJPQ)

Check if we lost any dependency. If yes, it means we need to try to do 3NF. In this case, no dependency was lost.