Homework 3

Due 11:59PM November 17, 2016. **READ ALL DIRECTIONS VERY CAREFULLY! Only PDF** will be accepted. **No scans** of handwritten work will be accepted. You **MUST** put each problem on a separate page with 1a on the first page, for example 1a will be on page 1 and 1b will be on page 2. You **MUST** put every problem in the submission, even if you are not answering the problem, just leave a blank page. You **MUST** put your name and student ID in the upper right hand corner of the first page. **FAILURE TO FOLLOW ALL DIRECTIONS COULD RESULT IN YOUR ASSIGNMENT NOT BEING GRADED!**

1) Consider Table 1 Car for the following problems:
    a) What is π_{city} for the relation Car as a set?
    b) What about as a bag?
    c) What is the average value of the tuples in the projection as a set?
    d) What about as a bag?

Table 1. Car

Model	City	Highway	MSRP
1001	33	36	$26,000
1002	38	43	$27,600
1003	30	34	$22,500
2001	33	38	$23,000
2002	40	42	$33,200
3001	30	34	$23,000
3002	33	36	$25,600

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

Table 2. Product

Maker	Model	Year
A	1001	2011
A	1002	2015
A	1101	2014
B	2001	2014
B	2003	1999
B	2101	2005
B	2102	2011
B	2201	2007
C	3001	2007
C	3201	2016

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, year)
Car(model, city, highway, style, passengers, trunk, msrp)
Pickup(model, city, highway, passengers, cargo, towing, msrp)
EV(model, range, battery, passengers, msrp)

   a) What EV models have a range less than 35miles?
   b) Find all of the Pickup models that have a cargo capacity of at least 75cu ft. and a highway fuel economy less than 25MPG.
   c) Find all automakers that sell at least one vehicle that msrp less than $25,000 and at least one vehicle greater than $60,000.
   d) Find the passenger capacities 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 pickup with a city fuel economy lower than all the cars it sells.
   h) Find automaker(s) that sell conventional vehicles (cars and pickups) with at least three different msrps.

4) Repeat problem 3 using SQL queries instead of Datalog. You may find http://sqlfiddle.com/#!15 helpful.