ECS 165A Homework 3

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1. (a) As a set, the projection $\pi_{city}(Car)$ is:

City
33
38
30
40

   (b) As a bag, the projection $\pi_{city}(Car)$ is:

City
33
38
30
33
40
30
33

   (c) The average of the set projection $\pi_{city}(Car)$ is:

$$\frac{33+38+30+40}{4} = \frac{141}{4} = 35.25$$

   (d) The average of the bag projection $\pi_{city}(Car)$ is:

$$\frac{33+38+30+33+40+30+33}{7} = \frac{237}{7} = 33.\overline{857142}$$

2. Car $\rtimes$ Product:

model	city	highway	price	maker	model	type
1001	33	37	25000	A	1001	Car
1002	38	43	27000	A	1002	Car
null	null	null	null	A	1101	Pickup
2001	30	32	22500	B	2001	Car
2002	33	38	26000	B	2002	Car
2003	40	46	31000	null	null	null
null	null	null	null	B	2101	Pickup
null	null	null	null	B	2201	EV
3001	30	33	23000	null	null	null
3002	33	36	26500	C	3002	Car
null	null	null	null	C	3201	EV

3. (a)

$$Answer(m) \leftarrow Car(m, c, \_, \_, \_, \_, \_) \text{ AND } c < 32$$

(b)

$$Answer(m) \leftarrow Pickup(m, \_, h, \_, c, \_, \_) \text{ AND } c \geq 75 \text{ AND } h > 20$$

(c)

$$\begin{aligned}
Less(model) \leftarrow\ & (Car(model, _, _, _, _, _, price) \text{ AND } price < 20000) \\
& \text{OR } (Pickup(model, _, _, _, _, _, price) \text{ AND } price < 20000) \\
& \text{OR } (EV(model, _, _, _, price) \text{ AND } price < 20000) \\
More(model) \leftarrow\ & (Car(model, _, _, _, _, _, price) \text{ AND } price > 50000) \\
& \text{OR } (Pickup(model, _, _, _, _, _, price) \text{ AND } price > 50000) \\
& \text{OR } (EV(model, _, _, _, price) \text{ AND } price > 50000) \\
Answer(m) \leftarrow\ & Product(m, model, _) \text{ AND } Product(m, model1, t) \\
& \text{AND } Less(model) \text{ AND } More(model1)
\end{aligned}$$

(d)

$$\begin{aligned}
Answer(city) \leftarrow\ & (Car(m, city, _, _, _, _, _) \text{ AND } Car(m1, city, _, _, _, _, _) \text{ AND } m \neq m1) \\
& \text{OR } (Car(_, city, _, _, _, _, _) \text{ AND } Pickup(_, city, _, _, _, _, _)) \\
& \text{OR } (Pickup(m, city, _, _, _, _, _) \text{ AND } Pickup(m1, city, _, _, _, _, _) \text{ AND } m \neq m1)
\end{aligned}$$

(e)

$$\begin{aligned}
C(c, h, m) \leftarrow\ & Car(m, c, h, _, _, _, _) \text{ AND NOT } (\\
& Car(m, c, h, _, _, _, _) \text{ AND } Car(m1, c1, h1, _, _, _, _) \\
& \text{AND } c * 0.55 + h * 0.45 > c1 * 0.55 + h1 * 0.45) \\
P(c, h, m) \leftarrow\ & Pickup(m, c, h, _, _, _, _) \text{ AND NOT } (\\
& Pickup(m, c, h, _, _, _, _) \text{ AND } Pickup(m1, c1, h1, _, _, _, _) \\
& \text{AND } c * 0.55 + h * 0.45 > c1 * 0.55 + h1 * 0.45) \\
Both(m) \leftarrow\ & (C(c, h, m) \text{ AND } P(c1, h1, m1) \\
& \text{AND } c * 0.55 + h * 0.45 \leq c1 * 0.55 + h1 * 0.45) \\
& \text{OR } (P(c, h, m) \text{ AND } C(c1, h1, m1) \\
& \text{AND } c * 0.55 + h * 0.45 \leq c1 * 0.55 + h1 * 0.45) \\
Answer(maker) \leftarrow\ & Product(maker, model, _) \text{ AND } Both(model)
\end{aligned}$$

4. (a)

```
SELECT model
FROM Car
WHERE city < 32
```

(b)

```
SELECT model
FROM Pickup
WHERE cargo >= 75 AND highway > 20
```

(c)

```
SELECT maker
FROM Product P
JOIN (
    SELECT model
    FROM Car
    WHERE price < 20000
    UNION
    SELECT model
    FROM Pickup
    WHERE price < 20000
    UNION
    SELECT model
    FROM EV
    WHERE price < 20000
) L ON P.model = L.model

INTERSECT

SELECT maker
FROM Product P
JOIN (
    SELECT model
    FROM Car
    WHERE price > 50000
    UNION
    SELECT model
    FROM Pickup
    WHERE price > 50000
    UNION
    SELECT model
    FROM EV
    WHERE price > 50000
) M on P.model = M.model
```

(d)

```
SELECT DISTINCT C1.city
FROM Car C1, Car C2
WHERE C1.city = C2.city AND C1.model <> C2.model

UNION
```

```
SELECT DISTINCT P1.city
FROM Pickup P1, Pickup P2
WHERE P1.city = P2.city AND P1.model <> P2.model
```