Due date: Thursday, September 22, 2022 at 2:50 PM (Baltimore Time)

Part 1: Database Schema Design

Your task is to design a database to support the needs of the DontSueMe Car Insurance Company, including information about drivers, their tickets and accidents, their cars and available options on their cars, their policies and agents, and other information that could support the determination of car insurance rates.

Please design a database using the E-R and relational table representations that is capable of providing answers to the following questions. You should include other attributes and relationships that are not explicitly required by the questions below if you think that they are appropriate for a good and complete database design. Completeness and good design principles will be rewarded.

Although not all of the queries below would be asked by (ethical) insurance agents, almost all of this information is available on-line to large insurance companies for real-time policy rate determination.

(a) List the date, location and cause of all accidents that Kim Kardashian was responsible for, including the:

1. make and model of the car she was driving,
2. the percentage responsibility that Kim Kardashian had for the accident
3. the cost of the physical damage that Kim Kardashian’s car received in the accident

(b) List the name, birthdate and state of residence of all drivers who have been victims in an accident in which Kim Kardashian was the responsible driver. In the same result table, list the make and models of the cars that the victims were driving, the percentage responsibility each victim had for the accident, and the cost of bodily injury to the victims of the accident.

(c) List the VIN number of all white Tesla Roadster’s manufactured before 2022 owned by a driver licensed in the state of California.

(d) List the names and ages of all female drivers who hold insurance policies sold by agent Martin O’Malley of the Rockville, MD office.

(e) For all drivers who hold an insurance policy sold by agent Martin O’Malley of the Rockville, MD office, list the date and location of all accidents they were responsible for, including the make, model and year of the car they were driving.

(f) List all of the options that have been installed on VIN number 1KAL989BC319216DA7, including the name of the option, its base cost, its insurance discount rate, and whether the option is factory-installed or dealer-installed on this car.

# (g) List the name and option-ID-number of all options that are available for the make, model and year of car 1KAL989BC318216DA7, but have not been installed on this car.
(h) List the VIN numbers of all cars sold by Apple Ford of Columbia with dealer-installed anti-lock breaks that have been involved with an accident with the cause of “brake failure”.

(i) List the names of all drivers who own a Volkswagen Beatle manufactured before 1982 and a Volkswagen Beatle manufactured after 2022.

(j) List the names of all drivers who own both a Ferrari and Tesla and do not live in Los Angeles or Dallas.

(k) List the names of all drivers who own both a Ferrari (any model) and Ford Pinto and have received a ticket in the Pinto but not in the Ferrari.

(l) List all tickets that Martin O’Malley received in Maryland between 12-28-2019 and 09-13-2022, including the color, make and model of the car she was driving, the date of the ticket and the type of violation she was cited for.

(m) List the names and SSN of all insurance agents who have sold an insurance policy to themselves (state any assumptions that you need to make here).

(n) List the names and ages of all drivers who own a car that is the same make, model and color of a car that Jeff Bezos owns.

(o) List the date, location, time, cause and the name of the responsible driver of all accidents that VIN number 1KAL989BC319216DA7 has been involved in (either as the responsible party’s vehicle or a victim’s vehicle).

(p) List the name of all drivers who have received a ticket in a car they do not own.

(q) List the name of all drivers who have received a ticket in every car that they own.

(r) List the name of all drivers who have received a ticket in every car that they own and have been responsible for an accident in every car that they own.

(s) List the VIN numbers of all cars that do not have anti-lock brakes installed, but are of a make, model and year of a car where anti-lock brakes are an available option.

(t) List the names and ages of owners of red sportscars with sunroofs who who have never had a ticket in their red sportscar with a sunroof.

Assumptions:
You should assume that drivers can own more than one car and that cars can have more than one owner. You should also assume that all car insurance policies have exactly one vehicle and one primary driver, and that being the primary driver on a vehicle is not necessarily correlated with owning the vehicle.

For all accidents, you should assume that there is exactly one driver that is “responsible for” the accident (with some percentage of liability) and other driver(s) who are “victims” of the accident (but may also have some percentage liability). Responsible drivers and victims in an accident do not always own (or are insured for) the cars they are driving in.
the accident. Also, tickets can be given to drivers that do not own (or have insurance for) the cars they are driving at the time.

You may simplify the model by assuming that a driver’s address, state of residence and driver’s license number does not change with time (i.e. there is exactly one driver’s license number per driver). You may also assume that the owner(s) of a car do not change with time. A given generic make and model of car has a variety of safety options such as anti-lock breaks available, but these do not have to be installed on all physical cars. The available safety options may be required or optional, factory installed or dealer installed.

To Do:

1.1 (21 points) Design the database using the entity-relationship database model and draw it. Your design should minimize repetitions of information. Be sure to mark the mapping constraints (↔→←), participation constraints (→⇒) and underline primary keys.

You should very briefly justify any unusual or potentially controversial design decisions you make. Do not spend much time on such notes.

This section will be graded on aesthetics and completeness as well as correctness.

1.2 (10 points) Represent this database design using the relational model. You should use a tabular notation and include at least one row of sample values for each relation.

You should very briefly justify any unusual or potentially controversial decisions you make in the conversion process. Do not spend much time on such notes.

1.3 (9 points) As part of the second phases of homework 1 (handed out in a few days), write relational algebra expressions to answer some of the English queries (a) through (t) given on page 1-2 of this assignment, based on your E-R design submitted here. The exact numbers and details for each 315/415/615 section will be specified later.

You may use assignment to intermediate relations to make your expressions clearer and simpler.

Submission will be via gradescope, and instructions for gradescope submission will be emailed to the class and posted on piazza.