

Homework 3

Due 11:55PM February 29, 2016. **Only PDF** will be accepted. **No scans** of handwritten work will be accepted.

- 1) What is π_{highway} for the relation Car as a set? What about as a bag? What is the average value of the tuples in the projection as a set? What about as a bag?

Table 1. Car

Model	City	Highway	Price
1001	33	37	\$25,000
1002	38	43	\$27,000
2001	30	33	\$22,500
2002	33	38	\$26,000
2003	40	43	\$31,000
3001	30	33	\$23,000
3002	33	36	\$26,500

- 2) What is the outer join of Car with the relation Product?

Table 2. Product

Maker	Model	Type
A	1001	Car
A	1002	Car
A	1101	Pickup
B	2001	Car
B	2003	Car
B	2101	Pickup
B	2102	Pickup
B	2201	EV
C	3001	Car
C	3201	EV

- 3) Assuming the relations from homework 1, listed below. Write safe Datalog rules for the following, you may use multiple IDB predicates corresponding to subexpressions:

Product(maker, model, type)

Car(model, city, highway, style, passengers, trunk, price)

Pickup(model, city, highway, passengers, cargo, towing, price)

EV(model, range, battery, passengers, price)

- a) What Car models have a highway fuel economy less than 35MPG?
 - b) Find all of the Pickup models that have a cargo capacity of at least 75cu ft. and a city fuel economy less than 25MPG.
 - c) Find all automakers that sell at least one vehicle that costs less than \$25,000 and at least one vehicle that costs greater than \$60,000.
 - d) Find the highway fuel economies that exist for two or more vehicles.
 - e) Find the automaker(s) of the highest combined fuel economy (55% city, 45% highway) of conventional vehicles (cars and pickups).
 - f) Find the vehicle model with the highest miles per gallon gasoline equivalent (MPGGE). For this problem assume combined fuel economy formula from above, and that a gallon of gasoline is equivalent to 33.1kWh.
 - g) Find automaker(s) that sell a car with a highway fuel economy lower than all the pickups it sells.
 - h) Find automaker(s) that sell conventional vehicles (cars and pickups) with at least three different highway fuel economies.
- 4) Repeat problem 3 using SQL queries instead of Datalog.