Homework 3

Yepei Zhang 912465089

February 29, 2016

1.

for a set: $\pi_{Highway}$

Highway
37
43
33
38
36

AVG(Highway) = (37+43+33+38+36)/5=37.4

for a bag: $\pi_{Highway}$

Highway
37
43
33
38
43
33
36

AVG(Highway)=(37+43+33+38+43+33+36)/7=37.57

2.

Model	City	Highway	Price	Maker	Type
1001	33	37	$25000	A	Car
1002	38	43	$27000	A	Car
2001	30	33	$22500	B	Car
2002	33	38	$26000	$\perp$	$\perp$
2003	40	43	$31000	B	Car
3001	30	33	$23000	C	Car
3002	33	36	$26500	$\perp$	$\perp$
1101	$\perp$	$\perp$	$\perp$	A	Pickup
2101	$\perp$	$\perp$	$\perp$	B	Pickup
2101	$\perp$	$\perp$	$\perp$	B	Pickup
2201	$\perp$	$\perp$	$\perp$	B	EV
3201	$\perp$	$\perp$	$\perp$	C	EV

3.

(a)

$Answer(model) \leftarrow Car(model, city, highway, style, passengers, trunk, price)\ AND\ highway < 35$

(b)

$Answer(model) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)\ AND\ cargo \geq 75\ AND\ city < 25$

(c)

$W(model) \leftarrow Car(model, city, highway, style, passengers, trunk, price)\ AND\ price \geq 25000\ AND\ price \leq 60000$
$M(model) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)\ AND\ price \geq 25000\ AND\ price \leq 60000$
$N(model) \leftarrow EV(model, range, battery, passengers, price)\ AND\ price \geq 25000\ AND\ price \leq 60000$
$MODEL(model) \leftarrow W(model)$
$MODEL(model) \leftarrow M(model)$
$MODEL(model) \leftarrow N(model)$
$Answer(maker) \leftarrow Product(maker, model, type)\ AND\ NOT\ MODEL(model)$

(d)

$HC(mc, hc) \leftarrow Car(mc, city, hc, style, passengers, trunk, price)$
$HCS(mcs, hcs) \leftarrow HC(mcs, hcs)$
$AnswerC(hc) \leftarrow HC(mc, hc)\ AND\ HCS(mcs, hcs)\ AND\ mc = mcs\ AND\ hc! = hcs$
$HP(mc, hc) \leftarrow Pickup(mc, city, hc, passengers, cargo, towing, price)$

$HPS(mcs, hcs) \leftarrow HP(mc, hc)$
$Answer(hc) \leftarrow HP(mc, hc)\ AND\ HPS(mcs, hcs)\ AND\ mc = mcs\ AND\ hc! = hcs$
$Answer(hc) \leftarrow AnswerC(hc)$

(e)

$CMCH(model, city, highway) \leftarrow Car(model, city, highway, style, passengers, trunk, price)$
$PMCH(model, city, highway) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)$
$ALL(model, city, highway) \leftarrow CMCH(model, city, highway)$
$ALL(model, city, highway) \leftarrow PMCH(model, city, highway)$
$ALLS(m, c, h) \leftarrow ALL(model, city, highway)$
$NoMaxOrMin(model, city, highway, m, c, h) \leftarrow ALL(model, city, highway)\ AND\ ALLS(m, c, h)\ AND$
$0.55{*}city{+}0.45{*}highway < 0.55{*}c{+}0.45{*}h$
$NoMax(model) \leftarrow NoMaxOrMin(model, city, highway, m, c, h)$
$Answer(maker) \leftarrow Product(maker, model, type)\ AND\ NOT\ NoMax(model)$

(f)

$M(model, city, highway, battery, range) \leftarrow Car(model, city, highway, style, passengers, trunk, price)$
$AND\ range = 0\ AND\ battery = 1$
$M(model, city, highway, battery, range) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)$
$AND\ range = 0\ AND\ battery = 1$
$E(model, city, highway, range, battery) \leftarrow EV(model, range, battery, passengers, price)$
$AND\ city = 0\ AND\ highway = 0$
$NoMax(model) \leftarrow M(model, city, highway, battery, range)\ AND\ E(m, c, h, r, b)$
$AND\ 0.55 * city + 0.45 * highway + 33.1 * range/battery$
$< 0.55 * c + 0.45 * h + 33.1 * r/b$
$Answer(maker) \leftarrow Product(maker, model, type)\ AND\ NOT\ NoMax(model)$

