Assignment 4

EECS341 Spring 2019

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Due: Thursday, Feb 28, 2019

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1. Find the name of users associated with only the area "Cleveland City"

a. Relational algebra

$$\Pi_{user.name} \left(\sigma_{user.id = user\_role.user\_id \wedge user\_role.role\_id = role\_area.role\_id \wedge role\_area.area\_id = area.id} \left(user \times user\_role \times role\_area \times area \right) - \right.$$
$$\left. \sigma_{user.id = user\_role.user\_id \wedge user\_role.role\_id = role\_area.role\_id \wedge role\_area.area\_id = area.id \wedge area.name <> 'Cleveland\ City'} \left(user \times user\_role \times role\_area \times area \right) \right)$$

b. Tuple relational calculus

$\{t | (\exists u)(u \in user \wedge t[name] = u[name] \wedge (\exists ur)(ur \in user\_role \wedge ur[user\_id] = u[id]$
$\wedge (\exists ra)(ra \in role\_area \wedge ra[role\_id] = ur[role\_id] \wedge (\forall a)(a \in area \wedge a[id] = ra[area\_id] \Rightarrow a[name] =$
$"Cleveland\ City")))))\}$

c. SQL

```sql
SELECT DISTINCT u.name
FROM user u, user_role ur, role_area ra, area a
WHERE u.id = ur.user_id
  AND ur.role_id = ra.role_id
  AND ra.area_id = a.id
  AND u.id NOT IN (
    SELECT user.id
    FROM user, user_role, role_area, area
    WHERE user.id = user_role.user_id
      AND user_role.role_id = role_area.role_id
      AND role_area.area_id = area.id
      AND area.name <> 'Cleveland City');
```

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2. Find the name of users associated with every area except "Cleveland City"

a. Relational algebra

$$\Pi_{user.name,\ area.id}(\sigma_{user.id\,=\,user\_role.user\_id\ \wedge\ user\_role.role\_id\,=\,role\_area.role\_id \wedge role\_area.area\_id=area.id}\,(user \times$$
$$user\_role \times role\_area \times area))/\Pi_{area.id}(\sigma_{area.name<>'Cleveland\ City'}\,(area))$$

b. Tuple relational calculus

$$\{t|(\exists u)(u \in user \wedge t[name] = u[name] \wedge (\forall a)(a \in area \wedge a[name] <>' Cleveland\ City' \Rightarrow (\exists ur)(ur \in$$
$$user\_role \wedge ur[user\_id] = u[id] \wedge (\exists ra)(ra \in role\_area \wedge ra[role\_id] = ur[role\_id]$$
$$\wedge\ a[id] = ra[area\_id]))))\}$$

c. SQL

```sql
SELECT u.name
FROM user u
WHERE NOT EXISTS (
  SELECT a.id
  FROM area a
  WHERE a.name <> 'Cleveland City' AND a.id NOT IN (
    SELECT area.id
    FROM user_role, role_area, area
    WHERE u.id = user_role.user_id
      AND user_role.role_id = role_area.role_id
      AND role_area.area_id = area.id));
```