(g)

$MC(model, highway) \leftarrow Car(model, city, highway, style, passengers, trunk, price)$
$MP(model, highway) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)$
$CarMaker(maker, model, highway) \leftarrow Product(maker, model, type)\ AND\ MC(model, highway)$
$PickupMaker(m, mo, h) \leftarrow Product(m, mo, type)\ AND\ MP(mo, h)$
$NoLower(maker) \leftarrow CarMaker(maker, model, highway)\ AND\ PickupMaker(m, mo, h)\ AND$
$maker = m\ AND\ highway > h$
$Answer(maker) \leftarrow CarMaker(maker, model, highway)\ AND\ NOT\ NoLower(maker)$

(h)

$MH(model, higway) \leftarrow Car(model, city, highway, style, passengers, trunk, price)$
$MH(model, highway) \leftarrow Pickup(model, city, highway, passengers, cargo, towing, price)$
$VeMaker(maker, model, highway) \leftarrow Product(maker, model, type)\ AND\ MH(model, highway)$
$VeMakerS(ms, mos, hs) \leftarrow VeMaker(ms, mos, hs)$

$VeMakerSS(mss, moss, hss) \leftarrow VeMaker(mss, moss, hss)$
$Diff(maker, model, highway, ms, mos, hs, mss, moss, hss) \leftarrow VeMaker(maker, model, highway)\ AND$
$VeMakerS(ms, mos, hs)\ AND\ VeMakerSS(mss, moss, hss)\ AND$
$maker = ms\ AND\ maker = ms\ AND\ highway! = hs\ AND$
$highway! = hss\ AND\ hs! = hss$
$Answer(maker) \leftarrow Diff(maker, model, highway, ms, mos, hs, mss, moss, hss)$

4

(a)
SELECT model
FROM Car
WHERE highway<35;

(b)
SELECT model
FROM Pickup
WHERE cargo>=75 AND city<25;

(c)
((SELECT maker FROM Product, Car WHERE Product.model = Car.model AND price<25000)
UNION
(SELECT maker FROM Product, Pickup WHERE Product.model = Pickup.model AND
price<25000)
UNION
(SELECT maker FROM Product, EV WHERE Product.model = EV.model AND price<25000))
INTERCEPT
((SELECT maker FROM Product, Car WHERE Product.model = Car.model AND price>60000)
UNION
(SELECT maker FROM Product, Pickup WHERE Product.model = Pickup.model AND
price>60000)
UNION
(SELECT maker FROM Product, EV WHERE Product.model = EV.model AND price>60000));

(d)
(SELECT Car1.highway AS highway
FROM Car Car1, Car Car2
WHERE Car1.model< > Car2.model AND Car1.highway=Car2.highway)
UNION
(SELECT Pickup1.highway AS highway
FROM Pickup Pickup1, Pickup Pickup2

```
WHERE Pickup1.model< > Pickup2.model AND Pickup1.highway=Pickup2.highway);

    (e)
SELECT maker
FROM
        (( SELECT maker, (0.55*city+0.45*highway) AS economy
        FROM Product NATURAL JOIN Car)
        UNION
       ( SELECT maker, (0.55*city+0.45*highway) AS economy
        FROM Product NATURAL JOIN Pickup))
WHERE economy = MAX(economy);

    (f)
SELECT maker
FROM
        (( SELECT maker, (0.55*city+0.45*highway) AS economy
        FROM Product NATURAL JOIN Car)
        UNION
       ( SELECT maker, (0.55*city+0.45*highway) AS economy
        FROM Product NATURAL JOIN Pickup))
        UNION
       ( SELECT maker, 33.1*range/battery AS economy
        FROM Product NATURAL JOIN EV))
WHERE economy = MAX(economy);

    (g)
SELECT maker
FROM Car,
        (SELECT maker, MIN(highway) AS p, model AS m
        FROM Product, Pickup
        GROUP BY maker)
WHERE Car.model = m, AND highway <p;

    (h)
(SELECT maker)
FROM Product NATURAL JOIN Car
GROUP BY maker
HAVING COUNT( DISTINCT highway) >= 3)
UNION
(SELECT maker)
FROM Product NATURAL JOIN Pickup
```

GROUP BY maker
HAVING COUNT(DISTINCT highway) >= 3)